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Editor
David Thurtell

Chapter Authors
Resource and energy overview: David Thurtell
Macroeconomic outlook: Thuong Nguyen
Steel and iron ore: Joseph Moloney
Metallurgical and thermal coal: Monica Philalay
Gas: Nikolai Drahos
Oil: Kate Martin
Gold: Thuong Nguyen
Aluminium, alumina and bauxite: Andrea Bath
Uranium, copper, nickel and zinc: Mark Gibbons

Special topic Lithium: Mark Gibbons

Acknowledgements
The authors would like to acknowledge the contributions of:
Mark Cully, Melissa Bray, Jamie Todling, Ken Colbert, Kelly O’Brien and Monica Conaghan.

Cover image source: Shutterstock
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ISSN 1839-5007
Vol. 8, no. 3

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Department of Industry, Innovation and Science, GPO Box 9839, Canberra ACT 2601 or by emailing chiefeconomist@industry.gov.au.

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Foreword

The combined effect of a weaker exchange rate outlook and persistent strength in the price of some resource and energy commodities — particularly thermal coal and oil, which affects LNG prices — has led us to revise up our resource and energy export forecasts. We now expect Australia’s resources and energy export earnings in 2018–19 to reach a new high of more than a quarter of a trillion dollars.

Strong world demand and some concerns over supply have helped keep the prices of oil and thermal coal relatively high over the past quarter, boosting the prospects for Australian export earnings over the outlook period.

Bulk commodity prices are expected to decline modestly over the outlook period, as global supply of these commodities improves. These price declines will more than offset the impact of growth in export volumes during that period, leading to a modest decline in export earnings in 2019–20. Export earnings should still be well above 2017–18 levels however, reflecting the tightness of resource and energy commodity markets and the benefits of rising Australian commodity production.

International Monetary Fund expectations are for solid global economic growth over the next few years. The US economy continues to grow strongly, helped by tax cuts and still relatively loose monetary conditions. Strong economic growth in emerging and developing economies is also expected to continue, but at a more subdued pace than in recent years, as economic growth in China slows.

There is some risk to the strong outlook for the world economy and thus commodity demand. Escalating trade tensions between the world’s two largest economies — the United States and China — have raised fears that economic growth in China might slow significantly, with flow-on effects for that country’s commodity demand. Indeed, after the forecasts for this publication were finalised, the US announced it would impose tariffs on a further US$200 billion of imported Chinese products. The implications of this announcement for commodity markets will become clearer in coming months, and will be considered in more detail in the December 2018 Resources and Energy Quarterly.

The other main risk to the world economic outlook is that, notwithstanding the recent significant rise in the US dollar, the US economy may soon run in to capacity constraints, sparking a sharper than expected rise in US inflation. This may force the US Federal Reserve to raise interest rates more than expected, and these rate rises could hurt US economic growth and have ripple effects across the rest of the world economy.

The prospect of a rapid rise to prominence of electric vehicles has created a lot of interest in lithium, which was a relatively minor commodity for decades. Electric vehicles require large batteries, and rising sales are expected to create huge markets for battery-grade lithium over the coming years. This edition of the Resources and Energy Quarterly includes a special chapter on lithium, covering its growing global market, new mines opening in Western Australia and the emergence of refining infrastructure that will lift Australia up the supply chain, and future prospects for the lithium industry in Australia. Future editions of the Resources and Energy Quarterly will include a regular lithium chapter, reflecting its growing importance as an Australian mineral export.

Mark Cully
Chief Economist
Department of Industry, Innovation and Science
About this edition

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

Each September edition of the *Resources and Energy Quarterly* features a ‘short term’ (two year) outlook for Australia’s major resource and energy commodity exports. A ‘medium term’ (five year) outlook is published in the March quarter edition of the *Resources and Energy Quarterly*.

Underpinning the forecasts 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 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, 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.

Data in this edition of the Resources and Energy Quarterly is current as of 17 September 2018. This edition also includes a feature chapter on lithium. This edition was originally published on 2 October 2018, and republished with corrections to Chapter 15 on the 6th of October.

### Resources and Energy Quarterly publication schedule

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*Source: Department of Industry, Innovation and Science (2018)*
Overview
Resources and Energy Quarterly September 2018

Resources and energy sector

- **9%** of Australia's GDP growth in the June quarter 2018
- **8%** of GDP in 2017–18
- **57%** Australia's goods and services exports in 2017–18
- **246,000** people employed (as at August 2018)
- **72%** of Australia's exports of goods in 2017–18

Australia's resources and energy exports, A$ billion

- **Iron ore**
  - 2017–18: A$56 billion
  - 2018–19: A$48 billion
  - 2019–20: A$41 billion
- **Met Coal**
  - 2017–18: A$31 billion
  - 2018–19: A$24 billion
  - 2019–20: A$20 billion
- **LNG**
  - 2017–18: A$19 billion
  - 2018–19: A$19 billion
  - 2019–20: A$19 billion

Major markets for Australia's resources and energy exports, 2017–18 (A$ billion)

- **EU28**
- **India**
- **South Korea**
- **Japan**
- **China**

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1.1 Summary

- Australia’s resources and energy export volumes are expected to show firm growth over the outlook period. While the prices of Australia’s major resource commodities have generally been rising, we expect them to decline in 2019–20 because of moderating demand and rising supply.
- Helped by the decline in the Australian dollar over the past quarter, Australia’s resource and energy exports are likely to hit a new record high of $252 billion in 2018–19, but fall back to $238 billion in 2019–20.
- While global economic growth, industrial production and manufacturing output have continued to grow strongly so far in 2018, there are some concerning signs for resource and energy commodity producers, particularly with rising global trade tensions.

1.2 Export values

Australia’s export values to a quarter of a trillion dollars in 2018–19

The Office of the Chief Economist’s (OCE) Resources and Energy Export Values Index (preliminary estimate) rose by 22 per cent in the year to the September quarter 2018. This was due to a 17 per cent rise in prices and a 5 per cent rise in volumes. Figure 1.2 shows that in 2018–19, a forecast 4.4 per cent rise in prices will add to the impact of a 7.1 per cent rise in export volumes. The value of resource and energy exports is thus forecast to rise by 11.8 per cent to a record $252 billion. 2019–20 is forecast to see export values drop by 5.6 per cent to $238 billion, as a 9.2 per cent fall in prices more than offsets the impact of a 4.0 per cent rise in volumes.

The weaker AUD/USD has added significantly to commodity returns

In Australian dollar terms, the Office of the Chief Economist’s Resources and Energy Commodity Price Index grew by 4.4 per cent (preliminary estimate) in the September quarter, to be 17.0 per cent higher than a year earlier. In US dollar terms, the Index grew by 2.2 per cent in the quarter, to be 9.7 per cent higher than a year earlier. Figure 1.3 shows that prices for resources commodities rose by 2.2 per cent, while prices of energy commodities grew by 7.2 per cent in the quarter in Australian dollar terms.
1.3 Macroeconomic and trade war influences

The global macroeconomic outlook is not as benign as it has been for the past year at least, clouding the resource and energy commodity outlook slightly. Leading indicators of industrial activity, including Purchasing Managers’ Indices and base metal prices, point to slower growth ahead; US trade moves are impacting on global supply chains and have raised uncertainty, which is starting to impact on investment in some countries. US monetary conditions are set to tighten further, as US inflation rises.

US inflation is rising as the recent corporate and income tax cuts push the economy near capacity limits; increased tariffs on US imports may also raise consumer prices. Widening interest rate differentials and the US trade protection measures have helped push the US dollar higher. While the stronger US dollar lessens some US inflation pressures, it is also putting a strain on countries such as Turkey, Argentina, South Africa and Indonesia, as capital flows out of these nations to the US. South Africa, Indonesia and other emerging nations account for an inordinate amount of growth in resource commodity consumption, as they attempt to grow and develop.

US dollar gains have contributed to weakness in resource commodity prices, especially base and precious metals. While the overwhelming majority of Chinese steel output is consumed domestically, base metal and gold demand are much more susceptible to the impacts of trade wars impacting on Asia. Gold would normally benefit from safe-haven flows induced by heightened economic/financial market uncertainty, however investors in emerging markets may be liquidating gold to shore up losses elsewhere. Investors have sold gold as the US dollar has risen and as real US bond yields held their March quarter 2018 gains.

The impact of US Administration trade moves — to protect some domestic industries from imports and try to force its trading partners to lower barriers to US exports — and growing retaliatory moves by affected nations, has yet to show up meaningfully in trade and economic activity statistics. Making interpretation even more difficult, detailed Chinese trade data post March 2018 has not been released by China’s official statisticians. The main US trade moves have been against China, but Mexico, the EU, Canada and Turkey have also been hit by significant protective measures. It could be expected that unless the new US trade barriers are reduced or abolished, there will be a significant impact on world economic growth — and hence commodity usage — over the forecast period. If recent US trade measures do succeed in trading partners such as China lowering/removing trade and investment barriers, the main benefits will be in non-commodity sectors.

The impact of winter production cuts in China continues to change the pattern of consumption of inputs to ferrous and non-ferrous metal production, making interpretation of the underlying conditions in resource and energy markets much more difficult. Strong summer Chinese steel production drew in high imports of iron ore and metallurgical coal; steel inventories will build eventually — causing steel prices to fall and harm the demand for imported iron ore and metallurgical coal — but extremely strong inventory gains are not expected in the forecast period.
Chinese economic growth appears likely to show only minor change from its current pace, as trade war impacts are offset by a recent sharp fall in the Chinese currency, cuts to bank reserve requirements and a government-supported infrastructure push.

The rest of the world is still growing slightly above trend, and low inflation in all major economies except the US continues to provide scope for easy monetary conditions to continue.

1.4 Prices

The iron ore price has been supported by the ongoing strength in China’s steel market. The iron ore price is forecast to decline modestly over the next two years, as Chinese steel output eases and world supply grows.

Metallurgical coal spot prices stabilised in the September quarter, after sharp falls in the June quarter. Some ongoing near-term price support is expected: China’s imports of metallurgical coal are expected to remain elevated over the next couple of months, as steel margins remain high.

Australian thermal coal prices have been unexpectedly strong. Their strength is partly related to strong Chinese imports — as a hot summer raised Chinese power demand — and partly related to an ongoing air-quality push for high quality coal in Asia. Prices are expected to ease through the December quarter 2018 and through 2019, as supply rebounds and demand moderates.

Oil prices have held much of the gains of the June quarter, which are set to flow through to LNG revenues over the December quarter. With oil prices expected to hold near current levels over the outlook period, Australia’s growing oil, condensate and LNG volumes should result in petroleum and LNG revenues holding at relatively high levels.

The gold price recently drifted below the US$1,200 an ounce mark for the first time since January 2017 — when US dollar strength associated with the beginning of the Trump Administration weakened the yellow metal. A rebound is expected when the US dollar finishes its rise some time in 2019.
1.5 Export volumes

Export volumes to grow, driven by growing energy exports

The 4.7 per cent year-on-year gain in the Office of the Chief Economist’s Resources and Energy Export Volumes Index (preliminary estimate) in the September quarter 2018 took the index to a new record high. Resource commodity volumes rose by 5.5 percent, and energy commodity volumes rose by 3.5 per cent.

Iron ore, zinc and copper supported annual growth in overall resources and energy export volumes in the September quarter. Growth in iron ore exports is forecast to be 1.4 per cent in 2018–19, before moderating to 0.9 per cent in 2019–20. Rio Tinto and BHP continue to ramp up towards record output levels. BHP is expected to lift capacity at its Port Hedland operations, with output forecast to reach 290 million tonnes by mid-2019.

1.6 Contribution and investment

Mining industry continues to support overall economic growth

Australia’s real Gross Domestic Product (GDP) grew by 0.9 per cent in the June quarter 2018. The mining industry directly accounted for 9.0 per cent of the growth in Australia’s GDP in the year to the June quarter. Since the start of the commodity boom, swings in resource and energy export earnings have correlated closely with swings in nominal GDP. Figure 1.6 suggests that with growth in resource and energy exports likely having peaked in late 2018, nominal GDP growth may have done the same.

Oil and gas extraction and iron ore mining have been the largest contributors to mining industry value-added growth in the last few years, propelled by growing export volumes. In the coming few years, it is likely that slowing export growth and relatively low investment will see a smaller contribution to Australia’s GDP growth from the oil and gas sector.

Coal mining made its strongest contribution to growth in more than three years in the June quarter 2018. The Australian coal industry is reacting to high prices, and has had fewer weather, transport and industrial disruptions than in 2016–17.

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


Mining investment has stabilised, and could begin to rise again

Investment in Australia’s mining industry rose in the June quarter 2018, partly offsetting falls earlier in the year. Investment edged down to $36 billion over 2017–18 as a whole — a 7 per cent decline from 2016–17. The June recovery points tentatively to a bottoming out in mining investment. Investment expectations remain somewhat negative for 2018–19, but have risen from their previous levels.

The recent signs of stabilisation in investment follows years of declines from a peak of $95 billion in 2012–13 — see Figure 1.7. The largest contributor to this fall was the LNG sector — see Figure 1.8. Investment in the LNG sector fell by 7 per cent in the June quarter, and has fallen nearly three quarters from its late 2013 peak, when quarterly investment was $16 billion. The fall in LNG investment reflects the completion of large projects such as Wheatstone and Ichthys, as well as the US$54 billion Gorgon LNG project, one of the largest capital investments ever undertaken.
Coal mining investment has been largely stable in recent times, easing by 2 per cent in the June quarter, to be 3 per cent higher through the year. Growth in investment remains largely confined to the metal ore sector, where investment rose by a strong 19 per cent in the quarter and 14 per cent through the year. This follows a recent surge in prices for copper, nickel, zinc, and lithium.

1.7 Revisions to the outlook

The outlook for Australia’s resources and energy export earnings in 2018–19 has been revised up by around $13.7 billion from the June 2018 Resources and Energy Quarterly. The weaker AUD/USD factored into our forecasts is estimated to add $10.6 billion to export values, while higher-than-expected thermal coal and LNG prices account for the rest of the forecast gain. The forecast for Australia’s resources and energy export earnings in 2019–20 has been revised up by $5.9 billion, reflecting both a larger than previously forecast rise in energy prices and a slightly weaker outlook for the AUD-USD exchange rate in the latter half of 2019.
Figure 1.10: Australia’s major resource & energy commodity exports

Notes: per cent change is compound annual growth (CAGR) from 2017–18 to the specified year; f forecast.
Table 1.1: Outlook for Australia’s resources and energy exports

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<td>226,737</td>
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Notes: b In 2018–19 Australian dollars. f forecast.

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

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<td>A$m</td>
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Notes: f forecast. CAGR is compound annual growth rate in percentage terms from 2017–18 to 2019–20.
The global economy continues to grow strongly at a solid pace, with world output forecast to grow by 3.9% in 2018 and 2019.

Drivers — Robust labour market and rising business confidence in the United States.

Risks — Trade tensions between the US and its major trading partners, sharp depreciation of the Chinese Yuan, slow Brexit talks, and financial vulnerabilities in Turkey and other developing and emerging markets.
2.1 Summary

- The global economy continues to grow at a firm pace, propelled by an economic expansion in the United States (US). Economic growth in China remains solid, as Beijing seeks to offset the impact of winter production cuts and deal with rising trade tensions. The Eurozone is also performing well, driven by rising household consumption.

- The global economy is forecast to grow at 3.8-3.9 per cent a year between 2018 and 2020, driven by strong growth in both advanced and emerging economies.

- Risks to the global economic outlook have risen. Trade tensions between the US and its trading partners persist. The depreciation of the Chinese Yuan is expected to continue, reducing China’s demand for imported commodities. Other risks include Brexit negotiations between the UK and the EU, and the US economy becoming overheated.

2.2 Global economy

Global economic growth remained firm in the June quarter 2018, driven by economic expansion in both advanced and emerging economies. The US economy grew by 2.8 per cent year-on-year, Japan by 1.0 per cent, the Eurozone by 2.2 per cent and South Korea by 2.9 per cent. Of the key emerging economies, China grew by 6.7 per cent year-on-year, while India grew by 8.2 per cent year-on-year (Figure 2.1).

The continuing strong expansion of manufacturing activity has been the main contributing factor to this solid global economic growth. China, the US, Japan and the EU all have manufacturing PMIs above the 50 level (Figure 2.2), pointing to ongoing growth in their manufacturing sectors in the short term. The global manufacturing Purchasing Managers Index (PMI) was at 52.5 in August 2018, down from a cycle high of 54.5 in December 2017, indicating the global manufacturing sector continues to expand, albeit at a slower pace.
Nonetheless, economic growth in some advanced economies such as the Eurozone and Japan appears to have peaked, with lower economic growth rates recorded for the June quarter 2018. Among emerging economies, China’s economic growth rate was also lower in the June quarter 2018, reflecting the combined influences of rising oil prices, a stronger US dollar, and worries over escalating trade tensions. The recent sharp decline in base metal prices (as summarised by the London Metal Exchange Index in Figure 2.3) signals the world industrial production cycle may have peaked.

Figure 2.3: World industrial production growth vs LME Index

According to the International Monetary Fund’s (IMF) World Economic Outlook released in July 2018, advanced economies are expected to continue to expand above their potential GDP growth rates until 2019, before decelerating. Global economic growth is expected to remain firm over the outlook period, reaching 3.9 per cent annually in 2018 and 2019, and 3.8 per cent in 2020.

In the US, the US$1.5 trillion corporate and personal income tax cuts implemented in late 2017 are expected to stimulate consumption and investment further, and reduce the US unemployment rate to the lowest level in 50 years. Strong economic growth in emerging and developing economies is also expected to continue, but at a more subdued pace than in recent years, as economic growth in China slows.

The risks to the global economic outlook have mounted in recent months, as trade tensions between the US and some of its trading partners intensify. The so-called ‘trade war’ has the potential to affect world economic growth by dampening global trade and investment, disrupting global supply chains, and undermining business and financial market confidence (refer Box 2.1).

Financial vulnerabilities in Turkey and Argentina also pose minor risks to the global economic outlook. The Turkish Government is dealing with the rapid decline of the Turkish Lira (which has dropped 40 per cent against the US dollar so far in 2018), and a diplomatic fallout with the US. Signs of contagion to other emerging markets have been apparent in the Argentine Peso, which has recently fallen to historic lows against the US dollar. These dramatic falls have prompted the country’s central bank to raise the official interest rate to 60 per cent — one of the highest rates among emerging nations.

The US Federal Reserve’s target for the US Federal Funds rate has increased from 0.50-0.75 per cent in January 2017 to 1.75-2.00 per cent in August 2018. The rises in US interest rates have started to affect other countries, particularly those nations running large current account deficits. Already, capital flows back to the US (seeking the higher yields on offer) have led some central banks (such as Indonesia), to raise official interest rates to defend their currencies. Higher interest rates are expected to hurt economic activity in those countries, with flow-on effects to their trading partners.
## Box 2.1: Trade tensions between the US and its trading partners

### Major developments:

<table>
<thead>
<tr>
<th>Month</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>October and November 2017</td>
<td>The US International Trade Commission found that imports of solar panels and washing machines have damaged US industries.</td>
</tr>
<tr>
<td>February 2018</td>
<td>The US Administration imposed global safeguard tariffs on $8.5 billion in imports of solar panels and $1.8 billion of washing machines, effective 7 February 2018. The US Department of Commerce released its reports on US steel and aluminium imports, finding that imports of steel and aluminium products threaten national security.</td>
</tr>
<tr>
<td>March 2018</td>
<td>The US Administration announced tariffs on all trading partners of 25 per cent on steel and 10 per cent on aluminium, effective from 23 March 2018. Australia, Argentina and Brazil received indefinite exemptions. The US Administration released its unfair trade practices investigation, finding China is conducting unfair trade practices related to technology transfer, intellectual property (IP) and innovation.</td>
</tr>
<tr>
<td>April 2018</td>
<td>The Chinese Government imposed antidumping duties of 178 per cent on $957 million US sorghum imports. China also imposed retaliatory tariffs on aluminium waste and scrap, pork, fruits and nuts, and other US products, worth $2.4 billion.</td>
</tr>
<tr>
<td>May 2018</td>
<td>South Korea challenged the US solar panel and washing machine tariffs through the World Trade Centre (WTO), claiming they violated the WTO rules. The US Administration announced it was considering raising tariffs to 25 per cent on imported autos and parts from key US allies, totaling $208 billion.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Month</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2018</td>
<td>The European Union imposed 25 per cent tariffs on $3.4 billion of US exports such as cranberries, Harley Davidson motorcycles, blue jeans and bourbon. The US imposed 25 per cent tariffs on $46.3 billion of imports (electrical equipment, mechanical appliances, and machinery) from China, effective 6 July 2018. China imposed 25 per cent tariffs on US soybeans and vehicles, totaling $29.6 billion, effective from 6 July 2018. Other US products such as crude oil, plastics, chemicals and liquefied propane (worth $20 billion) are also subject to 25 per cent tariffs, although at the time of writing these had not yet been implemented.</td>
</tr>
<tr>
<td>July 2018</td>
<td>Canada imposed tariffs on US steel, aluminium, agricultural and food products, and consumer goods, totaling $12.8 billion.</td>
</tr>
<tr>
<td>August 2018</td>
<td>The US Trade Representative considered 25 per cent tariffs on US$200 billion of Chinese imported products. China warned it could add duties to 25 per cent on $60 billion of US goods, including US LNG. The US Administration doubled tariffs on Turkish steel (to 50 per cent) and aluminium (to 20 per cent).</td>
</tr>
<tr>
<td>September 2018</td>
<td>The US announced tariffs on a further $200 billion of Chinese imports, including consumer products, effective 24 September. The tariff will start at 10 per cent and increase to 25 per cent on 1 January 2019. President Trump also threatened to immediately impose almost US$270 billion of additional tariffs if the Chinese government announces retaliatory measures against US farmers and manufacturers. China announced tariffs on $60 billion of US goods which include an additional 5 percent duty on about 1,600 kinds of US products and an extra 10 percent duty on more than 3,500 items. Source: Bloomberg Economics (2018); Department of Industry, Innovation and Science (2018); Peterson Institute for International Economics (2018)</td>
</tr>
</tbody>
</table>
One study suggests that a global trade war could detract 0.5 per cent from world GDP (or $450 billion) by 2020 (Figure 2.4). The main contributing factors would include a sell-off in US equities, higher inflation and lower investment, which could lead to lower consumption, not only in the US but around the world. The impact of a worldwide equity sell-off on China’s economy would likely be minimal, reflecting the limited role of equities as a source of capital or store of wealth in China, and the limited openness of Chinese financial markets to global investors.

Figure 2.4: Possible effects of a global trade war and equity slump

The Productivity Commission found that a US trade war with China and Mexico (where 45 per cent and 35 per cent tariffs are levied, respectively, and both countries retaliated in kind) would lower economic growth in all 3 nations, and particularly severely in Mexico, unleashing a significant reorganisation of world trade. However, in the longer term, Australian economic activity would be little affected, and the US trade deficit would not be narrowed by raising protection from Chinese and Mexican imports.

2.3 United States

The US had its strongest quarter of economic growth in 3 years in the June quarter 2018, with the economy expanding by 2.8 per cent year-on-year. Growth was propelled by higher government and consumer spending, strong employment growth, and robust trade. Growth is close to the US target of 3 per cent.

US manufacturing activity continued to expand in July and August, with the US Institute for Supply Management (ISM) Manufacturing Index remaining high. The unemployment rate was 3.9 per cent in August 2018, unchanged from July. Initial jobless claims — the number of people filing to receive unemployment insurance — fell by 5,000 (on average) in August 2018, pointing to a further decline in US unemployment over the near term. Median weekly wages rose by just 0.3 per cent in the June quarter 2018. Despite ongoing strong employment growth, an absence of strong wage growth suggests the labour market is not yet excessively tight (Figure 2.5).

Figure 2.5: US unemployment rate and Initial jobless claims

The short-term outlook for the US economy is solid, due to a robust labour market, a continued recovery in consumer confidence and private investment, and expansionary fiscal policy (i.e. corporate and personal income tax cuts and increased government spending). Wider budget deficits will result if tax cuts are not accompanied by offsetting reductions in government spending and an expanding tax base. The status of the US dollar as the world’s reserve currency allows the US Government to run inordinately large fiscal and current account deficits.

Monetary tightening in the US is expected to continue through 2018 and 2019. Expectations are that the US Federal Reserve will lift interest rates (Figure 2.6) two more times in 2018 in order to contain inflation, and quarterly rate increases in 2019 appear possible. The recent introduction of tariffs by the United States will likely result in an increase in the cost of imports in the short term, which will be only partly offset by the impact of the stronger US dollar — flowing through to increased consumer prices.

**Figure 2.6: US Federal funds rate, CPI and 10-Year bond yield**

The Chinese economy grew by 6.7 per cent year-on-year in the June quarter 2018, fractionally below the 6.8 per cent level in the March quarter 2018. Despite this slight decline, the economy sustained internal and external challenges: restructuring is continuing, drivers of growth are changing, and the quality of growth is improving steadily. In the June quarter, the tertiary sector (mainly services) grew by 7.6 per cent, outpacing the growth of the manufacturing and industry sector (6.1 per cent), and the primary or agricultural sector (3.2 per cent).

China’s industrial production increased at a slightly faster pace in August 2018 — 6.1 per cent year-on-year, up from 6.0 per cent in July — but was down from 6.8 per cent rise in May 2018, as the impact of deleveraging continued to impact on economic activity. China’s Markit manufacturing PMI remains at modestly expansionary levels. This reflects concerns among Chinese manufacturers about the potential impacts of the US-China trade war and of strict environmental policies impacting winter production.

The Chinese Government is committed to reducing the nation’s financial vulnerabilities (including large public debt) and increasing environmental protection, which could affect investment and economic growth in the short term. In addition, the trade war with the US is expected to have a material impact on China’s economic activity by raising the cost of Chinese imports to the US. However, China’s large foreign exchange reserves will likely help to limit the fallout on its economy.

In an effort to stop the economy from slowing too sharply, the Government is expected to use fiscal stimulus (by cutting taxes and granting subsidies to industries that are directly impacted by the US tariffs) in the outlook period. The People’s Bank of China (PBoC) is also expected to loosen monetary policy by cutting bank reserve requirement ratios (RRR). The central bank has already reduced the RRR twice in the first 8 months of 2018. Chinese financial regulators have, for the time being, shelved the release of new rules aimed at reducing risky lending.
The Chinese Renminbi has dropped more than 6 per cent against the US dollar in 2018 (see Figure 2.7), as trade tensions mount, interest rate differentials deteriorate and economic growth slows to its lowest rate in almost two years. Any loosening in monetary policy is likely to see the Renminbi depreciate even further against the US dollar.

The Chinese Government may seek to limit the potential for further trade tensions with the US by moving to try to prevent further large declines in the Renminbi. On 3 August 2018, the PBoC imposed a 20 per cent reserve requirement on onshore Chinese foreign exchange forward transactions. This measure aims to reduce the downward pressure on the Renminbi, by making foreign exchange forward trading more expensive.

Figure 2.7: The US dollar and Chinese Renminbi

A weaker Renminbi reduces China’s demand for imported commodities — usually denominated in US dollars — relative to domestic output. This makes commodities such as coal, which China has plenty of reserves of its own, particularly vulnerable to substitution.

2.5 Other economies

Japan

Japan’s economy grew by 1.0 per cent year-on-year in the June quarter, propelled by a strong rebound in household consumption and a faster rise in business spending. Seasonal factors, such as early summer bonus payments and store sales, contributed to growth in private consumption. The hosting of the 2020 Summer Olympics is the main catalyst for rising capital expenditure. However, the June quarter saw weaker exports. The manufacturing PMI fell to 52.3 in August from 53.0 in July, as output rose at a slower pace and new orders rose the least since late 2016.

Figure 2.8: Japan’s government debt

Japan’s economic growth is forecast to slow to 0.3 per cent in 2020, as increased protectionism and rising energy costs affect investment and exports. A rise in global bond yields, particularly in the US, could possibly trigger Yen weakness and higher government interest payments. At 237 per cent of GDP, government debt levels are already very high (Figure 2.8). Japan’s dependence on exports as a driver of growth poses serious risks given the rising tensions over trade.
Europe
The Eurozone economy grew by 2.2 per cent year-on-year in the June quarter 2018, driven by increased consumer spending in Germany (the Eurozone’s largest economy), and increased construction output. In Germany, a record low unemployment rate and wage rises have lifted personal consumption.

The Eurozone’s manufacturing PMI fell to a 2-year low of 54.6 in August 2018, amid worries about the trade war and rising prices. Despite this decline, the Eurozone’s PMI is still well above 50 — indicating that the sector is still expanding firmly (Figure 2.9).

Eurozone business sales growth slowed in July 2018, as fears over a trade war with the US, and weaker global expansion, lowered investment optimism. Private consumption in the Eurozone has been relatively weak during the recent recovery; a pickup could offset some of the impact of a trade war with the US. Economic growth is forecast at 2.5 per cent in 2018, declining to 1.8 per cent in 2020.

Eurozone inflation rose to above the European Central Bank’s (ECB) 2.0 per cent target limit in the middle of the year. Inflation in the 19 countries sharing the euro rose to 2.1 per cent in July, from 2.0 per cent a month earlier, as a big surge in energy costs more than offset a muted rise in the price of services and industrial goods.

At its meeting in September, the ECB cut its growth forecast for the Eurozone but reaffirmed plans to continue withdrawing its monetary stimulus in the coming months, arguing that a benign picture at home offset turbulence in emerging economies.

In Turkey, diplomatic tensions and market concerns about the Turkish Government’s influence over monetary policy sent the Turkish Lira into a downward spiral in the September quarter. The Lira dropped 18 per cent on 10 August 2018 — the biggest one-day drop since Turkey’s 2001 financial crisis — reaching a new historic low (around 0.15 USD). The Lira has lost more than 40 per cent of its value against the US dollar in 2018. In an attempt to stop the currency from further falling, the Central Bank of Turkey raised its benchmark interest rates to 24 per cent on 13 September. The US doubled tariffs on imports of Turkish steel (to 50 per cent) and aluminium (to 20 per cent), following the detention of a US pastor. Markets are concerned about some European banks’ (including France’s BNP Paribas, Italy’s UniCredit, and Spain’s Banco Bilbao Vizcaya Argentaria) large exposures to Turkey.

Figure 2.9: Eurozone Composite PMI and Real GDP

Source: Bloomberg (2018); International Monetary Fund (2018)
South Korea

South Korea’s economy grew by 2.9 per cent year-on-year in the June quarter 2018, driven by exports of semiconductors and Chinese tourist arrivals. Export volumes increased by 0.8 per cent, while import volumes contracted by 2.6 per cent. Weak imports reflected some softness in domestic consumption. The rise in unemployment, and the depreciation of the South Korean Won against the US dollar, appear to have dampened consumer confidence and willingness to spend.

The trade war between the US and its trading partners is the biggest risk to the outlook for the South Korean economy. The country is heavily reliant on trade, with exports accounting for 42 per cent of GDP. A slowdown in the export sector is likely to weigh on growth over the coming quarters. South Korea’s PMI was at 49.9 in August 2018, marking the sixth consecutive month of contraction. This points to weakness in the overall economy.

The Bank of Korea (BoK) has held its base rate steady (at 1.5 per cent) for a fourth consecutive month, citing trade tensions and below target inflation. Economic growth is forecast to slow to 2.8 per cent in 2020.

India

India’s real GDP growth rate rose to 8.2 per cent year-on-year in the June quarter, as the recovery from the introduction of the goods and services tax (GST) gathers speed (Figure 2.10). The Indian GST has improved productivity, and provided the government with additional revenue to spend on social and infrastructure projects. India also continues to open up to foreign investors. However, the IMF has lowered GDP growth forecasts for India, reflecting rising energy costs and a faster than anticipated monetary policy tightening (due to higher than expected inflation).

The Indian Rupee (INR) fell to a new historic low on 11 September 2018. The fall in the currency has the potential to further compound the impact of the recent rise in oil prices on India, which is a large oil importing country.

The Indian economy is forecast to grow at an average annual rate of 7.7 per cent over the next two years — making it the world’s fastest growing economy.

Figure 2.10: Indian GDP, Quarterly YoY per cent growth

Table 2.1: Key world macroeconomic assumptions

<table>
<thead>
<tr>
<th>Per cent</th>
<th>2017</th>
<th>2018&lt;sup&gt;a&lt;/sup&gt;</th>
<th>2019&lt;sup&gt;a&lt;/sup&gt;</th>
<th>2020&lt;sup&gt;a&lt;/sup&gt;</th>
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<td>3.1</td>
<td>2.9</td>
</tr>
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<td>Eurozone</td>
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<tr>
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<td>1.7</td>
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<td>2.2</td>
<td>2.1</td>
<td>1.5</td>
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<tr>
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<td>0.9</td>
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<tr>
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<td>2.9</td>
<td>3.0</td>
</tr>
<tr>
<td>South Korea</td>
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<td>2.8</td>
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<td>1.5</td>
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<td>2.7</td>
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<td>ASEAN-5&lt;sup&gt;d&lt;/sup&gt;</td>
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<td>6.4</td>
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<td>2.0</td>
<td>2.0</td>
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<td>6.5</td>
<td>6.5</td>
<td>6.5</td>
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<tr>
<td>India</td>
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<td>7.3</td>
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<td>World&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>3.9</td>
<td>3.9</td>
<td>3.8</td>
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</tbody>
</table>

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 (2018) World Economic Outlook
Table 2.2: Exchange rate and inflation assumptions

<table>
<thead>
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<th></th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
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<tr>
<td><strong>AUD/USD exchange rate</strong></td>
<td>0.77</td>
<td>0.76</td>
<td>0.76</td>
<td>0.78</td>
</tr>
<tr>
<td><strong>Inflation rate</strong></td>
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<td></td>
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</tr>
<tr>
<td>United States</td>
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<td>100.0</td>
<td>102.2</td>
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<tr>
<td>Australia</td>
<td>95.9</td>
<td>97.8</td>
<td>100.0</td>
<td>102.4</td>
</tr>
</tbody>
</table>

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 2018 dollars.


<sup>1</sup> Productivity Commission (2017) Rising protectionism: challenges, threats and opportunities for Australia, Canberra
Steel

To produce 1,000 kg of crude steel in a blast furnace, 1,400 kg of iron ore are needed. Additionally, 800 kg of metallurgical coal are needed.

Steel consumption per capita (kilograms per person), 2017:
- United States: 327 kg
- European Union: 335 kg
- China: 568 kg
- India: 72 kg
- Japan: 592 kg
- Indonesia: 58 kg
- Africa: 30 kg
- Australia: 270 kg

Major steel producers, 2017:
- China: 49%
- European Union: 10%
- Rest of the world: 16%
  - Japan: 6%
  - India: 6%
  - United States: 5%
  - South Korea: 4%
  - Russia: 4%

Steel use by sector:
- 50% Construction
- 16% Mechanical machinery
- 15% Other applications
- 13% Automotive
- 4% Electrical equipment
- 2% Domestic appliances
3.1 Summary

- World steel production increased strongly in the seven months to July compared to last year, driven by high steel prices and margins, robust production in China — the world’s largest steel maker — and a rise in the capacity utilisation of steel mills in major producing nations.
- World steel production is forecast to rise to 1.8 billion tonnes in 2020, as broad growth elsewhere offsets declining production in China — where ongoing supply-side reforms continue to reduce capacity.
- World consumption is forecast to rise to 1.8 billion tonnes in 2020, led by growth in emerging markets, while China — the world’s largest consumer — is forecast to decline by 0.5 per cent annually, driven by an expected slow-down in infrastructure projects and construction.
- The threat of escalating protectionist trade policies is a key risk to the outlook, with the potential to disrupt downstream demand for steel related products and vehicle manufacturing.

3.2 World consumption and production

World steel production increased by 5.1 per cent in the seven months to July, compared to the same period in 2017. Most countries reported higher production, particularly China which accounts for half of world production.

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

Chinese steel production increased by 6.8 per cent year-on-year in the seven months to July, driven by high prices and margins. China’s steel prices were supported by strong domestic demand. China’s apparent steel consumption (production plus net imports), increased by 8.6 per cent year-on-year in the seven months to July, driven by stronger demand from the construction sector and, to a lesser extent, from vehicle production.

Profit margins for Chinese steel makers were historically high in the June quarter, however, higher input costs in July and August have since reduced these high profit margins. The impact of ongoing supply-side reforms in China — reducing some loss-making steel mill capacity — have propelled capacity utilisation rates to historically high levels, reaching 78 per cent in June 2018 (Figure 3.1).

China’s steel production forecast to peak in 2018

China’s steel production is forecast to increase in 2018. Production growth was stronger than expected in the first half of 2018, and will likely grow in the September quarter, as steel makers bring forward production ahead of government-mandated winter production restrictions — expected to apply from October 2018 to March 2019.

Upcoming winter production cuts are expected to have a greater impact on Chinese steel makers than they did the same period last year. The 2018–19 winter restrictions aim to reduce blast furnace capacity at selected cities by 30–50 per cent. Over 440 million tonnes of steel capacity is expected to be affected by the pollution controls, which will likely lower the demand for steel-making inputs, iron ore and metallurgical coal.

Chinese steel consumption is forecast to increase by 2.8 per cent in 2018, driven by strong demand from the construction sector as ‘Tier 2’ (medium sized) cities continue to develop at a rapid pace. Steel consumption is also expected to be boosted by fiscal stimulus which will likely create favourable conditions for residential construction over the short term.
China’s steel consumption is forecast to decline by 1.9 per cent in 2019 and by a further 2.3 per cent to 776 million tonnes in 2020, largely driven by slower urban residential construction and infrastructure investment.

China’s steel production is expected to decline over the outlook period to 2020, driven by a suite of government policies, including stricter environmental regulations, supply-side reforms reducing some loss-making production capacity, and measures to reduce debt.

China’s steel exports decreased by 13 per cent year-on-year in the first eight months of 2018 to 47 million tonnes, as strong domestic demand absorbed more local output. Exports are expected to be increasingly directed towards emerging markets in South East Asia, however, lower production will limit the potential for strong export growth (Figure 3.2).

**Figure 3.2: China’s steel consumption, production and exports**

![Graph showing China's steel consumption, production, and net exports from 2014 to 2020](image)


India set to become the second largest steel producer in 2018

Indian crude steel production increased by 5.5 per cent year-on-year in the first seven months of 2018 to 62 million tonnes. India is expected to overtake Japan as the world’s second largest steel producer in 2018, with production reaching 108 million tonnes. Production will be driven by the ongoing expansion of steel-making capacity, as producers strive to keep pace with rising Indian consumption. India’s steel consumption is forecast to grow strongly over the outlook period, driven by rapid urban population growth, substantial government investment in infrastructure, housing and urban development, and a growing manufacturing sector. India’s steel output is forecast to grow by 6.7 per cent annually to reach 123 million tonnes in 2020, representing 7.0 per cent of world production.

Favourable economic conditions supporting the steel industry elsewhere

Steel production in the European Union increased by 2.0 year-on-year in the first seven months of 2018, to 102 million tonnes. Production in the EU has been buoyed by higher steel prices driven by growth in the construction and manufacturing sectors. Steel output in the EU is forecast to remain steady over the outlook period, increasing by 1.3 per cent annually from 172 million tonnes in 2017 to 175 million tonnes in 2020.

Japan’s steel production increased by 0.8 per cent year-on-year in the first seven months of 2018, to 61 million tonnes. Steel production in Japan is forecast to grow modestly in the short-term, supported by a rebound in capital expenditure and demand from 2020 Olympics-related projects.

Protectionist trade policies are a key risk to the outlook for both regions, especially with the US now considering tariffs on vehicle imports.

Steel output in United States to be boosted by tariffs on imports

Steel production in the United States grew by 3.6 per cent year-on-year in the first seven months of 2018, driven by rising domestic steel prices. US steel tariffs appear to be impacting the market — US Hot Rolled Coil (HRC) steel prices increased from US$647 a short tonne in January to US$913 a short tonne in August. The capacity utilisation of US steel mills increased to 78 per cent in August — the highest since September 2014.

Imports of steel products subject to the 25 per cent tariff increased by 14 per cent year-on-year in the six months of 2018, as US residents brought forward purchases before the tariffs took effect. However, the tariffs are expected to reduce steel imports over the outlook period.
Table 3.1: World steel consumption and production

<table>
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<th>Crude steel consumption</th>
<th>2017(^s)</th>
<th>2018(^f)</th>
<th>2019(^f)</th>
<th>2020(^f)</th>
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<td>1,759</td>
<td>1,762</td>
<td>1,758</td>
<td>3.5</td>
<td>0.2</td>
<td>–0.2</td>
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<td>China</td>
<td>788</td>
<td>810</td>
<td>794</td>
<td>776</td>
<td>2.8</td>
<td>–1.9</td>
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<td>European Union 28</td>
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<td>112</td>
<td>111</td>
<td>4.0</td>
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<td>96</td>
<td>102</td>
<td>108</td>
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<td>59</td>
<td>59</td>
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<table>
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<tr>
<th>Crude steel production</th>
<th>2017</th>
<th>2018(^f)</th>
<th>2019(^f)</th>
<th>2020(^f)</th>
<th>2018(^f)</th>
<th>2019(^f)</th>
<th>2020(^f)</th>
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<td>1,771</td>
<td>1,768</td>
<td>1,759</td>
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<td>861</td>
<td>842</td>
<td>4.2</td>
<td>–2.8</td>
<td>–2.2</td>
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<tr>
<td>European Union 28</td>
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<tr>
<td>Japan</td>
<td>105</td>
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<td>India</td>
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<td>United States</td>
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<td>72</td>
<td>0.6</td>
<td>0.2</td>
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<tr>
<td>South Korea</td>
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<tr>
<td>Brazil</td>
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<td>34</td>
<td>34</td>
<td>34</td>
<td>–1.2</td>
<td>0.3</td>
<td>0.8</td>
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</tbody>
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Notes: \(^s\) estimate \(^f\) forecast.
Source: World Steel Association (2018); Department of Industry, Innovation and Science (2018)
Iron Ore
Resources and Energy Quarterly September 2018

Australia is the largest exporter of iron ore in the world.

849 million tonnes exported in 2017-18
That's enough to build 10,050 Sydney Harbour bridges

29% largest iron ore reserves in the world

$61 billion exported in 2017–18

Major Australian iron ore deposits (Mt)
- <229
- 230–813
- 814–1,777
- 1,778–3,042
- 3,043–5,446
- >5,447

Map showing deposits and operating mines.

Global share of iron ore exports in 2017
- 52% Australia
- 24% Brazil
- 4% South Africa
- 3% Canada
- 2% Ukraine
- 15% Rest of the world

Australia’s iron ore key export destinations, 2017–18
- 83% China
- 8% Japan
- 6% South Korea
- 2% Taiwan
- 1% Rest of the world

Global share of iron ore imports in 2017
- 69% China
- 9% European Union
- 8% Japan
- 5% South Korea
- 16% Rest of the world
4.1 Summary

- The iron ore price is forecast to decline to US$51 a tonne (FOB Australia) in 2020, as a result of a forecast decline in steel production in China and a well-supplied seaborne iron ore market.
- Australia’s iron ore export volumes are forecast to increase from 849 million tonnes in 2017–18, to 878 million tonnes in 2019–20, driven by a ramp up in production from Australia’s largest producers.
- The value of Australia’s iron ore exports is forecast to decline from $61 billion in 2017–18 to $56 billion in 2019–20, with lower prices more than offsetting growth in export volumes.

4.2 Prices

Iron ore prices diverge on quality

The FOB (free on board) Australia iron ore price (62% Fe) — the price at which most Australian iron ore is sold — decreased by 13 per cent year-on-year in the September quarter 2018, to average US$56 a tonne. Lower grade ores lagged behind high grade ore (65% Fe CFR), which increased by 11 per cent over the same period, in line with higher steel prices.

Figure 4.1: Iron ore and steel prices

The price difference between premium and lower grade ores has widened throughout 2018 (Figure 4.1), driven by Chinese steel makers’ increasing preference for high grade ores to maximise production and comply with more stringent environmental policies. Higher prices for premium ores diminished profit margins for Chinese steel makers in the three months to August. Nonetheless, profits remain high and steel makers continue to prefer high grade ores (largely supplied by Brazil) as well as greater use of scrap to maximise steel production.

High steel prices, and China’s ongoing government push to improve air quality through increasingly stringent air pollution policies, are expected to maintain the price premium for high grade iron ore and discounts for impurities contained in iron ore, namely alumina and silica.

Figure 4.2: Iron ore price, FOB Australia and CFR China, quarterly

The iron ore price is forecast to gradually decline to average US$52 a tonne (FOB Australia) in 2019 and US$51 a tonne in 2020, as a result of declining demand, a well-supplied seaborne market and growing supply of Chinese steel scrap (Figure 4.2). The supply of high grade ores (65% Fe) and...
pellets from Brazil is expected to increase as Vale’s S11D project continues to ramp up, and their Sao Luis pellet plant restarts this September quarter — expected to raise pellet production to 55 million tonnes. The demand for, and supply of, high iron content alternatives is expected to weigh on the (62% Fe) iron ore price over the outlook period.

China’s steel sector is expected to continue to be affected by ongoing capacity reductions and policies to address air pollution (see the Steel chapter). Recently announced winter production cuts are likely to weaken the demand for iron ore between mid-November 2018 and mid-March 2019, and thus weigh on iron ore prices, especially for lower grade ores.

4.3 World trade

World exports are forecast to rise by 1.3 per cent annually to 1,621 million tonnes in 2020, as new mines and expansions ramp up in Australia and Brazil. Emerging markets are expected to increasingly drive import demand for iron ore, while demand from China — the world’s largest importer — is set to decline, driven by lower steel production (see the Steel chapter).

China’s iron ore imports projected to gradually decline

China’s iron ore imports were subdued over the eight months to August, declining by 0.6 per cent year-on-year. The lacklustre demand for iron ore imports is at odds with strong growth in steel production over the same period. Weaker-than-expected import demand was driven by a rundown in inventories as well as greater use of scrap, pellets and high grade iron ores, which displaced lower grade ores in steel making.

The sharp decline in the Renminbi over the past four months makes new imports relatively more expensive than the (mainly low grade) inventories of ore that have been building in Chinese ports over the past year. As a result, imports may slow until these inventories have been drawn down.

China’s iron ore imports are forecast to gradually decline at an average annual rate of 1.7 per cent over the outlook period, to 1.02 billion tonnes in 2020.
Growth elsewhere unlikely to offset lower Chinese demand

Import demand from emerging economies (excluding China) is forecast to grow over the outlook to 2020, partially offsetting the expected decline from China. India’s iron ore production is forecast to reach 197 million tonnes in 2020, underpinned by rapidly growing demand from its domestic steel industry. However, Indian consumption of iron ore is expected to exceed domestic production marginally in 2019, and by over 5 million tonnes in 2020, making India a net importer of iron ore.

World export volumes forecast to rise, primarily from Brazil

The seaborne iron ore market is forecast to be well-supplied in the short term, with world iron ore exports forecast to grow by 3.2 per cent and 1.1 per cent year-on-year in 2018 and 2019, respectively. Exports from Brazil are forecast to grow by 4.1 per cent and 7.8 per cent over the same period, reaching 430 million tonnes by 2019. The rise in Brazilian output comes as Vale’s S11D project at the Carajás complex ramps up production. Anglo American’s Minas-Rio expansion is also expected to reach full capacity of 26.5 million tonnes by 2020.

Seaborne iron ore trade is forecast to taper in 2020, declining by 0.3 per cent year-on-year, driven by higher domestic consumption in emerging markets displacing some exports (mainly from India). The world’s two largest exporters (Australia and Brazil) are expected to increase market share, with iron ore exports to reach 881 and 437 million tonnes in 2020, respectively, as both major producers reach record production targets.

4.4 Australia

Record iron ore export volumes in 2017–18

Australia’s iron ore export volumes grew by 3.8 per cent to 849 million tonnes in 2017–18, setting a new record high. Growth was driven by Australia’s two largest producers (Rio Tinto and BHP) as they continued to ramp up towards record production levels. Rio Tinto’s output has increased following the ramp up of the Silvergrass operations and improvements to rail infrastructure.
Australian export volumes are expected to increase by 2.3 per cent to 869 million tonnes in 2018–19, and by a further 1.0 per cent to 878 million tonnes in 2019–20, as expansions and additions are completed. Higher volumes should be supported by productivity improvements, and by replacement mines at Rio Tinto’s and BHP’s operations, as both companies attempt to reach their long-term production targets.

BHP is expected to expand capacity at its Port Hedland operations, with output forecast to reach 290 million tonnes by mid-2019. The company has also committed US$2.9 billion in capital expenditure for the South Flank iron ore project in Western Australia. South Flank is expected to produce 80 million tonnes annually from 2020 onwards, replacing the existing production of Yandi as it ramps down by 2022. Fortescue Metal Group’s Eliwana mine in the Pilbara region of Western Australia, is expected to produce 30 million tonnes annually commencing in 2020.

**Australia’s iron ore export earnings to be weighed down by lower prices**

Despite high production and export volumes, lower prices led to a fall in export earnings to $61 billion in 2017–18. This was 2.2 per cent lower than in 2016–17. The majority of Australian iron ore is of medium or lower grade, for which prices have been subdued over much of 2018.

Export values are forecast to be steady in 2018–19 and then decline to $56 billion in 2019–20. Export earnings are expected to be undermined by lower iron ore prices, offsetting higher volumes.

**Iron ore export earnings have been revised up**

Export earnings have been revised up by $2.6 billion in 2018–19 since the June Resources and Energy Quarterly. The upwards revision reflects a weaker outlook for the Australian dollar. Export earnings remain broadly unchanged in 2019–20, as revised lower volumes are offset by the more favourable outlook for the exchange rate. The price outlook remains broadly unchanged in US dollar terms at US$51 a tonne in 2020.
### Table 4.1: World trade in iron ore

<table>
<thead>
<tr>
<th></th>
<th>Million tonnes</th>
<th>Annual percentage change</th>
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<tbody>
<tr>
<td><strong>Total world trade</strong></td>
<td>1,554</td>
<td>1,605</td>
</tr>
<tr>
<td><strong>Iron ore imports</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>1,075</td>
<td>1,059</td>
</tr>
<tr>
<td>European Union 28</td>
<td>144</td>
<td>157</td>
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<tr>
<td>Japan</td>
<td>127</td>
<td>131</td>
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<tr>
<td>South Korea</td>
<td>72</td>
<td>76</td>
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<tr>
<td>India</td>
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<td>8</td>
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<tr>
<td><strong>Iron ore exports</strong></td>
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<tr>
<td>Australia</td>
<td>827</td>
<td>858</td>
</tr>
<tr>
<td>Brazil</td>
<td>384</td>
<td>399</td>
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<tr>
<td>Ukraine</td>
<td>33</td>
<td>32</td>
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<tr>
<td>India</td>
<td>29</td>
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**Notes:** s Estimate; f Forecast.

**Source:** World Steel Association (2018); International Trade Centre (2018); Department of Industry, Innovation and Science (2018)
### Table 4.2: Iron ore outlook

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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>– nominal</td>
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<td>– reald</td>
<td>US$/t</td>
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<td>59.1</td>
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<td>6.8</td>
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**Notes:** b fob Australian basis; c Spot price, 62 per cent iron content basis; d In 2018 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 (2018) International Trade in Goods and Services, Australia, 5368.0; Bloomberg (2018) Metal Bulletin; World Steel Association (2018); AME Group (2018); Company Reports; Department of Industry, Innovation and Science (2018)
Metallurgical Coal

Resources and Energy Quarterly September 2018

1st

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.

It takes more than 200 tonnes of world production in 2017 to make every wind turbine.

179 million tonnes exported in 2017–18 valued at $38 billion.

Share of world metallurgical coal exports, 2017

Australia

USA

Canada

Mongolia

Russia

Other

Share of world metallurgical coal imports, 2017

China

India

Japan

European Union

South Korea

Taiwan

Rest of the world

Australia’s metallurgical coal key export earnings by destination, 2017–18

Taiwan

Other

Japan

China

India

South Korea

Netherlands
5.1 Summary

- Metallurgical coal prices have been supported by strong import demand from both China and India. Some further near-term support is expected amidst persistently high steel margins in China.
- The premium hard coking coal spot price is forecast to decline from an average of US$197 a tonne in 2018 to US$145 a tonne in 2020. The impacts of improved supply and weakening demand from China are expected to outweigh the impact of growing demand in India.
- Australia’s export volumes are forecast to grow from 179 million tonnes in 2017–18 to 198 million tonnes in 2019–20. This reflects an expected recovery from supply disruptions and modest production growth.
- Australia’s metallurgical coal export earnings reached a record $38 billion in 2017–18, driven by strong prices. Export earnings are forecast to fall to $31 billion in 2019–20, as rising export volumes are partly offset by lower prices.

5.2 Prices

Near-term support expected for the metallurgical coal price

The premium hard coking coal (HCC) spot price (FOB Australia) averaged an estimated US$187 a tonne in the September quarter, down by 16 per cent quarter-on-quarter and 2.0 per cent year-on-year. Prices earlier in the quarter were weighed down by growth in global exports, but strong import demand from both China and India drove a subsequent rebound in the price. Some ongoing near-term price support is expected. China’s imports of metallurgical coal are expected to remain elevated over the next couple of months as steel margins remain high, and as steel producers bring forward production before the winter production cuts.

Beyond 2018, the premium HCC spot price is forecast to decline from an average of US$197 a tonne in 2018 to US$157 a tonne in 2019 and US$145 a tonne in 2020, weighed down by softening demand from China and supply growth from a number of new projects around the world. Nevertheless, with strong demand growth expected from India, the price is expected to remain well above the lows of 2016 (Figure 5.1).

5.3 World trade

World export trade in metallurgical coal grew by a solid 4.5 per cent in 2017 to 327 million tonnes, driven by firm economic growth and consequently strong growth in steel output around the world. However, the momentum that has driven the upswing in global economic activity appears to have peaked, with leading indicators, such as world industrial production, pointing to slowing growth in the future. Growth in world metallurgical coal trade is forecast to slow to an annual average of 1.8 per cent over the outlook period.

India is forecast to be the key source of import growth, driven by the ongoing expansion of its domestic steel sector (Figure 5.2). While Australia will comfortably remain the largest exporter of metallurgical coal — accounting for a forecast 57 per cent of the seaborne market in 2020 — this represents a decline from 60 per cent in 2016. Other countries, including Canada, Russia and Mozambique, are expected to increase their exports and market share.
World imports

China’s metallurgical coal imports expected to drift lower

In line with expectations, China’s metallurgical coal imports rebounded after a slow start to the year, growing by an estimated 23 per cent year-on-year from May to July 2018. Strong steel margins have driven steel output to record highs. At the same time, domestic production of coal has declined, driving demand for imports higher.

China’s imports of metallurgical coal are expected to remain elevated over the next couple of months, with steel producers expected to bring forward production ahead of the winter production cuts that will begin in November. However, the enforced production cuts are bigger in coverage and scale than the previous year’s, and are thus likely to have more of an impact on net steel production and on demand for metallurgical coal.

The trajectory of China’s imports largely depends on domestic production, which accounts for around 90 per cent of total metallurgical coal consumption. If domestic output remains lower than expected, this could have a positive effect on import demand. China’s imports of metallurgical coal are forecast to drift lower over the outlook period, as steel production gradually declines and as safety and environmental regulations ease and domestic coal output picks up.

India expected to become the largest metallurgical coal importer by 2020

India’s imports of metallurgical coal grew by 26 per cent year-on-year to 28 million tonnes in the first half of 2018. Growth in metallurgical coal imports has been driven by the ongoing expansion of India’s steel sector, with steel production increasing by 8.8 per cent over the same period.

Australia’s share of India’s metallurgical coal imports has declined from around 90 per cent in the March quarter of 2017 (just before Cyclone Debbie) to 75 per cent in the June quarter of 2018. India’s steel mills have increasingly turning to the United States and Canada as an alternative source of supply, as a result of high prices and disruptions to Australian supply, particularly after Cyclone Debbie in 2017. Import growth from the United States is expected to soften as prices decline and production falls.

India is forecast to overtake China as the world’s largest importer of metallurgical coal by 2020, with India’s imports set to grow steadily over the outlook period. India has limited domestic reserves of metallurgical coal, and will need to increase imports to support the rapid growth of its domestic steel industry.

Japan’s imports of metallurgical coal to grow modestly

Japan’s metallurgical coal imports have been broadly steady year-on-year in the June quarter of 2018, after a decline in the March quarter. Stabilising imports reflect stronger growth in steel production, which is expected to continue over the outlook period, supported by robust domestic demand from the construction sector.

Marginal decline forecast for South Korea’s metallurgical coal imports

South Korea’s imports of metallurgical coal declined by 5.8 per cent year-on-year in year to July, and imports are forecast to remain subdued over the outlook period. South Korea’s steel sector has been affected by soft domestic demand and declining exports, which have been subject to a range of anti-dumping and protectionist measures implemented by the United States, European Union, and Canada.

Figure 5.2: Metallurgical coal imports in Asia

Notes: 2018 and onwards are forecasts.
Source: IEA (2018); Department of Industry, Innovation and Science (2018)
World exports

Resilient prices have led to a lift in supply through increased production, the restart of idled operations, and decisions to proceed with the development of new mines around the world, including in Australia (Figure 5.3).

Russia and Mozambique’s exports are forecast to grow

While Russia’s metallurgical coal exports have remained broadly steady year-on-year, they are forecast to increase over the outlook period, as projects in the east — where there are substantial untapped deposits — are developed. Notably, the Elga mine is expected to gradually ramp up and produce over 28 million tonnes annually at full capacity.

Exports from Mozambique have grown substantially, although from a low base, as the Moatize mine reached record production in the June quarter of 2018. Exports are forecast to grow, as the mine continues to ramp up to a target of 22 million tonnes annually by 2022. Exports will also be supported by the development of the Nacala Logistics Corridor, which will reduce transport costs from mine to port.

Strong growth from North America, but US exports forecast to decline

Exports from Canada increased by 9.6 per cent year-on-year to 15 million tonnes in the first half of 2018, driven by strong demand from India and, to a lesser extent, Japan and South Korea. Canada’s export growth is forecast to slow as prices decline, with exports forecast to grow at an average annual rate of 1.5 per cent in 2019 and 2020.

Metallurgical coal exports from the United States have steadily increased, growing by 24 per cent to 29 million tonnes in the first half of 2018. The growth has been primarily driven by a surge in exports to India, which more than doubled over the same period. Exports to China and Japan have also grown substantially.

China’s Ministry of Commerce imposed a 25 per cent tariff on coal from the United States, which came into effect on 23 August 2018. This tariff makes coal from the United States — which already faces higher freight costs than other exporters — uncompetitive in Chinese markets.

Nevertheless, the tariffs are not expected to have a substantial impact on exports of metallurgical coal from the United States, with China accounting for only 5.8 per cent of exports in the first half of 2018.

An expected softening of prices is expected to have more of an impact, with exports from the United States forecast to drift lower over the outlook period as some of the higher cost operations are rendered uneconomic.

Mongolia’s exports expected to be constrained

While Mongolia has substantial reserves of metallurgical coal, exports have been constrained as a result of transportation bottlenecks at the China border. Substantial investment into road and rail infrastructure will be required for any substantial export growth. Earlier in 2018, Aspire Mining signed a memorandum of understanding for the construction of a railway to link the Ovoot mining area to the existing Erdenet railway. The proposed project will eventually enable coal from Mongolia’s Ovoot mining area to be transported via the Trans-Mongolian railway. In the meantime, however, Mongolia’s coal exports are forecast to remain subdued.

Figure 5.3: Annual change in world metallurgical coal exports

Source: IEA (2018); Department of Industry, Innovation and Science (2018)
Modest recovery in Australia’s coal exploration expenditure

In the June quarter of 2018, Australia’s coal exploration expenditure totaled $45 million, the highest quarterly expenditure since 2015, and an increase of 24 per cent from the March quarter of 2018, and of 74 per cent year-on-year. Australia’s coal exploration expenditure totaled $156 million in 2017–18, up 29 per cent from 2016–17 (Figure 5.4).

The recovery in coal exploration expenditure reflects firmer prospects for the sector, on the back of the recent improvement in market conditions. Earlier in 2018, the Queensland Government called for tenders to explore for coal across more than 540 square kilometers in the Bowen, Surat and Galilee Basins.

A record high in metallurgical coal export earnings

In 2017–18, the value of Australia’s metallurgical coal exports grew by 6.7 per cent to a record $38 billion, primarily driven by stronger prices (Figure 5.5).

Despite 2016–17 volumes being severely affected by Cyclone Debbie, export volumes in 2017–18 grew only modestly by 0.9 per cent, or 1.7 million tonnes, to 179 million tonnes. Export volumes in 2017–18 have been weighed down by weather and infrastructure related disruptions, such as congestion at ports. The narrowing gap between the price of semi-soft metallurgical coal and thermal coal has also seen some semi-soft cargoes sold in to thermal coal markets. Semi-soft coal can be sold as thermal coal without going through the process and costs of washing the coal.

Nevertheless, production growth has been strong across several operations, notably at BHP and Anglo American’s operations where record production volumes were achieved in 2017–18.
Metallurgical coal export earnings forecast to drift lower

Australia’s metallurgical coal export earnings are forecast to decline by 3.8 per cent to $36 billion in 2018–19, and by a further 16 per cent to $31 billion in 2019–20, driven by a forecast decline in prices (Figure 5.5). A forecast increase in production and export volumes is expected to partially offset the impact of softer prices (Figure 5.6). Metallurgical coal export volumes are forecast to grow by 7.2 per cent in 2018–19 to 192 million tonnes, and by a further 3.1 per cent to 198 million tonnes in 2019–20.

Several idled mines are expected to restart over the outlook period, including Sojitz’s recently acquired Gregory Crinum, Baralaba Coal’s Baralaba, and Bounty Mining’s Cook operations, all in the Bowen Basin (Table 5.1). The ramp up of Qcoal’s newly-started Byerwen mine and Stanmore’s Isaac Plains East mine, and planned expansions and productivity improvements at Anglo American and BHP’s operations are also expected to support production growth over the outlook period. Just beyond the outlook period, Pembroke Resource’s Olive Downs project is targeting first coal in the second half of 2020.

In February 2018, Aurizon implemented changes to the maintenance and operating practices for the Central Queensland Coal Network (CQCN) in response to the Queensland Competition Authority’s (QCA) draft access undertaking proposal (UT5). Aurizon have noted that the maintenance changes have resulted in potential lost capacity of 7 to 8 million tonnes in 2017–18, however all current contractual obligations have been met. There is some uncertainty regarding the future impacts of changes to the maintenance regime of the CQCN. The QCA is expected to hand down its final decision on UT5 by the end of 2018.

Revisions to the outlook

The forecasts for Australia’s metallurgical coal export earnings are broadly unchanged from the June 2018 Resources and Energy Quarterly.

Table 5.1: Selected upcoming metallurgical coal projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Company</th>
<th>Development type</th>
<th>Capacity* (Mt)</th>
<th>Estimated start date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isaac Plains East</td>
<td>Stanmore Coal</td>
<td>Greenfield</td>
<td>1.2</td>
<td>2018</td>
</tr>
<tr>
<td>Cook</td>
<td>Bounty Mining</td>
<td>Restart</td>
<td>1.5–2</td>
<td>2018</td>
</tr>
<tr>
<td>Baralaba North</td>
<td>Baralaba Coal</td>
<td>Restart</td>
<td>2–3</td>
<td>2018</td>
</tr>
<tr>
<td>Gregory/Crinum</td>
<td>Sojitz</td>
<td>Restart</td>
<td>2</td>
<td>2019</td>
</tr>
<tr>
<td>Olive Downs</td>
<td>Pembroke Resources</td>
<td>Greenfield</td>
<td>4 (First stage)</td>
<td>2020 (under assessment)</td>
</tr>
</tbody>
</table>

Notes: *Estimated annual ultimate saleable capacity in million tonnes
Source: Company reports; IHS Markit (2018); AME Group (2018)
### Table 5.2: World trade in metallurgical coal

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>2017</th>
<th>2018&lt;sup&gt;f&lt;/sup&gt;</th>
<th>2019&lt;sup&gt;f&lt;/sup&gt;</th>
<th>2020&lt;sup&gt;f&lt;/sup&gt;</th>
<th>2018&lt;sup&gt;f&lt;/sup&gt;</th>
<th>2019&lt;sup&gt;f&lt;/sup&gt;</th>
<th>2020&lt;sup&gt;f&lt;/sup&gt;</th>
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</thead>
<tbody>
<tr>
<td><strong>World trade</strong></td>
<td>Mt</td>
<td>327</td>
<td>332</td>
<td>345</td>
<td>346</td>
<td>1.6</td>
<td>3.8</td>
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<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>China</td>
<td>Mt</td>
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<td>74</td>
<td>72</td>
<td>69</td>
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<td>Mt</td>
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<td>48</td>
<td>49</td>
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<td>1.8</td>
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<td>India</td>
<td>Mt</td>
<td>47</td>
<td>56</td>
<td>64</td>
<td>73</td>
<td>18.4</td>
<td>15.2</td>
<td>13.2</td>
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<td>European Union 28</td>
<td>Mt</td>
<td>44</td>
<td>47</td>
<td>48</td>
<td>49</td>
<td>4.9</td>
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<td>2.8</td>
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<td>–1.0</td>
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<td><strong>Metallurgical coal exports</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>Mt</td>
<td>173</td>
<td>180</td>
<td>198</td>
<td>199</td>
<td>4.0</td>
<td>10.4</td>
<td>0.3</td>
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<td>United States</td>
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<td>53</td>
<td>45</td>
<td>41</td>
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<td>–15.2</td>
<td>–8.3</td>
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<td>Mt</td>
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<td>30</td>
<td>31</td>
<td>31</td>
<td>4.8</td>
<td>1.5</td>
<td>1.5</td>
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<tr>
<td>Russia</td>
<td>Mt</td>
<td>23</td>
<td>25</td>
<td>26</td>
<td>26</td>
<td>8.0</td>
<td>4.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Mozambique</td>
<td>Mt</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>13</td>
<td>31.0</td>
<td>19.8</td>
<td>21.1</td>
</tr>
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</table>

Notes: <sup>f</sup> Forecast.

Source: IHS (2018); Department of Industry, Innovation and Science (2018)
Table 5.3: Metallurgical coal outlook

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<thead>
<tr>
<th>World</th>
<th>Unit</th>
<th>2017</th>
<th>2018(^f)</th>
<th>2019(^f)</th>
<th>2020(^f)</th>
<th>2018(^f)</th>
<th>2019(^f)</th>
<th>2020(^f)</th>
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<td></td>
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<tr>
<td>– nominal</td>
<td>US$/t</td>
<td>210</td>
<td>201</td>
<td>159</td>
<td>145</td>
<td>–4.1</td>
<td>–21.1</td>
<td>–8.8</td>
</tr>
<tr>
<td>– real(^d)</td>
<td>US$/t</td>
<td>215</td>
<td>201</td>
<td>156</td>
<td>140</td>
<td>–6.5</td>
<td>–22.8</td>
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<td><strong>Spot prices(^g)</strong></td>
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<td></td>
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<td></td>
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<td>– nominal</td>
<td>US$/t</td>
<td>190</td>
<td>197</td>
<td>157</td>
<td>145</td>
<td>4.0</td>
<td>–20.6</td>
<td>–7.7</td>
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<tr>
<td>– real(^d)</td>
<td>US$/t</td>
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<td>197</td>
<td>153</td>
<td>140</td>
<td>1.5</td>
<td>–22.4</td>
<td>–8.7</td>
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<td><strong>Australia</strong></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production(^s)</td>
<td>Mt</td>
<td>184</td>
<td>180</td>
<td>191</td>
<td>201</td>
<td>–1.9</td>
<td>5.7</td>
<td>5.2</td>
</tr>
<tr>
<td>Export volume</td>
<td>Mt</td>
<td>177</td>
<td>179</td>
<td>192</td>
<td>198</td>
<td>0.9</td>
<td>7.2</td>
<td>3.1</td>
</tr>
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<td>– nominal value</td>
<td>A$m</td>
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<td>37,687</td>
<td>36,269</td>
<td>30,556</td>
<td>6.7</td>
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<td>– real value(^l)</td>
<td>A$m</td>
<td>36,845</td>
<td>38,554</td>
<td>36,269</td>
<td>29,832</td>
<td>4.6</td>
<td>–5.9</td>
<td>–17.7</td>
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Notes: \(d\) In 2018 US dollars. \(e\) Contract price assessment for high-quality hard coking coal. \(f\) forecast. \(g\) Hard coking coal fob Australia east coast ports. \(s\) estimate. Source: ABS (2018) International Trade in Goods and Services, Australia, 5368.0; Department of Industry, Innovation and Science (2018); IHS (2018)
Australia is the second largest thermal coal exporter in the world.

Around 80% of Australia’s thermal coal is exported.

1 tonne of coal powers the average Australian household for approximately 4 months.

Australia’s thermal coal export earnings by destination, 2017–18

- Japan: 44%
- China: 21%
- South Korea: 13%
- Taiwan: 11%
- Malaysia: 3%
- India: 2%
- Other: 6%

203 million tonnes exported in 2017–18, valued at $22.6 billion

Share of world trade (2017)

- Rest of World: 20%
- United States: 11%
- Indonesia: 37%
- Australia: 20%
- Russia: 14%
- Columbia: 8%
- South Africa: 7%

- Japan: 14%
- Europe: 18%
- China: 19%
- South Korea: 13%
- Taiwan: 10%
6.1 Summary

- Australian thermal coal prices have been supported in recent months, driven by strong demand in Asia. However, the Newcastle benchmark spot price is forecast to decline from an average of US$105 a tonne in 2018 to US$75 a tonne in 2020, as demand growth slows.
- Australia’s export volumes are forecast to grow from 203 million tonnes in 2017–18 to 208 million tonne in 2019–20, reflecting a recovery from supply disruptions in Australia in 2017, and modest production growth from new capacity and productivity improvements.
- Australia’s thermal coal export earnings reached a record $23 billion in 2017–18, driven by strong prices. Export earnings are forecast to reach a new record of $25 billion in 2018–19, before declining to $19 billion in 2019–20, as lower prices offset rising export volumes.

6.2 Prices

Prices are forecast to be weighed down by softening demand

The Newcastle benchmark spot price surged to a six-year high of over US$120 a tonne in July, before softening as temperatures cooled and hydro output increased in China. Nevertheless, demand from China and India have been robust, driven by strong power demand and constrained domestic thermal coal output. The thermal coal spot price averaged an estimated US$117 a tonne in the September quarter, up 13 per cent on the quarter and 25 per cent on the year (Figure 6.1).

The divergence between prices for higher and lower quality coal continued to grow in the September quarter, primarily driven by softening demand from China for lower energy content coal.

In August, it was confirmed that Glencore and several Japanese utilities settled the thermal coal contract for April 2018 to March 2019 at US$110 a tonne. This follows the abandoned negotiations between Glencore and Japan’s Tohoku Electric Power (traditionally the lead negotiator for the Japanese reference price) earlier in the year, which resulted in the Asian thermal coal market being left without an industry benchmark.

Figure 6.1: Thermal coal spot prices, weekly

Smaller market participants were left to look to index-linked pricing and term contracts between other smaller buyers and miners for price guidance. Reforms in Japan have resulted in increased competition in the energy sector, resulting in utilities cutting costs, diversifying supply and increasing participation in the spot market. Nevertheless, contract prices are likely to continue to play a role in thermal coal markets, as utilities attempt to reduce their exposure to volatile coal prices. Glencore and Tohoku have reportedly resumed negotiations for an annual supply contract starting in October.

The Newcastle benchmark spot price is forecast to drift lower over the next two and a half years, from an average of US$105 a tonne in 2018, to US$84 a tonne in 2019 and $75 a tonne in 2020. The forecast decline in the thermal coal price is underpinned by an expected softening in import demand, particularly as domestic supply picks up in China, and as nuclear reactors come back online in Japan and South Korea. The thermal coal Japanese reference price is also forecast to decline in line with spot prices, from US$110 a tonne in JFY 2018–19 to US$83 a tonne in JFY 2019–20 and $72 a tonne in JFY 2020–21.
6.3 World trade

World thermal coal markets have remained tight, as supply struggles to keep up with strong demand, particularly from China and India. World trade in thermal coal is forecast to grow by 1.1 per cent to 1.1 billion tonnes in 2018.

Demand for thermal coal is expected to soften over the following two years, driving a modest decline in world thermal coal trade of 0.8 per cent to 1.09 billion tonnes in 2019, and 1.0 per cent to 1.08 billion tonnes in 2020.

Import demand for thermal coal is expected to be weighed down by domestic coal supply picking up in China, nuclear reactors coming back online in Japan and South Korea, and developed countries continuing to shift away from coal-fired power generation, particularly in the European Union. Modest demand growth from emerging economies, particularly India, is expected to cushion the decline. Indonesia and Australia are expected to remain the largest and second largest exporters of thermal coal, respectively.

World imports

China’s coal imports will continue to be driven by government policy

China’s thermal coal imports surged by an estimated 21 per cent over June and July, driven by a prolonged heatwave, which increased air conditioning usage and pushed up electricity demand. China’s thermal power output (mostly comprising of coal-fired power stations) grew by 6.2 per cent year-on-year in the first half of 2018.

There has also been a decline in China’s domestic coal output (Figure 6.2). In addition to the closure of 80 million tonnes of capacity in the year to July — as part of the annual target of 150 million tonnes — there have been renewed efforts to reduce pollution and improve mine safety. Subdued domestic coal production is expected to continue to provide support for imports in the near-term.

China’s imports of thermal coal are subsequently forecast to decline over the remainder of the outlook period to 190 million tonnes in 2020. Despite ongoing capacity cuts and output restrictions in China’s domestic coal sector, the addition of new capacity is expected to result in a net increase in output over the following two years, and consequently reduce import demand. China has large reserves of thermal coal, and in 2017, domestic production accounted for 86 per cent of total thermal coal consumption. Another factor affecting China’s coal imports will be the growing consumption of gas, with government policies encouraging gas use in place of coal to reduce air pollution.

Government policy will continue to be the key factor affecting coal imports, and remains the largest uncertainty to the outlook. In particular, the government is expected to increasingly use coal import restrictions to target domestic coal prices within a price range. When domestic prices are high, import restrictions are likely to be relaxed in order to help cool domestic thermal coal markets. When domestic prices are low, import restrictions are likely to be more stringent to support domestic coal producers.
India’s thermal coal imports are forecast to grow
India’s imports of thermal coal grew by 26 per cent in the first half of 2018. The rise in imports reflects strong demand from growing coal-fired power generation (which reached a record high 92 terawatt hours in May 2018), coupled with subdued domestic output.

India’s thermal coal imports are forecast to remain robust over the outlook period, growing at an average of 1.9 per cent annually, as growth in consumption outpaces growth in domestic supply. In August, Coal India, the state-owned mining company which accounts for around 80 per cent of domestic supply, acknowledged that the production target of one billion tonnes by 2020 would not be met. While India has large reserves of thermal coal, domestic production has continued to face barriers to growth, including logistics, transport, regulatory and environmental challenges.

Japan’s imports of thermal coal are forecast to remain broadly steady
Japan’s imports of thermal coal declined by 1.9 per cent year-on-year in the first half of 2018. Japan’s thermal coal imports have been affected by the ongoing restart of nuclear reactors following the Fukushima disaster in 2011. At the time of writing, nine of Japan’s fleet of 42 nuclear reactors had gained approval to restart, though operations at Ikata No. 3 have been suspended pending a High Court injunction.

Japan’s thermal coal imports are forecast to remain broadly steady out to 2020. While Japan’s thermal coal demand is expected to be affected by ongoing nuclear restarts, with another two reactors expected to restart by 2020, there are new coal-fired power plants in the project pipeline which will support import demand. At the time of writing, there are 11 coal-fired power plant projects with a combined capacity of 4.5 gigawatts that are expected to come online over the next two to three years.

South Korea’s thermal coal imports forecast to decline
South Korea’s thermal coal imports grew marginally, by 1.5 per cent year-on-year, in the first seven months of the year, supported by prolonged maintenance work at over half of its nuclear power fleet. Over the same period, imports from Australia declined by 24 per cent, while imports from Russia, South Africa and Canada grew by 14 per cent, 20 per cent and 63 per cent, respectively, primarily driven by price differentials. New regulations on the sulphur content of coal consumption could further support a substitution away from Australian coal, which has higher than average sulphur. However, as the sulphur content cap applies to consumption, not imports, it does not exclude imports from Australia — these just need to be blended with lower sulphur coal from elsewhere.

South Korea’s thermal coal exports are forecast to decline over the outlook period, as more nuclear reactors come back online from maintenance work. Coal exports are also expected to be affected by government efforts to shift away from coal-fired power generation. The latest, in a series of measures aimed at reducing coal use, is a proposed additional consumption tax on coal (which could take effect in April 2019), representing the largest coal tax rise to date.

Demand from emerging Asia forecast to grow
Emerging countries in Asia are expected to become increasingly important sources of demand growth, driven by new coal-fired power projects (Figure 6.3).

**Figure 6.3: New coal-fired power capacity expected online in South Asia and South East Asia, 2018 to 2020**

![Chart showing new coal-fired power capacity in South Asia and South East Asia from 2018 to 2020.](chart)

**Notes:** Only includes power stations under construction. Indonesia has been excluded as it is self-sufficient in coal.

**Source:** GlobalData Power (2018)
**World exports**

**Indonesia’s thermal coal exports forecast to grow**

Despite inclement weather, Indonesia’s thermal export exports grew by 14 per cent year-on-year in the first five months of 2018. Indonesia is expected to remain the world’s largest exporter of thermal coal, with exports forecast to grow by 4.4 per cent in 2018 and by 0.9 and 1.2 per cent in 2019 and 2020, respectively.

Prices for Indonesia’s thermal coal, which is typically lower energy than Australian coal, have declined, especially relative to the Newcastle 6000kcal benchmark price. This has supported strong growth in exports of Indonesian coal to India, which is a particularly price sensitive buyer.

Indonesia’s thermal coal exports growth is expected to be driven by more supportive government policy over the outlook period. The government has historically prioritised securing low-cost coal for the domestic power sector, through the implementation of price caps and a requirement to sell at least 25 per cent of coal domestically (the Domestic Market Obligation — DMO).

However, coal is one of Indonesia’s largest exports, and there is growing pressure to increase coal exports to help narrow the country’s current account deficit. In August, the Indonesian Ministry of Energy and Mineral Resources revised the 2018 coal production target up by 25 million tonnes to 510 million tonnes, with the additional tonnes intended to increase exports.

**South Africa’s thermal coal exports to remain broadly steady**

South African thermal coal exports totaled 45 million tonnes in the first 7 months of 2018, remaining broadly steady year-on-year. South Africa’s thermal coal exports are forecast to remain flat over the outlook period.

Eskom, the national electricity utility, has had financial difficulties due to large debts, and its coal supply contracts with domestic producers are expiring soon. There is a risk that after the contracts expire, the utility will not be able to secure coal at prices it can afford, resulting in the South African Government potentially intervening and requiring producers to divert sales from export markets to the domestic market, which could further reduce South Africa’s exports.

**Russia’s thermal coal exports set to grow**

After a strong start to the year, Russia’s thermal coal exports have slowed, driven by a seasonal decline in demand from Europe and weather-related disruptions. Nevertheless, Russia’s thermal coal exports have grown by 16 per cent year-on-year in the first five months of 2018, and are expected to continue to grow, supported by growing sales to the Asian market, a weak Ruble, and rail and port capacity expansions.

**United States’ coal exports expected to decline**

Thermal coal exports from the United States have continued to surge, growing by 42 per cent on the year in the first half of 2018 as a result of high prices and strong demand. However, exports from the United States are forecast to drift lower over the next two years, as prices decline and as tariffs imposed by China and Turkey take effect.

![Figure 6.4: Annual change in world thermal coal exports](image-url)
6.4 Australia

Australia’s thermal coal export earnings reach a record high

High thermal coal prices have driven Australia’s export earnings to a record $23 billion in 2017–18, an increase of 19 per cent from the previous financial year. Over the same period, export volumes only grew marginally, by 0.4 per cent to 203 million tonnes (Figure 6.5).

Australia’s thermal coal export earnings are forecast to grow by a further 13 per cent to new record of $25 billion in 2018–19. Despite a forecast decline in spot prices, export earnings are expected to be supported by the high contract price settled for the 2018–19 Japanese fiscal year (March 2018 to April 2019). An estimated 30 to 40 per cent of Australian thermal coal is sold under term contracts, with the remainder sold on spot markets. Thermal coal export earnings are forecast to decline by 24 per cent to $19 billion in 2019–20, as both contract and spot prices decline.

A forecast increase in production and export volumes is expected to partially offset the impact of softer prices (Figure 6.6). Export volumes are forecast to increase to 208 million tonnes in 2019–20. Growth in export volumes over the outlook period is expected to be supported by an easing of logistical constraints that affected exports in 2016–17, including congestion at ports, industrial action and rail maintenance. The only substantial new addition to capacity over the outlook period is MACH Energy’s Mount Pleasant mine, which is expected to gradually ramp up to 7.5 million tonnes of output annually. Export growth will also be supported by planned expansions, most notably at Yancoal’s Moolarben mine, and productivity improvements across several operations.

Revisions to the outlook

Australia’s thermal coal export earnings for 2018–19 have been revised up by $2.9 billion from the June 2018 Resources and Energy Quarterly. Both spot and contract prices have been stronger than expected. Export earnings for 2019–20 are broadly unchanged.
### Table 6.1: World trade in thermal coal

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<th>Unit</th>
<th>2017</th>
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<th>2019&lt;sup&gt;f&lt;/sup&gt;</th>
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<th>2020&lt;sup&gt;f&lt;/sup&gt;</th>
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<td>Asia</td>
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Notes: <sup>f</sup> forecast.
Source: IHS (2018); Department of Industry, Innovation and Science (2018)
### Table 6.2: Thermal coal outlook

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Notes: <sup>b</sup> Japanese Fiscal Year (JFY), starting April 1, fob Australia basis. <sup>c</sup> Australia–Japan average contract price assessment for steaming coal with a calorific value of 6700 kcal/kg gross air dried; <sup>d</sup> in current JFY US dollars; <sup>e</sup> fob Newcastle 6000 Kcal; <sup>f</sup> in 2018 US dollars; <sup>g</sup> forecast; <sup>h</sup> in 2018–19 Australian dollars.

Source: ABS (2018) International Trade in Goods and Services, Australia, Cat. No. 5368.0; IHS (2018); NSW Coal Services (2018); Queensland Department of Natural Resources and Mines (2018); Company Reports, Department of Industry, Innovation and Science (2018)
Gas
Resources and Energy Quarterly September 2018

LNG is natural gas cooled to −162°C

Australia exported 62 million tonnes of LNG in 2017–18

18% rise from 2016–17 export volumes

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

Most Australian LNG is sold on oil-linked contracts

Australia’s LNG export earnings by destination, 2017–18

- 47% Japan
- 34% China
- 12% South Korea
- 3% Singapore
- 2% Taiwan
- 3% Rest of the world

Share of world LNG exports in 2017

- 26% Qatar
- 18% Australia
- 9% Malaysia
- 7% Nigeria
- 6% United States
- 34% Rest of the world

Share of world LNG imports in 2017

- 29% Japan
- 13% China
- 12% South Korea
- 6% India
- 5% Taiwan
- 35% Rest of the world

Australia’s LNG projects and gas basins
7.1 Summary

- The value of Australia’s LNG exports is forecast to increase from $31 billion in 2017–18 to $48 billion in 2019–20, driven by higher export volumes and higher prices.
- The completion of the final two LNG projects in Australia’s recent wave of LNG investment will underpin strong growth in export volumes and bring total export capacity to 88 million tonnes.
- LNG contract prices — at which most Australian LNG is sold — are forecast to rise in 2018–19 before stabilising in 2019–20.
- Global LNG markets are expected to enter a short period of overcapacity between 2019 and 2020. However, there a number of risks to the outlook that could see demand absorb new supply capacity, putting upward pressure on LNG spot prices.

7.2 Prices

LNG prices in Asia remain elevated

Gas prices and gas pricing mechanisms vary from region to region. Most LNG in Asia is sold under long-term contracts where the price of LNG is linked to the price of oil. Prices in US$ per million British thermal units (MMbtu) are generally set by applying a scaling factor (of around 14 per cent) to an oil price in US$ per barrel, such as Japan Customs-cleared Crude (JCC), with a lag of about three months.

Oil-linked contract prices have been rising steadily since early 2016 when the JCC reached a low of US$30 a barrel. In June 2018, the JCC oil price was US$76 a barrel, its highest level since December 2014. The average price of LNG imported into Japan — the world’s largest LNG buyer — was about US$10 per MMbtu (A$13 a gigajoule) in July (see Figure 7.1).

LNG spot prices in Asia have also been on the rise since early 2016, and have shown considerable volatility over the past two northern hemisphere winters. During the last northern winter (over late 2017 and early 2018), spot prices increased sharply on the back of strong seasonal demand from major buyers in Asia, particularly China. Spot prices have subsequently held those gains over the northern hemisphere summer, in part due to increased oil prices. Buyers have some flexibility in terms of the volume of LNG they purchase on long-term oil-linked contracts, and higher oil prices raise the attractiveness of spot cargoes, pushing up spot prices. Over the first half of September 2018, LNG spot prices in Asia averaged over US$11 per MMbtu (A$15 a gigajoule).

Figure 7.1: Gas and LNG prices, monthly

LNG contract and spot prices to decline from current highs

Tracking oil prices, LNG contract prices in Asia are forecast to decline modestly from current highs, but remain well above levels seen over the past few years. The JCC oil price is forecast to average US$72 a barrel in 2020, down slightly on current levels of US$76 a barrel, but up from an average of US$54 a barrel in 2017.

LNG spot prices in Asia are also expected to decline from current levels over the next two years, as additions to global supply capacity outstrip growth in LNG demand. The futures curve suggests a modest tapering in Asian LNG spot prices, as shown in Figure 7.2. At the time of writing, the average Asian LNG futures price on the New York Mercantile Exchange
(NYMEX) was US$11 per MMbtu in 2019 (A$13 a gigajoule at the forecast exchange rate) and US$9 per MMbtu in 2020 (A$12 a gigajoule at the forecast exchange rate).

**Figure 7.2: Asian LNG futures price and open contracts, monthly**

It is worth noting, however, that the cost of delivering US LNG to Asia is expected to be below these futures prices, and that liquidity on the futures curve declines sharply after around 6 months, as shown in Figure 7.2. At the time of writing, the number of open futures contracts on the NYMEX — i.e. open interest — was around 2900 between October 2018 and March 2019, but only 60 for 2020 as a whole. It is possible that LNG spot prices could decline further than the futures price suggests.

The futures curve also suggests that seasonal tightness in Asian LNG markets will continue over the next few years. In Asia, gas storage, which moderates the impact of seasonal demand spikes on prices, is limited. Across the major LNG importers in Asia — Japan, China, South Korea and Taiwan — underground gas storage (UGS) was 5 per cent of gas consumption in 2016, compared to a global average of 12 per cent.

### 7.3 World trade

After a period of relatively low growth between 2011 and 2015, world LNG trade has expanded rapidly in the past few years. Strong growth is expected to continue: imports are projected to rise from 290 million tonnes in 2017 to around 365 million tonnes in 2020. Emerging Asia — led by China — and Europe are expected to drive demand growth.

**Figure 7.3: Global supply capacity by country and world LNG demand**

LNG markets have been expected to enter a period of overcapacity for some time, but stronger than expected demand growth coupled with delays in project completions have delayed its arrival (see Box 7.1). However, the expansion in global LNG supply capacity is soon expected to outpace growth in LNG demand, resulting in a short period of overcapacity in global LNG markets starting sometime in 2019 and lasting through to 2020 (Figure 7.3).

However, there are a number of risks to the forecast that could see LNG markets tighten earlier than expected, including stronger than expected LNG demand from China or further delays in bringing new LNG projects online (Box 7.3). From early next decade, the LNG market is expected to begin rebalancing, as demand growth absorbs the available capacity.
7.4 World imports

Nuclear restarts to reduce Japan’s LNG imports

Japan sources almost all its gas using LNG imports, and has been the leading buyer of LNG in the world since the 1970s. Japan’s LNG imports declined by 2.4 per cent in the first seven months of 2018, compared with the same period last year. Gas competes with nuclear power in Japan and several nuclear reactors have come back online over the past year, reducing LNG imports. Increasing renewable energy use and slower economic activity have also contributed to lower LNG requirements.

Japan’s LNG imports are projected to fall from 85 million tonnes in 2017 to 81 million tonnes in 2020. The main factor affecting gas demand is the pace at which offline nuclear reactors are recommissioned. To date, the pace of nuclear restarts has been slow, with nuclear energy continuing to face public opposition and legal challenges. There remain significant risks of delays and slippages in nuclear restarts.

At the time of writing, 9 of Japan’s fleet of 42 nuclear reactors had gained approval to restart, though operations at Ikata No. 3 have been suspended pending a High Court injunction. Japan’s Institute of Energy Economics expects 2 more reactors to restart by March 2020. Eighteen reactors have applications for restart with the Nuclear Regulation Authority — the administrative body charged with ensuring the safety of nuclear plants.

China to be the largest contributor to growth in LNG demand

China edged past South Korea to become the second largest LNG buyer in the world in 2017, with its imports reaching over 36 million tonnes (50 billion cubic metres). Gas consumption rose strongly, with China putting in place policies to address air pollution by encouraging gas use in place of coal. Strong growth continued into 2018, with LNG imports up 53 per cent year-on-year in the first six months of 2018.

The Chinese government is aiming to raise the share of gas in the energy mix from 5.3 percent in 2015 to a target range of 8.3-10 per cent in 2020. LNG is likely to play a major role in servicing rising Chinese gas demand. By 2020, China’s LNG imports are forecast to have reached 53 million tonnes (73 billion cubic metres).

A key factor affecting China’s LNG demand will be the extent of competition from domestic gas production and gas imported through pipelines. China is expected to begin importing gas from Russia via the Power of Siberia pipeline by 2020. Imports are expected to be about 5 billion cubic metres in the first year of operation, reaching 38 billion cubic metres in the sixth year. China’s domestic production is expected to grow steadily over the outlook period. China is reportedly targeting natural gas production of 200 billion cubic metres in 2020, up from around 150 billion cubic metres in 2017. China faces challenges in lifting domestic output, and is expected to fall short of this target: it has difficult geology and gas resources are located in densely populated or heavily cultivated areas.

Modest growth projected for South Korea’s imports

South Korea was the world’s 3rd largest LNG buyer last year, and its imports were up 15 per cent year-on-year in the first seven months of
2018. Gas use in electricity generation increased, supported by a heatwave across Northeast Asia that pushed up electricity demand. The South Korean government took some of the country’s older coal-fired power stations offline from March to June, in order to cut air pollution, and this likely boosted gas demand over this period. Import growth is expected to slow in the second half of 2018, as coal-fired power stations resume service.

South Korea’s imports are forecast to increase from just under 36 million tonnes in 2017 to 38 million tonnes in 2020. South Korea’s long-term plan is to increase the share of gas in the energy mix from 15 per cent in 2016 to around 19 per cent by 2030. Most recently, South Korea has announced a plan to lower taxes on LNG imports and raise taxes on thermal coal imports. The new tax rate will apply to LNG cargoes shipped from their supply source after 1 April 2019.

Other emerging Asian economies and Europe to also drive demand
Other economies in emerging Asia are expected to make a large contribution to growth in global LNG imports, including India, Pakistan, Bangladesh, Indonesia, Thailand and Singapore. The strong growth in emerging Asia is being facilitated by the use of Floating Storage and Regasification Units (FSRUs), which provide a low-cost avenue for relatively small LNG import volumes.

Europe is another major driver of increasing LNG demand. European LNG imports totalled 45 million tonnes in 2017, and are expected to grow strongly to 2020 despite relatively flat growth in gas consumption. LNG imports are being driven by long-term declines in domestic gas production, particularly from the Groningen field in the Netherlands. LNG is also seen as a means to diversify energy supply sources in Europe.

Outside of emerging Asia and Europe, Taiwan represents another growth market. By 2025, Taiwan aims to increase the share of LNG in its energy mix to 50 per cent from 35 per cent at present, reducing coal and phasing out nuclear power. In August, Taiwan’s state-owned oil and gas company CPC signed a 25-year contract with US exporter Cheniere for 2 million tonnes of LNG per year, with prices linked to US Henry Hub gas prices. The contract takes effect after 2020, which is outside the outlook period.

7.5 World exports
A major expansion of world LNG supply capacity is underway
The next few years are expected to see a major lift in global LNG supply capacity, driven primarily by the US, followed by Australia and Russia. Over half of new supply capacity is expected to come from the United States.

The nameplate capacity of US LNG projects is on track to triple to around 70 million tonnes, with six plants expected to be operational by the end of 2019. This expansion in LNG infrastructure is expected to make the US the third largest LNG exporter in the world, behind Australia (where nameplate capacity will soon reach 88 million tonnes) and Qatar (where nameplate capacity is expected to remain at 77 million tonnes for the next few years). In September 2018, four trains were operating at Sabine Pass, Louisiana (18 million tonnes) and one train at Cove Point, Maryland (5.3 million tonnes). There are four more US plants under construction, plus an additional train at Sabine Pass. These plants are Elba Island, Freeport, Corpus Christi and Cameron.

LNG has recently been caught up in trade tensions between China and the United States. On 24 September, China imposed a 10 per cent tariff on imports of LNG from the United States as part of its response to US$200 billion in tariffs on Chinese goods announced by the US Administration. China imports a relatively small share of its LNG from the United States (just 4 per cent in 2017). However, US LNG exports to China did surge over the recent northern hemisphere winter when LNG spot prices spiked, acting as a source of flexible supply during the gas supply crunch in China (Figure 7.5). While the implications of Chinese tariffs on US LNG remain to be seen, one view is that they will encourage a reorganisation of trade flows, with China bringing in more LNG from other sources (from Qatar and Australia for example), and US LNG displacing the exports of major LNG producers in other markets.
A longer-term risk is that tariffs discourage or delay final investment decisions (FIDs) for a second wave of US LNG projects. A long-term supply deal between US exporter Cheniere Energy and China National Petroleum (for 1.2 million tonnes of LNG per year) supported an FID in May 2018 for a third 4.5 million tonne train at Cheniere’s Corpus Christi LNG project.

Figure 7.5: US LNG exports, monthly

![Graph showing US LNG exports, monthly](image)

Source: EIA (2018)

Major new capacity additions are also expected in Australia (discussed below) and Russia. Russia’s LNG exports are expected to increase over the next few years as the Yamal LNG project (nameplate capacity of 16.5 million tonnes) comes online. The Yamal project shipped first LNG from the second of its three trains in August 2018 and a number of cargoes from the project have been shipped to Asia via the Northern Sea route through the Arctic.

Qatar’s LNG exports are projected to remain largely unchanged

Qatar exported 75 million tonnes of LNG in 2017, making it the world’s largest exporter of the liquefied fuel. Since 2011, Qatar’s exports have ranged from 72-77 million tonnes a year, and they are expected to remain in this range over the outlook period.

Qatar’s plan to increase LNG production capacity by 30 per cent to 100 million tonnes is not expected to flow through to increases in its exports for another 5–7 years.

7.6 Australia

LNG export earnings reached a record in 2017–18

Australia exported $31 billion of LNG in 2017–18, making gas Australia’s 3rd largest resource and energy export. Export prices were up on 2016–17, as oil prices continued to recover. Figure 7.6 shows how Australian export prices have risen in line with the rebound in the 3-month lagged JCC oil price.

Figure 7.6: Australian LNG export prices and the JCC price, monthly

![Graph showing Australian LNG export prices and the JCC price, monthly](image)

Notes: Export prices are export unit values. The JCC price is lagged three months. Source: ABS (2018); Department of Industry, Innovation and Science (2018)
Box 7.1: Overcapacity in LNG markets

Australia has recently experienced a surge in LNG investment, with 8 new projects commissioned between 2007 and 2012. This surge in investment was mirrored around the world, most notably in the US where final investment decisions were taken for 6 projects.

For many years, it has been thought this wave of investment would lead to a period of overcapacity in global LNG markets. In 2016, overcapacity appeared to have arrived. Asian LNG spot prices fell as low as US$4.10 per MMbtu, averaging US$5.80 per MMBtu for the year. Record low spot prices led some commentators to suggest that new US LNG export capacity could be uneconomic and might be shut in for a period of time.

This period of low LNG spot prices, however, was short-lived. A combination of supply-side and demand-side factors have seen LNG markets tighten substantially over 2017 and 2018. On the supply-side, the completion of many LNG projects has been pushed back, and some LNG projects have also encountered technical difficulties while ramping up production. Delays such as these have allowed time for demand to close the gap on growing supply capacity.

On the demand-side, LNG imports have grown more quickly than expected. China pulled LNG markets out of a period of overcapacity by increasing imports by over 40 per cent in 2017. Increased imports were driven by China’s efforts to reduce air pollution, coupled with a decline in pipeline imports from Turkmenistan over late 2017, with Turkmenistan reportedly diverting domestic gas production to domestic consumers.

In Japan, LNG imports have not declined as anticipated, largely holding steady in 2017. Efforts to restart nuclear reactors have been complicated by community opposition and legal challenges, although several reactors have come online more recently and imports have begun to edge down. South Korea’s imports increased in 2017 and have continued to increase in 2018, despite expectations of largely flat gas demand on the back of weak economic activity and competition from other fuels.

The outlook for LNG demand has also improved over the past few years. Delays to nuclear restarts mean that Japan is only just beginning to wind back LNG imports. The election of a new government in South Korea has seen announcements that should support LNG imports moving forward, such as the temporary closure of old coal-fired power stations between March and June each year. India and Taiwan have announced more aggressive targets for the share of gas in the energy mix. Projections for the LNG imports of emerging Asia have been upgraded, as these countries have been drawn into the market by expectations of low prices. Strong LNG demand in Asia might explain why LNG demand in Europe — traditionally the destination of last resort for LNG cargoes, given its ample gas storage capacity — has fallen short of some forecasts.

While LNG markets are expected to remain well supplied over the next two years, a number of eventualities could see demand absorb new supply capacity. Delays in bringing US projects online would give demand more time to catch up to the growing supply capacity. Where China’s gas consumption reaches in the Government’s target range could have a major impact on LNG markets. China’s target of lifting the share of gas in the energy mix implies gas consumption of 305-365 billion cubic metres. Fifty billion cubic metres of gas is equivalent to around 37 million tonnes of LNG — as much LNG as China imported in 2017.

If overcapacity in LNG markets does arrive in coming years, it seems likely it will be shorter lived than previously expected. If it does not, and the gap between supply capacity and demand closes quickly, LNG markets could potentially face a hard landing in the early 2020s where spot prices increasing rapidly. Investment in new projects has faltered over the past few years and new supply cannot be brought to market quickly, given long lead times (of around 5 years) for LNG projects.

Recent developments in LNG markets illustrate one of the key challenges facing forecasters; namely, that ‘base case’ forecasts can only be built on the best set of inputs available at the time; inputs that can change quickly as events unfold.
Higher export values in 2017–18 were also driven by increasing export volumes. Production ramped up over the year at Australia’s second largest LNG project — Gorgon in Western Australia. LNG shipments also commenced at the Wheatstone facility in Western Australia.

Higher prices and volumes to lift LNG export earnings further
Australia’s LNG export earnings are forecast to increase by 57 per cent to $48 billion in 2018–19 and remain around this level in 2019–20. As Figure 7.7 shows, the recent rally in oil prices is expected to result in higher prices for Australian LNG in 2018–19, before prices ease in 2019–20.

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

![Graph showing annual growth in Australia's LNG export values, contributions from prices and export volumes]

Notes: Log change is used to approximate percentage change. The approximation becomes less accurate the larger the percentage change.
Source: ABS (2018); Department of Industry, Innovation and Science (2018)

Increasing export volumes are expected to continue to drive Australia’s LNG export earnings higher over the next two years. Australia’s LNG export volumes are forecast to reach 77 million tonnes in 2019–20, up from 62 million tonnes in 2017–18. Higher export volumes will be driven by the ramp up of production at Wheatstone, and the completion of the Ichthys and Prelude projects. Ichthys and Prelude are the final two projects in Australia’s recent wave of LNG investment and their completion will bring the combined nameplate capacity of Australia’s LNG projects to 88 million tonnes.

The first shipment of LNG from the Ichthys project had not occurred at the time of writing, but is expected before the end of September 2018 according to the project’s operator Inpex. Shell has indicated that the Prelude Floating LNG project will begin LNG production before the end of the year.

Technical studies are underway for a second train at Woodside’s Pluto project, likely in the 4-5 million tonne per annum range. The additional train at the Pluto LNG project forms part of Woodside’s plans to develop the Scarborough gas resource in the Carnarvon Basin, connecting the offshore resource to the Pluto LNG plant via a 430 kilometre pipeline. However, the brownfield development is not expected to affect exports within the outlook period. A FID is being targeted for 2020, and first LNG is being targeted for 2024. The cost estimate is US$11 billion in 2018 dollar terms, which includes upstream capacity as well as a second LNG train at Pluto.

On current projections, Australia will edge past Qatar as the world’s largest LNG exporter in 2019 when exports reach 76 million tonnes, and extend its lead slightly further in 2020. However, given the narrow difference between the projected exports of the two nations, Australia overtaking Qatar is not a certainty.

**LNG export earnings have been revised up**
Forecast LNG export earnings have been revised up by $4.9 billion in 2018–19 and $5.4 billion in 2019–20 since the June Resources and Energy Quarterly. The upwards revision reflects an improved outlook for oil prices and a weaker outlook for the Australian dollar. Forecasts for export volumes are broadly unchanged from the previous quarter.
### Table 7.1: Gas outlook

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<td>56.3</td>
<td>54.9</td>
<td>1.3</td>
<td>2.4</td>
<td>–2.6</td>
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<tr>
<td>– Western market</td>
<td>Bcm</td>
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<td>63.8</td>
<td>72.8</td>
<td>73.4</td>
<td>28.7</td>
<td>14.1</td>
<td>0.7</td>
</tr>
<tr>
<td>– Northern market c</td>
<td>Bcm</td>
<td>1.3</td>
<td>1.4</td>
<td>9.8</td>
<td>12.7</td>
<td>5.5</td>
<td>598.2</td>
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<tr>
<td>LNG export volume d</td>
<td>Mt</td>
<td>52.1</td>
<td>61.7</td>
<td>74.7</td>
<td>77.4</td>
<td>18.4</td>
<td>21.1</td>
<td>3.5</td>
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<td>– nominal value</td>
<td>A$m</td>
<td>22,308</td>
<td>30,934</td>
<td>48,415</td>
<td>47,799</td>
<td>38.7</td>
<td>56.5</td>
<td>–1.3</td>
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<tr>
<td>– real value e</td>
<td>A$m</td>
<td>23,261</td>
<td>31,646</td>
<td>48,415</td>
<td>46,667</td>
<td>36.0</td>
<td>53.0</td>
<td>–3.6</td>
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<td>LNG export unit value s</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– nominal value</td>
<td>A$/GJ</td>
<td>8.1</td>
<td>9.5</td>
<td>12.3</td>
<td>11.7</td>
<td>17.1</td>
<td>29.2</td>
<td>–4.6</td>
</tr>
<tr>
<td>– real value e</td>
<td>A$/GJ</td>
<td>8.5</td>
<td>9.7</td>
<td>12.3</td>
<td>11.4</td>
<td>14.9</td>
<td>26.3</td>
<td>–6.9</td>
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<tr>
<td>– nominal value</td>
<td>US$/MMBtu</td>
<td>6.5</td>
<td>7.8</td>
<td>9.7</td>
<td>9.6</td>
<td>20.4</td>
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<td>–1.3</td>
</tr>
<tr>
<td>– real value e</td>
<td>US$/MMBtu</td>
<td>6.7</td>
<td>8.0</td>
<td>9.7</td>
<td>9.4</td>
<td>18.1</td>
<td>22.0</td>
<td>–3.6</td>
</tr>
</tbody>
</table>

**Notes:**
- a JCC stands for Japan Customs-cleared Crude;
- b Production includes both sales gas and gas used in the production process (i.e. plant use) and ethane. Historical gas production data was revised in the June quarter 2017 to align with Australian Petroleum Statistics published by the Department of Environment and Energy;
- c Gas production from Bayu-Undan Joint Production Development Area is not included in Australian production. Browse basin production associated with the Ichthys project is classified as Northern market;
- d 1 million tonnes of LNG is equivalent to approximately 1.36 billion cubic metres of gas;
- e In 2018–19 Australian dollars;
- f Forecast;
- g 1 MMBtu is equivalent to 1.055 GJ;
- h In 2018 US dollars;
- s Estimate;
- t 2017 is an estimate.

**Source:** ABS (2018) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Dept of Industry, Innovation and Science (2018); Company reports; Nexant World Gas Model (2018)
8. Oil

Resources and Energy Quarterly September 2018

Around 70% of crude and condensate production comes from the Carnarvon basin, offshore from WA.

Australia’s production of crude and condensate peaked in 2000, at 41,300 ML.

Around 23% of refinery feedstock is domestically produced. On average 76% is imported.

Share of Australia’s refined product consumption produced domestically:

- 33% Diesel
- 42% LPG
- 59% Automotive gasoline
- 40% Aviation turbine fuel
- 67% Fuel oil

In 2017–18, around 70% of Australia’s imported petroleum came from:

1. Korea 9874
2. Malaysia 9772
3. Singapore 9619
4. Japan 5076
5. UAE 3994

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

- Highest price: $117, 6/09/2013
- 2018 average: $72
- Lowest price: $26, 19/01/2016

Note: excludes natural gas imports. Measured in million litres.
8.1 Summary

- Oil prices are expected to remain around current levels over the outlook period, with world production being carefully managed by OPEC. The Brent spot price is forecast to average US$72 a barrel in 2020.
- Australia’s export volumes are expected to increase from 226 thousand barrels a day in 2017–18 to a forecast 331 thousand barrels a day in 2019–20, supported by rising condensate output at new LNG projects.
- The value of Australia’s crude and condensate exports is set to increase from $7.0 billion in 2017–18 to a forecast $11 billion in 2019–20, driven by higher volumes and steady prices.
- Trade tensions and any downturn in world economic activity pose a risk to oil consumption and the oil price outlook.

8.2 Prices

Oil markets settle with OPEC compliance

Oil prices were broadly stable over the September quarter 2018 — a break from the volatility witnessed over the past four years. An adjustment to the OPEC+ production agreement gave markets confidence around output levels. The agreed adjustment allowed members to raise output to offset unexpected lower output from other members. The Brent spot price is estimated to be US$75 a barrel in the September quarter. This was little changed from the previous quarter, and 45 per cent higher than the same period in 2017, as shown in Figure 8.1.

Oil prices expected to stabilise around current levels

Over the outlook period, oil prices are expected to maintain recent price gains, see Figure 8.2. Markets are expected to be balanced over the short term, as higher production is countered with modest consumption growth. The Brent oil spot price is forecast to average US$72 a barrel in 2018, US$15 a barrel higher than in 2017. Prices are expected to stay around this level over the outlook period, however there are significant risks: world supply shortages due to sanctions on Iran, uncertainty around production from OPEC producers Libya and Nigeria. Any downturn in economic activity will weigh on prices.
8.3 World oil consumption

World oil consumption is forecast to average 99 million barrels a day in 2018, 1.2 per cent higher than in 2017. Marginal growth over the outlook period is expected, with consumption forecast to reach 101 million barrels a day in 2020. Consumption growth is expected to occur primarily in non-OECD economies — most significantly China and India (Figure 8.3).

Non-OECD economic growth supports oil consumption growth

Non-OECD countries account for around half of world oil consumption. Over the next two years, non-OECD consumption is forecast to grow by around 2.3 per cent per year to reach 54 million barrels a day in 2020. Consumption in China is forecast to increase by around 3.3 per cent a year, to reach a forecast 13.8 million barrels a day in 2020. The most significant growth rate is expected in India, where consumption is forecast to increase at an average rate of almost 5 per cent a year, to reach 5.2 million barrels a day in 2020.

Consumption growth is sensitive to price, and higher oil prices over the last year have weighed on potential consumption growth. Some countries, including Indonesia, removed oil price subsidies in recent years are now acting to shelter consumers from current higher prices. Ongoing high prices could have a negative impact on consumption growth. As such, it is expected OPEC and other major producers will act to keep prices within an acceptable range.

Economic activity important for continuing OECD consumption

Over the outlook period, OECD consumption is expected to be flat — in 2020 consumption is forecast to be similar to current levels, at 48 million barrels a day.

Consumption growth is expected to be balanced by energy efficiency improvements, particularly with tighter emissions controls in transport and shipping (see Figure 8.4). Heightened trade tensions, which may weigh on manufacturing and trade activity, pose a risk to oil consumption growth.
8.4 World oil production

World oil production is expected to increase materially in 2018, after two years of little aggregate change. A slight adjustment to the OPEC production agreement has prompted higher production from Russia, Kuwait and the UAE, while US production continues to grow despite infrastructure constraints.

World oil production is forecast to increase by an average 1.5 per cent a year over the next two years, to reach 102 million barrels a day in 2020. At this rate, world production growth is expected to exceed consumption growth the end of the outlook period.

OPEC+ continues to comply with adjusted production agreement

The 2017 production agreement, established between OPEC, Russia, Mexico and eight other countries (collectively known as OPEC+) has been upheld in 2018. The agreement targets a 1.8 million barrel a day combined decrease in production. In July 2018, the OPEC+ agreement was adjusted in response to concerns about production shortages; OPEC production had been lower than the target amount, leading to a fall in inventories. The adjusted agreement allows individual countries to increase production, to bring combined OPEC+ production closer to the target level, rather than falling short. This change has helped alleviate concerns about falling Venezuelan production and the future reductions in Iran’s output (see Figure 8.5). At this stage, it is unclear how significant the impact of the US sanctions on Iran will be. The restrictions, due to come into full effect in November, have prompted some countries to cease imports of Iranian crude, while other countries are seeking exemptions. Over the outlook period it is expected OPEC, and in particular Saudi Arabia, will control production to maintain current price levels.

Continued US production growth

US production is expected to increase considerably over the next two years, as production from shale plays continues to grow. Output is forecast to increase to almost 17 million barrels a day in 2020. Infrastructure constraints and stagnating productivity may weigh on growth.
8.5 Australia’s production and trade

Export earnings growth supported by oil prices and condensate production

Australia’s petroleum exports grew to $7.0 billion in 2017–18, 27 per cent higher than the previous year. This increase was mostly attributable to the rise in oil prices.

Over the next two years, export earnings are forecast to continue growing, as oil prices maintain recent gains and condensate production ramps-up as new LNG projects come online. Export earnings are forecast to reach $11 billion in 2019–20, as shown in Figure 8.7.

Export earnings have been revised down by $65 million since the June Resources and Energy Quarterly, due to downward revisions to production forecasts outweighing the positive contribution of higher export prices.

Continued volumes growth supports exports

The volume of Australia’s petroleum exports totalled 226 thousand barrels a day in 2017–18, increasing by 2.6 per cent over the year.

Export volumes are forecast to increase by around 20 per cent a year over the outlook period, reaching 331 thousand barrels a day in 2019–20. Higher condensate production from the LNG projects, which will primarily be directed to export markets, is expected to support this growth.

Lower crude oil production outweighed by higher condensate production

Australia’s crude and condensate production averaged 286 thousand barrels a day in 2017–18, a marginal increase on the previous year.

Total petroleum production is forecast to increase over the outlook period, despite declining crude oil production from mature fields. New condensate production from the Ichthys, Wheatstone and Prelude projects is expected online before the end of 2018. As production from these projects ramps up, Australia’s total crude and condensate production is forecast to reach 401 thousand barrels a day in 2019–20 (see Figure 8.8). Woodside’s Greater Enfield project, with a capacity of 40 thousand barrels a day, is expected to be producing by mid-2019. LPG production and export capacity is also set to increase, as discussed in box 8.1.
Exploration expenditure

Australia’s petroleum exploration expenditure was $1.0 billion in 2017–18, 25 per cent lower than the previous year. Lower oil prices have contributed to subdued exploration activity. In the September quarter, there was news of a 186 million barrel discovery in the Dorado oil field, in the North West Shelf.

Australia’s refinery production

Australia’s refinery production was 494 thousand barrels a day in 2017–18, up 4.8 per cent over the year, as refineries maintained strong operating rates. Refined product imports also increased slightly, up 3.4 per cent over the year, to reach 645 thousand barrels a day in 2017–18. Over the outlook period, refinery production is forecast to average 475 thousand barrels a day in 2019–20. To address growing consumption, imports are forecast to increase at an average annual rate of 1.6 per cent.

Box 8.1: Looking into LPG

LPG (liquefied petroleum gas) is made up of propone and butane. Around 70 per cent of Australia’s LPG is naturally occurring and is co-produced at gas fields. The remainder is produced as part of the crude oil refining process.

Australia’s LPG production exceeds domestic consumption. Australia’s LPG production was around 50 thousand barrels a day in 2017–18, around 80 per cent of which is exported. In Australia, LPG is used in light vehicle transportation, forklifts, household appliances and heating. Around 2.4 billion litres of LPG was consumed in 2016–17.

Australia’s LPG production is expected to increase over the next few years as new capacity comes online. The largest of these new projects is Inpex’s Ichthys project, which is expected to add annual capacity of 1.6 million tonnes, almost doubling Australia’s LPG output potential. Another development is Origin’s prospective LPG import terminal currently being considered in South Australia. This project could provide a diversified fuel source and stored capacity for Origin’s Quarantine power station.
### Table 8.1: Oil outlook

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>2017</th>
<th>2018&lt;sup&gt;f&lt;/sup&gt;</th>
<th>2019&lt;sup&gt;f&lt;/sup&gt;</th>
<th>2020&lt;sup&gt;f&lt;/sup&gt;</th>
<th>Annual percentage change</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production&lt;sup&gt;a&lt;/sup&gt;</td>
<td>mb/d</td>
<td>97.4</td>
<td>99.1</td>
<td>100.8</td>
<td>101.9</td>
<td>1.7</td>
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<td>Consumption&lt;sup&gt;a&lt;/sup&gt;</td>
<td>mb/d</td>
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<td>99.0</td>
<td>100.4</td>
<td>101.4</td>
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<tr>
<td>• Nominal</td>
<td>US$/bbl</td>
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<td>67.4</td>
<td>67.3</td>
<td>66.0</td>
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<tr>
<td>• Real&lt;sup&gt;b&lt;/sup&gt;</td>
<td>US$/bbl</td>
<td>52.1</td>
<td>67.4</td>
<td>65.8</td>
<td>63.9</td>
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<tr>
<td>• Nominal</td>
<td>US$/bbl</td>
<td>54.3</td>
<td>72.4</td>
<td>72.8</td>
<td>71.5</td>
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<tr>
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<td>US$/bbl</td>
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<td>72.4</td>
<td>71.1</td>
<td>69.1</td>
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<tr>
<td>Crude and condensate</td>
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<td></td>
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<td></td>
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<tr>
<td>Production&lt;sup&gt;a&lt;/sup&gt;</td>
<td>kb/d</td>
<td>283</td>
<td>286</td>
<td>333</td>
<td>401</td>
<td>1.2</td>
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<td>Export volume&lt;sup&gt;a&lt;/sup&gt;</td>
<td>kb/d</td>
<td>221</td>
<td>226</td>
<td>275</td>
<td>331</td>
<td>2.6</td>
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<tr>
<td>• Nominal value</td>
<td>A$m</td>
<td>5,476</td>
<td>6,963</td>
<td>9,682</td>
<td>11,376</td>
<td>27.2</td>
</tr>
<tr>
<td>• Real value&lt;sup&gt;g&lt;/sup&gt;</td>
<td>A$m</td>
<td>5,710</td>
<td>7,123</td>
<td>9,682</td>
<td>11,107</td>
<td>24.8</td>
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<td>Imports&lt;sup&gt;a&lt;/sup&gt;</td>
<td>kb/d</td>
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<td>386</td>
<td>391</td>
<td>373</td>
<td>10.0</td>
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<td>LPG production&lt;sup&gt;ac&lt;/sup&gt;</td>
<td>kb/d</td>
<td>52</td>
<td>50</td>
<td>82</td>
<td>111</td>
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<td>Refined products</td>
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<td></td>
<td></td>
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<tr>
<td>• Refinery production&lt;sup&gt;a&lt;/sup&gt;</td>
<td>kb/d</td>
<td>471</td>
<td>494</td>
<td>483</td>
<td>475</td>
<td>4.8</td>
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<tr>
<td>• Export volume&lt;sup&gt;ad&lt;/sup&gt;</td>
<td>kb/d</td>
<td>18</td>
<td>18</td>
<td>17</td>
<td>18</td>
<td>–3.5</td>
</tr>
<tr>
<td>• Import volume&lt;sup&gt;a&lt;/sup&gt;</td>
<td>kb/d</td>
<td>616</td>
<td>645</td>
<td>666</td>
<td>670</td>
<td>4.6</td>
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<td>• Consumption&lt;sup&gt;d&lt;/sup&gt;</td>
<td>kb/d</td>
<td>1,006</td>
<td>1,042</td>
<td>1,077</td>
<td>1,093</td>
<td>3.6</td>
</tr>
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**Notes:**<br> a Number of days in a year is assumed to be exactly 365.25; b in 2018 calendar year dollars; c Primary products sold as LPG; d Domestic sales of marketable products; f forecast; g in 2018–19 financial year Australian dollars. A barrel of oil equals 158.987 litres.Source: ABS (2018), cat. No. 5464.0; International Energy Agency (2018); Department of Industry, Innovation and Science (2018).
Uranium
Resources and Energy Quarterly September 2018

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

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

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

Uranium makes up 11% of global electricity generation.

There are 245 civil research reactors operating across 55 countries.

More than 450 nuclear power reactors in operation across 30 countries.

Major Australian uranium deposits (tonnes)

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

Deposit
Operating mine

Uranium required in 2017 (tonnes)

- USA: 17,847
- France: 9,216
- Russia: 7,767
- China: 7,757
- South Korea: 4,816
- Japan: 2,517
9.1 Summary

- Uranium spot prices lifted sharply in July, and appear to be firming up after a long period of decline and stagnation. Prices are expected to retain their recent lift and rise gradually in the medium term, reaching US$28 a pound by 2020.

- Uranium production in Australia is expected to be largely steady at around 7,000 tonnes annually over the outlook period. However, there is potential for higher growth beyond the outlook period should further price recovery encourage a re-opening of the Honeymoon mine in South Australia.

- Slow growth in prices should support a gradual rise in Australia’s uranium export earnings, which are forecast to reach almost $700 million by 2019–20.

9.2 Prices

Prices stabilised in early 2018, and rose in July

Uranium spot prices appear to be slowly recovering in the wake of several significant production cuts from major producers in Kazakhstan and Canada. Prices rose from US$22.65 a pound in June to US$25.78 a pound in July and $US26.30 in August. While this price level remains unprofitable for most producers, it is the highest price since mid-2016, and well above the low point of US$18 a pound reached in late 2017. Prices are expected to largely hold onto the recent rise, and increase a little further over the medium term, averaging US$26.20 in 2019 and US$28.00 in 2020 (see Figure 9.1).

However, although production cuts are significant and potentially long-lasting, the uranium market remains awash in inventories. Inventory build-up will likely soften any significant price pressure in the short-term. New reactors in China, India and the Middle East will raise demand over the longer term, but this rise will be partially checked by efficiency gains among the newer reactors, and by the gradual emergence of new reactor technology which allows more spent fuel to be recycled.
9.3 World consumption

Nuclear power growth is moderate — but a new region is showing interest

Uranium use is projected to grow from 84,100 tonnes in 2018 to 94,300 tonnes by 2020, but conditions among individual countries are mixed, with growth concentrated in China (see Figure 9.3).

Conditions for nuclear generation remain difficult in the US, with six reactors closing since 2013 and several others moving towards early closure as high regulatory costs make them uncompetitive against cheap shale gas. Plant operators have warned that recent tariff threats targeting uranium would further reduce their competitiveness, with the US Department of Commerce launching an investigation as a result.

In the EU, Germany and Italy have shut down reactor constructions, with Germany aiming to shift away from nuclear energy by 2022. Partly offsetting this, France has re-committed to nuclear power, while Eastern European and Nordic nations continue to add new reactors incrementally.

In other countries, nuclear power deployment is accelerating, with more plants under construction across the world than at any time in the last 25 years. China, with 41 reactors, intends to build more than 200 more. China connected the largest reactor ever built in June, with the 1660 megawatts electric (MWe) Taishan unit 1 commencing generation in Guangdong province. One day later, the Sanmen unit 1 reactor commenced in Zhejiang. Shortly after this, the Sanmen 2 reactor was completed, and the Haiyang 1 reactor advanced into fuel loading. The Haiyang and Sanmen reactors are the first AP1000 units to be built.

New reactors are also being deployed in other parts of Asia: Russia and India are seeking to double their nuclear capacity, while capacity in the Middle East is expected to more than triple over the next 10 years.

In Japan, Kansai Electric and Kyushu Electric recommenced generation at two significant reactors in the September quarter. A further 18 reactors have applied to re-open, though approvals remain slow. Japan’s new energy plan, released in July, calls for nuclear energy to account for 20-22

![Figure 9.3: World uranium consumption and inventory build](source)

![Figure 9.4: World uranium production and secondary supply](source)
per cent of power generation by 2030 — approximately equal to the share projected for renewable energy. The most significant phase-outs now appear to be targeting coal and oil, which are expected to decrease to 26 per cent and 3 per cent of generation (respectively) by 2030. The plan confirms that nuclear power remains ‘an important baseload power source that contributes to the stability of the long-term energy supply’.

9.4 World production

Production cuts are likely to last for some time

Global uranium production has been squeezed by a series of suspensions and production cuts in Canada, Niger, and Kazakhstan. This is expected to cut mine output by more than 10 per cent in 2018, to 62,100 tonnes.

Large producers appear to be doubling down on these production cuts, with Cameco extending its production pauses indefinitely at the McArthur River and Key Lake mines in Canada. The firm is seeking to draw down inventories and improve efficiency to support its cash flow. The pause means that production from the McArthur River mine — the largest uranium mine in the world — will be effectively nil in 2018.

Mineral supply may rise in other places, however, with the Tanzanian government recently stepping up in its implementation of International Atomic Energy Agency (IAEA) recommendations, which include stronger regulatory infrastructure and proper legislation for safe mining and sales. Tanzania’s progress suggests it is prioritising efforts to become a significant uranium producer in the future.

Supply may lift from secondary sources as well. Canada’s SNC-Lavelin company has recently agreed to expand its supply of Natural Uranium Equivalent fuel to the Qinshan Phase III plant in China. This fuel is made up from depleted and recycled uranium, and further expansions in use of this fuel type could expand the secondary market in uranium. Nuclear generation continues to slowly pivot towards a more recycling-based, ‘closed loop’ approach, which should significantly cut waste and reduce future dependence on uranium mining.
9.5 Australia

Australia’s uranium exploration has virtually dried up

As Figure 9.6 shows, only $1.6 million was spent on uranium exploration in the June quarter 2018. This is the lowest spend since 2004, and reflects the impact of a long period of low prices as well as a recent state government ban on new uranium mines in Western Australia.

Uranium exploration is now largely confined to a few sites in South Australia, the Northern Territory, and Queensland. Recent price gains may create an incentive for wider exploration in subsequent quarters.

Production is expected to remain largely steady over the next two years

As Figure 9.7 shows, Australian production is expected to lift from 6,654 tonnes in 2017–18 to 7,140 tonnes in 2018–19 and 7,240 tonnes in 2019–20. This reflects a resumption of normal production at Olympic Dam, which previously reduced output during its 2017 mine upgrades.

Prospects for the restart of Boss Resources Honeymoon uranium project in South Australia have recently lifted, with the firm claiming it has de-risked the project commercially and technically. Efforts to restart production have begun, and will likely progress through 2019 and 2020. However, any eventual resumption will occur beyond the outlook period, and will depend on further gains in the uranium price.

Conditions for exporters remain difficult, but Australia is still well placed

Price growth should support export values in coming years, with earnings forecast to lift from $642 million in 2017–18 to $698 million by 2019–20 (see Figure 9.8). Export volumes are expected to edge back from 7,684 tonnes in 2017–18 (a result inflated by the timing of shipments) to 7,240 tonnes by 2019–20.

Although conditions remain tough, the recent price rise is the strongest sign of improvement in some years. Australia remains highly cost-competitive among uranium producers globally, and is well-placed to capture the gains should conditions continue to improve.
Table 9.1 Uranium outlook

<table>
<thead>
<tr>
<th>World</th>
<th>Unit</th>
<th>2017</th>
<th>2018f</th>
<th>2019f</th>
<th>2020f</th>
<th>2018f</th>
<th>2019f</th>
<th>2020f</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td>kt</td>
<td>69.0</td>
<td>62.1</td>
<td>65.9</td>
<td>72.5</td>
<td>61.0</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>Africab</td>
<td>kt</td>
<td>9.1</td>
<td>8.8</td>
<td>9.2</td>
<td>10.0</td>
<td>4.8</td>
<td>8.6</td>
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<tr>
<td>Canada</td>
<td>kt</td>
<td>15.6</td>
<td>8.2</td>
<td>11.8</td>
<td>16.8</td>
<td>43.3</td>
<td>42.3</td>
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<td>Kazakhstan</td>
<td>kt</td>
<td>26.7</td>
<td>27.0</td>
<td>27.0</td>
<td>27.5</td>
<td>0.0</td>
<td>1.5</td>
<td></td>
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<tr>
<td>Russia</td>
<td>kt</td>
<td>3.6</td>
<td>3.7</td>
<td>3.7</td>
<td>3.8</td>
<td>0.0</td>
<td>3.1</td>
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<tr>
<td><strong>Consumption</strong></td>
<td>kt</td>
<td>80.9</td>
<td>84.1</td>
<td>89.7</td>
<td>94.3</td>
<td>6.8</td>
<td>5.0</td>
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<tr>
<td>European Union 28</td>
<td>kt</td>
<td>22.9</td>
<td>22.5</td>
<td>23.5</td>
<td>23.3</td>
<td>4.6</td>
<td>–0.6</td>
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<tr>
<td>United States</td>
<td>kt</td>
<td>21.8</td>
<td>21.8</td>
<td>21.8</td>
<td>21.7</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>China</td>
<td>kt</td>
<td>10.4</td>
<td>12.9</td>
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<td>26.3</td>
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<tr>
<td>Russia</td>
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<td>8.0</td>
<td>8.1</td>
<td>0.1</td>
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<tr>
<td>Japan</td>
<td>kt</td>
<td>1.3</td>
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<td>1.9</td>
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<td>0.0</td>
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<tr>
<td><strong>Spot price</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>US$/lb</td>
<td>21.7</td>
<td>23.7</td>
<td>26.2</td>
<td>28.0</td>
<td>10.8</td>
<td>6.9</td>
<td></td>
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<tr>
<td>realc</td>
<td>US$/lb</td>
<td>22.2</td>
<td>23.7</td>
<td>25.6</td>
<td>27.1</td>
<td>8.3</td>
<td>5.7</td>
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<tr>
<td>Mine production</td>
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<td>6,654</td>
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<td>7.3</td>
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<td>Export volume</td>
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<td>7,240</td>
<td>–7.1</td>
<td>1.4</td>
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<tr>
<td>– nominal value</td>
<td>A$m</td>
<td>596</td>
<td>642</td>
<td>675</td>
<td>698</td>
<td>5.1</td>
<td>3.4</td>
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<tr>
<td>– real valued</td>
<td>A$m</td>
<td>621</td>
<td>657</td>
<td>675</td>
<td>681</td>
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<td>1.0</td>
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<tr>
<td>Average price</td>
<td>A$/kg</td>
<td>84.2</td>
<td>83.6</td>
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<td>96.4</td>
<td>–0.7</td>
<td>13.1</td>
<td></td>
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<tr>
<td>– reald</td>
<td>A$/kg</td>
<td>87.8</td>
<td>85.5</td>
<td>94.5</td>
<td>94.1</td>
<td>10.5</td>
<td>–0.4</td>
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</tbody>
</table>

Notes: b Includes Niger, Namibia, South Africa, Malawi and Zambia; c In 2018 US dollars; d in 2018–19 Australian dollars; f forecast.
Source: Australian Department of Industry, Innovation and Science (2018); Cameco Corporation (2018); Ux Consulting (2018) Uranium Market Outlook
Gold
Resources and Energy Quarterly September 2018

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

303 tonnes of gold produced by Australia in 2017–18

9% of world mine gold supplied by Australia in 2017–18

World record find: Australia holds the record for the world’s largest gold nugget weighing 72 kg, found in Victoria in 1869.

Key jewellery consumer markets (tonnes):
- Hong Kong: 44
- Iran: 45
- UAE: 46
- United States: 124
- India: 594
- China: 648

Major Australian gold deposits (t):
- <20
- 21–70
- 71–185
- 186–473
- 474–1,027
- >1,028

Global uses of gold:
- 53% Jewellery
- 25% Gold coins and bars
- 5% Global Backed Exchange Traded Funds
- 9% Central Bank Reserves
- 7% Electronics and Industrial
- 1% Dental and medical
10.1 Market summary
- A rising US dollar has placed downward pressure on gold prices during the past five months.
- However, gold prices are likely to be supported in 2019 and 2020 by higher inflation and interest rates in the US.
- Australia’s export earnings for gold are forecast to fall slightly in 2018–19, but recover in 2019–20 to reach $20 billion. This is expected to be driven by higher gold prices and a lift in export volumes to 361 tonnes by the end of the outlook period.

10.2 Prices

Gold prices were under pressure in the first eight months of 2018
The London Bullion Market Association (LBMA) gold price reached a 20 month low on 17 August, falling to $US1,179 an ounce. This was driven by monetary policy tightening in the United States and the strengthening of the US dollar. The US Federal Funds Rate has been raised steadily, increasing the target range from 0.50-0.75 per cent in January 2017, to 1.75-2.0 per cent by August 2018.

The US Trade Weighted Index (TWI) — a measure of the foreign exchange value of the US dollar against a basket of major foreign currencies — remains at very high levels (around 126), as the strength of the US economy becomes apparent. Weak gold demand from India has also placed downward pressure on gold prices. And the meeting between the US and North Korea in Singapore in June 2018 has led to some easing in geopolitical risks, which has led to slightly lower demand for safe-haven assets. Gold prices are expected to remain under pressure for the rest of 2018 US interest rates and the US dollar continue to rise, reducing the relative attractiveness of gold (Figure 10.1).

Reflecting these factors, the forecast average price for 2018 has been revised downward, from US$1,352 an ounce forecast in the June quarter Resources and Energy Quarterly (REQ) to average US$1,304 an ounce.

Figure 10.1: Gold price and US dollar

Gold prices to increase in 2019 and 2020
Gold is likely to benefit from a levelling out in the US dollar in 2019 and 2020, as US economic growth peaks. Gold prices are expected to recover modestly in 2019 and beyond, as the US interest rate cycle tops out and US inflation pushes above the US Federal Reserve’s 2 per cent target.

The US economy has been stoked by tax cuts and a flood of repatriated capital in 2018. With US monetary conditions tightening steadily over the next fifteen months, a correction in US equity markets remains a significant risk over the forecast period. Such a correction would likely result in fund flows into gold, after outflows from the gold market over the past few quarters.

Gold price is forecast to increase by 1.8 and 0.4 per cent in 2019 and 2020, to average US$1,328 and US$1,333 an ounce, respectively.
10.3 Consumption

World gold consumption declined in the first half of 2018

World gold consumption fell to 1,960 tonnes in the first half of 2018 — a fall of 6.1 per cent year-on-year. Higher US interest rates and a stronger US dollar led global investors to seek higher returns elsewhere. Demand for gold bars and coins declined by 7.6 per cent year-on-year in the first half of 2018, to 509 tonnes. This was driven by lower purchases in China, Germany and the US, where attractive equity valuations and strong economic growth dampened the demand for gold. Over this period, inflows into gold-backed exchange traded funds (ETFs) dropped by 62 per cent year-on-year to 61 tonnes. Demand for jewellery fell slightly (by 0.5 per cent year-on-year), largely due to weaker demand from India. Partially offsetting this, the use of gold in electronic devices and equipment rose by 3.9 per cent year-on-year to 132 tonnes (Figure 10.2).

World gold demand is forecast to increase by 3.3 per cent in 2019 and 1.9 per cent (to 4,369 tonnes) in 2020. Growth is expected to be driven by increased consumption from India and China, with the US-China trade war stimulating Chinese demand. Economic growth in India and China is expected to remain relatively strong, leading to higher income and wages, which should also support gold demand. Fears of further Chinese currency weakness is likely to be a strong catalyst for increased gold consumption in China, as gold is often used as a currency hedge. China’s recent fiscal stimulus policy (which includes personal income tax cuts), may also boost gold demand in 2018. In India, the impact of the Kerala floods appear to be temporary, and expectations remain positive as consumers prepare for the traditional buying (wedding) season from October to December.

Escalating trade tensions, rising inflation rates in some advanced economies, and increasing economic uncertainty in Turkey, Argentina and the United Kingdom are all likely to have some effects on consumer and business confidence. As a result, strong demand for safe-haven assets (including gold) is expected over the forecast period.

![Figure 10.2: World gold consumption](source: World Gold Council (2018) Demand Trends; Department of Industry, Innovation and Science (2018))

10.4 Production

World gold supply increased in the first-half of 2018

World gold supply rose by 5.1 per cent year-on-year in the first-half of 2018 to 2,227 tonnes, driven by rising mine production and increased recycling. Over this period, supply from gold mine production grew by 3.7 per cent year-on-year to 1,630 tonnes, as several projects ramped up. Output is rising from the Tanami gold mine in Australia, the Natalka mine in Russia, the Grasberg mine in Indonesia, and the Brucejack, Rainy River and Moose River mines in Canada.

However, production in the first half of 2018 in China — the world’s largest gold producer — continued to decline, falling by 5 per cent year-on-year. Environmental reforms introduced in 2017 have impacted the country’s gold production, and in June 2018, the Chinese Ministry of Ecology and Environment launched the largest ever number of compliance inspections. Gold recycling grew by 0.8 per cent year-on-year in the first-half of 2018, reaching 575 tonnes. Turkey and Iran were the main drivers of the growth,
as the depreciation of both nations’ currencies raised local currency gold prices, encouraging gold consumers to take profits on their holdings. Over this period, recycling in India grew by 4.5 per cent to 46 tonnes, as Indian farmers sold gold to fund their farming equipment and seed purchases.

**World gold supply forecast to grow between 2018 and 2020**

World gold supply is forecast to increase at an average annual growth rate of 2.1 per cent in 2018 and 2019, reaching 4,631 tonnes in 2019 before declining to 4,530 tonnes in 2020. Supply growth in 2018 and 2019 is expected to be mainly driven by stronger mine and scrap output (Figure 10.3).

Global mine production is forecast to increase by 2.1 per cent (to 3,370 tonnes) in 2019 and by 1.2 per cent (to 3,409 tonnes) in 2020. An expected rise in gold prices and solid project pipelines in Australia and Russia are likely to drive higher global gold output, with miners focusing on expansion and joint-venture partnerships after years of cost cutting.

In Russia, output remains dominated by locally owned miners, as strict regulation of foreign investment limits overseas entrants to the sector. However, the increasing trend towards partnerships is likely to boost project development. Highland Gold Mining (a UK-based gold producer) has spent US$229 million developing its flagship Kekura gold mine project (located near the Arctic Circle, in remote far eastern Russia), which is expected to begin production in 2020. In July 2018, India’s Sun Gold and China National Gold launched a joint Kluchevskoye gold mining project in Russia’s Siberia region.

Russian gold and silver producer Polymetal commissioned its Kyzyrl mine in Kazakhstan in June 2018. The mine is expected to ramp-up production to 8.8 tonnes of gold in 2019 and 10 tonnes of gold in 2020.

China’s gold mine production is expected to fall over the forecast period, due to declining ore grades and the impact of tightened environmental standards.

**Figure 10.3: World primary and secondary gold production**


However, Chinese gold producers are expected to ramp up investment in foreign gold mines, with firms such as Shandong Gold Group and Shaanxi Gold Group already investing in gold projects abroad.

In South Africa, gold producers recently offered annual wage increases of up to 6.5 per cent to miners. The wage rise is added further cost pressure to the country’s gold industry, which has already facing difficulties with depressed prices, labour unrest and soaring power bills.

At the company level, Canadian Barrick Gold is the world’s largest gold producer, supported by high grade reserves and low operating costs. The company has maintained its production guidance for 2018, with estimates of around 156 tonnes of gold. This would position the company to lose its place to US Newmont Mining, which aims to raise output to 168 tonnes of gold in 2018.
10.5 Australia

Exploration expenditure continues to increase in trend terms

Australia’s gold exploration expenditure rose by 16 per cent year-on-year in the June quarter 2018, to $220 million, likely driven by an expected rise in gold prices in 2019 and beyond. Western Australia remained the centre of gold exploration activity in Australia, accounting for 74 per cent (or 162 million) of total gold exploration expenditure (Figure 10.4).

Figure 10.4: Australia’s gold exploration

![Graph showing gold exploration expenditure by quarter for Western Australia and Rest of Australia from 2008 to 2018.]


Australian gold mine production increased in 2017–18

Australia’s gold mine production increased by 3.5 per cent in 2017–18, to 303 tonnes, propelled by increased production in several large gold mines in the Northern Territory and Western Australia. The joint-venture AngloGold Ashanti and Independence Group’s Tropicana production increased by 8.2 per cent, to nearly 15 tonnes, driven by an improved grade streaming process. Newmont’s Tanami production rose by 21 per cent, to 15 tonnes, driven by higher throughput and ore grade milled. However, production at Newcrest’s Cadia mine in New South Wales decreased by 3.2 per cent, to 19 tonnes, as one of the mine’s two tailings dams suffered a wall slide. Newmont’s Boddington gold mine production fell by 12 per cent, to 23 tonnes, due to lower ore grades and recoveries.

Australian gold mine output forecast to grow moderately in the short term

Australia’s gold mine production is forecast to grow by 1.1 per cent in 2018–19, to 306 tonnes, and then by a further 4.5 per cent to 320 tonnes in 2019–20. The growth is driven by mine expansions and by the commencement of production at several new gold mine projects. Gold Roads’ Gruyere gold mine (annual production of 8.4 tonnes) is expected to come online in early 2019. Capricorn Metals’ Karlawinda gold mine project (annual production of 4.0 tonnes) is expected to be commissioned in 2020. Newcrest’s Cadia Valley expansion project, due to be completed in 2019, is expected to add 3.3 tonnes of gold a year. Northern Star’s Jundee expansion project — worth around 1.1 tonnes of gold per annum — is also expected to finish by 2020.

In April 2018, OZ Minerals received approval from the South Australian Government to start the second phase of development of its $916 million Carrapateena copper-gold project — one of the largest mines being developed in Australia — with an annual production of 2.0 tonnes of gold. Carrapateena is currently in phase 1 of construction, with an estimated commissioning date in the December quarter 2019.

Junior gold producers are expected to assist production growth, with several projects now underway. Kin Mining received approval from the Western Australia Government to begin construction at its Leonora gold mine project (annual production of 2.2 tonnes), which is expected to commence production in the first-half of 2019.

Figure 10.5 shows gold production cash costs for Australia, Russia, China, the US, Papua New Guinea, Chile and South Africa for 2017. Australia’s gold cash costs (at US$630 an ounce of gold) were higher than Russia, China and the US. However, Australia’s mining costs were about 25 per cent below South Africa’s, reflecting lower processing costs (by 45 per cent), and lower administration and support costs (by 13 per cent). Australia’s gold industry thus remains competitive and profitable, despite recent falls in the gold prices.
Australian gold exports increased in 2017–18

Australia’s gold exports increased by 4.8 per cent in 2017–18, to nearly $19 billion, propelled by higher production and export volumes in the first-half of 2017–18. Over this period, export volumes rose by 4.2 per cent to 348 tonnes. The jump in exports was driven by increased local mine production and higher imports of gold ore from Papua New Guinea (PNG) for refining — the Ok Tedi mine in PNG is ramping up production, which is shipped to the Perth Mint for further processing and re-export (Figure 10.6).

Exports forecast to fall slightly in 2018–19, but resume growing in 2019–20

Australia’s gold export earnings are forecast to decrease by 2.3 per cent in 2018–19 to just above $18 billion, as export volumes and prices fall. However, gold exports are forecast to resume growing in 2019–20, lifting by 7.5 per cent to $20 billion, as a result of increased export volumes and prices. Australia’s gold producers are expected to experience strong conditions over the outlook period, in an environment of high local currency returns and rising global demand.

China (including Hong Kong) is the main export market for Australian gold, accounting for 58 per cent (or 202 tonnes) of Australia’s total gold export volumes of 348 tonnes in 2017–18. The Chinese market is expected to provide further upside to Australian gold producers and exporters over the outlook period. Demand for bar and coin from China rose by 8 per cent in 2017 to 314 tonnes, and is forecast to grow strongly in the next two years, driven by rising fears of local currency depreciation and trade tensions with the US. In addition, gold used in technology is expected to grow further, driven by wireless applications. The traditional technology hubs in mainland China and Hong Kong are likely to consume more gold from Australia in meeting increased demand for printed circuit boards — tools that provide mechanical and electronic connections.
Table 10.1: Gold outlook

<table>
<thead>
<tr>
<th>World</th>
<th>Unit</th>
<th>2017</th>
<th>2018f</th>
<th>2019f</th>
<th>2020f</th>
<th>2018f</th>
<th>2019f</th>
<th>2020f</th>
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<tr>
<td>Total demand</td>
<td>tonnes</td>
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<td>4,148</td>
<td>4,286</td>
<td>4,369</td>
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<td>3.3</td>
<td>1.9</td>
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<td>Fabrication consumptionb</td>
<td>tonnes</td>
<td>2,515</td>
<td>2,599</td>
<td>2,671</td>
<td>2,725</td>
<td>3.3</td>
<td>2.8</td>
<td>2.0</td>
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<td>Mine production</td>
<td>tonnes</td>
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<td>3,370</td>
<td>3,409</td>
<td>3,397</td>
<td>2.0</td>
<td>1.2</td>
<td>–0.4</td>
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Pricec

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<tr>
<td>Nominal</td>
<td>US$/oz</td>
<td>1,257</td>
<td>1,304</td>
<td>1,328</td>
<td>1,333</td>
<td>3.7</td>
<td>1.8</td>
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<td>Reald</td>
<td>US$/oz</td>
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<td>1,304</td>
<td>1,298</td>
<td>1,289</td>
<td>1.2</td>
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Australia

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<tbody>
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<td>Mine production</td>
<td>tonnes</td>
<td>293</td>
<td>303</td>
<td>306</td>
<td>320</td>
<td>3.5</td>
<td>1.1</td>
<td>4.5</td>
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<td>Export volume</td>
<td>tonnes</td>
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<td>348</td>
<td>336</td>
<td>361</td>
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<td>18,875</td>
<td>18,433</td>
<td>19,810</td>
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<td>–2.3</td>
<td>7.5</td>
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<tr>
<td>Real valuee</td>
<td>A$m</td>
<td>18,783</td>
<td>19,309</td>
<td>18,433</td>
<td>19,341</td>
<td>2.8</td>
<td>–4.5</td>
<td>4.9</td>
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Price

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<tbody>
<tr>
<td>Nominal</td>
<td>A$/oz</td>
<td>1,720</td>
<td>1,665</td>
<td>1,709</td>
<td>1,705</td>
<td>–3.2</td>
<td>2.6</td>
<td>–0.2</td>
</tr>
<tr>
<td>Reale</td>
<td>A$/oz</td>
<td>1,793</td>
<td>1,703</td>
<td>1,709</td>
<td>1,664</td>
<td>–5.0</td>
<td>0.3</td>
<td>–2.6</td>
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</table>

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

11.1 Summary

- Uncertainty in global aluminium supply chains is expected to drive prices up during 2018, to US$2,146 a tonne for aluminium and US$449 a tonne for alumina. Prices are then forecast to decline to US$2,092 a tonne for aluminium and US$354 a tonne for alumina by 2020.

- Australia’s aluminium and alumina exports are expected to be steady through to 2019–20, at 1.4 million tonnes and 18 million tonnes per annum respectively. Bauxite exports are forecast to increase from 30 million tonnes in 2017–18 to 32 million tonnes in 2019–20.

- Total Australian export earnings for aluminium, alumina and bauxite are forecast to decline from an estimated $14 billion in 2017–18 to $13 billion in 2019–20, reflecting a decline in prices.

11.2 Prices

**Prices to remain high in 2018 due to supply uncertainty**

Aluminium prices have eased after reaching a seven year high of US$2,603 (London Metal Exchange (LME) spot price) during the June quarter 2018. The spike in the aluminium price followed the US administration placing sanctions on major aluminium and alumina supplier, United Company Rusal, earlier in the year. While the sanctions have not been lifted, the US has given buyers an extended period to end contracts with Rusal and the opportunity for Oleg Deripaska — the major shareholder of Rusal and target of the sanctions — to divest and relinquish majority ownership of the company. A resolution between the company and US administration is expected to be forthcoming. In the September quarter, Aluminium prices have tracked back towards pre-sanctions levels.

The Free On Board (FOB) Australia alumina price reached a historical high of US$643 a tonne on 1 May 2018. Like aluminium, the alumina price has subsequently fallen back. The price has remained relatively high due to ongoing supply concerns, primarily in China, the curtailment of production at the Alunorte refinery in Brazil and workers striking at Alcoa’s Australian operations. The alumina price is forecast to be US$449 a tonne in 2018, and is expected to sustain aluminium prices at US$2,146 a tonne.

**Prices to fall modestly in 2019 and 2020**

The LME aluminium spot price and the FOB Australian alumina price are both estimated to fall from 2018 levels as supply concerns ease. The LME aluminium spot price is estimated to average US$2,093 a tonne in 2019 and US$2,092 a tonne in 2020. The FOB Australian alumina price is estimated to average US$363 a tonne in 2019 and US$354 a tonne in 2020 (Figure 11.1).

Despite the forecast declines, prices for 2019 and 2020 are still high relative to previous years, as capacity controls and restrictions on production due to air pollution concerns continue to keep the market tight in China — the world’s largest aluminium and alumina producer. The Chinese Government’s focus on reducing air pollution is expected to continue until at least 2020. The policy lowers the likelihood of aggressive capacity expansion in China.

**Figure 11.1: World aluminium and alumina prices**

![Figure 11.1: World aluminium and alumina prices](source: LME (2018) spot prices; Metals Bulletin (2018) Alumina monthly price; Department of Industry, Innovation and Science (2018).)
11.3 Consumption

**China driving global consumption**

Despite some signs of softening global consumption, aluminium demand is expected to grow in 2018. Global consumption fell by 2.9 per cent year-on-year over the first half of 2018. The fall in consumption was primarily driven by a 2.5 per cent year-on-year fall in Chinese demand. China is the world’s largest consumer of aluminium, accounting for 54 per cent in 2017. China’s Purchasing Managers Index for the June quarter was down from March and year-on-year, a potential effect of escalating trade tensions.

The decline came despite a 2.6 per cent year-on-year rise in vehicle sales, a major use of aluminium, for the first seven months of 2018. In addition, investment in Chinese real estate expenditure remained strong through to July compared with the same period a year ago. Global aluminium consumption is forecast to grow by 2.7 per cent in 2018 to reach 61 million tonnes.

World alumina consumption decreased by 2.2 per cent year-on-year in the June quarter 2018, driven by decreased alumina consumption in China (down 3.3 per cent year-on-year). Declines in alumina consumption broadly matched aluminium production for the quarter. World alumina consumption is forecast to increase by 2.6 per cent to 115 million tonnes in 2018: a trend roughly in line with aluminium usage.

**Aluminium and alumina demand expected to grow**

Over the forecast period, world primary aluminium demand is projected to grow at an average annual rate of 2.4 per cent, to reach 64 million tonnes in 2020 (Figure 11.2). China’s aluminium consumption is expected to continue to grow firmly over the next two years (reaching 35 million tonnes in 2020), supported by strengthening residential and infrastructure construction.

A significant driver of aluminium demand is expected to come from automobiles, particularly energy-efficient vehicles with an increasing portion of aluminium components. China is expected to be a major driver of energy-efficient vehicle production, with a new energy vehicle (NEV) credit mandate taking effect in 2018. The mandate has a NEV target of 10 per cent of the passenger car market in 2019 and 12 per cent in 2020. Demand for automobiles is expected to remain strong through to 2020.

World alumina consumption is projected to grow at an average annual rate of 2.1 per cent, reaching 120 million tonnes in 2020 — in line with the average annual growth rate of aluminium production.

![Figure 11.2: World aluminium consumption](source)

**11.4 Production**

**Tighter supply for aluminium and alumina in 2018**

In early August, the Chinese central government announced that the winter production cuts implemented in 2017–18 would be repeated during 2018–19. As in 2017–18, operations in 28 cities will be targeted, with coal-fired aluminium and alumina plants required to cut production by 30 per cent over the winter. Producers implementing environmentally clean technology and already cutting production beyond requirements could be exempt or subject to lower cuts. As with the previous winter cuts,
production could be expected to front-load in the months before enforcement. Aluminium production for 2018 is expected to finish at 61 million tonnes.

Alumina production for the first seven months of 2018 has declined by 4.8 per cent year on year, driven by a 5.5 per cent reduction in Chinese production and an 18 per cent reduction in South American production. Lower output at the Alunorte alumina refinery in Brazil drove the reduction in South American production, with curtailment of production by 50 per cent since March 2018 for environmental reasons. The Brazilian refinery—the largest in the world, has announced that timing of a return to full capacity is uncertain, however could be achieved between October 2018 and mid-2019. In addition, some alumina refineries in China have reported limited availability of bauxite as a production constraint.

Alumina production is expected to reach 126 million tonnes for 2018. Risks to this estimate include the Chinese winter production cuts, the return of the Alunorte refinery to full capacity, and the pending resolution of US sanctions on United Company Rusal.

Global bauxite production increased by 9.2 per cent year on year in the first six months of 2018. The increase in production was driven by developments in Guinea, where production increased by 7.7 million tonnes, or 39 per cent year-on-year. This was partially offset by no Malaysian production occurring for the first half of 2018 due to a ban on bauxite mining by the Malaysian government. Over the same period in 2017, Malaysia had produced 3.4 million tonnes of bauxite. The ban, originally put in place for environmental considerations during early 2016, has been extended to the end of 2018. Global bauxite production is forecast to reach 331 million tonnes in 2018, an 8.4 per cent increase from 2017.

Environmental regulation in China to slow world aluminium/alumina output
Over the outlook period, growth in supply of world aluminium is expected to be slowed by China’s environmental policies. The Chinese government’s second round of winter production cuts demonstrate an ongoing commitment to curbing air pollution in major cities. Outside of China, new aluminium capacity is expected to come online during 2019 and 2020 primarily in Iran, Bahrain and India. World aluminium production is forecast to grow at a slower rate to reach 62 million tonnes in 2019 and 64 million tonnes in 2020 (Figure 11.3).

There are two risks to this assessment. Firstly, the potential restart of idled aluminium capacity in the US as import tariffs take effect. Secondly, uncertainties regarding China’s curtailment policy will make supply more unpredictable over the outlook period. These uncertainties include the potential addition and restart of new and idled capacity in areas outside of the pollution-affected areas, and the scale of production curtailment exemptions granted to large state-owned corporations.

**Figure 11.3: World aluminium, alumina and bauxite production**

![Graph showing world aluminium, alumina, and bauxite production from 2010 to 2020](image)

Source: International Aluminium Institute (2018); World Bureau of Metal Statistics (2018); Department of Industry, Innovation and Science (2018)

World alumina production is forecast to increase to reach 128 million tonnes in 2019 and 131 million tonnes in 2020. This growth rate is slower than that of the previous few years, due to China’s environmental reforms. New alumina capacity is expected to come online in the UAE and India over the outlook period.
Australia and Guinea to drive rising global bauxite output in 2019 and 2020

World bauxite production is forecast to grow at an average annual rate of 5.3 per cent to reach 357 million tonnes in 2019 and 367 million tonnes by 2020. The gains will be driven by new capacity coming online in Australia — notably the commissioning of Bauxite Hill and Amrun projects — and in Guinea. Guinea is currently the world’s third largest bauxite producer behind Australia and China, and could grow further given the scale of its untapped reserves.

11.4 Australia’s exports and production

A decline in export values to follow high values in 2017–18 and 2018–19

The value of Australia’s aluminium, alumina and bauxite exports finished at an 11-year high of $14 billion in 2017–18. The increase was driven by higher volumes of bauxite exports and higher export unit values for alumina and aluminium. Despite a 2.7 per cent decline in export volumes, stronger alumina prices saw alumina export earnings reach a historical high in 2017–18, at $8.5 billion.

After the high values of 2017–18, it is forecast that aluminium, alumina and bauxite export earnings will be maintained at $14 billion during 2018–19. This is expected to be driven by high alumina prices forecast for the first half of 2018–19. Export values are expected to decline in 2019–20 to $13 billion. This decline is due to an expected softening of prices for aluminium and alumina over the outlook period, which will be partially offset by increased export volumes of bauxite.

Environmental priorities are likely to remain an important influence on the Chinese aluminium, alumina and bauxite industries, with flow-on effects to 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 which fail to meet new environmental regulations. While this is expected to tighten global aluminium and alumina supply, it will also reduce demand for Australian alumina and bauxite in the short term because they are inputs. A risk to this assessment is that global bauxite supply could tighten if the Malaysian bauxite mining ban remains in place, and Chinese pollution policies focus on bauxite mining. This presents a potential upside to Australia’s bauxite export earnings.

The majority (87 per cent) of Australia’s aluminium and alumina production is destined for export markets. Although there are emerging opportunities for Australia from the forecast high aluminium and alumina prices, exports are likely to be constrained by capacity limits and increased competition from low-cost producers in other nations. Australia is exempt from the US tariffs on aluminium imports, and so has an opportunity to expand sales into the US. In addition, Australian alumina exports into the US could rise if idle US aluminium capacity is restarted as a result of the impact of the tariffs.

Export earnings revised upwards

Total forecast earnings for aluminium, alumina and bauxite have been revised up in 2018–19 by $996 million from the June Resources and Energy Quarterly. The upwards revision largely reflects an improved outlook for alumina prices due to supply concerns, and to a smaller degree increased volumes of bauxite exports expected as new export-oriented projects come online over the outlook period.

Steady aluminium/alumina production, but moderate growth in bauxite production in 2017–18

Australia produced 1.6 million tonnes of primary aluminium in 2017–18, up 3.0 per cent from 2016–17. The increase is attributed to the return of full production to the Portland Aluminium smelter, where production was cut during December 2016 due to a power outage (Figure 11.4). Alumina production during 2017–18 was 20 million tonnes, a 1.6 per cent decline from 2016–17 (Figure 11.5).

Australia’s bauxite production was 94 million tonnes in 2017–18, an increase of 11 per cent from 2016–17 (Figure 11.6). A new bauxite mining operation, Metro Hills, began production in north Queensland in April 2018, with an initial planned annual output of two million tonnes, rising to six million tonnes per annum in the next three years.
New capacity to contribute to strong growth in bauxite production

With no planned expansions to smelter or refinery capacity in the short-term, Australian output is forecast to remain at 1.6 million tonnes per annum for aluminium and 20 million tonnes for alumina in 2018–19 and 2019–20. Australia’s bauxite production is projected to grow at an annual average rate of 8.3 per cent, to 108 million tonnes in 2019–20.

Figure 11.4: Australia’s aluminium exports and production

![Australia’s aluminium exports and production chart]


The strong growth is due to the Bauxite Hills mine increasing production towards full capacity and the commencement of Rio Tinto’s Amrun project in early 2019. Another potential addition to Australia’s bauxite production is in Queensland at Metallica Minerals’ Urquhart mine. The company obtained a mining lease from the Queensland Government in early 2018, and mining is pending final approvals and the completion of infrastructure.

A potential risk to the outlook in 2018–19 is the ongoing industrial action at Alcoa Australia’s alumina and bauxite operations. A worker’s strike began in early August 2018 and was ongoing at the time of writing. The company announced that alumina production had been cut by about 15,000 tonnes over August as a result.

Figure 11.5: Australia’s alumina exports and production

![Australia’s alumina exports and production chart]


Figure 11.6: Australia’s bauxite exports and production

![Australia’s bauxite exports and production chart]

Table 11.1: Aluminium, alumina and bauxite outlook

<table>
<thead>
<tr>
<th>World</th>
<th>Unit</th>
<th>2017</th>
<th>2018(^f)</th>
<th>2019(^f)</th>
<th>2020(^f)</th>
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<td></td>
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<td>2018(^f)</td>
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<tr>
<td>Primary aluminium</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Production</td>
<td>kt</td>
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<td>2,393</td>
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<td>2.0</td>
<td>2.0</td>
<td>1.8</td>
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<tr>
<td>Prices aluminium(^c)</td>
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<td></td>
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<td></td>
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<td></td>
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<tr>
<td>– nominal</td>
<td>US$/t</td>
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<td>2,146</td>
<td>2,093</td>
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<tr>
<td>– real(^d)</td>
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<td>97.3</td>
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<tr>
<td>– nominal</td>
<td>US$/t</td>
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<td>353.8</td>
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<tr>
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<td>US$/t</td>
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<tr>
<td>Primary aluminium</td>
<td>kt</td>
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<td>1,564</td>
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<td>Bauxite</td>
<td>Mt</td>
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<td>94.2</td>
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<td>1,381</td>
<td>1,381</td>
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<td>4,010</td>
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<td>3,595</td>
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<td>17,746</td>
<td>17,389</td>
<td>17,511</td>
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<td>A$m</td>
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<td>7,980</td>
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</tr>
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<td>9,094</td>
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<td>30,481</td>
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</tr>
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<td>A$m</td>
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<td>1,190</td>
<td>1,311</td>
<td>1,326</td>
<td>14.2</td>
</tr>
<tr>
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<td>A$m</td>
<td>1,087</td>
<td>1,217</td>
<td>1,311</td>
<td>1,295</td>
<td>12.0</td>
</tr>
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<td>Total value</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>– nominal value</td>
<td>A$m</td>
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<td>13,737</td>
<td>14,203</td>
<td>12,988</td>
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<tr>
<td>– real value(^e)</td>
<td>A$m</td>
<td>11,329</td>
<td>14,053</td>
<td>14,203</td>
<td>12,680</td>
<td>24.0</td>
</tr>
</tbody>
</table>

Notes: b Producer and LME stocks; c LME cash prices for primary aluminium; d In 2018 calendar year US dollars; e In 2018-19 financial year Australian dollars; f Forecast; Source: ABS (2018) International Trade in Goods and Services, 5368.0; AME Group (2018); LME (2018); Department of Industry, Innovation and Science (2018); International Aluminium Institute (2018); World Bureau of Metal Statistics (2018)
Australia is the world's 7th largest producer of copper in the world.

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

The average home contains 180 kg of copper.

Key copper consumer markets (thousand tonnes), 2017

- China: 11,923
- United States: 1,781
- Germany: 1,200
- Japan: 974
- South Korea: 656
- Italy: 652
- South Korea: 656
- Japan: 974
- Germany: 1,200
- United States: 1,781

Major Australian copper deposits (Mt)

- >6.9
- 2.2–6.8
- 0.9–2.1
- 0.03–0.8
- <0.01

Australia is the 3rd largest exporter of copper ores and concentrates.

Global uses of copper

- Building Construction: 30%
- Infrastructure: 15%
- Transport: 12%
- Industrial: 12%
- Equipment: 31%
12.1 Summary

- Trade tensions have hit copper prices in recent months, causing a 20 per cent decline. However, rising demand is expected to gradually reverse this fall, with prices forecast to rise from US$6,726 a tonne in 2018 to US$7,734 by 2020.

- Australia’s copper exports are forecast to rise from 888,000 tonnes in 2017–18 to over 1 million tonnes (in metal content terms) in 2019–20. This reflects an increase in production from several existing mines.

- Australia’s copper export earnings are forecast to lift from $8.5 billion in 2017–18 to $11.3 billion by 2019–20. Exports should benefit from rising production and from price growth later in the outlook period.

12.2 Prices

Copper prices have dropped, temporarily
Copper prices have turned bearish in recent months, plunging by 20 per cent to a 14-month low (of around $US6,000 a tonne) in early August. US–China trade tensions played a significant part in the recent decline: these tensions are widely considered to be one of the leading threats to global economic growth in the coming year. Copper is often considered a global economic barometer as a result of its importance for infrastructure development and manufacturing.

Instability in copper prices has been exacerbated by events in Turkey, where high current account deficits and a government freeze on interest rates have led to a currency crisis. Recent progress in wage talks at Escondida — the world’s largest copper mine — has also boosted copper supply, stemming potential upward pressure on copper prices.

Copper prices are expected to recover
Copper prices appear increasingly out of step with the fundamentals of global copper supply and demand, and are consequently expected to start recovering in the near-term. While trade tensions are likely to continue, it is...
expected that this will lead to greater price volatility rather than further declines. Rising demand (see Figure 12.2) should see copper prices recover late in 2018, and then lift to around $US7,088 a tonne in 2019 and $US7,774 a tonne in 2020. The fundamental conditions for copper remain strong, with industrial production rising and new consumer products emerging rapidly.

12.3 World consumption
Copper consumption is set for solid growth over the next two years. Global copper consumption is projected to rise from 24.5 million tonnes in 2018, to 25.7 million tonnes by 2020. Higher copper consumption reflects solid growth in global industrial production (see Figure 12.3) and a ramp-up in the development of copper-intensive technologies. Consumption over the short term is likely to be constrained to some degree by recent soft outcomes for fixed asset investment in Chinese manufacturing, real estate and infrastructure. Spending on Chinese infrastructure has been consistently below expectations in recent months (see Figure 12.4). As China consumes around half of all copper, this drop in usage has led to a significant fall in monthly consumption, even though industrial demand from the US and other countries has remained solid (see Figure 12.5).

Partly offsetting this, China has recently announced significant stimulus measures, in an effort to offset the impact of trade tensions with the US. These measures include tax cuts, which have been heavily targeted at research and development (R&D) spending. (Any resulting rise in R&D spending should benefit long term copper demand, due to copper’s use in many forms of emerging technology.) The Chinese Government has also brought forward a planned release of RMB1.35 trillion in bonds to sponsor infrastructure investment by local governments. These measures are expected to boost copper usage from mid-2019.

Dependence on China may also be reduced in the medium term by a rise in global electric vehicle usage. Electric vehicles typically contain about 90 kilograms of copper, and strong growth in sales across many nations is likely to result in a more balanced global market in the next few years.
12.4 World production

World copper mine production has been constrained by supply disruptions

Copper production faced some significant disruptions in the first half of 2018. Persistent threats of industrial action in Chile, export curbs in Indonesia, and sudden cuts in recycled supply from China have all created volatility and uncertainty within copper markets. However, the primary uncertainty now appears to have switched to the consumption side, and as supply has steadied, prices have plunged significantly. It is expected that, on the supply side at least, copper will have a less volatile end to 2018, with new supply kicking in from several sources.

The underlying supply picture remains strong, as Figure 12.6 shows. Output from South America and Southeast Asia provided a solid lift to global copper production during 2018. Production in Chile has increased by almost 14 per cent over the past year, and the threat of industrial action at the Escondida mine (which accounts for almost 5 per cent of global supply) has receded for the time being. Management at the mine has announced a deal in a new labour contract with the union, though the terms have yet to be put to the rank-and-file union members for a vote. At the time of writing, strikes at the mine have been put on hold after several months of unrest.

Copper supply from Zambia is also rising significantly, as substantial investment begins to unlock new ore deposits. Investment has been supported by improved stability in Zambia’s domestic power supply, as well as a period of strong growth in prices. Output from Indonesia is also growing significantly, after its temporary ban on concentrate exports was terminated in April.

Partly offsetting these positive supply trends, production in Canada and the US appears to be contracting at present, with trade tensions affecting investor confidence and discouraging some potential ramp-ups.
World mine production is expected to recover rapidly

Rising output from South Asia and South America should support a lift in global copper mine production, which is forecast to rise from 21.2 million tonnes in 2018 to 23.2 million tonnes in 2020. Two mines are likely to play a particularly significant role in enabling supply growth over the outlook period: First Quantum Minerals’ new Cobre Panama mine is expected to produce 330,000 tonnes annually from 2019, while Qulong’s new copper mine in Tibet is expected to supply 120,000 tonnes. A further 300,000 tonnes is expected to be added by expanded capacity and upgrades across numerous other mines around the world.

Rising production remains subject to several risks. These include a potential re-emergence of industrial unrest in Chile, as well as ongoing US-China and US-EU trade tensions, which could discourage output from marginal facilities. However, copper stocks are currently relatively sound (see Figure 12.7) which could curb supply risks somewhat.

World refined copper output is expected to rise over the outlook period

World refined copper output is forecast to grow from 24.3 million tonnes in 2018 to 25.5 million tonnes in 2020. This is expected to be driven by emerging markets, which have already accounted for virtually all growth in refined copper output over 2018 to date.

Over the first half 2018, output from Africa increased by about 10 per cent (through the year), while output from South America grew by just over 4 per cent, and output from Asia rose by 2 per cent. Output from the EU has been largely stable, while output from the US declined during the first half of 2018. Efforts to build new refinery capacity have been concentrated in countries with significant raw materials and relatively low labour costs, with Chinese companies making up the most significant investors.

Secondary production faced some volatility after China cut its imports of low grade scrap under new environmental laws (see Figure 12.8). Recycled copper output is expected to drop in 2019 and then rebound in 2020, as Thailand and the Philippines move into the recycling market.
12.5 Australia

Mine production will be supported by rising output from existing mines

Australian production is projected to rise from 885,000 tonnes in 2017–18 to just over 1 million tonnes in 2019 and 2020 (see Figure 12.9). This reflects higher output from several key mines, including Newcrest’s sizeable Cadia Valley mine, which is expected to ramp up its production significantly in 2019. CuDeco’s Rocklands mine in Queensland is also ramping up production, while Sterlite Industries’ Mount Lyell mine is set to return to normal production in 2019 following a brief period of care and maintenance.

Copper production in Australia is likely to be supported by the strong outlook of the fast-growing electric vehicle market. Growth in global electric vehicle sales are expected to lift sharply from the early 2020s as electric vehicles become fully price competitive with petrol vehicles. This is likely to draw significantly on copper supplies, which are essential for electric vehicle batteries. Rapid growth in battery supply chains is already encouraging firms to lock in additional raw materials and develop new refinery capabilities. Cassini Resources is currently seeking to develop substantial deposits of copper and nickel in South Australia to support the electric vehicle market, and the company has already received a $US3 million placement from Guanzhou Tinci Materials in China.

BHP is also assessing the options for a potential $2.1 billion expansion of its Olympic Dam mine. This expansion would lift copper output from the facility by around 50 per cent to over 300,000 tonnes per year. A decision is expected by 2020. Although the long-term prospects for Olympic Dam remain strong, the mine has had some mixed results this year, with copper production disrupted in August by the failure of boiler tubes at its acid plant. This led to some further technical difficulties which are expected to hinder production for around two months.

Copper exports are expected to keep rising over the outlook period

Australia’s copper export earnings are estimated to have lifted by 11.9 per cent to $8.5 billion in 2017–18. This represents a slight downward revision from the last Resources and Energy Quarterly, reflecting the recent price drop. Export earnings have, however, been supported by a return to normal production among operations at the Cadia Valley, Mount Lyell and Rocklands mines.

Higher production and modest price growth are expected to increase Australia’s copper export earnings from $8.5 billion in 2017–18 to $10.5 billion in 2018–19. Further price growth is then forecast to push earnings up to $11.3 billion by 2019–20 (see Figure 12.9).

Figure 12.9: Australia’s copper exports

Source: Department of Industry, Innovation and Science (2018)

Exploration expenditure is picking up, with broad growth across states

Exploration spending lifted from $46.2 million in the March quarter to $59.8 million in the June quarter 2018. Higher exploration was recorded in NSW, Queensland, South Australia and Western Australia.
Table 12.1: Copper outlook

<table>
<thead>
<tr>
<th>World</th>
<th>Unit</th>
<th>2017</th>
<th>2018(^f)</th>
<th>2019(^f)</th>
<th>2020(^f)</th>
<th>2018(^f)</th>
<th>2019(^f)</th>
<th>2020(^f)</th>
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<tbody>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– mine</td>
<td>kt</td>
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<td>21,204</td>
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<td>23,181</td>
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<td>3.2</td>
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<tr>
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<td>3.0</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td><strong>Closing stocks</strong></td>
<td></td>
<td>1,063</td>
<td>878</td>
<td>608</td>
<td>447</td>
<td>–17.4</td>
<td>–30.8</td>
<td>–26.4</td>
</tr>
<tr>
<td>– weeks of consumption</td>
<td></td>
<td>2.3</td>
<td>1.9</td>
<td>1.3</td>
<td>0.9</td>
<td>–19.9</td>
<td>–32.8</td>
<td>–27.7</td>
</tr>
<tr>
<td><strong>Prices LME</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– nominal</td>
<td>US$/t</td>
<td>6,164</td>
<td>6,572</td>
<td>7,037</td>
<td>7,774</td>
<td>6.6</td>
<td>7.1</td>
<td>10.5</td>
</tr>
<tr>
<td></td>
<td>USc/lb</td>
<td>280</td>
<td>298</td>
<td>319</td>
<td>353</td>
<td>6.6</td>
<td>7.1</td>
<td>10.5</td>
</tr>
<tr>
<td>– real (^b)</td>
<td>US$/t</td>
<td>6,317</td>
<td>6,572</td>
<td>6,882</td>
<td>7,517</td>
<td>4.0</td>
<td>4.7</td>
<td>9.2</td>
</tr>
<tr>
<td></td>
<td>USc/lb</td>
<td>287</td>
<td>298</td>
<td>312</td>
<td>341</td>
<td>4.0</td>
<td>4.7</td>
<td>9.2</td>
</tr>
<tr>
<td><strong>Australia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mine output</td>
<td>kt</td>
<td>917</td>
<td>885</td>
<td>1,019</td>
<td>1,034</td>
<td>–3.5</td>
<td>15.1</td>
<td>1.5</td>
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<tr>
<td>Refined output</td>
<td>kt</td>
<td>448</td>
<td>367</td>
<td>409</td>
<td>397</td>
<td>–18.0</td>
<td>11.3</td>
<td>–3.0</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– ores and cons. (^c)</td>
<td>kt</td>
<td>1,752</td>
<td>1,988</td>
<td>2,200</td>
<td>2,336</td>
<td>13.5</td>
<td>10.7</td>
<td>6.2</td>
</tr>
<tr>
<td>– refined</td>
<td>kt</td>
<td>413</td>
<td>316</td>
<td>375</td>
<td>364</td>
<td>–23.6</td>
<td>18.8</td>
<td>–2.9</td>
</tr>
<tr>
<td>– total metallic content</td>
<td>kt</td>
<td>920</td>
<td>890</td>
<td>1,003</td>
<td>1,030</td>
<td>–3.2</td>
<td>12.6</td>
<td>2.7</td>
</tr>
<tr>
<td><strong>Export value</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– nominal</td>
<td>A$m</td>
<td>7,569</td>
<td>8,426</td>
<td>9,958</td>
<td>11,691</td>
<td>11.3</td>
<td>18.2</td>
<td>17.4</td>
</tr>
<tr>
<td>– real (^d)</td>
<td>A$m</td>
<td>7,892</td>
<td>8,620</td>
<td>9,958</td>
<td>11,414</td>
<td>9.2</td>
<td>15.5</td>
<td>14.6</td>
</tr>
</tbody>
</table>

Notes: \(^b\) In 2018 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
Nickel
Resources and Energy Quarterly September 2018

Key nickel consumer markets (tonnes)

1. China 1,094,000
2. European Union 323,000
3. Japan 148,000
4. United States 146,000

Global uses of nickel

- 68% Stainless steel
- 16% Alloys
- 9% Plating
- 3% Casting
- 3% Batteries
- 1% Other

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

Australia produces >200 thousand tonnes of nickel each year
Nickel exports contribute more than $3b to Australia’s economy
10% of world nickel mined is in Australia

5th largest miner in the world

Nickel
Resources and Energy Quarterly September 2018

Key nickel consumer markets (tonnes)

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- 0.59–0.83
- 0.84–1.69
- >1.70

Deposit
Operating mine

Australia produces >200 thousand tonnes of nickel each year
Nickel exports contribute more than $3b to Australia’s economy
10% of world nickel mined is in Australia

5th largest miner in the world
13.1 Summary

- Nickel prices fell in the September quarter, but are expected to stabilise in the coming months, to average around US$13,600 a tonne in 2018. Prices face competing pressures from rising stainless steel demand and global trade tensions, and are expected to ease slightly to around US$13,500 a tonne in 2019 and US$13,250 by 2020.
- Strong demand conditions and a significant upgrade to the Kwinana nickel refinery should see Australia’s refined and intermediate nickel production rise — from 135,000 tonnes in 2017–18 to 157,000 tonnes by 2019–20.
- Strong prices, in conjunction with rising mined and refined production, should see Australia’s nickel export earnings lift to $3.1 billion in 2018–19 and $3.3 billion by 2019–20.

13.2 Prices

Nickel prices are edging back from a peak in June

Nickel prices are currently easing back from a surge in May and early June, when higher stainless steel production drove prices up. From a peak of $US15,600 a tonne in early June, prices fell back noticeably in July, before steadying in August (averaging under $US14,000 a tonne).

Nickel prices have been subject to high volatility in recent months, buffeted by trade tensions, production pauses among Asian refineries, and various other minor disruptions and industrial disputes, which have led to swings in nickel supply. Prices are expected to smooth out somewhat as markets settle in coming months, averaging around US$13,500 a tonne in the September quarter and just over US$13,600 for 2018 as a whole.

Prices are expected to remain relatively stable over the subsequent two years, edging down slightly to around US$13,250 by 2020 as new production enters the market (see Figure 13.1). Higher battery demand may start to place pressures on nickel supply from 2020, but, this is not expected to produce a significant price impact until after the end of the outlook period.

Figure 13.1: Nickel LME spot prices and stocks


13.3 World consumption

Rising stainless steel output is driving nickel usage

Nickel consumption is expected to rise from 2.3 million tonnes in 2018 to 2.5 million tonnes by 2020. Stainless steel accounts for a majority of nickel use and is also expected to account for most of this growth. However, the situation with stainless steel is complex. Demand growth for stainless steel is likely to ease from the current rate (of around 5 per cent each year) due to inventory build. However, changes in stainless steel composition may counteract this trend. Chinese state-owned Tsingshan, which recently opened a new stainless steel production facility in Indonesia, is now producing a stainless steel alloy with more than 8 per cent nickel: well above the typical ratio of less than 2.5 per cent.

Batteries and energy storage are expected to double their share of the nickel market — from 3 per cent to 6 per cent — by 2020. Beyond 2020, nickel demand for batteries is likely to accelerate further as electric vehicle sales gain momentum. Recent research suggests nickel could play a crucial role in improving battery stability and longevity.
13.4 World production

Production growth is being driven by several new mines

World nickel supply continues to rise steadily, supported by higher Indonesian output. Mined nickel output is projected to rise from 2.3 million tonnes in 2018 to 2.4 million tonnes in 2019, and then to 2.6 million tonnes in 2020 (see Figure 13.2).

Nickel supply from Indonesia grew rapidly over the year to June 2018, with the country now accounting for almost one quarter of global mine production. The rise in Indonesian output was driven in part by significant Chinese capital investment. Indonesian nickel ore is being largely directed to Chinese nickel pig iron producers, who are in turn supplying Tsingshan’s huge new stainless steel plant.

Elsewhere, mine cutbacks from firms including Vale are expected to keep supply relatively tight, though some relaxation in these cuts is likely should prices pick up again. New supply from Indonesia is likely to support relatively strong production over the outlook period, with the current supply deficit expected to narrow slightly by 2020.

Refined nickel output is expected to grow a little more rapidly than mined output, as production from Chinese smelters increases and improvements in efficiency reduce wastage from ores.

13.5 Australia

Exploration expenditure is on a rising arc

Exploration for nickel and cobalt continues on a solid growth trend in the June quarter, increasing from $46 million to $65.4 million. This compares to a quarterly spend of around $10 million dollars early in 2016 (see Figure 13.3).

Higher exploration reflects strong price trends recorded in 2017 and early 2018, with the biggest share of investment targeting the large untapped deposits of Western Australia.
Australian production is expected to rebound from a low point

Over the forecast period, Australia’s nickel production is expected to rapidly recover following a string of mine and facility closures in 2016 and 2017. Mine production is expected to rise from an estimated 163,000 tonnes in 2017–18 to 166,000 tonnes in 2018–19, and to 178,000 tonnes in 2019–20 (see Figure 13.4).

Production growth will be driven primarily by the new Mincor mine at Kambalda in Western Australia, as well as Poseidon Nickel’s new mine at Mount Windarra, also in Western Australia. Several older mines are also expected to contribute through modest ramp-ups in production.

The emerging electric vehicle market is awakening new interest in previously closed nickel mines, including the Avebury Nickel Project in Tasmania, which has been in care and maintenance for almost 10 years. Investor interest in the electric vehicle market was also evident in the recent initial public offering (IPO) for Indonesian producer Nickel Mines, which raised $200 million on the Australian Securities Exchange (ASX). This was one of the largest IPOs of any ASX company over the last year.

Australia’s annual refined and intermediate nickel production is expected to rise to 138,000 tonnes in 2018–19, and to 157,000 tonnes by 2019–20. This is largely the result of a projected rise in output from BHP’s Kwinana plant in Western Australia, where upgrades are expected to lift nameplate capacity to 100,000 tonnes a year from April 2019.

Export earnings are expected to rebound in line with production

The expansion of the Kwinana refinery should provide a significant boost to Australia’s nickel export earnings for refined and mined nickel output. Total nickel export earnings are forecast to rise to $3.1 billion in 2018–19, and then to $3.3 billion in 2019–20. Refined nickel exports are expected to account for the bulk of this, reaching $2.7 billion in 2018–19 and $2.9 billion in 2019–20 (see Figure 13.5).
Table 13.1: Nickel outlook

<table>
<thead>
<tr>
<th>World</th>
<th>Unit</th>
<th>2017</th>
<th>2018(^f)</th>
<th>2019(^f)</th>
<th>2020(^f)</th>
<th>2018(^f)</th>
<th>2019(^f)</th>
<th>2020(^f)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– mine</td>
<td>kt</td>
<td>2,145</td>
<td>2,261</td>
<td>2,446</td>
<td>2,581</td>
<td>5.4</td>
<td>8.2</td>
<td>5.5</td>
</tr>
<tr>
<td>– refined</td>
<td>kt</td>
<td>2,079</td>
<td>2,192</td>
<td>2,371</td>
<td>2,486</td>
<td>5.4</td>
<td>8.2</td>
<td>4.8</td>
</tr>
<tr>
<td><strong>Consumption</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>kt</td>
<td>2,162</td>
<td>2,283</td>
<td>2,395</td>
<td>2,498</td>
<td>5.6</td>
<td>4.9</td>
<td>4.3</td>
</tr>
<tr>
<td><strong>Stocks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– weeks of consumption</td>
<td></td>
<td>10.0</td>
<td>7.4</td>
<td>6.5</td>
<td>6.0</td>
<td>–26.1</td>
<td>–11.7</td>
<td>–8.1</td>
</tr>
<tr>
<td><strong>Price LME</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– nominal</td>
<td>US$/t</td>
<td>10,404</td>
<td>13,613</td>
<td>13,525</td>
<td>13,250</td>
<td>30.8</td>
<td>–0.6</td>
<td>–2.0</td>
</tr>
<tr>
<td></td>
<td>Usc/lb</td>
<td>472</td>
<td>617</td>
<td>613</td>
<td>601</td>
<td>30.8</td>
<td>–0.6</td>
<td>–2.0</td>
</tr>
<tr>
<td>– real(^b)</td>
<td>US$/t</td>
<td>10,662</td>
<td>13,613</td>
<td>13,227</td>
<td>12,812</td>
<td>27.7</td>
<td>–2.8</td>
<td>–3.1</td>
</tr>
<tr>
<td></td>
<td>Usc/lb</td>
<td>484</td>
<td>617</td>
<td>600</td>
<td>581</td>
<td>27.7</td>
<td>–2.8</td>
<td>–3.1</td>
</tr>
</tbody>
</table>

| **Australia**  |      |      |            |            |            |            |            |            |
| **Production** |      |      |            |            |            |            |            |            |
| – mine\(^c\)   | kt   | 201  | 163        | 166        | 178        | –18.8      | 1.9        | 7.1        |
| – refined      | kt   | 112  | 106        | 122        | 141        | –5.1       | 15.1       | 15.6       |
| – intermediate |      | 37   | 26         | 16         | 16         | –29.9      | –37.7      | 0.0        |
| **Export volume\(^d\)** |      | 190  | 191        | 196        | 219        | 0.7        | 2.2        | 11.7       |
| – nominal value\(^e\) | kt | 2,275 | 2,621 | 3,080 | 3,277 | 15.2 | 17.5 | 6.4 |
| – real value\(^e\) | kt | 2,372 | 2,681 | 3,080 | 3,199 | 13.0 | 14.9 | 3.9 |

Notes: \(^b\) In 2018 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 (2018) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Innovation and Science; International Nickel Study Group (2018); LME (2018); World Bureau of Metal Statistics (2018)
Zinc

Resources and Energy Quarterly September 2018

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

Zinc exports contribute more than $3 billion to the Australian economy.

Australia holds 20% of the world’s known zinc resources.

Zinc exports contribute more than $3 billion to the Australian economy.

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

Key zinc consumer markets

1. China 6,724kt
2. United States 819kt
3. India 689kt
4. South Korea 622kt
5. Germany 481kt
6. Japan 470kt

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

Global uses of zinc

- 50% galvanise steel
- 17% diecasting
- 17% make brass and bronze alloys
- 6% rolled zinc
- 6% chemicals
- 4% other
14.1 Summary
- Zinc prices are currently in decline, after hitting an 11 year peak in early 2018. Prices are expected to rebound to some extent in the near term, as fears of oversupply and trade tensions ease. But the long-term trajectory leans towards prices slowly easing, to be around US$2,625 a tonne by 2020.
- Australia’s production is expected to lift over the next two years, as production ramps up at the re-opened Century mine in Queensland. Export volumes of ores and concentrates are forecast to rise from 1.8 million tonnes in 2017–18 to 2.9 million tonnes by 2019–20.
- Export values are expected to lock in the substantial gains recorded in 2017–18, remaining above $3.8 billion annually over the outlook period.

14.2 Prices
Zinc prices appear to have passed their peak, with decline setting in
The London Metal Exchange zinc price is in retreat, after a strong start to 2018. Monthly average prices peaked at US$3,540 a tonne in February before easing in June and then dropping sharply (to just above US$2,500) in August. Prices have since recovered slightly and stabilised in September, but remain well down on levels earlier in the year.

Lower prices reflect an increase in output from a number of new and expanded existing facilities, which have led to expectations of rising inventories. US-China trade tensions have also played a part, with hedge funds shorting base metals markets in the wake of political uncertainty.

Global zinc inventories remain relatively tight, however, and expectations of rising inventories are not expected to persist. Chinese smelters have recently announced significant supply cuts, and this, in conjunction with slowly rising demand, should result in a rebound in the zinc price in the short term. However, prices are expected to continue easing over the longer term, averaging US$2,850 a tonne in 2019 and US$2,625 a tonne by 2020 (see Figure 14.1).
14.3 World consumption
Consumption growth is expected to moderate over the outlook period
World refined zinc consumption is forecast to lift moderately over the outlook period (see Figure 14.2), rising from 14.2 million tonnes in 2018 to 15.4 million tonnes by 2020. Manufacturing and construction activity remain robust across most of the world, and this is expected to drive steady increases in zinc use. Construction is expected to account for around half of global zinc demand over the outlook period, with consumer products and industrial equipment accounting for most of the rest.

China, which consumes around half of all zinc, remains the key uncertainty in the global zinc outlook. The country is seeking to shift towards higher quality growth with more focus on environmental sustainability. At the same time, it continues a long-run transition towards a more consumer-led economic model, though high private debt has placed some constraints on the pace of transition. China's Belt and Road Initiative — potentially the largest infrastructure program ever undertaken — is likely to benefit zinc producers considerably, but the timing and scale of spending under this program remains uncertain.

14.4 World production
Mine output should rise over the next two years
Global mined output is expected to grow steadily over the outlook period, as previous capital investment begins to pay off. While zinc production has faced some disruptions in 2018, significant supply is expected to return to the market in 2018 and 2019. Key projects expected to add to output include Vedanta's Gamsberg mine in South Africa, as well as several expansions and re-openings of zinc mines in Australia (see below).

Supply is forecast to rise from 13.8 million tonnes in 2018 to 14.3 million tonnes in 2019, and further to 14.9 million tonnes in 2020.

Refined production could act as a bottleneck
Although zinc mine output is rising, there is potential for some bottlenecks to emerge at the refining stage over the next two years. Global refining capacity faces some disruption as a result of recent cuts in output from Chinese facilities. Partly offsetting this, Yunnan Luoping, which owns an 80,000 tonne per annum refinery in China, was cleared to resume operations in September after satisfying environmental checks.

Facilities elsewhere are also expected to expand output marginally, and as ore becomes more plentiful, refined output is forecast to rise from 14.2 million tonnes in 2018 to 15.4 million tonnes by 2020. This is broadly in line with demand, and should keep the metal market in balance, albeit with marginal supply deficits potentially emerging by 2020.

14.5 Australia
Exploration expenditure bounced back after a brief fall
Exploration spending for silver, lead and zinc recovered to $27.8 million in the June quarter, after price growth in early 2018. This effectively reverses the decline of the March quarter. Exploration is marginally above the level of a year ago, but with zinc prices now turning down, it is possible that exploration spending will ease back over the coming year.

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

Australian mined production is recovering, due to a surge in investment. Australia’s zinc production recovered in the June quarter — rising from 239,000 tonnes to 244,000 tonnes in metal content terms — after a brief drop in output from Glencore’s McArthur River mine in the Northern Territory depressed the March quarter figures.

Annual production is forecast to rise significantly in 2018 following a period of strong capital investment. Australia’s production of zinc is forecast to lift from 944,000 tonnes in 2017–18 to 1.3 million tonnes in 2018–19 and to 1.4 million tonnes by 2019–20.

The rise in Australian output stems primarily from New Century Resources’ newly re-opened Century mine in Queensland, which was previously the largest zinc mine in the world. After acquiring the mine — in order to extract from its tailings dam — New Century Resources has begun producing output through a process of slurry flotation. Hydraulic mining in the tailings dam commenced in August, and the company is seeking to ramp up operations through the remainder of 2018 and in 2019.

In addition to improving the concentrate quality, the company will seek to upgrade the flotation plant and install a large new pipeline, airport, and mining fleet at the site.

Some rise in output is also expected from MMG’s Dugald River mine in Queensland, which is ramping up production over 2018 and early 2019.

Zinc exports are expected to grow in line with rising production. Australia has relatively modest domestic zinc use. As a result, the export outlook is expected to largely track the production outlook, with exports of ore and ore concentrates expected to rise from 1.7 million tonnes in 2017–18 to 2.9 million tonnes by 2019–20.

Export earnings are projected to largely hold their value, with higher volumes offsetting expected declines in prices. As Figure 14.5 shows, earnings are projected to increase from $4.0 billion in 2017–18 to $4.1 billion in 2018–19, before settling back to $3.9 billion as prices ease in 2019–20.
<table>
<thead>
<tr>
<th>Table 14.1: Zinc outlook</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>World</strong></td>
</tr>
<tr>
<td><strong>Production</strong></td>
</tr>
<tr>
<td>– mine</td>
</tr>
<tr>
<td>– refined</td>
</tr>
<tr>
<td><strong>Consumption</strong></td>
</tr>
<tr>
<td><strong>Closing stocks</strong></td>
</tr>
<tr>
<td>– weeks of consumption</td>
</tr>
<tr>
<td><strong>Price</strong></td>
</tr>
<tr>
<td>– nominal</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>– real(^b)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Australia</strong></td>
</tr>
<tr>
<td>Mine output</td>
</tr>
<tr>
<td>Refined output</td>
</tr>
<tr>
<td><strong>Export volume</strong></td>
</tr>
<tr>
<td>– ore and conc.(^c)</td>
</tr>
<tr>
<td>– refined</td>
</tr>
<tr>
<td>– total metallic content</td>
</tr>
<tr>
<td><strong>Export value</strong></td>
</tr>
<tr>
<td>– nominal</td>
</tr>
<tr>
<td>– real(^d)</td>
</tr>
</tbody>
</table>

**Notes:** \(b\) In 2018 US dollars; \(c\) Quantities refer to gross weight of all ores and concentrates; \(d\) In 2018–19 Australian dollars; \(f\) Forecasts

**Source:** ABS (2018) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Innovation and Science; International Lead Zinc Study Group (2018); LME (2018); World Bureau of Metal Statistics (2018)
Lithium
Resources and Energy Quarterly September 2018

Lithium's unique properties make it vital for emerging technology such as electric vehicles.

Lithium, hydrogen and helium were the three key elements produced in the big bang.

Lithium is the lightest and densest metal, and has huge potential for power generation.

Australia has 17% of the world's lithium and is the world's biggest exporter.

Global electric vehicle sales are expected to increase from 2 million to 50 million by 2030.

Australian lithium exports tripled to be worth $780 million in 2017.

Major Australian Lithium deposits:

- Lithium deposits

Global uses of Lithium:

- 46% Rechargeable batteries
- 26% Ceramics & glass
- 11% Greases & polymers
- 11% Other uses
- 4% Industrial powders
- 2% Air treatments
15.1 Summary

- Lithium has recently begun to draw significant global interest. Demand for lithium has risen sharply, with prices tripling since 2010.
- Global lithium use has risen from around 149,000 tonnes in 2012 to 211,000 tonnes in 2017 (in lithium carbonate equivalent [LCE] terms). Global use is expected to reach almost 1.3 million tonnes by 2027, driven by rising demand for lithium batteries in electric vehicles.
- Australian exports of spodumene ore (the precursor material for lithium) have risen from around $117 million in 2012 to $780 million in 2017, and are expected to rise to around $1.1 billion by 2020. Far greater value could be unlocked should Australia progress in refining these ores into more valuable forms of lithium.

15.2 The forms and uses of lithium

A new market has emerged for a previously marginal commodity

Lithium is the lightest, or least dense, elemental metal, being about half as dense as water. It lacks the strength and durability of steel, but has traditionally found a role in the production of ceramics, glass, greases, steel making, aluminium smelting, as well as air treatment and polymer production, as Figure 15.1 shows.

It has long been known that lithium has very high electrode potential — lithium ion batteries can generate almost 50 per cent more volts per cell than lead-acid batteries. However, it was not until the development of smart-phones and other portable devices that this attribute of lithium was fully harnessed. By 2007, lithium-ion batteries accounted for around 25 per cent of all lithium use. Growth in battery use subsequently slowed for a time, but is now beginning to surge again.

The rise is driven largely by electric vehicles, which are rapidly growing as a proportion of global vehicle sales, becoming a serious alternative to traditional internal combustion engine vehicles (see Figures 15.2 and 15.3).
The rapid take-up of electric vehicles reflects several important advantages. Electric vehicles require no fuel and have fewer moving parts than traditional petrol vehicles, resulting in significantly lower maintenance and running costs over a vehicle lifetime. They do not emit pollution, and can be powered from carbon-free sources. In the future, they are likely to be easier to upgrade and customise. Drawbacks primarily relate to the higher initial purchase cost and battery range. However, significant progress has recently been made on these fronts, with costs falling and range rising rapidly as technology improves.

Electric vehicle sales doubled in 2017 and are set to keep growing strongly, albeit unevenly across countries. Electric vehicles already account for one-third of all vehicle sales in Norway, and have become substantial also in Denmark and in other countries where incentives exist.

Electric vehicle growth is likely to ease slightly in the near-term as China (the largest market) tapers back government support for some light electric vehicles. However, in general terms, the dependence of the technology on government incentives around the world is now starting to recede. Crucial price points are likely to be crossed in the early 2020s, with electric vehicles expected to become fully price competitive with petrol vehicles by around 2023. Electric vehicle production is expected to increase exponentially over the next 10 years, rising from around 2 million vehicle sales in 2017 to more than 40 million sales by 2027.

There are signs of hitches emerging on the supply side. Tesla — the most high profile producer of electric vehicles — is currently failing to meet production timetables as a result of technical issues in its fabrication plants. These issues reflect, in part, the complexity of building a car manufacturing process from scratch: other vehicle makers are currently adapting existing processes relatively smoothly, and the scale of announced plans makes it clear that a massive surge in electric vehicle (and hence lithium) demand is expected in coming years, especially when the crucial price crossover step is reached.

Electric vehicles require large batteries, and rising sales are expected to create huge markets for battery-grade lithium over the next 10 years.

<table>
<thead>
<tr>
<th>Country</th>
<th>Term</th>
<th>Scope</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>n/a</td>
<td>Ban of ICEs</td>
<td>High</td>
</tr>
<tr>
<td>Denmark</td>
<td>2050</td>
<td>Vehicle CO2 Targets</td>
<td>Medium</td>
</tr>
<tr>
<td>France</td>
<td>2040</td>
<td>Ban of ICEs; Paris by 2030</td>
<td>Medium</td>
</tr>
<tr>
<td>Germany</td>
<td>2030</td>
<td>Ban of ICEs</td>
<td>Medium</td>
</tr>
<tr>
<td>India</td>
<td>2030</td>
<td>Ban of ICEs</td>
<td>Low</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2030</td>
<td>Ban of ICEs</td>
<td>High</td>
</tr>
<tr>
<td>Norway</td>
<td>2025</td>
<td>Ban of ICEs</td>
<td>High</td>
</tr>
<tr>
<td>South Korea</td>
<td>2020</td>
<td>Electric vehicle target - 250,000 (30% market share 2017-2020)</td>
<td>High</td>
</tr>
<tr>
<td>Spain</td>
<td>2020</td>
<td>Ban of ICEs in Madrid centre (car models pre-2000)</td>
<td>High</td>
</tr>
<tr>
<td>Sweden</td>
<td>2030</td>
<td>Ban of ICEs</td>
<td>High</td>
</tr>
<tr>
<td>UK</td>
<td>2040</td>
<td>Ban of ICEs; Scotland by 2032</td>
<td>High</td>
</tr>
<tr>
<td>California</td>
<td>2027-30</td>
<td>Ban of ICEs</td>
<td>High</td>
</tr>
</tbody>
</table>

Global lithium use is expected to grow from around 211,000 tonnes in 2017 (with just under half accounted for by electric vehicles) to 1,265,000 tonnes by 2027 (with almost 90 per cent of use expected to be accounted for by electric vehicles).

**Hard rock deposits have an advantage in the emerging market**

Lithium does not occur naturally in a pure form, and must be refined from other materials. These materials are found in a mix of brine and hard rock deposits. Brine deposits occur when lakes, geothermal waters or petroleum brines are enriched with lithium. These deposits are mainly found in Chile, Argentina and Bolivia, though lower grade brine deposits have also been found in the United States and China (see Figure 15.5).

Lithium also exists in mineral deposits (spodumene or pegmatite). Almost all lithium-rich ore bodies also contain a range of other co-located minerals. Among these, Australia’s Greenbushes mine in Western Australia has the world’s largest developed deposit, though other lithium-rich hard rock deposits also exist in the United States, Mexico, Congo, and Morocco.

Brine deposits produce lithium carbonate — a compound with various industrial and chemical uses (see Figure 15.4) but with a relatively limited use in electric vehicles outside of some cathode material. To create a more suitable material for electric vehicle batteries, lithium carbonate must be refined into lithium hydroxide.

Hard rock deposits such as Australia’s are technically more expensive to extract initially, but have an important advantage in electric vehicle markets: while the initial output is spodumene ore, a relatively simple beneficiation process is applied to transform the ore directly into lithium hydroxide, effectively removing a step from the refining process. This gives Australia — which has large amounts of hard rock deposits — a cost advantage of around 10-15 per cent relative to the largest South American brine producers. This has in turn helped Australia gain an edge in lithium mining (see Figure 15.6).

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**Figure 15.4: Lithium supply chain and primary uses**

![Lithium supply chain and primary uses](source)

**Figure 15.5: Lithium reserves by country**

![Lithium reserves by country](source)
15.3 Global market conditions

Lithium supply and demand are approaching balance, but prices remain elevated

Rising demand for lithium has placed pressure on every step of the supply chain, with the greatest pressure occurring at the refinement stages. Demand for spodumene ore is rising, but the sheer scale of new output from Australia will likely lead to some degree of oversupply in this market in coming years. It is not expected, however, that oversupply will be severe, and early predictions of sharp falls in spodumene prices have not been borne out. Spodumene prices are instead converging among different markets.

Prices in China — where Australia sells most of its spodumene output — eased to under US$800 per tonne in 2017. However, prices elsewhere in the world continue to rise. As a result, prices are converging towards a global norm. This will likely reduce the bounty of income to Australia to some degree, though any severe decline is likely to be checked as global prices put a floor under Chinese prices.

At $17,000 a tonne, the price of more refined lithium hydroxide is historically strong, but slightly lower than its peak in 2017 (see Figure 15.7). While underlying supply and demand factors have played a part in the recent price surge, some of the recent strength derives from concerns over security of supply. These concerns reflect the fact that supply chains feeding the electric vehicle market are highly complex, and many car manufacturers have released very ambitious production schedules. The need for strong and secure supply in a generally opaque and immature market has led to successive rounds of hasty buying, as electric vehicle makers seek to reduce risks to their production schedules.

Electric vehicle production targets are expected to check any sharp drop in lithium prices. To reduce risk, electric vehicle batteries are generally built well in advance of the cars in which they are placed. Matching lithium production against current electric vehicle demand can thus produce a misleading result. When matched against electric vehicle sales twelve months ahead, spodumene and lithium supplies appear more than...
sufficient, but a saturated spodumene market is unlikely. It is thus expected that spodumene ore prices will moderate somewhat over the next two years.

Supply of refined lithium faces more mixed prospects. Lithium carbonate faces relatively minimal bottleneck risks, and may in fact be significantly oversupplied in the coming years. Carbonates have a more limited application to the electric vehicle market, and a lot of brine production is expected to come online in 2020 and 2021 in Chile and Argentina.

Some supply bottlenecks may emerge in early stage lithium hydroxide refining, where spodumene ore from hard rock deposits is beneficiated. However, any bottlenecks at this stage will likely not persist for long. The beneficiating process is relatively simple and many countries (including Australia) are well underway with developing the capacity. Concerns about security of supply have elevated prices for lithium hydroxide somewhat: a modest correction to this is expected in the short term, followed by a return to rising prices as electric vehicle demand gathers pace.

The last stage of refining is likely to be where the greatest demand pressure and potential bottlenecks emerge. Refining lithium hydroxide to produce battery material (including high-grade lithium as well as components such as cathodes) is a complex and energy-intensive process. Developing refineries to produce battery grade material can take up to five years when factoring in approval, development, and construction. However, managing potential bottlenecks at this refining stage will be important to keep electric vehicle prices falling.

The final step in the supply chain is the construction of batteries from high-grade battery materials. Plans for the construction of battery facilities are already well advanced in many countries. A 35GWh (gigawatt hours of batteries) Gigafactory is under construction in Nevada. Germany is progressing plans to build a facility known as Terra-E, with a consortium of 17 companies aiming to construct a 34GWh plant by 2028. Northvolt plans to bring 32GWh of battery construction capacity to Sweden, with construction to start in April 2019. Further plants are under construction in China and other parts of Asia.

With demand for lithium certain to grow, and with large investment underway in each stage of its supply chain, it is expected that lithium use will rise by around 600 per cent over the next 10 years (see Figure 15.8). Lithium use in electric vehicle batteries is expected to grow by a factor of ten, even though improvements in chemistry and efficiency will likely reduce the quantity of lithium in individual batteries. Growth is expected to peak in the early to mid-2020s, tapering after 2030 as electric vehicle sales stabilise. The key risk appears to be the possibility that refineries producing high-grade battery material fail to match the speed of other stages in the refining process, creating potential bottlenecks and price volatility at that step.

Lithium prices are expected to remain well above their historical average, but volatility should reduce in time as lithium markets start to operate with more transparency. Lithium, unlike cobalt, cannot be substituted, and remains crucial to electric vehicle batteries. This means steeply rising demand is effectively locked in. The certainty of rising demand is creating strong conditions for new investment.
15.4 Lithium in Australia

Australia is investing heavily in primary supply and early-stage refining. Australia’s dominance of hard rock deposits grants it several key advantages in the emerging lithium market. Lithium produced from hard rock is more easily refined into lithium hydroxide, which makes it more suitable for supplying electric vehicle markets than the carbonate-based output from brine deposits such as those in South America.

This grants Western Australian hard rock producers a 10-15 per cent cost advantage relative to competitors in Chile and Argentina. Hard rock operations in Western Australia also have capacity to increase output faster, as the investment and capital required for initial extraction is lower. Key mines such as Pilangoora are also benefitting from substantial off-take agreements with China and other countries, which lock in certain minimal levels of demand.

Lithium hydroxide is expected to account for about 25 per cent of all lithium compounds used in batteries by 2021. As electric vehicles increasingly dominate the market, this share is expected to rise to almost 60 per cent over the next ten years. This suggests lithium sourced from Australia has growth potential above even what is suggested by the most optimistic lithium demand projections.

Australian production has traditionally been dominated by the Greenbushes mine — the world’s largest hard rock deposit. However, as Figure 15.9 shows, a succession of new mines and projects is now emerging across Western Australia. This is feeding directly into export value. Earnings for spodumene ore out of Western Australia increased by 166 percent in 2017, to $780 million (see Figure 15.10). The quantity of spodumene produced in Western Australia doubled over the year as a result of output from several large new mines. These include Jiangxi Ganfeng Lithium’s Mount Marion project, and Mineral Resources’ Wodgina project. A third project — Galaxy Resources’ Mt Cattlin mine, which commenced in 2017 — is now approaching its full production capacity.
Spodumene output is forecast to increase sharply again in 2018, as Pilbara Minerals and Altura Mining’s projects at Pilgangoora commence, and Mineral Resources’ Wodgina project ramps up. A further rise in output in 2019 is expected, which would leave Australia accounting for almost 80 per cent of global supply from hard rock deposits.

Substantial investment in new mines is being accompanied by an even larger wave of investment in beneficiation. These plants will create a sizeable body of infrastructure capable of refining huge quantities of raw spodumene into more valuable lithium hydroxide. Five large beneficiating plants are now planned or under construction in Western Australia.

As Figure 15.11 shows, China holds an outsized role in spodumene processing. As a result, many Korean and Japanese firms are supporting Australian beneficiation plants as a means to protect their security of supply and reduce their dependency on Chinese facilities. Such investment holds significant promise for Australia: as Figure 15.12 shows, there are far greater potential earnings in refined lithium than in spodumene ore, and beneficiation plants will start to bring Australia into that market.

A significant beneficiation plant is under construction is at Greenbushes, where Talison Lithium supplies about one-third of the world’s lithium. Talison’s parent company — Tianqi Lithium — is building a new refinery facility in two stages, each with capacity to produce 24,000 tonnes of lithium hydroxide. The plant is on schedule for completion in June quarter 2019, and is expected to offer significant logistical benefits to the company, due to its location near the mine.

Output from this facility and the associated mine could rise in the future, with the firm considering adding two further processing plants, a new crusher, a larger tailings dam and an increased power supply. The total cost for this investment is around $700 million, with $400 million already committed and a subsequent $300 million mooted for the second stage.
Albermarle is building a similar plant at Kemerton in Western Australia, which will have capacity to produce 100,000 tonnes of lithium hydroxide a year by 2025.

Kidman, which owns a site at Kwinana in Western Australia, is also planning to construct a plant, with annual nameplate capacity of 44,000 tonnes of lithium hydroxide. A joint venture between Kidman and Chile’s SQM (called WA Lithium) has contracted to supply Tesla with lithium hydroxide from a Kwinana refinery. Operations are expected to begin in 2021, with the project forecast to create 400 construction jobs and 150 ongoing jobs.

Neometals are also seeking a partner for the proposed plant at Kalgoorlie in Western Australia, which will cost around $200 million and produce 10,000 tonnes of lithium hydroxide annually. The facility is intended to draw on spodumene from the company’s Mount Marion mine.

Finally, Mineral Resources is planning a facility near Port Hedland in Western Australia, which would be capable of producing up to 50,000 tonnes of lithium hydroxide per year.

**Figure 15.13: Key refinery proposals for Australia**

<table>
<thead>
<tr>
<th>Owner</th>
<th>Lithium hydroxide output (tonnes)</th>
<th>Commencing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albermarle</td>
<td>100,000</td>
<td>After 2022</td>
</tr>
<tr>
<td>Mineral Resources</td>
<td>50,000</td>
<td>After 2022</td>
</tr>
<tr>
<td>Talison Lithium</td>
<td>48,000</td>
<td>After 2019</td>
</tr>
<tr>
<td>Kidman</td>
<td>44,000</td>
<td>2021</td>
</tr>
<tr>
<td>Neometals</td>
<td>10,000</td>
<td>After 2022</td>
</tr>
</tbody>
</table>

This investment pipeline will ensure that Australia shifts rapidly beyond the first stage of primary production, becoming a refiner of significant scale by the early 2020s. More than $3 billion is committed to the development of facilities that will supply lithium hydroxide to the electric vehicle market, and the number of full-time workers on lithium projects in Western Australia has increased from 399 in December 2014 to more than 2600, with thousands more to come.

Lithium royalties are also rising sharply. Royalties for non-iron ore commodities in Western Australia are set to rise to $834 million in 2017-18. Lithium is expected to earn around $131 million of this, with lithium royalties set to rise by $41 million over the year. This will see lithium surge past nickel, copper and alumina to become the third biggest royalty earner (behind iron ore and gold) for Western Australia in 2018-19.

**Australia has potential to move further up the value chain**

Although Australia is currently gaining considerable income from the production of spodumene, over the long term it is likely that this form of output will account for only 0.7% of the potential value of the lithium supply chain. Australia is already moving beyond this, however, due to its substantial investments in facilities to produce lithium hydroxide.

While Australia has clear advantages in early-stage refining (due to the scale of its spodumene supply and the desire of many international firms to reduce their dependence on Chinese refineries), later-stage refining is likely to be better distributed globally. The opportunities around high-level refining (transformation of lithium hydroxide into high-grade precursor chemicals and battery parts such as cathodes) are likely to be particularly significant, and Australia holds several significant advantages in entering this market.

Australia holds a distinct geological benefit when compared to potential alternatives. Electric vehicle batteries and other large-scale energy storage devices require around 35 raw materials, and all are readily available in Western Australia. Refineries in Western Australia would have access to world class port facilities, with a new port opening soon in Kwinana. Kwinana also has pre-existing facilities for chemical production and supply, which would simplify the supply chain for advanced refining processes. Western Australia also has relatively low energy costs and reliable gas supplies.
While high-grade refining facilities will be expensive and slow to construct, it is likely that they will generate considerable value over time. Supply bottlenecks (and potential opportunities for filling niche markets) are likely to create particularly lucrative opportunities for high-level refineries in an era of rapid technological change.

However, some issues need to be addressed in order to improve the prospects for large investments. Lithium markets are evolving rapidly, and long-term investment may depend, in part, on the ability to quickly obtain skilled workers when and where they are needed.

Important research is currently underway among firms in Western Australia in areas such as cathode development, which may prove highly beneficial to long-term efforts to build a high-end refining industry in Australia.

Australia also faces relatively high construction costs relative to places like Sichuan, where Chinese competition is likely to emerge. While other advantages in logistics and raw material supply may offset this, expedited approvals (or pre-approvals for specified sites in existing industrial hubs) may provide an important competitive edge for lithium refining in Australia.

A relatively small number of firms hold patents over the pivotal technologies, and such firms would need to be approached to ascertain what incentives might draw them to Western Australia.

Although high-grade refining would present many opportunities to Australia, a further opportunity also exists. As noted previously, a number of countries are already constructing facilities which will transform high grade material into batteries. Australia’s prospects for entry into this market are mixed. Australia would likely need to be strongly established at all previous stages of the supply chain in order to position itself for battery production.

This is partly for logistical reasons: if high-grade battery materials were not produced here, they would have to be imported, with the batteries subsequently exported to offshore electric vehicle producers. This would add considerably to logistical costs, given batteries are large, heavy, and relatively fragile. Electric vehicle firms are already demonstrating a preference for building battery facilities directly connected (or sited very close) to electric vehicle assembly plants.

Battery production would thus depend heavily on the existence of high-grade refineries in Australia. The presence of an electric vehicle assembly plant in Australia would also boost the chances for a connected battery facility, though such a development would likely be contingent on a successful expansion of electric vehicles onto Australia’s roads.

Policy will play an important role in the immediate future

Australia has strong potential to move to the centre of the global lithium supply chain given its geological advantages, its experience in rolling out mining investment, and the skills of its workforce. It is unlikely, however, that Australia will move into battery assembly straight away. The core question at this moment is whether Australia can become a destination for high-grade lithium refining.

Various factors will need to be considered, such as site pre-approvals, research and development, and access to skilled workers. Given the pace of change and efforts now underway to solidify the supply chain, it is likely that key decisions around the future of lithium in Australia will need to be made within the next few months. Countries which capitalise on the opportunities of the emerging global lithium market could earn hundreds of billions of dollars in coming decades, and could play a pivotal role in fostering a new wave of clean energy technology around the world.
Table 15.1: Lithium outlook

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<tbody>
<tr>
<td>Lithium production a</td>
<td>kt</td>
<td>366</td>
<td>384</td>
<td>403</td>
<td>411</td>
<td>5.0</td>
<td>5.0</td>
<td>2.0</td>
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<tr>
<td>Consumption</td>
<td>kt</td>
<td>211</td>
<td>234</td>
<td>264</td>
<td>305</td>
<td>10.8</td>
<td>13.1</td>
<td>15.4</td>
</tr>
<tr>
<td>Stocks</td>
<td>kt</td>
<td>383</td>
<td>533</td>
<td>672</td>
<td>778</td>
<td>39.3</td>
<td>26.0</td>
<td>15.8</td>
</tr>
<tr>
<td>– weeks of consumption</td>
<td></td>
<td>94.4</td>
<td>118.6</td>
<td>132.2</td>
<td>132.6</td>
<td>25.7</td>
<td>11.4</td>
<td>0.4</td>
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Spodumene price

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<tr>
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</thead>
<tbody>
<tr>
<td>– nominal</td>
<td>US$/t</td>
<td>739</td>
<td>850</td>
<td>824</td>
<td>735</td>
<td>15.0</td>
<td>–3.1</td>
<td>–10.8</td>
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<tr>
<td>– real b</td>
<td>US$/t</td>
<td>756</td>
<td>850</td>
<td>807</td>
<td>707</td>
<td>12.5</td>
<td>–5.0</td>
<td>–12.5</td>
</tr>
</tbody>
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Lithium hydroxide price

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<tr>
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<tbody>
<tr>
<td>– nominal</td>
<td>US$/t</td>
<td>17,540</td>
<td>16,500</td>
<td>16,000</td>
<td>12,000</td>
<td>–5.9</td>
<td>–3.0</td>
<td>–25.0</td>
</tr>
<tr>
<td>– real b</td>
<td>US$/t</td>
<td>17,934</td>
<td>16,500</td>
<td>15,679</td>
<td>11,540</td>
<td>–8.0</td>
<td>–5.0</td>
<td>–26.4</td>
</tr>
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</table>

Australia

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<tbody>
<tr>
<td>Mine production a</td>
<td>kt</td>
<td>211</td>
<td>247</td>
<td>295</td>
<td>301</td>
<td>17.1</td>
<td>19.4</td>
<td>2.0</td>
</tr>
<tr>
<td>Export volume c</td>
<td>kt</td>
<td>1037</td>
<td>1212</td>
<td>1448</td>
<td>1477</td>
<td>16.9</td>
<td>19.5</td>
<td>2.0</td>
</tr>
<tr>
<td>– nominal value a</td>
<td>A$m</td>
<td>780</td>
<td>1030</td>
<td>1193</td>
<td>1086</td>
<td>32.1</td>
<td>15.8</td>
<td>–9.0</td>
</tr>
<tr>
<td>– real value bs</td>
<td>A$m</td>
<td>798</td>
<td>1030</td>
<td>1169</td>
<td>1044</td>
<td>29.1</td>
<td>13.5</td>
<td>–10.7</td>
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</table>

Notes: a Lithium Carbonate Equivalent. This is a measure of the quantity of refined product produced from spodum ore. b In 2018 calendar year US dollars; c Spodumene concentrates; s Estimate; f Forecast.

Sources: Department of Industry, Innovation and Science (2018); Company reports; Roskill (2018); Government of Western Australia Department of Mines, Industry Regulation and Safety (2018)
Trade summary charts
Figure 16.1: Contribution to GDP


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

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

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

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

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

Source: ABS (2018) International Trade in Goods and Services, 5368.0
Figure 16.5: Principal markets for Australia's total exports, 2017–18 dollars

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

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

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

Figure 16.7: Proportion of goods and services exports by sector


Figure 16.8: Proportion of merchandise exports by sector

### Table 16.1: Principal markets for Australia's thermal coal exports, 2018–19 dollars

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>$m</td>
<td>8,388</td>
<td>7,634</td>
<td>7,256</td>
<td>8,587</td>
</tr>
<tr>
<td>South Korea</td>
<td>$m</td>
<td>3,778</td>
<td>2,942</td>
<td>1,837</td>
<td>3,657</td>
</tr>
<tr>
<td>China</td>
<td>$m</td>
<td>3,017</td>
<td>2,870</td>
<td>2,675</td>
<td>2,673</td>
</tr>
<tr>
<td>Taiwan</td>
<td>$m</td>
<td>1,806</td>
<td>1,900</td>
<td>1,671</td>
<td>2,356</td>
</tr>
<tr>
<td>Malaysia</td>
<td>$m</td>
<td>377</td>
<td>628</td>
<td>521</td>
<td>671</td>
</tr>
<tr>
<td>Thailand</td>
<td>$m</td>
<td>315</td>
<td>293</td>
<td>333</td>
<td>303</td>
</tr>
<tr>
<td>Total</td>
<td>$m</td>
<td>18,269</td>
<td>17,277</td>
<td>15,644</td>
<td>19,709</td>
</tr>
</tbody>
</table>

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

### Table 16.2: Principal markets for Australia's metallurgical coal exports, 2018–19 dollars

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>$m</td>
<td>5,261</td>
<td>5,393</td>
<td>4,891</td>
<td>8,727</td>
</tr>
<tr>
<td>China</td>
<td>$m</td>
<td>6,405</td>
<td>5,133</td>
<td>4,110</td>
<td>7,981</td>
</tr>
<tr>
<td>Japan</td>
<td>$m</td>
<td>6,015</td>
<td>4,961</td>
<td>4,625</td>
<td>7,235</td>
</tr>
<tr>
<td>South Korea</td>
<td>$m</td>
<td>2,688</td>
<td>2,560</td>
<td>2,214</td>
<td>3,847</td>
</tr>
<tr>
<td>Taiwan</td>
<td>$m</td>
<td>1,274</td>
<td>1,226</td>
<td>1,030</td>
<td>1,900</td>
</tr>
<tr>
<td>Netherlands</td>
<td>$m</td>
<td>1,098</td>
<td>895</td>
<td>970</td>
<td>1,967</td>
</tr>
<tr>
<td>Total</td>
<td>$m</td>
<td>25,431</td>
<td>23,453</td>
<td>20,988</td>
<td>36,845</td>
</tr>
</tbody>
</table>

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

### Table 16.3: Principal markets for Australia's crude oil and refinery feedstocks exports, 2018–19 dollars

<table>
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<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>$m</td>
<td>338</td>
<td>36</td>
<td>376</td>
<td>957</td>
</tr>
<tr>
<td>Indonesia</td>
<td>$m</td>
<td>2,160</td>
<td>1,955</td>
<td>668</td>
<td>1,056</td>
</tr>
<tr>
<td>China</td>
<td>$m</td>
<td>1,786</td>
<td>1,356</td>
<td>736</td>
<td>587</td>
</tr>
<tr>
<td>Thailand</td>
<td>$m</td>
<td>696</td>
<td>1</td>
<td>476</td>
<td>469</td>
</tr>
<tr>
<td>South Korea</td>
<td>$m</td>
<td>5</td>
<td>29</td>
<td>748</td>
<td>737</td>
</tr>
<tr>
<td>Malaysia</td>
<td>$m</td>
<td>321</td>
<td>4</td>
<td>153</td>
<td>445</td>
</tr>
<tr>
<td>Total</td>
<td>$m</td>
<td>12,155</td>
<td>9,307</td>
<td>5,774</td>
<td>5,710</td>
</tr>
</tbody>
</table>

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

### Table 16.4: Principal markets for Australia's LNG exports, 2018–19 dollars

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>$m</td>
<td>16,465</td>
<td>15,392</td>
<td>11,169</td>
<td>11,795</td>
</tr>
<tr>
<td>China</td>
<td>$m</td>
<td>697</td>
<td>1,406</td>
<td>3,117</td>
<td>5,948</td>
</tr>
<tr>
<td>South Korea</td>
<td>$m</td>
<td>480</td>
<td>1,022</td>
<td>1,780</td>
<td>2,664</td>
</tr>
<tr>
<td>Singapore</td>
<td>$m</td>
<td>0</td>
<td>152</td>
<td>421</td>
<td>1,491</td>
</tr>
<tr>
<td>Taiwan</td>
<td>$m</td>
<td>190</td>
<td>43</td>
<td>170</td>
<td>265</td>
</tr>
<tr>
<td>India</td>
<td>$m</td>
<td>0</td>
<td>0</td>
<td>535</td>
<td>641</td>
</tr>
<tr>
<td>Total</td>
<td>$m</td>
<td>17,831</td>
<td>18,165</td>
<td>17,579</td>
<td>23,261</td>
</tr>
</tbody>
</table>

Table 16.5: Principal markets for Australia’s iron ore exports, 2018–19 dollars

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China $m</td>
<td>62,368</td>
<td>45,269</td>
<td>41,124</td>
<td>53,739</td>
<td>51,325</td>
</tr>
<tr>
<td>Japan $m</td>
<td>10,569</td>
<td>7,200</td>
<td>4,966</td>
<td>5,617</td>
<td>5,442</td>
</tr>
<tr>
<td>South Korea $m</td>
<td>6,668</td>
<td>4,351</td>
<td>3,238</td>
<td>4,075</td>
<td>3,648</td>
</tr>
<tr>
<td>Taiwan $m</td>
<td>1,870</td>
<td>1,395</td>
<td>1,083</td>
<td>1,493</td>
<td>1,262</td>
</tr>
<tr>
<td>Indonesia $m</td>
<td>45</td>
<td>30</td>
<td>58</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>India $m</td>
<td>45</td>
<td>117</td>
<td>7</td>
<td>5</td>
<td>279</td>
</tr>
<tr>
<td>Total $m</td>
<td>81,662</td>
<td>58,618</td>
<td>50,693</td>
<td>65,293</td>
<td>62,780</td>
</tr>
</tbody>
</table>

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

Table 16.6: Principal markets for Australia’s aluminium exports, 2018–19 dollars

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan $m</td>
<td>1,219</td>
<td>1,566</td>
<td>739</td>
<td>972</td>
<td>1,404</td>
</tr>
<tr>
<td>South Korea $m</td>
<td>745</td>
<td>826</td>
<td>1,183</td>
<td>772</td>
<td>861</td>
</tr>
<tr>
<td>Thailand $m</td>
<td>332</td>
<td>308</td>
<td>285</td>
<td>320</td>
<td>383</td>
</tr>
<tr>
<td>Taiwan $m</td>
<td>485</td>
<td>525</td>
<td>316</td>
<td>215</td>
<td>334</td>
</tr>
<tr>
<td>Indonesia $m</td>
<td>214</td>
<td>148</td>
<td>100</td>
<td>158</td>
<td>187</td>
</tr>
<tr>
<td>India $m</td>
<td>45</td>
<td>117</td>
<td>7</td>
<td>5</td>
<td>279</td>
</tr>
<tr>
<td>Total $m</td>
<td>3,908</td>
<td>4,181</td>
<td>3,485</td>
<td>3,302</td>
<td>4,102</td>
</tr>
</tbody>
</table>

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

Table 16.7: Principal markets for Australia’s copper exports, 2018–19 dollars

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China $m</td>
<td>4,307</td>
<td>3,920</td>
<td>3,804</td>
<td>2,813</td>
<td>3,862</td>
</tr>
<tr>
<td>Japan $m</td>
<td>1,776</td>
<td>2,139</td>
<td>1,514</td>
<td>1,414</td>
<td>1,571</td>
</tr>
<tr>
<td>Malaysia $m</td>
<td>668</td>
<td>566</td>
<td>654</td>
<td>896</td>
<td>890</td>
</tr>
<tr>
<td>India $m</td>
<td>1,033</td>
<td>864</td>
<td>544</td>
<td>712</td>
<td>876</td>
</tr>
<tr>
<td>South Korea $m</td>
<td>639</td>
<td>393</td>
<td>520</td>
<td>465</td>
<td>296</td>
</tr>
<tr>
<td>Philippines $m</td>
<td>312</td>
<td>270</td>
<td>233</td>
<td>414</td>
<td>171</td>
</tr>
<tr>
<td>Total $m</td>
<td>9,522</td>
<td>9,105</td>
<td>8,601</td>
<td>7,892</td>
<td>8,643</td>
</tr>
</tbody>
</table>

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

Table 16.8: Principal markets for Australia’s gold exports, 2018–19 dollars

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong $m</td>
<td>165</td>
<td>204</td>
<td>2,677</td>
<td>10,022</td>
<td>8,210</td>
</tr>
<tr>
<td>United Kingdom $m</td>
<td>700</td>
<td>627</td>
<td>4,177</td>
<td>4,080</td>
<td>3,344</td>
</tr>
<tr>
<td>China $m</td>
<td>8,841</td>
<td>7,477</td>
<td>6,943</td>
<td>2,418</td>
<td>3,009</td>
</tr>
<tr>
<td>Singapore $m</td>
<td>2,486</td>
<td>3,348</td>
<td>1,268</td>
<td>315</td>
<td>1,184</td>
</tr>
<tr>
<td>Thailand $m</td>
<td>486</td>
<td>965</td>
<td>269</td>
<td>555</td>
<td>1,169</td>
</tr>
<tr>
<td>Switzerland $m</td>
<td>377</td>
<td>16</td>
<td>92</td>
<td>235</td>
<td>799</td>
</tr>
<tr>
<td>Total $m</td>
<td>14,228</td>
<td>14,029</td>
<td>16,637</td>
<td>18,783</td>
<td>19,309</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUD/USD exchange rate</td>
<td>0.77</td>
<td>0.76</td>
<td>0.76</td>
<td>0.78</td>
</tr>
<tr>
<td>Inflation rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>97.6</td>
<td>100.0</td>
<td>102.2</td>
<td>103.4</td>
</tr>
<tr>
<td>Australia</td>
<td>95.9</td>
<td>97.8</td>
<td>100.0</td>
<td>102.4</td>
</tr>
</tbody>
</table>

Notes: The inflation rate for Australia is used to covert 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 2018 dollars.

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 A2: OCE terminology for time horizons

<table>
<thead>
<tr>
<th>Outlook period</th>
<th>Years</th>
<th>Terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current period</td>
<td>Current (Incomplete data or subject to revision)</td>
<td>Estimate</td>
</tr>
<tr>
<td>Short–term</td>
<td>1 to 2 years</td>
<td>Forecast</td>
</tr>
<tr>
<td>Medium–term</td>
<td>3 to 5 years</td>
<td>Projection</td>
</tr>
</tbody>
</table>

Source: Department of Industry, Innovation and Science (2018)

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 A3: Resources and energy commodities groupings and definitions

<table>
<thead>
<tr>
<th>Resources (non–energy)</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td></td>
</tr>
<tr>
<td>Resource commodities are non–energy minerals and semi–manufactured products produced from non–energy minerals</td>
<td>Energy commodities are minerals and petroleum products that are typically used for power generation</td>
</tr>
<tr>
<td>Australian Harmonised Export Commodity Classification (AHECC) chapters</td>
<td>25 (part); 26 (part); 28 (part); 31 (part); 73 (part); 74; 75; 76; 78; 79; 80; 81</td>
</tr>
<tr>
<td>Commodities for which data is published, forecasts are made and analysed in detail in this report</td>
<td>27 (part)</td>
</tr>
<tr>
<td>Aluminium; alumina; bauxite; copper; gold; iron ore; crude steel; nickel; zinc; lithium</td>
<td>Crude oil and petroleum products; LNG; metallurgical coal; thermal coal; uranium</td>
</tr>
</tbody>
</table>

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)
### A.5 Chapter authors and contact details

<table>
<thead>
<tr>
<th>Chapter/s</th>
<th>Author</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td>David Thurtell</td>
<td><a href="mailto:david.thurtell@industry.gov.au">david.thurtell@industry.gov.au</a></td>
</tr>
<tr>
<td>Steel and iron ore</td>
<td>Joseph Moloney</td>
<td><a href="mailto:joseph.moloney@industry.gov.au">joseph.moloney@industry.gov.au</a></td>
</tr>
<tr>
<td>Metallurgical and thermal coal</td>
<td>Monica Philalay</td>
<td><a href="mailto:monica.philalay@industry.gov.au">monica.philalay@industry.gov.au</a></td>
</tr>
<tr>
<td>Gas</td>
<td>Nikolai Drahos</td>
<td><a href="mailto:nikolai.drahos@industry.gov.au">nikolai.drahos@industry.gov.au</a></td>
</tr>
<tr>
<td>Oil</td>
<td>Kate Martin</td>
<td><a href="mailto:kate.martin@industry.gov.au">kate.martin@industry.gov.au</a></td>
</tr>
<tr>
<td>Gold, Macroeconomics</td>
<td>Thuong Nguyen</td>
<td><a href="mailto:thuong.nguyen@industry.gov.au">thuong.nguyen@industry.gov.au</a></td>
</tr>
<tr>
<td>Aluminium, alumina and bauxite</td>
<td>Andrea Bath</td>
<td><a href="mailto:andrea.bath@industry.gov.au">andrea.bath@industry.gov.au</a></td>
</tr>
<tr>
<td>Copper, Nickel, Zinc, Lithium, Uranium</td>
<td>Mark Gibbons</td>
<td><a href="mailto:mark.gibbons@industry.gov.au">mark.gibbons@industry.gov.au</a></td>
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