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Foreword

Australia's resource and energy exports are forecast to hit a record \$296 billion in 2020–21, a strong result, in the context of the COVID-19 pandemic. A modest decline to \$288 billion (in real terms) is likely in 2021–22, at which point earnings stabilise over the remainder of the outlook period.

Every March edition of the *Resources and Energy Quarterly* provides an extended five-year outlook, rather than the usual two-year horizon. This allows us to consider additional structural factors beyond near-term cyclical and one-off issues. One-off issues have been quite prominent in recent years: the COVID-19 pandemic and China trade issues being the most significant. Both may also present structural implications. Another structural issue expected to gain momentum over the five-year outlook period is the global energy transition, particularly regarding batteries for electric vehicles.

Australia's exports of the commodities that are central to new and low emission technologies are set to surge over the next five years. From an estimated \$1 billion in 2020–21, lithium exports are set to rise more than five-fold in real terms. Nickel exports are expected almost double, while copper exports are set to increase by a third over the same period. Revenue from these three commodities combined are now set to exceed current thermal coal revenue (in real terms) by 2025–26, as Australia's resources sector captures growth opportunities presented by new technologies and energy systems that are evolving.

The rollout of an effective COVID-19 vaccine presents the opportunity to bring the pandemic under greater control in major economies in the first half of the outlook period. This will boost economic activity and thus resource and energy commodity demand, but also reduce disruptions to resource and energy commodity supply. After a fall of 3.5% in 2020, the IMF forecasts world GDP growth of 5.5% in 2021 and 4.2% in 2022.

Higher commodity prices, Australia's relative success at containing COVID-19, and signs that China's informal import restrictions have not

been as significant as initially expected by markets, have seen the Australian dollar strengthen further in recent months. The stronger Australian dollar has partly diminished the impact of higher US dollar commodity prices on export earnings, but will also act to contain any inflationary pressures.

Coal markets have quickly adjusted to the Chinese trade disruptions on Australian coal. As China switched to buying cargoes (from Indonesia, Russia, Colombia, South Africa, Canada and the United States) normally destined for other consuming nations in the region (such as India, Japan and South Korea), Australian exporters have filled the void. However, the exercise has had an impact on prices, with the bottom line for Australian coal exporters being that they are receiving lower premiums for their coal. If this is sustained, it could raise broader questions around production levels at some of higher-cost mines.

Unlike much of the rest of the world, China's economy managed to grow in 2020 — albeit at a slower pace than the decade average. The IMF forecasts Chinese GDP growth of 8.1% in 2021 and 5.6% in 2022. This outlook has been helped by stimulatory policy actions and high foreign demand for goods — both for the problems created by, and to cope with, the COVID-19 pandemic. Chinese exporters have pivoted from the US to Europe. If US-China trade relations improve earlier than expected, it presents upside risks to the IMF's growth outlook.

Australian iron ore earnings appear set to record an all-time high in 2020–21: after topping the \$100 billion mark (for the first time ever for any commodity) in 2019–20, iron ore export earnings are forecast to rise by one third to \$136 billion in 2020–21. Gold has surrendered some of the sharp gains of 2020, but is still high in historical terms. Base metals have recovered to pre-COVID-19 levels, as markets look to successful vaccine rollouts and surging demand for new and low emission technologies.

One downside risk to the forecasts is for substantial delays in the successful rollout of effective COVID-19 vaccines to a large number of the world's working population. Another downside risk is the extent of further disruption to Australian resource and energy commodity trade with China.

About this edition

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

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

Underpinning the forecasts/projections contained in the *Resources and Energy Quarterly* is the Office of the Chief Economist's outlook for global resource and energy commodity prices, demand and supply. The forecasts/projections for Australia's resource and energy commodity exporters are reconciled with this global context.

The global environment in which Australia's producers compete can change rapidly. Each edition of the *Resources and Energy Quarterly* attempts to factor in these changes, and makes appropriate alterations to the forecasts/projections by estimating the impact on Australian producers and the value of their exports.

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

Unless otherwise stated, all Australian and US dollar figures in this report are in real (2020–21) terms. Inflation and exchange rate assumptions are provided in tables 2.1 and 2.2 in the *macroeconomic outlook* chapter.

Data in this edition of the *Resources and Energy Quarterly* is current as of 18 March 2021.

Resources and Energy Quarterly publication schedule

Publication	Expected release date	Outlook period final year
June 2021	28 June 2021	Australian data: 2022–23 World data: 2023
September 2021	30 September 2021	Australian data: 2022–23 World data: 2023
December 2021	20 December 2021	Australian data: 2022–23 World data: 2023
March 2022	4 April 2022	Australian data: 2026–27 World data: 2027

Source: Department of Industry, Science, Energy and Resources (2021)

Overview

Australia's mining sector



Around 10% of GDP

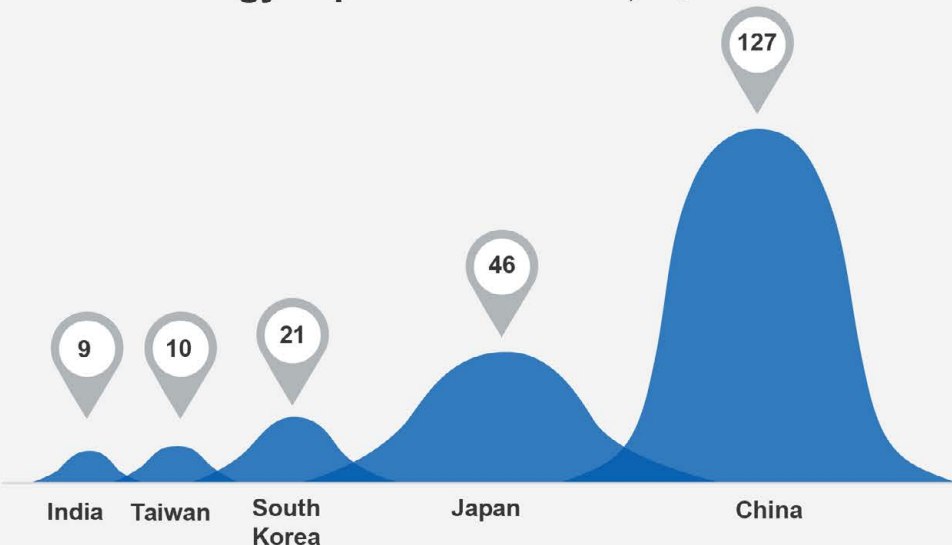


Makes up more than half of Australia's total exports

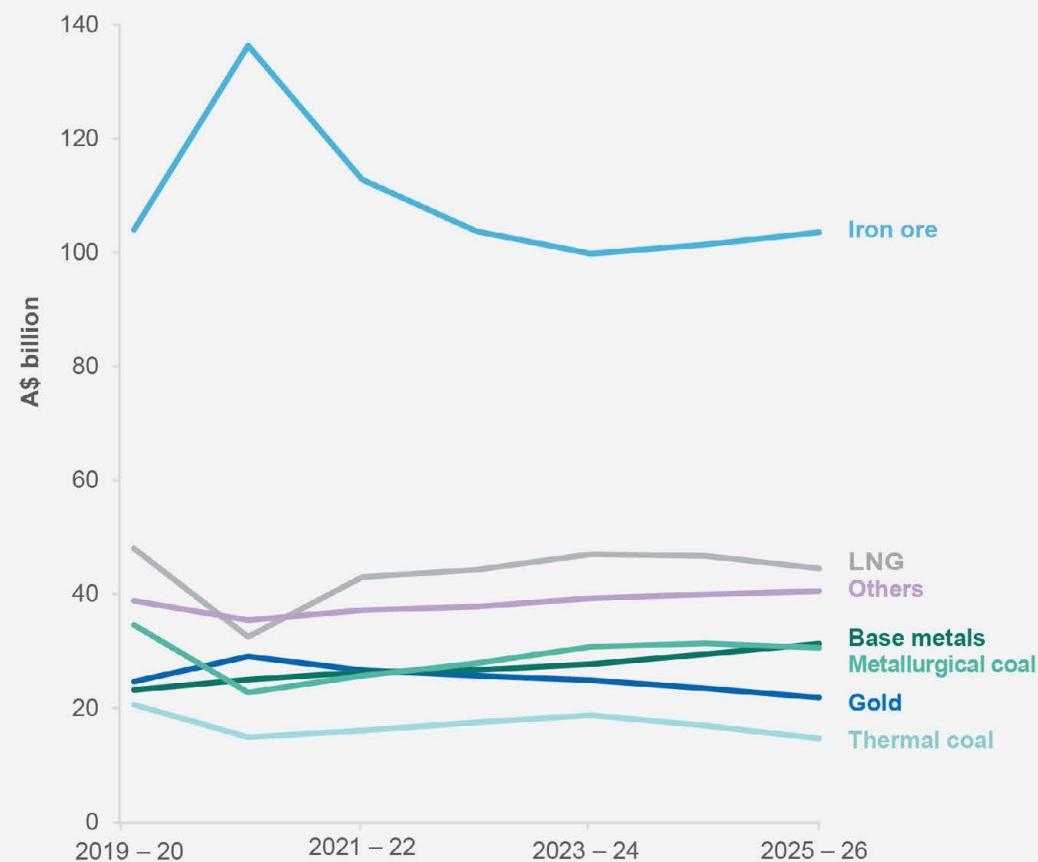


Directly employs around a quarter of a million people

Major markets for Australia's resources and energy exports in 2019–20, A\$billion



Australia's resources and energy exports



1.1 Summary

- The outlook for Australia’s mineral exports continues to improve, as the world economy rebounds from the impact of the COVID-19 pandemic. Australian miners have found their product in high demand, helped by the impact of government and central bank measures abroad.
- In 2020–21, export earnings are forecast to be a record \$296 billion, slightly higher in real terms than the record set in 2019–20. Earnings will fall modestly (down 3% to \$288 billion) in 2021–22, and then steady at about that level over the rest of the outlook period (to 2025–26).
- Australia’s resource sector is set to capture the growth in demand for resources from new and low emission technologies.

1.2 Export values

Australia’s export values are estimated at about \$296 billion in 2020–21

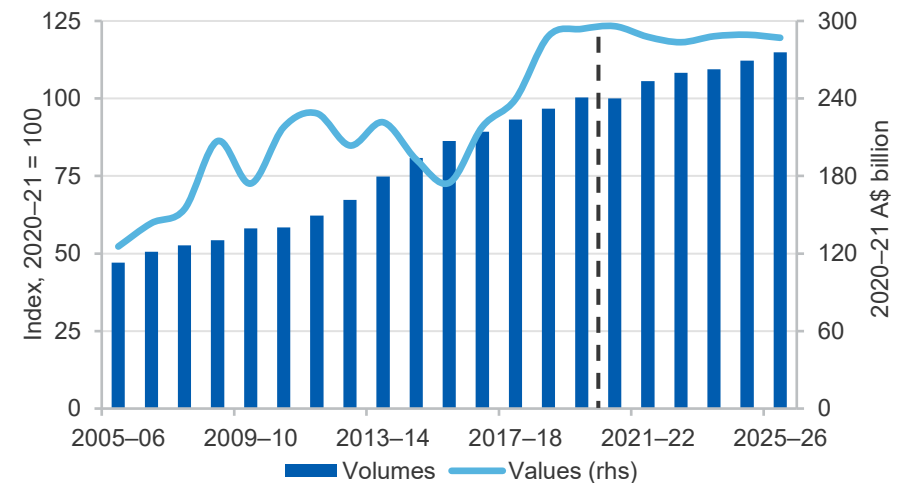
In the March quarter 2021, the Office of the Chief Economist’s (OCE) Resources and Energy Export Values Index rose 11.8% cent from March quarter 2020; a 1.8% rise in prices added to a 10% cent gain in volumes.

In the outlook period, exports are forecast at a record \$296 billion in 2020–21 (up slightly in real terms from 2019–20) and \$288 billion in 2021–22, where they will broadly stay over the rest of the outlook period (Figure 1.1). With volumes growing modestly, price swings will determine much of the change in earnings (Figure 1.2). These price swings seem likely to be much less sharp than in the past seven years.

Rising Australian dollar constrained some of the surge in earnings

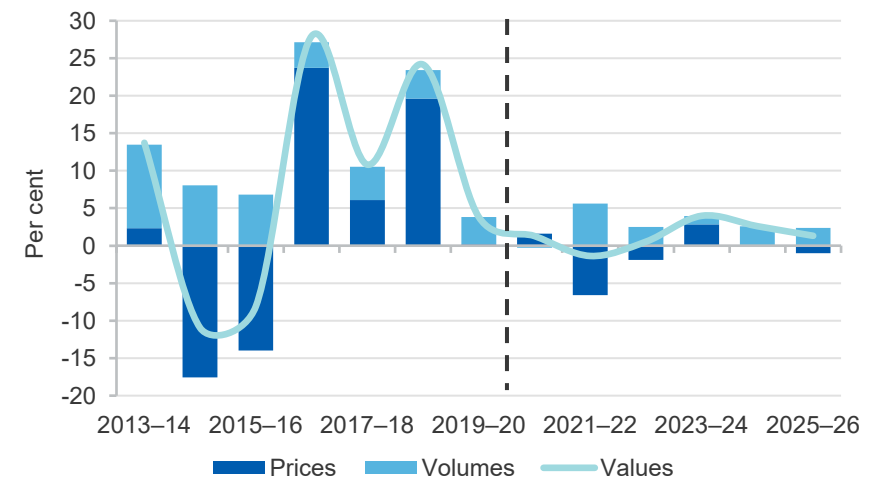
In Australian dollar terms, the OCE’s Resources and Energy Commodity Price Index rose by 18.5% (preliminary estimate) in the March quarter 2021 to be up 3.0% on a year ago. In US dollar terms, the index rose by 23.1% in the quarter, and was 18.9% higher than a year ago. The index of prices for resource commodity exports (Australian dollar terms) rose by an estimated 24.8% in the year to the March quarter 2021, while energy commodity prices fell by 28.4% (Figure 1.3). The surge in iron ore prices to nine-year highs drove the surge in the resource commodity price index.

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



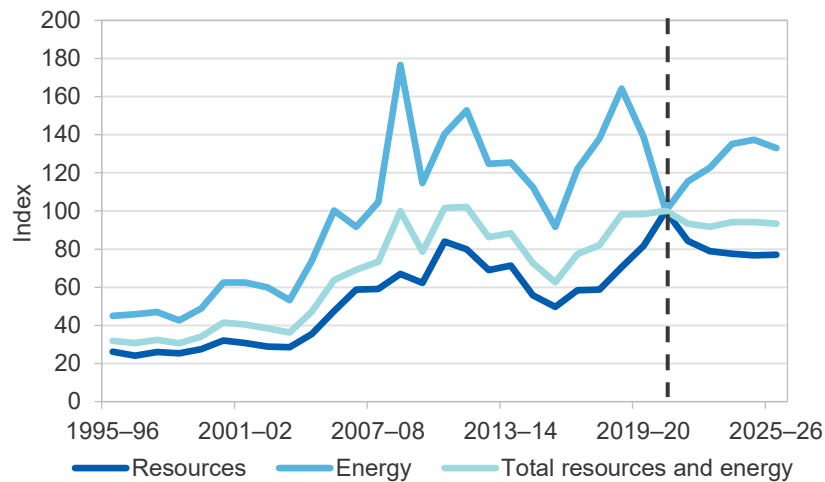
Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

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



Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

Figure 1.3: Resource and energy export prices, AUD terms



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

Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

1.3 Macroeconomic, policy, trade and other factors

With fresh waves of COVID-19 infections in some nations, world economic activity has recovered less rapidly than expected in recent months, but is still expected to rise strongly in 2021. Renewed containment measures in a number of major economies have hurt economic activity and (particularly energy) commodity demand. A colder than normal Northern Hemisphere winter raised energy demand. The outlook is for a strong economic recovery in the first half of the outlook period, once vaccines are rolled out more broadly across the world's major economies. The rebound will be partly fuelled by government stimulus measures and reducing supply chain vulnerabilities in their nations.

COVID-19 infections are falling sharply in many nations, as vaccines are rolled out and containment measures impact. A concern is the risk of COVID-19 mutations and how these might play out in years to come.

With air and land-based travel still impacted by border restrictions and COVID-19 containment measures, oil demand is weak but recovering. Vaccine 'passports' could help drive a recovery in international air travel, and hence jet fuel demand. Until air travel recovers, land based travel should provide a partial offset to oil demand.

The Chinese economy continues to expand at a relatively good pace. Travel restrictions imposed over the Chinese New Year period meant that production was stronger than normal, adding to input consumption. Appreciation pressures on the RMB have helped contain inflation and helped lift import demand. China's property sector has cooled, in response to modest government measures.

The US Government has passed a significant US\$1.9 trillion fiscal stimulus package to boost the US economy. President Biden has signed an Executive Order re-joining the Paris Climate Accord, with potential implications for future global resources and energy trade.

The most recent IMF forecasts put world GDP growth at 5.5% in 2021, after a contraction of 3.5% in 2020. The IMF forecasts world GDP growth to then moderate towards more typical levels in 2022. Over the rest of the outlook period, growth is assumed at 3-3.5%. Commodity demand should thus be healthy over the outlook period.

The extent of further official and unofficial Chinese government restrictions on imports of some Australian resource and energy commodities poses a downside risk to the forecasts. Australian exporters of coal and copper concentrates and ores have been able to pivot to other markets; a colder-than-normal Northern Hemisphere assisted thermal coal exporters in this pivot. At present, a high degree of uncertainty exists around the extent to which China's informal import restrictions will persist through the outlook period.

Our projections suggest that by the end of the outlook period (2025-26), a surge in exports earnings of metals used in technologies central to the world energy transition — copper, lithium and nickel — will replace the fall in thermal coal earnings arising from that transition.

1.4 Prices

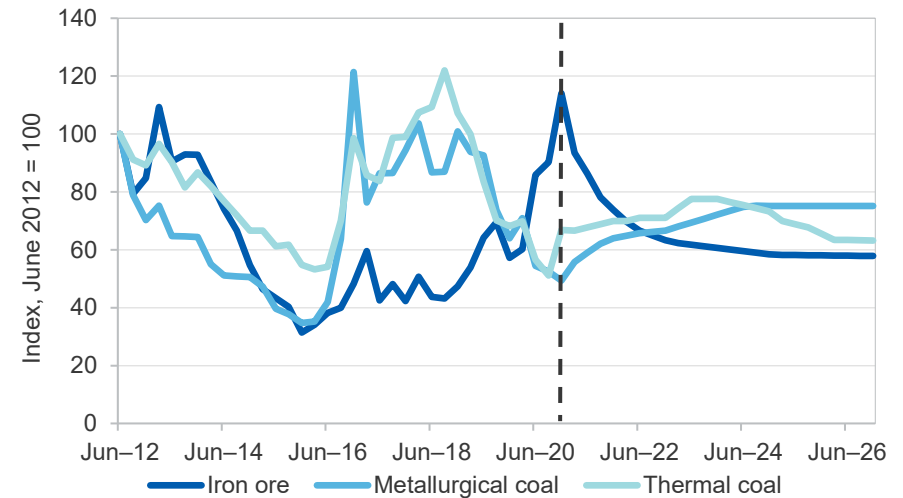
The iron ore price has remained strong since the December 2020 *Resources and Energy Quarterly*, currently at a 9-year high. A recovery in demand in some of the advanced industrialised nations has added to strong Chinese demand, to keep prices high in a market still heavily constrained by low Brazilian supply (Figure 1.4). Prices are expected to ease by 2022, as Brazilian supply recovers and world demand moderates.

Australian metallurgical coal prices have regained some of the losses incurred as a result of China's informal import restrictions. Australia's dominant position in the seaborne market has meant that our exporters have sold coal to replace the (mainly North American and Russian) cargoes bought by China typically sold elsewhere. A price lift is likely in the forecast period, as ex-Chinese usage recovers further. Winter demand from Asian coal-fired power utilities combined with output cuts to help lift thermal coal prices to pre-COVID-19 levels. Prices are likely to be flat in the outlook period, as supply matches demand (Figure 1.4).

Oil prices have regained all of the sharp declines of the first four months of 2020. Production cuts have combined with a recovery in demand to remove some inventory from the market. In the March quarter 2021, demand is likely to be impacted by renewed COVID-19 containment measures introduced in some nations. The price seems likely to be capped at US\$60-70 a barrel over the outlook period, as re-opened production matches higher demand. Spot LNG prices are forecast to be flat as new supply enters the market.

The gold price has declined, as US real bond yields rise and news of several effective COVID-19 vaccines pushes investment flows away from precious metals. A recovery in scrap supply will offset improved jewellery demand over the outlook period. Further out, the price is likely to fall, as equity markets rise further and real bond yields rise. Base metal prices have more than recovered their COVID-19 losses, largely on the back of the Chinese economic rebound (Figure 1.5). Base metal demand should rise, as world industrial activity recovers further from COVID-19 restrictions and the world energy transition continues.

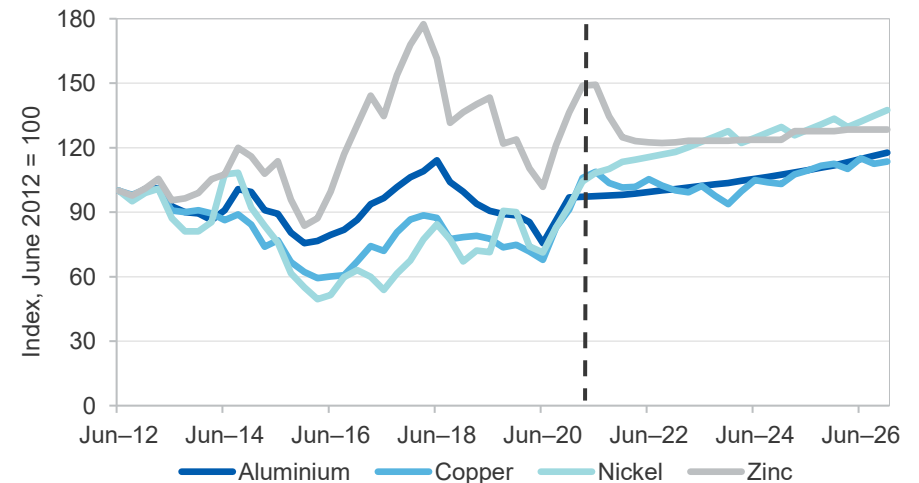
Figure 1.4: Bulk commodity prices



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

Source: Bloomberg (2021); Department of Industry, Science, Energy and Resources (2021)

Figure 1.5: Base metal prices



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

Source: Bloomberg (2021); Department of Industry, Science, Energy and Resources (2021)

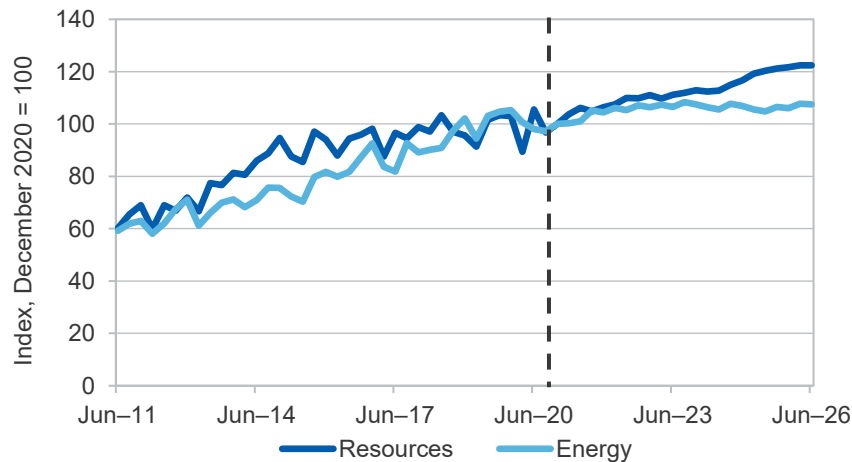
1.5 Export volumes

Weaker Australian export volumes, driven by resource exports

The OCE's Resources and Energy Export Volumes Index (preliminary estimate) rose by 2.8% in the March quarter 2021 from the December quarter, and was 8.9% higher than a year before (Figure 1.6). Within this total, resource commodity volumes rose by 15.9% in the year to the March quarter 2021, while energy commodity volumes fell by 0.4%. The volume of energy exports was affected by the slowdown in Asian economic activity (due to COVID-19) and China's informal import restrictions on our coal.

In volume terms, resources exports are likely to show further significant growth over the outlook period. Economic growth and industrial production is rebounding amongst our main trading partners, increasing their demand for our ferrous and non-ferrous metals. The global energy transition will also see strong demand for new technology commodities such as copper, lithium and nickel. Energy export volumes are forecast to recover pandemic losses during 2021, and then tend to level out. However, this volume recovery will likely not be sufficiently strong to offset lower energy prices and thus see export earnings surpass pre-COVID-19 levels.

Figure 1.6: Resource and energy export volumes



Source: Department of Industry, Science, Energy and Resources (2021)

1.6 Contribution to growth and investment

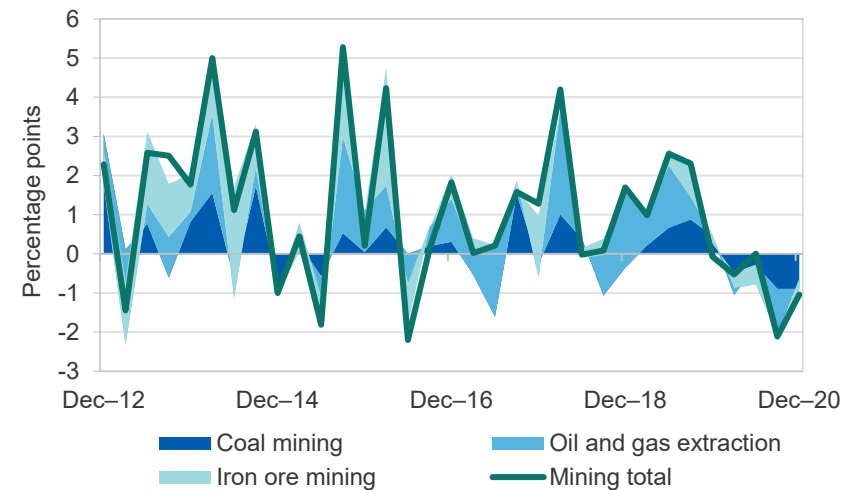
Mining industry contracted, but by much less than the rest of the economy

Australia's real Gross Domestic Product (GDP) rose by 3.1% in the December quarter 2020, but was down 1.1% through the year since the December quarter 2019.

Mining value-added fell by 1.0% in the December quarter, to be down 3.6% over the previous twelve months.

In the coming year, it is likely that the iron ore sector will make a significant contribution to GDP growth, as high prices and margins drive growing volumes. The coal sector is likely to make only a modest contribution to growth in the first half of the outlook period. Gas production is likely to make a positive contribution to growth, on the back of stronger LNG demand and a recovery in prices.

Figure 1.7: Contribution to quarterly growth, by sector

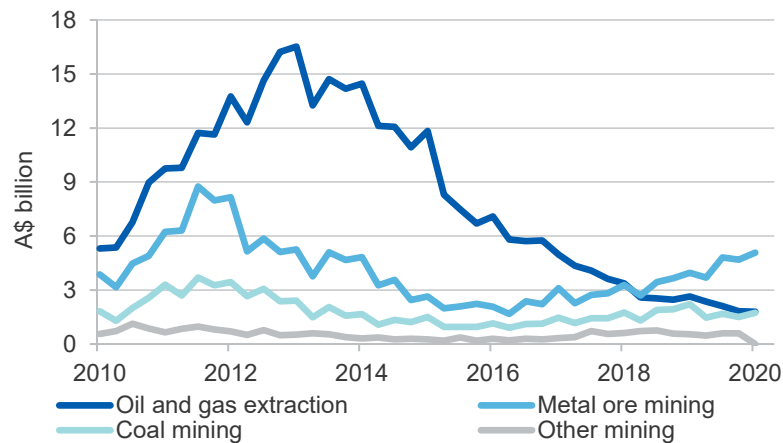


Source: ABS (2021) Australian National Accounts, 5206.0

Mining investment is picking up

The ABS Private New Capital Expenditure and Expected Expenditure survey for the December quarter 2020 shows that Australia's mining industry invested \$9.3 billion in the quarter. This is up by 7.7% in the quarter, but down 0.8% from the December quarter 2019. In recent quarters, growth in investment by the metal ore mining sector has been strong, with strong growth in the December quarter (Figure 1.8). This likely reflects the surge in iron ore prices.

Figure 1.8: Mining industry capital expenditure by commodity

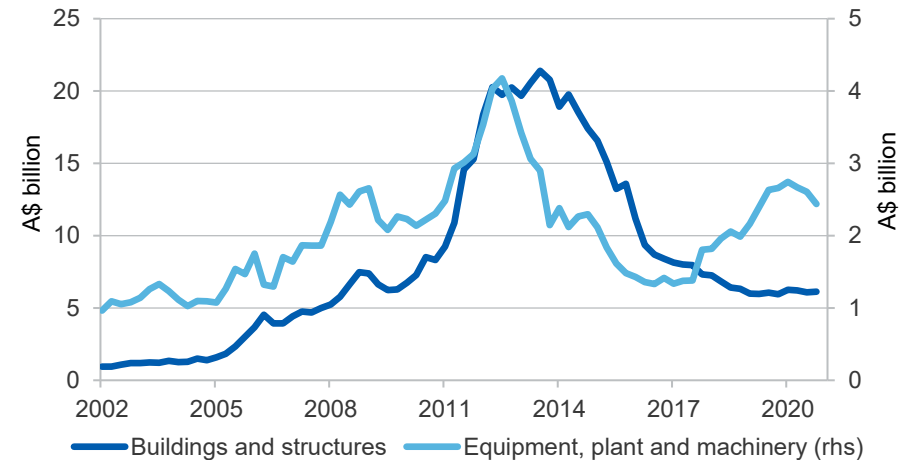


Notes: Other mining includes non-metallic mineral mining and quarrying and exploration and other mining support services; chart data is in nominal terms

Source: ABS (2021) Private New Capital Expenditure and Expected Expenditure, 5625.0

Expenditure on buildings and structures rose in the December quarter 2020, however spending on machinery and equipment fell (Figure 1.9). However, the latter remains well above its average level of recent years. Mining companies invested \$35 billion in 2019–20, with forward expectations suggesting that investment in 2020–21 will be slightly higher (Figure 1.10). Strong prices for gold, iron ore and other minerals are leading to new investment plans, including the re-opening of mines. However, investment in new greenfield projects remains well below the levels of the previous decade.

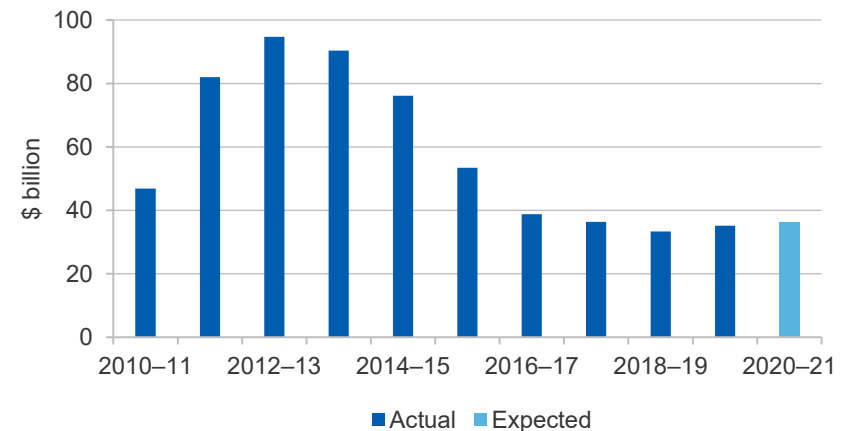
Figure 1.9: Mining industry capital expenditure by type, quarterly



Notes: Chart data is in nominal terms

Source: ABS (2021) Private New Capital Expenditure and Expected Expenditure, 5625.0

Figure 1.10: Mining industry capital expenditure, fiscal year

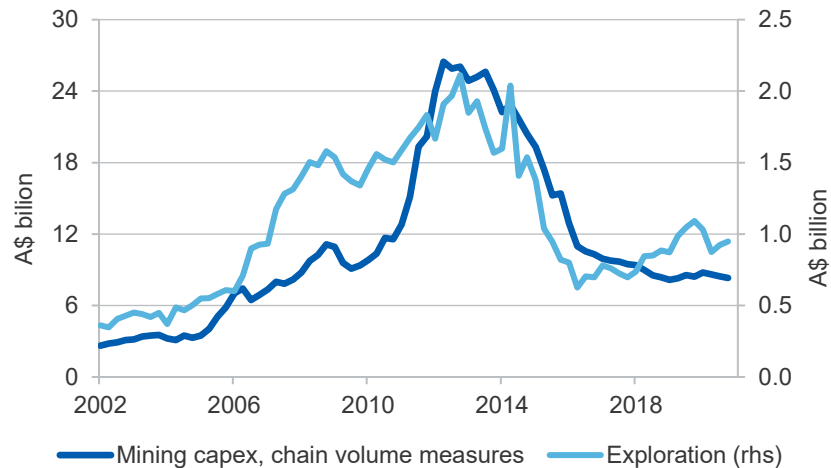


Notes: Chart data is in nominal terms

Source: ABS (2021) Private New Capital Expenditure and Expected Expenditure, 5625.0

Data on exploration spending (adjusted for inflation) suggests that mining capital expenditure is recovering at a marginal pace following falls in early 2020 (Figure 1.11). Exploration spending edged up in the December quarter, with spending for all commodities rising to \$947 million.

Figure 1.11: Mining capital expenditure vs exploration (real), quarterly



Source: ABS (2021) Private Capital Expenditure Survey, Chain Volume measure, 5625.0

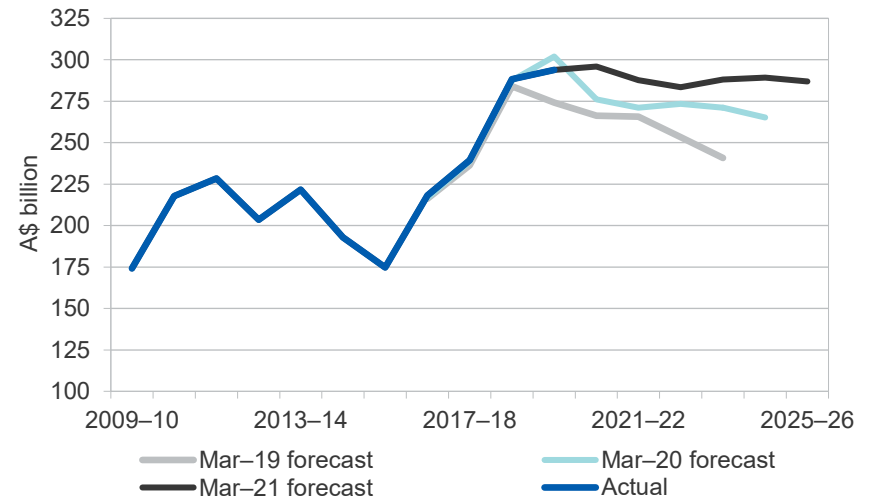
1.7 Revisions to the outlook

At \$296 billion in 2020–21 and \$292 billion in 2021–22, Australia’s resources and energy exports in nominal terms are up \$17 billion and \$28 billion, respectively, from those contained in the December quarter 2020 *Resources and Energy Quarterly*. Compared to March 2020, earnings are now forecast to hold up much better in the out years (Figure 1.12).

Stronger metal (mainly iron ore) exports have driven the upward revisions.

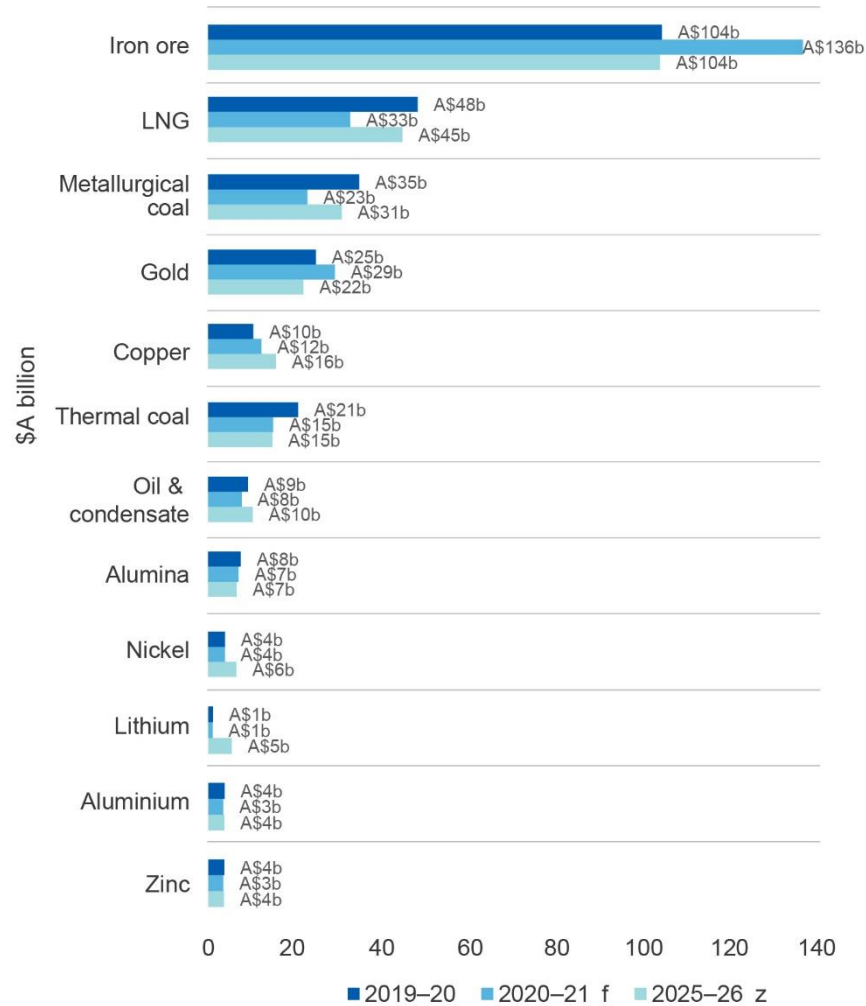
The stronger rise in the Australian dollar now forecast has offset a small amount of the gains from higher export volumes.

Figure 1.12: Resource and energy exports, by forecast release



Source: Department of Industry, Science, Energy and Resources (2021)

Figure 1.13: Australia's major resources and energy commodity exports, 2020–21 dollars



CAGR % change from 2019–20

	2020–21			2025–26 z		
	volume	EUV	value	volume	EUV	value
Iron ore	▲	▲	▲	▲	▼	→
	4	26	31	4	-4	0
LNG	▼	▼	▼	→	▼	▼
	-2	-31	-32	0	-2	-1
Metallurgical coal	▼	▼	▼	▲	▼	▼
	-2	-33	-34	1	-3	-2
Gold	▼	▲	▲	▲	▼	▼
	-2	20	18	3	-5	-2
Copper	▼	▲	▲	▲	▲	▲
	-1	20	18	1	6	7
Thermal coal	▼	▼	▼	▲	▼	▼
	-3	-25	-28	1	-7	-5
Oil & condensate	▲	▼	▼	▲	→	▲
	3	-18	-16	2	0	2
Alumina	▲	▼	▼	▲	▼	▼
	2	-9	-7	1	-3	-2
Nickel	▼	▲	▼	▲	▲	▲
	-13	14	-1	1	8	9
Lithium	▲	▼	▼	▲	▲	▲
	10	-19	-11	17	11	30
Aluminium	▼	▼	▼	▼	→	→
	-4	-3	-7	-1	0	0
Zinc	▼	▲	▼	▲	▼	→
	-7	2	-5	2	-3	0

Notes: f forecast. EUV is export unit value. Per cent change is from 2019–20.

Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

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

Exports (A\$m)	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^z	2023–24 ^z	2024–25 ^z	2025–26 ^z	CAGR ^r
Resources and energy	290,778	295,981	292,457	294,324	306,618	315,705	321,118	1.7
– real ^b	293,855	295,981	287,665	283,545	288,167	289,346	287,006	-0.4
Energy	115,532	81,816	99,844	107,666	118,631	119,826	116,773	0.2
– real ^b	116,755	81,816	98,208	103,723	111,492	109,822	104,368	-1.9
Resources	175,245	214,165	192,613	186,658	187,987	195,879	204,345	2.6
– real ^b	177,100	214,165	189,457	179,822	176,675	179,525	182,638	0.5

Notes: **b** In 2020–21 Australian dollars; **f** forecast; **r** Compound annual growth rate; **z** projection.

Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

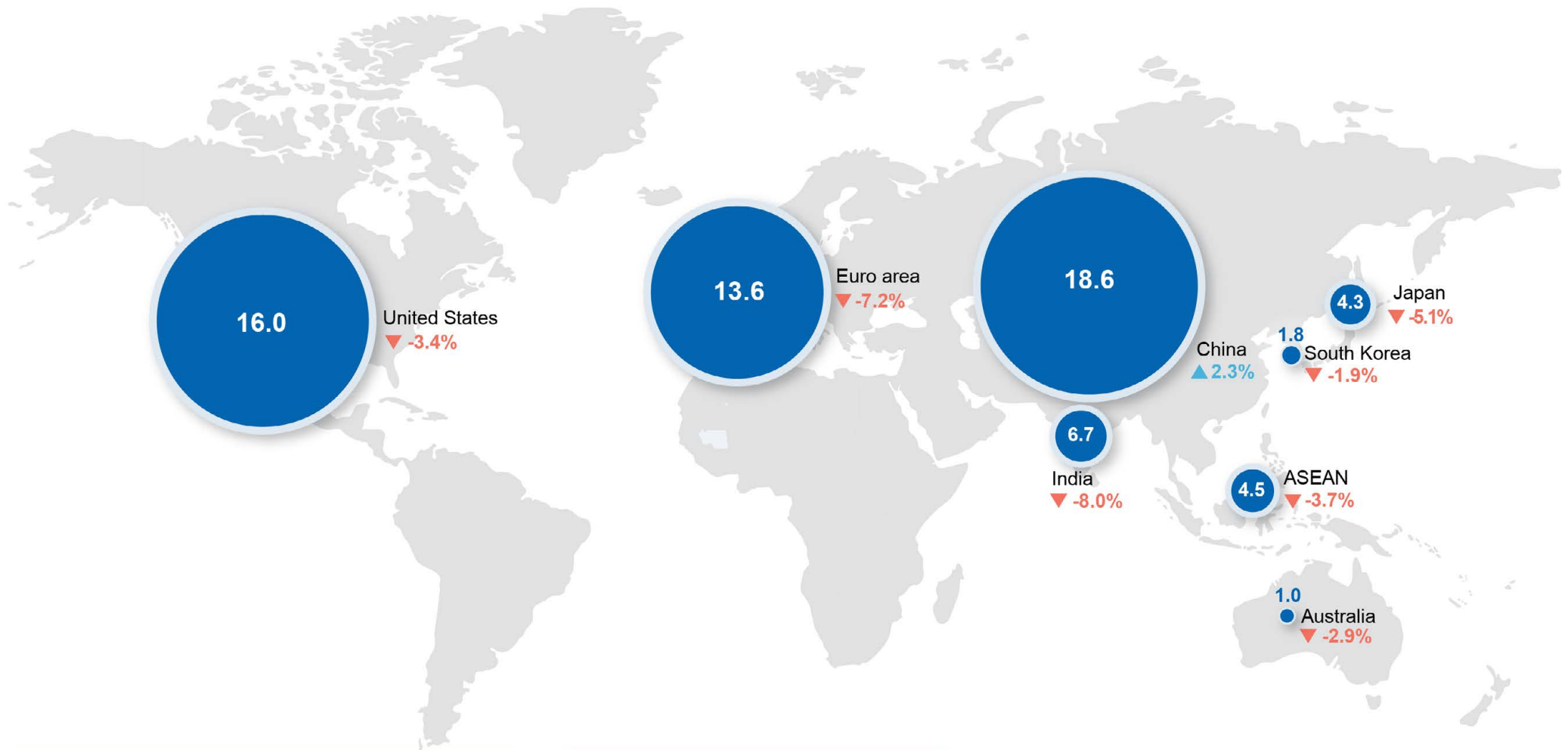
Table 1.2: Australia's resource and energy exports, selected commodities

	Unit	Prices			Unit	Export volumes			Export values (real 2020–21 terms), A\$b		
		2019–20	2020–21 ^f	2025–26 ^z		2019–20	2020–21 ^f	2025–26 ^z	2019–20	2020–21 ^f	2025–26 ^z
Iron ore	US\$/t	91	128	77	Mt	858	893	1,097	104	136	104
LNG	A\$/GJ	11	8	12	Mt	79	78	81	48	33	45
Metallurgical coal	US\$/t	145	119	166	Mt	177	173	191	35	23	31
Gold	US\$/oz	1,562	1,841	1,364	t	350	344	418	25	29	22
Thermal coal	US\$/t	63	60	61	Mt	213	206	231	21	15	15
Copper	US\$/t	5,666	7,649	8,837	Kt	924	919	992	10	12	16
Crude oil	US\$/bbl	52	53	66	Kb/d	291	299	327	9.1	7.7	10.2
Alumina	US\$/t	282	275	338	Mt	17,876	18,254	18,438	7.5	7.0	6.6
Nickel	US\$/t	13,982	16,663	22,566	Kt	231	201	246	3.8	3.8	6.5
Zinc	US\$/t	2,206	2,677	2,469	Kt	1,530	1,419	1,747	3.6	3.4	3.5
Aluminium	US\$/t	1,675	1,883	2,227	Kt	1,430	1,372	1,387	3.7	3.5	3.7
Lithium	US\$/t	561	440	712	Kt	1,503	1,647	3,855	1.1	1.0	5.4
Uranium	US\$/lb	27	30	50	t	7,195	6,486	5,800	0.7	0.5	0.7

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

Source: ABS (2021) International Trade in Goods and Services, Australia, Cat. No. 5368.0; LME; London Bullion Market Association; The Ux Consulting Company; US Department of Energy; Metal Bulletin; Japan Ministry of Economy, Trade and Industry; Department of Industry, Science, Energy and Resources (2021)

Macroeconomic Outlook



In 2020, global economic activity contracted by an estimated 3.5% due to COVID-19. If containment measures are gradually relaxed over the outlook period, economic growth is forecast to recover to 5.5% in 2021.



Risks: Containment measures lingering, subsequent waves of COVID-19, potential medical breakthroughs, and resurfacing trade tensions.



= Share of global GDP



= Economic growth in 2020



= Economic contraction in 2020

Summary

- World economic growth forecasts continue to be revised up after the COVID-19 pandemic. After an estimated 3.5% contraction in 2020, the global economy is forecast to grow by 5.5% in 2021 and 4.2% in 2022.
- International trade recovered to pre-COVID-19 levels in November 2020. World trade rose 4% on a quarterly basis in the December quarter 2020, taking calendar year growth to 1.3%. Previous annual average growth for the 2010-2019 decade was around 3.6%.
- Elevated infrastructure spending should see China's construction and manufacturing activity remain in expansionary territory throughout 2021, generating strong demand for base metals and iron ore. Strong commodity demand is likely to ease in subsequent years however, as infrastructure led stimulus slows.

Global economic outlook

IMF upgrades economic outlook for 2021

The International Monetary Fund (IMF) raised its economic growth forecasts in January 2021, based on the assumption that a successful rollout of COVID-19 vaccines and more fiscal stimulus will offset the immediate challenge posed by the recent resurgence of the pandemic (particularly in Europe and the US) at the start of 2021. After an estimated 3.5% contraction in 2020, the IMF forecasts the global economy to grow by 5.5% in 2021.

Despite the expected slight dampening of current output in early 2021, economic activity is anticipated to rise throughout the second half of the year, as vaccines mitigate the need for lockdowns, allowing further contact-intensive activity to return, and as further extensive fiscal stimulus is rolled out across many advanced economies.

The IMF's growth estimate for 2020 has also been substantially upgraded — by almost a full percentage point — due to a stronger than expected recovery in the second half of last year in many nations, including Australia. Several countries experienced a surge in consumption through

the September and December quarters, as COVID-19 containment measures continued to ease.

This has resulted in a stronger 2021 forecast and a more optimistic outlook for consumption, investment and employment. However, uncertainty still remains, and lingering concerns regarding the impact of the pandemic have persisted, as surging infections resulting from new variants of virus have spread in the United Kingdom and Europe. Further uncertainty about the efficacy rates and distribution challenges of the vaccines could skew economic growth weaker than the latest January 2021 IMF forecast.

Exploring the medium-term outlook scenario, the IMF forecasts world GDP growth will increase by 4.2% in 2022 before steadily easing back to its average of just over 3% by 2026. The recovery is expected to be uneven, as advanced economies have been able to provide expansive fiscal and monetary support to protect their economies and will likely benefit from faster distribution of the vaccine rollouts. Emerging and developing economies, some of which were unable to provide similar levels of fiscal support and are likely to experience slower vaccine distribution, may face more divergent recovery paths. Oil exporters and tourism-based economies will face challenges, owing to the relatively subdued outlook for oil prices and the slower normalisation of cross-border travel.

Outlook for advanced economies supported by fiscal policies

The 2021 forecast has improved for the advanced economy group, where growth is forecast to average 4.3% in 2021. Additional fiscal support — mostly in the United States and Japan — together with expectations of earlier widespread vaccine availability, have improved growth prospects for the coming year, though strong risks remain.

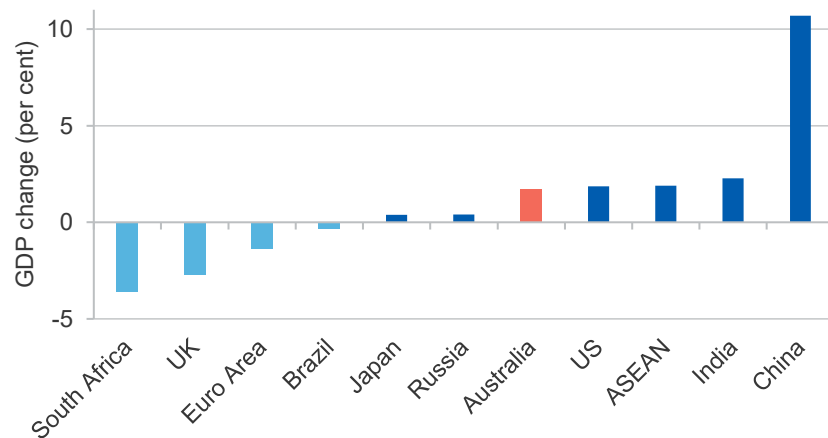
The US saw one of the biggest upgrades to its outlook following the approval of a \$900 billion relief plan. The IMF forecasts the US economy will grow 5.1% this year, compared with a 3.1% forecast in October. The forecast does not incorporate \$1.9 trillion stimulus package passed in March 2021, which the IMF preliminarily estimates would add another 1.25% to output this year and 5% over the next three years.

Japan, which has announced its own stimulus of more than \$700 billion, also saw a significant upward revision. The IMF now projects 2021 economic growth at 3.1%, compared with 2.3% previously.

Uncertainty surrounds these baseline projections, as the positive outlook contrasts with the United Kingdom (UK) and Europe, where a new wave of COVID-19 cases has spurred new restrictions. The Euro-area growth forecast was cut by a full percentage point to 4.2%, on the expectation that the December quarter decline at the end of 2020 will continue. The UK was cut by almost a point and a half to 4.5%. The resurgence of infections and the tightening of containment measures, is likely to dampen economic recovery across Western Europe, although future lockdowns are expected to have a smaller impact than in 2020.

The US and Japan are expected to regain their end-2019 activity levels in the second half of 2020, while the Euro area and UK will remain below those levels into 2022. More than 150 economies are expected to have output levels by the end of 2021 that are below end 2019 (Figure 2.1).

Figure 2.1: Forecast pandemic recovery by end 2021



Notes: Forecast comparative size of economies by December quarter 2021 compared to December quarter 2019

Source: IMF

World trade recovers to pre-COVID levels

World trade rose by 4% on a quarterly basis in the December quarter 2020, taking growth for the whole of 2020 to 1.3%. This meant that world trade had recovered to pre-COVID-19 levels by the end of 2020.

In January 2021, trade levels were 0.6% higher than December, mainly helped by exports from advanced economies such as the US and imports from emerging economies. Global industrial production also grew by 1.3% in December 2020, consistent with early 2020.

Recovery in industrial demand and manufacturing leading indicators

World industrial output is forecast to rise by about 6% through 2021, after falling 4.4% through 2020 (resulting from stymied demand and global trade resulting from the pandemic's restrictions worldwide).

China's industrial output (a good proxy for commodity demand) fell during the nation's initial lockdown period in February 2020, but has recovered strongly, reaching pre-COVID-19 levels by September 2020. The recent rise in China's industrial output can be primarily explained by policy support (for building new infrastructure) and strong foreign demand for goods to use in/cope with the pandemic. China produced more than 1 billion tonnes of crude steel in 2020, an annual record. India's industrial output has recovered (after falling over 10% through 2020) to above pre-COVID-19 levels of output, with the electricity sector and manufacturing registering growing at 5.1% and 1.6% respectively (Figures 2.2 and 2.3).

The end of 2020 also saw rates of growth in global manufacturing production and new orders reach historical highs, as the sector continued to recover from the COVID-19 related downturn earlier in the year. The J.P. Morgan Global Manufacturing PMI was unchanged from November's 33-month high of 53.8. This is despite a shortage of semiconductor chips, which is affecting global automotive production.

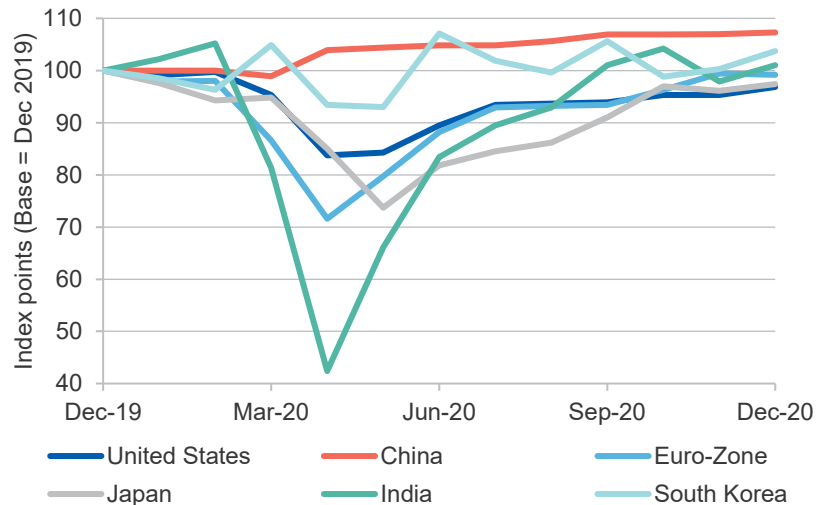
Germany, Brazil and India saw the strongest output growth. While expansions were also seen in the large industrial regions including China, the US and the Eurozone (Japan being a notable exception), output volumes have now stabilised following 23 months of decline.

Rising commodity prices, but 'super-cycle' unlikely

The recovery in global industrial production is supporting commodity prices, including for some of Australia's key exports. Iron ore, coal and oil prices all increased sharply over the end of 2020 and start of 2021. This rising optimism has led to predictions of a new commodities 'super-cycle' across 2021, as economies are fuelled by large government and central bank support. Commodity-intensive infrastructure spending is likely to rise in many nations, including plans for the infrastructure linked to economies' plans for lower carbon emissions.

The rapid economic development of China — starting at the beginning of the century, and helped significantly by that nation's admission to the World Trade Organisation — brought about the last commodity super-cycle. With a similar sized (but younger) population, India could eventually replicate China's extraordinary demand for resource and energy commodities.

Figure 2.2: Industrial output above pre-COVID-19 levels in China, South Korea, the EU and India



Notes: India is not seasonally adjusted

Source: Bloomberg

Figure 2.3: Forecast world output and industrial production



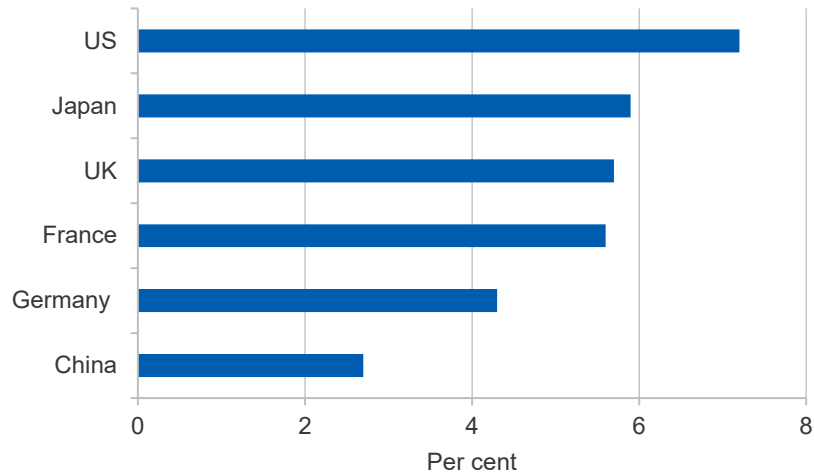
Source: IMF; Wood Mackenzie

Major trading partner economic outlook

Australia's major trading partners' GDP is expected to grow by 7% in 2021 and by 4.5% in 2022 in year-average terms. Overall, global economic activity is expected to recover faster than in a typical recession because much of the weakness has been the result of mandated constraints rather than weak underlying demand. Also, in many advanced economies the scarring effects on the labour market are likely to have been more limited than usual because of proactive fiscal and monetary policy responses.

Consumers in the world's largest economies are also believed to have amassed US\$2.9 trillion in extra savings, owing to the COVID lockdowns. Half of that total, US\$1.5 trillion is within the US, a spending splurge of this proportion would push economic growth to almost 9% for 2021 (almost double the forecast 4.6%). Such savings could provide incredible growth in consumption — similar to what was witnessed in many nations during the September quarter 2020 — as the rollout of vaccinations potentially brings about control over the pandemic (Figure 2.4).

Figure 2.4: Excess savings as share of GDP



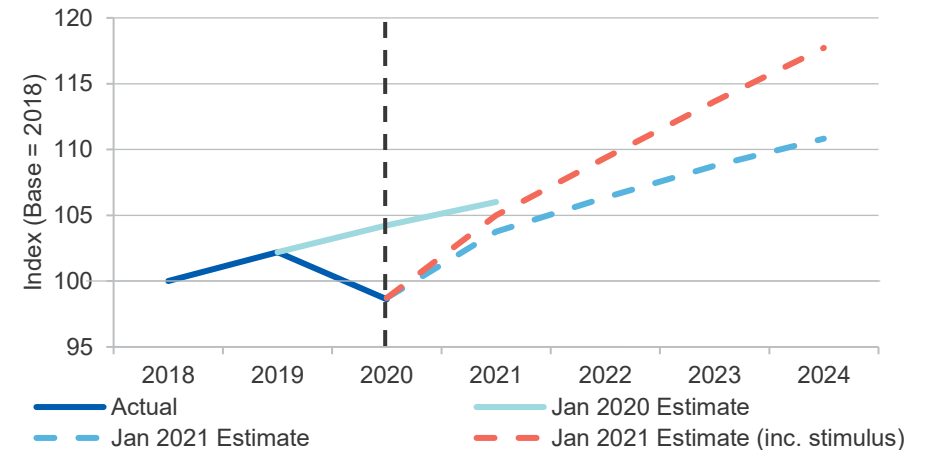
Source: Bloomberg Economics

US expected to expand fiscal stimulus

The IMF forecasts the world's largest economy to increase by 5.1% this year, versus 3.1% in the previous October forecast. The projection does not incorporate the US government's further US\$1.9 trillion stimulus package, which was approved by the Biden administration in mid-March. The IMF preliminary estimates conclude that additional stimulus spending, on top of the current US\$2.9 trillion already committed in stimulus aid, and could add another 1.25% to GDP output in 2021 and an additional 5% over the next three years (Figure 2.5).

In addition, the Biden Administration and business groups largely agree on the need for additional large-scale government funding to modernise US infrastructure, finance research and development and promote low-emissions energy. A significant portion of this spending would be resource-commodity intensive. Some estimates put the US Administration's proposals at a cost of US\$2-4 trillion, depending on the specifics. The White House has not set out any detailed plans of its next economic proposal centred on infrastructure, transport, and clean energy.

Figure 2.5: United States output boosted by potential stimulus



Notes: Based on IMF stimulus assumptions from a 2018 base of economic output

Source: IMF

Federal Reserve holds key interest rate on uneven US economic recovery

The Federal Reserve left its key overnight interest rate near zero and made no change to its monthly bond purchases at the commencement of 2021, pledging again to keep those economic pillars in place until there is a full rebound from the pandemic-triggered recession. Fed chairman Powell has suggested that the Fed sees no need to alter its ultra-low interest rate policies in the near-term. However there is rising nervousness in the bond market about a potential surge in inflation. The inflation concerns derive from the latest fiscal package adding to the impact of the Fed's continued low rates, and progress in combating the COVID-19 pandemic now that nation-wide vaccinations programs are rolling out.

US-China trade relations remain complex

Over the past four years, the US took a series of trade measures, including tariff raising, aimed at achieving lower US trade deficits with China. Average US tariffs on Chinese imports are now at 19.3%, whilst the average Chinese tariffs on U.S. imports are at 20.3%. So far, the new US Administration has not indicated whether it will change US tariffs.

China's 2020 growth exceeded forecasts as COVID-19

China's economy surpassed pre-pandemic growth rates in the December quarter 2020, as its industrial production fired up to meet surging demand for exports. Gross Domestic Product climbed 6.5% in the final quarter from a year earlier, pushing calendar year growth to 2.3%.

The IMF slightly scaled down its forecast for China's output during 2021 and 2022, likely resulting from the stronger than expected performance through 2020, although GDP is still forecast to grow by 8.1% and 5.6% respectively. Thus, leaving the world's second-largest economy driving global growth and potentially passing U.S. output by 2028 — two years earlier than previously expected.

China's factory activity expands at a slower pace in February

China's factory activity expanded in February, but at a slower pace than a month earlier, missing market expectations after brief COVID-19-related disruptions earlier in the year. The Caixin Manufacturing Purchasing Managers' Index (PMI) fell to 50.9 in February, its lowest level since May, while the official PMI fell to 50.6 from 51.3 in January.

Weaker overseas demand appears to be taking a toll: new export orders have eased relative to the rapid pace of expansion towards the end of 2020. The official PMI, which largely focuses on big and state-owned firms, showed the sub-index for new export orders was 48.8 in February compared with 50.2 in January, slipping back into contraction after months boosted by overseas demand.

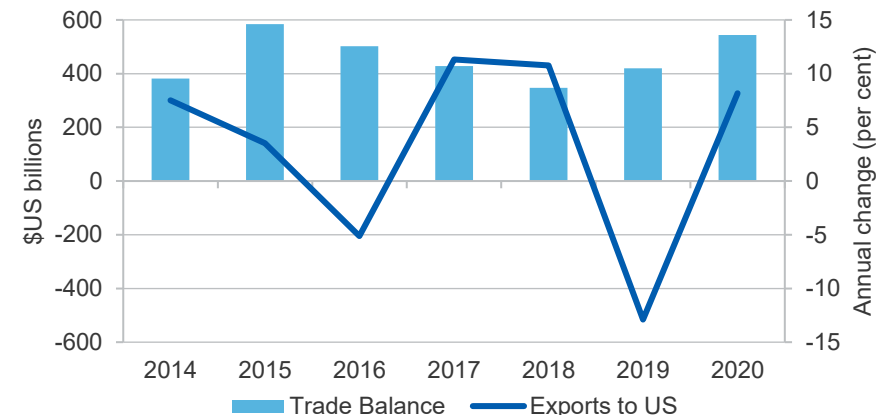
China bolsters its dominance of global trade

Despite the expectation of de-globalisation occurring amidst the pandemic, and tensions with the United States, surging global demand for everything from hazmat suits to work-from-home technology has allowed China to capture record market share of global exports.

China was aided in this by the relatively brief shutdown of its factories while the rest of the world grappled with COVID-19 containment. China has ended 2020 with a record high trade surplus of US\$78 billion. In

December 2020, exports grew by 18.1% and imports grew 6.5% (year-on-year). China's exports to the US grew by 8% in 2020, after declining 12% in 2019. For the whole year of 2021, China's exports are expected to grow by around 6%, after rising 4% in 2020 (Figure 2.6).

Figure 2.6: China's annual trade balance and exports to the US



Notes: Annual trade balance (billions) and annual percentage change of total Chinese exports to the US

Source: Bloomberg

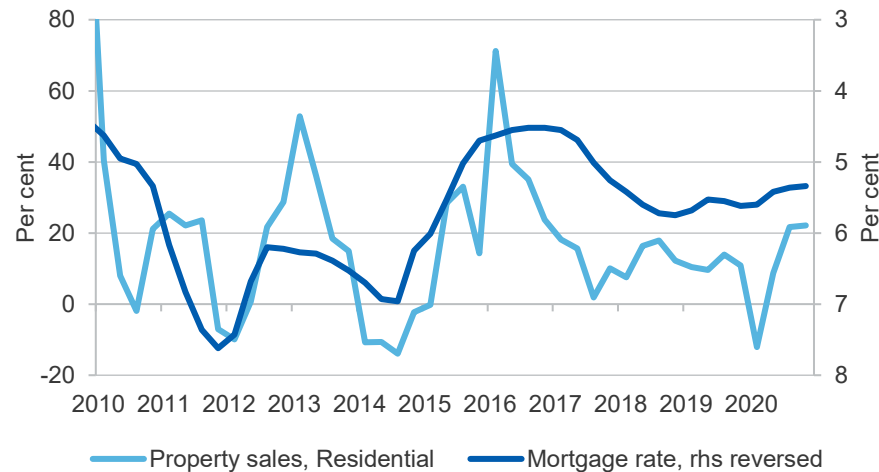
Tightening monetary policy conditions risk Chinese housing sector

Financial conditions are likely to support growth and employment in China; however, Chinese policy makers are facing pressure to deleverage high levels of government debt, via tightening monetary policy, whilst avoiding a credit crunch or housing market collapse. Local government debt rose through 2020 after Beijing raised its fiscal budget deficit level for infrastructure investment funding to provide the economic stimulus necessary to recover from the pandemic. However, while investment in fixed assets such as real estate and infrastructure grew by 2.9%, consumption spending per capita fell 4% in 2020 from a year earlier.

Although reliant on debt-fuelled infrastructure investment for growth, the property sector is a significant driver of the Chinese economy and a key source of demand for Australian commodity exports. During 2010-11,

China's central bank crashed the housing market through mortgage rate hikes (Figure 2.7). Although authorities have confirmed that reducing government debt and risk in the financial sector remains a key policy objective, any tightening of monetary conditions is likely to occur gradually.

Figure 2.7: Mortgage rates and property sales in China



Notes: Annual monthly property sales, year-on-year change with PBoC mortgage rate
Source: PboC; Bloomberg

India exits recession amid risks from resurgence in virus cases

India's economy returned to growth in the December quarter, but a new surge in coronavirus infections is complicating the short term outlook. GDP grew by 0.4% in the December quarter 2020, after two consecutive quarters of decline. Any further sharp improvement in the economy's performance is likely to be contingent on a drop in COVID-19 infections.

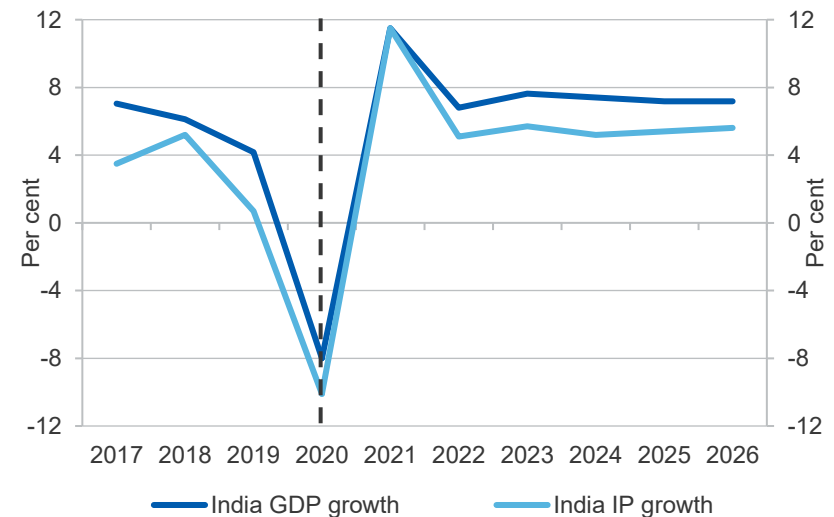
The government recently announced fiscal steps to support the economy, including a near-record borrowing in its latest budget. The budget for next financial year (April 2021 to March 2022), unveiled on 1 February, focuses on energy infrastructure spending to boost the economy.

This includes a new US\$42 billion scheme to help power distribution companies upgrade their infrastructure and expand the use of natural gas

in India. The budget mentions adding 100 new districts to the gas network in the next three years. It also proposes a gas pipeline to the union territory of Jammu and Kashmir. The cold climate in this Himalayan region makes Kashmir well suited for making use of gas for residential heating and cooking purposes.

The latest PMI results for the Indian manufacturing sector continued to point to an economy on the mend, as the IHS Markit India Manufacturing PMI reached 57.5 in February 2021. This signals strong expansion in the manufacturing sector, as both new orders and output continued to grow strongly. As the economy restarts, construction and infrastructure spending has recovered driving up power and steel demand. This led to Indian imports of raw materials recovering to pre-pandemic levels by October last year. IMF forecasts GDP growth of 11.5% through 2021 (calendar year), matched by expectations of industrial production which is forecast to recover by 11.5% also (Figure 2.8).

Figure 2.8: India GDP and IP growth forecast to 2026



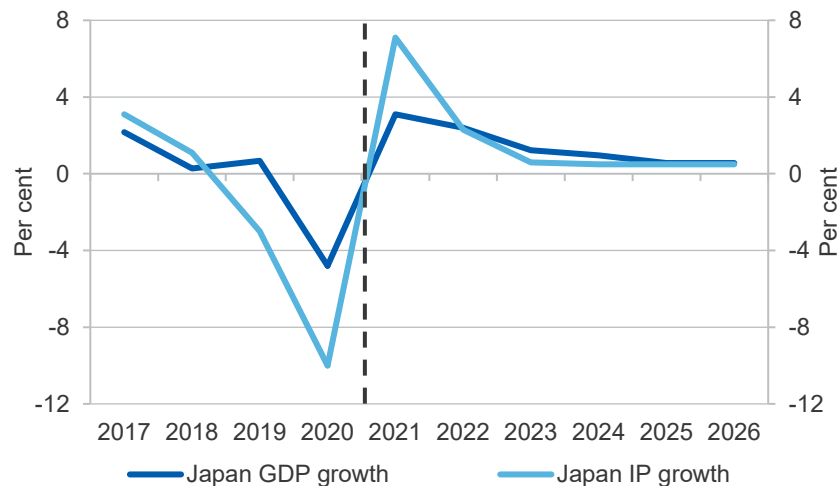
Source: IMF and Wood Mackenzie

Japanese economy maintains strong economic fundamentals into 2021

Japan fell into a deep recession in the first half of 2020, but staged an impressive recovery in the second half of the year. Despite the 2020 second half of the year rally, Japan's real Gross Domestic Product still shrank 4.8% over the year (Figure 2.9), the first annual contraction since the 2009 global financial crisis. Government stimulus of about US\$3 trillion has provided crucial support, keeping unemployment at just 2.9%, however, another decline in GDP appears unavoidable in the March quarter 2021 due to the state of emergency called by Prime Minister Yoshihide last month (which covers Tokyo and other areas accounting for 55% of the nation's population).

The IMF still forecasts the Japanese economy to recover by 3.1% through 2021 and 2.4% through 2022. Further on the downside for 2021, Japanese observers believe it is unlikely the postponed 2020 Olympic Games will go ahead, unless the pandemic is completely under control. Visitors coming from overseas will likely not be admitted to the Games.

Figure 2.9: Japanese GDP and IP growth forecast to 2026



Source: IMF and Wood Mackenzie

Japan's factory PMI activity slid back into "contraction" territory in January (49.8). Japanese firms attributed the move to a renewed fall in output volumes, as indicators showed suppliers' delivery times and new export orders had dropped at their fastest pace in several months. However, growth expectations for the year ahead remain positive, with industrial output expected to recover strongly through 2021. The IMF expects GDP growth to decline to about 0.6% by 2025 and 2026, as the effects of the stimulus implemented after the COVID-19 pandemic finally diminish.

Manufacturing and exports lift Korea out of economic recession

In 2020, the South Korean economy is estimated to have contracted by 1.1%, reflecting the impact of the COVID-19 pandemic on domestic activity and trade. The fall in economic activity was moderated by a broader, global recovery in trade and production through the second half of the year, bolstered by accommodative fiscal and monetary policies by the South Korean Government and Bank of Korea throughout 2020.

South Korean exports bounced back from the September quarter 2020, as domestic and international restrictions on movement saw a considerable shift in consumer preferences toward goods consumption. The rebound included a 16% quarter-on-quarter rise in exports to September, led by strengthened demand for electronics and a recovery in auto demand.

Leading into 2021, manufacturing continues to show positive signs of recovery, with PMI reaching 55.3 in February – its highest level since April 2010. Business expectations for the coming twelve months also reached their highest level since February 2013. This is helping to offset a more modest recovery to date in household consumption and services demand, with both expected to pick up in pace through 2021.

The IMF expects the South Korean economy to recover to growth of 3.1% in 2021 and 2.9% in 2022, sustained by the ongoing recovery of global economic activity and trade. In spite of ongoing risks associated with the recovery due to COVID-19, over the medium term, growth is expected to increase at a moderate but steady rate, as higher global demand supports the export-oriented South Korean economy.

Table 2.1: Key IMF GDP assumptions

	2019	2020 ^a	2021 ^a	2022 ^a	2023 ^a	2024 ^a	2025 ^a	2026 ^a
Economic growth ^b								
Advanced economies	1.7	-4.9	4.3	3.1	2.2	1.9	1.7	1.7
– Australia	1.9	-2.9	3.5	2.9	2.6	2.6	2.5	2.5
– Eurozone	1.7	-7.2	4.2	3.6	2.5	2.0	1.6	1.6
– France	1.5	-9.0	5.5	4.1	2.3	1.9	1.7	1.7
– Germany	0.6	-5.4	3.5	3.1	1.8	1.3	1.2	1.2
– Japan	0.7	-5.1	3.1	2.4	1.2	1.0	0.6	0.6
– New Zealand	3.0	-6.1	4.4	2.6	2.6	2.5	2.5	2.5
– South Korea	2.0	-1.9	2.9	3.1	2.9	2.6	2.4	2.4
– United Kingdom	1.5	-10.0	4.5	5.0	1.9	1.7	1.6	1.6
– United States	2.3	-3.4	5.1	2.5	2.3	1.9	1.8	1.8
Emerging economies	3.7	-2.4	6.3	5.0	4.9	4.8	4.7	4.7
– ASEAN-5 ^d	4.8	-3.7	5.2	6.0	5.6	5.4	5.3	5.3
– China ^e	6.1	2.3	8.2	5.6	5.6	5.6	5.5	5.5
– India	4.2	-8.0	11.5	6.8	2.6	2.6	2.5	2.5
– Latin America	0.1	-7.4	4.1	2.9	2.7	2.5	2.5	2.5
– Middle East	1.3	-3.2	3.0	4.2	2.8	2.9	2.7	2.7
World ^c	2.9	-3.5	5.5	4.2	3.8	3.6	3.5	3.5

Notes: a Assumption; b Year-on-year change; c Calculated by the IMF using purchasing power parity (PPP) weights for nominal country gross domestic product; d Indonesia, Malaysia, the Philippines, Thailand and Vietnam. e Excludes Hong Kong.

Sources: Bloomberg (2021); Department of Industry, Science, Energy and Resources (2021); IMF (2021)

Table 2.2: Exchange rate and inflation assumptions

	2019	2020 ^a	2021 ^a	2022 ^a	2023 ^a	2024 ^a	2025 ^a	2026 ^a
AUD/USD exchange rate	0.70	0.70	0.78	0.78	0.76	0.75	0.75	0.75
Inflation rate ^b								
United States	1.8	1.2	2.0	2.1	2.3	2.3	2.3	2.3
	2018–19	2019–20	2020–21 ^a	2021–22 ^a	2022–23 ^a	2023–24 ^a	2024–25 ^a	2025–26 ^a
Australia ^e	1.6	1.3	1.1	1.7	2.1	2.5	2.5	2.5

Notes: a Assumption; b Change from previous period; c Calculated by the IMF using purchasing power parity (PPP) weights for nominal country gross domestic product; e Average of daily rates.
Sources: ABS (2021) Consumer Price Index, 6401.0; Bloomberg (2021); Department of Industry, Science, Energy and Resources; RBA (2021) Reserve Bank of Australia Bulletin.



Steel

Australian steel refineries



Steel facts



Made in specialised blast furnaces mostly out of **iron and carbon**



1,000 kg of steel requires 1,400 kg of iron and 800kg of coal to make



Pure steel is **1,000 times stronger** than iron



Steel is the **world's 2nd largest industry**

World consumption



50%
Construction



16%
Mechanical machinery



15%
Other applications



13%
Automotive



4%
Electrical equipment



2%
Domestic appliances

Australia's steel



5.3m tonnes
produced
each year

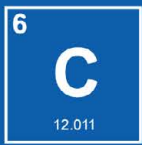


100,000+
employed in
steelmaking



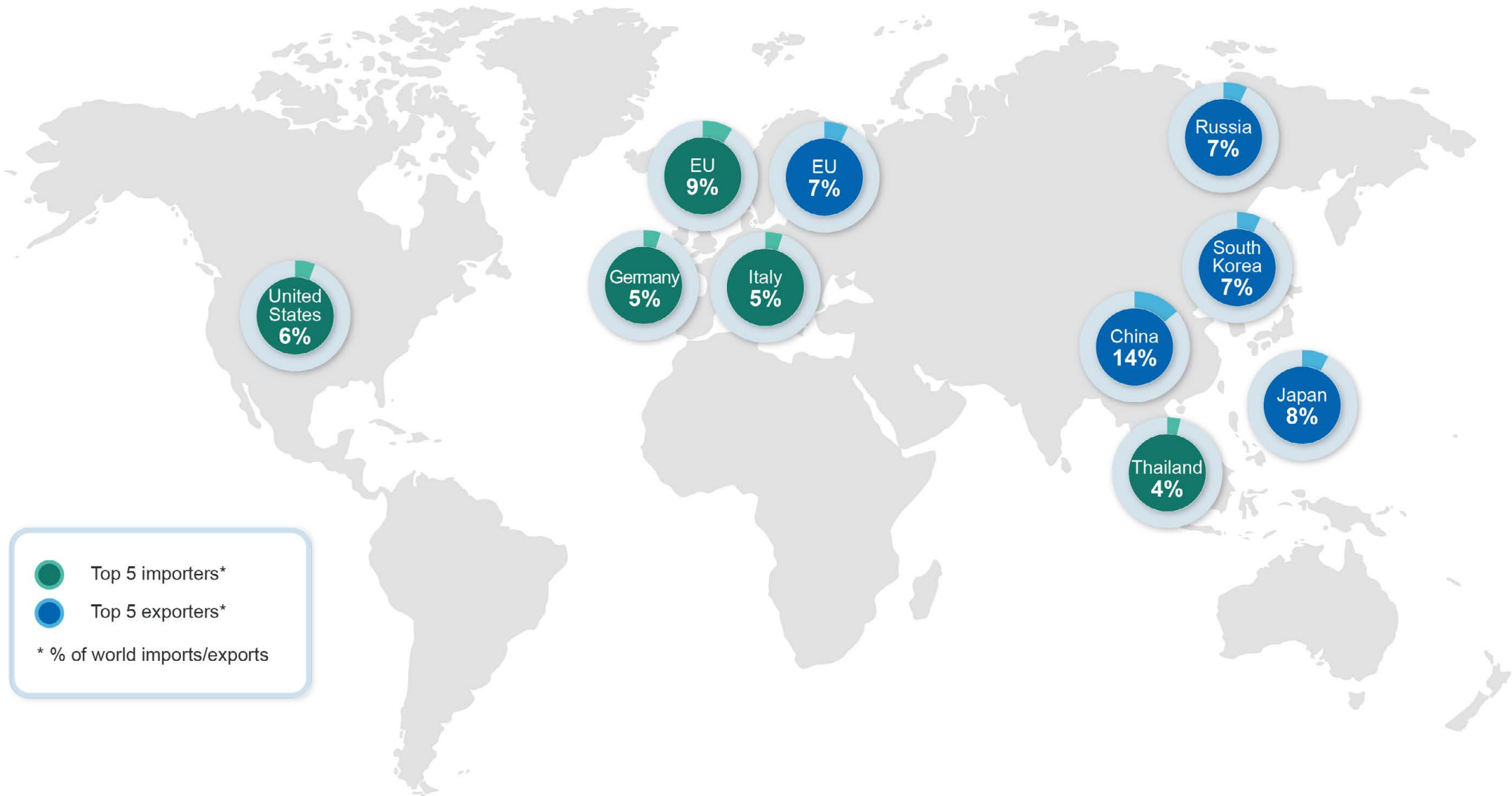
Significant
export
markets

- China
- Japan
- South Korea
- Singapore
- US



Steel

Trade map | March 2021



 Top 5 importers*

 Top 5 exporters*

* % of world imports/exports

3.1 Summary

- World steel consumption declined by 0.9% in 2020, as global industrial activity was affected by the COVID-19 pandemic and resulting economic downturn. Chinese steel consumption grew during the year, but consumption in Europe, the US and Japan was down sharply.
- World steel consumption is forecast to rebound as the global economy recovers, growing by 3.6% in 2021. Growth eases back slightly in subsequent years.
- Steel output is forecast to follow a similar trend, with a 0.8% fall in 2020 expected to be followed by 3.0% rise in 2021 and 2.8% in 2022. Growth is expected to ease off slightly in subsequent years.

3.2 World consumption and production

Steel production is likely to be robust in 2021

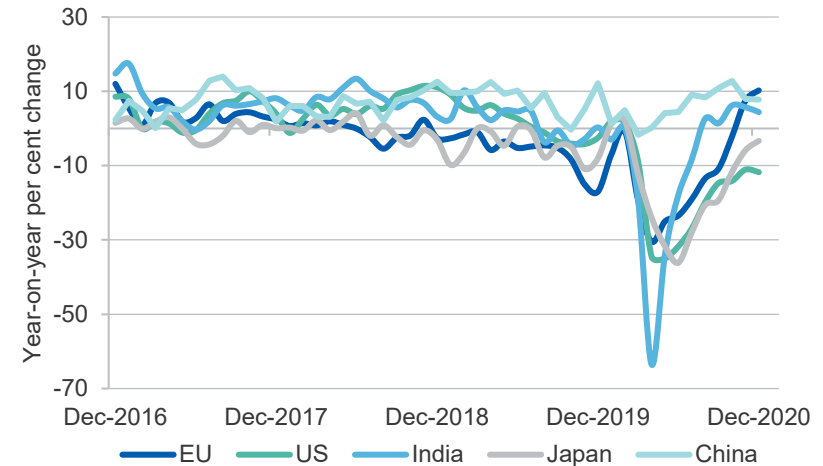
Global steel production is now fully recovered, with global monthly production 6% higher in December 2020 relative to the pre-COVID level of December 2019 (Figure 3.1). However, this trend conceals a drastic shift in market structure, with historically high output in China acting as an offset for Europe, the United States, and Japan, where steel output remains at recessionary levels (Figure 3.2). Many steel smelters around the world remain closed or on standby.

China is likely to retain its dominance over global steel markets

Steel production is expected to recover across much of the OECD, and expand rapidly in line with demand growth across Southeast Asia (Figures 3.3 and 3.4). However, the pace of the OECD recovery is rather unclear, with some smelters in OECD countries now unlikely to re-open, while the pace of steel smelter expansions in much of Asia remains slow.

Chinese steel production rose to over one billion tonnes in 2020, as steel smelting across much of the rest of the world was closed or reduced. This has led China to increase its imports of iron ore, notably from Australia. Australia now accounts for more than half of all seaborne iron ore trade, and more than 60% of China's iron ore imports.

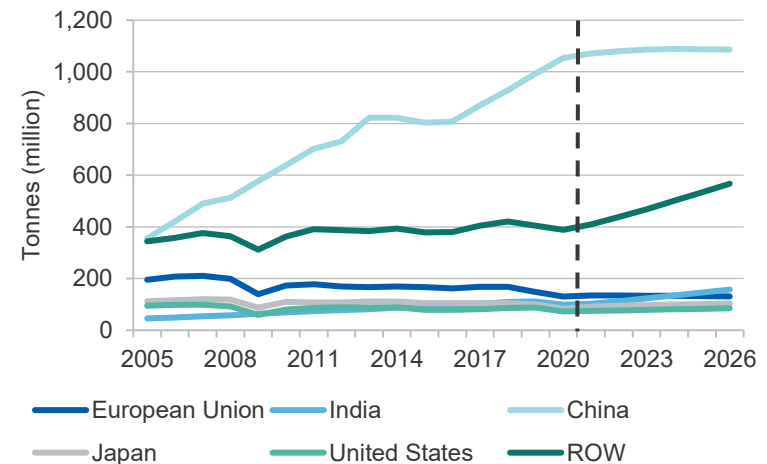
Figure 3.1: Steel production, monthly change



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

Source: Bloomberg (2021) China BOF Steel Profit Index

Figure 3.2: Steel production by region



Source: World Steel Association (2021); Bloomberg (2021)

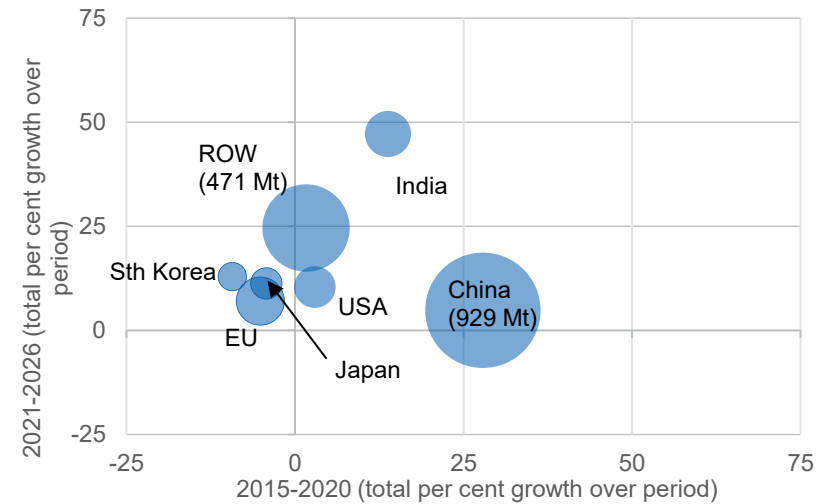
China is now seeking to reduce this dependency, with the Ministry of Industry and Information Technology recently releasing a draft policy document which outlines an objective for China to supply at least 45% of its iron ore needs from sources it controls. Currently, China only obtains around one-third of inputs for steel production from such sources, though some of these — such as domestic scrap steel recycling — have shown promising growth in recent years.

Use of scrap steel in China is expected to grow over the next five years. The Chinese Government previously curbed its imports of scrap steel in 2018 and 2019, in an attempt to prevent potential ‘dumping’ of low-quality scrap waste into Chinese supply chains. However, carve-outs have now been created to allow more scrap steel imports. Following the removal of the import tariff at the start of 2020, scrap steel imports to China more than doubled over the subsequent year. Imports of steel billets are estimated to have grown by around 700% over the year, rising above 18 million tonnes. However, thus far, this has not noticeably affected demand for imported iron ore.

With iron ore prices set to remain relatively high, scrap imports are likely to grow at a rapid pace in 2021, albeit from a low base (China’s electric arc furnace usage rate was less than 10 per cent in 2018, compared to the US rate of 72 per cent). However, Chinese scrap steel imports remain subject to significant short-term constraints, which will likely prevent large-scale substitution for imported iron ore. These constraints include limited availability, with the largest exporters (the EU, US and Japan) not expected to ramp up scrap steel exports dramatically over the outlook period. China will also face growing competition for scrap steel from other nations, including India. Rising competition for the material has already seen scrap steel costs rise, with imports to China now costing upwards of \$US50 a tonne more than the cost of domestically sourced material.

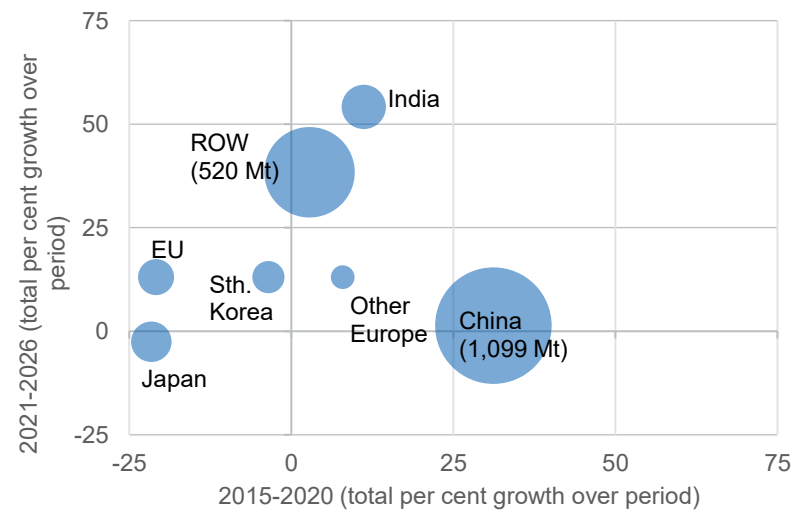
Market conditions provide some further upside to scrap steel use. Electric Arc Furnaces — which are used to recycle scrap — saw significant growth in profitability in 2020, as high iron ore prices placed pressure on other forms of steelmaking.

Figure 3.3: Steel consumption growth by region



Source: Department of Industry, Science, Energy and Resources (2021)

Figure 3.4: Steel production growth by region



Source: Department of Industry, Science, Energy and Resources (2021)

Scrap steel recycling currently provides less than one-fifth of raw materials used for steelmaking in China. With strong market conditions, improving technology, and supportive policy, it is expected that this share will lift to more than a quarter by 2026 — with increasingly rapid growth towards the end of the outlook period.

With Chinese iron ore mines depleting, efforts are underway to draw iron ore from new sources, including the proposed Simandou mine in Guinea (see *iron ore* section). However, these efforts are not likely to produce significant output within the outlook period. Scrap recycling is thus expected to provide the primary source for increased Chinese domestic supply over both the short- and long-term. With China's steel demand likely to stay strong, it is expected China's imports of Australian iron ore will remain steady over the outlook period.

Growth outside China is expected to pick up

Substantial new steelmaking capacity is planned across Southeast Asia, with many nations announcing new or upgraded steel plans. Some of these growth plans have been disrupted by the COVID-19 pandemic. However, China's Belt and Road initiative is likely to provide expanded funding sources for new steelmaking across Southeast Asia over the coming years.

Substantial new steel proposals include 18 million tonnes of new steelmaking capacity which is now planned for the Philippines. This capacity comprises a 10 million tonne per year plant in the Misamis Oriental province, to be developed by China's Panhua Group. This plant is expected to commence in late 2022 or early 2023. A second plant, with annual capacity of 8 million tonnes, is being progressed by a joint venture between SteelAsia, a Pilipino company, and HBIS, a Chinese steelmaker.

In Malaysia, a 10 million tonne per year plant is proposed by Wen'an steel, a Chinese company. However, the plant's construction timetable remains uncertain due to opposition from other steelmakers in the nation, who have raised concerns over potential domestic overcapacity and lower prices.

In Myanmar, Chinese steelmaker Kunming Steel is progressing with a 4 million tonne per year plant, while China's Hubei Beishi company is progressing with plans for a 3 million tonne per year plant in Indonesia. China's Baowu Group is also proposing a 3 million tonne per year plant in Cambodia.

It is expected that further plants will be proposed and developed across Southeast Asian countries over the outlook period. Steel production growth across the region is expected to be the largest driver of overall global steel production growth over the coming years. The region remains subject to strong steel demand through population growth, urbanisation and industrialisation, while steel supply is likely to be supported by investment and capital from large Chinese companies.

In 2017, the Indian Government announced its National Steel Policy, which contains detailed proposals for expansion and upgrade of its domestic steel industry. India's domestic steel needs are growing rapidly, with the India Brand Equity Foundation forecasting a lift in consumption from 99 million tonnes in 2018–19 to 230 million tonnes by 2030–31. The Indian steel industry is consolidating, and seeking to leverage the benefits of relatively low labour costs and the presence of some significant untapped iron ore reserves. Progress on steel policies have been delayed by the COVID-19 pandemic, but Indian steel production is nonetheless expected to increase rapidly — by more than 40% over five years — from a low point in 2020. Much of this is expected to be met through higher domestic iron ore output over that period.

After a sharp dip, South Korean steel production has recovered to be near pre-COVID levels, with new facilities and upgrades expected to provide a further modest lift by the end of the outlook period.

However, steel production in Europe is not expected to fully recover, with some steel mills expected to close permanently. This will result in the acceleration of a long-running shift in steel production towards emerging economies across southern and eastern Asia.

On balance, it is expected that steel production will follow the trajectory of global industrial production, and grow more rapidly in the first two years of the outlook period (Figure 3.5). Growth is expected to continue at a slower pace in subsequent years, as Chinese steel output reaches its peak.

Figure 3.5: Global steel production and industrial production



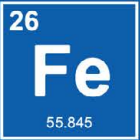
Source: OECD (2021), CPB Netherlands Bureau for Economic Policy Analysis (2021); Department of Industry, Science, Energy and Resources (2021)

Table 3.1: World steel consumption and production

Million tonnes								
Crude steel consumption	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^e
China	900	933	953	961	967	974	978	1.4
European Union ^g	160	163	164	166	169	171	174	1.4
United States	112	116	119	121	123	126	128	2.3
India	102	106	112	123	134	145	156	7.5
Japan	65	67	68	70	72	73	75	2.4
Russia	43	44	44	45	46	46	47	1.7
South Korea	53	55	56	58	59	60	62	2.6
Brazil	23	24	27	30	32	35	36	7.4
World steel consumption	1,823	1,889	1,942	1,990	2,040	2,089	2,133	2.6
Crude steel production	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^e
China	1,054	1,071	1,080	1,086	1,089	1,087	1,086	0.5
European Union	130	134	134	134	133	132	131	0.1
India	99	102	113	124	135	146	157	8.0
Japan	83	92	94	97	99	101	104	3.7
United States	72	75	77	79	81	83	84	2.6
Brazil	31	32	36	40	44	48	52	8.9
Russia	71	73	76	78	82	86	90	3.9
South Korea	67	73	75	77	79	81	83	3.5
World steel production	1,828	1,883	1,936	1,986	2,038	2,083	2,129	2.6

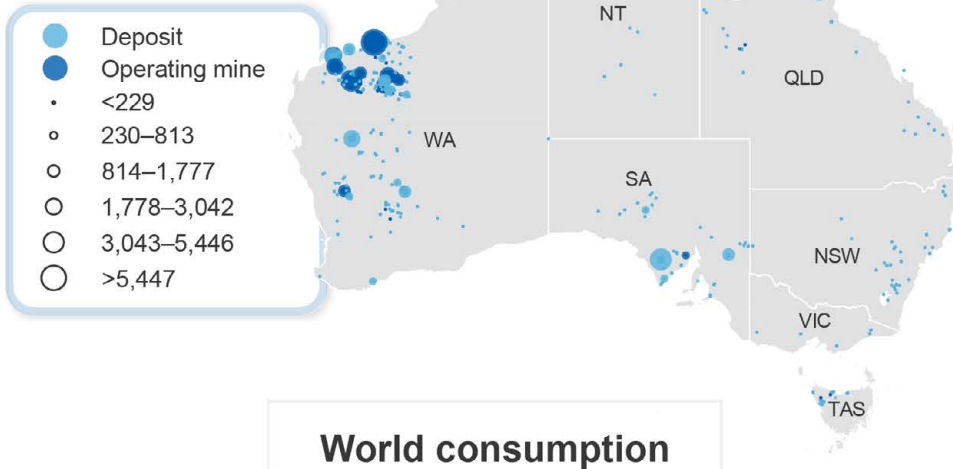
Notes: **e** Estimate; **f** Forecast; **g** European Union 27 encompasses the aggregate output and demand for the 27 states which comprise the European Union; **z** Projection.

Source: World Steel Association (2021); Department of Industry, Science, Energy and Resources (2021)

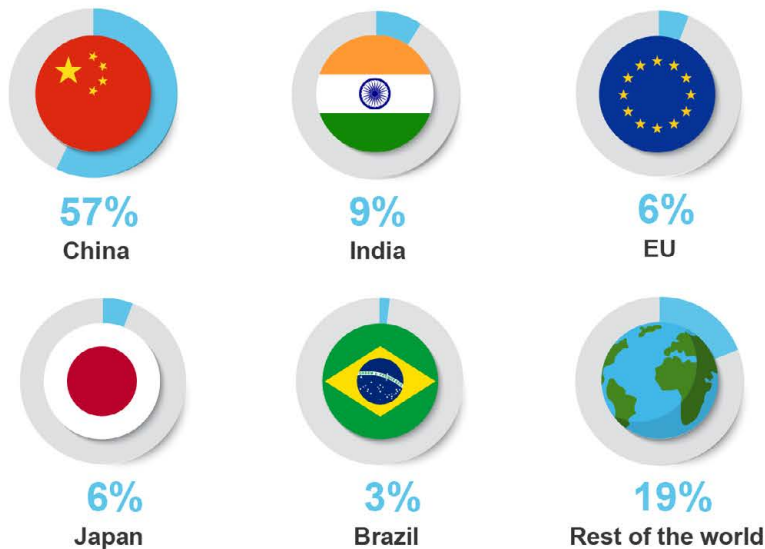


Iron Ore

Major Australian iron ore deposits (Mt)



World consumption



Iron ore



Iron is the most abundant element on earth, forming much of the **planet's core**



Iron ore deposits were originally **formed by algae**



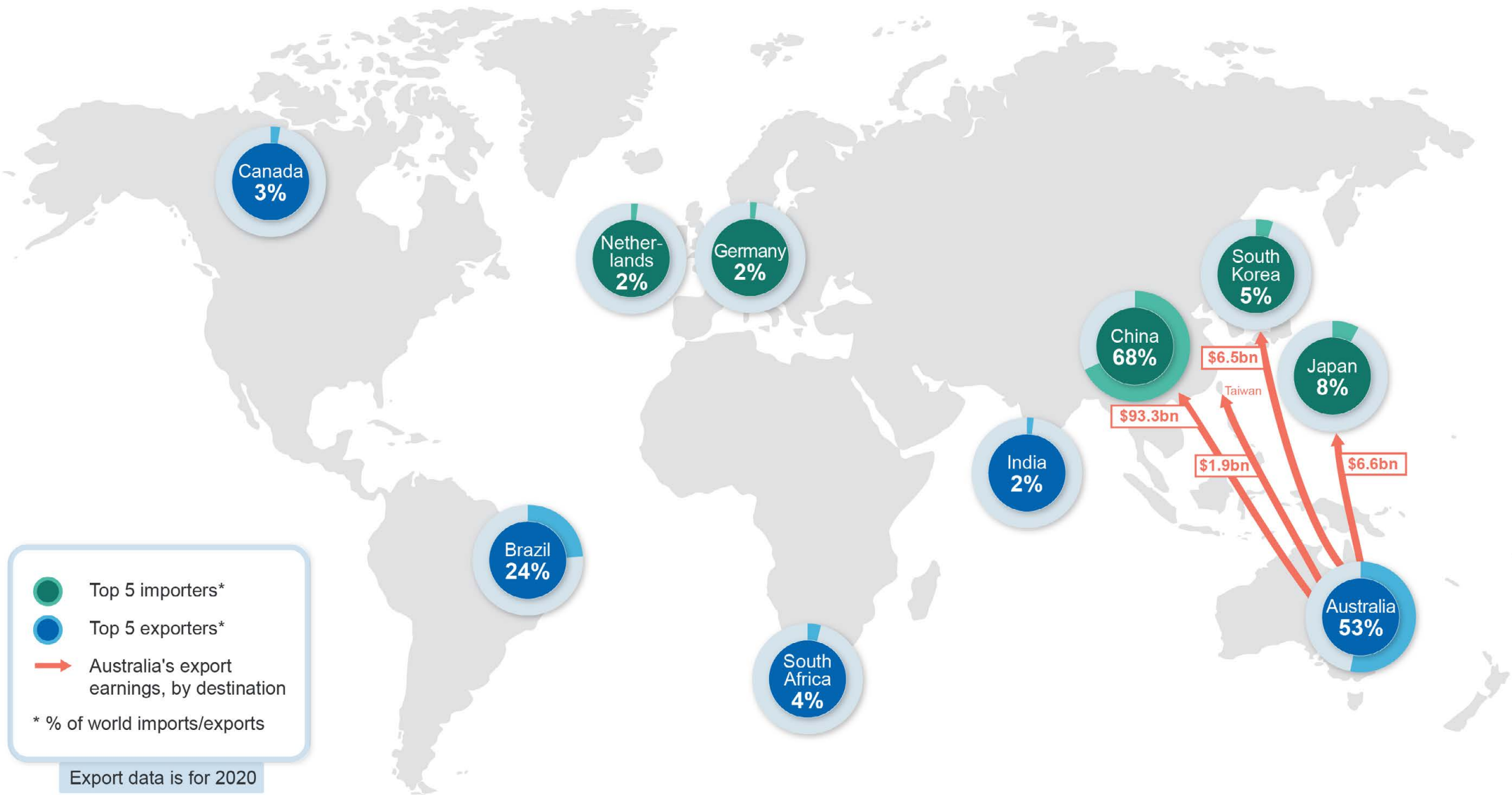
Humans have been working with iron for at least **5,000 years**



Iron was central to the **industrial revolution**

Australia's iron ore





4.1 Summary

- The iron ore price surged in December and January, and is now at its highest level since 2011. Prices have been driven by high demand in China and (fears of) disrupted supply in Brazil and elsewhere. The iron ore price is forecast to remain well above US\$100 a tonne until late 2021, before easing gradually over subsequent years, ultimately reaching US\$72 (in real terms) by the end of 2026.
- Australia's export volumes are expected to grow from around 900 million tonnes in 2020–21 to 1.1 billion tonnes by 2025–26, as several mines open or expand in Western Australia (see [Australia section](#)).
- Stronger prices are expected to push Australia's iron ore export values up to a peak of \$136 billion in 2020–21 (in real terms). Iron ore exports are forecast to earn more than \$700 billion over the outlook period, remaining above \$100 billion annually for each of the next five years.

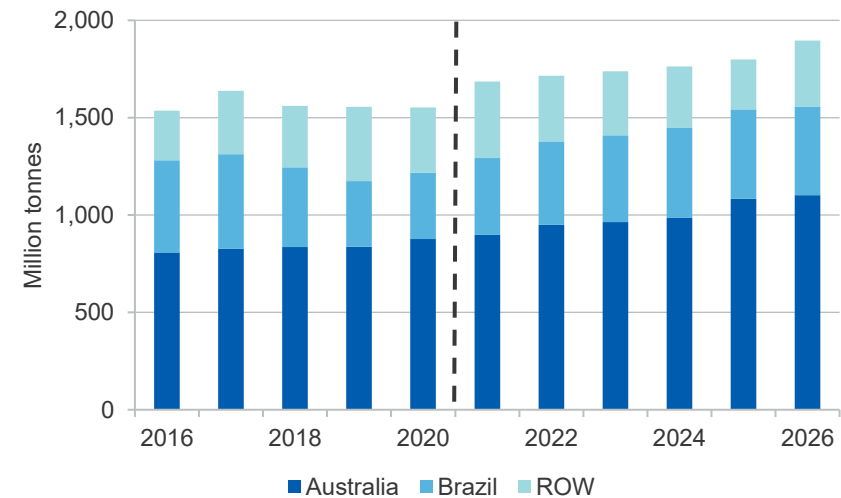
4.2 World trade

Australia's dominance of iron ore markets will face challenges

Global trade remains dominated by Australia, which exported more than half of seaborne iron ore in 2020. However, iron ore output from South America and Africa is expected to increase over the outlook period, (Figure 4.1).

China is investigating a number of possible iron ore mines in Africa, including large deposits in Gabon and Madagascar. However, the most notable prospect in Africa is the proposed Simandou iron ore mine, located in the Nzérékoré region of Guinea. This region is relatively remote and far from any port facilities, but the deposit is large and high-quality, and Rio Tinto has announced that roadworks at the site are now underway. The company is currently reviewing the cost and feasibility of investments required for the mine. These investments are likely to include port connections and more than 600 kilometres of railway to transport ore, and the review is expected to conclude by the end of the 2020-21 financial year.

Figure 4.1: Outlook for global iron ore exports



Source: World Steel Association (2021); Department of Industry, Science, Energy and Resources (2021)

While the project is expected to proceed, the infrastructure and capital requirements are significant. Full output is not expected before 2027 or 2028, though some initial output may occur towards the end of the outlook period. The Simandou deposit is subject to complex ownership arrangements, with the southern blocks controlled by a joint venture between Rio Tinto, Chinalco and the Guinean Government, while much of the northern area is controlled by a separate Chinese joint venture. The northern area is currently closer to development, with a \$14 billion infrastructure contract now signed by the consortium. Should both areas produce at full output, the mine could produce close to 200 million tonnes of iron ore per year, or around 15-20% of output currently produced in the Pilbara region of Western Australia.

Brazilian iron ore output is expected to recover over the next 12-18 months. Prices for Brazilian ore have risen by more than 50% in December 2020 relative to December 2019, creating favourable investment conditions. Export volumes have recently shown signs of

significant recovery, following a series of difficulties and delays; exports increased from 25 million tonnes in December 2019 to 33 million tonnes by December 2020. In conjunction with higher prices, this led to a doubling of export revenue to Brazil over the year to December 2020.

Vale has released detailed plans to add over 100 million tonnes of new iron ore output to the market by end 2023. This includes its US\$1.5 billion Serra Sul 120 project, which progressed well in 2020 and is due to be commissioned as 2024 begins. This upgrade will open access to extra mining areas, incorporate extra processing lines and provide a duplicate long-distance conveyor. However, progress may be checked by the complexity of the projects and by a series of missed deadlines in the company's recovery plans. Conditions in Brazil remain difficult, due to the COVID-19 pandemic and after-effects from the Brumadinho dam collapse.

Vale remains subject to a range of court actions, added regulations and other requirements, as well as disruptions to port and rail facilities in the south of Brazil. On balance, it is expected that Brazilian output will largely recover pre-dam collapse levels by early 2022, with steady growth over the following years, as new projects gradually commence production.

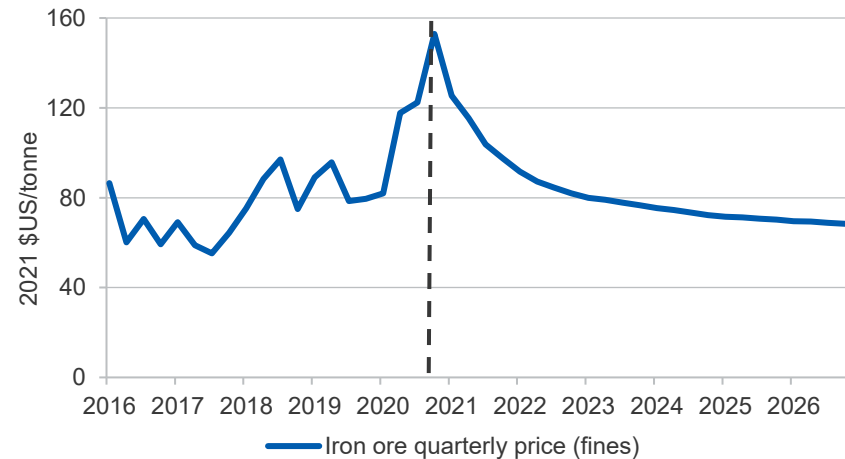
Global iron ore markets are expected to remain tight, with slow growth in both supply and demand over the next five years. Market structure is not expected to alter significantly, with Australia's market share expected to hold up. A recovery in Brazilian supply is likely in the short-term, but a number of high-cost mines in Brazil and China are also expected to face closure or depletion over the next 10 years.

4.3 Prices

Iron ore prices are holding at the highest level for almost a decade

Iron ore prices surged in December, lifting from around \$US115 a tonne at the start to the month to close out 2020 at over \$US140 a tonne — the highest level since 2011. Prices have subsequently lifted higher still, averaging over \$US150 a tonne during January 2021 and reaching US\$170 a tonne during parts of February (Figure 4.2).

Figure 4.2: Iron ore price outlook, quarterly



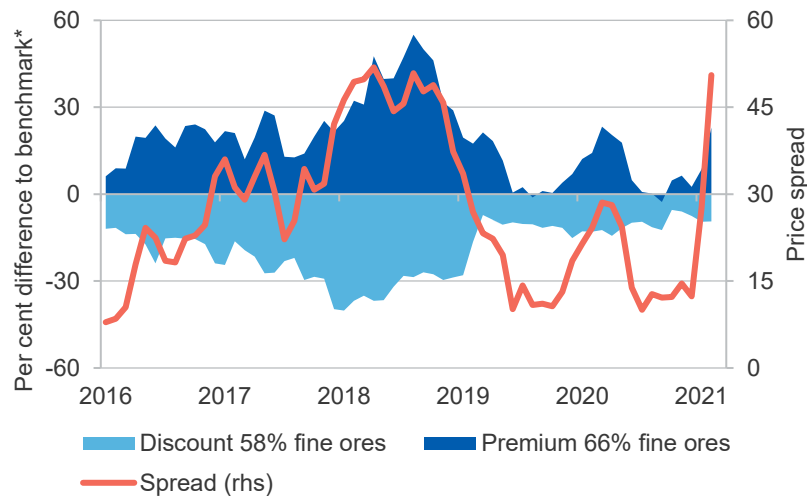
Notes: China import Iron ore fines 62% Fe spot (CFR Tianjin port)
 Source: Bloomberg (2021) Department of Industry, Science, Energy and Resources (2021)

Figure 4.3: China's iron ore port stocks and spot price



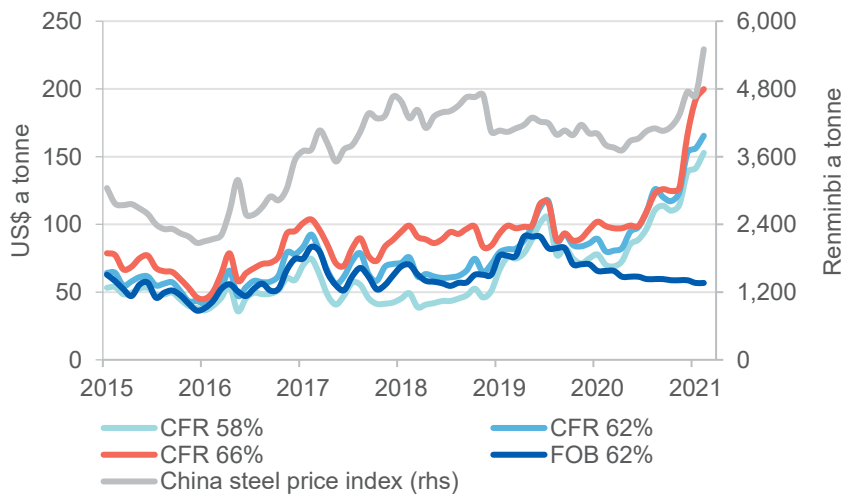
Notes: China import Iron ore fines 62% Fe spot (CFR Tianjin port)
 Source: Bloomberg (2021) Antaika iron ore port stocks; Metal Bulletin

Figure 4.4: Iron ore price spread between grades



Notes: *Benchmark used is 62% iron fines CFR
Source: Bloomberg (2021) China import prices

Figure 4.5: Iron ore price by grade and China steel price index



Source: Bloomberg (2021); Department of Industry, Science, Energy and Resources (2021)

Prices (and premium prices in particular) have thus remained at near-10 year highs for two months without significant retreat. Prices have been pushed up by consistently high steel production in China, which has been driven by COVID-19 related stimulus measures (Figures 4.3 and 4.4). These strong demand influences have magnified the impact of lower supply estimates from Vale, which has reduced its production guidance significantly over the past 12 months.

Iron ore production remains highly concentrated, with a small number of firms accounting for a high share of overall output. High entry costs present a significant curb on new competition. The dominant firms have scaled down investment in recent years, in an attempt to reduce debt and adjust to (at the time) relatively low prices and strong supply conditions. On the demand side, competition is far more intense despite the relative domination of the market by China. Chinese steel mills compete with each other, and are rivalrous in their efforts to secure available supply and gain access to potential new supply sources.

Iron ore prices are expected to stay high into 2021

The primary drivers of high iron ore prices are expected to hold throughout 2021. Although Vale has announced plans to expand its capacity significantly, much of the resulting output is not expected to reach seaborne markets for at least two to three years. BHP and Rio Tinto are bringing new mines to production in the Pilbara region of Western Australia, but much of the resulting output will substitute for depleting mines in the same area (see *Australia* section). Consequently, overall output growth is not expected to occur at a pace which reduces prices significantly.

A range of factors could put downward pressure on prices over the coming months. Some price falls are expected, as Vale's Brazilian operations steadily return to output levels prior to the January 2019 Brumadinho dam collapse. Overall, Brazilian output expected to recover to normal levels by the end of 2021. More rapid progress on this front could lower prices more swiftly. Chinese steel mills, which are facing severe pressure on margins, may also seek to postpone some output in order to manage price

pressures over the coming months (Figures 4.5 and 4.6). Chinese Government stimulus measures could also be phased down in the second half of 2021, reducing the imperative for rapid purchases of iron ore to meet production schedules and allowing some build-up of iron ore at ports.

However, risks also exist in the other direction. The two largest supply sources — Western Australia and Brazil — are both subject to regular disruption to production and transport from extreme weather events. These include heavy rains which sometimes disrupt operations in Brazil, and cyclonic activity which periodically affects Australian shipments from Port Hedland, Dampier and Cape Lambert. The likelihood of further events presents a perpetual risk of price spikes over the coming years.

Figure 4.6: Iron ore price vs China steel production growth



Notes: China import Iron ore fines 62% Fe spot (CFR Tianjin port)
 Source: Bloomberg (2021) China import prices; World Steel Association (2021)

4.4 Australia

Iron ore export earnings are set to reach a new record in 2020–21

The recent price surge for iron ore has added markedly to the value of Australia’s iron ore exports. Export earnings hit new a record of \$104 billion in 2019–20 (in real terms). However, Australia’s position as the most reliable and dominant supplier has placed it in a position to capture a huge share of the added gains from the latest surge in prices. Export earnings are now forecast to reach above \$136 billion in 2020–21 (real terms).

A shift back towards more typical prices is expected to reduce earnings somewhat over subsequent years, although iron ore is still expected to earn over \$100 billion every year over the outlook period, with a cumulative total of above \$700 billion earned by 2025–26.

Australia’s iron ore export volumes are expected to grow

Export volumes are expected to rise over the outlook period, partly offsetting the likely correction in prices. Mines expected to come online include Mesa B, C & H at Rio Tinto’s Pannawonica site in mid-2021, though the new output from this site will be offset by the closure of Mesas J and A in the same area.

BHP is expected to bring its South Flank project to full production (of around 80 million tonnes per year) in 2021, though this will largely act as a replacement for the Yandi mine, which is closing.

The Roper Bar mine in the Northern Territory has recently restarted production, in response to strong prices. Nathan River, which owns the site, has announced that the project is expected to ramp up to 1.5-2 million tonnes of production each year from 2021.

NT Bullion’s new Frances Creek mine is also producing on schedule, following its opening in August 2020. Output is shortly expected to reach 2 million tonnes per year, which will last beyond the outlook period.

Fortescue’s newly developed Eliwana project is successfully ramping up, with output expected to reach almost 30 million tonnes per year from 2021.

Rio Tinto's new Koodaideri mine has an even larger potential, and is ramping up towards an output of around 40 million tonnes per year from 2022. Other sources of new output include Magnetite Mines' Razorback project in South Australia, Strike Resources' Paulsens East project in Western Australia, and Grange Resources' proposed expansion to its mine in Tasmania.

Export volumes are expected to increase from 893 million tonnes in 2020–21 to reach almost 1,100 million tonnes by 2025–26 (Figure 4.7). However, exports will remain sensitive to conditions in China, which remains Australia's primary export market (Figure 4.8). The wave of new openings and output replacements also presents a significant logistical challenge across multiple sites. Any disruptions due to weather or other external factors could present a risk to export volumes (on the downside) or iron ore prices (on the upside).

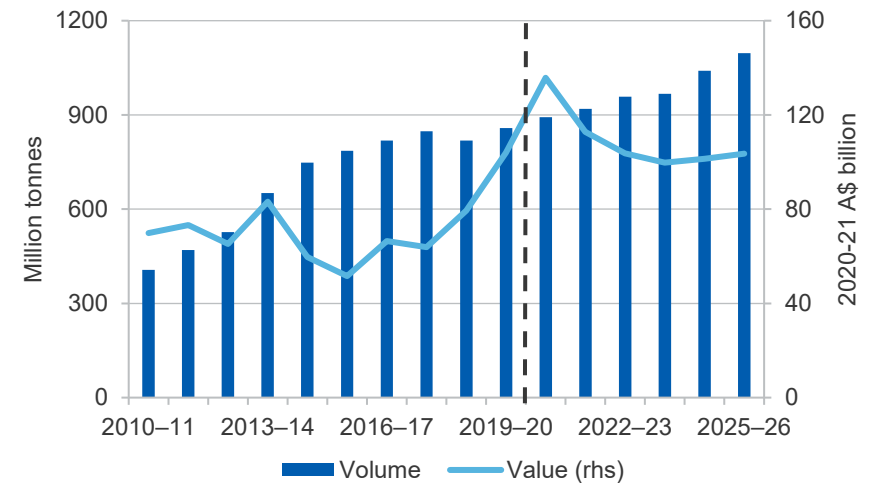
Iron ore exploration expenditure is growing as prices lift

A total of \$111 million was spent on iron ore exploration in the December quarter. This is virtually unchanged from exploration in the September quarter, but 31% higher than in December 2019. Exploration has been elevated in recent quarters as iron ore prices have continued to reach historical highs.

Revisions

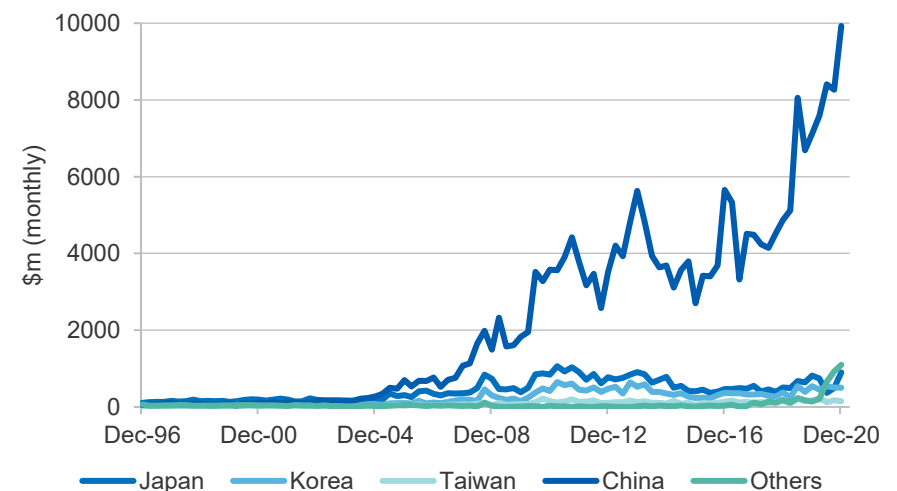
Forecast export earnings for 2020–21 have risen from \$123 billion in the December *Resources and Energy Quarterly* (in nominal terms) to just over \$136 billion in this edition. This reflects stronger-than-expected Chinese demand and persistently high prices, following repeated cuts in Vale's production guidance. Australian export earnings have been revised up by a similar amount for 2021–22.

Figure 4.7: Australia's iron ore export volumes and values



Source: ABS (2021) International Trade, Australia, 5368.0; Department of Industry, Science, Energy and Resources (2021)

Figure 4.8: Australia's iron ore export destinations, monthly



Source: ABS (2021) Department of Industry, Science, Energy and Resources (2021)

Table 4.1: World trade in iron ore

	Million tonnes							
	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
Total world trade	1,552	1,686	1,716	1,739	1,763	1,799	1,844	2.9
Iron ore imports								
China	1,175	1,268	1,292	1,295	1,295	1,296	1,309	1.8
European Union 28	97	112	112	112	112	112	112	2.4
Japan	99	113	116	119	122	125	128	4.3
South Korea	58	76	78	80	82	84	86	6.9
India	5	5	5	20	40	70	70	53.6
Iron ore exports								
Australia	868	897	950	963	987	1,084	1,103	4.1
Brazil	341	396	428	446	461	459	455	4.9
Ukraine	30	22	26	25	24	20	26	-2.2
India	34	40	30	30	28	23	31	-14.3

Notes: **e** estimate; **f** forecast; **r** Average annual growth between 2020 and 2026 or 2019–20 and 2025–26; **z** projection.

Source: World Steel Association (2021); International Trade Centre (2021); Department of Industry, Science, Energy and Resources (2021)

Table 4.2: Iron ore outlook

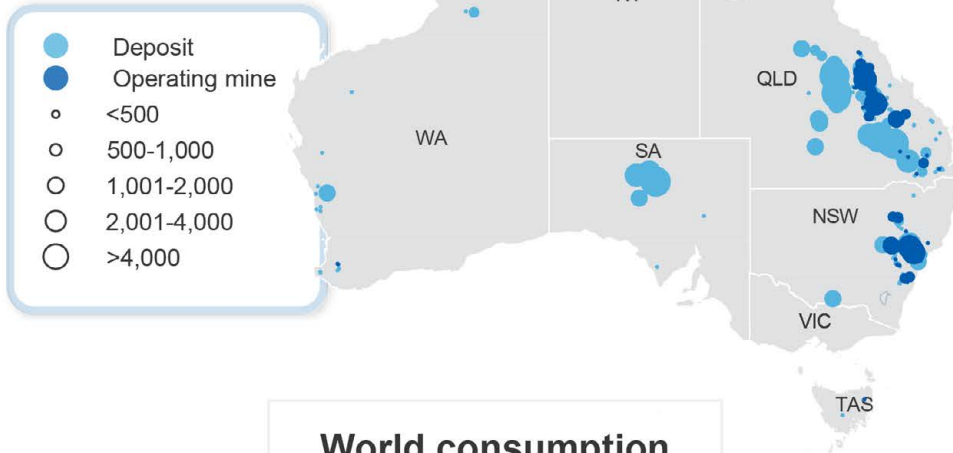
World	Unit	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
Prices ^{bc}									
– nominal	US\$/t	116.7	110.4	88.1	81.9	78.9	77.5	77.1	-6.7
– real ^d	US\$/t	119.0	110.4	86.3	78.4	73.9	70.9	69.0	-8.7
Australia	Unit	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^z	2023–24 ^z	2024–25 ^z	2025–26 ^z	
Production									
– Steel ^{hs}	Mt	5.53	5.55	5.59	5.59	5.59	5.59	5.59	0.2
– Iron ore	Mt	911.8	923.7	942.5	980.7	992.1	1 067.6	1 124.0	3.5
Exports									
Steel	Mt	0.88	0.89	0.96	0.96	0.96	0.96	0.96	1.5
– nominal value	A\$m	1 011	816	871	835	726	726	726	-5.4
– real value ^{hi}	A\$m	1 022	816	857	804	682	665	648.9	-7.3
Iron ore	Mt	858.1	892.5	919.0	957.6	966.9	1 040.4	1 096.8	4.2
– nominal value	A\$m	102,861	136,311	114,669	107,618	106,163	110,645	115,820	2.0
– real value ⁱ	A\$m	103,950	136,311	112,790	103,676	99,775	101,407	103,517	-0.1

Notes: **b** fob Australian basis; **c** Spot price, 62% iron content basis; **d** In 2021 US dollars; **e** estimate; **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 2020–21 Australian dollars; **r** Average annual growth between 2020 and 2026 or 2019–20 and 2025–26; **z** projection.

Source: ABS (2021) International Trade in Goods and Services, Australia, 5368.0; Bloomberg (2021) Metal Bulletin; World Steel Association (2021); AME Group (2021); Company Reports; Department of Industry, Science, Energy and Resources (2021)

Metallurgical coal

Major Australian coal deposits (Mt)



Metallurgical coal



Metallurgical coal is primarily used to make steel



Contains more carbon and less ash & moisture than thermal coal



1x tonne of steel made in a blast furnace uses 780kg of met coal



Electric arc furnaces don't use met coal as a raw material

World consumption



59%
China



10%
India



7%
Russia



5%
EU28



5%
Japan



4%
South Korea

Australia's metallurgical coal



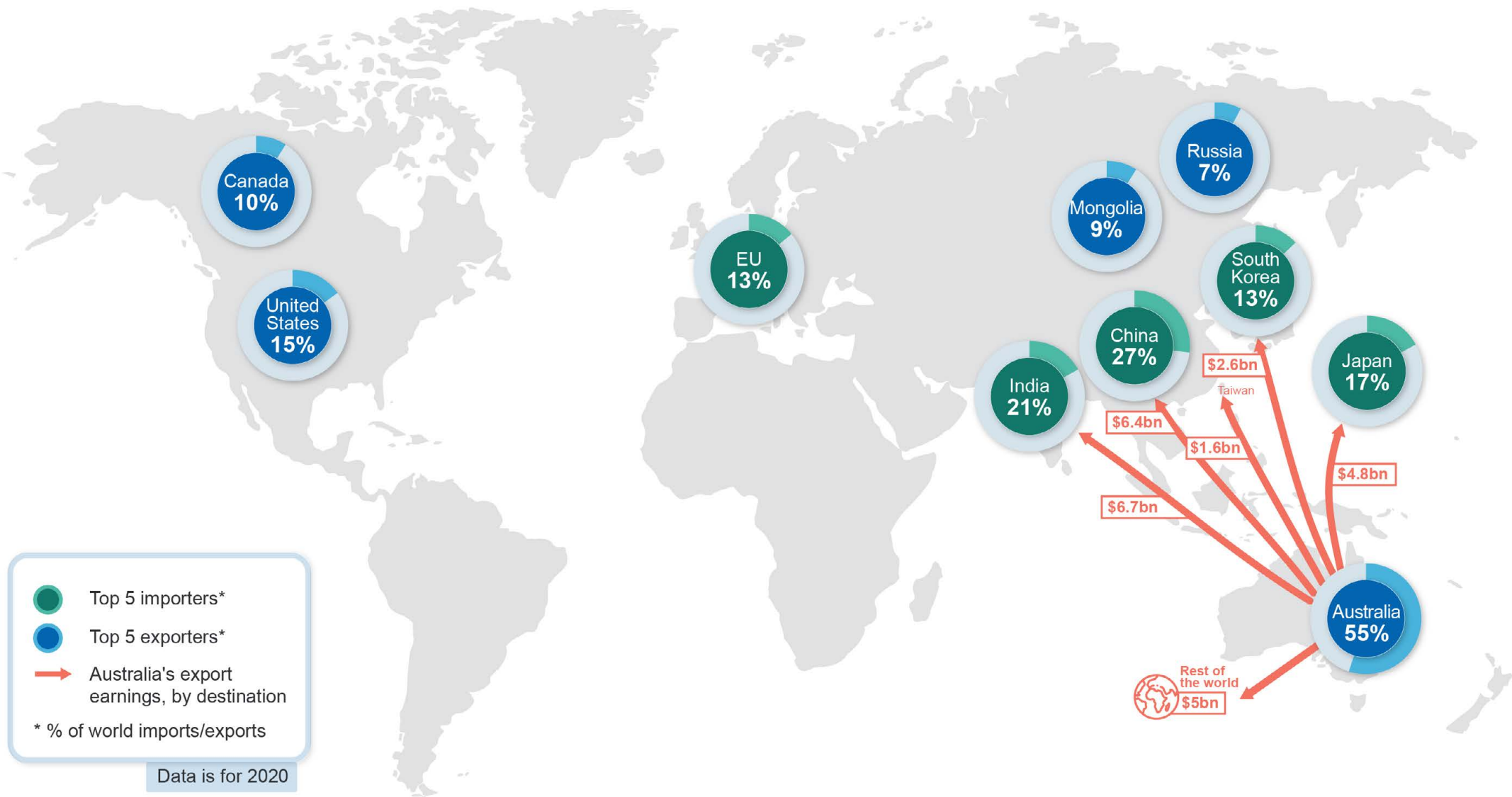
World's no.1 metallurgical coal exporter



177m tonnes of metallurgical coal exported in 2019-20



Almost all of Australia's met coal is exported



5.1 Summary

- Metallurgical coal prices have recovered in line with improving global industrial production and economic activity. The Australian premium hard coking coal (HCC) price is projected to increase from US\$133 a tonne in 2021 to US\$166 by 2026 as steelmaking grows around the world.
- Australia's exports are projected to rise from a 2020-21 low of 173 million tonnes to reach 191 million tonnes by 2025–26. Supply chains disrupted by China's informal import restrictions have already largely reorganised, allowing Australia to successfully redirect to new markets (see [Australia section](#)).
- Australia's metallurgical coal export values are forecast to increase from a low of \$23 billion in 2020–21, to above \$30 billion by 2025–26.

5.2 World trade

World metallurgical coal trade fell by 40 million tonnes, or around 13% in 2020. This was in large part due to the effect of the COVID-19 pandemic and associated containment measures, which severely affected industrial production and steelmaking across most countries. Most steelmaking now occurs in Asia, and while Chinese steelmaking remained strong, there were sharp falls in metallurgical coal demand in India, Japan, South Korea, and Russia.

A gradual easing in COVID-19 containment measures late in 2020 led to some recovery in steel production outside China, which in turn led to a broadly based rise in metallurgical coal imports in late 2020 and early 2021. However, steel output in China continues to lead the world, with China's steel industry recording strong growth in 2020 as a result of stimulus measures. This has resulted in an atypically China-centered metallurgical coal market at the start of 2021.

World trade in metallurgical coal is expected to recover and rebalance over the remainder of 2021 and 2022 as industrial production outside of China returns to normal levels. Metallurgical coal markets are expected to

grow most rapidly in India, and more slowly in Japan, South Korea and Europe.

China, where output grew in 2020, is expected to remain largely stable in its use of metallurgical coal as steel demand gradually peaks over the next few years and alternative forms of steelmaking (notably through scrap steel) increase in importance.

On balance, it is expected that metallurgical coal has a stronger recovery prospect than thermal coal, which faces a range of technological and policy headwinds (see *thermal coal chapter*). The divergence in outlook is particularly apparent in the US, where steelmaking remains a key priority while power companies have continued to retire their aging thermal coal capacity in the face of tighter air emissions standards and deteriorating cost-competitiveness.

5.3 World imports

[China's imports are levelling off in the early part of 2021](#)

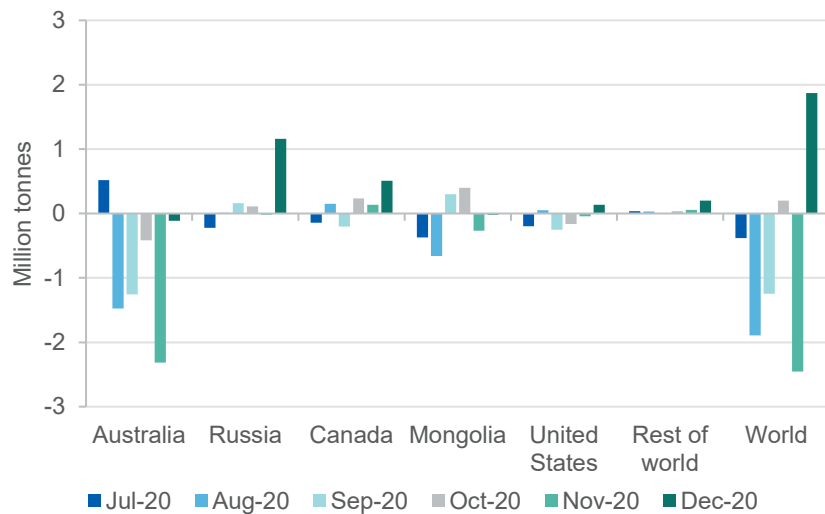
China is the world's largest steel maker and largest metallurgical coal buyer, importing around 73 million tonnes of metallurgical coal in 2020. Imports to China remained strong through much of 2020, despite some easing late in the year (Figure 5.1). Imports from Russia increased in late 2020 as China sought alternatives to Australian product.

Chinese metallurgical coal imports are forecast to ease over the outlook period as the country builds its scrap steel industry and improves its domestic output. Imports are expected to ease to 69 million tonnes in 2022 and to 64 million tonnes by 2026.

[India's metallurgical coal imports are recovering](#)

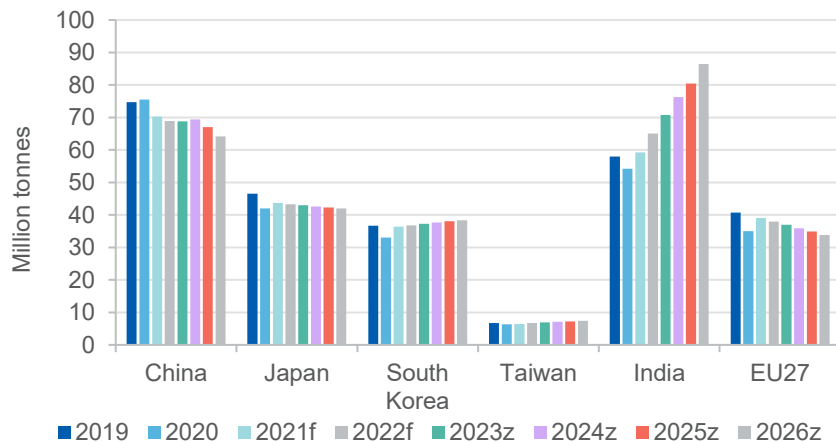
India is the world's second largest steel producer and second biggest metallurgical coal buyer, and is estimated to have imported 54 million tonnes in 2020. This is down from 58 million tonnes in 2019, reflecting the effects of the COVID-19 pandemic on Indian steelmaking. However, as Indian steelmaking gradually emerged from the worst effects of the pandemic, imports lifted in the second half of the year.

Figure 5.1: China's metallurgical coal imports, year-on-year change



Notes: China customs released combined January/February data for 2020.
Source: Bloomberg (2021); China customs (2021)

Figure 5.2: Metallurgical coal imports



Notes: f Forecast; z Projection
Source: IHS (2021); Department of Industry, Science, Energy and Resources (2021)

India has released plans to increase its crude steel production capacity from 142 million tonnes to 300 million tonnes per year by 2030. This will place pressure to increase imports given India's limited domestic reserves of metallurgical coal.

With steelmaking a key priority in India, it is projected that India's metallurgical coal imports will increase from 54 million tonnes in 2020, to 65 million tonnes by 2022 and 80 million tonnes by 2026. (Figure 5.2). Australia is well placed to supply much of this extra requirement.

Japan's imports to fall, while South Korea's to rise slightly after 2020

Japan is the world's third largest metallurgical coal importer, importing 40 million tonnes in 2020. This was down from 43 million tonnes in 2019, though the December quarter results show clear signs of strengthening. With two major producers planning to retire some steelmaking capacity over the outlook period, Japan's metallurgical coal imports are not expected to fully recover to their pre-COVID levels, remaining largely steady at just over 40 million tonnes annually over the outlook period.

South Korea is the world's fourth largest metallurgical coal importer, buying 33 million tonnes in 2020. This is around 10% below the level of 2019, but some recovery is expected in 2021, with imports projected to reach 38 million tonnes by 2026.

5.4 World exports

US export volumes have plunged, and are likely to stay down

The US has long been the world's second largest exporter of metallurgical coal after Australia. However, its exports plunged sharply (from 50 million tonnes to 37 million tonnes) in 2020. Exports from the United States were hit particularly hard as its largest buyers (especially Brazil and the EU) cut their steel production.

Coal production in the US occurs largely inland, resulting in relatively high transportation and production costs, which make it hard for the US to redirect to more distant markets (see Figures 5.1 and 5.3).

Exports from the US are expected to continue struggling over the outlook period, as Brazil and Europe face a slow (and potentially incomplete) recovery in steelmaking. US metallurgical coal exports are expected to contract over the longer term due to high costs and a long-term reduction in steelmaking capacity across Europe. (Figure 5.4).

Russia's exports fall for now

Russian exports are estimated to have fallen by 10% in 2020, to around 23 million tonnes. However, exports strengthened in the second half of the year, and are expected to recover to 24 million tonnes by 2021, growing gradually over the rest of the outlook period to reach 32 million tonnes by 2026. (Figure 5.6). Russian coal is extremely low in sulphur, making it suited for emerging Asian markets where pollution laws are becoming more stringent. Russia is also investing significantly in new mining capacity, and rail/port expansions, which should improve cost competitiveness (Figure 5.3) and increase access to buyers in the EU and South Asia.

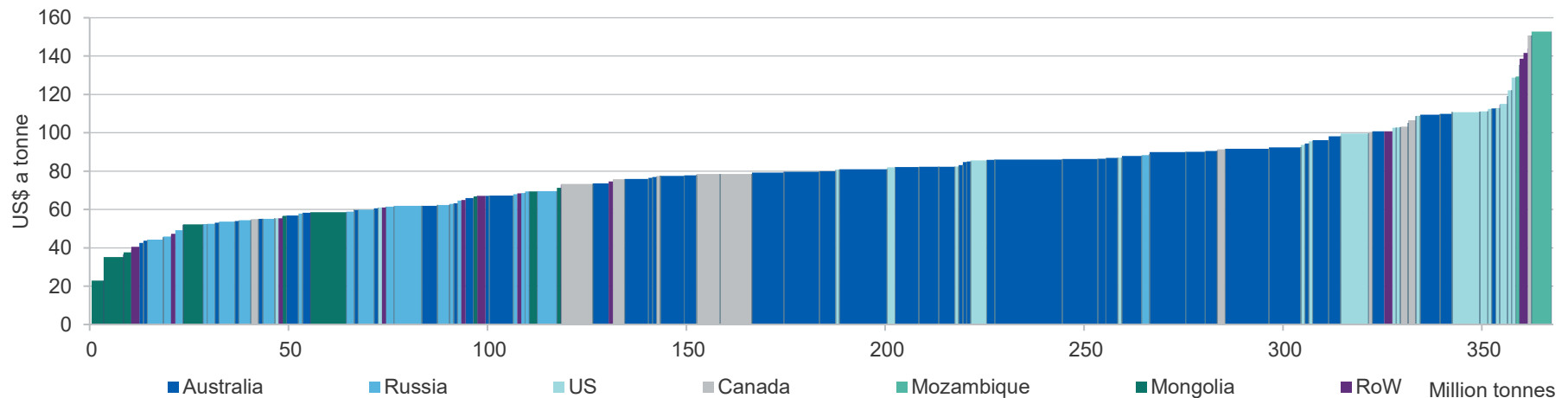
Mongolia's exports remain subject to conditions in China

Mongolian exports are estimated to have fallen by around 15% in 2020, largely due to COVID-19 containment measures impacting exports to China. Mongolian exports have subsequently recovered with the resumption of normal trade, and are expected to resume at pre-COVID-19 levels (around 30 million tonnes per year) from 2021. Exports are then expected to increase over the outlook period, reaching 32 million tonnes by 2026. Exports will be supported by recent tariff cuts in China under the Asia-Pacific Trade Agreement and by the completion of a key railway connecting mines in Mongolia with buyers in northern China.

Exports from Canada could partly fill China's Australia gap

Canada exported 31 million tonnes of metallurgical coal in 2020, around 10% below its typical export levels (Figure 5.4). However, only around 10% of this was shipped to China, leaving Canada relatively exposed to the weakness of non-Chinese markets. Exports to China are now increasing as Canadian production is drawn to the fill the space created by China's informal import restrictions on Australian coal.

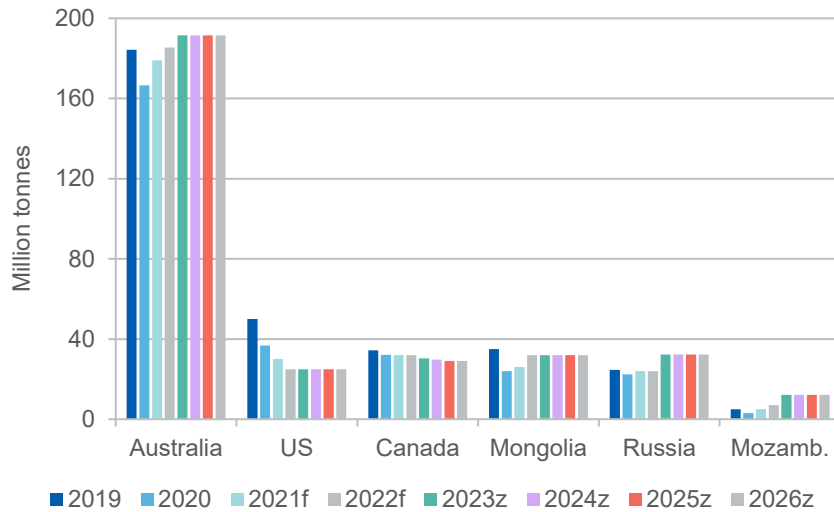
Figure 5.3: Metallurgical coal (including hard coking, PCI and semi-soft) global cost curve, FOB, 2020



Notes: FOB is Free on Board. RoW is rest of world.

Source: AME Group (2021); Department of Industry, Science, Energy and Resources (2021)

Figure 5.4: Metallurgical coal exports



Notes: f Forecast. s Estimate; z Projection.

Source: IHS (2021); Department of Industry, Science, Energy and Resources (2021)

Canada’s metallurgical coal exports are expected to lift temporarily to 32 million tonnes in 2020, though in the longer term its relatively high production costs and long shipping routes are projected to see its exports edge down to 29 million tonnes by 2026.

Mozambique’s exports will take time to recover

Mozambique currently has two exporting metallurgical coal mines: Vale’s Moatize project and Jindal Steel’s Songa project. Mozambique’s exports fell sharply in 2020, as low prices heavily affected the country’s relatively high cost producers (Figure 5.3). A recovery is expected over the next few years, with output forecast to reach 7 million tonnes in 2022 and 12 million tonnes by 2026. The rise is expected to be driven in large part by the ramp up of Vale’s Moatize mine, and facilitated by the 912 kilometre Nacala logistics corridor rail line and Nacala port expansion.

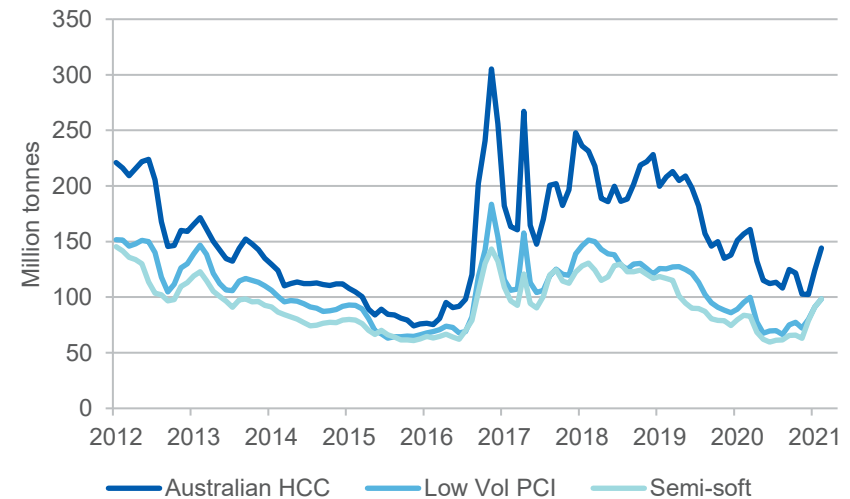
5.5 Prices

Metallurgical coal prices volatile on China uncertainty

Metallurgical coal prices lifted sharply in January, effectively reversing the fall which followed China’s informal restrictions on Australian metallurgical coal imports in October 2020. The price for Australian premium low-volatile hard coking coal rose by around 60% in January as suppliers locked into new demand sources and buyers and sellers reorganised supply chains. Prices were also boosted by fears over weather disruptions at Queensland ports, with cyclone season often peaking in the late summer.

Price rebounds for Australian coal have led to broader price pressure on Asian seaborne metallurgical coal. Demand has risen in Japan, India and the EU, where steel output is recovering from the effects of the COVID-19 pandemic. However, prices have shown signs of softening again in recent weeks, adding to volatility in early 2021.

Figure 5.5: Metallurgical coal prices, monthly

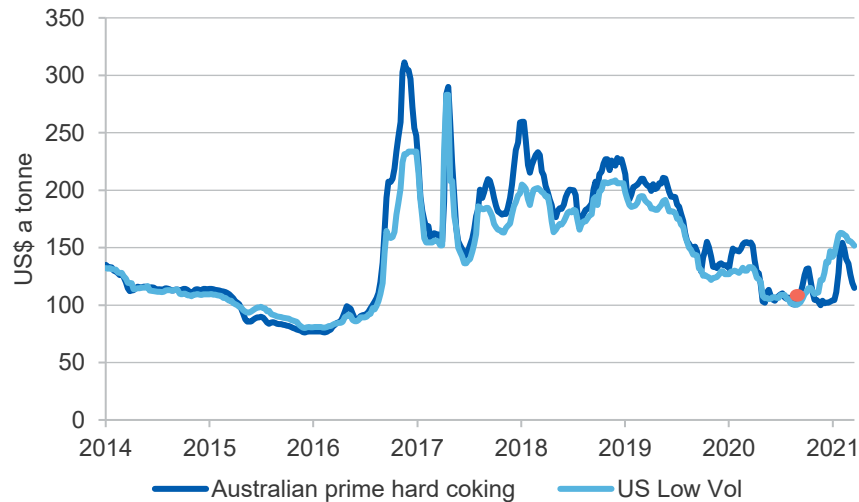


Notes: HCC stands for hard coking coal. PCI stands for pulverized coal for injection.

Source: Platts (2021)

Metallurgical coal prices have diverged significantly since China's informal restrictions on Australian coal. The move led to lower prices for Australian coal relative to coal sourced elsewhere (Figures 5.5 and 5.6), though prices for Australian output have subsequently recovered as supply chains adjusted and Australian coal found new markets.

Figure 5.6: Metallurgical coal prices - Australian Prime Hard vs US Low Vol, FOB



Source: IHS (2021). Low vol = low volatile coking coal. Red marker indicates approximate timing of informal import restrictions from China.

The recovery in metallurgical coal prices is expected to resume during 2021, as steelmaking continues to rebound. The premium Australian HCC price is forecast to average US\$136 a tonne in 2021 and US\$145 a tonne in 2022, rising to US\$166 by 2026. Despite this growth, prices are expected to remain well below the 2019 average (Figure 5.7).

The most significant upside risk to prices is likely to be potential for extreme weather events over autumn, which has potential to disrupt shipping from Queensland. Any disruption to supply is likely to have stronger than usual effects given the strong growth currently occurring in global steelmaking as the world economy recovers.

Figure 5.7: Australian premium HCC spot price, quarterly



Source: Platts (2021); Department of Industry, Science, Energy and Resources (2021)

5.6 Australia

Metallurgical coal export earnings are set to fall in 2020–21

Australia is the world's largest exporter of metallurgical coal, accounting for around half of global seaborne supply. Australian metallurgical coal exports are expected to fall to 173 million tonnes in 2020-21 (Figure 5.8), largely due to China's informal restrictions on imports of Australian coal persisting into 2021. Some of this loss is likely to be offset by rising exports to India, Bangladesh, Pakistan and the Middle East, with newly formed supply chains expected to persist through the outlook period.

The most significant shift in supply chains is likely to take place between Australia and Mongolia. Australia was the largest exporter to China over the first half of 2020 as China closed its border with Mongolia due to COVID-19. This shift reversed late in the year as China imposed informal import restrictions on Australian coal and resumed trade with Mongolia. Metallurgical coal prices have become 'two-tiered', with Chinese import restrictions reducing the price of Australian output relative to output

sourced elsewhere. However, prices for Australian output showed signs of recovery in January-February, amidst concerns over potential summer weather disruptions and market speculation around a potential easing in Chinese import restrictions.

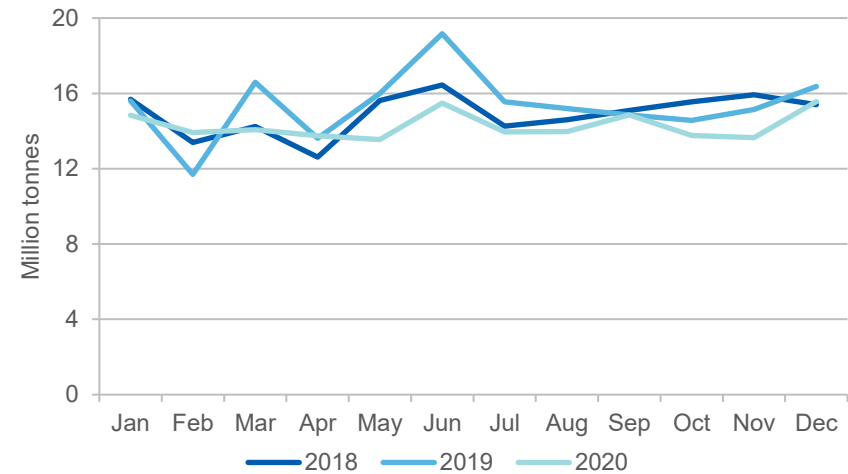
Conditions are mixed among individual mines. BHP production edged down from 20 million tonnes in the first half of 2020, to 19 million tonnes in the second half. BHP has not revised its production guidance (of 40-44 million tonnes for 2020-21), but it is expected that output for the year will fall into the lower half of the range. Whitehaven has lifted its production to 7.2 million tonnes in the second half of 2020, a slight rise from the equivalent part of 2019. Production was temporarily affected by smoke and dust at its Narrabri project, but has largely returned to normal.

Illawarra Metallurgical Coal lifted its output by 11% (to 3.3 million tonnes) in the second half of 2020, relative to the same period in 2019. Output appears to be benefiting from the company's return to a three-longwall configuration, which improves its capacity to mine two coal seams at once.

Australia's exports are recovering overall following several mine closures enacted after prices fell in the early part of 2020. These include Peabody's Wambo mine in NSW, which closed in July and August, and several Glencore mines which halted output in September and October. The re-opening of these mines (and solid production elsewhere) is expected to see exports lift in 2021 relative to 2020. This lift in supply is likely to match growing demand as steel production and industrial activity recover in Europe, the US and Asia.

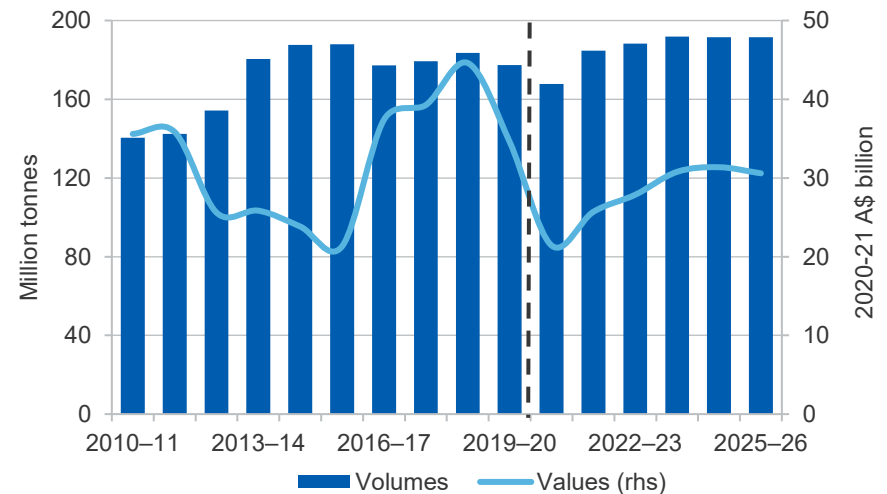
Metallurgical coal export earnings are expected to fall to \$23 billion in 2020-21, impacted by China's informal import restrictions and by the subsequent lowering in prices for Australian coal (Figures 5.7 and 5.9). However, a recovery is expected through the outlook period, as mines resume operations, newly formed supply chains strengthen and demand grows in India, Europe and South Asia. This recovery is expected to lift export volumes back to 191 million tonnes, and export earnings up to \$31 billion (in real terms) by 2026.

Figure 5.8: Australia's metallurgical coal exports, monthly



Source: ABS (2021)

Figure 5.9: Australia's metallurgical coal exports



Source: ABS (2021) International Trade, Australia 5454.0; Department of Industry, Science, Energy and Resources (2021)

However, risks remain weighted to the downside. The most significant risk in the near-term is the potential for disruptive heavy rainfall in coal producing regions of Queensland and NSW. The Australian Bureau of Meteorology (BOM) advises that La Niña conditions are expected to continue through the March quarter 2021.

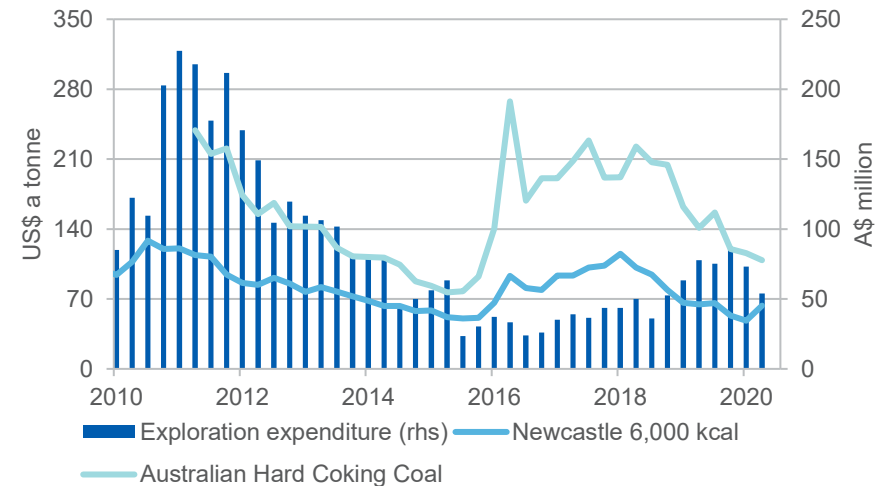
Coal exploration expenditure may have peaked

Australia's coal exploration expenditure decreased by 30% year-on-year to \$54 million in the December quarter 2020, but remains higher than the lows recorded over 2016 and 2017. The growth from 2016 lows is likely in response to high coal prices, especially metallurgical coal, in the intervening years. High prices persisted for several years then started to decline from mid-2019. Current low prices are expected to translate to lower coal exploration expenditure over the coming year or two (Figure 5.10). Export margins vary widely across Australian deposits, adding to the risk for exploration when prices are volatile (Figure 5.11).

Revisions to the outlook for Australian metallurgical coal exports

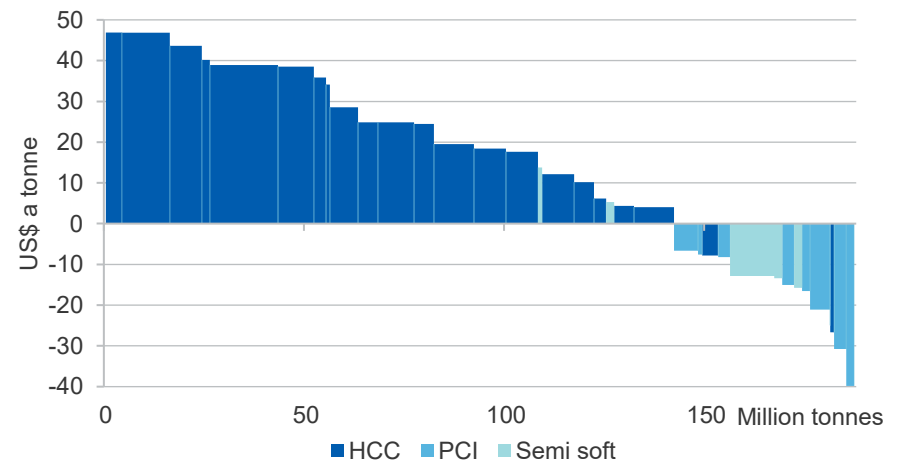
Australia's forecast metallurgical coal export earnings have been revised up by \$0.2 billion in 2020–21, but down by \$1 billion in 2021–22 (in nominal terms) since the December *Resources and Energy Quarterly*. The result reflects the impact of China's recent import policy and the resulting shifts in prices for Australian exports.

Figure 5.10: Australian coal exploration expenditure and prices



Source: ABS (2021); IHS (2021); Platts (2021)

Figure 5.11: Export margins of Australian metallurgical coal mines



Notes: 'Semi soft' is semi-soft coking coal; PCI is pulverized coal for injection; HCC is hard coking coal. Price assumptions are HCC = US\$120 a tonne; PCI = US\$70 a tonne; semi soft = US\$65 a tonne. Mines are categorized into HCC, PCI and semi soft. If a mine produces a more than one type, they are categorised according to their dominant product for simplicity.

Source: AME (2021); Department of Industry, Science, Energy and Resources (2021).

Table 5.1: World trade in metallurgical coal

	Unit	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
World trade	Mt	293	304	313	331	331	330	330	2.0
Metallurgical coal imports									
China	Mt	76	70	69	69	69	67	64	-2.7
India	Mt	54	59	65	71	76	80	86	8.1
Japan	Mt	42	44	43	43	43	42	42	0.0
European Union	Mt	35	39	38	37	36	35	34	-0.6
South Korea	Mt	33	36	37	37	38	38	38	2.5
Metallurgical coal exports									
Australia	Mt	172	179	185	191	192	191	191	1.8
United States	Mt	37	30	25	25	25	25	25	-6.2
Canada	Mt	32	32	32	30	30	29	29	-1.7
Russia	Mt	22	24	24	32	32	32	32	6.3
Mongolia	Mt	24	26	32	32	32	32	32	5.0
Mozambique	Mt	3	5	7	12	12	12	12	26.5

Notes: **f** Forecast; **s** Estimate; **z** Projection.

Source: IEA (2021) Coal Information; IHS (2021); Department of Industry, Science, Energy and Resources (2021)

Table 5.2: Metallurgical coal outlook

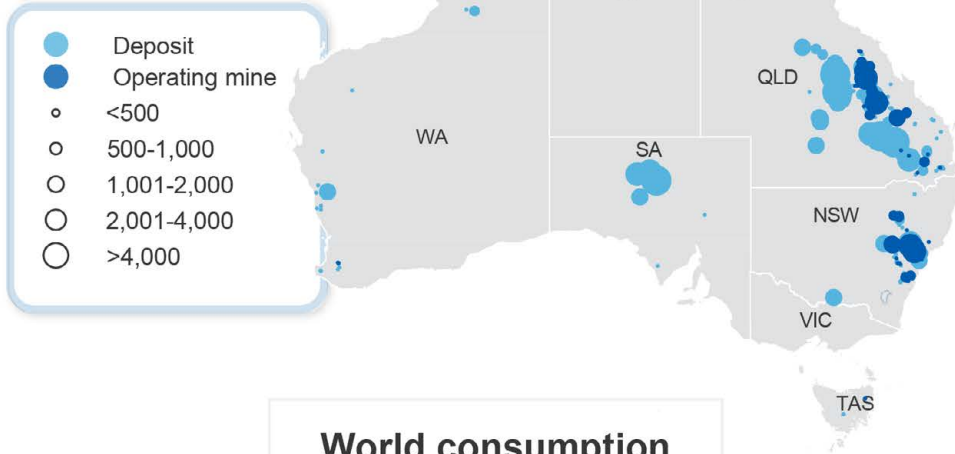
World	Unit	2020 ^f	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
Contract prices ^e									
– nominal	US\$/t	127	130	145	154	164	166	166	4.6
– real ^d	US\$/t	129	130	142	147	154	152	148	2.3
Spot prices ^g									
– nominal	US\$/t	125	133	145	155	165	166	166	4.8
– real ^d	US\$/t	128	133	142	148	154	152	148	2.5
Australia	Unit	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^z	2023–24 ^z	2024–25 ^z	2025–26 ^z	CAGR ^r
Production ^s	Mt	184	175	190	194	198	197	197	1.2
Export volume	Mt	177	173	185	188	192	192	191	1.3
– nominal value	A\$m	34,245	22,723	26,130	28,931	32,757	34,219	34,222	0.0
– real value ⁱ	A\$m	34,607	22,723	25,702	27,871	30,786	31,362	30,587	-2.0

Notes: **d** In 2020 US dollars. **e** Contract price assessment for high-quality hard coking coal. **i** In 2020–21 Australian dollars. **f** Forecast. **g** Hard coking coal fob Australia east coast ports. **s** Estimate. **z** Projection.

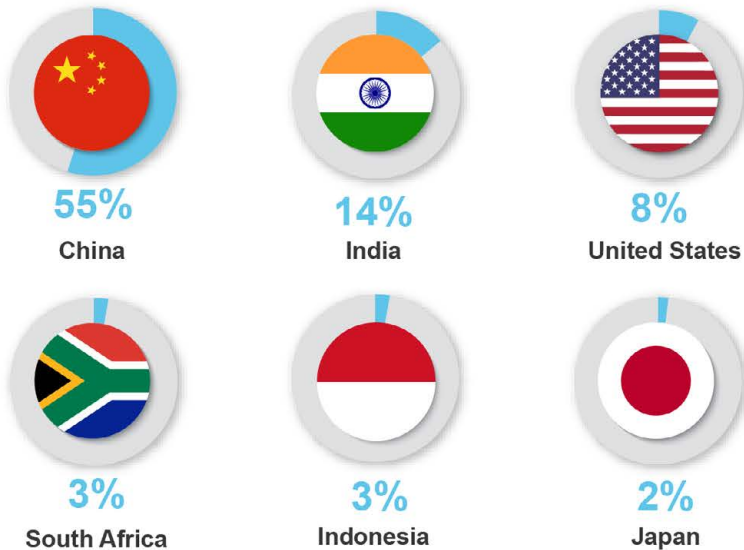
Source: ABS (2021) International Trade in Goods and Services, Australia, 5368.0; Department of Industry, Innovation and Science (2021); Platts (2021)

Thermal coal

Major Australian coal deposits (Mt)



World consumption



Thermal coal



Thermal coal is primarily used in **electricity generation**



Coal accounted for **38%** of power generation globally in 2018



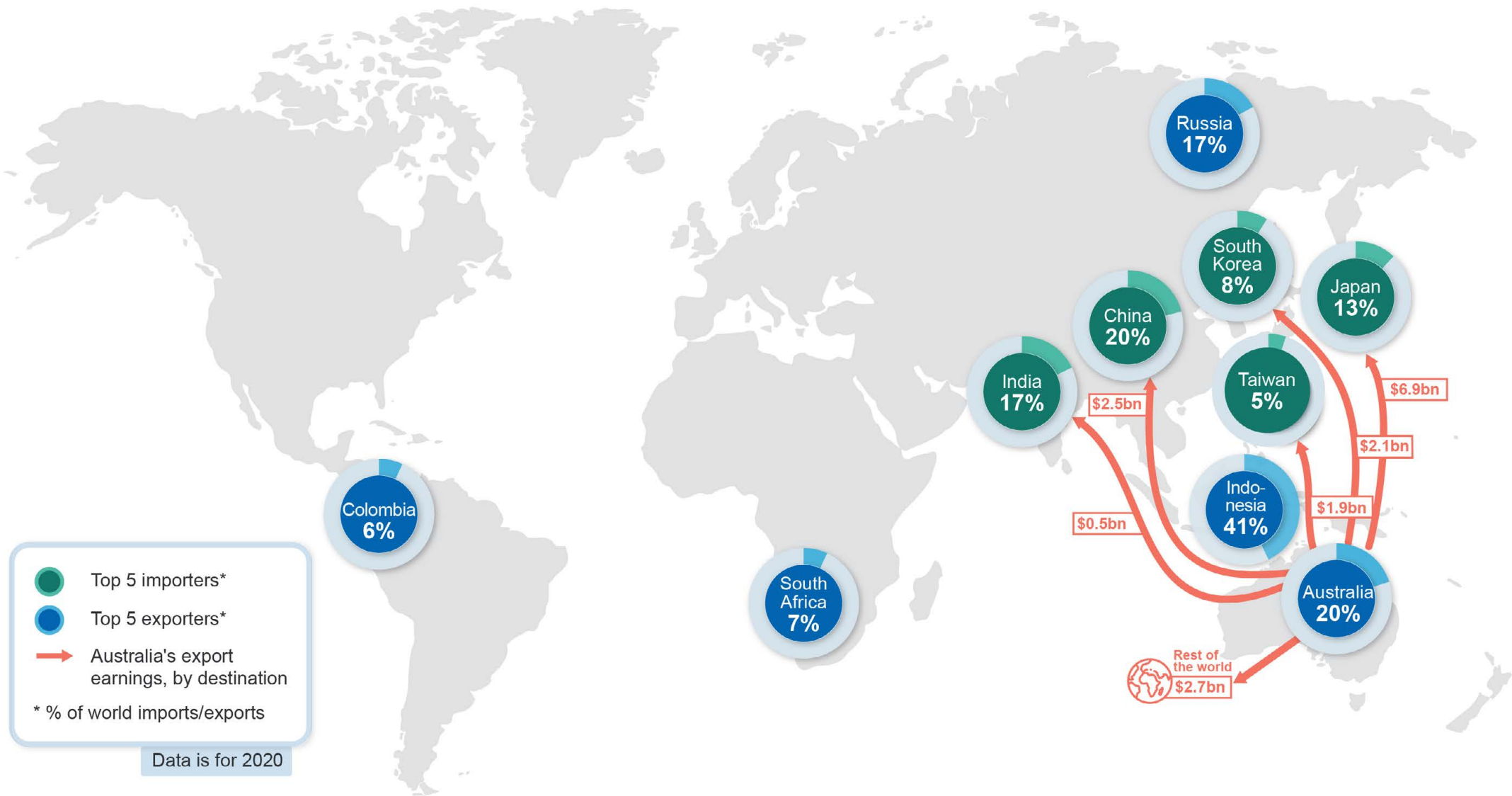
Mines are open cut or underground depending on the **geology of the deposit**



Coal formation began 290-360 million years ago

Australia's thermal coal





6.1 Summary

- Thermal coal spot prices have recovered following production cuts in major exporting countries and recent growth in demand as Asian economies emerged from COVID-19 containment measures. The Newcastle benchmark price is forecast to average US\$64.50 a tonne in 2021, rising slowly to US\$73 a tonne by 2023, before easing to around US\$60 a tonne by 2026.
- Import restrictions imposed by China on Australian coal have contributed to a decline in exports, from 213 million tonnes in 2019–20 to 206 million tonnes in 2020–21. However, exports are projected to rise to 231 million tonnes by 2025–26, as supply chains adjust and global markets increasingly prioritise high-quality coal (see [Australia section](#)).
- Australia's thermal coal export values are forecast to fall from \$21 billion in 2019–20 to \$15 billion in 2020–21. Earnings are expected to remain largely steady at this level out to 2025–26.

6.2 World trade

Global thermal coal use fell sharply in 2020 as a result of the COVID-19 pandemic and subsequent global containment measures, which led to significant falls in electricity use around the world. World thermal coal trade fell in 2020 for only the second time this century (the first being in 2015). Falls in thermal coal imports were particularly sharp in India and the EU, though demand also fell significantly in South Korea and Japan.

Coal trade has also been affected by significant competition from gas. Price reductions have allowed gas to be more competitive in the merit order and allowed it to dispatch more often. The flexibility of gas generation has also allowed it to be more competitive in providing back-up generation for renewables, which enhances the ability of renewables to compete with coal.

The substitution of coal power with gas and renewables has been evident in the US and Europe, though the trend is now evident in other regions as

well. While thermal coal demand is forecast to increase in Southeast Asia, plans for coal plant construction have been revised down substantially in a number of countries including Vietnam, Indonesia, Bangladesh and the Philippines. Gas and renewables are also expected to play a greater role in South Korea and Japan. Technology to convert hydrogen gas into ammonia is also being adopted to resolve intermittency problems with renewables.

In Africa, coal use is unlikely to rise on the scale of Asia, with the pace dropping considerably following Egypt's cancellation of its coal development plans.

Policy measures are adding to structural pressures on coal power, with potential impacts on coal demand beyond the outlook period. A range of countries have recently upgraded their commitments to reduce emissions. Policy measures are building on recent announcements from the private sector seeking to invest in the global energy transition. Access to capital has become more challenging for some investments, and some insurers are also reducing their exposure to fossil fuels.

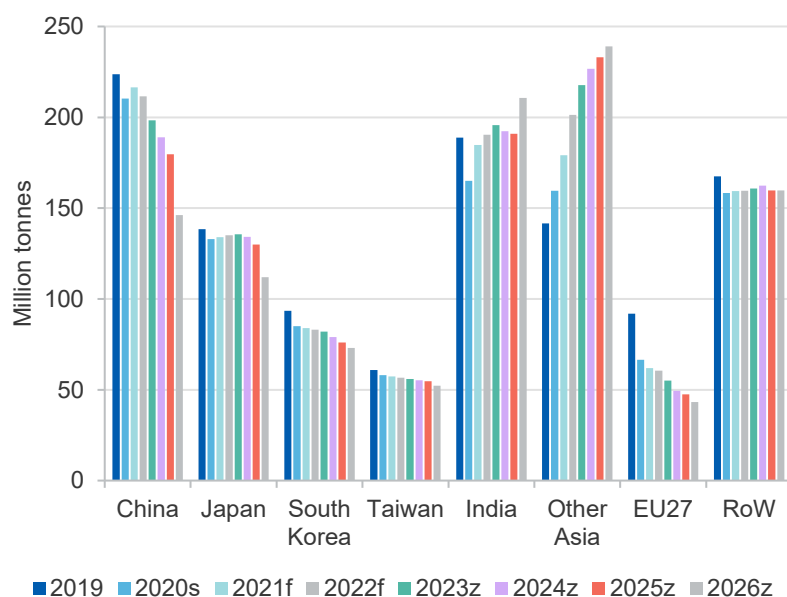
The coal plant construction pipeline, which previously spanned much of Asia, has contracted in recent years. Most of the residual construction proposals are now in China, though coal use is also expected to rise in Southern Asia (though to a lower peak than previously expected). Coal use is expected to be supported by increases in overall electricity use in India, Bangladesh and a number of ASEAN nations as industries and cities expand and more people are connected to power grids for the first time. Short-term gains in thermal coal use are also expected to as the global economy continues to recover from the recession caused by COVID-19. The recent rebound in gas prices is also likely to assist coal demand and provide a short-term upside for coal usage in Southeast Asia, India the EU and the US.

However consistent with IEA projections, we expect global coal imports to decline in many regions over time (see Figure 6.1). The decline in global

coal imports is expected to be most rapid in Europe and North America, where use was falling prior to the COVID-19 pandemic. Among OECD countries, coal demand is expected to decline at an accelerating rate after 2021. Costs for alternative energy sources including wind and solar are also expected to keep falling, with improvements in supporting technologies such as batteries accelerating.

In the US, use of shale oil is expected to continue rising after a brief disruption caused by COVID-19. A range of large mining and power companies in the US remain committed to moves away from thermal coal despite recent growth in gas prices.

Figure 6.1: Thermal coal imports



Note: **s** Estimate; **f** Forecast; **z** Projection. ROW = Rest of World.

Source: IHS (2021); IEA (2021) Coal Market Report; Department of Industry, Science, Energy and Resources (2021)

6.3 World imports

China's import price premium remains high as import restrictions persist

Coal use in China remained relatively robust through 2020 and into the early part of 2021. China's thermal coal imports in the December quarter 2020 were around 10% higher than the same period in 2019, reflecting greater output from most of the country's larger power generators. Coal use is expected to flatten out in China over the outlook period. The Chinese Government's latest Five-Year plan reiterated commitments to reach peak emissions by 2030 and attain carbon neutrality before 2060.

However, imports will also be subject to other forces affecting domestic coal use in China. China saw a wave of new coal plant constructions following a policy change in 2014, which delegated coal plant approvals to regional governments. In 2016, the Chinese Government revised the policy again, curbing coal plant constructions to prevent overcapacity. In early 2020 the policy was tweaked further, with the National Energy Administration simplifying its process for coal plant approvals. This is likely to see coal plant constructions progress more rapidly over the next few years. However, many of these new plants are replacements for old capacity, and the greater efficiency of the newer plants will likely curb any growth in coal use. In 2020, China's State Council released new guidelines intended to more strictly control new plant approvals.

China's reliance on coal power will thus persist for several decades, with the majority of its coal plants still relatively new. However, it is expected that future plant approvals will remain largely confined to replacement for older capacity. Domestic coal output in China is expected to remain strong, curbing import growth over the outlook period (Figure 6.1). China's coal mining industry produces more than 3 billion tonnes of coal per year, accounting for around half of global coal output. Despite the impacts of COVID-19 containment measures in the early months of the year, China's domestic coal mining appears to have maintained its typical output over 2020. This led to downward price pressure on the seaborne market.

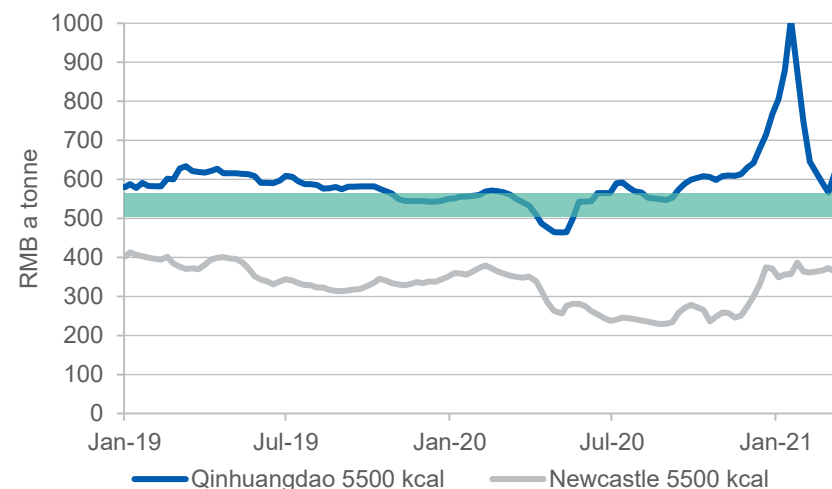
Australia's thermal coal exports to China declined in 2020, despite a rise in the early part of the year. China has actively sought to manage coal import levels over the past few years; in part to provide support for its domestic coal industry and in part to pursue energy security goals. However, the restrictions on Australian exports have had effects on domestic coal prices and availability in China.

In January 2021, China's National Development and Reform Commission (NDRC) released a regulatory plan which includes a target to stabilise China's domestic prices within a price band of 500 to 570 Renminbi (RMB), equivalent to US\$76–87 a tonne at the current exchange rate. Prices in this range are understood to be broadly acceptable to China's power generators and industrial consumers, and also ensure sufficient margins for domestic coal miners. The NDRC typically eases import restrictions when the domestic benchmark prices exceed RMB570 a tonne, and tightens restrictions when the price goes below RMB500. The price range is shown as a green zone in Figure 6.2.

As this chart shows, China's informal import restriction on Australian coal has resulted in significant price pressure for Chinese consumers, with costs for China's domestic product lifting to around double the price of the equivalent Australian coal (see comparison with QHD prices in Figure 6.2). If there was a continuation of this policy, it is likely to see domestic coal prices remain elevated in China through 2021 and potentially beyond.

In the short-term, China's thermal coal demand is expected to lift in 2021 and 2022 in line with economic growth. While significant new power generation is expected to come from hydro, gas and renewable sources, a number of coal-fired power plants are well progressed in their construction. This may not flow through significantly to imports, partly due to the scale of China's domestic output and partly because the high-efficiency low-emissions technology used in newer coal plants is expected to improve their efficiency relative to the plants they are replacing.

Figure 6.2: China's domestic vs Australian thermal coal export price



Notes: The 'green zone' is a price band from 500-570RMB. Qinhuangdao (QHD) prices are a key benchmark for coal prices in northeastern China. The Newcastle benchmark series (traded in USD) is converted to RMB at 18 November 2020 exchange rate. Note that the Newcastle series excludes freight costs which typically add around US\$10/t or 66 RMB.

Source: Bloomberg (2021)

India's power and industrial sectors are recovering

Indian thermal coal imports fell in 2020 (Figure 6.3), though with significant divergence among import sources. Australian exports to India have surged, reaching a monthly record in January, at almost 7 million tonnes – nearly double the level of a year ago. This growth has largely come at the expense of Indonesia, where imports fell to just under 6 million tonnes in January. Indonesian output is now being increasingly directed to China, as a substitute for Australian coal. This effectively raises the quality of coal imported to India while reducing the calorific quality of imports to China. It is expected that this supply chain shift will persist during the outlook period.

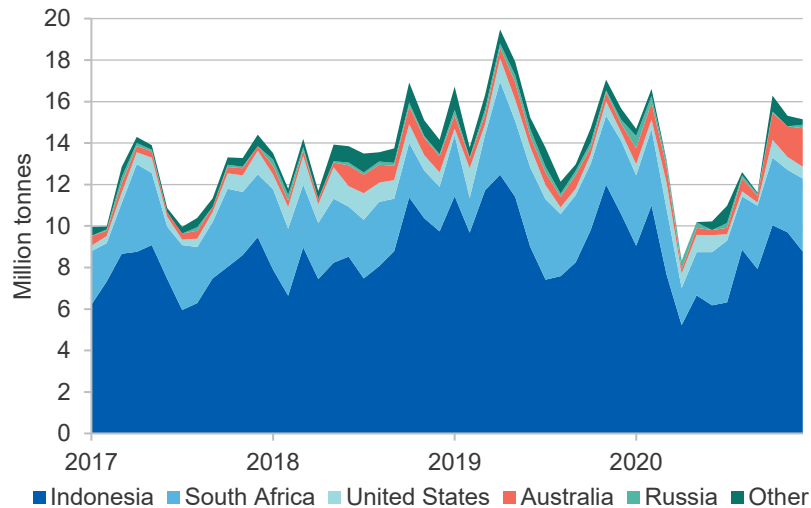
India has continued with its efforts to reduce its import reliance by expanding its private sector domestic coal production. To this end, the

Indian Government has announced a second round of commercial coal block auctions following the first sale in November 2020. The new release includes 75 blocks, of which 68 are thermal and two are metallurgical coal, with the remaining two blocks being mixed. Development time varies widely, with some blocks potentially able to commence production within one year, while others may take up to five. The two auctions combined will technically add around 200 million tonnes annually to Indian domestic production capacity, though it is not clear how much of this production will ultimately occur.

At the time of writing, Indian coal imports have largely recovered to their pre-COVID-19 pandemic level, with containment measures easing and steel demand rising as a result of construction and infrastructure activity.

On balance, it is expected that India's thermal coal imports will lift gradually over the next two years, reaching 190 million tonnes in 2022. After 2022, imports will be constrained by government targets and policy.

Figure 6.3: India's thermal coal imports, monthly



Source: IHS (2021)

Resources and Energy Quarterly **March 2021**

In February 2020, India's Minister for Coal and Mines reaffirmed plans for India to rely fully on domestic coal production by 2023–24. While this has been a long-term and difficult goal for India, the announcement signals a renewed policy drive for energy self-sufficiency.

Japan's imports have partially recovered

Japan is the world's third largest thermal coal importer. However, imports to Japan have been relatively constrained in late 2020 despite a colder-than-usual winter. Coal faced competition from cheaper gas as electricity use declined during the period of COVID-19 pandemic. Japan's thermal coal imports were 10% lower in the December quarter compared to the same period in 2019 (Figure 6.4).

Beyond 2020, there are competing trends at work: Japan still has high-efficiency coal-fired power plants under construction, but almost two-thirds of proposed coal constructions have been cancelled since 2016. Coal consumption will also be reduced by the retirement of up to 100 older power plants by 2030. With population declining, Japan's energy demand is expected to remain on a downward trend over time.

However, nuclear power generation is expected to have declined during the 2020-21 winter period, creating more space for coal generation. At the time of writing, only nine of Japan's 42 nuclear reactors have gained approval to restart following the Fukushima accident in 2011, and some of these remain idle due to new requirements for anti-terrorism upgrades. Most of these upgrades are scheduled to complete by mid-2021, and another four reactors are currently seeking approval and could be online by 2023. However, the slow pace of overall approvals is likely to constrain competition from nuclear power over the outlook period.

In his first general policy address to the Diet on 26 October 2020, Prime Minister Yoshihide Suga announced that Japan would pursue a national target of net-zero emissions by 2050. Depending on how policies are implemented and the evolution of technologies, this could have a material impact on Japan's demand for thermal coal beyond the outlook period.

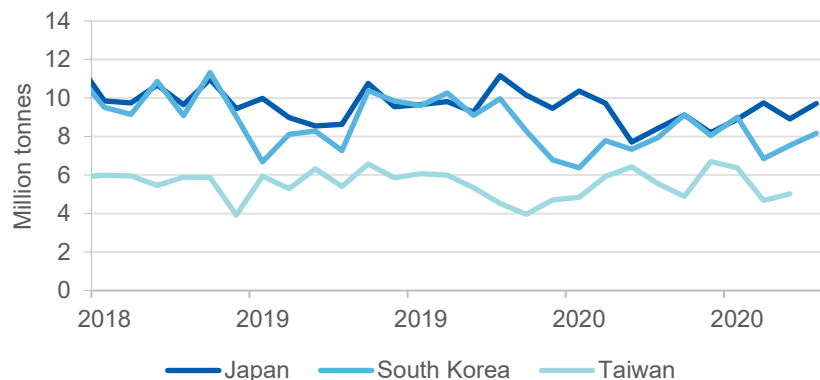
In mid-2021, Japan's 6th Basic Energy Plan is expected to be released, setting out a roadmap to the 2050 goal. Accelerating the pace of nuclear reactor restarts may be a part of that plan, but nuclear energy continues to face public opposition in Japan.

South Korea is set to reduce coal imports slowly

South Korea is the world's fourth largest thermal coal importer, but its imports fell sharply in the December quarter 2020 (Figure 6.4), even as the South Korean economy continued to recover from the effects of the COVID-19 pandemic. Nuclear generation increased over the winter, largely accommodating higher electricity demand for heating. The government's winter fine dust policy, which seeks to improve air quality, is also now in effect, and has forced a temporary closure of around 16 coal-fired power stations over the March quarter 2021.

South Korea's import and consumption of thermal coal has been declining since 2018, as government policies have been implemented to manage air pollution problems. This has included new tax arrangements aimed at encouraging the use of gas over coal. The country plans to convert a quarter of its coal-fired capacity to gas by 2031.

Figure 6.4: Japan, South Korea and Taiwan's thermal coal imports



Source: IHS (2021)

Resources and Energy Quarterly **March 2021**

In October 2020, South Korea's president declared in a policy speech in the national assembly that the country will be carbon neutral by 2050. Seven coal power units currently under construction are likely to be completed. However, thermal coal use will be subject to anti-pollution measures including periodic planned shut-downs of coal plants (including the closure of 9-16 plants over three months from December 2020). South Korea's thermal coal imports are forecast to fall steadily over the second half of the outlook period assuming some of the measures under South Korea's draft 2020–2034 energy plan come into effect.

Taiwan's imports resilient in 2020

Electricity demand held up relatively well in Taiwan during 2020, reaching 58 million tonnes. This reflects the country's early success in containing COVID-19. However, imports are edging down, and are expected to decline further over the outlook period as a result of the government's energy transition policies. Taiwan is aiming to shift its power generation mix towards gas and renewables and away from nuclear power and coal. Under Taiwan's current energy plan, coal's share of power generation is expected to fall from 46% at present to 27% by 2025.

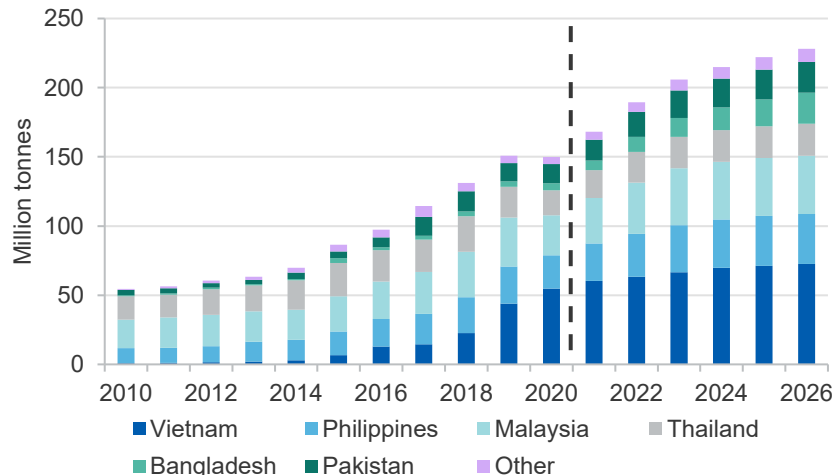
Southeast and South Asia imports to grow, led by Vietnam

In 2020, nations in Southeast and South Asia (excluding India) collectively imported around 150 million tonnes of thermal coal, and are expected to play a substantial and growing role in thermal coal markets into the 2020s. The largest importers of thermal coal in these regions are Malaysia, Vietnam, and the Philippines, and growth in thermal coal use is expected to continue in the latter two countries for the full outlook period. Vietnam is expected to be a key driver of import demand growth, with around 5.5 Gigawatts of additional coal-fired power generation capacity likely to come online in the outlook period in that country alone. An early 2020 resolution of Vietnam's government sought to prioritise renewables and gas over thermal coal, but uncertainty over the level and duration of policy support may undermine the required investment.

Growth in coal use is nonetheless likely to cap out at a lower level than previously expected. Vietnam's National Steering Committee for Power Development has revised its 2025 coal generation target from 50% to 37% of total generation, while the Philippines has placed a moratorium on new coal constructions. Capital flight has also led to the cancellation of nine proposed coal plants in Bangladesh. The COVID-19 pandemic has also slowed momentum on a range of industrial and energy grid policies underway, and progress in alternative methods for energy generation (including ammonia use) is likely to bring forward the peak in coal use across South Asian nations.

Broad factors including economic and population growth continue to drive demand for electricity, and additional coal-fired power is expected to play a role in meeting it. On balance, it is expected that thermal coal imports to Southeast and South Asia will increase, reaching 189 million tonnes in 2022 and 228 million tonnes by 2026 (Figure 6.5).

Figure 6.5: South and South East Asia thermal coal imports



Source: IEA (2021) Coal Information; Department of Industry, Science, Energy and Resources (2021); IHS (2021)

6.4 World exports

World thermal coal exports fell by about 13% in 2020, with producers cutting their aggregate output significantly. However, there were significant divergences in individual coal markets over the year, with the biggest impact being on high-cost suppliers (including the United States and Columbia) in the Atlantic Basin market, where demand and prices dropped particularly sharply.

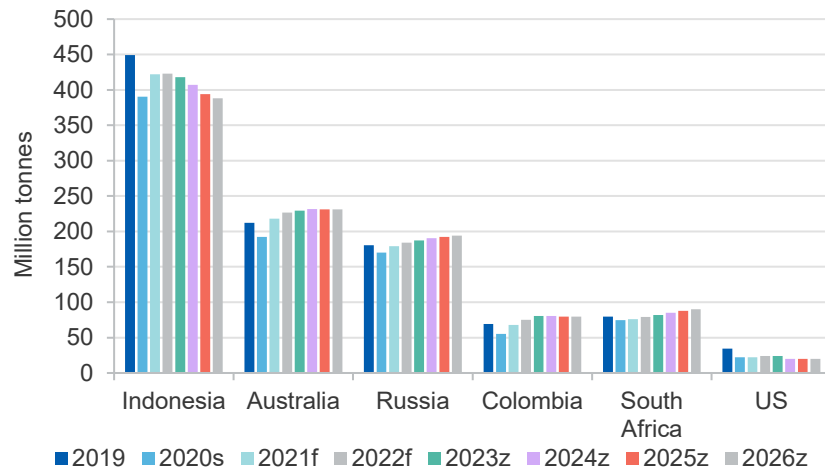
Coal exports are expected to partially recover in the Atlantic Basin and Asia Pacific markets in 2021 as the COVID-19 vaccines roll out, allowing economies to gradually return to normal. Electricity use is expected to lift over 2021, reaching normal levels by the second half of the year. The impact of emissions reduction commitments, change in Chinese coal import settings and the development of India coal reserves by private companies all remain uncertain, creating complex scenarios for thermal coal exporters.

Indonesia's exports decline sharply

Indonesia is the world's largest thermal coal exporter, exporting around 400 million tonnes in 2020. This represents a fall from the record level of 2019, reflecting difficult conditions since the outbreak of the COVID-19 pandemic. While Indonesia's coal reserves are substantial, many are subject to high costs, which left them uneconomic during the period of low prices in the early and middle part of 2020. The calorific quality of Indonesian coal is also relatively low, at a time when markets are placing a premium on higher quality coal.

The Chinese Government's informal import restrictions on Australian coal has led to a shift to buying Indonesian coal by Chinese importers. This demand led to a brief shortage of thermal coal in the domestic Indonesian market, resulting in a deferral in deliveries to China and capped a volatile year for Indonesian coal exporters.

Figure 6.6: Thermal coal exports



Notes: s Estimate. f Forecast; z Projection.

Source: IHS (2021); IEA (2021) Coal Information; ABS (2021); Department of Industry, Science, Energy and Resources (2021)

Indonesian coal production fell by around 17%, to 42 million tonnes over the year to January 2021. This likely reflects the impacts of a strong monsoon season, which affected loading activity at several key ports, as well as weather impacts from La Niña, which have lasted into January.

Indonesian authorities have determined a production target of 550 million tonnes for 2021. This is slightly below the 562 million tonnes produced in 2020, but still sufficient to maintain relatively healthy exports over the year.

On balance, Indonesia’s exports are expected to rise slightly in the first half of the outlook period as prices recover (Figure 6.6). However, output is not expected to return to 2019 levels. Coal prices remain low and volatile despite their recent growth, and this is likely to act as a curb to coal investment in Indonesia. Coal exports will also be constrained by the Indonesian government’s recently announced plans to limit annual exports in order to safeguard coal reserves for domestic use.

US exports face significant cost and infrastructure challenges

The US is estimated to have exported about 22 million tonnes of thermal coal in 2020, a sharp fall from the 34 million tonnes in 2019 (Figure 6.6). Most US producers are high-cost due to the inland position of many mines, which adds to the length of freight required. As such, US exports remain price sensitive, and are not expected to pick up significantly unless coal prices rise further. The US coal sector was already under pressure due to low natural gas prices, falling demand domestically and in Europe, and a lack of infrastructure on the US west coast (near Asian markets). There are few prospects for a change in any of these factors over the outlook period, and with demand in the Atlantic market now in structural decline, it is not expected that US coal exports will lift noticeably.

Colombia’s exports fell sharply, but recovery is in prospect

Colombia remains a relatively important thermal coal supplier, but its exports fell by around one-fifth (to 55 million tonnes) in 2020 amidst difficult global conditions. Falling prices prompted Glencore to suspend its output at multiple sites in late 2020 and to return its Prodeco mine production licence. Columbian output was also disrupted by strikes at the large Cerrejón coal mine. Exports are expected to rise to 80 million tonnes by 2023 and hold at around this level as disruptions pass.

South African exports have recovered

South Africa’s exports recorded a second consecutive quarter of growth in the December quarter 2020, marking a strong recovery for the country’s coal industry. By 2022, South Africa’s exports are expected to return to 79 million tonnes (Figure 6.6). South African exports to India are expected to rise, with miners also seeking opportunities in other Asian markets — such as Pakistan — as European thermal coal use falls. A modest decline in domestic use of thermal coal is also likely to push up export volumes. Domestic use is being cut back in line with the South African government’s October 2019 plan to reduce coal-fired power generation capacity from the current 37 Gigawatts, to 33 Gigawatts by 2030.

Russia's production and exports lost ground in 2020, but should recover

After years of strong production growth, Russia's coal industry faced a challenging year in 2020. Low prices weighed on production over the year, despite falls in the value of the Russian Ruble. Exports are forecast to lift in the early part of the outlook period before levelling off after 2024 (Figure 6.6). Russia has invested significant sums in infrastructure to support shipments to the Asian market, and the low sulphur content of Russian coal gives it an edge in countries like South Korea where pollution laws have tightened up in recent years.

6.5 Prices

International thermal coal prices recover as COVID-19 impacts recede

Thermal coal prices fell sharply in early 2020, but rebounded in November and early December. In early 2021, prices are roughly on-par with their pre-COVID-19 pandemic levels. Recent price growth has been driven in part by cold weather in Northeast Asia, and in part by supply cuts among the most price-sensitive producers. Australian exports from the Port of Newcastle also faced disruption in early 2021 due to equipment problems (see *Australia section*). Although prices have mostly recovered in aggregate terms, differentials have shifted in favour of non-Australian sources due to import restrictions imposed by China.

The benchmark Australian thermal coal spot price — Newcastle 6,000 kcal/kg — rose strongly in December and January, reaching around US\$80 as Korean power companies increased their spot market bids (see Figure 6.7). Prices subsequently stabilised and have eased slightly, though they remain well above the 2020 average.

As weather conditions normalise, price pressure will likely ease. However, ongoing economic recovery through 2021 may result in more favourable conditions for thermal coal prices over the rest of the year. Recent net zero emissions commitments by large coal consumers are expected to place a long-term constraint on potential growth in coal prices.

6.6 Australia

Australian thermal coal exporters face volatile conditions in 2021

Australian thermal coal exports faced difficult conditions in 2020, affected initially by a broad decline in global energy use, and subsequently by China's unofficial restriction on imports of Australian coal. Chinese import restrictions resulted in the largest ever fall in exports (15% year on year) in the September quarter 2020, and has subsequently affected prices for Australian product (Figure 6.8). In the December quarter, exports remained weak, but recovered by around 6% in quarterly terms.

Thermal coal exports have been supported by the relatively high quality of Australian product, which has facilitated its diversion to other markets. Despite this, export revenue recorded its largest fall for more than 30 years in 2020. Signs are more positive in early 2021, with earnings recovering and volumes picking up, as coal previously destined for China's ports was successfully diverted.

Australian coal exports also remained subject to long-term structural factors, including increasing competition from gas. Low natural gas prices have provided competition for Australian coal exports in recent quarters, though this is likely to ease slightly as gas prices lift (see *LNG chapter*), and as the high quality of Australia's coal gives a measure of protection.

Exports have also been disrupted on the supply side, with La Niña weather damaging a coal loader at the Port of Newcastle. Shipments have also been affected by output cuts from Glencore — Australia's largest coal producer — which were initiated in response to falling prices.

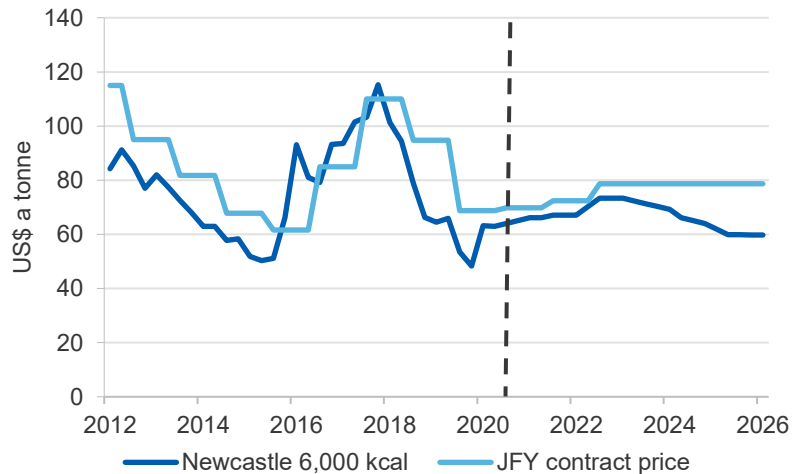
Conditions for Australian thermal coal producers remain difficult on balance. In December 2020, Glencore announced plans to close four Australian mines by 2023 as the mines' currently-developed resource becomes exhausted. In the Hunter Valley, Glencore may close Liddell, Integra and Glendell. In the Bowen Basin, the metallurgical and thermal coal mine Newlands also faces potential closure. These mines represent

11.5 million tonnes a year, or around 4% of Australia’s thermal coal production. The ramp up of Glencore’s million tonne a year United-Wambo joint venture with Peabody will act as a partial offset, but write-downs have affected the value of the company’s thermal coal business.

Other recent announcements include Whitehaven’s announced losses of \$94 million over the first half of the 2020–21 financial year, while BHP has announced in an operational update that its New South Wales Energy Coal assets will face a write-down of between \$1.15 billion and \$1.25 billion, cutting their value to \$250-\$350 million.

On balance, it is expected that Australian exports will grow slowly after a brief decline (Figures 6.9 and 6.10), though prices will remain constrained. Australia’s thermal coal export volumes are forecast to edge down from 213 million tonnes in 2019–20 to 206 million tonnes in 2020–21, but to then grow over time, reaching 231 million tonnes by 2025–26.

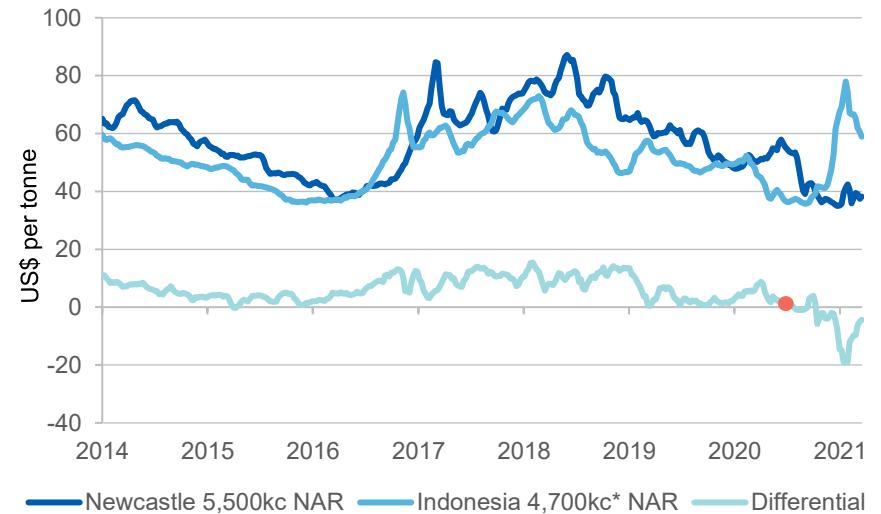
Figure 6.7: Thermal coal price outlook



Note: JFY is Japanese Fiscal Year (April to March).

Source: IHS (2021); Department of Industry, Science, Energy and Resources (2021)

Figure 6.8: Thermal coal prices — Australian vs Indonesian



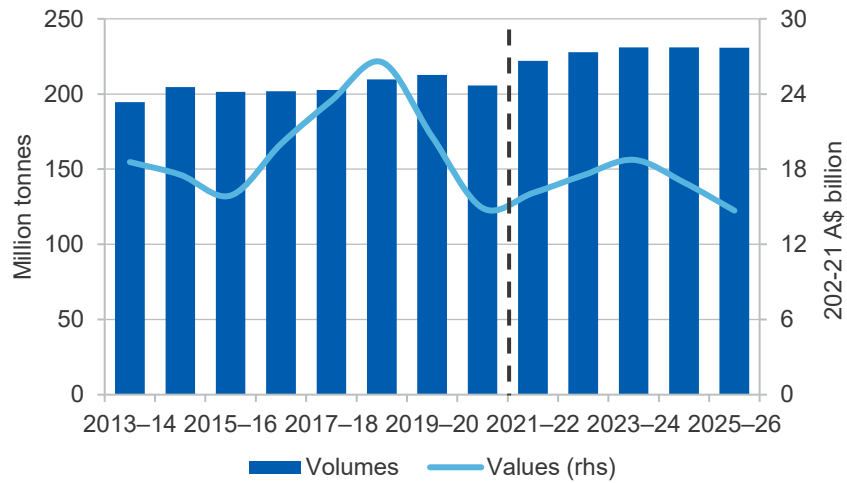
Source: IHS (2021). NAR = Net as received. Red marker indicates approximate timing of Chinese informal import restrictions.

Thermal coal export earnings are forecast to decline by \$6 billion to \$15 billion in 2020–21, remaining largely steady over subsequent years as growing volumes offset ongoing weakness in prices.

Revisions to the outlook for Australian thermal coal exports

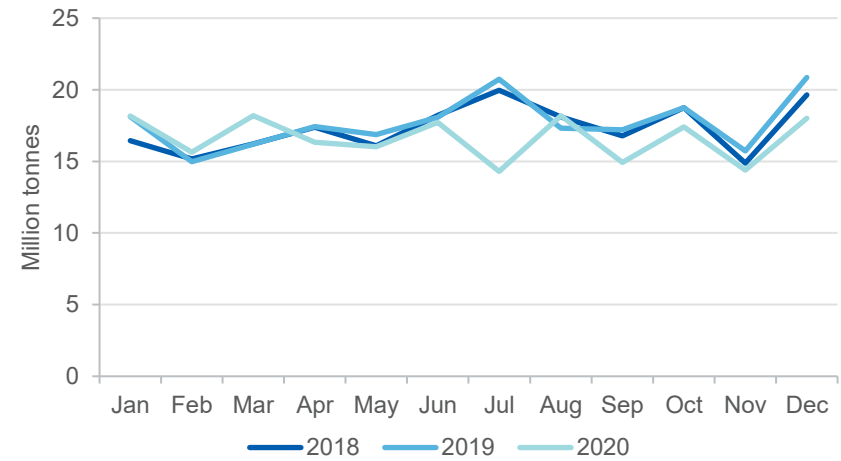
Since the December release, the thermal coal export earnings forecast for 2020–21 has been revised up marginally in nominal terms (from \$14.6 billion to \$14.9 billion) reflecting a moderate lift in prices over recent months. The forecast for 2021–22 is largely unchanged from the December *Resources and Energy Quarterly*.

Figure 6.9: Australia's thermal coal exports



Source: ABS (2021); Department of Industry, Science, Energy and Resources (2021)

Figure 6.10: Australia's thermal coal exports, monthly



Source: ABS (2021)

Table 6.1: World trade in thermal coal

	Unit	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
World trade	Mt	1,036	1,077	1,098	1,101	1,088	1,071	1,071	0.6
Thermal coal imports									
Asia	Mt	811	856	878	885	876	864	833	0.4
China	Mt	210	216	212	198	189	180	146	-5.9
India	Mt	165	185	190	196	192	191	211	4.1
Japan	Mt	133	134	135	136	134	130	112	-2.8
South Korea	Mt	85	84	83	82	79	76	73	-2.5
Thermal coal exports									
Indonesia	Mt	390	422	423	418	407	394	388	-0.1
Australia	Mt	199	218	227	230	232	231	231	2.5
Russia	Mt	170	179	184	187	190	192	194	2.2
Colombia	Mt	55	68	75	80	80	80	80	6.4
South Africa	Mt	75	76	79	82	85	88	90	3.2
United States	Mt	20	22	24	24	20	20	20	-0.3

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

Source: International Energy Agency (2021); IHS Markit (2021); Department of Industry, Science, Energy and Resources (2021)

Table 6.2: Thermal coal outlook

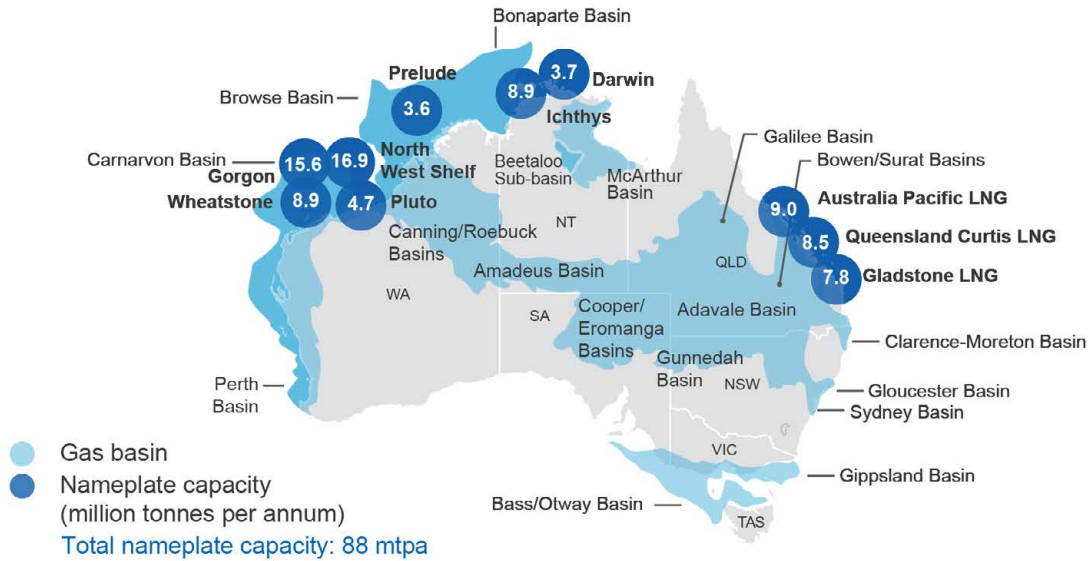
World	Unit	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
Contract prices ^b									
– nominal	US\$/t	69	68	70	76	74	67	63	-1.5
– real ^c	US\$/t	69	66	67	71	68	60	57	-3.1
Spot prices ^d									
– nominal	US\$/t	58	65	67	73	71	64	60	0.6
– real ^e	US\$/t	59	65	65	69	66	59	54	-1.6
Australia	Unit	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^z	2023–24 ^z	2024–25 ^z	2025–26 ^z	CAGR ^r
Production	Mt	268	250	276	281	282	282	281	0.8
Export volume	Mt	213	206	222	228	231	231	231	1.4
– nominal value	A\$m	20,376	14,898	16,364	18,177	19,946	18,484	16,441	-3.5
– real value ^h	A\$m	20,591	14,898	16,095	17,511	18,746	16,941	14,695	-5.5

Notes: **b** Japanese Fiscal Year (JFY), starting April 1, fob Australia basis. Australia–Japan average contract price assessment for steaming coal with a calorific value of 6700 kcal/kg gross air dried; **c** In current JFY US dollars; **d** fob Newcastle 6000 kcal net as received; **e** In 2020 US dollars; **f** Forecast; **h** In 2020–21 Australian dollars; **s** estimate

Source: ABS (2021) International Trade in Goods and Services, Australia, Cat. No. 5368.0; IHS (2020); NSW Coal Services (2021); Queensland Department of Natural Resources and Mines (2021); Company Reports; Department of Industry, Science, Energy and Resources (2021)

Gas

Australia's LNG projects and gas basins



Gas facts



LNG is produced by cooling natural gas to **-161°C**



LNG shrinks to **1/600th** the volume of natural gas



LNG accounted for **12%** of global gas demand in 2020



Natural gas accounted for **23%** of the world's primary energy mix in 2019

Global gas use by sector



20%
Industry



19%
Transport



22%
Residential



40%
Electricity

Australia's LNG



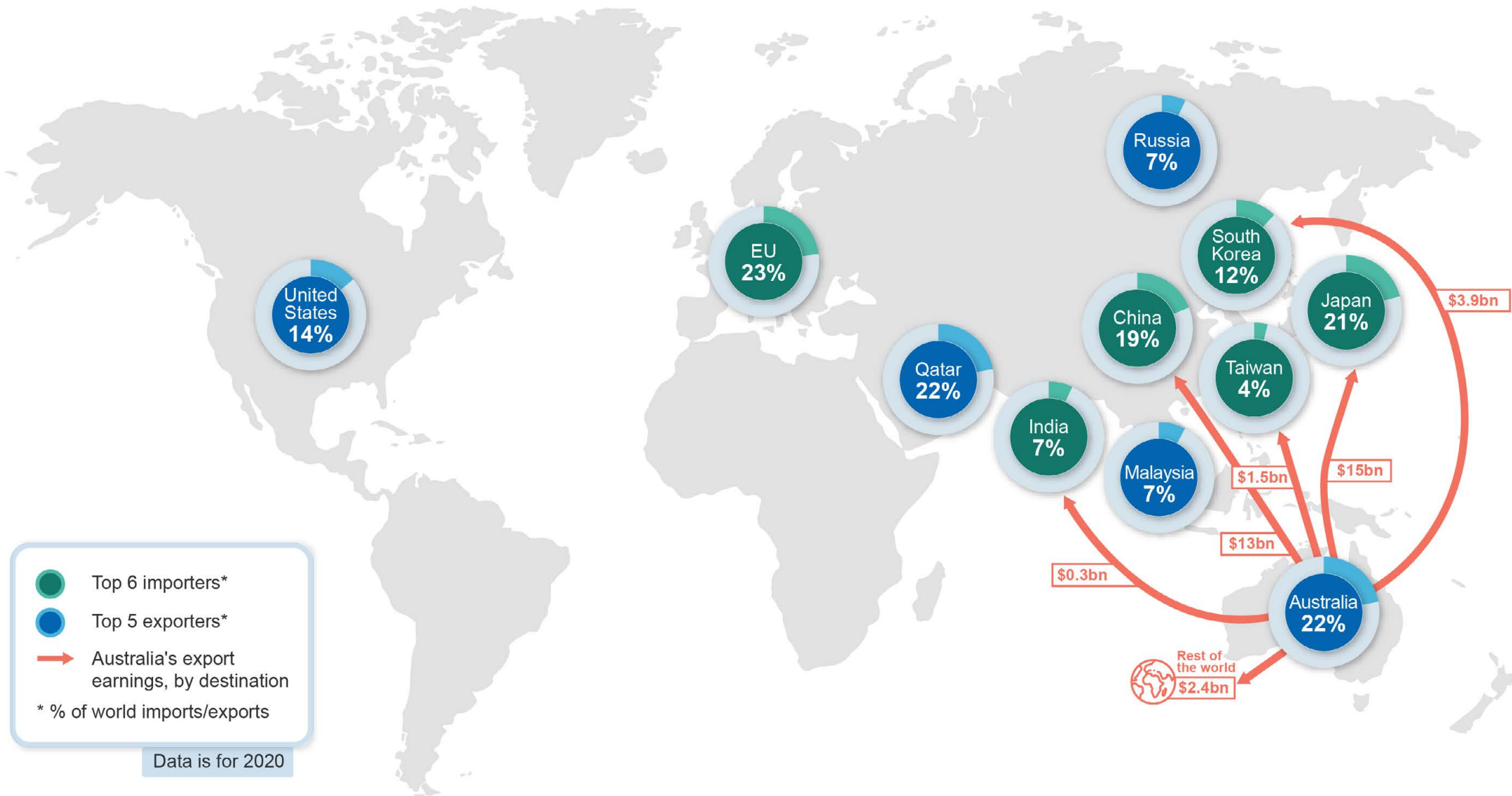
79m tonnes exported in 2019-20



\$48bn in export earnings in 2019-20



Around **3/4** sold on long-term contracts



7.1 Summary

- Asian LNG spot prices and oil-linked contract LNG prices are expected to increase modestly over the projection period, as the global LNG market remains well supplied and oil prices stabilise.
- Australian export volumes are forecast to decline to 78 million tonnes in 2020–21, due to technical issues at the Prelude and Gorgon LNG plants. Exports are then forecast to recover to 81 million tonnes in 2021–22, and remain around these levels out to 2025–26 (see [Australia section](#)).
- Australia’s LNG exports earnings (in real terms) are forecast to increase from \$33 billion in 2020–21 to \$45 billion in 2025–26, as prices recover.

7.2 World trade

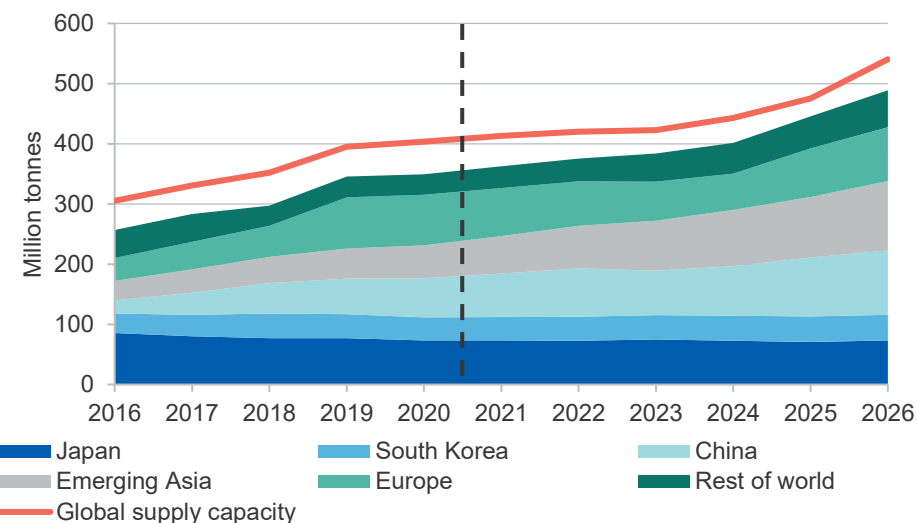
LNG trade to increase over the projection period

In 2020, global LNG trade reached 349 million tonnes, a modest increase of 1.0% (Figure 7.1). This improvement was in stark contrast to the strong growth from previous years, reflecting the impacts of the COVID-19 pandemic on LNG demand. In recent months, global LNG trade has picked up, driven by structural factors — such as the easing impacts of the COVID-19 pandemic and returning demand growth in emerging Asia — and seasonal factors — such as a colder-than-normal Northern Hemisphere winter.

Global LNG trade is expected to increase in 2021 and 2022, growing by about 6.0% a year. Between 2023 and 2026, trade is assumed to grow by an average annual rate of 3.7%. Ongoing demand growth is expected to result in a tightening of the global LNG market, as demand approaches supply capacity.

Nonetheless, given the large scale expansion of global LNG capacity in recent years, demand is expected to remain short of total supply throughout the projection period.

Figure 7.1: LNG demand and world supply capacity



Source: Nexant (2021) World Gas Model; Department of Industry, Science, Energy and Resources (2021)

7.3 World imports

Japanese LNG imports to fall as nuclear power returns

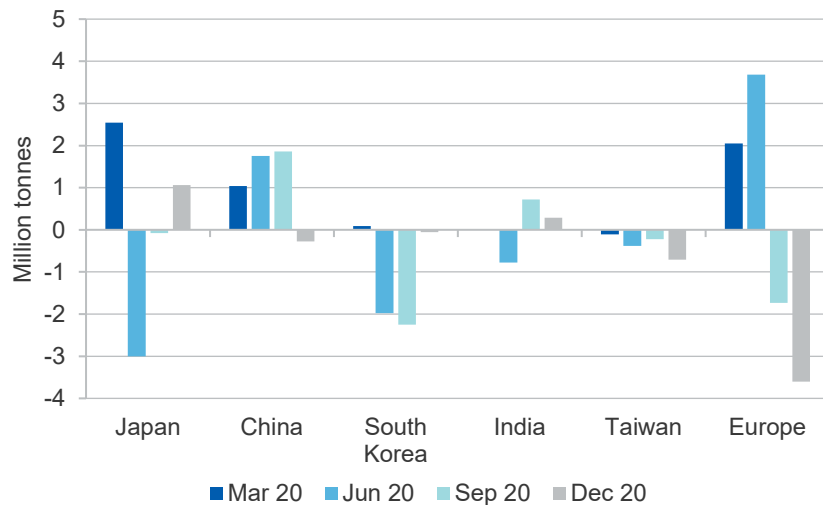
Japan imported 75 million tonnes of LNG in 2020, 4.7% lower than in 2019 (Figure 7.2). Import losses were related to the impact of the COVID-19 pandemic, though the impacts were moderated by coal-to-gas switching, nuclear plant outages and strong heating demand in the lead up to an exceptionally cold winter.

Nuclear generation is estimated to have hit a 3-year low during the 2020–21 winter period. At the time of writing, only nine of Japan’s 42 nuclear reactors have gained approval to restart since Fukushima in 2011. Another 16 reactors are currently seeking approval for restart, and could be online by 2022.

Higher nuclear generation is expected to cause Japan’s LNG imports to fall in 2021 and 2022, and will more than offset any increases to LNG imports from the assumed economic recovery. However, the pace of

increase in nuclear generation remains uncertain, and subject to potential delays and slippages. LNG imports are expected to continue declining over the rest of the outlook period, due to energy efficiency improvements and higher nuclear output. Imports late in the projection period are also likely to be negatively affected by Japan's pledge to achieve net-zero emissions by 2050. In 2026, Japan's LNG imports are projected to fall to 70 million tonnes, down 7.7% from 2020.

Figure 7.2: Quarterly LNG imports, year-on-year change

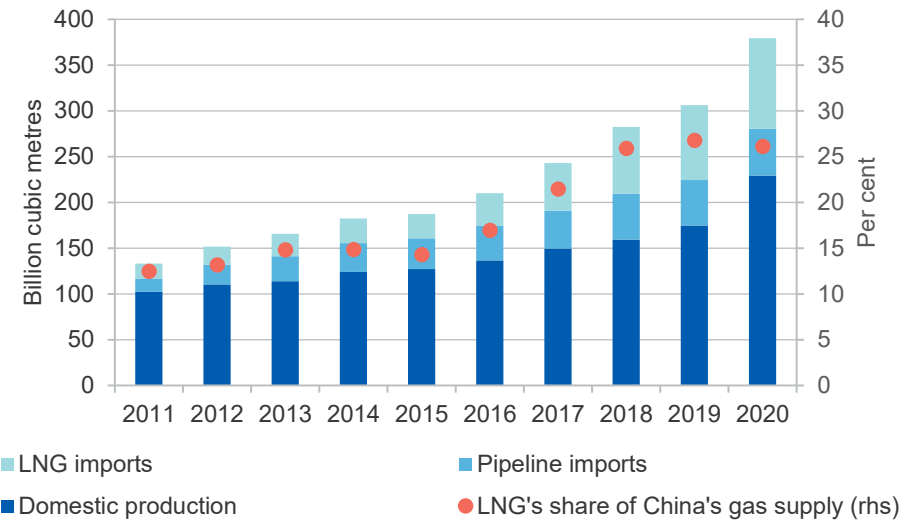


Source: Bloomberg (2021)

China to become the world's largest LNG importer

China's LNG imports increased by 15% in 2020, reaching 66 million tonnes — making it the world's second largest LNG importing country. China's gas consumption was resilient in 2020, driven by the industrial and residential sectors, and ongoing coal-to-gas switching. The share of LNG in Chinese gas demand remained historically high in 2020, reflecting low LNG prices (Figure 7.3). Australia accounted for the largest share of China's LNG imports in 2020, at 43%. However, in 2020 imports from Australia were 5.2% lower year-on-year.

Figure 7.3: China's gas supply by source

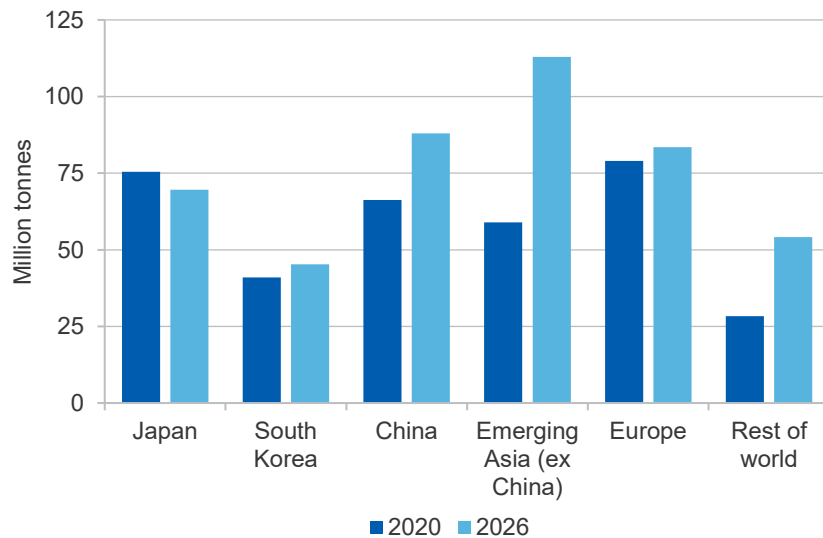


Source: Bloomberg (2021); National Bureau of Statistics of China (2021) General Administration of Customs

Chinese imports of US LNG resumed in April 2020, as a result of the US-China Phase One trade deal, and reached 1.1 million tonnes in December. This follows virtually no LNG imports from the US in 2019, due to Chinese tariffs imposed amidst rising trade tensions. Chinese targets for purchases of US energy products are expected to remain in place over the projection period. As such, future US-China diplomatic relations present risks to Chinese LNG demand from other exporters, including Australia.

Chinese LNG imports are expected to remain a key driver of global LNG demand growth, rising by an average 9.7% annually over the next two years. China is then expected to become the world's largest LNG importer in 2022, overtaking Japan. China's 14th Five Year Plan indicates that gas will play an important role in the country's energy transition to meet its 'carbon-neutral by 2060' pledge. Between 2023 and 2026, Chinese LNG demand growth is projected to moderate, though it will likely still exceed other major importers. Imports are projected to be 88 million tonnes in 2026, up from 66 million tonnes in 2020 (Figure 7.4).

Figure 7.4: World LNG import projections



Notes: Emerging Asia includes India.

Source: Nexant (2021) World Gas Model; Department of Industry, Science, Energy and Resources (2021)

Gas consumption is expected to be supported by ongoing gas market reforms and by supportive policies designed to increase gas use in the industrial and residential sectors. The recent creation of PipeChina — a national midstream company that operates pipelines, terminals and storage facilities — is expected to support growth in LNG imports.

Over the projection period, China's LNG import demand is expected to face intensifying competition from domestic sources and pipeline imports. Despite China facing geological challenges in tapping into its extensive gas reserves, domestic gas output is expected to increase due to supportive government policies (the 14th Five Year Plan's energy resource security strategy includes increased domestic gas production). Pipeline imports are also expected to grow, in large part due to the Power of Siberia pipeline that opened in December 2019. The pipeline has

nameplate capacity of 38 billion cubic metres of gas a year — equivalent to around 28 million tonnes of LNG.

South Korea's LNG demand to be supported by government policies

South Korea's LNG imports increased strongly in the last few months of 2020, supported by temporary nuclear and coal power plant outages, and strong buying ahead of winter. This follows relatively weak LNG imports earlier in 2020, when imports were weighed down by both the impacts of the COVID-19 pandemic on power demand, and by the restart of nuclear power plants. Over the full year, South Korea's LNG imports declined by 2.3% to 41 million tonnes.

South Korea's LNG imports are forecast to stage a modest recovery in 2021 and 2022, rising by about 1.5% a year. Although gas demand is expected to be negatively affected by growing nuclear capacity, it is also expected to benefit from government policies that favour gas usage over coal. The transition away from coal is expected to benefit LNG imports in the medium term, as the government plans to convert a quarter of coal-fired capacity to gas by 2031. Although the South Korean government's recent net-zero pledge is likely to affect gas consumption beyond the projection period, gas is likely to play an important role in the energy transition. South Korean LNG imports are projected to increase from 41 million tonnes in 2020 to 45 million tonnes in 2026.

Taiwan's LNG demand has held steady

Taiwan's LNG demand was relatively resilient in 2020 despite the impacts of COVID-19, supported by increases in gas-fired power generation. As the impacts of COVID-19 ease, LNG import growth is expected to rise, driven by supportive government policies. The Taiwanese government is aiming to increase the share of gas-fired power generation in its electricity mix, from the current share of 35% to 50% by 2025. Taiwan's LNG imports are projected to grow by 7.0% a year to reach 24 million tonnes by 2026.

India is expected to be a major source of LNG demand growth

India's LNG imports were volatile in 2020, negatively affected by the lockdowns earlier in the year. In the second half of 2020, imports rose

markedly due to the opportunistic buying of cheap LNG on the spot market, predominantly from Qatar. India's LNG imports increased by 14% to 35 million tonnes in 2020, and are forecast to increase further to 36 million tonnes in 2021. Growth in 2021 is likely to be moderated by the recent rally in LNG spot prices, since India is an extremely price sensitive buyer of LNG. Over the projection period, Indian imports are expected to rise, increasing by an average 2.9% annually between 2022 and 2026. However, the timing and pace of this growth is highly uncertain. The Indian government has ambitions to lift the share of gas in its energy mix from about 6% now to 15% in 2030. Its success will depend on a range of factors, including gas market reforms, infrastructure development, and higher domestic gas output. Gas import growth will also depend on the refining and fertiliser sectors, with both sectors having what some commentators see as ambitious growth targets.

Emerging Asia to become more influential in global LNG markets

Other south and southeast Asian economies have been a major source of demand growth in the second half of 2020, despite the impacts of COVID-19. Customs data shows Pakistan's LNG imports in the second half of 2020 rose by 11% year-on-year, Bangladesh's by 5.5%, and Thailand's by 8.4%.

Over the projection period, emerging Asian imports are expected to increase due to declining domestic production, the expansion of gas-fired power generation and new LNG infrastructure developments. Individually, these countries are relatively small importers of LNG, although collectively they are expected to account for a growing share of global LNG demand going forward. The region (including India) is forecast to import 113 million tonnes of LNG by 2026, 91% higher than 2020 volumes (Figure 7.5).

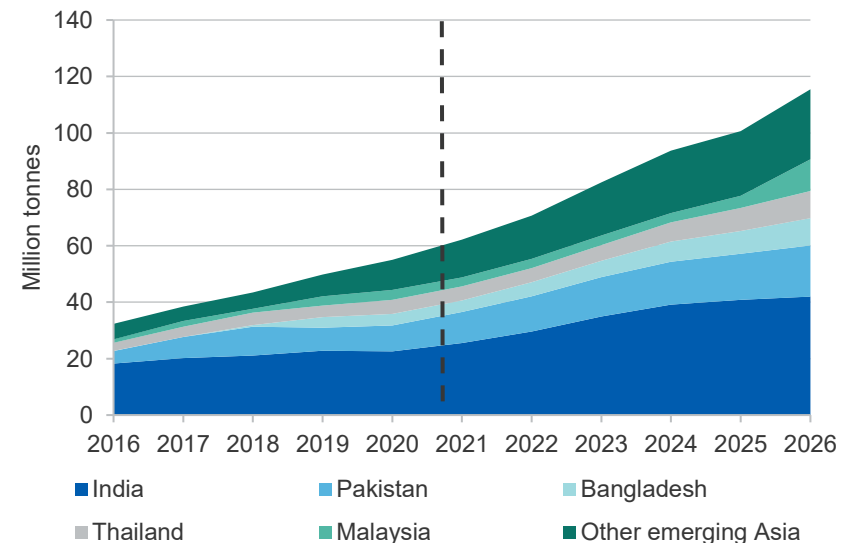
Europe's LNG imports have slowed

In recent years, Europe has played an important role in balancing the global LNG market, by having extensive storage capacity and liquid gas hubs to absorb large volumes of LNG. However, in recent months, the region has absorbed fewer LNG cargoes, due to stronger Asian demand and lower US exports.

Europe's LNG imports are forecast to decline over the next two years, as the global LNG market tightens. The ramp up of two new gas pipelines is also expected to place downward pressure on LNG imports. The Trans Adriatic Pipeline began commercial operations in November 2020, and has an annual nameplate capacity of 10 billion cubic metres (about 7.4 million tonnes of LNG). The other European gas pipeline, Nord Stream 2, was expected to begin production by 2021, but could now face delays due to geopolitical tensions. Nord Stream 2 is a 55 billion cubic metre pipeline (40 million tonnes) that will transport gas from Russia to Germany. Any delays for Nordstream 2 are likely to put upward pressure on European LNG imports.

European imports are forecast to fall from 79 million tonnes in 2020 to 70 million tonnes in 2022, reflecting significantly higher pipeline gas imports. Later in the outlook period, European imports are projected to increase to 84 million tonnes as pipeline gas imports fall slightly.

Figure 7.5: LNG imports from emerging Asian countries



Source: Nexant (2021) World Gas Model; Department of Industry, Science, Energy and Resources (2021)

7.4 World exports

Weak economic conditions have resulted in deferrals of project FIDs

At the end of 2020, global LNG capacity was estimated at around 400 million tonnes an annum (mtpa), with another 125 mtpa of capacity under construction or sanctioned for development. These new projects will contribute to significant growth in global LNG capacity over the next few years, albeit at a slower pace than in recent years.

There is over 900 mtpa of proposed LNG capacity in the pre-FID stage, though much of this is not likely to proceed. There were pre-COVID-19 pandemic expectations that about 50 mtpa of new LNG capacity would be approved in 2020. However, weak spot LNG and oil prices have since resulted in the deferral of most of these FIDs. Only one liquefaction project was approved in 2020 — Sempra Energy's 2.5 mtpa Costa Azul project in Mexico. FID deferrals could impact on the timing of the next wave of LNG capacity additions, which could result in a tighter global LNG market towards the end of this decade.

US to be a key driver of export growth

The recent recovery in global exports has been largely driven by the US. After falling significantly between June and September 2020, US LNG exports have rebounded. US exports were first constrained by weak global gas prices relative to the Henry Hub price, which reduced the competitiveness of US LNG exports to Asia and Europe. Later in the year, supply disruptions in other major exporters increased Asian and European prices, and increased the competitiveness of US exports. As a result, US exports increased dramatically, reaching a record high in December 2020. For the full year, US LNG exports increased by 25% in 2020 to reach 48 million tonnes.

In early 2021, US gas production has been affected by the Texas winter storm, which caused a significant amount of production capacity to be shut-in. These storms also affected gas-fired power plants.

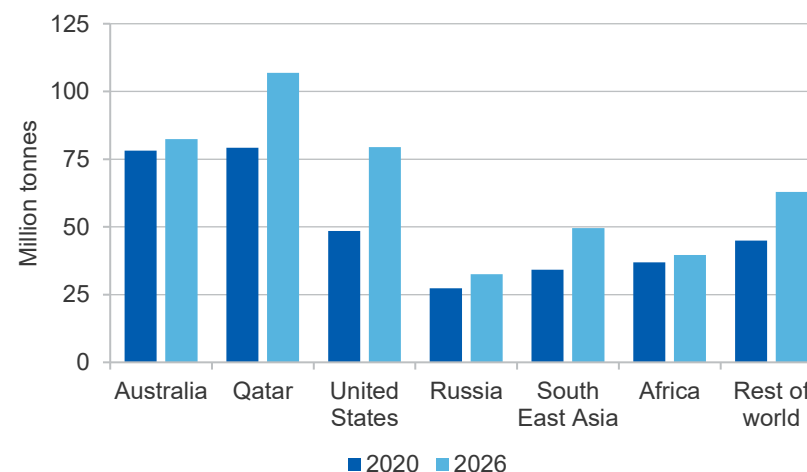
US LNG exports are forecast to reach 58 million tonnes by 2022, as new LNG projects continue to ramp up. Around 15 mtpa of US LNG capacity is

expected to commence operations by the end of 2021, and another 30 mtpa of LNG capacity is expected to commence operations between 2023 and 2025. US LNG exports are projected to reach 80 million tonnes by 2026 (Figure 7.6).

Qatar's exports have been resilient

Qatar's LNG exports were largely resilient in 2020. Shipping data indicates that Qatar may have been the world's largest LNG exporter in 2020, reclaiming the title from Australia. However, given the marginal difference between the two country's exports and uncertainty surrounding the precise level of Qatar's LNG exports, an accurate assessment of totals is difficult.

Figure 7.6: World LNG export projections



Source: Nexant (2021) World Gas Model; Department of Industry, Science, Energy and Resources (2021)

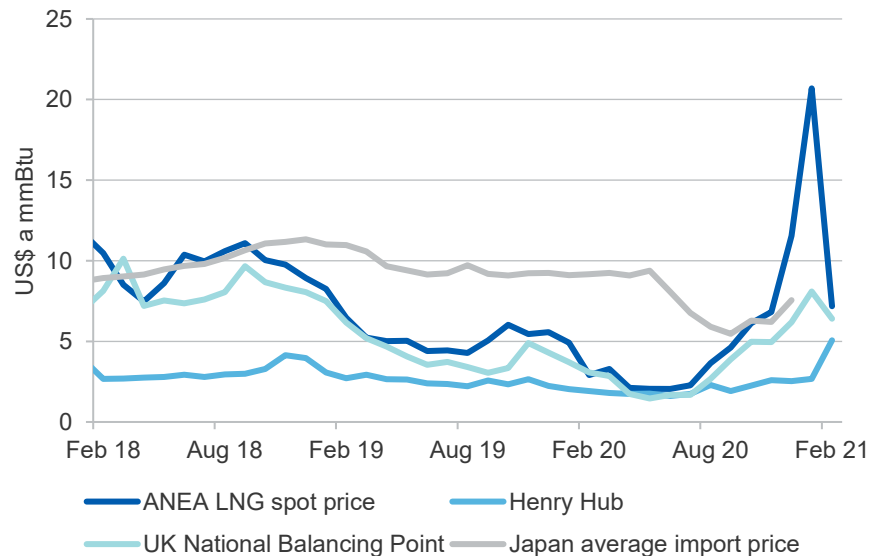
Qatar's LNG exports are forecast to be relatively steady in 2021, hovering around 79 million tonnes. However, later in the projection period, Qatar's LNG exports are expected to increase significantly, as a result of the \$US29 billion North Field East project, anticipated to be completed in late 2025. This project has a nameplate capacity of 33 million tonnes, lifting Qatar's export capacity to 110 million tonnes. Qatar has reaffirmed its intention to increase LNG capacity beyond the 126 mtpa target by 2027.

7.5 Prices

LNG spot price volatility to ease

The Asian LNG spot price has swung dramatically in the past year, setting both record highs and lows. Prices increased from a historically low US\$1.68 a mmBtu on 30 April 2020 to reach an all time high of US\$39.72 a mmBtu on 13 January 2021. This price growth was gradual at first, as the impacts of COVID-19 on gas consumption eased. However, prices shot up in December 2020 and early-January 2021, as an exceptionally cold Asian winter coincided with supply disruptions affecting several major exporters. Prices spiked as Asian buyers turned to the spot market to source cargoes, although traded volumes remained relatively low. The spot price averaged an estimated US\$12.05 a mmBtu (A\$15.85 a GJ) in the March quarter 2021, 48% higher than the December quarter, and 225% higher year-on-year.

Figure 7.7: Global gas and LNG prices, monthly

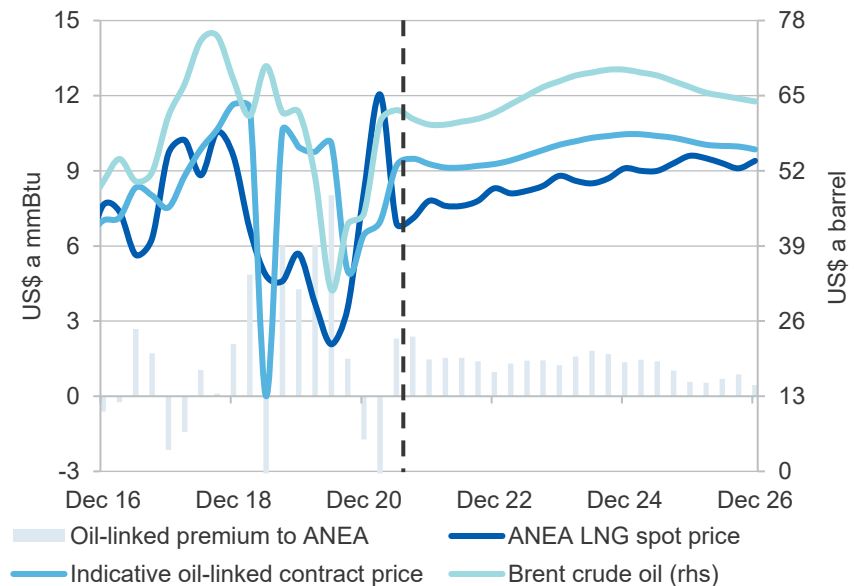


Notes: ANEA is the Argus Northeast Asia spot price. LNG prices are DES (Delivered Ex Ship), which include shipping and insurance.

Source: Argus (2021); Bloomberg (2021)

In early 2021, regional gas prices have diverged, driven by regional cold snaps and logistical difficulties in diverting cargoes to higher price markets (Figure 7.7). The difference between Asian spot prices and Henry Hub prices reached a record high in January 2021, as congestion in the Panama Canal limited the opportunity for US exporters to meet demand from Asian buyers. US and European prices have both risen sharply, as cold weather lifted heating demand for gas. US prices have also risen as a result of the Texas winter storm, which shut in large volumes of gas production. There have also been a number of supply disruptions at major exporters — including Australia, Qatar and the US — which have facilitated strong price gains.

Figure 7.8: LNG spot and contract prices, quarterly

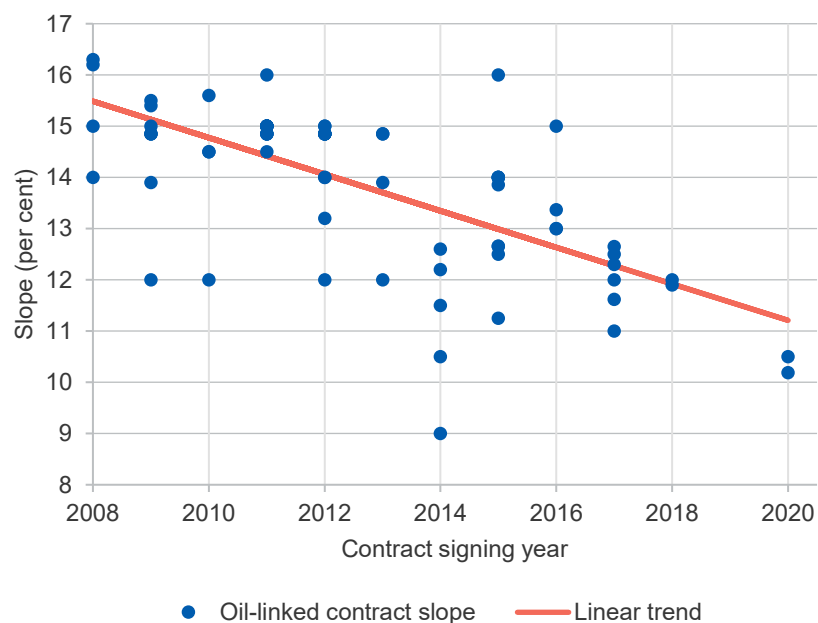


Notes: ANEA is the Argus Northeast Asia spot price. LNG prices are DES (Delivered Ex Ship), which include shipping and insurance. The long-term oil-linked contract price is indicative, and is estimated at 14% of the 3-month lagged JCC oil price plus shipping. The oil-linked premium to ANEA represents the differential between these two prices.

Source: Argus (2021); Bloomberg (2021); Department of Industry, Science, Energy and Resources (2021)

The Asian LNG spot price is forecast to average US\$6.90 a mmBtu in the June quarter 2021, as heating demand eases. Over the rest of 2021, prices are expected to stabilise at relatively low levels, as supply disruptions facing major exporters recede. Spot prices are expected to increase gradually between 2022 and 2026, as global consumption growth resumes following the largest impacts of the COVID-19 pandemic (Figure 7.8). Demand from China and emerging Asian economies is expected to grow particularly fast. However, the global LNG market is also expected to remain well supplied — likely limiting the magnitude of any price rally — as US LNG exports ramp up further over the next two years.

Figure 7.9: Oil-linked contract slopes by signing year



Notes: The oil-linked contract slope measures the extent to which the LNG contract price changes with respect to oil price changes. Only shows contracts where data is available.
 Source: BloombergNEF (2021) Global LNG contracts database; Nexant (2021) World Gas Model

Recent oil price recovery to drive LNG contract prices higher

Almost 70% of the LNG traded in Asia is sold via long-term contracts which link the price of LNG to the price of oil (commonly the Japanese customs-cleared crude price), typically lagged by around three to six months (depending on contractual arrangements). In the March quarter 2021, oil prices recovered to above US\$60 a barrel, as OPEC+ supply cuts resulted in a draw down in oil stocks. This follows the multi-year record low oil prices recorded in the first half of 2020. Due to the contract lag of several months, the oil price recovery will be reflected in June quarter 2021 LNG contract prices. Oil prices are expected to remain relatively steady over the projection period, as higher production negates recovering consumption (see the *oil* chapter).

If current differentials between LNG spot and long-term contract prices persist, contract prices are likely to come under downward pressure. Contracts covering around 30% of global LNG demand are set to expire by 2025. As these contracts expire, low spot prices relative to oil-linked contract prices may encourage buyers to push for shorter, more flexible, or more favourably-priced contracts. Buyers may also push for lower oil-linked contract slopes, continuing the trend of recent years (Figure 7.9).

7.6 Australia

Australia's export volumes up, earnings down in the December quarter

In the December quarter 2020, Australia's LNG export earnings increased to \$7.3 billion, up by 21% quarter-on-quarter. Despite this, values were 40% lower year-on-year, as weak oil-linked contract prices affected export earnings. Almost three-quarters of Australian LNG is sold via long-term contracts that link the price of LNG to the price of oil with a lag of around three to six months, depending on contractual arrangements. The lag between oil price movements and its impact on LNG prices means that the sharp decline in oil prices that occurred between March and May 2020, was reflected in the export earnings from the September quarter 2020 and, to a lesser extent, the December quarter 2020.

Australia's LNG export volumes recovering

LNG export volumes rose by 3.5% year-on-year and 12% quarter-on-quarter in the December quarter 2020. Exports were driven up by strong Asian demand ahead of the Northern Hemisphere winter. Exports are expected to increase further in the March quarter 2021 as production resumes at Prelude. The Prelude FLNG project was shut in February 2020, as a result of technical issues. Production resumed in January 2021, and has been ramping up since. The Prelude FLNG project shipped its first cargo in June 2019, however has not yet produced at its full annual nameplate capacity of 3.6 million tonnes.

Gorgon's output has also been disrupted, with the shutdown of Train 2 initially extended to October, and then to 23 November, after cracks were discovered in its heat exchangers. After a period of uncertainty, a shutdown of the whole plant was avoided in favour of phased shutdowns. Train 1 was taken offline for inspections in November 2020, and issues similar to those affecting Train 2 were found in January 2021. Repairs to Train 1 were completed late in the March quarter 2021, and Train 3 is expected to be taken offline for inspections in the June quarter 2021.

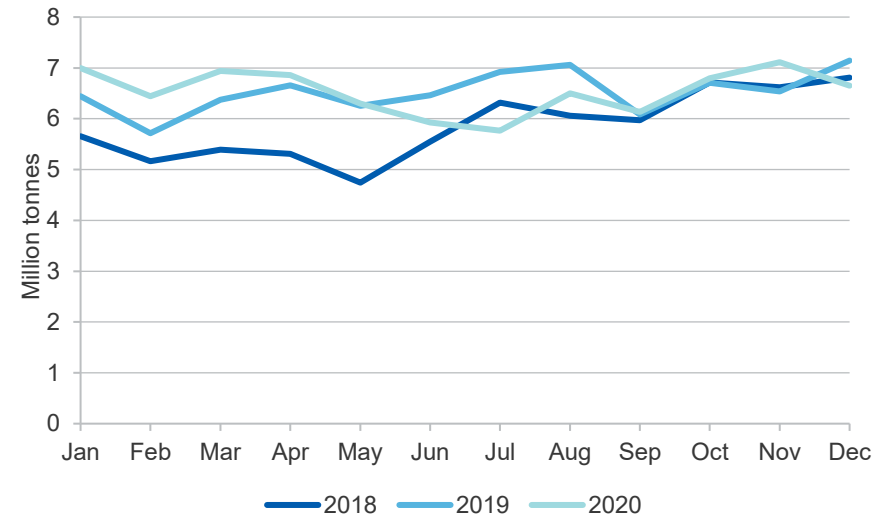
LNG export volumes expected to return to above pre-COVID-19 levels

Australia's LNG exports are expected to decline from 79 million tonnes in 2019–20 to 78 million tonnes in 2020–21, reflecting the impacts of the COVID-19 pandemic on demand, as well as technical issues at the Prelude and Gorgon LNG plants (Figure 7.10). A gas processing unit was shut at Wheatstone in early December, after an anomaly was detected during routine inspections. These technical problems were resolved in the March quarter 2021. LNG exports are forecast to rebound to around 81 million tonnes in 2021–22. The rebound reflects a recovery in demand (as economies return to growth), an assumed resolution of technical issues, and Prelude ramping up towards its nameplate capacity.

In January 2021, Santos announced an FID for an infill drilling program in the Bayu-Undan field. This program will extend output at the Darwin LNG facility, which was previously expected to halt production in 2022. This investment decision is expected to narrow the time between its depletion

and start-up of the Barossa backfill project. In early December 2020 Santos deferred the FID for the Barossa project for a second time, to 2021, citing a preference to first finalise offtake agreements.

Figure 7.10: Australia's monthly LNG shipments



Source: Bloomberg (2021)

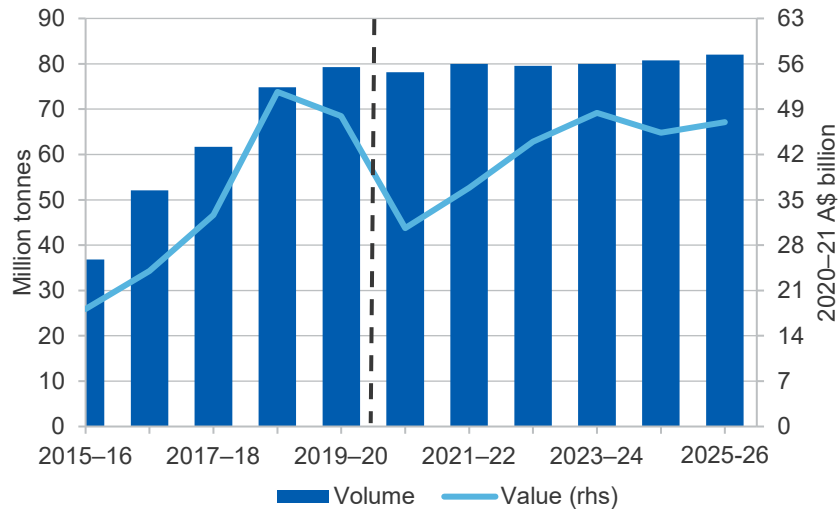
Capacity utilisation at the North West Shelf (NWS) is expected to decline in 2022, as gas from existing fields is depleted. NWS has secured short-term infill from Pluto and Waitsia, two projects with shorter lead times. However, large scale backfill projects are required for the longer term. Given the complex commercial arrangements associated with the NWS and high capital costs, there is potential for further backfill project delays. Browse is earmarked as backfill to the NWS, however this project has faced FID deferrals until at least 2023 due to weak market conditions.

Higher prices to lift Australia's LNG export earnings

Australia's LNG export earnings are forecast to fall sharply in 2020–21, to \$33 billion, from \$48 billion in 2019–20 (Figure 7.11). The decline in export earnings is expected to be primarily driven by weak contract prices and, to a lesser extent, lower export volumes. Export earnings are forecast to

increase to \$43 billion in 2021–22 (in 2020–21 dollars), tracking an expected rise in contract and spot prices, as well as a recovery in export volumes. Over the rest of the projection period, LNG export earnings (in 2020–21 dollars) are projected to vary between \$44 and \$47 billion.

Figure 7.11: Australia’s LNG exports



Source: ABS (2021); Department of Industry, Science, Energy and Resources (2021)

Uncertainty surrounds the next wave of investment

The outlook for the next wave of investment in Australian LNG projects is shrouded by considerable uncertainty, with weak market conditions resulting in FID deferrals (see the *Resources and Energy Major Projects 2020* publication). Most LNG projects in the investment pipeline are backfill

projects required to support the ongoing operation of existing LNG facilities. The proposed Scarborough to Pluto LNG expansion — where a 5 mtpa train would be added to Pluto — is the only substantial expansion to Australia’s LNG capacity in the investment pipeline.

Over the projection period, it is likely that at least one import terminal will reach a FID and commence importing LNG. The five potential projects are concentrated in south eastern Australia, and are aiming to start commercial operation by 2022 or 2023. Despite the possible shortage in the east coast market over the short term, it is unlikely that all five projects currently under consideration will proceed.

Revisions to the outlook

Since the December 2020 *Resources and Energy Quarterly*, the forecast for Australia’s LNG export earnings has been revised up by around \$1.5 billion in 2020–21 and \$6.2 billion in 2021–22 (nominal terms). These increases are mostly due to significantly higher oil-linked contract and spot prices. Export volumes in 2020–21 and 2021–22 have also been revised up slightly.

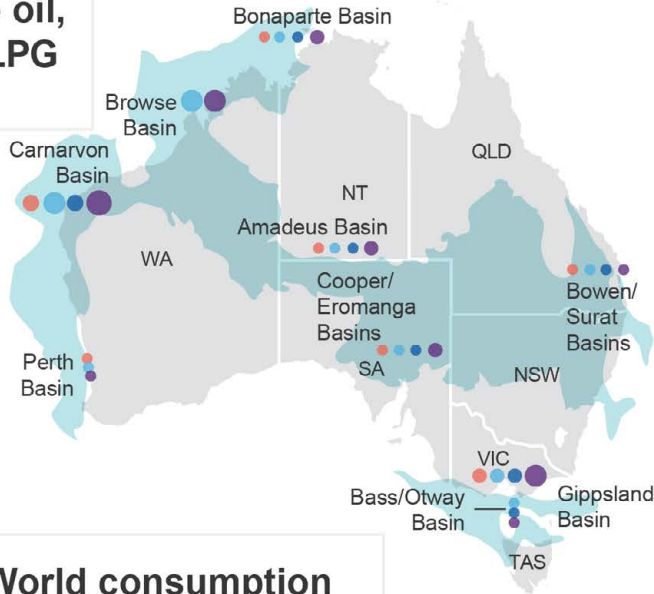
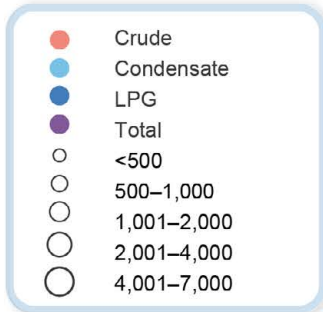
Table 7.1: Gas outlook

World	Unit	2020	2021 ^f	2022 ^f	2023 ^f	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
JCC oil price ^a									
– nominal	US\$/bbl	45.4	61.0	60.9	65.6	69.1	67.9	64.8	6.1
– real ^h	US\$/bbl	46.3	61.0	59.6	62.8	64.7	62.1	57.9	3.8
Asian LNG spot price ^g									
– nominal	US\$/MMBtu	4.4	8.5	7.8	8.4	8.7	9.2	9.3	13.5
– real ^h	US\$/MMBtu	4.5	8.5	7.7	8.0	8.2	8.4	8.3	11.0
Gas production ^s	Bcm	3,937	4,097	4,200	4,250	4,345	4,441	4,499	2.3
Gas consumption ^s	Bcm	3,945	4,116	4,189	4,258	4,344	4,443	4,511	2.3
LNG trade ^{ds}	Mt	349	369	392	397	410	431	453	4.4
Australia	Unit	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^f	2023–24 ^z	2024–25 ^z	2025–26 ^z	CAGR ^r
Production ^b	Bcm	157.6	153.7	160.1	161.1	162.4	163.2	161.3	0.4
– Eastern market	Bcm	57.5	55.7	54.4	54.6	54.5	53.8	57.2	-0.1
– Western market	Bcm	85.7	82.5	90.7	91.4	90.4	89.4	84.2	-0.3
– Northern market ^c	Bcm	14.4	15.5	15.0	15.0	17.5	20.0	20.0	5.6
LNG export volume ^d	Mt	79.2	78.0	81.4	82.7	81.8	81.0	81.0	0.4
– nominal value	A\$m	47,525	32,525	43,702	45,968	50,003	51,008	49,811	0.8
– real value ^e	A\$m	48,028	32,525	42,986	44,285	46,994	46,749	44,520	-1.3
LNG export unit value ^g									
– nominal value	A\$/GJ	11.4	7.9	10.2	10.5	11.6	11.9	11.6	0.4
– real value ^e	A\$/GJ	11.5	7.9	10.0	10.1	10.9	10.9	10.4	-1.6
– nominal value	US\$/MMBtu	8.1	6.2	8.4	8.6	9.2	9.4	9.2	2.3

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; **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 2020–21 Australian dollars; **f** Forecast; **g** 1 MMBtu is equivalent to 1.055 GJ; **h** In 2021 US dollars; **r** Average annual growth between 2020 and 2026 or 2019–20 and 2025–26; **z** Projection.
Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021); Company reports; Nexant (2021) World Gas Model

Oil

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



World consumption



29%
Diesel



26%
Gasoline



12%
LPG and Ethane



12%
Other



8%
Aviation turbine fuel



7%
Fuel oil

Oil facts



Carnarvon basin produces around **2/3 of Australia's crude & condensate**



Brent spot price ranged from **US\$17–86 a barrel**, in the last 5 years



Around 27% of refinery feedstock is **domestically produced**

Australia's oil



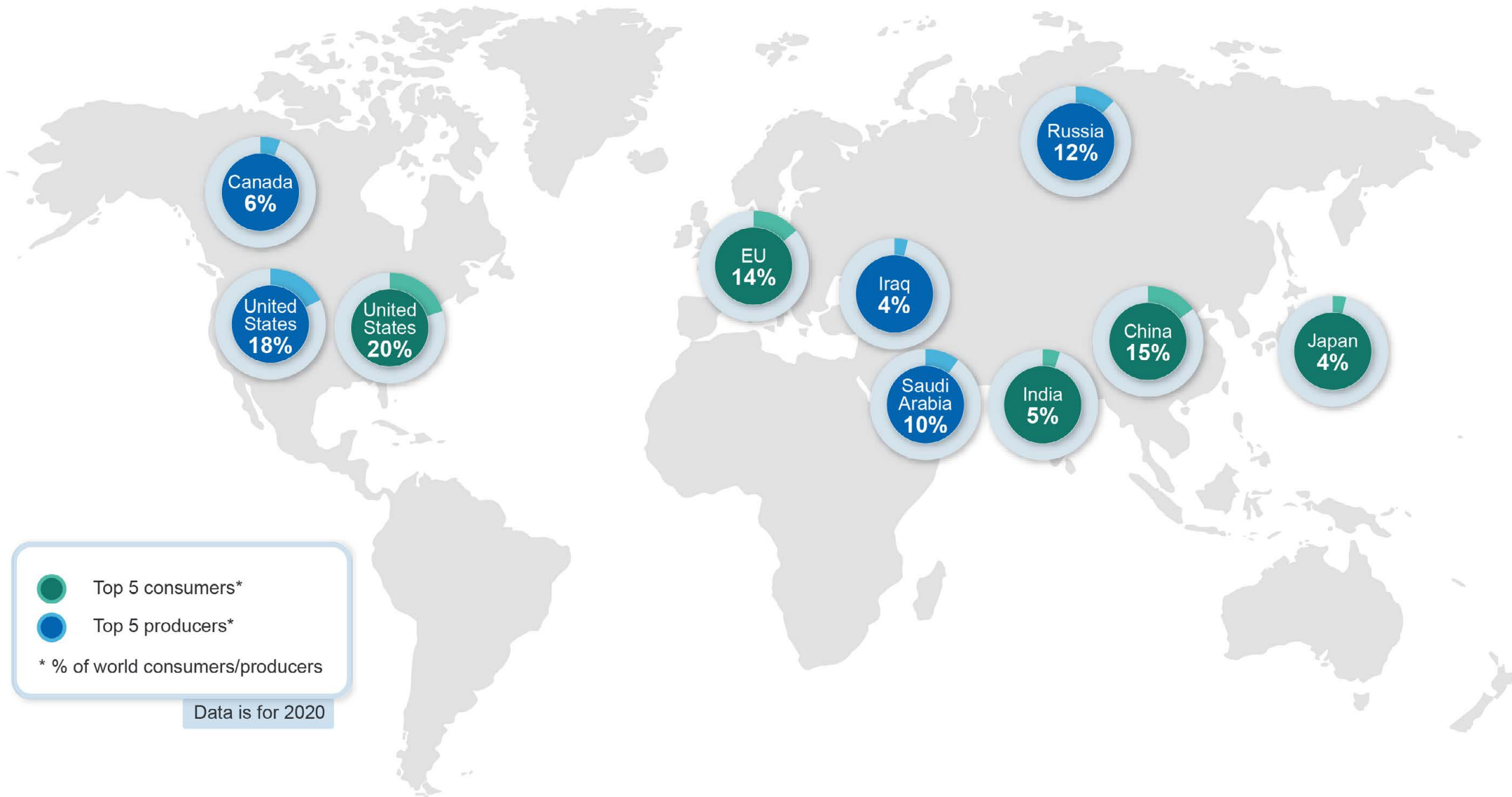
Holds **0.3%** of the world's oil resources



Oil exports worth **\$9.0b** in 2019-20



Accounts for **0.3%** of oil production



8.1 Summary

- Oil prices are forecast to average US\$61 a barrel in 2021, significantly higher than 2020, when prices were severely affected by COVID-19. Over the medium term, prices are projected to remain around US\$60 a barrel in real terms, as higher production offsets consumption growth.
- Australian crude oil and condensate exports are projected to remain relatively flat, as a result of the numerous FID deferrals during 2020 (see [Australia section](#)).
- Australian export earnings (in real terms) are projected to increase from \$7.7 billion in 2020–21 to \$10 billion in 2025–26, as prices recover.

8.2 World Consumption

Aviation travel expected to constrain oil consumption

Oil consumption in 2020 declined by 6.7% to 93 million barrels a day. This was the largest historical decline in volume terms, and the first recorded decline since 2009. Consumption fell in most countries, as COVID-19 containment measures impacted road and air travel and industrial production. World oil consumption was lowest in the June quarter, however the recovery has been unsteady and uneven across countries. In some cases, containment measures have persisted as countries struggle to bring the pandemic under control, or have been reintroduced to address subsequent COVID-19 waves.

Oil consumption is forecast to increase by 1.8% in 2021, reaching 95 million barrels a day. A large proportion of this recovery is due to higher transport demand. Road activity was affected for much of 2020, declining by around 50% in some major cities in April. Since then, the recovery has been moderated as COVID-19 spread and as containment measures have lingered or been reintroduced. In recent months, Northern Hemisphere road activity has been affected by persistently high COVID-19 cases in the US and a resurgence in COVID-19 cases in the EU. In early 2021, the Chinese government discouraged non-essential travel over the Lunar

New Year. Travel over the Lunar New Year was higher than severely affected 2020 levels, although it remained much lower than 2019 levels.

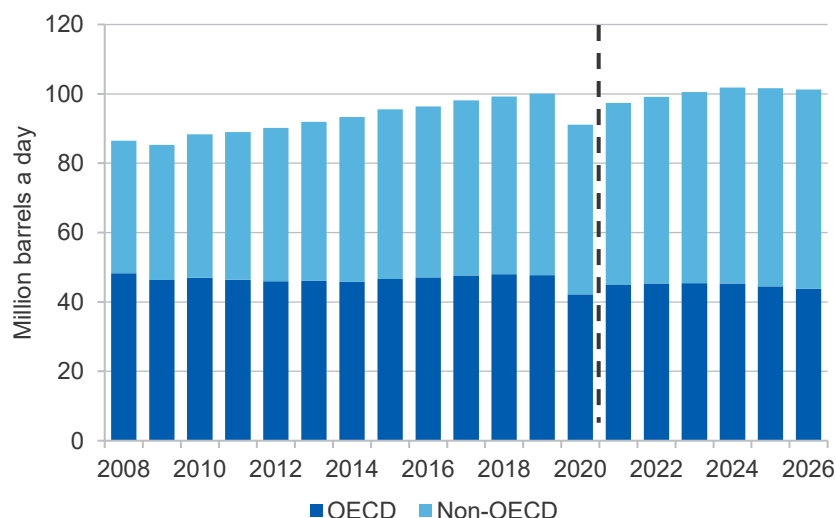
The recovery in aviation demand was much more muted than road travel during 2020, and this sluggish growth is expected to persist over the outlook period. International air travel fell by around three-quarters in 2020, much greater than domestic air travel, which declined by around half. The significant decline in international travel severely affected global oil consumption in 2020, as around two-thirds of global passenger traffic is from international travel. Over the projection period, international air travel is expected to increase gradually. This growth is first expected through the establishment, and widening, of travel bubbles. Later in the outlook period, international air travel is expected to recover as vaccine doses are administered around the world. However, there are likely to be some lingering impacts from the COVID-19 pandemic, as consumer confidence remains somewhat affected. Domestic air travel is expected to rise gradually over the projection period, as governments continue easing restrictions on internal travel. The International Air Transport Association expects that global passenger traffic will not return to 2019 levels until 2024.

Oil consumption for the manufacturing of plastic and other petrochemicals has recovered strongly from the COVID-19 induced decline in the first half of 2020. This reflects the smaller consumption impacts compared to other elements of oil consumption and the sharp recovery in global industrial production. Growth over the outlook period is expected to be moderate, and broadly in line with industrial production growth (see the *macroeconomic outlook* chapter).

Some countries have chosen to capitalise on low prices to fill up their strategic reserves. Stock accumulation appears to have ended in the June quarter 2020, with OPEC+ supply restraint and constrained production in other producers leading to stocks being drawn down in the second half of 2020 and the March quarter 2021.

There may be some behavioural shifts once the COVID-19 pandemic recedes that will have material impacts on the oil market. This may occur through a shift towards working from home, avoiding public transport, and lingering impacts on long haul air travel. This raises the level of uncertainty for oil consumption late in the projection period. In 2022, consumption is forecast to rise by 3.7% to 99 million barrels a day (Figure 8.1). Consumption is projected to reach 102 million barrels a day in 2024, before declining marginally to 101 million barrels in 2026.

Figure 8.1: OECD and non-OECD oil consumption



Source: Department of Industry, Science, Energy and Resources (2021); International Energy Agency (2021)

OECD consumption to return to 2019 levels

The COVID-19 pandemic and the associated containment measures have significantly disrupted OECD oil consumption. Between 2012 and 2019, OECD oil consumption was steady at around 48 million barrels a day, as ongoing energy efficiency improvements offset higher transport needs. This period of stability ended in 2020, as consumption fell to 42 million barrels a day. Containment measures impacted road travel and aviation

demand, particularly in the June quarter 2020. The subsequent recovery has been constrained by a surging number of COVID-19 cases in the Northern Hemisphere, which is primarily occurring in OECD economies. As such, 2021 consumption growth is likely to depend on containment measures easing in the EU and the US. OECD consumption is forecast to recover to 45 million barrels a day in 2021. Consumption is forecast to decline later in the projection period, reflecting energy efficiency measures and the energy transition away from oil intensive consumption. Consumption is projected to fall marginally to 44 million barrels a day in 2026, as transport demand is affected by the transition to electric vehicles (see the *lithium* chapter).

US consumption declined by 11% to 18 million barrels a day in 2020, as persistently high COVID-19 cases impacted road activity and air travel demand. Further growth in US oil consumption is likely to depend on falling COVID-19 cases, complicated by variability across states. US demand is forecast to increase to 20 million barrels a day in 2023. Moderate declines in US oil consumption are expected later in the projection period, falling to 19 million barrels a day in 2026. This decline is expected to be driven by the assumed uptake in electric vehicles.

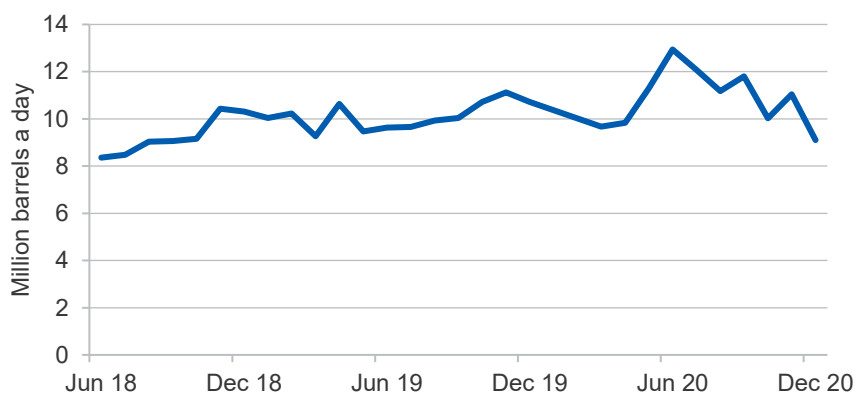
EU consumption declined by 13% to 12 million barrels a day in 2020. Consumption fell late in the year, as some EU member states introduced containment measures to address rising COVID-19 cases. Going forward, the recovery in EU consumption is expected to be uneven and unsteady across member states. Consumption is forecast to recover to 13 million barrels a day in 2021, and remain around these levels in 2022. Beyond 2022, EU oil consumption is projected to fall to 12 million barrels a day in 2026, reflecting increased electric vehicle uptake.

Consumption in other OECD countries is expected to recover out to 2022, generally returning to around 2019 levels. Beyond 2022, consumption is expected to marginally decrease. These declines vary across countries, reflecting varying climate policies between countries. Notably, Japanese and South Korean consumption between 2022 and 2026 is expected to fall by 12% and 14% respectively, reflecting net-zero emission pledges.

Non-OECD consumption to grow, driven by China and India

Non-OECD consumption declined by 3.5 million barrels a day to 49 million barrels a day in 2020, after increasing 1.1 million barrels a day in 2019. However, the change in 2020 consumption varied across countries, with Indian consumption declining considerably while Chinese consumption increased moderately. Consumption is forecast to increase by 3.5 million barrels a day in 2021, to reach 52 million barrels a day. However, similar to 2020, growth is expected to vary considerably across countries.

Figure 8.2: Chinese crude oil imports



Source: Bloomberg (2021)

Chinese consumption rose by 0.6% to 14 million barrels a day in 2020, in stark contrast to most other nations. Containment measures severely affected consumption in the March quarter 2020, but consumption recovered rapidly later in 2020. In 2021, consumption is forecast to rise by 5.3%. The (temporary) impact that this growth has on global prices may be tempered by the record Chinese imports made when prices reached multi-decade lows during the June quarter 2020 (Figure 8.2).

Going forward, lower Chinese imports would negatively affect global oil prices, since China accounted for over 80% of oil consumption growth in 2019. Chinese growth is expected to moderate over the medium term, but to remain the key driver of growth in world oil usage. Slower growth in

industrial production will weigh on future growth in Chinese oil usage, as will the expected sharp uptick in electric vehicle sales. Chinese usage is projected to increase by an average 2.8% an annum, reaching 17 million barrels a day in 2026.

Indian consumption declined by 9.1% to 4.7 million barrels a day in 2020. Indian consumption was deeply affected by the national lockdown for much of the June quarter 2020, and the subsequent recovery has been affected by varying containment measures across states. Indian consumption is forecast to increase over the rest of the outlook period, reaching 5.0 million barrels a day in 2021 and 5.4 million barrels a day in 2022. Consumption is projected to reach 6.7 million barrels a day in 2026.

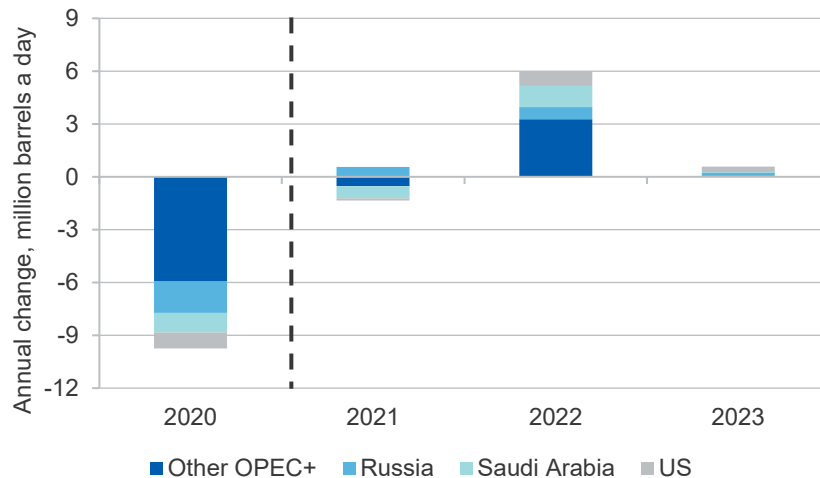
In 2026, non-OECD usage is projected to be 57 million barrels a day, implying 2.7% annual growth, driven by higher demand in China and India.

8.3 World Production

In 2020, global oil production declined by 6.7% to 93 million barrels a day, as OPEC+ cut production and output in other nations (such as the US) declined in response to lower global prices (Figure 8.3). Output is forecast to increase by 1.8% in 2021, as a recovery in non-OPEC+ producers more than offsets the marginal decline in full-year average OPEC+ production. Production is projected to increase gradually over the rest of the outlook period, as OPEC+ output targets increase and production in non-OPEC+ members recovers. Production is projected to increase to 99 million barrels a day in 2022, before reaching 102 million barrels a day in 2026.

The expected increase in oil production may be affected by lingering impacts from 2020, when exploration expenditure and investment decisions were both negatively affected by low prices. Although investment decisions are most sensitive in higher-cost producer nations such as Canada and the US, all producing nations have been somewhat affected. These impacts, combined with the structural adjustment from the transition away from fossil fuels, may weigh on world production later in the projection period.

Figure 8.3: Change in oil production by major producers



Notes: This assumes OPEC+ members fully comply with output targets.
 Source: Department of Industry, Science, Energy and Resources (2021); International Energy Agency (2021)

OPEC+ output targets have succeeded in lowering world production

OPEC+ production varied considerably during 2020. Production was elevated between January and April, as OPEC+ failed to agree to output targets to address the impacts of COVID-19. In response to plummeting prices, OPEC+ eventually reached an agreement to reduce production by 9.7 million barrels a day in May and June. Over 2020, OPEC+ output targets were lowest between May and July, before output cuts were reduced from August 2020. Throughout 2020, OPEC+ compliance with output cuts was high, with the countries that exceeded monthly quotas compensating with lower production in later months.

OPEC+ output targets increased by 0.5 million barrels a day in January 2021, lower than previously scheduled. OPEC+ also announced they would hold monthly meetings, where they could decide to adjust production for the following month by up to 0.5 million barrels a day. Over the rest of the outlook period, OPEC+ output is expected to rise steadily.

However, the timing of these increases is uncertain. Our forecasts assume that OPEC+ members fully comply with production targets. However, compliance with the OPEC+ agreement across member nations is a key risk to excess global output, and may result in renewed OPEC+ tensions.

Production could rise considerably for the nations exempt from the current OPEC+ agreement, although the timing and rate of these gains is highly uncertain. For much of 2020, Libyan output was affected by blockades on oilfields and export facilities, initially imposed in January 2020 but remaining in place until September 2020. After this blockade passed, Libyan output rose noticeably, from 0.1 million barrels a day in September 2020 to 1.2 million barrels a day in February 2021. However, the outlook for future Libyan production remains uncertain, and will depend on the UN mediated truce remaining in effect. Libyan production is forecast to average 1.3 million barrels a day in 2021 and 1.5 million barrels a day in 2022. Production is projected to stabilise around these levels over the rest of the outlook period.

Production in Iran and Venezuela could also increase significantly if international sanctions ease. The potential for easing of these sanctions partly depend on whether there would be any diplomatic shifts by the new US administration. President Biden has indicated on numerous occasions that the US will return to full compliance with the Joint Comprehensive Agreement Plan of Action once Iran does. However, it is unclear whether oil sanctions would ease before the deal is reinstated. It is also unclear how flexible the US may be in enforcing these sanctions. The sanctions facing Iran and Venezuela are assumed to remain in place over the outlook period, and production over the projection period is forecast to remain around 2020 levels.

OPEC+ production in 2020 averaged 46 million barrels a day, down 16% from 2019. This year-on-year decline was limited by elevated production between January and April 2020. Output is forecast to fall further to 45 million barrels a day in 2021, as current output targets are assumed to stay in place for the whole of 2021. In 2022, production is forecast to recover to 51 million barrels a day, as output targets from the current

OPEC+ deal end in April 2022. OPEC+ production is expected to rise over the rest of the outlook period, reaching 55 million barrels a day in 2026.

Non-OPEC+ output to increase, largely in the US and Canada

In 2020, production also declined significantly in non-OPEC+ nations, as producers responded to low global prices. Non-OPEC+ output was lowest in the June quarter, before rising marginally as some producers responded to higher prices. Despite the recovery in production, investment decisions and exploration expenditure were both severely affected throughout 2020. This is expected to affect the ongoing recovery in oil production, especially in the US, as output from shale wells declines faster than conventional wells.

US production declined by 3.4% to 17 million barrels a day in 2020, with production being lowest in the June quarter. US capital expenditure and rig count both declined significantly during 2020. In combination with declining production from existing wells, this is expected to limit US production growth in 2021. US oil production may also be affected by the ongoing legal challenge on the Dakota Access Pipeline. Although the pipeline is allowed to continue operating while legal proceedings are ongoing, this presents a downside risk to US supply, as some fields may become unviable. US output is projected to reach 19 million barrels a day in 2026.

Canadian production is estimated to decline by 4.4% to 5.3 million barrels a day in 2020, as relatively high production costs and dwindling storage capacity influenced producer decisions. The new US Administration's decision to cancel permits for the Keystone XL pipeline is expected to affect future Canadian production. This pipeline would have transported Canadian oil sands to refineries on the US Gulf Coast. Canadian production is forecast to increase to 5.6 million barrels a day in 2021, and increase moderately over the rest of the projection period, reaching 5.8 million barrels a day in 2026.

8.4 Prices

Brent prices have returned to US\$60 a barrel

Oil prices have recovered to above US\$60 a barrel in recent months, reflecting some relenting in the consumption impacts of the COVID-19 pandemic. On 5 January 2021, Saudi Arabia announced that it would reduce output by 1 million barrels a day in February and March 2021; which helped drive up oil prices. High compliance in other OPEC+ member countries, and a limited recovery in production throughout other major producers has facilitated stock draw-downs, benefiting prices.

Figure 8.4: Brent oil prices in 2020 and 2021



Source: Bloomberg (2021)

Brent prices averaged US\$62 a barrel in February 2021, which was 46% higher than the COVID-19 affected levels of 2020 (Figure 8.4). Despite the recent recovery, prices have remained somewhat affected by tightening containment measures in response to renewed or persistent COVID-19 outbreaks in several major consumers. Fresh containment measures were introduced in the European Union, and in China over the Lunar New Year.

Prices to remain around US\$60 a barrel over the projection period

Oil prices throughout 2021 are forecast to remain around US\$60 a barrel, as production increases and containment measures are relaxed. Brent prices are estimated to average US\$58 a barrel in the March quarter 2021. Prices are estimated to increase further to US\$62 a barrel in the June quarter 2021, reflecting lower stock levels and assumed supply restraint from major producers. However, prices are forecast to decline marginally over the rest of 2021, as production increases. Brent prices are expected to average US\$61 a barrel in the September quarter 2021 and US\$60 a barrel in the December quarter 2021.

Despite these relatively flat (average) price forecasts for 2021, oil prices are likely to remain volatile, and be noticeably affected by demand-side uncertainty. Consumption may vary significantly, depending on unforeseen changes in COVID-19 containment measures, as governments and households react to subsequent waves of the pandemic, and as business and household confidence recovers as COVID-19 cases fall. The speed and effectiveness of COVID-19 vaccine rollouts is also expected to influence global oil consumption and prices. Although there exists significant uncertainty regarding the timing of the rollout of these vaccines, it is unlikely that oil consumption will significantly benefit until at the second half of 2021.

Substantial uncertainty also exists on the supply-side, primarily from OPEC+ members. OPEC+ increased production by 0.5 million barrels a day in January 2021. However, the rate of output increases beyond January 2021 remains uncertain, as production targets can be adjusted in monthly ministerial meetings. Output is also uncertain for the OPEC+ members currently exempt from production targets, including Libya, Iran and Venezuela. With production in these countries affected by either blockades or international sanctions, geopolitical flare ups are likely to affect global prices.

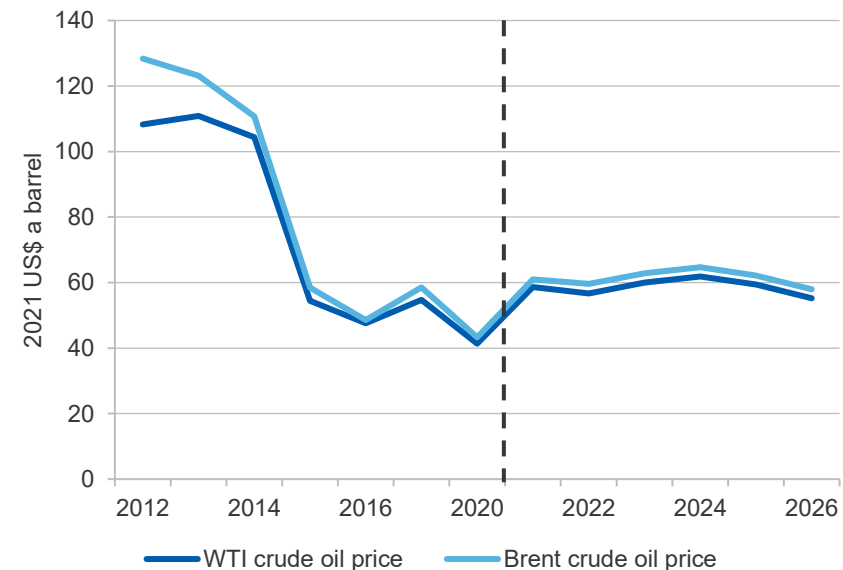
Over the rest of the outlook period, prices are projected to remain around US\$60 a barrel (in 2021 dollars), as OPEC+ members and non-OPEC+ members strive to raise revenue. Current price levels are expected to lead

to production recovering in countries such as the US, and also to provide incentives for OPEC+ to increase output targets. Production is expected to increase broadly in line with consumption, preventing further significant price gains.

Prices late in the projection period are expected to fall marginally, as consumption growth in China moderates and consumption falls in other major countries — as electric vehicle adoption reduces oil-intensive transportation.

Prices are projected to average US\$65 a barrel in 2024, before falling to US\$62 a barrel in 2025 and US\$58 a barrel in 2026 (in 2021 dollars) (Figure 8.5).

Figure 8.5: Projected oil prices



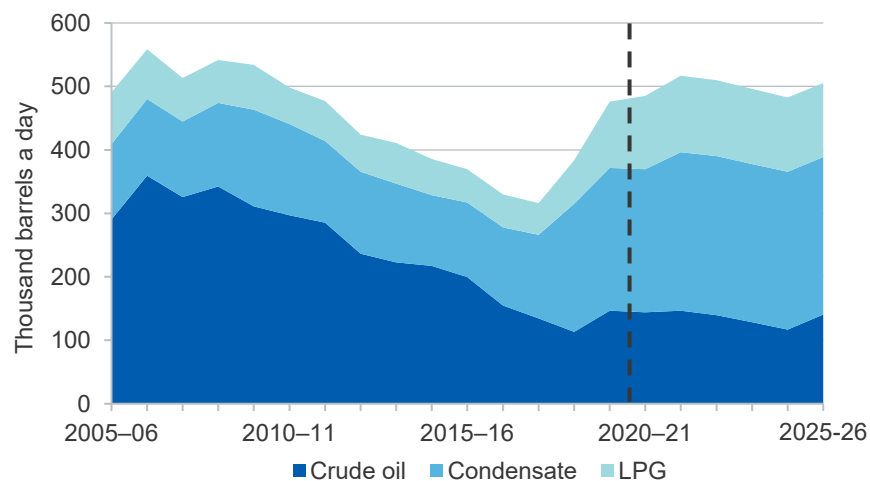
Source: Bloomberg (2021); Department of Industry, Science, Energy and Resources (2021)

8.5 Australia

Final investment decisions on gas projects to influence oil production

In 2020–21, Australian crude and condensate output is forecast to decline marginally to 370,000 barrels a day, as condensate output was affected by the temporary shutting of the Prelude FLNG project. Prelude was offline between February 2020 and January 2021, affecting Australian crude and condensate production for most of 2020–21. Gorgon is also experiencing ongoing technical issues, affecting Australia’s condensate production.

Figure 8.6: Composition of Australian oil production



Source: Department of Industry, Science, Energy and Resources (2021)

Later in the projection period, the deferral of final investment decisions (FID) for several gas projects may affect future condensate and LPG production, with the production of both commodities typically associated with gas production (see the *gas* chapter). In 2019–20, condensate and LPG accounted for 47% and 22% of total Australian oil output, respectively (Figure 8.6). Santos is expected to make a FID on the Dorado oil project in 2022. This project has an estimated new capacity of 85,000 barrels a day — around a quarter of 2019–20 Australian crude oil and condensate production. First production is expected in 2025, with this project expected

to increase Australian crude and condensate production late in the projection period.

In 2021–22, Australian crude and condensate production is forecast to increase by 7.1% to 396,000 barrels a day, as technical issues are assumed to pass at Prelude and Gorgon. In 2024–25, production is projected to fall to 365,000 barrels a day, due to lower output at existing fields. Output is projected to increase to 389,000 barrels a day in 2025–26.

Australia’s exports to recover

In 2020–21, export values are forecast to decline by 20% to \$7.6 billion, reflecting low oil prices. Exports are forecast to rise to \$9.5 billion in 2021–22, driven by higher prices. Between 2022–23 and 2025–26, export values are projected to remain around \$10 billion (in 2020–21 dollars).

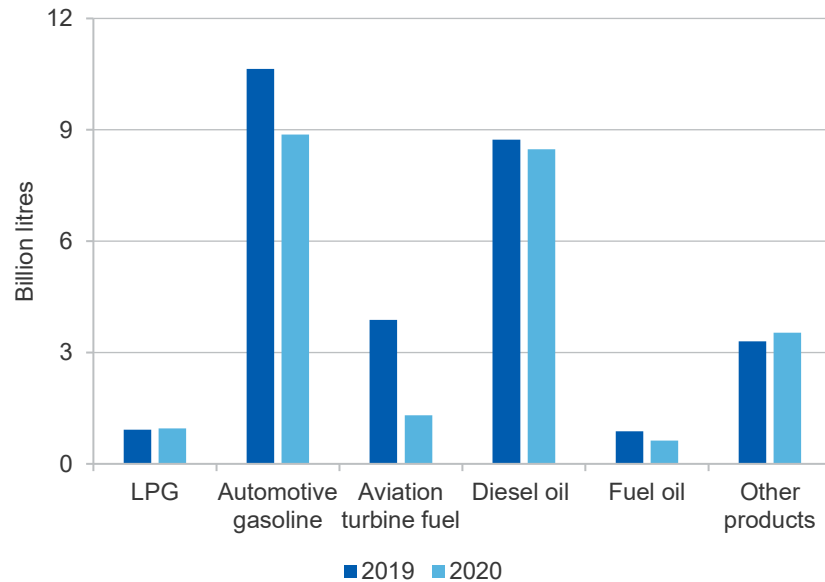
Australian refinery closures to reduce Australia’s throughput

Australian refinery throughput fell significantly in early 2020, as low transport demand reduced Australian refinery profitability (Figure 8.7). In October 2020, BP announced plans to close their Kwinana refinery and convert it to an import terminal. In February 2021, Exxon Mobil announced they were shuttering their Altona refinery, and converting the plant to an import and storage facility. Both companies attributed these decisions to persistent low refining margins and fierce competition with international fuel refineries. These competitive pressures may also affect the future operations of the remaining two Australian refineries, with Ampol and Viva Energy recently announcing that they are assessing the long-term viability of their Australian refineries.

Refinery production is forecast to decline out to 2022. The winding down of production at BP’s Kwinana refinery and Exxon Mobil’s Altona refinery is expected to more than offset a recovery in production at the remaining two refineries as the impacts of COVID-19 ease. Over the rest of the projection period, refinery throughput is forecast to remain around 2023 levels, fluctuating in line with plant maintenance. The remaining Australian oil refineries, Ampol’s Brisbane refinery and Viva Energy’s Geelong refinery, are expected to remain operational over the projection period.

Australian refined product consumption fell in 2019–20, as COVID-19 containment measures weighed heavily on activity in the first half of 2020. Consumption is forecast to recover in 2020–21, as containment measures across states ease. However, aviation demand is expected to remain low, as air travel remains depressed. In Australia, aviation consumption accounts for a relatively high share of product usage — around 15% of total consumption in 2019.

Figure 8.7: Australia’s refinery output, 2019 and 2020



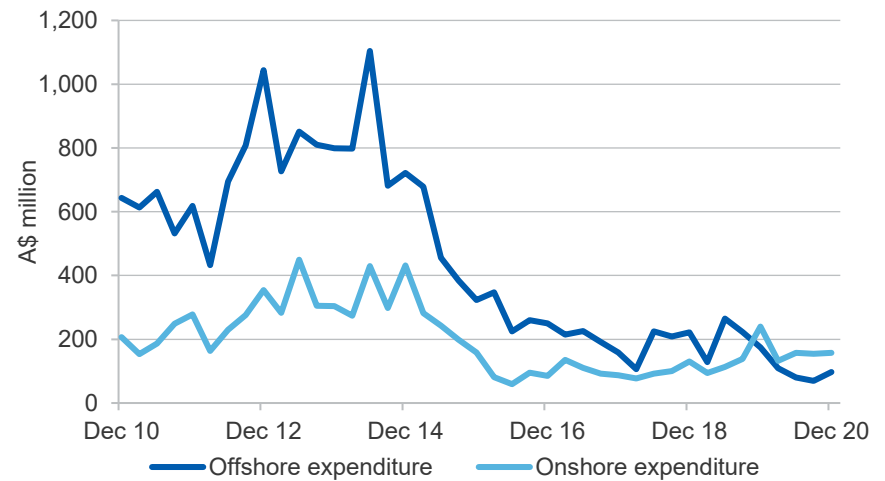
Source: Department of Industry, Sciences, Energy and Resources (2021)

Australian oil consumption is forecast to recover to 2018–19 levels in 2021–22. For the rest of the outlook period, Australian oil consumption is projected to increase marginally, reaching 1.1 million barrels a day by 2025–26. Australian imports of refined products are expected to increase significantly, as the Altona and Kwinana refineries wind down production.

Exploration

In the December quarter 2020, Australian petroleum exploration expenditure was a seasonally adjusted \$229 million, a quarterly increase of \$6.9 million or 3.1% (Figure 8.8). However, this is 39% lower year-on-year. A tighter domestic gas market could support ongoing growth in onshore petroleum exploration, with the Australian Energy Market Operator forecasting a possible shortfall of natural gas in Australian southern states by 2024.

Figure 8.8: Australian petroleum exploration



Source: ABS (2021) Mineral and Petroleum Exploration, Australia, 8412.0

Revisions to the outlook

Since the December 2020 *Resources and Energy Quarterly*, the forecast for Australia’s crude and condensate export earnings has been revised up by around \$120 million in 2020–21 and \$260 million in 2021–22 (nominal terms), due to higher oil price forecasts.

Table 8.1: Oil outlook

World	Unit	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
Production ^a	mb/d	93	95	99	100	101	101	102	1.5
Consumption ^a	mb/d	91	97	99	101	102	102	101	1.8
WTI crude oil price									
Nominal	US\$/bbl	41	59	58	63	66	65	62	7.3
Real ^b	US\$/bbl	41	59	57	60	62	59	55	4.9
Brent crude oil price									
Nominal	US\$/bbl	42	61	61	66	69	68	65	7.3
Real ^b	US\$/bbl	43	61	60	63	65	62	58	5.0
Australia	Unit	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^z	2023–24 ^z	2024–25 ^z	2025–26 ^z	CAGR ^r
Crude and condensate									
Production ^a	kb/d	372	370	396	390	378	365	389	0.8
Export volume ^a	kb/d	291	299	317	316	310	303	327	1.9
Nominal value	A\$m	9,009	7,678	9,575	10,213	11,081	11,111	11,425	4.0
Real value ^g	A\$m	9,104	7,678	9,418	9,839	10,414	10,183	10,212	1.9
Imports ^a	kb/d	317	216	117	119	125	131	132	-13.6
LPG production ^{ac}	kb/d	104	115	121	120	118	117	116	1.8
Refined products									
Refinery production ^a	kb/d	447	342	238	235	235	234	235	-10.1
Export volume ^{ad}	kb/d	17	13	9	9	9	9	9	-9.2
Import volume ^a	kb/d	640	744	925	941	954	968	981	7.4
Consumption	kb/d	984	1,016	1,068	1,082	1,096	1,111	1,126	2.3

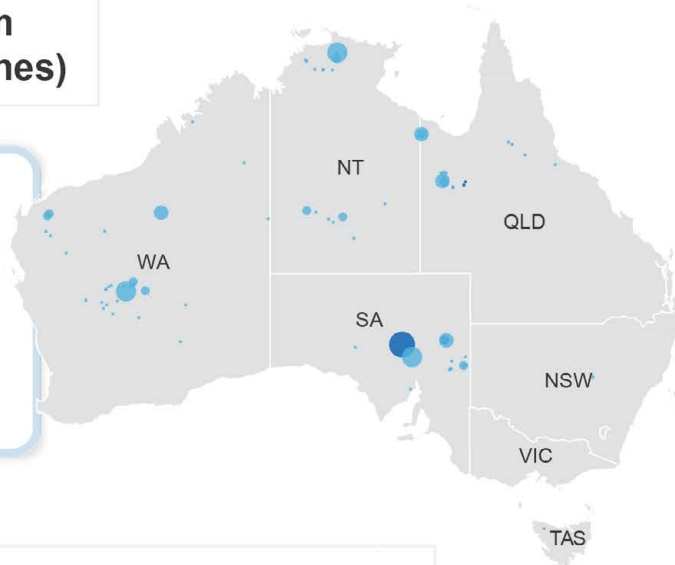
Notes: **a** The number of days in a year is assumed to be 365, and a barrel of oil equals 158.987 litres; **b** In 2021 calendar year US dollars; **c** Historical production data was revised in the September quarter 2020 to align with Australian Petroleum Statistics; **d** Primary products sold as LPG; **e** Excludes LPG; **g** Domestic sales of marketable products, including imports; **f** Forecast; **h** In 2020–21 financial year Australian dollars.

Source: ABS (2021) International Trade in Goods and Services, Australia, Cat. No. 5368.0; International Energy Agency (2021); EnergyQuest (2021); US Energy Information Administration (2021); Department of Industry, Science, Energy and Resources (2021).

Uranium

Major uranium deposits (tonnes)

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



Uranium facts



Originally formed in supernovae more than **6 billion years ago**



Nuclear plants can supply electricity to **4-5 million people**



Nuclear has among the **lowest death and accident rates** of any power source

Consumer markets



27%
EU



26%
USA



21%
Others



15%
China



9%
Russia



2%
Japan

Australia's Uranium



Ranked no 1
for uranium
resources



3rd largest
uranium producer
in the world



Exports
worth **\$688m**
in 2019-20

9.1 Summary

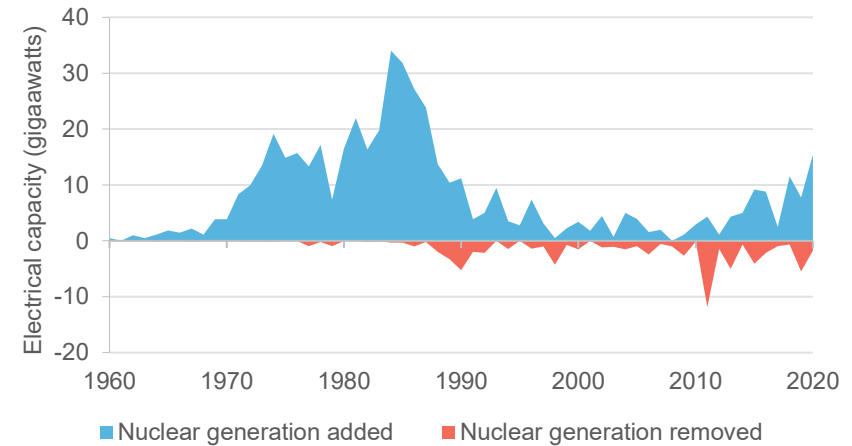
- Uranium prices are expected to rise steadily over the outlook period. Supply cuts at large mines in Canada and Kazakhstan, as well as the closure of Australia's Ranger mine in early 2021, will lead to some supply pressures. However, large producers retain the capacity to ramp up rapidly should prices grow significantly.
- Australian production is forecast to decline from 2021, as the number of active uranium mines falls from three to two (see [Australia section](#)).
- Export values are forecast to increase from \$520 million in 2020–21 to \$659 million by 2025–26 (in real terms), as prices pick up.

9.2 World consumption

Nuclear power faces mixed prospects over the next five years, despite a notable pick up in deployment rates over the last five (Figure 9.1). Countries including Japan, China, South Korea and the EU all announced significant upgrades to their climate change policies in 2020. Most climate models suggest that significant amounts of nuclear power will be needed, alongside other clean energy sources, in order to meet the emissions targets specified in the Paris Climate Accord. However, public debates and concerns over radiation and slow deployment, have acted as a significant constraint on deployment in OECD nations. This has exacerbated an existing problem in which reactors across the OECD are typically constructed in low numbers and with a multiplicity of designs, resulting in budgetary and timetable blowouts.

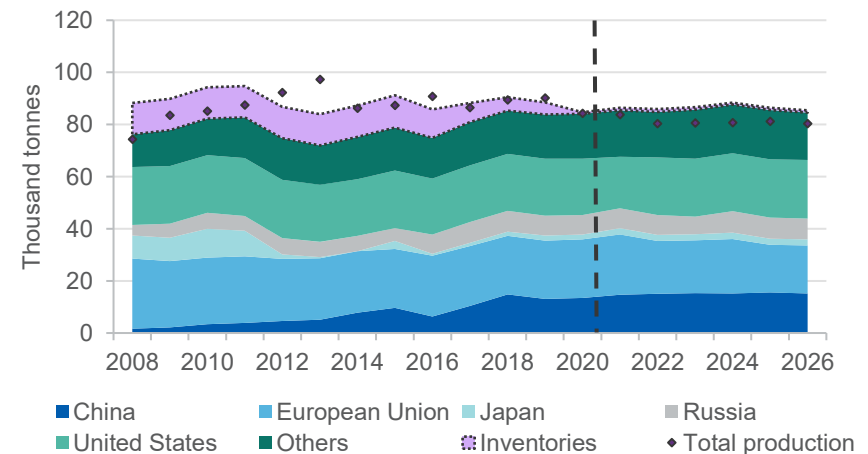
In contrast, construction by Chinese, Russian and South Korea firms have attained economies of scale using established designs, resulting in far more successful reactor deployments. Over the outlook period, most construction is expected to occur in Asian, African and Middle Eastern countries, with construction also expected to pick up in Eastern Europe. However, construction across the OECD is likely to remain sporadic and uncertain. Global uranium consumption is expected to lift steadily over the outlook period, rising from 84,700 tonnes in 2020 to a projected 85,500 tonnes in 2026 (see Figure 9.2).

Figure 9.1: World nuclear power generation capacity



Source: International Energy Agency (2021); World Nuclear Association (2021); Department of Industry, Science, Energy and Resources (2021)

Figure 9.2: World uranium consumption and inventory build (U3O8)



Source: International Energy Agency (2021); World Nuclear Association (2021); Ux Consulting (2021)

More countries are showing interest in nuclear reactors

China continued to lead the world in nuclear constructions over 2020, and successfully launched a new reactor late in the year. The CAP-1400 model, an upgrade from the AP1000 build, is relatively modular, being designed for rapid production and easy export. The development of this and other similar technologies, is likely to provide an incentive to countries considering rollouts of nuclear energy.

Unit 5 of China's Fuqing nuclear plant entered commercial operation in January. A second demonstration unit at the same site is expected to commence operation in the December quarter 2021, with cold functional testing concluding in January. Cold functional tests also concluded at the China Nuclear Corporation's newly developed gas-fired reactor in Shandong. Concrete is also being poured at the San'ao nuclear power plant in Zhejiang, with seven new reactors to be constructed at the site.

China's draft of its latest five-year plan includes a target to increase nuclear generation from 51GW at the end of 2020 to 70GW by 2025 and 180GW by 2035. This would amount to a significant expansion in global nuclear energy over the next 15 years assuming targets are reached. China's previous target was 58GW by the end of 2020.

India's Kakrapar nuclear plant connected its newly completed unit 3 to the grid in January. The reactor is India's first domestically-designed pressurised heavy water reactor. Other reactors of the same design (including unit 4 at the same site) are also under construction.

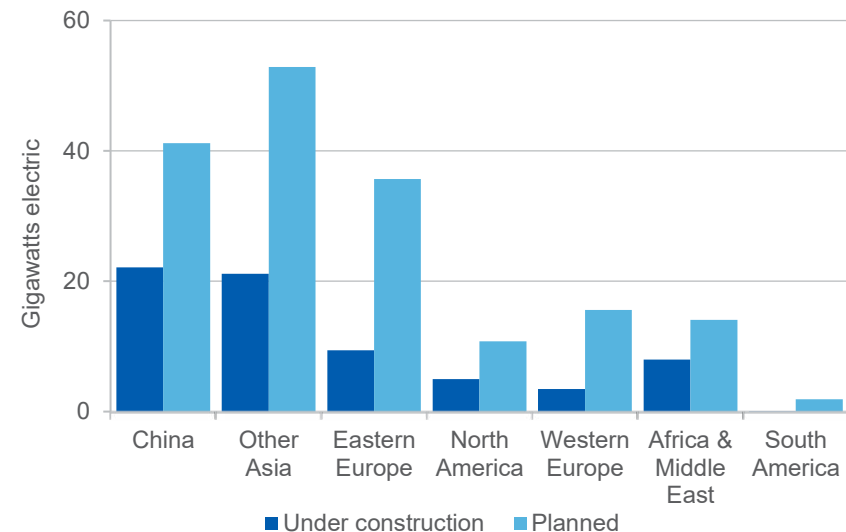
In the UK, construction of the Hinkley Point C nuclear plant has been delayed, with scheduled generation postponed by 6 months to June 2026. The delay is largely a result of the COVID-19 pandemic, and is likely to increase the cost of the project over its budget. Sizewell C — the likely successor plant after Hinkley C — is expected to benefit from greater economies of scale and experience. However, Hinkley C remains subject to considerable public debate, with finance not yet secured and site planning not expected to conclude until 2022.

In Belarus, Rosatom — a Russian firm — announced that unit 1 of its Ostravets reactor reached 100% capacity in January. The reactor is the first in Belarus and the first AES-2006 design to be built outside Russia.

Armenia has announced that the operating life of its Metsamor nuclear plant will be extended beyond its original closure date in 2026. A second unit is planned for construction as part of the country's energy strategy. Ukraine has also announced plans to further expand its nuclear power generation following the successful completion of units 3 and 4 at the Khmelnytsky plant. This follows similar announcements from Poland, Slovakia and Romania, and suggests that Eastern Europe could become a significant source of new nuclear generation over the coming years.

In Sweden, the Ringhals 1 reactor closed in 2020 after 44 years of operation. This follows the 2019 closure of Ringhals 2, which occurred five years ahead of schedule.

Figure 9.3: New nuclear capacity: medium-term expansion



Source: International Energy Agency (2021); World Nuclear Association (2021); Department of Industry, Science, Energy and Resources (2021)

9.3 World production

Large suppliers have reduced output in the wake of COVID-19

In December 2020, the OECD Nuclear Energy Agency and International Atomic Energy Agency released a joint report on uranium resources and demand. The report notes that there are sufficient uranium reserves to fuel long-term nuclear power output. However, short-term supply issues may arise over coming years, due to underinvestment over the last decade.

Uranium supply is expected to grow slowly from 2021, following the post-COVID-19 recovery (Figures 9.3 and 9.4). Uranium supply is also likely to depend more on primary production as mine output in Canada and Kazakhstan returns to more typical levels. This will substitute for a reduction in secondary supply brought about by steady reduction in inventory draw-down from utilities. Uranium inventories remain significant, but have shrunk over the last two years.

A gradual emergence of supply shortages may become apparent from 2023, with the market deficit growing over time. This shortfall will likely be met in the short-term through expanded mine output and utilisation of spare capacity among producing nations. However, more primary production is likely to be needed by the late 2020s.

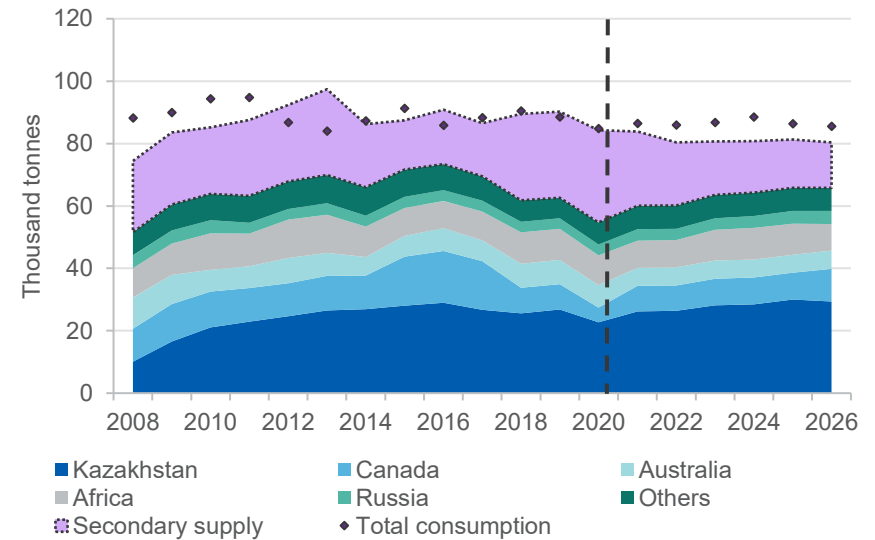
9.4 Prices

Prices are expected to rise slowly over the outlook period

Uranium spot prices rose significantly in early 2020, and held up above US\$30 a pound for five successive months in mid-2020. However, slower purchasing activity (linked to the COVID-19 pandemic) led to a fall in prices late in 2020, with an easing to US\$28 a pound by February 2021.

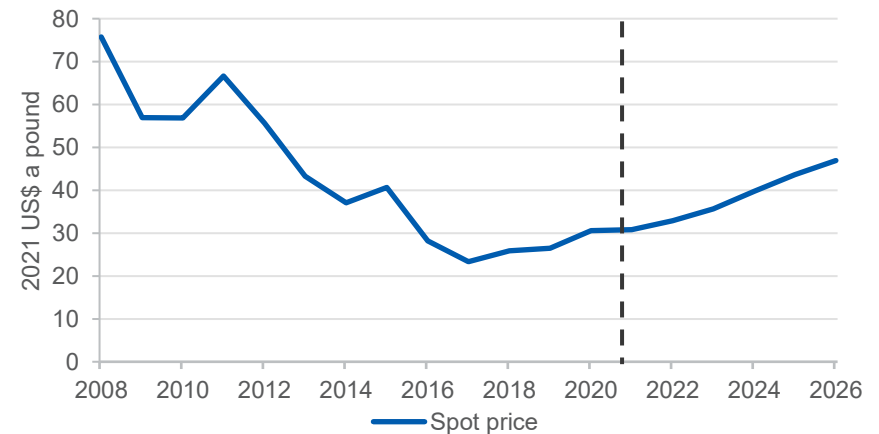
Global uranium supply has declined noticeably in recent years. Large miners in Canada and Kazakhstan paused or shut production as prices reached the lowest level in decades. The closure of Australia's Ranger mine is likely to act as a further constraint over the outlook period. The postponement/cancellation of mine projects during the long period of low prices after 2011 is likely to exacerbate medium term supply problems.

Figure 9.4: World uranium production and secondary supply (U3O8)



Source: International Energy Agency (2021); World Nuclear Association (2021); Ux Consulting (2021)

Figure 9.5: Uranium price outlook



Source: Cameco Corporation (2021) Uranium Spot Price; Ux Consulting (2021) Uranium Market Outlook+

Prices are expected to lift slowly over the outlook period (Figure 9.5) as large inventory stocks decline and potential shortfalls in enrichment capacity begin to affect processing times. Some of this price pressure can be offset in the short-term as producers gradually dial up output, though this is likely to lead to capacity limits being hit in the second half of the outlook period. Prices are forecast to increase from US\$29.96 in 2020 to around US\$33.50 by 2022 and US\$52 by 2026 (real terms). This price growth will be essential to ensure that investment in new mines occurs by the late 2020s, when supply shortfalls are likely to become significant.

9.5 Australia

Production and exports are set to decline from 2021

Processing at ERA's Ranger mine concluded on 8 January 2021, bringing operations at Australia's second largest uranium mine to a permanent close. The mine, which commenced operation in 1980, was bound by legislation requiring its closure by 2021. Most mining operations at the site had been halted since 2012, with recent output being drawn from stockpiled ore. Work is now underway on rehabilitation at the site, with this work due to conclude by 2026. The closure of this mine leaves Australia with two operating uranium mines — Olympic Dam and Four Mile, both in South Australia.

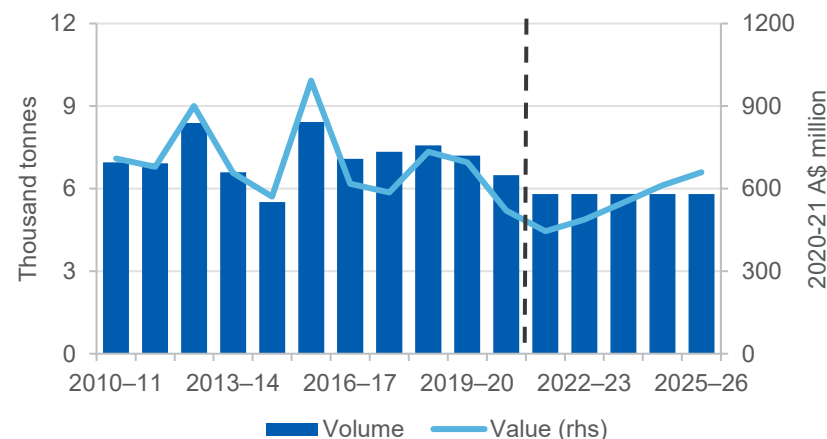
Production at Olympic Dam is expected to edge up slightly over the outlook period, though any significant changes to output at the site are likely to be contingent on conditions in the copper market (see *copper* chapter), since copper is the primary output from the mine. BHP has announced plans to push up output at the site incrementally, by modernizing facilities, with \$500 million allocated for smelter maintenance in 2021. However, at this stage, investments remain limited to maintaining existing production rather than increasing capacity. BHP's previously proposed \$3.5 billion brownfield expansion at the site has been indefinitely postponed, with the company noting that 'copper resources in the southern mine area are more structurally complex, and the higher grade zones less contiguous, than previously thought'.

Production at South Australia's Four Mile mine is expected to be steady over the outlook period, with the site still holding significant untapped ore deposits.

Australia also has significant uranium resources available at other sites. These deposits include Honeymoon in South Australia, as well as Wiluna, Yeelirrie, Mulga Rock and Kintyre in Western Australia. Progress in developing these sites is likely to be contingent on improvements in the uranium price, with potential for development at one or two sites towards the end of the outlook period.

Export volumes are expected to be largely steady, at 5,800 tonnes annually across the outlook period (Figure 9.6). However, price growth is expected to see export values increase from \$520 million in 2020–21 to \$659 million in 2025–26 (real terms).

Figure 9.6: Australia's uranium exports



Source: Department of Industry, Science, Energy and Resources (2021)

Exploration remains low, due to ongoing relatively weak prices

Uranium exploration lifted marginally in the December quarter, rising from \$1.8 million in the September quarter to \$2.2 million. Exploration was \$2.3 million in December 2019. This is relatively low compared to average spending over the past 10 years, and reflects ongoing weak prices.

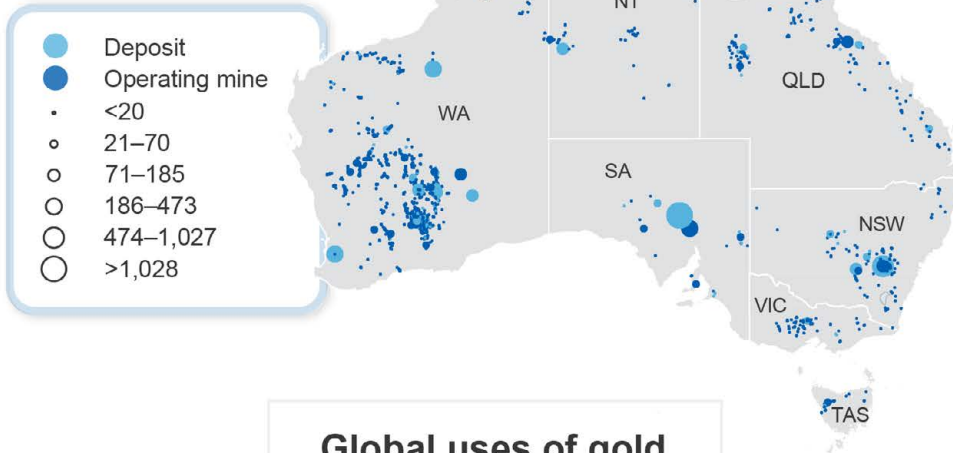
Table 9.1 Uranium outlook

World	Unit	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
Production	kt	54.7	60.1	60.1	63.5	64.2	65.8	65.8	3.1
Africa ^b	kt	9.6	8.8	8.8	9.9	10.1	9.9	8.5	-1.9
Canada	kt	4.8	8.2	8.2	8.6	8.6	8.6	10.5	14.0
Kazakhstan	kt	22.7	26.2	26.4	28.1	28.5	30.0	29.4	4.4
Russia	kt	3.4	3.6	3.6	3.7	3.9	4.1	4.2	3.5
Consumption	kt	84.1	85.5	84.8	85.7	87.6	85.5	84.6	0.1
China	kt	13.5	14.7	15.1	15.2	15.2	15.6	15.2	2.0
European Union 28	kt	22.4	23.1	20.3	20.3	20.9	18.2	18.4	-3.2
Japan	kt	1.9	2.4	2.4	2.4	2.4	2.4	2.4	3.9
Russia	kt	7.4	7.6	7.6	6.8	8.3	8.1	8.0	1.2
United States	kt	21.7	19.8	22.0	22.2	22.2	22.3	22.5	0.6
Spot price	US\$/lb	30.0	30.8	33.5	37.2	42.5	47.7	52.4	9.8
real ^c	US\$/lb	30.6	30.8	32.9	35.7	39.8	43.6	46.9	7.4
Australia	Unit	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^z	2023–24 ^z	2024–25 ^z	2025–26 ^z	
Mine production	t	7,349	6,486	5,800	5,800	5,800	5,800	5,800	-3.9
Export volume	t	7,195	6,486	5,800	5,800	5,800	5,800	5,800	-3.5
– nominal value	A\$m	688	520	453	506	584	667	737	1.2
– real value ^d	A\$m	695	520	445	488	549	612	659	-0.9
Average price	A\$/kg	95.6	80.2	78.0	87.3	100.7	115.1	127.2	4.9
– real ^d	A\$/kg	96.7	80.2	76.8	84.1	94.6	105.5	113.6	2.7

Notes: **b** Includes Niger, Namibia, South Africa, Malawi and Zambia; **c** In 2020 US dollars; **d** in 2020–21 Australian dollars; **e** estimate; **f** forecast; **r** Average annual growth between 2020 and 2026 or 2019–20 and 2025–26; **z** projection.

Source: Department of Industry, Science, Energy and Resources (2021); Cameco Corporation (2020); Ux Consulting (2021) Uranium Market Outlook

Major Australian gold deposits (tonnes)

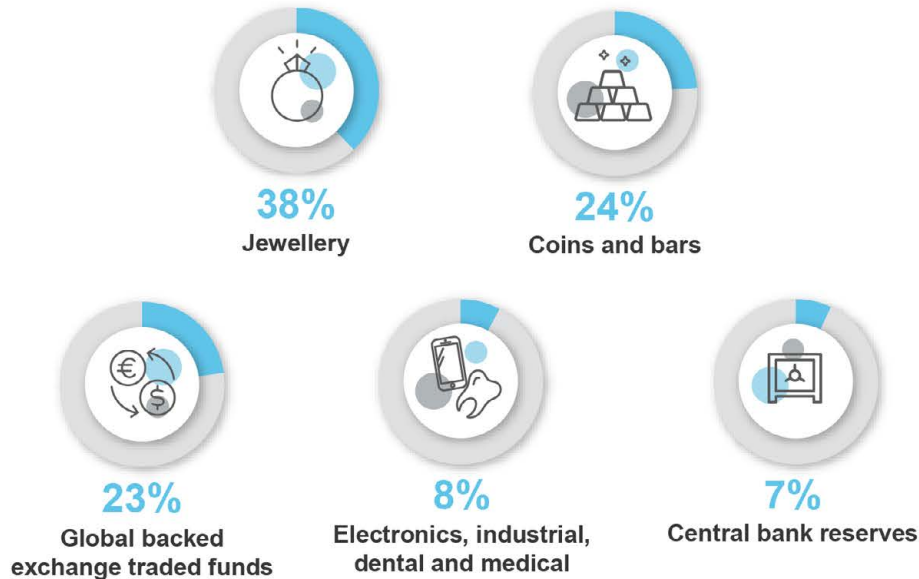


Gold



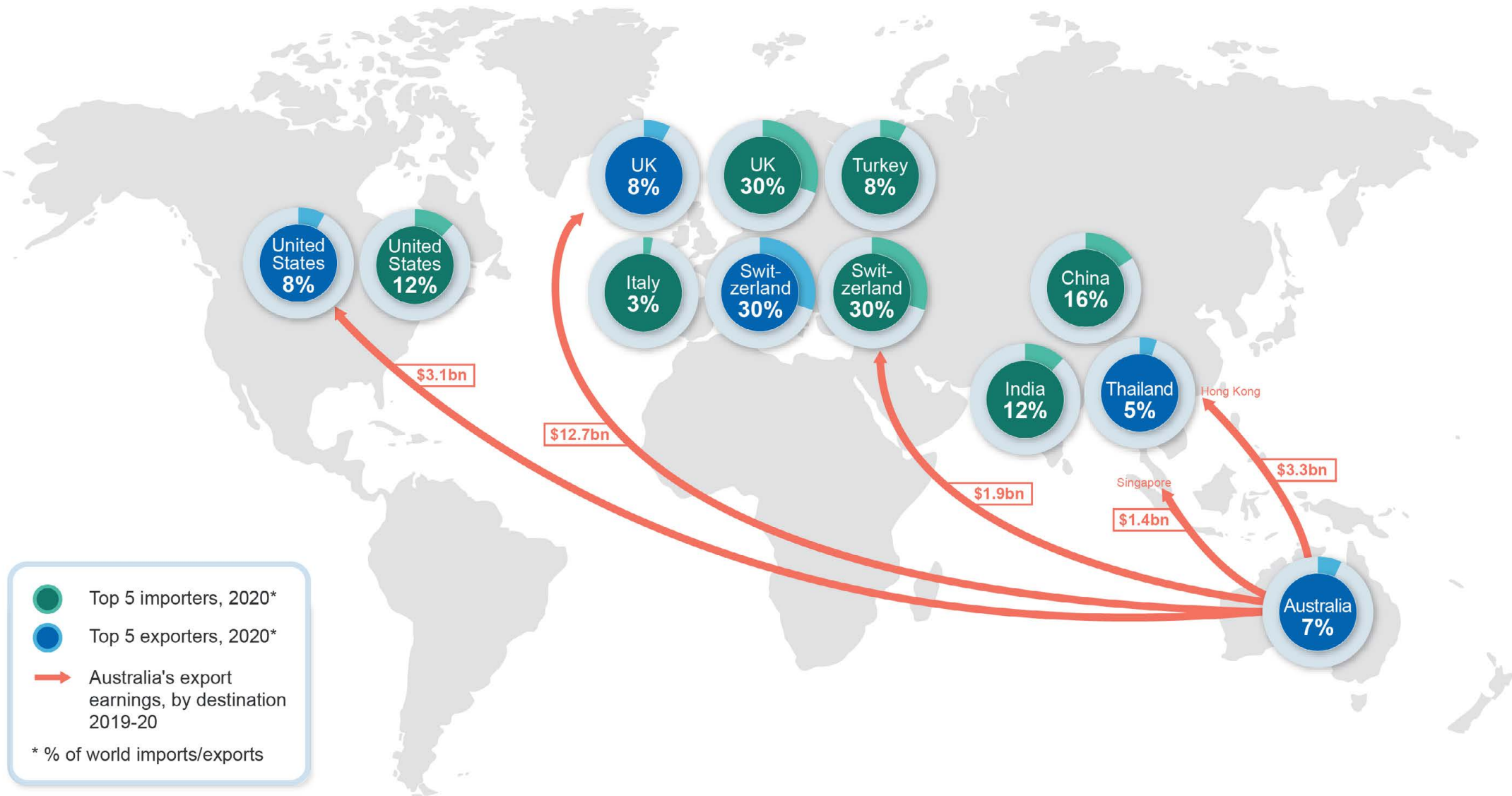
- Aprox 187,200 tonnes of gold mined since the **beginning of civilisation**
- The US Federal Reserve holds **6,700 tonnes of gold**
- Gold makes up **3 parts per billion** of the Earth's outer layer

Global uses of gold



Australia's gold





10.1 Summary

- Higher prices are expected to push the value of Australia's gold exports up to a record of \$29 billion in 2020–21. Earnings (in real terms) are then projected to decline to \$22 billion in 2025–26, as gold prices ease back.
- Export volumes are forecast to fall by 1.8% to 344 tonnes in 2020–21, as high gold prices reduce gold demand. Volumes are projected to reach 418 tonnes by 2025–26, as demand recovers (see [Australia section](#)).
- An effective COVID-19 vaccine rollout and consequent global economic rebound is projected to see the gold price slide from US\$1,700 in 2021 to US\$1,210 an ounce in 2026 in real terms.

10.2 Consumption

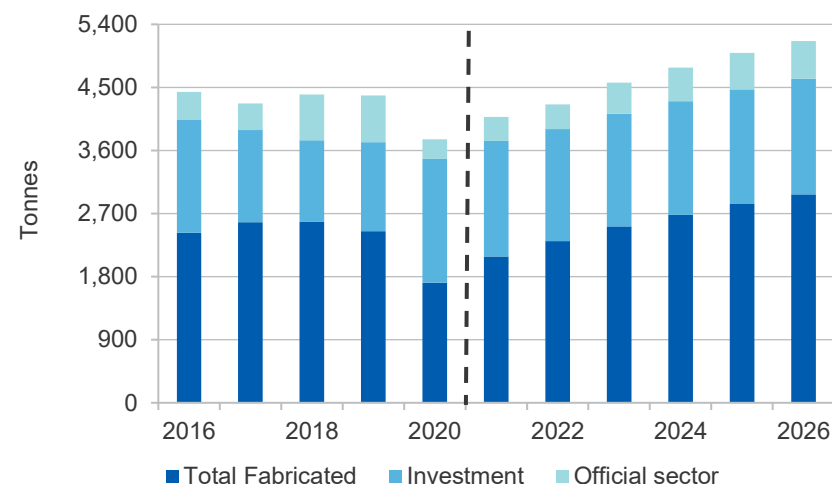
World gold consumption fell in 2020

World gold consumption declined by 14% to 3,760 tonnes in 2020 (Figure 10.1). COVID-19 containment measures and higher gold prices reduced gold jewellery consumption (which accounts for 38% of global gold demand). Jewellery consumption in China and India — the world's two largest jewellery consuming nations — declined by 35% and 42% in 2020, to 416 and 316 tonnes, respectively. In the US and Europe, jewellery demand fell by 10% and 21% in 2020, to 118 and 57 tonnes, respectively.

Net official sector (central banks and other government institutions) purchases fell by 59% to 273 tonnes in 2020. The need for more liquid assets during the COVID-19 pandemic appears to have been the main catalyst for some central banks' diminished appetite for gold. Mongolia, Sri Lanka and Tajikistan were the largest sellers of gold, while Turkey, India and the United Arab Emirates bought the most gold in 2020 (Figure 10.2).

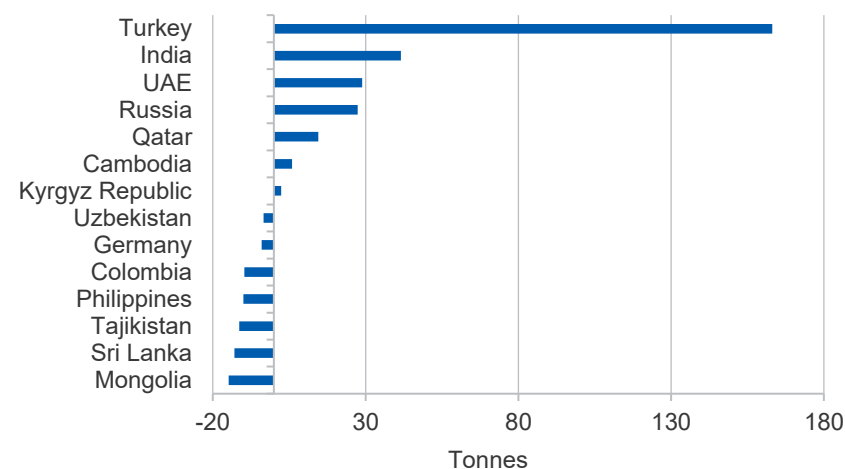
Gold used in industrial fabrication fell by 7.4% to 302 tonnes in 2020, as COVID-19 containment measures impacted on the sale of consumer electronics. Over this period, gold used in electronics declined by 5.3% to 248 tonnes. Higher gold prices also affected demand for gold in the dental sector; usage was down 14% in 2020, as consumers substituted ceramics for gold.

Figure 10.1: World gold consumption by sector



Source: World Gold Council (2021) Gold Demand Trends; Department of Industry, Science, Energy and Resources (2021)

Figure 10.2: Official sector's gold selling and buying*, selected countries, 2020



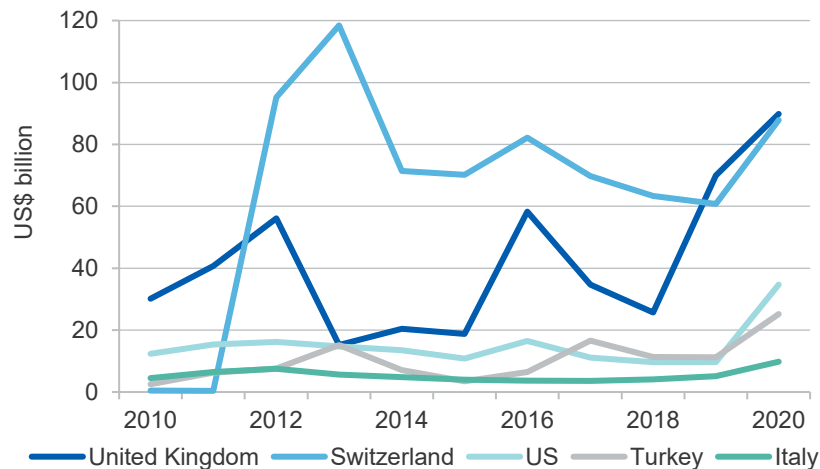
Note: *Gold bullions. Minus quantity indicates selling. Positive quantity indicates buying.
Source: World Gold Council (2021)

Offsetting falling gold consumption in the jewellery, official and industrial sectors, gold-backed exchange traded funds (ETF) holdings rose by 120% in 2020 to 877 tonnes (equivalent to US\$48 billion) — the largest inflows ever. The COVID-19 pandemic, low interest rate environment, and weaker equity markets in the first half of 2020 drove the flows into the ETFs.

Global gold imports rose in 2020

Global gold imports (including jewellery, gold bars and coins and ETFs) rose by 8.3% in 2020, to nearly US\$298 billion, driven by the ETFs based in the UK, Switzerland and the US. The UK was the largest gold importer in 2020, importing US\$90 billion of gold and accounting for over 30% of total global gold imports, followed by Switzerland (which imported US\$88 billion in 2020 and accounted for nearly 30% of total global gold imports) and the US (which imported US\$35 billion in 2020 and accounted for 12% of total global gold imports) (Figure 10.3).

Figure 10.3: Top 5 global gold imports* by country



Notes: *Gold imports include jewellery, gold bars and coins, and ETFs. Quarter 4 2020 trade data is provisional.

Source: International Trade Centre (2021)

Gold consumption expected to rise over the outlook period

Global gold consumption is forecast to increase by 8.5% to 4,080 tonnes in 2021, as lower gold prices and the roll-out of COVID-19 vaccines help to support the sale of gold jewellery (Figure 10.1). On 1 February 2021, the Indian government announced a cut in the total import duty from 12.5% to 10%. There are already signs of a turnaround in jewellery demand from China and India. China and India' December 2020 quarter jewellery demand was 145 and 137 tonnes, respectively. This is the highest level since the December 2019 quarter, up by 22% and 126% from the September 2020 quarter, respectively.

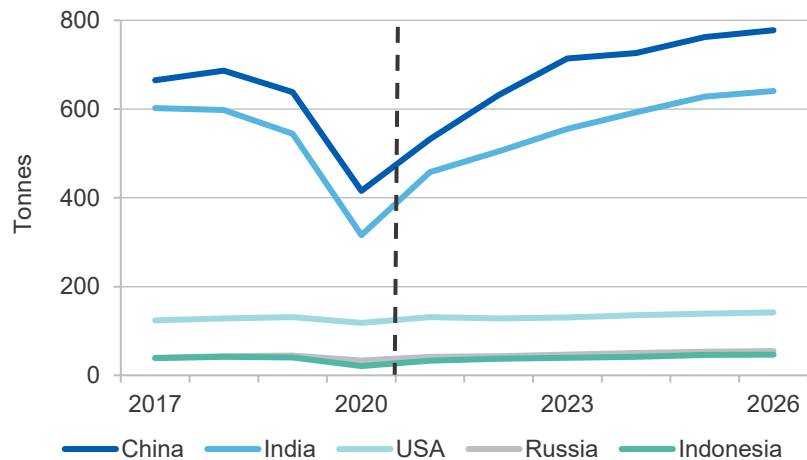
Global jewellery demand is expected to rise by 25% in 2021, to 1,764 tonnes. Central banks' gold buying is forecast to increase by 26% in 2021 to 344 tonnes, as some central banks increase gold reserves in 2021. After 2021, world gold consumption is projected to rise at an annual average rate of 4.8%, reaching 5,162 tonnes by 2026, as lower gold prices boost jewellery demand and retail investment (Figure 10.1).

Global jewellery consumption is projected to rise at an annual rate of 8.0% over the 5-year outlook. Consumption is projected to reach 2,589 tonnes by 2026, driven by an improvement in consumer sentiment, rising income and lower gold prices.

Demand from China is expected to pick up, as price-sensitive Chinese consumers react to price falls. Economic growth, ongoing urbanisation, and rising incomes are all expected to contribute to higher jewellery demand in India. In the US and Europe, an improvement in consumer confidence is also likely to support the demand for gold jewellery in those markets (Figure 10.4).

Gold retail investment is projected to grow at an annual rate of 1.8% over the outlook period, to reach 1,176 tonnes by 2026. The forecast decline in gold prices will likely attract retail and institutional investors back to the gold bar and coin markets.

Figure 10.4: Top 5 jewellery consuming countries



Source: Metals Focus (2021); Department of Industry, Science, Energy and Resources (2021)

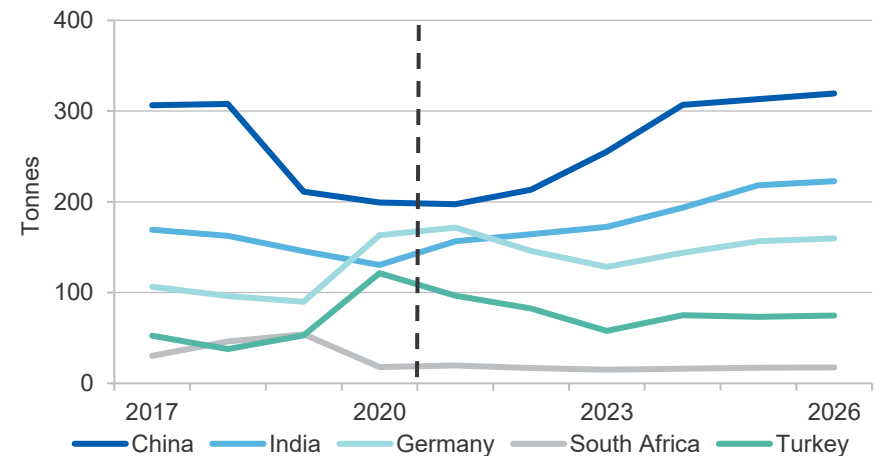
Physical gold investment in China and India is expected to grow over the outlook period, driven by bargain hunting (Figure 10.5). In the US and Europe, despite a forecast improvement in economic growth, inflationary expectations are likely to encourage investment in physical gold, with a surge in investment volumes expected from 2024 and onwards.

After reaching a ten-year low of 273 tonnes in 2020, the pace of central bank gold buying is projected to increase by an average 9.7% a year over the outlook period, reaching 540 tonnes in 2026. Many central banks are expected to shift their focus from accommodative liquidity requirements — to support economic growth during the COVID-19 pandemic — to reserves diversification — to protect their future wealth.

Risks to jewellery consumption remain in the short term

Despite growing online jewellery trading platforms, consumers still prefer a traditional face-to-face method of buying and selling jewellery. The threat of COVID-19 virus variants, partial or full COVID-19 containment measures and uncertainty around vaccine roll outs are all risks to the global economic recovery, which pose a risk to jewellery demand.

Figure 10.5: Top 5 physical gold investing countries



Source: Metals Focus (2021); Department of Industry, Science, Energy and Resources (2021)

10.3 Production

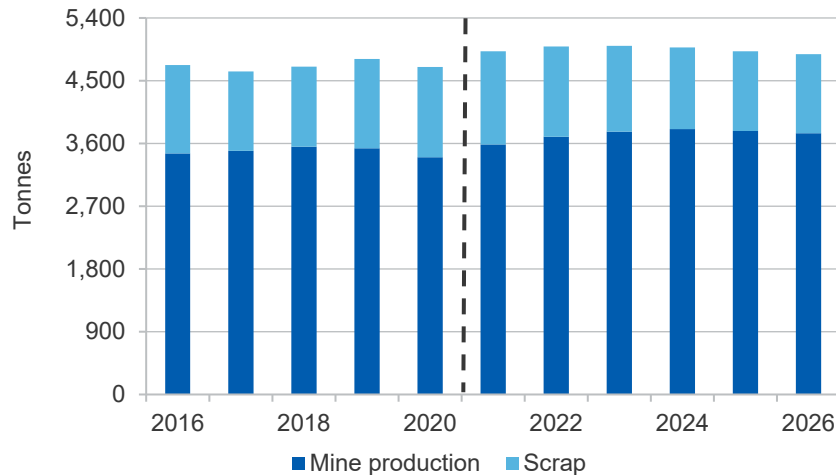
COVID-19 containment measures reduced world gold supply in 2020

World gold supply decreased by 3.9% in 2020 to 4,633 tonnes, as COVID-19 containment measures reduced gold mine output (which accounts for 73% of global gold supply) by 3.7% in 2020, to 3,401 tonnes (Figure 10.6).

Gold mine production in China — the world's largest gold producer — declined by 4.7% in 2020, to 365 tonnes, with COVID-19 containment measures and stricter environmental regulation leading to some modest production cuts (Figure 10.7). Over this period, Russia's gold mine production fell by 10%, to 295 tonnes, due to lower ore grades (Figure 10.7).

Outside of China, Papua New Guinea's gold mine production fell by around 28% in 2020, to 53 tonnes, as the country's largest gold mine (Porgera) was placed into care and maintenance from April 2020 following a dispute with the PNG government over the renewal of the mining lease.

Figure 10.6: World gold supply



Source: World Gold Council (2021) Gold Demand Trends; Department of Industry, Science, Energy and Resources (2021)

Gold mine production in Australia — the world’s second largest gold producer — was largely unaffected by COVID-19 containment measures, rising by 0.6% to 328 tonnes in 2020 (Figure 10.7).

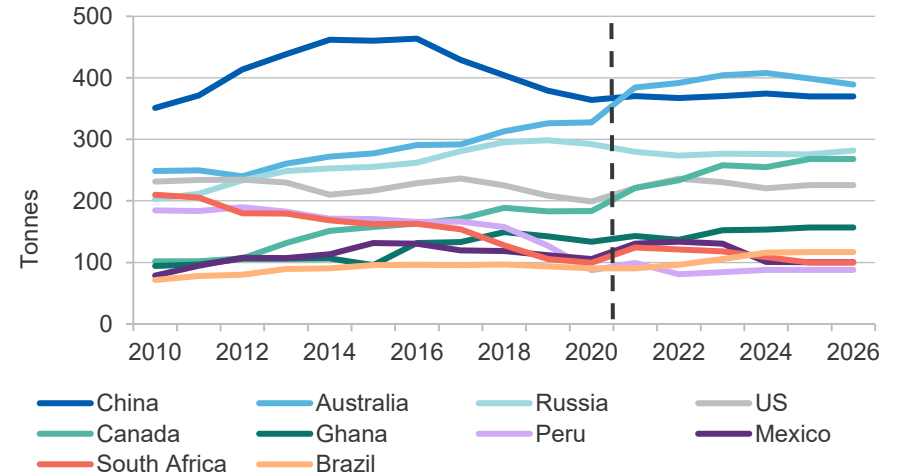
Movement restrictions during the COVID-19 pandemic discouraged gold recycling activities. Jewellery store closures reduced the physical exchange of gold for cash. In 2020, gold scrap supply grew at a slower pace (up 1.2% to 1,297 tonnes) than in 2019 (up 12%) (Figure 10.6).

World gold supply expected to peak in 2023

World gold supply is forecast to reach a peak of 5,051 tonnes in 2023, and then decline moderately to 4,893 tonnes in 2026. In the short term, increasing total gold supply will be propelled by higher mine production.

Global mine production is forecast to increase by 5.5% (to 3,588 tonnes) in 2021, by 3.0% (to 3,696 tonnes) in 2022, and by 2.0% (to 3,769 tonnes) in 2023 (Figure 10.6). The global rollout of COVID-19 vaccines is expected to minimise disruption to gold mine production after 2022.

Figure 10.7: Top 10 global gold producing countries



Source: Metals Focus (2021); S&P Market Intelligence (2021); Department of Industry, Science, Energy and Resources (2021)

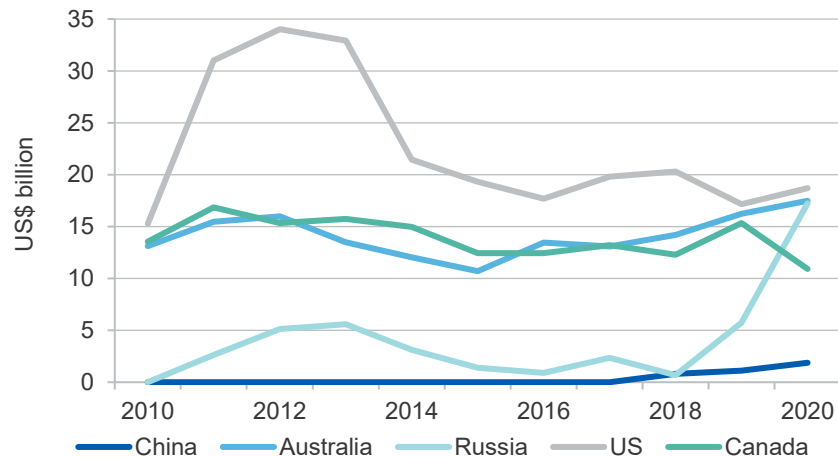
In 2021, gold mine production in Central and South America and Africa is expected to recover, following heavy losses in 2020. Production in Mexico is forecast to increase by 24% in 2021 to 128 tonnes, Peru (up 35% to 136 tonnes) and South Africa (up 24% to 124 tonnes).

A solid pipeline of projects in Australia and Canada are all likely to drive higher global gold mine output in the short term, with miners focusing on expansions and extending the life of existing mines.

Australia is expected to overtake China as the world’s largest gold producer in 2021, producing 384 tonnes (Figure 10.7), as miners respond to high gold prices (see *Section 10.5 Australia’s exports and production*). In China, stricter environmental regulations are likely to keep Chinese gold mine output at about 370 tonnes a year over the outlook period.

World gold mine production is projected to decline at an annual rate of 0.8% in 2025 and 2026, to 3,746 tonnes in 2026 (Figure 10.6), as ore grades decline and operational costs increase.

Figure 10.8: Gold exports, selected top 5 producing countries



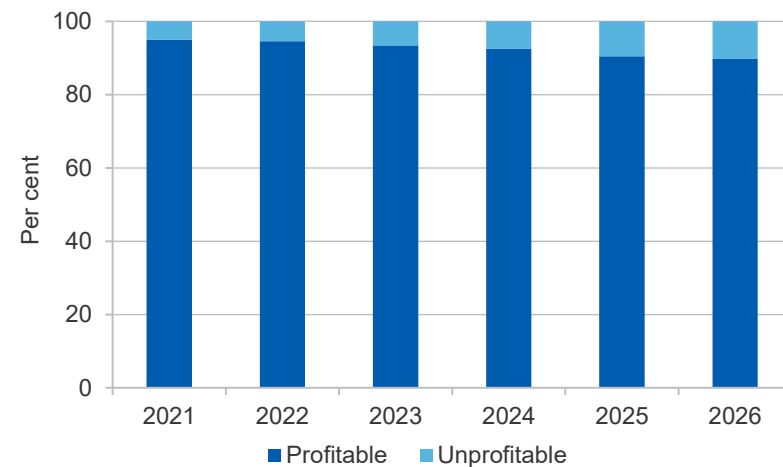
Notes: Quarter 4 2020 trade data is provisional.
Source: International Trade Centre (2021)

Figure 10.9 shows the share of profitable and unprofitable gold mines in the world. A mine is considered as profitable or unprofitable if its all-in sustaining costs — a measure of all direct and recurring costs required to mine a unit of ore — are below or above the average gold prices. The number of unprofitable gold mines is expected to rise from 5% in 2021 to 10% in 2026. Reflecting this rise, more mine closures and reduced gold mine production are expected.

The medium to long term future and sustainability of the Australian gold industry is reflected by its gold economic resources. Figure 10.10 shows the largest gold economic resources, of which Australia has the largest: 10,795 tonnes, accounting for 21% of global gold reserves, ahead of Russia (5,300 tonnes, 10%), South Africa (3,200 tonnes, 6.3%) and US (3,000 tonnes, 5.9%).

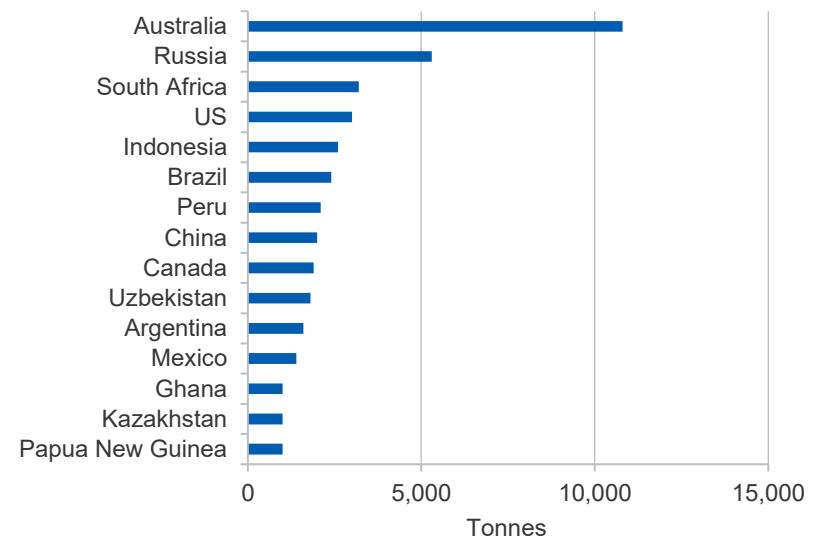
Gold scrap supply is projected to decline at an average annual rate of 3.2% over the outlook period, to 1,135 tonnes in 2026, as lower gold prices discourage gold selling in major jewellery consuming markets such as China and India.

Figure 10.9: Profitable and unprofitable global gold mines



Source: AME (2021); Department of Industry, Science, Energy and Resources (2021)

Figure 10.10: World gold economic resources, December 2019



Source: Geoscience Australia (2021)

10.4 Prices

Gold prices rose strongly in 2020

The London Bullion Market Association (LBMA) gold price averaged US\$1,805 an ounce in 2020, a rise of 26% from 2019 (Figure 10.11). An US dollar record of US\$2,064 an ounce was reached on 6 August 2020 — and the Australian dollar gold price — reached A\$2,861 an ounce on 7 August 2020.

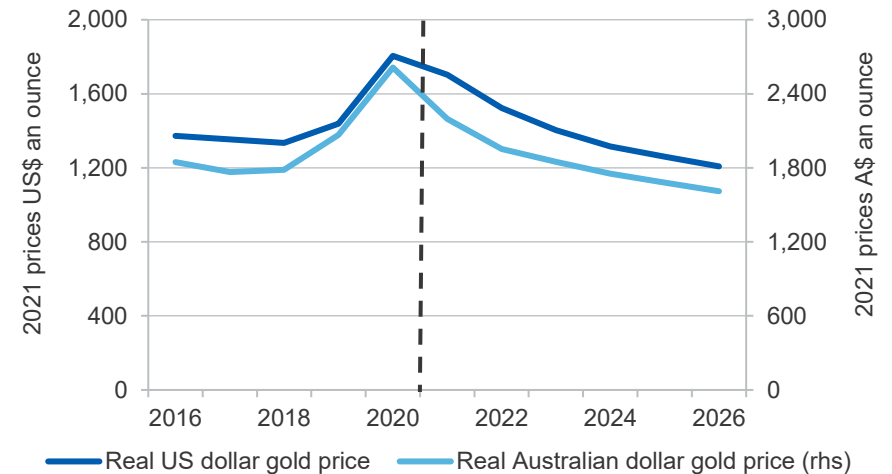
Gold has benefited from its status as a safe haven asset during the COVID-19 pandemic. The close correlation between lower real bond yields and the US dollar gold price has persisted; low (and negative) real yields caused a rush of investor money into gold in 2020, more than offsetting the impact of weaker demand from jewellery consumers and central banks (Figure 10.12).

Gold prices to fall in the short to medium term

In 2021, the rollout of COVID-19 vaccines and the global economic recovery has lifted real bond yields, and is expected to undermine some of gold's appeal to institutional and retail investors. Funds are expected to move out of safe haven assets like gold and into riskier assets such as equities and real estate. Reflecting this, the US gold price is forecast to decrease by 5.7% (in real terms) in 2021, averaging US\$1,700 an ounce, with the Australian gold price forecast to fall by 16% (in real terms) in 2021, averaging A\$2,200 an ounce (Figure 10.11).

After 2021, gold prices are projected to fall by an average 6.6% a year, to US\$1,208 an ounce in 2026 in real terms, due to the recovery of the global economy and a higher interest rate environment (Figure 10.11). The high interest rate environment is likely to be a major factor in curbing institutional investment demand for gold. With (real) interest rates increasing, the opportunity cost of holding gold is high, lowering its attractiveness as an investment asset. The lower US dollar gold price, in combination with a higher Australian dollar, is expected to push the Australian dollar gold price lower over the outlook period, to an average of A\$1,610 an ounce (real terms) in 2026.

Figure 10.11: US and Australian dollar real gold prices



Source: LBMA (2021) Gold price PM; Department of Industry, Science, Energy and Resources (2021)

Figure 10.12: US dollar gold price and real US 10-Year Treasury yield



Source: Bloomberg (2021)

There are several risks to the gold price assessment, including the effectiveness of COVID-19 vaccines now being rolled out across the world. Some new strains of the virus are much more infectious than others.

Another risk to the price assessment includes a possible correction in the global equity markets — which are at record levels and vulnerable to a rise in bond yields. A correction in equity markets may drive institutional investors back towards gold. A rise in the US dollar would put downward pressure on the US gold price. The US dollar may rally if growth in the US economy outpaces other major nations.

Geopolitical issues are expected to remain over the outlook period. Tensions in the Middle East and parts of the Indo-Pacific are not expected to be resolved within a short timeframe. There is uncertainty around the levels of world trade protection, as countries may look to support domestic manufacturing industries to aid economic recovery from the COVID-19 pandemic.

10.5 Australia's exports and production

Australia's gold exports increased in 2020

Australia's gold exports increased by 9.1% to over \$25 billion in 2020, propelled by a 26% rise in gold prices.

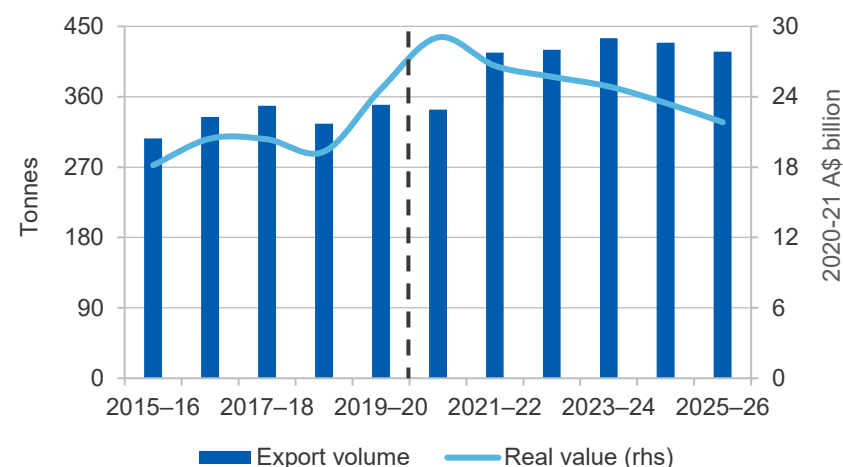
The value of Australia's gold exports is forecast to peak at a record \$29 billion (in real terms) in 2020–21, driven by higher gold prices (Figure 10.13). Gold prices rose by 26% in 2020 to US\$1,805 an ounce, and are expected to average US\$1,700 an ounce in 2021 (in real terms).

Export values are projected to decline after 2020–21, from \$29 billion in 2020–21 to \$22 billion in 2025–26 (2020–21 dollars) (Figure 10.13). The decline is expected to be driven by lower US and Australian dollar gold prices (see *Section 10.4 prices*).

Australia's gold mine production rose in 2020

Australia's gold mine production was largely unaffected by COVID-19 containment measures, and rose by 0.6% to 328 tonnes in 2020.

Figure 10.13: Australia's gold exports



Source: ABS (2021) *International Trade*, 5464.0; Department of Industry, Science, Energy and Resources (2021)

Production at Kirkland Lake Gold's Fosterville mine in Victoria increased by 3.4% in 2020 to nearly 20 tonnes, driven by increased mill throughput. Over the same period, production at Ramelius Resources' Mt Magnet and Vivien gold mine rose by 47% to 5.7 tonnes, propelled by higher grades.

Production at Evolution Mining's Cowal gold mine in NSW fell by nearly 17% in 2020, to 7.1 tonnes, due to planned maintenance in August 2020. Northern Star's Kalgoorlie Operations output declined by 17% to 9.2 tonnes in 2020, due to planned maintenance and lower grades.

Higher gold mine production until 2023–24

Australian gold mine production is forecast to grow at an average annual rate of 5.7% between 2020–21 and 2023–24, reaching a peak of 410 tonnes in 2023–24 (Figure 10.14). Growth is expected to be driven by mine reactivation and expansions, as well as production from new mines.

Red River Resources' 1.6 tonnes per year Hillgrove gold mine in NSW commenced production in March 2021. Red 5's 6.2 tonnes a year King of the Hills gold project is expected to start production in mid-2022.

NQ Minerals' 1.4 tonnes per year Beaconsfield gold mine in Tasmania is expected to start production in 2021, after production ceased in 2012.

Several gold projects are expected to ramp up production in the coming years. These include St Barbara's 7.9 tonnes a year Gwalia Expansion in WA and the 15 tonnes a year Tropicana Expansion project — a joint-venture between AngloGold Ashanti and Independence Group.

Production at Newmont's Boddington gold mine in Western Australia and Tanami gold operation in the Northern Territory is expected to reach nearly 26 and 16 tonnes of gold in 2021.

Several gold expansion projects are expected to be completed in 2022 and 2023. These include Newcrest's \$685 million and \$175 million Cadia Stage 1 and Stage 2 Expansion projects in NSW, and Newmont Mining's \$750 million Tanami Expansion 2 project in WA. Newmont's Tanami Expansion 2 project is expected to be commissioned in the first half of 2024, lifting the mine's average annual gold output from 15 tonnes a year in 2020 to 18 tonnes a year in 2025.

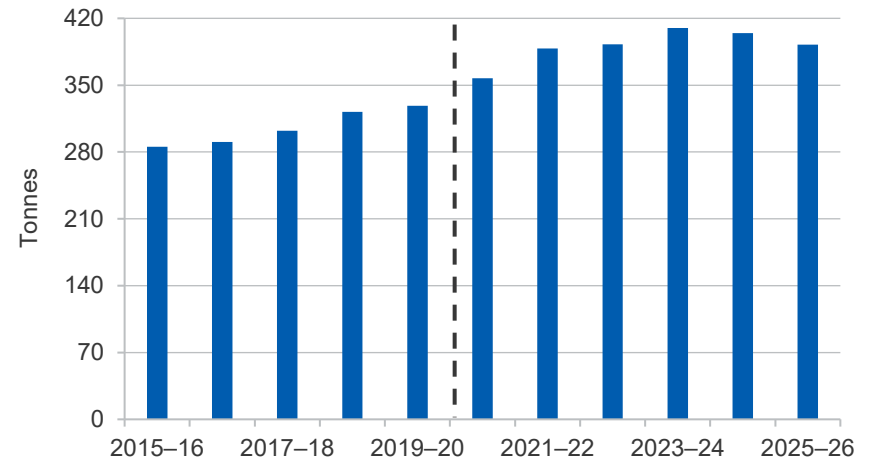
Lower production in the medium term

After reaching a peak in 2023–24, Australian mine output is projected to decline by 2.1% annually to 392 tonnes in 2025–26 (Figure 10.14). Output will be weighed down by lower grade ores, reserve exhaustion and closures, with prices also falling back. Production at Gold Fields' St Ives gold operation in WA is expected to decline from 11 tonnes in 2020 to 3.6 tonnes in 2026.

Western Australia is the centre of Australian gold production

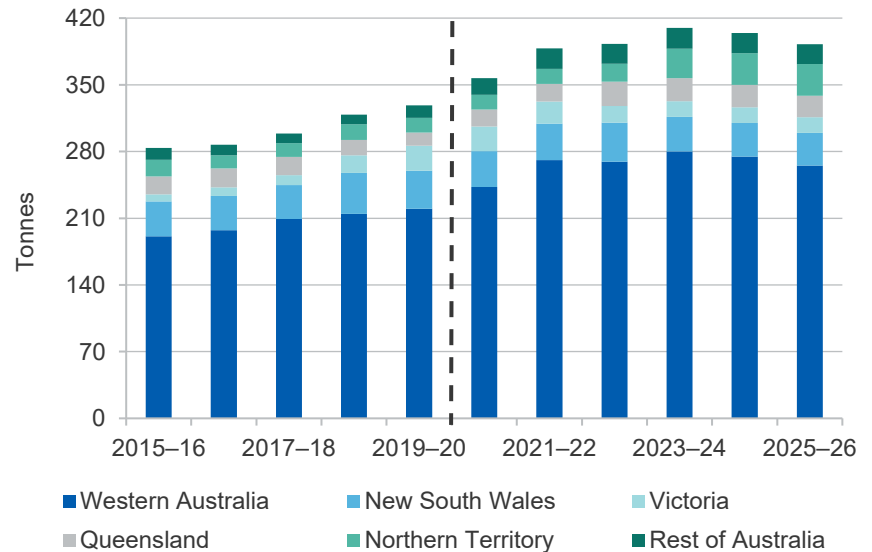
Western Australia is expected to be the largest gold mine producing state in Australia in 2020–21, accounting for 68% of Australian total gold mine output, followed by New South Wales (10%), Victoria (7.2%), Queensland (5.2%), the Northern Territory (4.3%), and the rest of Australia (4.9%). At the end of the outlook period (2025–26), Western Australia is expected to remain Australia's largest gold mine producing state. Production in New South Wales and Victoria is expected to fall, whereas production in Queensland and the Northern Territory is expected to rise (Figure 10.15).

Figure 10.14: Australia's gold production



Source: Department of Industry, Science, Energy and Resources (2021)

Figure 10.15: Production by State/Territory



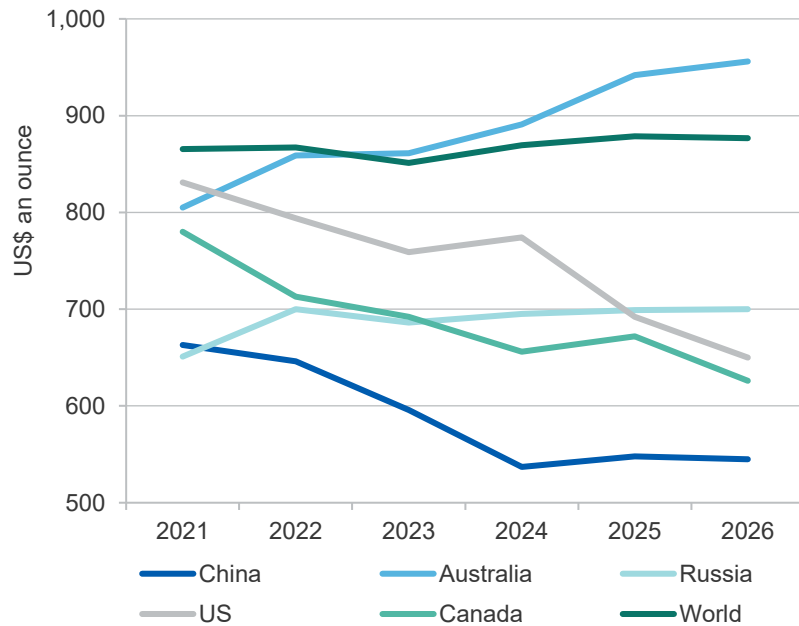
Source: Department of Industry, Science, Energy and Resources (2021)

Australia's gold mine production costs expected to rise in the medium term

Figure 10.16 shows gold production all-in sustaining costs (AISC) — a measure of all direct and recurring costs required to mine a unit of ore — of selected major gold producing nations between 2021 and 2026.

Australia's gold mine production costs are forecast to be lower than the world average costs in the short term, but are expected to be above the world average in the medium term. Australian gold miners are less competitive (have a higher AISC) than Chinese, Russian, and North American producers.

Figure 10.16: Gold mine AISC costs, by country

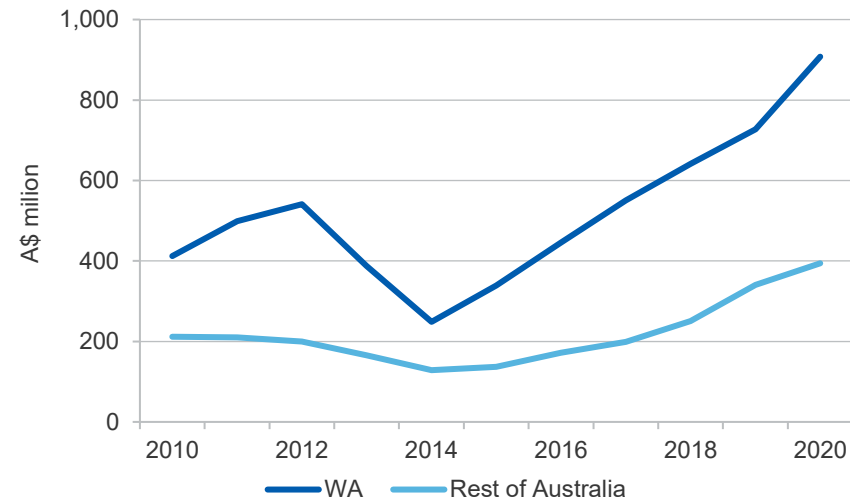


Source: AME (2021)

Exploration expenditure continued to rise in 2020

Australia's gold exploration expenditure increased by nearly 16% in 2020 to nearly \$1.3 billion — accounting for 47% of Australia's total minerals exploration expenditure during the year — driven by high US dollar and Australian dollar gold prices. Western Australia remained the centre of gold exploration activity in Australia, accounting for nearly 70% (or \$908 million) of total gold exploration expenditure (Figure 10.17).

Figure 10.17: Australian gold exploration expenditure



Source: ABS (2021) Mineral and Petroleum Exploration, Australia, 8412.0

Revisions to the outlook

The forecast for Australian gold export volumes in 2020–21 has been revised down by 5.5%, to 344 tonnes, from the forecast in the December 2020 *Resources and Energy Quarterly*. The downward revision reflects the lower than expected export volumes to the United States in the December quarter 2020, down 32% quarter-on-quarter. As a result of the export volume revision, the forecast for Australian gold export values in 2020–21 has been revised down to \$29 billion, down around \$1.0 billion from the forecast in the December 2020 *Resources and Energy Quarterly*.

Table 10.1: Gold outlook

World	Unit	2020	2021^f	2022^f	2023^f	2024^z	2025^z	2026^z	CAGR^r
Total demand	t	3,760	4,080	4,259	4,566	4,784	4,991	5,162	5.4
Fabrication consumption ^b	t	1,714	2,090	2,308	2,515	2,681	2,835	2,973	9.6
Mine production	t	3,401	3,588	3,696	3,769	3,807	3,777	3,746	1.6
Price ^c									
Nominal	US\$/oz	1,770	1,703	1,554	1,467	1,405	1,377	1,350	-4.4
Real ^d	US\$/oz	1,805	1,703	1,522	1,405	1,315	1,260	1,208	-6.5
Australia	Unit	2019–20	2020–21^f	2021–22^f	2022–23^f	2023–24^z	2024–25^z	2025–26^z	CAGR^r
Mine production	t	329	357	388	393	410	404	392	3.0
Export volume	t	350	344	416	420	435	429	418	3.0
– nominal value	A\$m	24,394	29,056	27,086	26,682	26,461	25,599	24,418	0.0
– real value ^e	A\$m	24,652	29,056	26,642	25,705	24,869	23,462	21,824	-2.0
Price									
– nominal	A\$/oz	2,338	2,480	2,024	1,976	1,893	1,855	1,818	-4.1
– real ^e	A\$/oz	2,363	2,480	1,991	1,904	1,780	1,700	1,625	-6.0

Notes: **b** includes jewellery consumption and industrial applications; **c** London Bullion Market Association PM price; **d** In 2021 calendar year US dollars; **e** In 2020–21 financial year Australian dollars; **f** Forecast; **z** Projection; **r** Compound annual growth rate for the period from 2020 to 2026, or from 2019–20 to 2025–26.

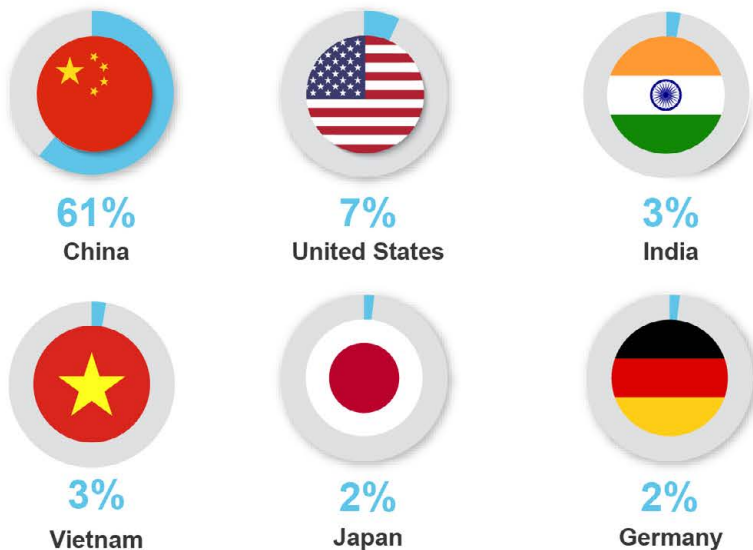
Source: ABS (2021) International Trade, 5465.0; London Bullion Market Association (2021) Gold Price PM; World Gold Council (2021); Department of Industry, Science, Energy and Resources (2021)

Aluminium

Major Australian bauxite deposits (Gt)



Key consumer markets for primary aluminium



Aluminium



Bauxite is refined to recover alumina and smelted to make aluminium



2-3 tonnes of bauxite is required to produce one tonne of alumina



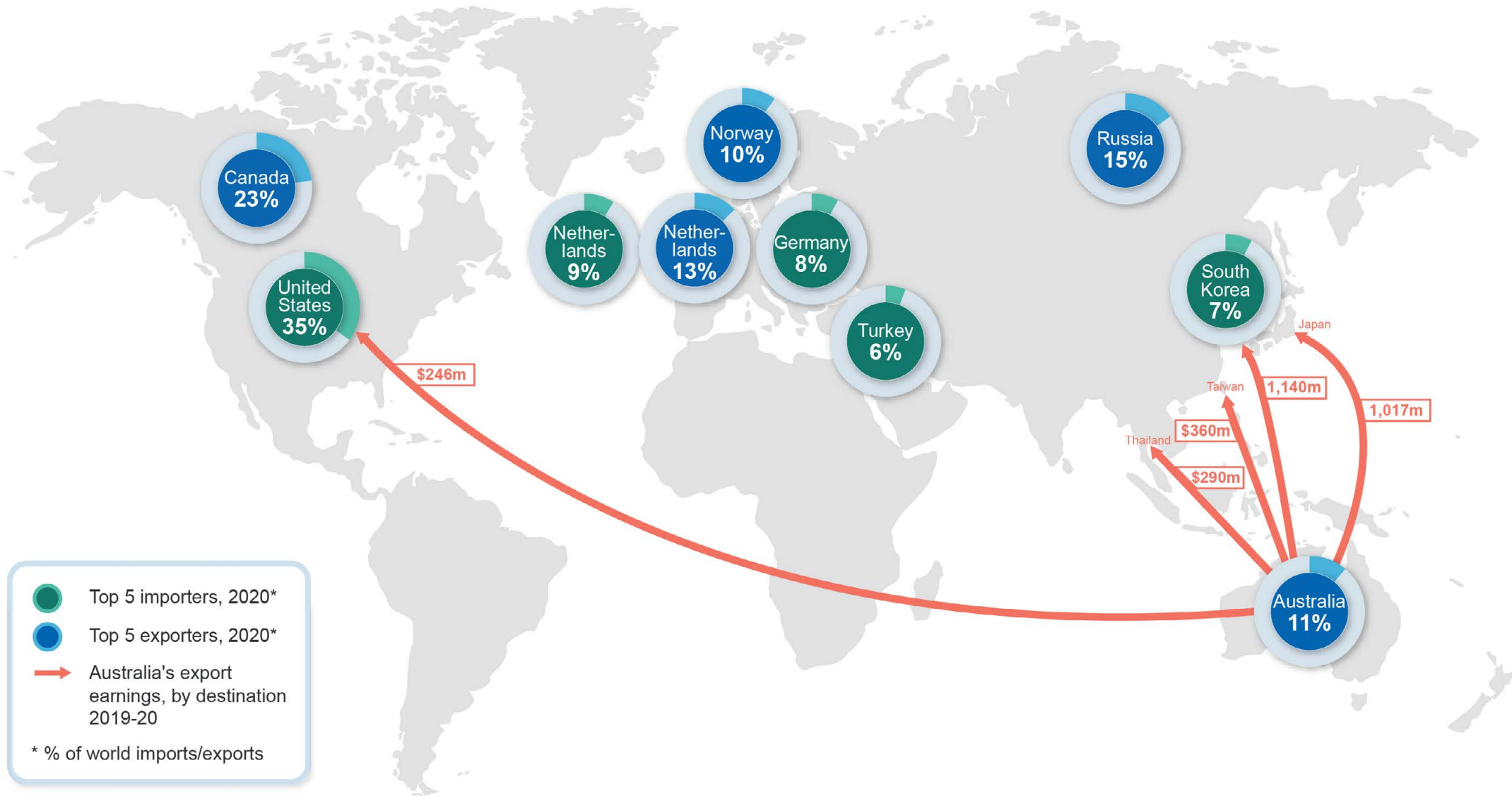
China is the world's largest producer & consumer of primary aluminium



Each electric vehicle contains 0.25 tonne of aluminium

Australia's aluminium





11.1 Summary

- A global economic recovery and the roll out of COVID-19 vaccines are expected to see support primary aluminium and alumina prices over the outlook period. Prices are projected to rise (in real terms) to US\$2,043 a tonne for aluminium and US\$310 a tonne for alumina by 2026.
- Australia’s primary aluminium and alumina export volumes are projected to remain steady over the outlook period — at 1.4 million tonnes of aluminium and 18 million tonnes of alumina a year (see [Australia section](#)). However, bauxite export volumes are expected to fall in the short term due to strong competition from Guinea and Indonesia.
- Australia’s aluminium, alumina and bauxite export earnings are projected to remain steady at \$12 billion a year (in real terms) until 2025–26, as lower alumina and bauxite exports are offset by increased aluminium export values (due to higher aluminium prices).

11.2 World consumption

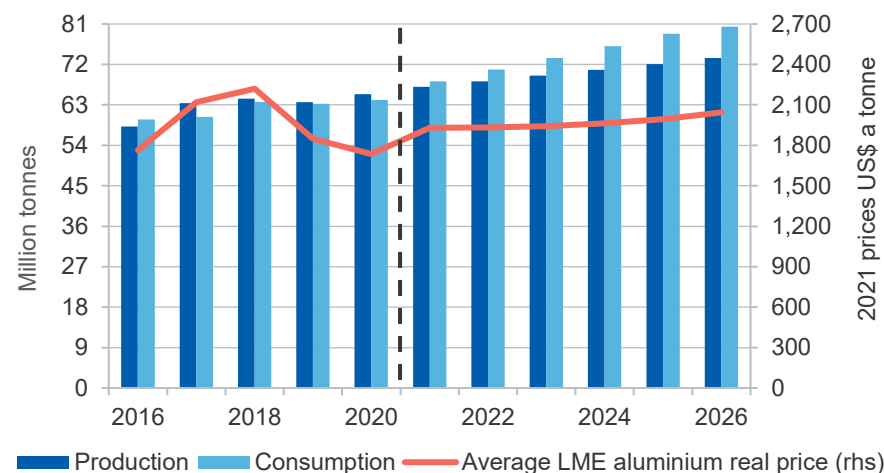
China led higher aluminium, alumina and bauxite consumption in 2020

Global aluminium consumption increased by 1.4% to 64 million tonnes in 2020 (Figure 11.1). This gain was driven by an 11% rise in consumption in China — the world’s largest primary aluminium consuming country. COVID-19 containment measures in the first quarter of 2020 reduced aluminium recycling activity, and the fall in aluminium collection activity led to a spike in the use of primary aluminium as a substitute for scrap aluminium. A rise in the use of aluminium in infrastructure and construction projects initiated with the Chinese government’s stimulus package also contributed to a large jump in Chinese aluminium consumption in 2020.

Vietnam’s primary aluminium consumption grew by 15% in 2020, to 1.6 million tonnes. This makes Vietnam the world’s fourth largest primary aluminium consumer after China, the US and India. Growth was driven by successful containment of the COVID-19 pandemic and the Vietnamese Government’s stimulus policy, which targeted manufacturing and construction sectors.

Offsetting the rise of primary aluminium consumption in China and Vietnam, was the fall in aluminium use in the automotive and aviation industries. At the peak of COVID-19 containment measures in April and May 2020, global automotive makers cut production at plants across Europe, North America and Asia. Car sales fell sharply across the world, as the loss of jobs and income reduced consumer spending on discretionary items. Despite some improvement in global economic activity in the second half of 2020, car sales in China fell by 1.9% to just over 25 million units in 2020, and in Europe, they fell by 21% to 14 million units.

Figure 11.1: World aluminium production, consumption and prices

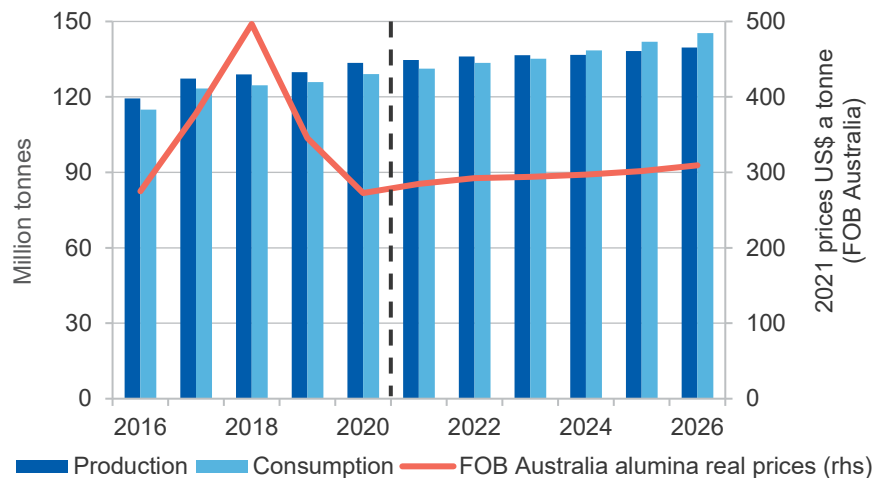


Source: International Aluminium Institute (2021); AME (2021); World Bureau of Metal Statistics (2021); Department of Industry, Science, Energy and Resources (2021)

World alumina usage increased by 2.5% in 2020 to 129 million tonnes, driven by higher global aluminium production, which was up by 2.7% in 2020 (Figure 11.2).

World bauxite usage rose by 3.0% in 2020 to 309 million tonnes, propelled by increased global alumina production (up 2.8% in 2020). The growth in alumina production was driven by the production ramp-up in China and the resumption of full production at Brazil’s 6.4 million tonnes per year Alunorte alumina refinery.

Figure 11.2: World alumina production, consumption and prices



Source: International Aluminium Institute (2021); AME (2021); World Bureau of Metal Statistics (2021); Department of Industry, Science, Energy and Resources (2021)

Aluminium, alumina and bauxite consumption to rise over medium term

Demand for primary aluminium in 2021 is expected to be mainly driven by China, as the Chinese government continues to inject stimulus into the economy through the first half of 2021. An economic recovery in the US, United Kingdom, Eurozone, India, South Korea and Japan in the second half of 2021 is likely to add more demand for primary aluminium. As a result, global primary aluminium consumption is forecast to increase by 6.4% in 2021, to 68 million tonnes.

After 2021, world primary aluminium consumption is projected to grow at an annual average rate of 3.3%, to 80 million tonnes by 2026. The global economic recovery is expected to support demand for cars, houses and electrical equipment, and thus aluminium consumption. Car sales are expected to recover as a result of the COVID-19 pandemic, which seems likely to shift consumer preferences in favour of car travel at the expense of some forms of public transport. Partly offsetting this, an increase in remote working is likely to reduce car usage in urban areas. On the

production side, global automotive makers are expected to ramp up production to accommodate higher car demand.

A significant driver of aluminium demand is expected to come from cars, particularly energy-efficient vehicles and electric vehicles (EV), which contain a higher proportion of aluminium components. Automakers across the world are working to replace internal combustion engines with electric battery engines, and are seeking to reduce vehicles' weight by increasing the use of aluminium, which is 10 to 40 % lighter than steel. Bloomberg New Energy Finance (BNEF) estimates that passenger EV sales will rise from 1.7 million units in 2020 to 11 million units in 2026. With an estimated average aluminium content of 250 kilograms per electric vehicle, aluminium usage in EVs is projected to increase from 484,000 tonnes in 2020 to about 3.1 million tonnes in 2026 (Figure 11.3).

World alumina usage is projected to rise at an average annual rate of 2.1% over the outlook period, reaching 145 million tonnes by 2026 (Figure 11.2). Alumina demand is driven by primary aluminium production, which is projected to lift by an average 1.8% a year between 2022 and 2026.

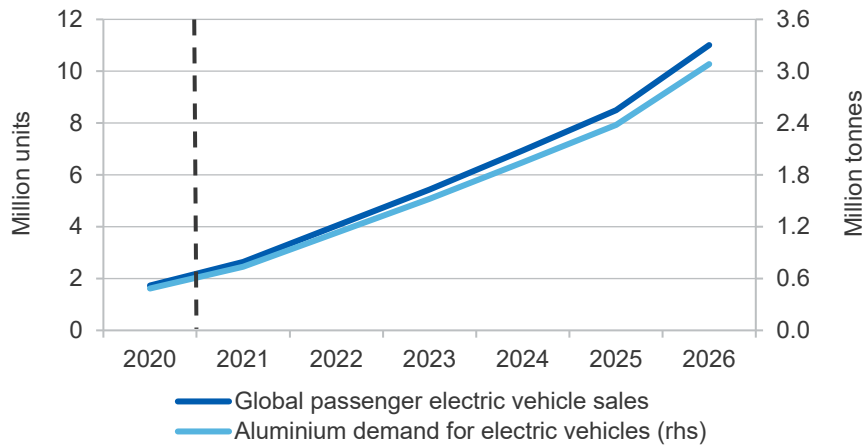
World bauxite usage is forecast to grow by 3.3% in 2021 and by 5.2% to 336 million tonnes in 2022. The gains are expected to be driven by higher alumina output from existing refinery capacities in China and Brazil. After 2022, world bauxite consumption is projected to grow at a slower (average annual growth rate of 0.2%) pace, reaching 339 million tonnes by 2026.

11.3 World Production

Aluminium, alumina and bauxite output grew in 2020

In 2020, world primary aluminium output was 65 million tonnes, a 2.7% rise from 2019, propelled by higher Chinese output (Figure 11.4). Output in China — the world's largest primary aluminium producer — rose by 5.8% to 37 million tonnes in 2020. China's primary aluminium producers raised output in response to government stimulus measures on infrastructure and construction.

Figure 11.3: Global electric vehicle sales and aluminium demand



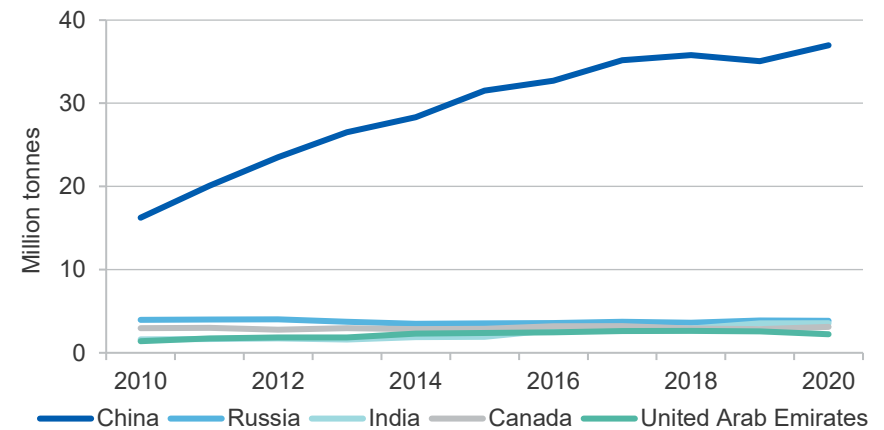
Source: Bloomberg New Energy Finance (2021); EY (2019) How advancing mobility will disrupt the mining and metals sector; Department of Industry, Science, Energy and Resources (2021)

Primary aluminium output in Canada rose by 9.1% to 3.1 million tonnes in 2020, driven by the ramp up of production at the Alouette aluminium smelter (600,000 tonnes per year). Over the same period, output in the Middle East rose by 3.8%, to 5.8 million tonnes, propelled by the ramp up of production at the Aluminium Bahrain smelter (annual capacity of 1.6 million tonnes) — the world’s largest aluminium smelter outside China.

World alumina supply rose by 2.8% to nearly 134 million tonnes in 2020, driven by higher output in China and Australia (Figure 11.2). Production in China — the world’s largest alumina producer — rose by 0.9% in 2020 to 73 million tonnes, as Chinese refiners raised output to accommodate higher aluminium production. Alumina production in Australia — the world’s second largest alumina producer — rose by 2.7% in 2020, to nearly 21 million tonnes, propelled by strong production at Rio Tinto’s refineries. Production in Brazil rose by 12% to over 10 million tonnes, as Norsk Hydro’s Alunorte refinery (annual capacity of 6.4 million tonnes) ramped up production from October 2020, following the completion of maintenance work at its Paragominas bauxite mine earlier in the month.

World bauxite production increased by 1.2% in 2020 to 359 million tonnes, driven by higher output in Guinea and Indonesia (Figure 11.5). Production in Guinea — the world’s second largest bauxite producer — increased by 9.1% in 2020, to 77 million tonnes. Production in Indonesia rose by 42% in 2020, to 21 million tonnes, as Indonesian bauxite producers ramped up production ahead of a new bauxite mining ban that is expected to be implemented in early 2022.

Figure 11.4: World’s top five primary aluminium producing countries



Source: International Aluminium Institute (2021); AME (2021); World Bureau of Metal Statistics (2021); Department of Industry, Science, Energy and Resources (2021)

Production in Brazil increased by 12%, to over 10 million tonnes, as Norsk Hydro’s Alunorte refinery (annual capacity of 6.4 million tonnes) ramped up production from October 2020, following the completion of maintenance work at its Paragominas bauxite mine earlier in the month.

Aluminium, alumina and bauxite output set to rise over the outlook period

World primary aluminium output is forecast to grow by 2.5% in 2021 and by 1.8% to 68 million tonnes in 2022 (Figure 11.4). The gain is expected to be driven by additional capacity in China and Iran. An estimated 2.9 million tonnes of new primary aluminium capacity to be added in 2021 is likely to bring China’s total primary aluminium production in 2021 to 39 million

tonnes (up 6.3% from 2020). More greenfield aluminium smelters are anticipated, located in regions where power is cheap and abundant (such as Yunnan province). Shenhua's 450,000 tonnes per year Shenhua Wenshan aluminium smelter — a greenfield aluminium project — is expected to start commercial production in the second half of 2021. East Hope' 330,000 tonnes a year East Hope Jinzhong aluminium expansion project is expected to be commissioned in 2022.

Outside of China, Iran is implementing a plan to raise its annual aluminium output to 1.5 million tonnes by 2025, with the first phase (300,000 tonnes) of the 1.0 million tonne per year SALCO aluminium smelter ramping up production over the outlook period. In Norway, production at Hydro's Husnes aluminium smelter is forecast to increase by 105% in 2021, to 195,000 tonnes, driven by the restart of its B line in November 2020.

World aluminium production is projected to rise by 1.8 per cent a year over the outlook period, reaching 74 million tonnes by 2026 (Figure 11.1). The gains will be driven by China, as more output is produced from greenfield aluminium smelters. China's primary aluminium production is projected to reach 43 million tonnes by 2026, edging closer to the capacity cap of 45 million tonnes of primary aluminium per year — a policy that was introduced by the Chinese government in 2017 in response to environmental and oversupply concerns. The Chinese government's Five Year Plan (2021–25), set in October 2020, calls for the China's production and capacity of both primary aluminium and alumina to peak by 2025.

The closer China edges to its primary aluminium capacity cap, the greater the opportunity for other primary aluminium producing countries — Russia, India, Canada and the United Arab Emirates — to fill the production gap.

The operation of Rio Tinto's 333,000 tonnes a year Tiwai Point aluminium smelter in New Zealand is expected to continue until 2024, following the company's successful negotiation on a power deal with an energy supplier, Meridian Energy, in February 2021. In July 2020, Rio Tinto announced the Tiwai Point aluminium smelter would cease its operation in August 2021, due to high energy costs and a challenging industry outlook.

A risk to primary aluminium production assessment is the lawsuit that was lodged in February 2021 by a group of communities in the lower Amazon region in the state of Para in Brazil. The outcome of the lawsuit is likely to impact the production of Norsk Hydro's 471,000 tonnes a year Albras aluminium smelter.

[Green aluminium expected to be a new manufacturing standard](#)

Low carbon aluminium production is expected to become a new manufacturing standard going forward. China's two largest aluminium producers (Chinalco and China Hongqiao) issued a joint-statement on 24 January 2021 calling for the Chinese aluminium and alumina industry to reduce carbon emissions, conserve energy and produce low carbon aluminium as part of China's plan to achieve carbon neutrality by 2060.

Outside of China, Rusal from Russia has partnered with Henan Mingtai from China to produce low carbon aluminium products at their Gwangyang plant in South Korea, expected in the second half of 2021. Emirates Global Aluminium and Dubai Electricity and Water Authority signed a partnership agreement in January 2021 to construct the world first solar powered primary aluminium production facility.

World alumina output is forecast to grow by 0.9% to 135 million tonnes in 2021, driven by rising output from existing refineries in China and Brazil (Figure 11.2). In China, Aluminium Corporation of China's 2.0 million tonnes per year Huasheng Alumina Refinery started producing in September 2020 and is expected to ramp up production in 2021. In Brazil, production at Norsk Hydro's 6.4 million tonnes per year Alunorte refinery is expected to continue to ramp up to full capacity. World alumina output is projected to hit almost 140 million tonnes by 2026 (Figure 11.2). The gains are forecast to be driven by India and other small alumina refining nations.

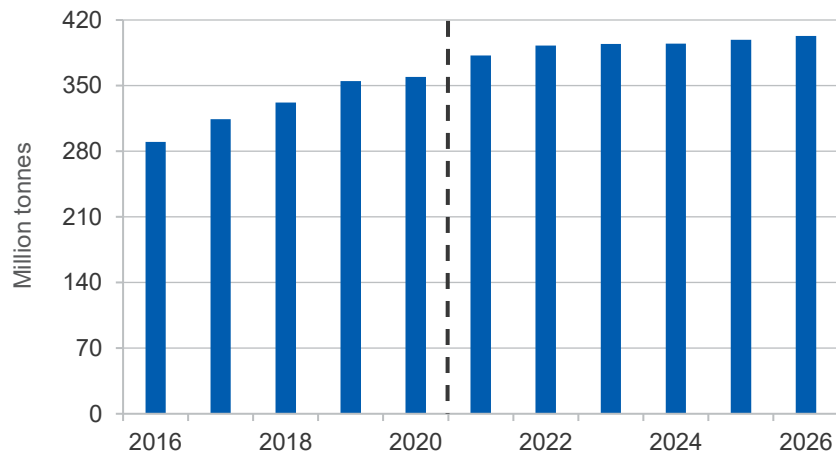
In India, bauxite sourcing has improved, with Vedanta planning to increase production capacity at its Lanjigarh refinery to 2.7 million tonnes in the short term, and to 6.0 million tonnes in the medium term. Hindalco's 1.5 million tonnes per year Utkal Alumina Refinery is expected to come online in 2022.

In Vietnam, Vietnam Coal and Minerals Industries Group's 650,000 tonnes a year Tan Rai Alumina Refinery is expected to commence commercial production in 2023. In Indonesia, China Hongqiao and joint-venture partners' 2.0 million tonnes per year Well Harvest alumina refinery expansion project is expected to come online in 2022.

World bauxite output is forecast to grow by 6.4% in 2021 and by 2.8% to 393 million tonnes in 2022 (Figure 11.5). The gains are expected to be driven by newly added capacity in Guinea, where output is rising rapidly.

Guinea's bauxite output is forecast to grow at an average rate of 7.0% a year in 2021 and 2022. The Compagnie des Bauxites de Guinée mine in Guinea, which expanded annual capacity from 13 to 18 million tonnes in 2019, is due to expand to 28 million tonnes by 2022. Emirates Global Aluminium is planning to ramp up output at its bauxite mine in Guinea, targeting 12 million tonnes per year towards the end of 2022. After 2022, world bauxite production is projected to grow at a slower pace, with an average annual growth rate of 0.6%, to 403 million tonnes in 2026.

Figure 11.5: World bauxite production

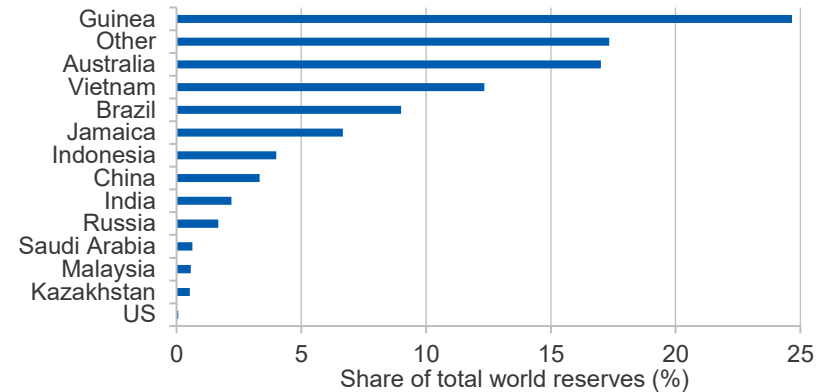


Source: Department of Industry, Science, Energy and Resources (2020)

Guinea leads in world bauxite resources

According to the US Geological Survey, global bauxite reserves are estimated around 30 billion tonnes, of which Guinea accounts for a quarter, followed by Australia (17%), Vietnam (12%), Brazil (9.0%) and Jamaica (6.7%) (Figure 11.6).

Figure 11.6: Shares of world bauxite reserves



Source: US Geological Survey (2021) Mineral Commodity Summaries

11.4 Prices

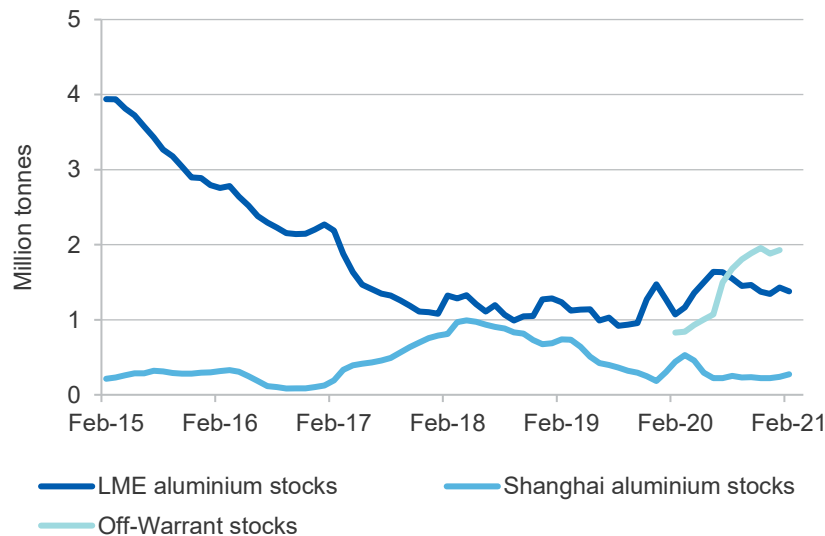
Aluminium and alumina prices fell in 2020

The London Metal Exchange (LME) spot price for aluminium fell by 6.2% in 2020, averaging US\$1,736 a tonne (Figure 11.8). Prices were affected by the COVID-19 containment measures that rippled through global manufacturing activity in the first half of 2020. COVID-19 containment measures affecting the global automotive industry had an adverse impact on aluminium usage. Car sales fell sharply across the world, as the loss of jobs and income reduced consumer spending on discretionary items. Global car sales decreased by 27 per cent year-on-year in the first half of 2020, to nearly 29 million units. Adding further pressure on primary aluminium prices was production growth production in China — Chinese primary aluminium producers took advantage of lower input costs (lower alumina and fuel prices) to ramp up production.

The free on board (FOB) Australian alumina price dropped by 21% in 2020, to an average US\$273 a tonne (Figure 11.8). The price fall was driven by rising production — a surplus of alumina output from 2019 (about 870,000 tonnes) and refineries returning to full production following the easing of COVID-19 related restrictions in the second half of 2020.

The speedy recovery of China’s economy from the COVID-19 pandemic drove up primary aluminium demand and prices in the second half of 2020, with both recovering to pre-COVID-19 levels. This increased usage contributed to a fall in LME aluminium inventories (Figure 11.7). Shanghai stocks have fallen since April 2020, as China’s consumption recovered. Other factor contributing to higher prices includes large scale strategic aluminium stockpiling by China’s aluminium producers/traders. LME off-warrant stocks have risen since data was first released in early 2020 (Figure 11.7).

Figure 11.7: Exchange aluminium stocks



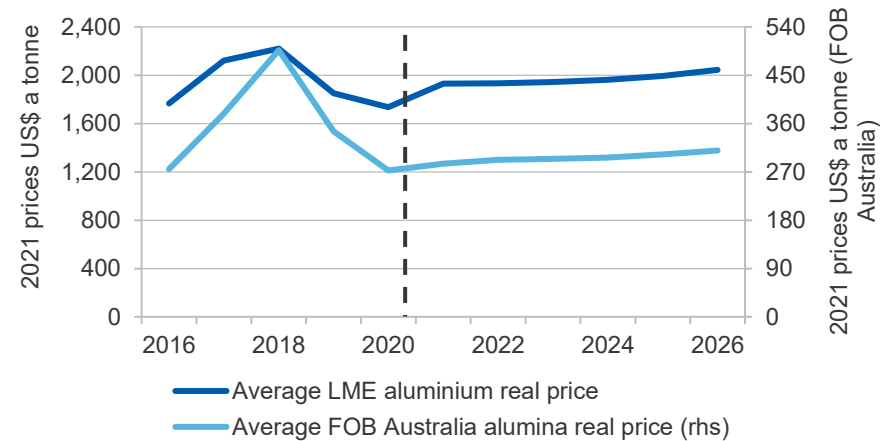
Source: London Metal Exchange (2021); World Bureau of Metals Statistics (2021)

Aluminium and alumina prices to rise over the outlook period

In February 2021, China’s industrial production growth was at a 21-month high, indicating strong short term demand conditions from the world’s largest base metals consumer. The global roll out of the COVID-19 vaccines is also expected to provide support for primary aluminium prices.

The LME aluminium spot price is forecast to increase by 11% to average US\$1,930 a tonne in 2021 (in real terms) (Figure 11.8). The rise reflects China’s robust industrial recovery, which is expected to lead to healthier global demand conditions going forward.

Figure 11.8: World aluminium and alumina prices



Source: LME (2021) spot prices; Bloomberg (2021); Department of Industry, Science, Energy and Resources (2021)

The risks to the price assessment are the new strains of COVID-19 and global oversupply of primary aluminium. Highly contagious COVID-19 cases detected in the United Kingdom, South Africa and some countries in Africa and Asia have the potential to drag the COVID-19 pandemic longer and derail the global economic recovery. Primary aluminium production in China — the world’s largest primary aluminium producer, accounting for nearly 60% of global production — is in full swing, and is expected to lift output by 6.3% in 2021.

The FOB Australian alumina price is forecast to increase by 4.5% in 2021, to average US\$285 a tonne (in real terms), driven by increased primary aluminium production in China (Figure 11.8).

After 2021, the LME aluminium price is projected to rise at an annual rate of 1.2% to average US\$2,043 a tonne in 2026 (in real terms). World alumina output is projected to grow at an annual rate of 0.7% after 2021. As a result, the FOB Australian alumina price (real terms) is projected to rise at 1.7% a year to US\$310 a tonne in 2026 (Figure 11.8).

11.5 Australia's production and exports

Steady aluminium, alumina and bauxite production over the outlook

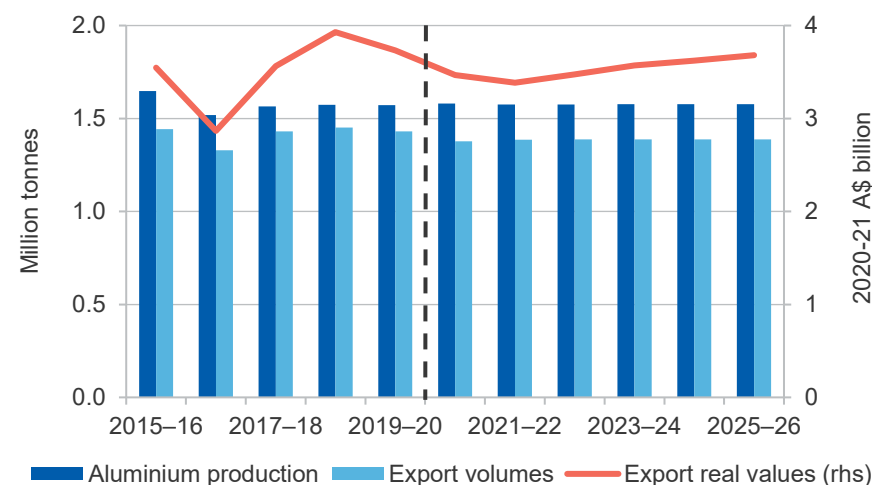
No expansions or major disruptions are expected at existing aluminium and alumina operations in Australia over the outlook period. This implies little change in production over the short to medium term. Australia's aluminium output is projected to remain at about 1.6 million tonnes a year out to 2025–26 (Figure 11.9). Alumina output is expected to remain at about 20 million tonnes per annum over the outlook period (Figure 11.10).

Risks to the aluminium outlook include the operating costs of aluminium smelters. Figure 11.11 shows the operating costs of aluminium smelters in selected major primary aluminium producing nations, including the United States, Australia, China, India and Russia. Australian smelters' operating costs are above the world average of US\$1,905 a tonne in 2021.

In December 2020, the Australian Government announced it will underwrite power system security revenue earned by Victoria's Portland Aluminium smelter, guaranteeing up to A\$76.8 million for services provided over four years to 2024-25, subject to negotiation.

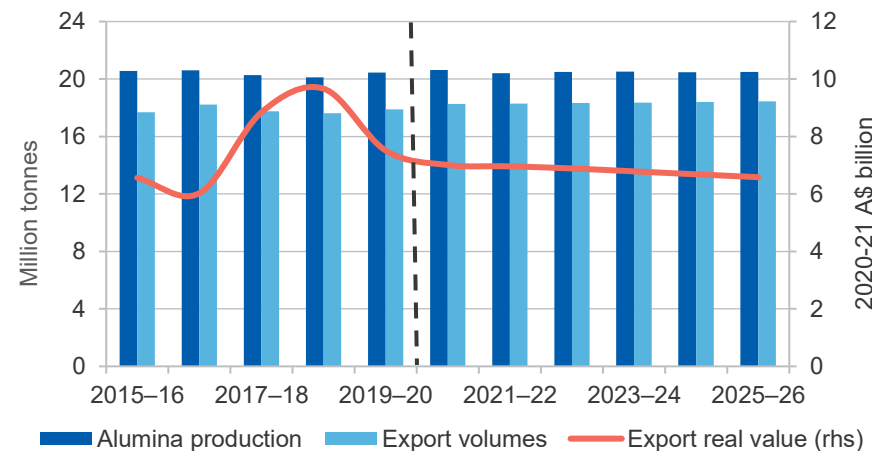
Australia's bauxite production is forecast to fall by 2.8% to 104 million tonnes in 2020–21, (Figure 11.12). This fall is related to the suspension of operations at Metro Mining's 6 million tonnes a year Bauxite Hills mine in Queensland from September 2020 to April 2021, due to the wet season shutdown and planned maintenance. After 2020–21, output is projected to be steady out to 2025–26, with no expansions or disruptions expected.

Figure 11.9: Australia's aluminium exports and production



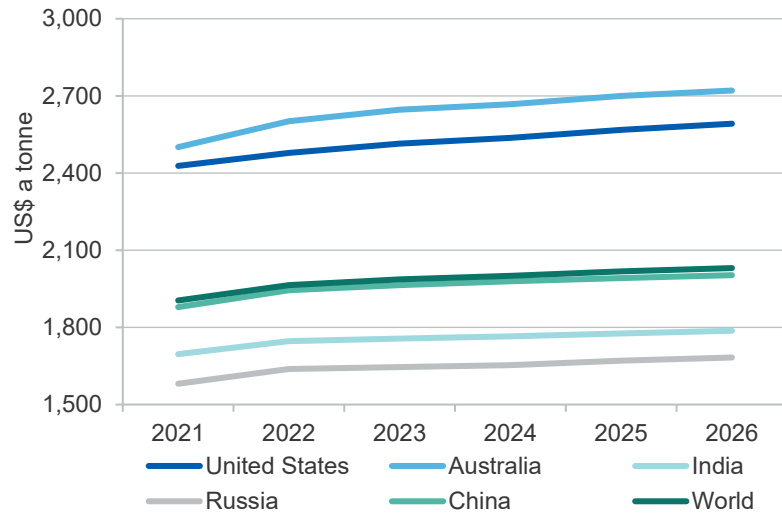
Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

Figure 11.10: Australia's alumina exports and production



Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

Figure 11.11: Aluminium smelter total operating costs



Source: AME (2021)

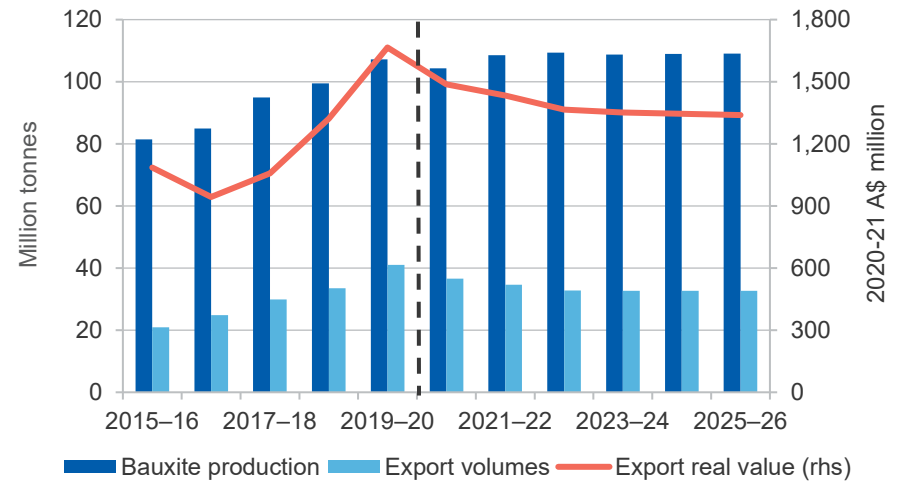
Steady aluminium, alumina and bauxite export earnings after 2020–21

Despite an expected improvement in aluminium and alumina prices in 2021, Australia’s aluminium, alumina and bauxite export earnings are forecast to fall by 7.3% to nearly \$12 billion (in real terms) in 2020–21. The fall in export earnings is expected to be driven by a drop in bauxite export volumes, which are forecast to fall by 11% to 37 million tonnes.

Over the last few years, companies from China and Europe have invested heavily in Guinea to build up the country’s bauxite production capacity. Guinea overtook Australia as China’s largest supplier of bauxite in 2017, and accounted for 47 per cent of China’s total bauxite imports by 2020 (Figure 11.13).

After 2020–21, Australia’s aluminium, alumina and bauxite exports are projected to be steady, at around \$12 billion a year in real terms until 2025–26. Lower alumina and bauxite export values are expected to be offset by increased export values of aluminium, as prices of primary aluminium are projected to rise over the outlook period.

Figure 11.12: Australia’s bauxite exports and production

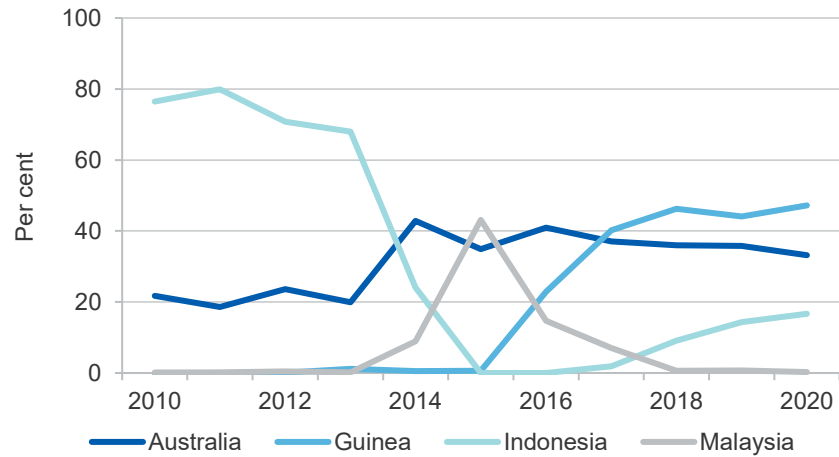


Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

The Indonesian government’s decision to delay the reintroduction of bauxite export bans (from 2022 to June 2023) is expected to increase global bauxite supply, and hence the level of competition for Australian bauxite exporters for the Chinese market.

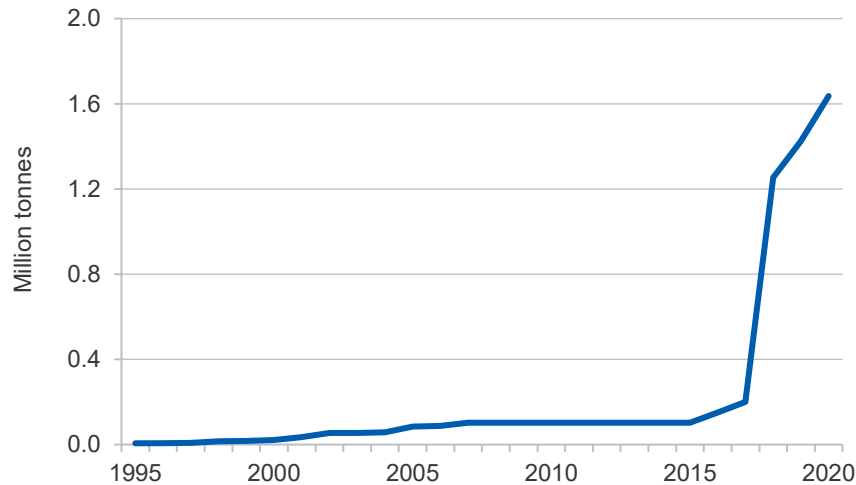
However, the rise in Vietnam’s primary aluminium consumption is expected to provide export opportunities for Australian exporters. Primary aluminium consumption in Vietnam has accelerated since 2017, with consumption growing at 527% in 2018, 14% in 2019 and 15% in 2020 (Figure 11.14). By the end of 2021, Vietnam is expected to be a major aluminium consuming country, with usage driven by strong economic growth, ongoing urbanisation and industrialisation.

Figure 11.13: China's bauxite imports by partner country



Source: Bloomberg (2021)

Figure 11.14: Vietnam's primary aluminium consumption



Source: World Bureau of Metals Statistics (2021)

Revisions to the outlook

The forecast for Australia's aluminium, alumina and bauxite exports earnings has been revised up from the December 2020 Resources and Energy Quarterly — by \$95 million in 2020–21, and by \$80 million to nearly \$12 billion in 2021–22. The revision reflects larger than expected rise in aluminium and alumina prices in the December quarter 2020.

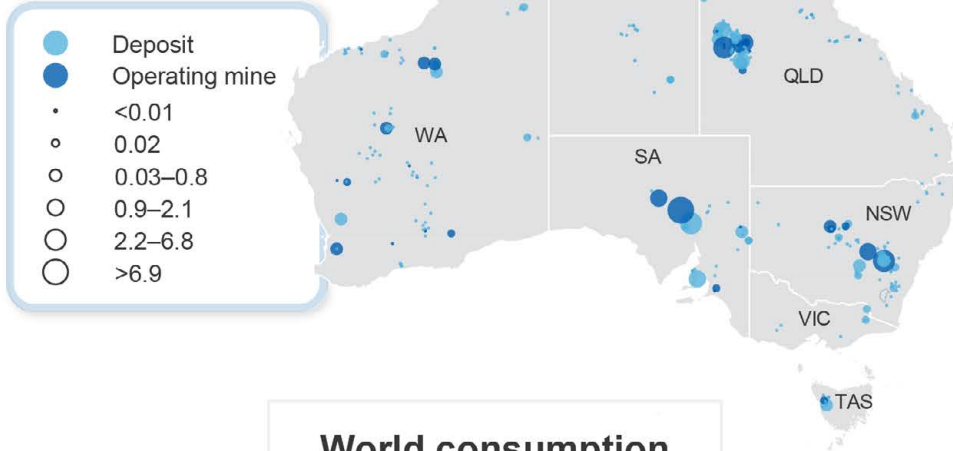
Table 11.1: Aluminium, alumina and bauxite outlook

World	Unit	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
Primary aluminium									
Production	kt	65,384	67,044	68,266	69,516	70,798	72,100	73,434	2.0
Consumption	kt	64,127	68,229	70,893	73,433	76,092	78,852	80,429	3.8
Prices aluminium^c									
- nominal	US\$/t	1,702	1,930	1,973	2,029	2,097	2,179	2,284	5.0
- real ^d	US\$/t	1,736	1,930	1,932	1,942	1,962	1,994	2,043	2.8
Prices alumina spot									
- nominal	US\$/t	267	285	299	307	317	330	346	4.4
- real ^d	US\$/t	273	285	292	294	297	302	310	2.2
Australia	Unit	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^z	2023–24 ^z	2024–25 ^z	2025–26 ^z	CAGR ^r
Production									
Primary aluminium	kt	1,572	1,581	1,575	1,576	1,577	1,576	1,577	0.0
Alumina	kt	20,451	20,635	20,396	20,494	20,508	20,466	20,489	0.0
Bauxite	Mt	107.2	104.3	108.6	109.4	108.8	108.9	109.0	0.3
Consumption									
Primary aluminium	kt	188	203	189	189	189	189	189	0.1
Exports									
Primary aluminium	kt	1,430	1,372	1,386	1,387	1,388	1,387	1,387	-0.5
- nominal value	A\$m	3,692	3,466	3,439	3,605	3,801	3,950	4,120	1.8
- real value ^e	A\$m	3,731	3,466	3,383	3,473	3,572	3,621	3,682	-0.2
Alumina	kt	17,876	18,254	18,291	18,328	18,364	18,401	18,438	0.5
- nominal value	A\$m	7,431	7,007	7,077	7,148	7,219	7,292	7,364	-0.2
- real value ^e	A\$m	7,510	7,007	6,961	6,886	6,785	6,683	6,582	-2.2
Bauxite	kt	41,026	36,630	34,627	32,805	32,638	32,672	32,705	-3.7
- nominal value	A\$m	1,648	1,487	1,457	1,417	1,438	1,468	1,499	-1.6
- real value ^e	A\$m	1,666	1,487	1,433	1,365	1,351	1,345	1,340	-3.6
Total value									
- nominal value	A\$m	12,771	11,960	11,973	12,169	12,458	12,710	12,983	0.3
- real value ^e	A\$m	12,907	11,960	11,777	11,724	11,708	11,649	11,604	-1.8

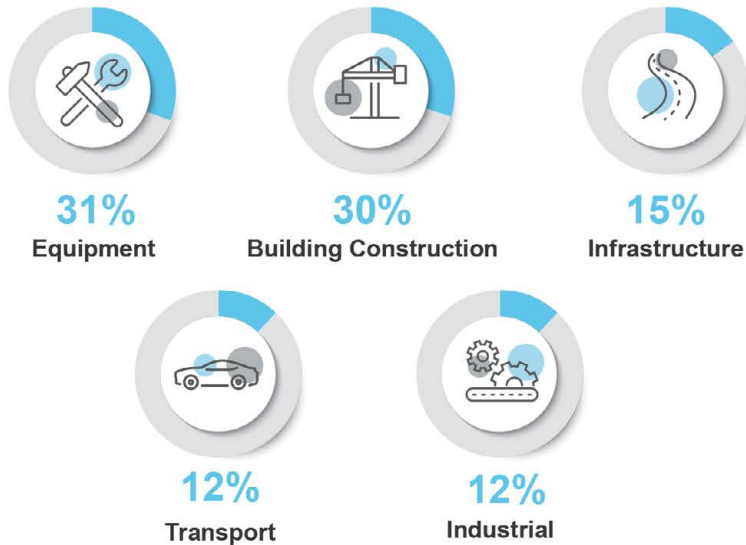
Notes: **c** LME cash prices for primary aluminium; **d** In 2021 calendar year US dollars; **e** In 2020–21 financial year Australian dollars; **f** Forecast; **r** Average annual growth between 2020 and 2026 or 2019–20 and 2025–26; **z** Projection. Source: ABS (2021) International Trade in Goods and Services, 5368.0; AME Group (2021); LME (2021); Department of Industry, Science, Energy and Resources (2021); International Aluminium Institute (2021); World Bureau of Metal Statistics (2021)

Copper

Major Australian copper deposits (Mt)



World consumption



Copper facts



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



80% of copper ever produced **is still in use today**



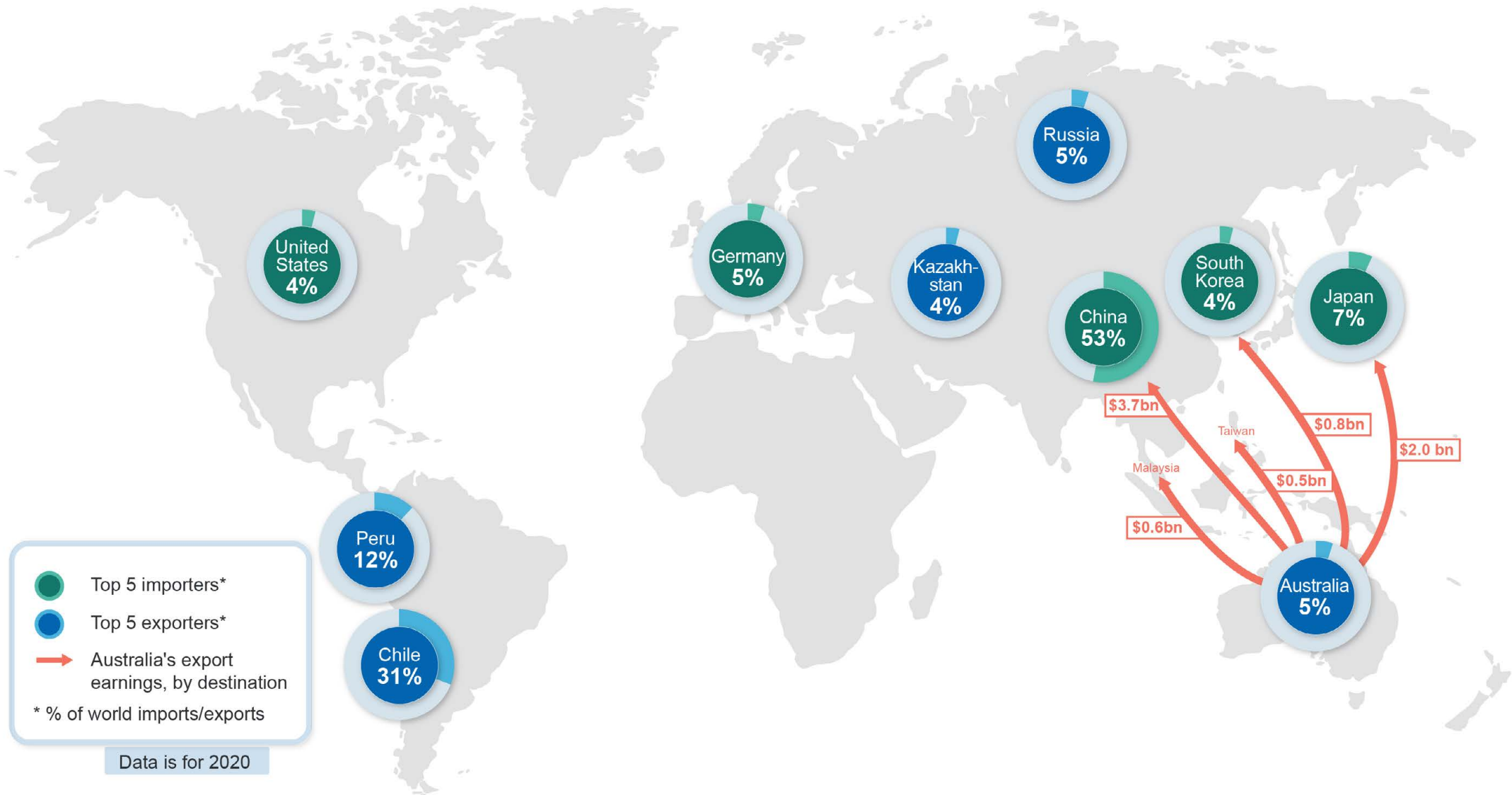
An electric car contains about **5x more copper** than an equivalent ICE car



China consumes half of the **world's copper**

Australia's copper





12.1 Summary

- The copper price is expected to be buoyed by the global economic recovery and rising investment in low-emissions technologies. Prices are forecast to increase to an average US\$8,260 a tonne in 2021, before stabilising around a projected US\$7,940 a tonne (in real terms) in 2026.
- Australia's copper exports are projected to rise from 924,000 tonnes in 2019–20 to around 992,000 tonnes (in metal content terms) in 2025–26, driven by growing production from new and existing mines (see [Australia section](#)).
- As prices and output grow, Australia's copper export earnings are projected to lift from \$10 billion in 2019–20 to \$16 billion (in real terms) in 2025–26, up an average 7% a year.

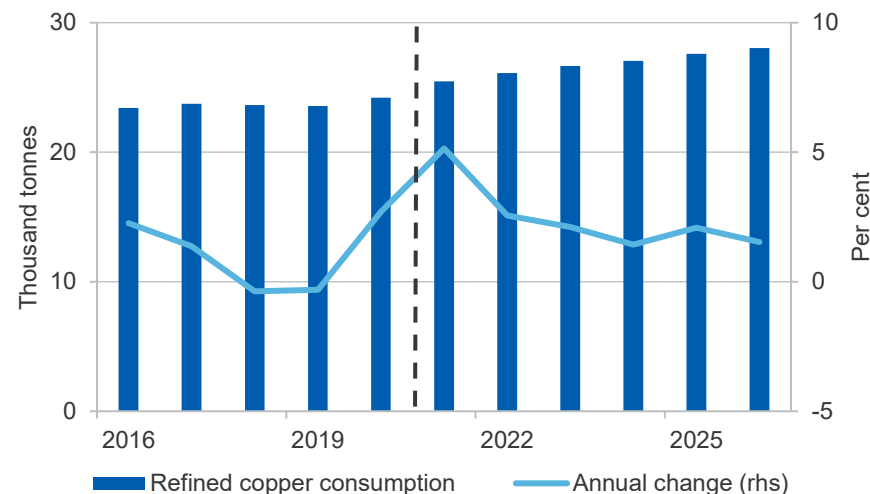
12.1 World consumption

Returning appetite for copper

Copper consumption is expected to continue recovering in 2021, driven by improving economic growth and copper's essential role in electrification. After increasing by an estimated 2% in 2020, refined copper consumption is forecast to increase by 5% in 2021, to reach 25 million tonnes (Figure 12.1). This consumption growth is expected to come from strong industrial and construction activity in China, as well as increased economic activity in India, the US and Italy. Manufacturing indexes for these countries showed expansion over January and February, and this is expected to continue over the year.

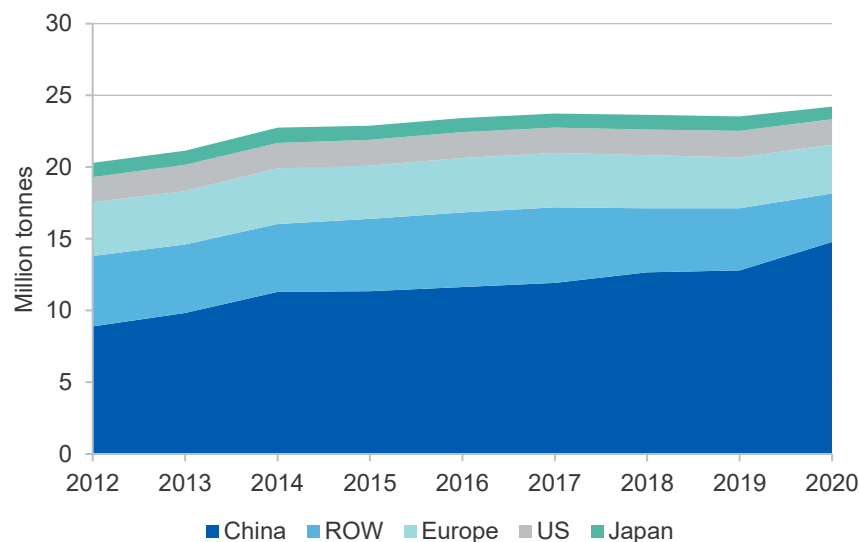
China consumes half of the world's copper, and was the dominant driver of copper market tightness towards the end of 2020 (Figure 12.2). China's Purchasing Managers Index (PMI) lowered in January and February although it remains in expansionary territory. Overall, March quarter consumption is expected to be healthy, as industrial, construction and manufacturing activity remain unseasonably strong amid reduced Lunar New Year shutdowns. Localised COVID-19 shutdowns seem to have broadly managed. China's copper consumption is forecast to grow an average 3% a year to reach 15 million tonnes in 2022.

Figure 12.1: Outlook for refined copper consumption



Source: World Bureau of Metal Statistics (2021); Department of Industry, Science, Energy and Resources (2021)

Figure 12.2: Refined copper consumption by major market



Source: World Bureau of Metal Statistics (2021)

Growth to moderate over medium term

Growth in world consumption is expected to be concentrated in the first half of the outlook period, before moderating with in line with expected trends in world industrial production (Figure 12.3). World copper consumption is projected to grow at an average 2.5% a year over the outlook period, to reach 28 million tonnes in 2026.

Industrial and manufacturing use is expected to continue around current levels in major consuming countries such as China, Japan and Germany. Economic growth and expanding industrial sectors in India, Africa and Brazil could see copper usage increase over the medium term.

Copper's antibacterial properties have also facilitated an interesting trend in the COVID-19 world — copper is having a revival as material of choice for door handles and rails, although thus far this still accounts for a small share of total consumption.

Government policies are expected to provide some direct support to copper consumption. Although specific policy details are still to be announced, China's 14th Five Year Plan includes increased investment in high speed rail, telecommunications, electrification of transport and renewable energy, all of which would result in greater copper use. These investment trends may be echoed outside of China, in line with net-zero carbon emission commitments and the increasing uptake of renewable energy.

In the US, policies targeting increased electric vehicle usage, wind generation capacity and investment in charging infrastructure will all support copper consumption, though some of these policies may require legislative backing.

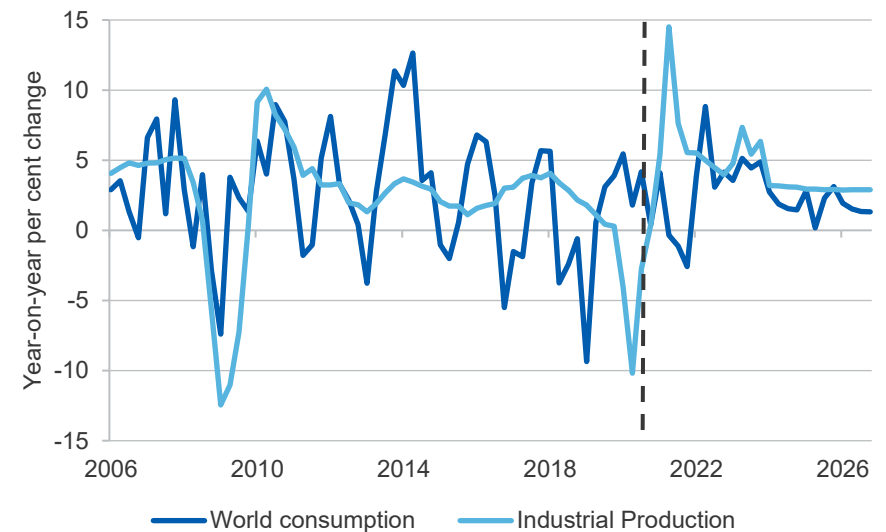
Energy transition and growing applications to support consumption

The worldwide energy transition towards low emissions technologies is expected to positively impact copper consumption over the outlook period, though this growth will be more prominent over a long-term horizon (Figure 12.3). Copper's conductivity, malleability and durability make it vital to electric vehicles (EVs), batteries and renewable energy generation.

Copper use will also be supported by expanding EV charging and electricity grid infrastructure. With EV sales projections at 26 million units by 2026 (see *lithium* chapter), copper has significant growth prospects in vehicles as well as public and private charging infrastructure. BloombergNEF forecast copper used in EV vehicles, batteries and chargers could account for as much as 10% of world refined production by 2030.

While this growth is significant, trends in traditional uses of copper will be the strongest driver of consumption activity going forward. As such, a more subdued economic recovery, particularly in major consuming countries like China, pose a risk to this outlook.

Figure 12.3: Industrial production and copper consumption



Source: World Bureau Metal Statistics (2021); Bloomberg (2021); Department of Industry, Science, Energy and Resources (2021)

12.2 World production

Positive momentum for copper mine production

World copper mine production was stable year-on-year in 2020, as mine expansions in Indonesia and resilient production in Chile balanced shutdowns in Peru and the Democratic Republic of the Congo (DRC) (Figure 12.4).

World mine production is projected to grow at an average 3% a year over the outlook period, to reach 25 million tonnes in 2026. Most of the growth is weighted towards the start of the outlook period, however, a fall in market conditions or stagnant prices could see investment delayed.

COVID-19 operational impacts continue in Chile and Peru

Copper mines in Chile, Peru and Panama all experienced shutdowns or reduced operations in 2020, owing to the COVID-19 pandemic. Although Chile's production expanded in 2020, operating restrictions continue and resulted in lower January 2021 production. At BHP's Chile facilities, COVID-19 management plans have meant workforces are 30% of normal levels. In Peru, 2020 output fell 12% year-on-year, but is expected to recover in 2021 as restrictions and community dispute issues are resolved.

Indonesia drives strong growth potential in copper production

Chile and Peru are expected to remain the largest copper producers over the outlook period, respectively accounting for around 25% and 12% of world production in 2026. However, significant investment in capacity in Indonesia is expected to be the biggest driver of world production growth over the outlook period. Elsewhere Anglo American's Quellaveco mine in Peru (estimated capacity of 300,000 tonnes per year), is expected to come online in 2022.

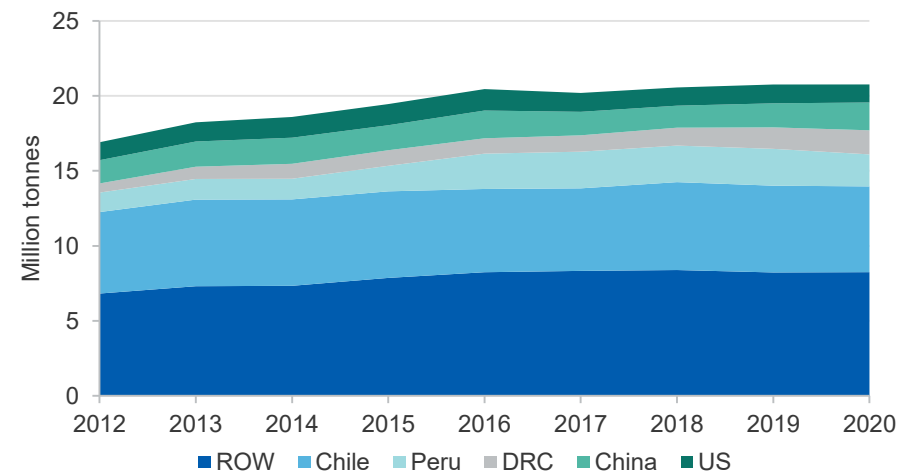
Structural issues impacting over medium-term

A number of structural issues weigh against significant increases in copper production over the medium-term and beyond. These pose a risk of deeper market deficits. Challenges facing mine operators include declining ore grades, aging facilities and increased production costs (particularly in a high price environment where input costs may increase). Producers will

look to offset these losses with increasing processing rates and productivity improvements. Environmental and social responsibility issues are other factors likely to impact on copper production, as has been seen in the delay in Southern Copper's Tia Maria project to Peru. In addition, most new projects in the development pipeline lack the scale of existing mega projects, like BHP's Escondida mine in Chile, which produced 1.2 million tonnes in 2020.

Copper prices and the prices of co-products — such as cobalt — will also be an important determinant of the pace of mine expansions and restarts over the outlook period. Delayed projects and temporary shutdowns, like the two year closure of Glencore's Mutanda cobalt-copper mine in the DRC, could worsen the current imbalance between supply and demand.

Figure 12.4: Mined copper production by major producer

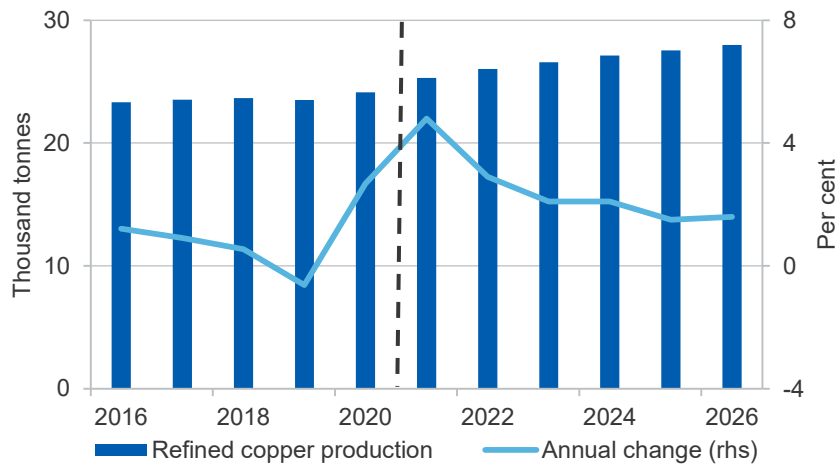


Source: World Bureau of Metal Statistics (2021)

Refined production growth dependent on China's capacity

World output of refined copper picked up by 4% to reach 26 million tonnes in 2020. Refining output in China, which accounts for about 40% of world refined production, recovered quickly from the COVID-19 related shutdowns in early 2020. Constraints on refinery inputs are expected to be overcome in the first half of 2021.

Figure 12.5: Outlook for refined copper production



Source: World Bureau of Metal Statistics (2021); Department of Industry, Science, Energy and Resources (2021)

Refinery production is projected to increase at an average 2.5% over the outlook period, to reach 28 million tonnes in 2026 (Figure 12.5). Over the outlook period, new refinery capacity is expected to come online in China, Peru, Russia and Indonesia. Refined copper production faces expansion challenges, concentrate and electricity cost pressures, increasingly tight emission and sulphur capture limits, as well as generally tighter approval processes.

12.3 Prices

Copper prices strengthen and stocks dwindle with recovering consumption

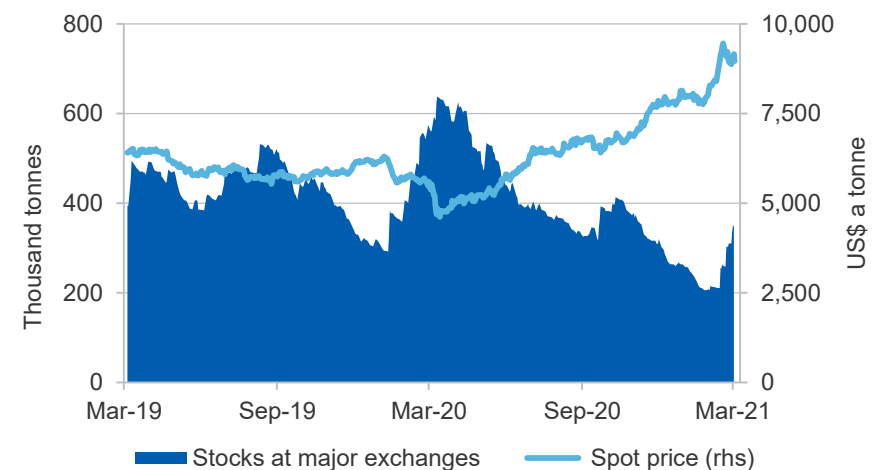
After recovering from sharp COVID-19 related price fall in March 2020, copper prices were strong towards the end of 2020 and early 2021. The London Metal Exchange (LME) copper spot price averaged US\$6,200 a tonne in 2020, 3% higher year-on-year (Figure 12.6). In the March quarter 2021, copper prices rose powerfully, driven by positive sentiment around vaccine rollouts and the world economic recovery. In February, the LME copper spot reached its highest point in over a decade, exceeding US\$9,000 a tonne, amid a weaker US dollar and strong consumption

expectations. These price increases have been accompanied by drawdowns in exchange stocks. In January, LME and Shanghai Futures Exchange stocks fell 28% and 31% respectively, following on from low levels at the end of December. Stock levels were somewhat restored in February, in line with seasonal patterns.

Over 2021, copper prices are expected to retreat from current elevated levels, but remain relatively high in historical terms. The copper spot price is forecast to average US\$8,260 a tonne in 2021 (up 31% year-on-year), maintained by an expected ongoing market deficit, and balanced by falling stocks. With expanding copper consumption expected to outstrip production growth over the rest of the outlook period, copper stocks (to consumption) are expected to fall, supporting prices. The spot price is projected to reach US\$7,940 a tonne (in real terms) by 2026, up an average 5% a year on the 2020 price (Figure 12.7).

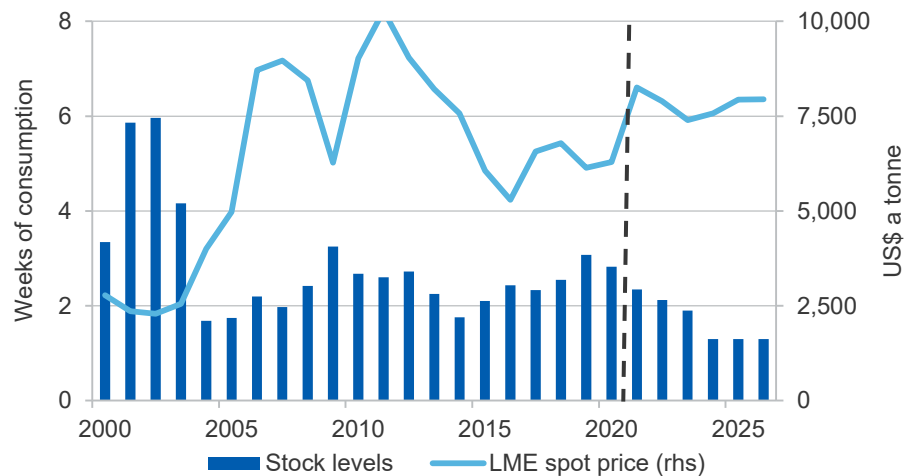
These price projections are sensitive to the balance in world copper markets, which will be affected by the pace of world economic growth, and the pace of low-emissions technology uptake.

Figure 12.6: Recent copper prices and stock movements



Source: LME (2021) official cash price; Bloomberg (2021)

Figure 12.7: Outlook for copper stocks and prices



Source: LME (2020) official cash price; Bloomberg (2020) Department of Industry, Science, Energy and Resources (2020)

12.4 Australia

Price and volumes growth boost copper export earnings

After little growth in 2019–20, copper export earnings are forecast to reach \$12 billion in 2020–21, 18% higher year-on-year. This growth is attributed to the recovery in the copper price over this period.

Further out over the outlook period, both price and volume increases are expected to support earnings growth. Copper exports are projected to reach \$16 billion in 2025–26 (real terms), increasing at an average rate of 7% a year (Figure 12.8).

Copper export volumes to grow, supported by higher production

After significant growth in 2018–19, Australia’s export volumes are expected to remain around current levels before increasing towards the end of the outlook period. In 2020–21, export volumes are forecast to fall slightly to 913,000 tonnes, before increasing an average 1.2% a year to 992,000 tonnes in 2025–26.

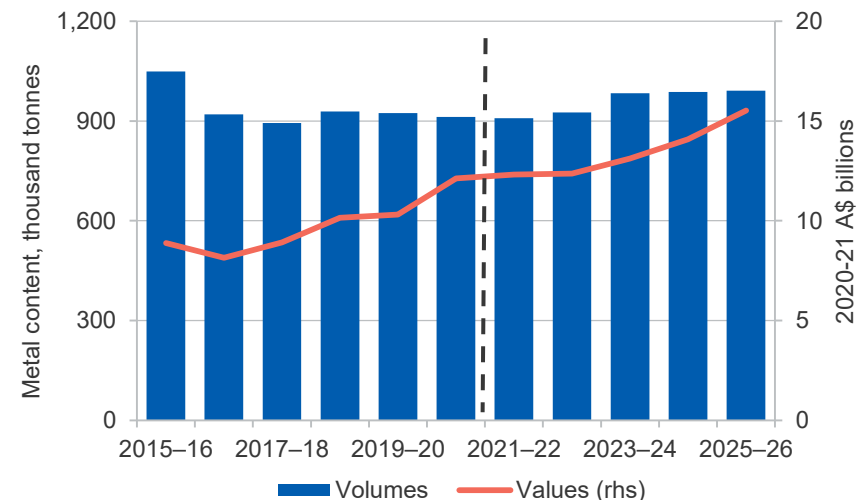
Copper production down before new capacity comes online

Mine production is expected to fall in 2020–21, as Hillgrove Resources’ Kanmantoo mine (South Australia) and Panoramic Resources’ Savannah mine (Western Australia) ceased operations in early 2020. From 2020–21, mine production is expected to increase gradually over the outlook period, reaching a projected 969,000 tonnes in 2025–26, up an average 1.2% a year on 903,000 tonnes in 2019–20.

This growth in production is expected to come from a number of development projects, including new projects and expansions. The pace and extent of project development will depend on the improving strength of world prices.

New projects expected to come online over the outlook period include Rex Minerals’ Hillside project (South Australia), KGL Resources’ Jervois mine (Northern Territory), and Copper Mountain Mining’s Eva project (Queensland).

Figure 12.8: Australia’s copper export volumes and values



Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

Havilah Resources have two projects at early stages of development, including the Kalkaroo copper-gold-cobalt project (South Australia), which also has the potential for rare earth element by-products. Other sizeable projects will continue drilling programs over the short-term, including BHP's Oak Dam (South Australia) and Rio Tinto's Winu project (Western Australia).

There are also a number of confirmed and potential mine life extension projects underway. Newcrest's expansion at Cadia is expected to be online in 2020–21, as will the expansion at Oz Mineral's Prominent Hill mine. A number of recent purchases of exploration projects alongside operating mines indicate potential for further mine life extensions.

Refined copper production to stabilise over the short-term

After recording 420,000 tonnes of refined copper production in 2019–20, refinery production is expected to stabilise over the short-term. Reduced operating levels at BHP's Olympic Dam refinery in 2020 will be balanced by lower production at Glencore's Townsville Refinery. Re-bricking is expected to take place at Glencore's Mt Isa smelter in 2021, and a recent grant will continue its operations until 2025. However, beyond that point, its continued operations, and production at Leichardt refinery, is uncertain. Refined production is projected to be 298,000 tonnes in 2025–26.

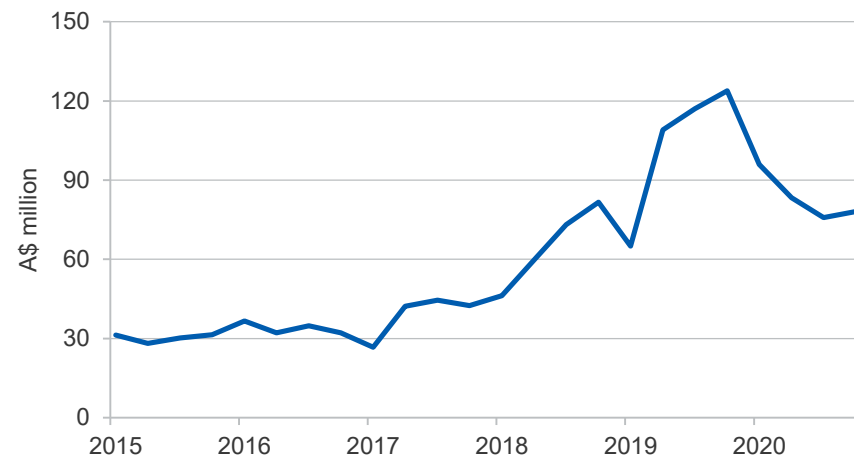
Copper exploration stable in December quarter 2020

Copper exploration was \$78 million in the December 2020 quarter, stable on September quarter levels but 37% lower year-on-year (Figure 12.9). This decline was largely driven by lower expenditure in Western Australia, which accounted for over 40% of total exploration expenditure in 2020. Australia accounts for about 10% of world copper exploration expenditure.

Revisions to the outlook

Since the December 2020 *Resources and Energy Quarterly*, the forecast for Australia's copper export earnings has been revised up by \$2 billion and \$1.7 billion in 2020–21 and 2021–22 respectively (nominal terms), as recent record-high prices have improved the outlook.

Figure 12.9: Australia's copper exploration expenditure



Source: ABS (2021)

Table 12.1: Copper outlook

World	Unit	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
Production									
–mine	kt	20,761	22,131	23,238	24,307	24,525	24,648	24,771	3.0
–refined	kt	24,134	25,292	26,026	26,572	27,130	27,537	27,978	2.5
Consumption	kt	24,213	25,459	26,110	26,662	27,044	27,608	28,031	2.5
Closing stocks	kt	1 315	1 148	1 064	975	1 060	989	936	-5.5
–weeks of consumption		2.8	2.3	2.1	1.9	2.0	1.9	1.7	-7.8
Prices LME									
–nominal	US\$/t	6,169	8,258	8,056	7,724	8,093	8,672	8,877	7.6
	USc/lb	280	375	365	350	367	393	403	7.6
–real ^b	US\$/t	6,292	8,258	7,891	7,395	7,575	7,936	7,942	4.8
	USc/lb	285	375	358	335	344	360	360	4.8
Australia	Unit	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^z	2023–24 ^z	2024–25 ^z	2025–26 ^z	CAGR ^r
Mine output	kt	905	888	897	915	973	973	969	1.1
Refined output	kt	420	446	451	451	452	412	298	-5.6
Exports									
–ores and cons ^c	kt	1,899	1,796	1,759	1,828	2,054	2,211	2,645	5.7
–refined	kt	392	412	416	416	417	380	275	-5.8
–total metallic content	kt	924	919	909	926	984	987	992	1.2
Export value									
–nominal	A\$m	10,208	12,207	12,520	12,844	13,956	15,364	17,367	9.3
–real ^d	A\$m	10,316	12,207	12,315	12,374	13,117	14,081	15,522	7.0

Notes: **b** In 2021 calendar year US dollars; **c** Quantities refer to gross weight of all ores and concentrates; **d** In 2020–21 financial year Australian dollars; **f** Forecast; **r** Average annual growth between 2020 and 2026 or 2019–20 and 2025–26; **z** Projection.

Source: ABS (2021) International Trade, 5465.0; LME (2021) spot price; World Bureau of Metal Statistics (2021) World Metal Statistics; Department of Industry, Science, Energy and Resources (2021)

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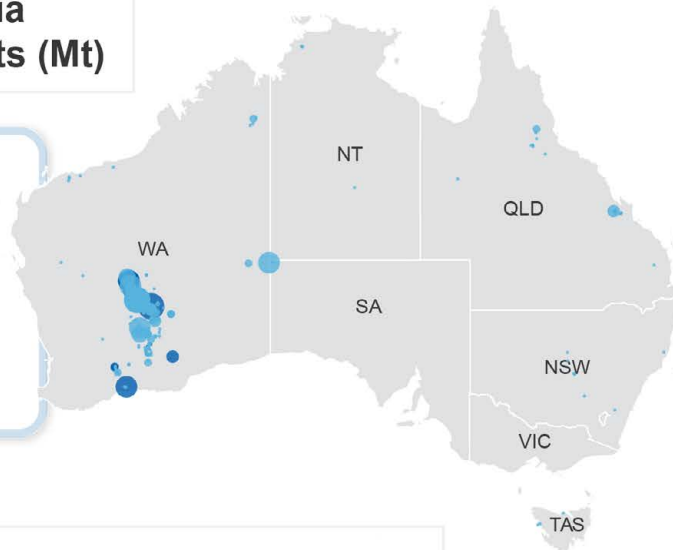
Ni

58.693

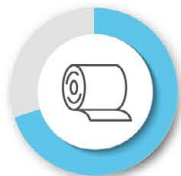
Nickel

Major Australia nickel deposits (Mt)

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



World consumption



70%
Stainless steel



8%
Alloys



8%
Plating



8%
Casting



5%
Batteries



1%
Other

Nickel facts



Nickel is used in the **US, UK and Euro coins**



Nickel has a growing role in **electric vehicle batteries**



Nickel is **magnetic** at room temperature and is **fully recyclable**



Nickel is the **second most abundant element** in the Earth's core after iron

Australia's nickel



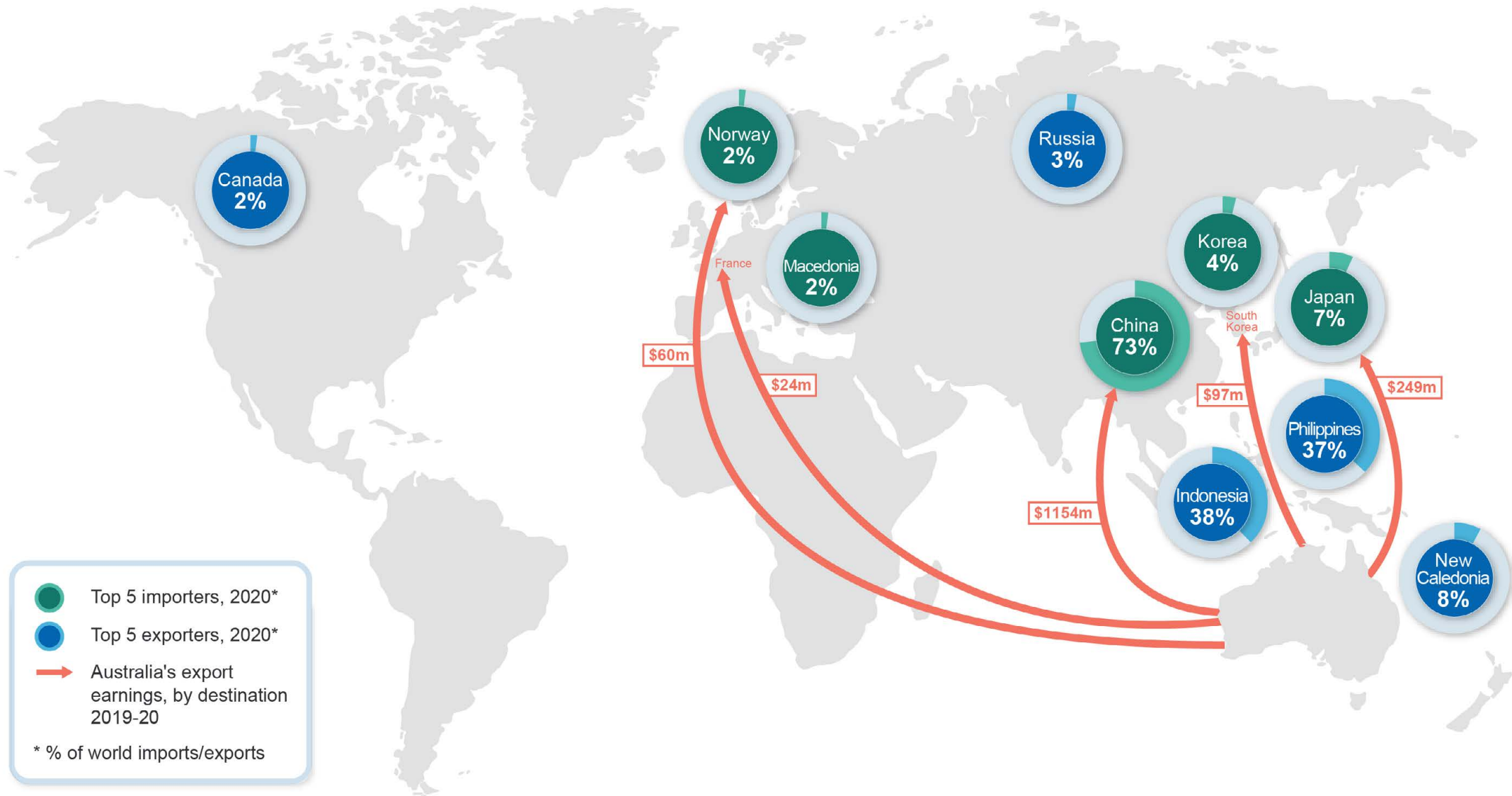
Australia has **26%** of world **nickel resources**



200,000 tonnes produced each year



Contributes **more than \$3b** to the economy



Summary

- Prices are forecast to rise from an average of US\$19,000 a tonne in 2021 to US\$21,000 a tonne in 2026, fuelled by returning levels of activity and consumption in stainless steel production. These factors, as well as increased nickel used in EV batteries, is expected to push the market into deficit by 2023.
- Australia's export volumes are forecast to rise from 201,000 tonnes in 2020–21 to 246,000 tonnes in 2025–26. Export volumes are forecast to peak during 2021–22 at 259,000 tonnes; however, further expansion in nickel production will be required for Australia to capitalise on the probable consumption expansion of commodities fuelling low-emission technology production (see [Australia section](#)).
- Australia's export earnings are forecast to increase from \$3.8 billion in 2019–20 to \$6.5 billion in 2025–26, driven by increased demand for Australia's higher quality nickel.

13.1 World consumption

Disruptions weighed on nickel usage in the first half of 2020

The nickel market in 2020 was heavily impacted by the global slowdown caused by the COVID-19 pandemic. Lockdown measures were implemented across the globe to slow the spread of the virus, which resulted in a reduction of end-use demand for nickel products.

Nickel consumption finished at almost 2.4 million tonnes in 2020 (down 1.3% on 2019), after significant COVID-19 related consumption losses in the first half of 2020. Consumption of primary nickel has risen strongly over the past decade, and the decline in 2020 was the first decline since the global financial crisis. Stainless steel demand was initially impacted by the repeated lockdowns; however, performed better than expected driven by strong consumption in China.

Going forward, growth is expected to be driven by returning economic activity and growing markets for nickel used in batteries. The surplus of nickel is expected to narrow in 2021, with the market likely reaching a

deficit by 2023, and by 2026 world consumption is forecast to be 3.2 million tonnes, increasing by an average 6% a year. (Figure 13.1)

China's 2020 refined nickel imports slump to 6-year low

China is the world's largest nickel consumer, accounting for over half of world primary nickel use and it is the largest producer of electric vehicle batteries.

In 2020, China's nickel consumption was 733,000 tonnes, down from 806,000 in 2019. However, despite China importing a record of surplus metal in 2020, Chinese imports of refined nickel fell by 32% year-on-year to 130,700 tonnes in 2020, the lowest level since 2014 (Figure 13.2).

China raw material imports remain strong, balancing the market

Despite total refined nickel consumption falling, China's stainless steel sector has remained strong. The country's stainless production rose by 4% in the September quarter 2020 (quarter-on-quarter), while production in the rest of the world fell by 9%. Due to this Chinese demand, and import restrictions on Indonesia's concentrates, China's imports of Indonesia's nickel pig iron (NPI) increased sharply in 2020. While China's refined metal imports declined further last year, those of ferronickel and NPI increased up to 80% from 2019, to 3.4 million tonnes (Figure 13.3).

It is the sharp recovery across the country's ferrous sector that has been lifting demand for nickel raw materials. China's stainless mills have enjoyed their share of the demand boom created by rapid COVID-19 recovery and government stimulus.

Nickel market likely driven by EV battery consumption through 2020s

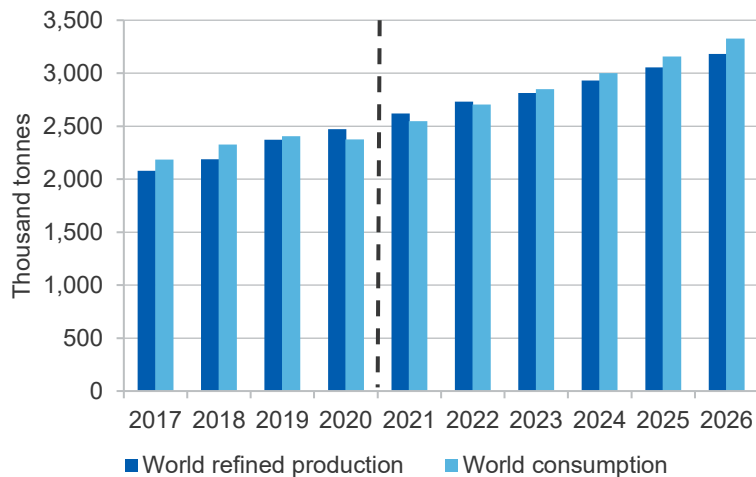
Currently around 60% to 70% of nickel consumption is used for stainless steel, with the emerging demand from the lithium-ion battery a slight addition of what the stainless steel market presently requires. Currently only about 5% of nickel is utilised in battery production.

Limiting stainless steel's share of the nickel market over the 2020s period, will be lithium-ion batteries used in electric vehicles that will see rapid uptake over the next decade. Owing to the rising demand for nickel

products suitable for processing to nickel sulphates (mostly Class I nickel), this is likely to impact stainless steel mills as they increasingly substitute higher purity nickel for Class II nickel and scrap.

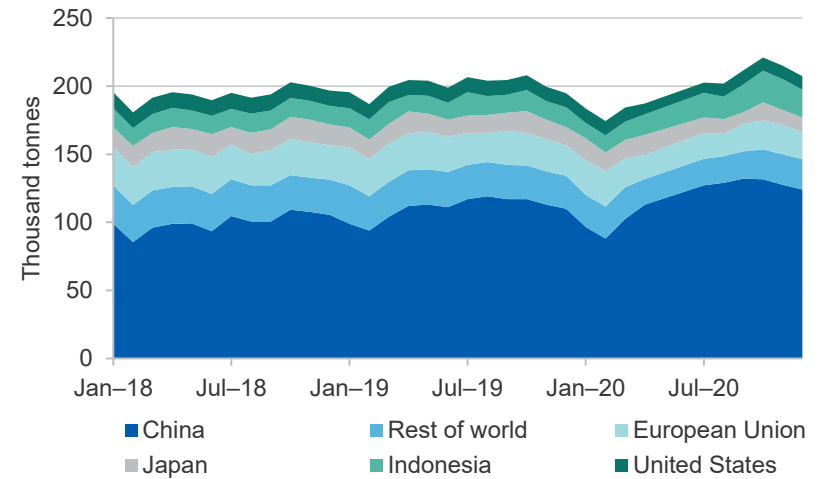
The composition of battery chemistry is likely to evolve over the next decade. With current forms of nickel content per battery cathode at about 33%, newer versions could see nickel content in EV batteries rise to over 90%. Despite the nickel market being in surplus, the type of nickel the lithium-ion battery industry requires, (higher quality, class-1 compositions of nickel sulphides to produce nickel sulphates), are in relative short supply. Producers currently rely on sulphide mines or high pressure acid leach (HPAL) refining operations to obtain class-1 nickel sulphate stocks. Past 2020, it is unclear how many new nickel projects will be able to supply the required class-1 and intermediate nickel products — currently, class-1 nickel, which must have a minimum purity of 99.8%, only accounts for less than 25% of the total finished nickel supply.

Figure 13.1: Nickel consumption to overtake production by 2023



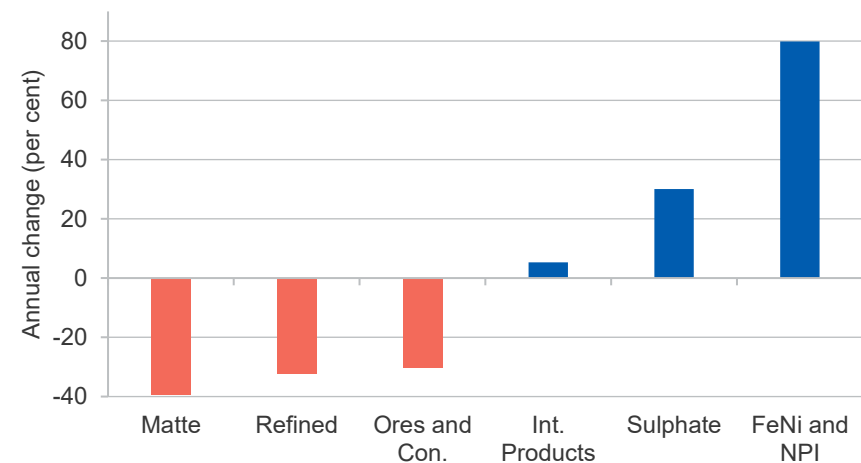
Source: International Nickel Study Group (INSG); Department of Industry, Science, Energy and Resources (2021)

Figure 13.2: Composition of world nickel consumption



Source: International Nickel Study Group; Department of Industry, Science, Energy and Resources (2021)

Figure 13.3: Change in China's nickel imports, 2019 to 2020



Source: Refinitiv (2021)

13.2 World production

Nickel production returns as consumption makes strong recovery

Total mined nickel production for 2020 suffered due to multiple mine closures and disrupted production due to the pandemic's lockdown effect. Total mined nickel production was down from 2019, falling 12% to 2.4 million tonnes in 2020.

Through 2021, nickel production is expected to recover to 2019 levels of around 2.6 million tonnes. Indonesia's ore export ban and potential halts to New Caledonia's production present downside risk for the year. The Philippines has been filling some of the gap and the rising price recovery in the first few months of 2021 has indicated an increased consumption activity.

Going forward, mine production is expected to grow as new refinery capacity in Indonesia creates a market for domestic mined output. Mine production is projected to grow an average 5% a year over the outlook period, to reach 3.2 million tonnes in 2026 (Figure 13.3).

New Caledonia's Vale mine collapses — halts refinery production

The coalition government in New Caledonia collapsed in December 2020, after pro-independence politicians resigned. This led to riots and protests related to the sale of Vale SA's nickel operation, which is opposed by pro-independence political parties.

The 35,000 tonne per year plant was forced to close resulting from the December riots, which did substantial damage to equipment, and is reported as unlikely to reopen until mid-2021. While other countries may ramp-up shipments to fill any supply gap from New Caledonia, a new deal with the New Caledonian government over Vale's exit from the nickel operation appears to have been achieved — avoiding the possibility of further protracted disruptions to operations. A key element of the new deal is that Tesla has agreed to be a technical and industrial advisor, using the operation to source raw materials for its EV batteries.

New Caledonia is the world's fourth-biggest producer of mined nickel, behind Indonesia, the Philippines and Russia. It exports ore mainly to South Korea, Japan and China, and accounts for roughly 9% of global mined nickel output, producing roughly 200,000 tonnes per year. The French territory is also the third-biggest nickel ore and concentrate supplier to top metals consumer, China.

Indonesian coal decline being replaced by value-add nickel exports

2020 saw remarkable progress in the Indonesian government's plans to increase domestic nickel processing. Government policy for over a decade has been to reduce the dependence on raw material exports and increase exports of value-add mineral products. Indonesian nickel is achieving this goal, with large Chinese investment starting after the first nickel ore ban in 2014. Investment continued during the partial ore export relaxation over 2017-2019 and has accelerated massively in the past 12 months. Indonesia's refined nickel exports, including stainless steel rose 49% year-on-year in 2020 to 667,000 tonnes (Figure 13.4).

Chinese investment has not stopped at processed nickel (ferronickel, nickel pig iron and matte) but has continued into stainless steel with two large producers now operating. From 2021, value-add will be expanded into nickel sulphates, the raw material for batteries used in electric vehicles. The value-add could continue into battery cells and electric vehicles with Tesla and several Korean and Chinese battery and automakers currently negotiating with the Indonesian government.

Responsible refining of nickel still remains a challenge for Indonesia

The Indonesian government is reportedly not willing to issue permits for deep-sea tailings placement (DSTP), a type of waste management system that disposes of mining waste in the ocean. Extracting nickel from Indonesian laterites requires high-pressure acid leaching (HPAL) that produces high volumes of waste tailings, about twice as much as comparable sulphide nickel mines in Australia. At least two Indonesian HPAL nickel projects with total capacity of 87,000 metric tons planned to use DSTP, representing 47% of planned Class 1 nickel production in the

country. Of these, QMB New Energy Materials withdrew its application back in October 2020.

Philippines' becomes largest supplier of NPI for stainless steel production

The Philippines has become the biggest supplier of nickel ores to top metals consumer, China, since Indonesia banned the export of unprocessed minerals in January 2020. Indonesia's mostly low-grade material is used in producing nickel pig iron, the main commodity used in stainless steel.

Philippine President Rodrigo Duterte has ordered a halt to all mining on an island in the southern province of Tumbagan Island in Languyan. However, the country's main ore production centres are unaffected.

China to expand investment in Indonesian nickel refining

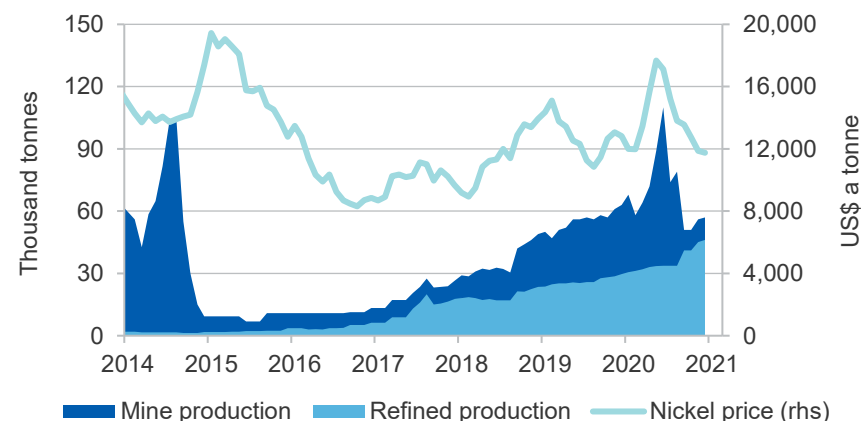
As China powers on with its major infrastructure-focused stimulus recovery from the Covid-19 induced recession, Indonesia expects to see investment in nickel processing double to US\$35 billion by 2033. This is expected to be primarily led by Chinese companies, countering Indonesia's ban on unprocessed ore exports. Among the projects under development is a plan by China's Contemporary Amperex Technology Co Ltd and Ningbo Lygend Mining to create an integrated lithium battery production facility, which would be the largest such facility in the world.

Norilsk Nickel partially suspends production at two large mines

Norilsk Nickel, the world's biggest producer of palladium and refined nickel, has partially suspended two of its main Arctic mines, due to water inflows at one of the interconnected operations. It is unclear how long operations will be affected while measures are taken to stop the inflow. To date, guidance from Norilsk has indicated a 35,000 tonne cut to production. Groundwater is a common challenge at deep mines, although it's less usual for producers to report any inflows.

Due to the current rally in nickel prices, any supply disruption will quickly add strongly to price increases. Russia accounted for around 11% of total nickel production during 2020.

Figure 13.4: Indonesia's growing production of refined nickel



Source: Bloomberg; International Nickel Study Group (INSG)

13.3 Prices

Nickel price surges early 2021 — potential to rise to US\$21,000 by 2026

Since suffering a Covid-19 related collapse in March 2020 — when the LME nickel spot price fell to US\$10,800 a tonne — nickel use in China's stainless steel mills has surged, triggering a price recovery. Combined with supply concerns around production (from New Caledonia and the Philippines), the nickel price rose in January 2021, from US\$16,800 to over US\$17,800 a tonne. In February 2021, the nickel price surged to US\$20,110 a tonne, the highest price since May 2014.

The major rise in nickel prices does slightly reflect speculative buying on EV demand expectations, but is predominantly driven by the current synchronised demand recovery in stainless steel production. Global stainless steel production is now significantly above pre-COVID-19 levels. However, this recent surge in stainless steel production appears unsustainable, and is expected to come to an end by mid-2021.

Expected increases to Chinese nickel consumption has driven expectations of a tightening in the nickel market, from a 100,000 tonne surplus in 2020, to around a 36,000 tonnes deficit in 2023. Forecast

average nickel prices for 2021 are around US\$19,000 tonne, up nearly 38% from the previous year (Figure 13.5).

While nickel prices are currently limited by the current level of inventories surplus, expectations of future market growth and resulting market tightness are likely to push prices significantly higher over the outlook period. This consumption growth is expected to facilitate prices reaching a projected US\$20,500 tonne by 2026 (in real terms), up an average almost 7% a year from 2021 (Figure 13.6). Speculative sentiment concerning the quantity and availability of nickel required for EV battery production is also perpetuating fears of a supply shortage in the nickel market. World EV sales increased by over 46% year-on-year in 2020, to 3.1 million units, and are expected to rise a further 15% to 3.6 million units for 2021. With EV sales expected to increase from 3.1 million in 2020 to 11 million in 2026, nickel consumption is expected to outpace production increases, resulting in a market deficit by 2023.

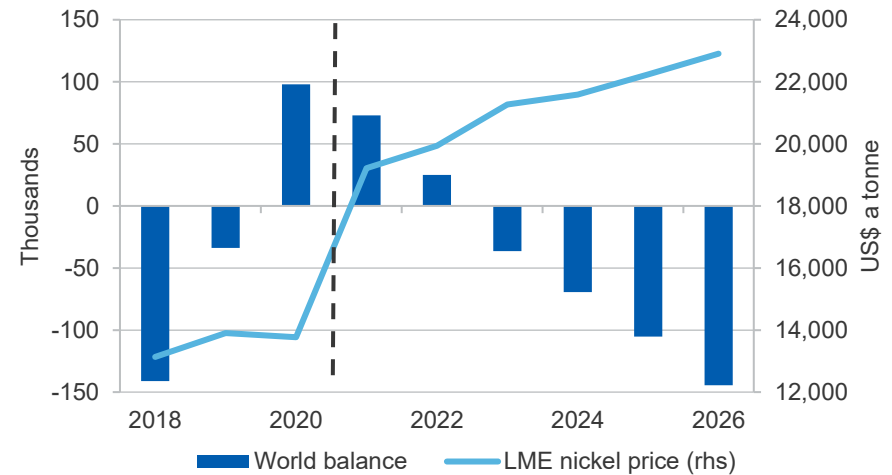
Price impacts of the EV market as nickel supply adapts to demand

A downside to nickel prices over the period could be the possible over-supply in nickel pig iron that has driven growing price discounts to LME nickel and nickel sulphate since November 2020.

The shortage of available class 1 nickel sulphites means that growth in battery demand over the decade may need to be met by growth in the processing of NPI or laterite ore supplies. The forecast battery demand growth from 2020-30 is equivalent to five new Nornickels — unlikely to happen under any nickel price scenario. However, there is debate over the actual conversion costs for NPI and laterite nickel to sulphates, with the refining process being highly energy-intensive and polluting.

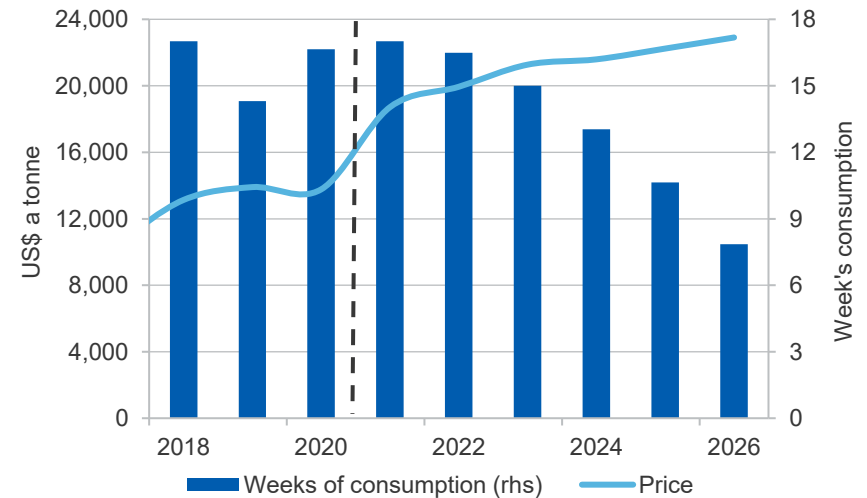
The excess of NPI currently within the market means the possibility of arbitrage between these forms of nickel grades has the potential to lower the premium to higher quality nickel prices. Tsingshan, the world's largest nickel and stainless steel producer, signed contracts to sell 75kt of nickel to Chinese battery interests derived from nickel NPI, a product previously only sold to the stainless steel industry.

Figure 13.5: Market deficit exerting upward pressure on prices



Source: Bloomberg (2021); Department of Industry, Science, Energy and Resources (2021)

Figure 13.6: Declining stocks pushing up prices



Source: Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

13.4 Australia

Exports declined through 2020, but are expected to rise over outlook

After reaching \$3.8 billion in 2019–20, nickel export earnings are forecast to remain steady in 2020–21, at \$3.8 billion (Figure 13.8). Volumes are expected to reduce slightly, balanced by a price surge close to US\$19,000 a tonne for 2021. Continued growth in export volumes will likely depend upon price increases driven by the eventuating demand for higher quality, class 1 nickel products used in batteries. Total nickel exports are projected to rise to over \$6.5 billion in 2025–26 (in real terms), up an average 9% a year (Figure 13.7).

Australia's production volumes set to expand over 2021 and beyond

Australia's nickel production is expected to increase over 2020–21, driven by strong prospects for mid-term consumption growth in EV battery manufacturing and the expected tightening of the nickel market to deficit by 2023. Mine production is forecast to lift from 180,000 tonnes in 2020–21 to 210,000 tonnes in 2021–22, up by 17%.

A number of firms have upgraded outlooks for their mines under consideration. In early December 2020, the Golden Swan Drill Drive construction project commenced at Black Swan. The Company plans to have a maiden resource reported for Golden Swan during Q3 2021, and have feasibility and processing options studies completed by the end of December 2021.

Mincor Resources has completed the first blasts at the Cassini nickel project and Northern Operations in Western Australia. Mincor guidance suggests full-scale construction and development activities should finalise through 2021, allowing first production by December quarter 2021. The mine is forecast to produce 71,000 tonnes of nickel with a peak production of 16,000 tonnes a year.

These projects and other development projects stand to capture the value of a surging nickel market through 2020 as rising nickel prices make more nickel development opportunities feasible. Australia stands to capitalise as the world shifts to low-emissions production with its abundant reserves of

responsibly sourced and high quality nickel for processing as battery inputs.

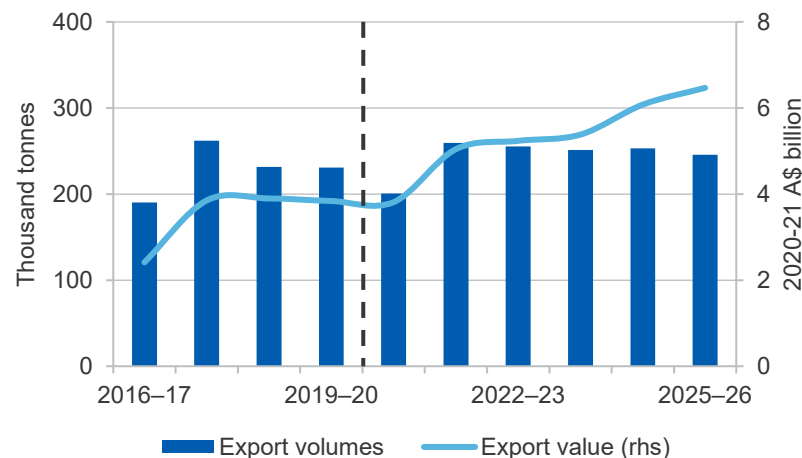
Forrestania revises down production guidance

Operational challenges at Western Areas' Forrestania operations continued to impact results during the December 2020 quarter. The company reported a 6% decrease in its nickel production target of 16,000-17,000 tonnes, as lower grade mining outpaced an increase in ore volumes.

Mined nickel production at the Forrestania operations therefore fell from the 4,147 tonnes reported in the September quarter to 3,518 tonnes in the three months to December, while nickel-in-concentrate production over the same period fell from 3,756 tonnes to 3,535 tonnes.

However, Western Areas noted that significant progress is being made with the Odysseus underground development. The mine is likely to be operational by September quarter 2022 for nickel concentrate — with an anticipated annual average production of 18,000 tonnes.

Figure 13.7: Australia's exports to approach \$6.5 billion by 2026



Source: Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

Nickel West has signed a renewable power purchasing agreement

BHP's Nickel West unit has agreed to buy up to 50% of its Kwinana refinery (Western Australia) electricity needs from the Merredin Solar Farm. The agreement with China-based solar developer Risen Energy is expected to displace 364,000 tonnes of CO₂ equivalent over the life of the contract and will contribute to achieving BHP's medium-term target to reduce scope one and two emissions by 30% by 2030.

Outlook for Australia's refined nickel production

In 2019–20, production at Nickel West decreased by 8% to 80,000 tonnes, due to the major quadrennial maintenance shutdowns at the Kwinana refinery. However, BHP are expected to complete construction of the nickel sulphate expansion project located at the Kwinana nickel refinery in the second half of 2021. The expansion will add 100,000 tonnes of nickel sulphate annual capacity to the Kwinana refinery.

Australia's refinery production is projected to rise from 108,000 tonnes in 2019–20 to 139,000 tonnes in 2025–26, growing at an average 4.4% a year. However, stronger increases in refined nickel production are likely, should nickel prices remain strong through the mid-2020s.

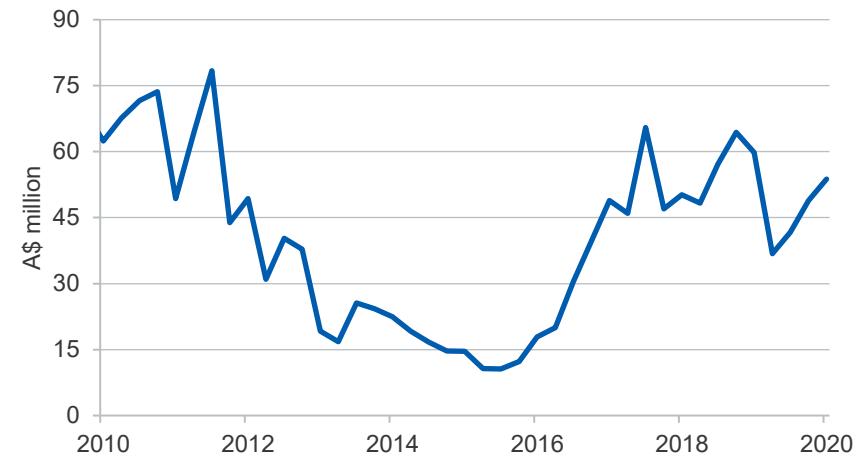
Exploration expenditure

In the December quarter 2020, nickel and cobalt exploration increased to \$54 million, however it was 10% lower than the same period in 2019. The increase is likely due to increased speculation of a sharp increase in demand for nickel used in batteries for electric vehicles, with miners seeking new deposits of minerals that will drive the world's low emissions transition (Figure 13.8).

Revisions to the outlook

The forecast for Australia's nickel export earnings have been revised slightly higher since the December 2020 *Resources and Energy Quarterly*, up, in nominal prices, \$0.1 billion to a forecast \$3.8 billion in 2020-21. This follows recent upward trends to the global nickel price as concerns around supply shortages remain in the short-term.

Figure 13.8: Nickel and cobalt exploration continues to expand



Source: Source: ABS International Trade in Goods and Services, 5368.0

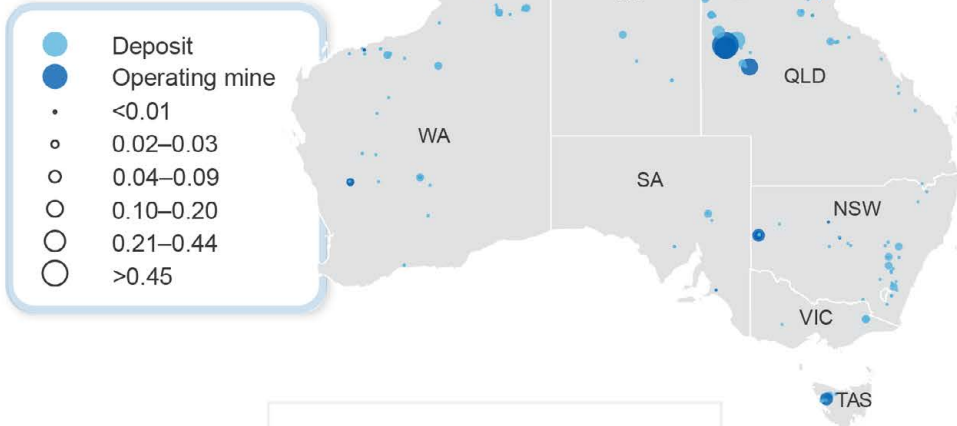
Table 13.1: Nickel outlook

World	Unit	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
Production									
–mine	kt	2,450	2,604	2,730	2,830	2,910	2,980	3,200	4.6
–refined	kt	2,472	2,620	2,730	2,812	2,930	3,053	3,182	4.3
Consumption	kt	2,374	2,547	2,705	2,849	3,000	3,159	3,326	5.8
Closing stocks	kt	758	831	856	819	750	645	501	-6.7
–weeks of consumption		16.6	17.0	16.5	15.0	13.0	10.6	7.8	-11.8
Prices LME									
–nominal	US\$/t	13,769	18,715	19,941	21,272	21,591	22,239	22,906	8.9
	USc/lb	625	849	905	965	979	1 009	1 039	8.9
–real ^b	US\$/t	14,044	18,715	19,532	20,366	20,210	20,351	20,494	6.5
	USc/lb	637	849	886	924	917	923	930	6.5
Australia	Unit	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^z	2023–24 ^z	2024–25 ^z	2025–26 ^z	CAGR ^r
Production									
– mine ^c	kt	161	180	235	237	236	235	220	5.4
– refined	kt	108	130	139	140	139	139	139	4.4
– intermediate	kt	15	27	33	32	30	30	33	13.1
Export volume	kt	231	201	259	255	251	253	246	1.1
– nominal value	A\$m	3,798	3,813	5,128	5,437	5,727	6,633	7,238	11.3
– real value ^d	A\$m	3,839	3,813	5,044	5,237	5,382	6,079	6,469	9.1

Notes: **b** In 2021 calendar year US dollars; **c** Quantities refer to gross weight of all ores and concentrates; **d** In 2020–21 financial year Australian dollars; **f** Forecast; **r** Average annual growth between 2020 and 2026 or 2019–20 and 2025–26; **z** Projection.


Source: ABS (2021) International Trade, 5465.0; LME (2021) spot price; World Bureau of Metal Statistics (2021) World Metal Statistics; Department of Industry, Science, Energy and Resources (2021)


Major Australian zinc deposits (Mt)





Zinc facts



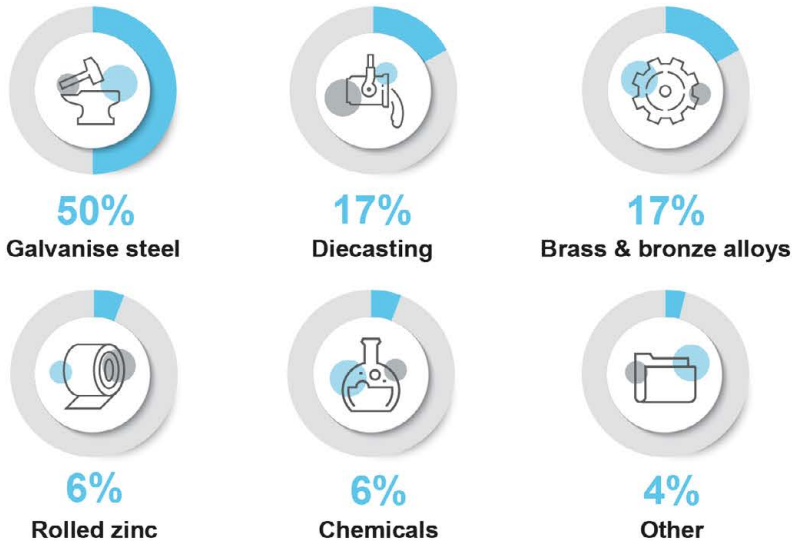
 Zinc ore was used in ancient Greece to produce brass

 Zinc is used by the human body to **fight infection**

 Zinc is used in wound-care and sunscreen

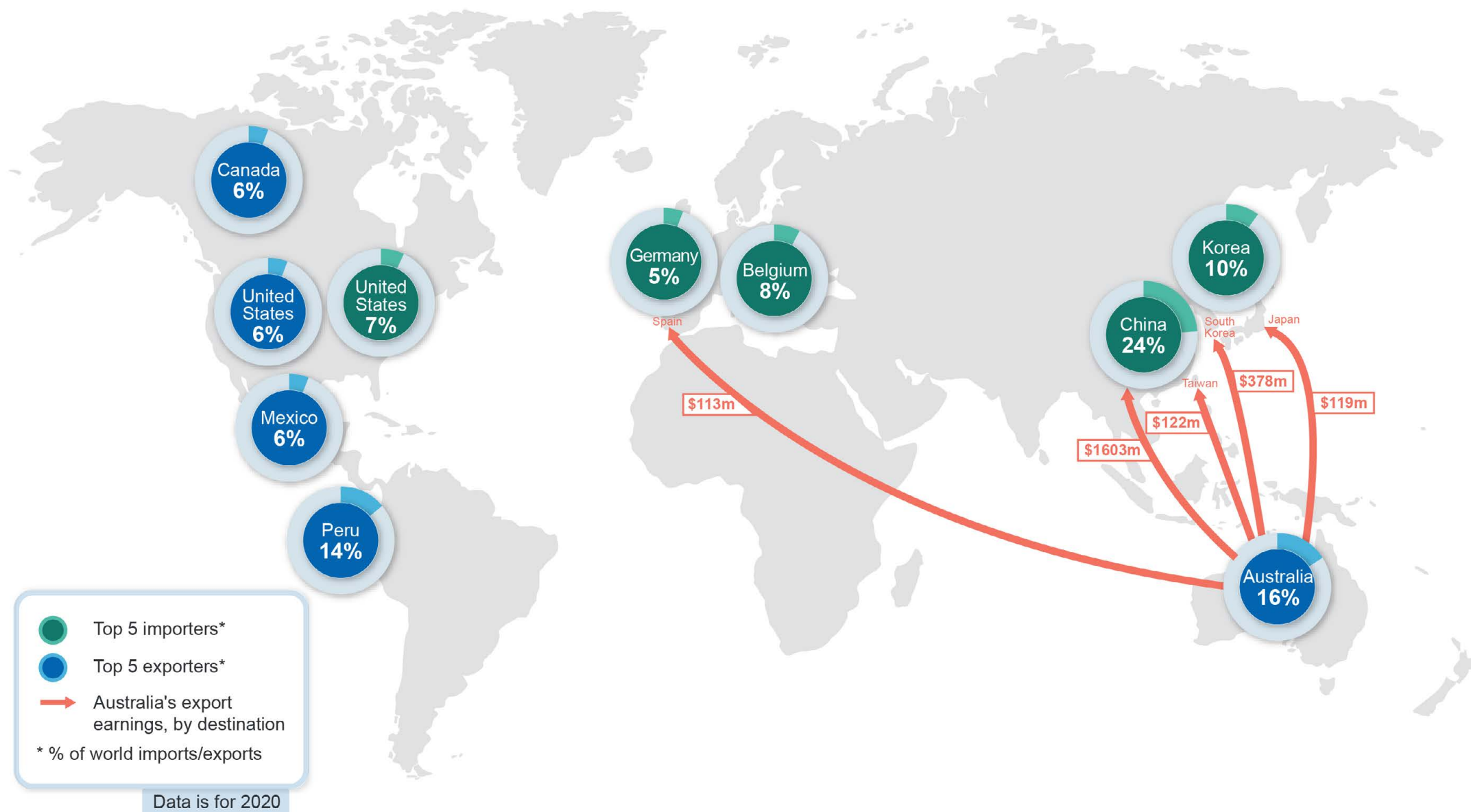
 Zinc is an **emerging battery mineral**

World consumption



Australia's zinc





Data is for 2020

14.1 Summary

- Prices (in real terms) are projected to fall from an average of US\$2,310 a tonne in 2020 to US\$2,220 a tonne in 2026, driven by increasing production, after a high of US\$2,690 a tonne in 2021.
- Australian exports of zinc are projected to rise from 1.5 million tonnes in 2019–20 to 1.7 million tonnes in 2025–26, driven by rising production (see [Australia section](#)).
- Australia's zinc export earnings (in real terms) are projected to decline from \$3.6 billion in 2019–20 to \$3.5 billion in 2025–26, as the impact of price declines outweighs production increases.

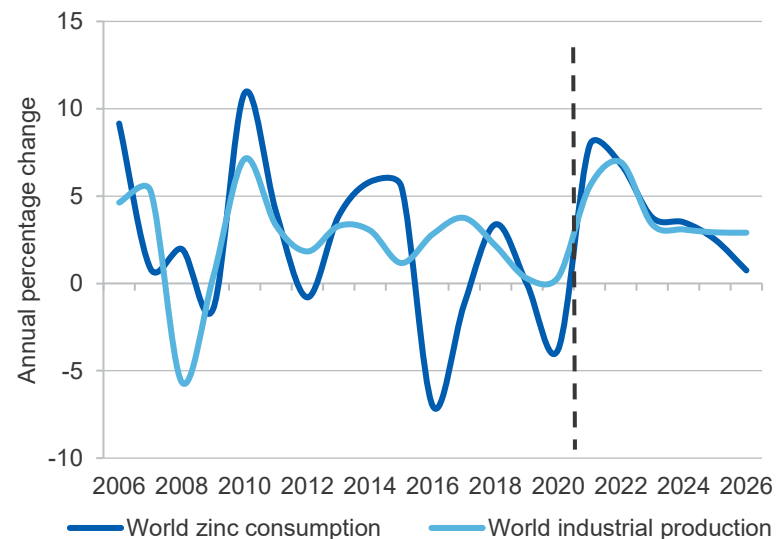
14.2 World consumption

After zinc consumption fell in 2020, modest increases expected

Zinc consumption has been reasonably well correlated with the world IP cycle – and, in turn, the steel production cycle – over the past decade (Figure 14.1). Zinc's primary role is in galvanising steel. Consumption is thus expected to continue to move with steel production (Figure 14.2). World refined consumption fell by 4.4% in 2020 compared to 2019, although over this period China's refined consumption increased by 1.3%, meaning world consumption excluding China decreased by 9.7%.

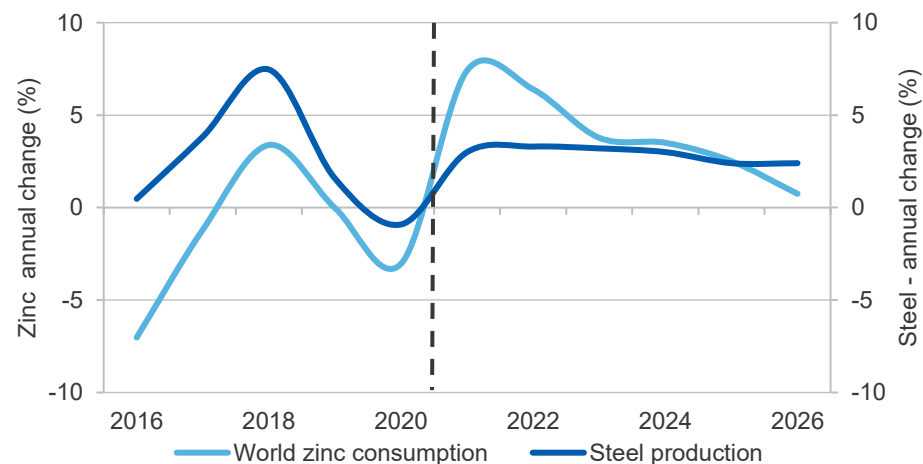
Forecasts of strong GDP and IP growth in 2021 and 2022 are positive for zinc. Part of this growth will derive from infrastructure spending, which will be steel-intensive (see *macroeconomic outlook* chapter). 'Green' stimulus packages in various nations buoyed recent electric vehicle (EV) sales, with purchases rising by 46% (year-on-year) over the 2020. However, the Chinese government's attempts to cap domestic steel production may mute the outlook for zinc (see *steel and iron ore* chapter). World zinc consumption is expected to rise modestly over the outlook period, rising from 13 million tonnes in 2021 to 14 million tonnes in 2026, up an average 1.1% a year (Table 14.1). Beyond galvanising, zinc consumption in batteries for renewable energy is also advancing with ASX listed, Redflow securing US contracts to supply Anaergia in California.

Figure 14.1: World zinc consumption vs industrial production



Source: International Iron and Steel Institute (2021); CPB Netherlands Bureau for Economic Policy Analysis (2021); Department of Industry, Science, Energy and Resources (2021)

Figure 14.2: Steel production vs world zinc consumption



Source: International Iron and Steel Institute (2021); Department of Industry, Science, Energy and Resources (2021)

14.3 World production

Mine production fell in 2020, leading to tight concentrate markets

Over 2020, world zinc mine production declined by 5.9% from 2019. Production fell by 3.7% in China compared with a 6.9% decline elsewhere in the world, highlighting China's strong role in zinc mine production.

China's mine production decreased by 2.1% in the December quarter 2020 compared to the same period in 2019. Production from Bolivia decreased by 3.0% but Peru increased by 15%, and Australia increased by 1.1%.

In 2020, Australia's production decreased by 1.8% from 2019. The decline in Australia's production was the result of a number of smaller deposits being put on 'care and maintenance', and other aging deposits producing less. The decline came despite output gains at the major zinc mines, such as Mt Isa and McArthur River. Production levels in China and South America, including Peru and Bolivia, have normalised to pre-COVID-19 levels.

The decrease in world mine production contrasted noticeably with metal production, which rose 1.2% in 2020 compared with 2019. The rise was dominated by China, which increased by 2.9%, compared with a 0.3% decline in the rest of the world. The increased metal production resulted in tightness in the concentrate markets and a decline in smelters treatment and refining charges, as refiners competed for concentrate. The shortage of zinc concentrate also caused an appreciation in the zinc price.

Mine production is expected to rise over the outlook period

World mine output was estimated at 12 million tonnes in 2020, and is projected to rise by 4% per year to 15 million tonnes in 2026 (Figure 14.3). The rise over the outlook period is the result of the expected continuation of investments in mine commissioning and expansions, encouraged by the strong prices of recent years. Overall Africa, Asia, Australia, and Canada are projected to increase their share of world zinc production over the outlook period with relative declines in China and elsewhere in the Americas.

High grade production is scheduled to come online from the Dairi project in Indonesia in 2021–22, with 51% of the project purchased by China Nonferrous Metal Industry's Foreign Engineering and Construction Company. The resource grade of 11.5% zinc makes this project one of the higher grade undeveloped resources in the world. High grade production on a similar timeframe is also due from the refurbishment of the Kipushi project in the Democratic Republic of Congo. Resource grades average just below 11%, but higher grade sections average over 35% zinc. The mine is being developed by Ivanhoe Mines Limited.

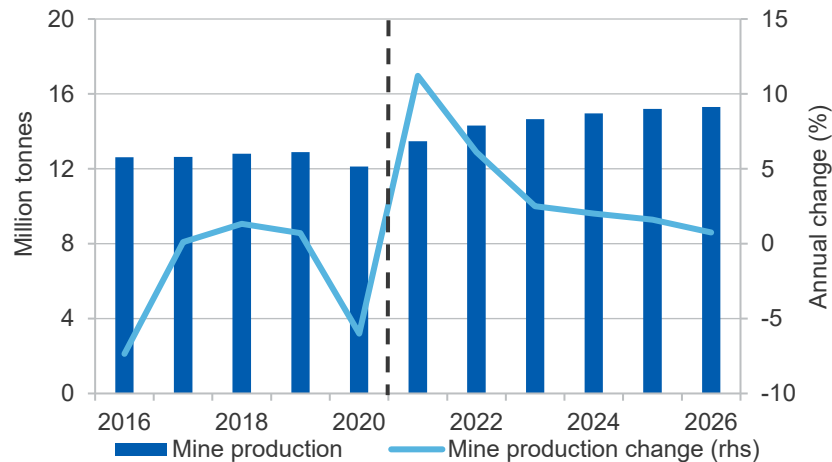
Imports normalised towards the end of 2020

Zinc trade continues to pivot on the activity in China, with China's domestic production currently supplying the majority of its needs. This supply is supplemented by concentrates from Australia and South America. Chinese global zinc concentrate imports for 2020 were 1.8 million tonnes, up by 21% on 2019. In the December quarter 2020, Australia's zinc concentrate exports to China increased by 56% from the September quarter, reversing the decrease of 45% for the September 2020 quarter. Trade in Australian zinc changed as Peruvian and US operations increased exports in the September quarter. Peruvian exports remained high in the December quarter, whilst US operations exported less. There has been reporting that Glencore are selling down some of their South American zinc interests, although maintaining their Australian interests.

World refinery production normalised

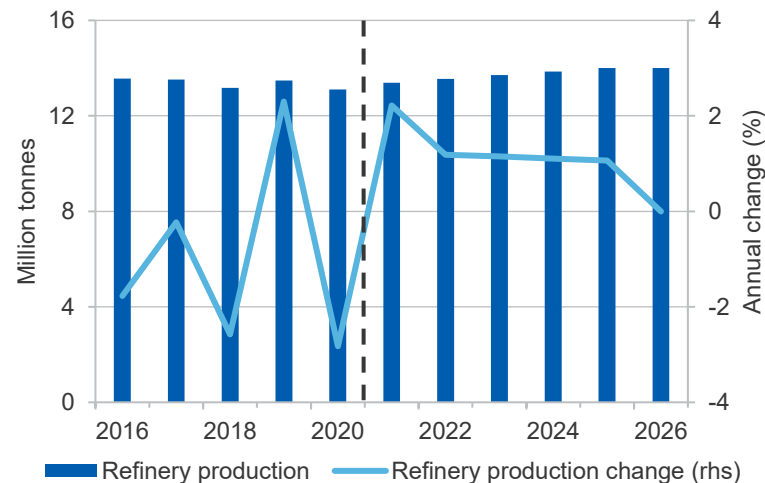
At 13 million tonnes in 2020, refined production (including recycling) was 1.2% above 2019, suggesting largely normal operations during the COVID-19 pandemic. A tighter market for concentrate has meant that smelters have maintained low treatment charges to attract concentrate. Primary and secondary zinc production rose by 1.0% and 1.1% respectively in 2020, with China's primary production output rising by 2.4%, and 'rest of world' production virtually flat compared to 2019.

Figure 14.3: World zinc mine production, metallic content



Source: International Lead Zinc Study Group (2021); AME Mineral Economics (2021); Department of Industry, Science, Energy and Resources (2021)

Figure 14.4: World zinc refinery production, metallic content



Source: International Lead Zinc Study Group (2021); Department of Industry, Science, Energy and Resources (2021)

In 2021–22, rising zinc concentrate supply may result in higher treatment and refining charges, as smelters approach capacity. However, refiners will need to consider the risk of further disruptions to mine supply, and may seek to rebuild strategic stockpiles of concentrates. Changes to refinery production are less responsive to price changes than mining production, due to the higher costs of restarting smelters. Refinery production is expected to follow mine production closely over the outlook period. Refined production is expected to increase by an average 1.1% a year over the outlook period, to 14 million tonnes in 2026 (Figure 14.4).

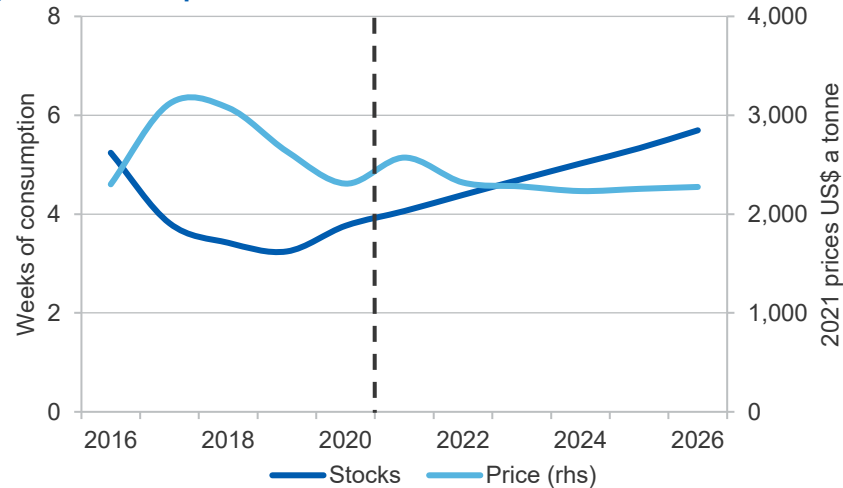
14.4 Prices

Price increases reflect tightness in concentrate supply

Zinc prices averaged US\$2,725 a tonne during the first two months of 2021, up from US\$1,928 a tonne in April/May 2020 at the peak of the pandemic sell off. Concentrate imports to China for the 12 months to December 2020 were up 21% compared with the prior period in 2019, placing upward pressure on prices. This pressure may ease as the government has called for a cap on steel production (see *iron and steel* chapter). However, China’s zinc smelters have called for a coordinated approach, similar to the copper smelters, requiring some stockpile rebuilding. Treatment and refining charges are at historical lows; close to \$US80 a tonne, compared with US\$240 a tonne a year ago. London Metals Exchange and Shanghai Futures Exchange zinc stocks are around 385,000 tonnes, higher than the previous quarter of 280,000 tonnes, but with markets currently more sentiment-driven than stocks-driven.

The LME zinc spot price is forecast to average US\$2,690 a tonne in 2021, decreasing to US\$2,220 a tonne in real terms in 2026, as world production increases (Figure 14.5). The strength of China’s recovery from the COVID-19 pandemic, as well as the impact of stimulus packages in other countries, is underpinning the outlook for zinc in the first couple of years of the outlook period (see *macroeconomic outlook* chapter). Short term tightness in the concentrate market is also expected to support prices in the near term.

Figure 14.5: Zinc prices and stocks



Source: London Metal Exchange (2021); Department of Industry, Science, Energy and Resources (2021)

14.5 Australia

Export earnings expected to decline modestly

Australia's zinc export earnings are projected to decline from \$3.6 billion in 2019–20 to \$3.5 billion in 2025–26 in real terms, as price declines outweigh the impact of production gains. Concentrate accounts for around 60% of total exports, and refined metal accounts for 40%.

Australia's production decreased slightly in 2020

In the December 2020 quarter, Australia's mined zinc production increased by 5.4% from the September 2020 quarter. However, output in 2020 was down by 1.8% from 2019. While the major mines increased production, output from smaller mines and ageing operations declined. The Broken Hill mine in NSW experienced a 4.1% decline in production in 2020 and Rosebery in Tasmania decreased by 20%, both year-on-year.

Glencore's Australia production increased by 6% in 2020; output came from the Mt Isa and McArthur River operations in Queensland and the Northern Territory, increasing 8.4% and 3.0% respectively in 2020. Over

the two years since late 2018 – when the company stated its aim to increase global zinc production – zinc production at Mt Isa and McArthur River has increased by 27% and 9.9% respectively.

Major operations in Queensland also increased production over 2020. At New Century Resources, with the ramp up of their Century tailings reprocessing operation, production increased by 38% on 2019. At South32's Cannington operation, production increased by 12% on 2019, having increased by 36% over the two years since December 2018. Dugald River increased by 4.5% in 2020 and by 14% over the two years to December 2020.

Refinery exports increased as concentrate was diverted

Australia's exports of zinc concentrate increased by 34% over the December 2020 quarter (quarter-on-quarter), after a similar sized decline in the September quarter. Total concentrate exports declined by 2.6% in 2020, relatively higher than production: concentrates appear to have been re-directed to be processed domestically, as 2020 refined zinc exports were up 16% year-on-year. Price surges and smelter capacity may have aided this trend.

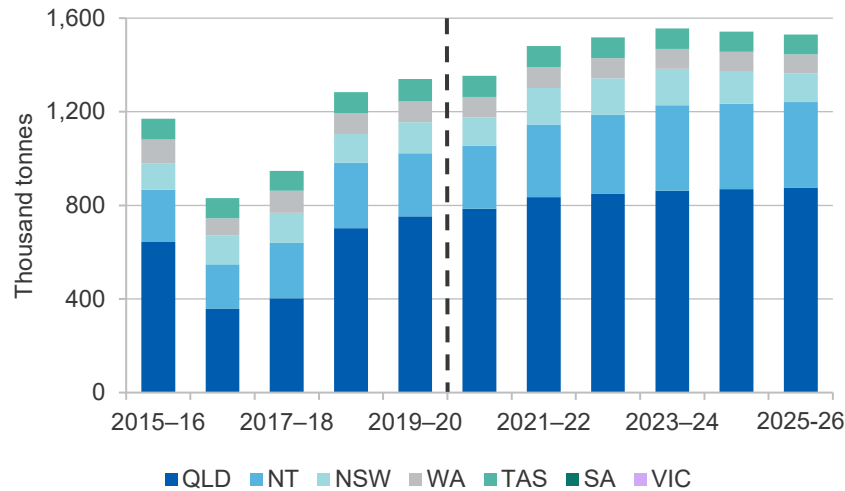
Australia's mine production is expected to increase and then stabilise

Australian production is expected to continue growing until the end of 2021–22, after which production is expected to remain steady for the duration of the outlook period (Figure 14.6). Australia's zinc mine output is expected to increase from 1.3 million tonnes in 2019–20 to a projected 1.6 million tonnes in 2025–26 (in metallic content), driven by further expansions at major operations in Queensland and the Northern Territory.

Refined production

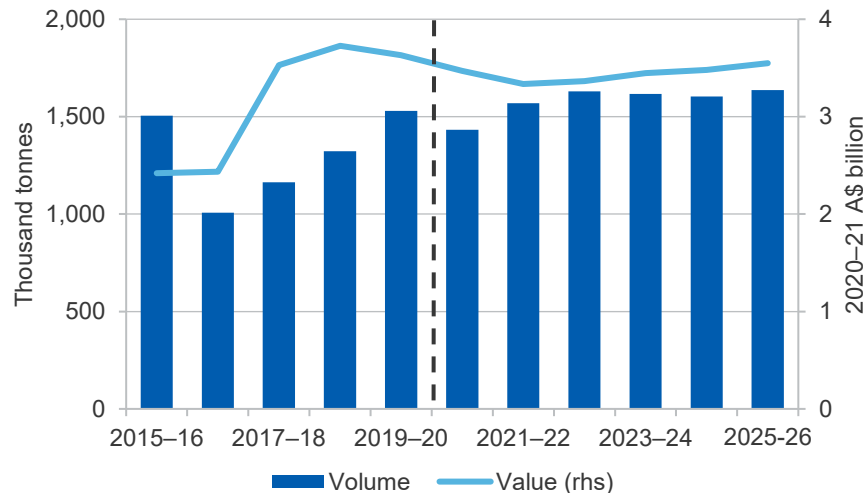
In 2020, refined zinc exports increased by 16% to 441,000 tonnes. Increasing refined zinc production from the expansion of Korean-owned Sun Metals is due in 2021, adding 50,000 tonnes per annum once fully ramped up. Sun Metals zinc smelter is located near Townsville. Refined production is forecast to be steady after 2022.

Figure 14.6: Australia's zinc mine output by state, metallic content



Source: Company reports; Department of Industry, Science, Energy and Resources (2021)

Figure 14.7: Australia's zinc exports, metallic content



Source: Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2021)

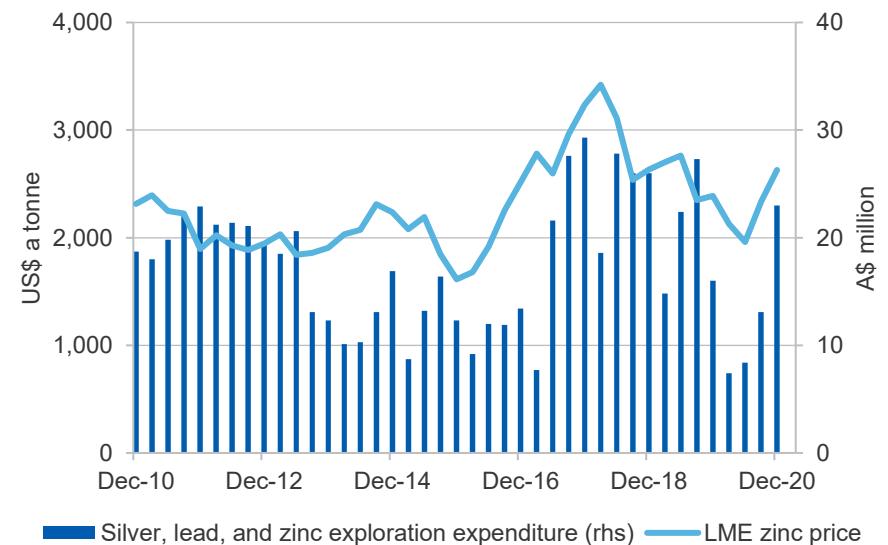
Australian zinc revenue

The rising Australian dollar may reduce revenue slightly, with export earnings in 2020–21 and 2024–25 projected to decline relative to 2019–20, despite increasing production. However, in 2025–26 production and exchange rate effects see revenue return close to 2019–20 levels in real 2020–21 dollar terms (Figure 14.7).

Exploration expenditure increased in the December quarter 2020

Exploration expenditure for silver, lead and zinc has increased 76% quarter-on-quarter for the December quarter, as the zinc price appreciated by a further 13% over the same period (Figure 14.8). The increase in exploration follows continued increased prices as a result of stimulus measures in response to due to the COVID-19 pandemic.

Figure 14.8: Exploration expenditure on silver, lead and zinc versus zinc prices



Source: ABS (2021) Mineral and Petroleum Exploration, Australia, 8412.0; Company reports; Department of Industry, Science, Energy and Resources (2021)

14.6 Revisions to the outlook

The revenue from zinc in Australia is forecast at \$3.4 billion for 2020–21 and 2021–22 in nominal terms, both up \$0.2 billion from those contained in the December quarter 2020 *Resources and Energy Quarterly*. The increase in revenue is based on appreciating zinc prices as well as slightly increased refined output.

Compared to the March 2020 forecast of \$3.1 billion (in real terms), earnings are now more robust in 2020–21 due to higher than anticipated zinc prices as a result of supply disruption resulting from the COVID-19 pandemic along with stimulus packages resulting to counter the effects of the pandemic. The forecast for 2021–22 is \$0.2 billion higher (in real terms) based largely on appreciating zinc prices.

Table 14.1: Zinc outlook

World	Unit	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
Production									
– mine	kt	12,120	13,478	14,301	14,659	14,955	15,197	15,309	4.0
– refined	kt	13,100	13,390	13,548	13,705	13,856	14,003	14,003	1.1
Consumption	kt	13,003	13,293	13,452	13,608	13,759	13,906	13,906	1.1
Closing stocks	kt	939	1,035	1,132	1,229	1,326	1,422	1,519	8.4
– weeks of consumption		3.8	4.1	4.4	4.7	5.0	5.3	5.7	7.1
Price									
– nominal	US\$/t	2,263	2,687	2,363	2,377	2,384	2,461	2,477	1.5
	USc/lb	103	122	107	108	108	112	112	1.5
– real ^a	US\$/t	2,308	2,687	2,314	2,275	2,232	2,252	2,216	-0.7
	USc/lb	105	122	105	103	101	102	101	-0.7
Australia	Unit	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^z	2023–24 ^z	2024–25 ^z	2025–26 ^f	CAGR ^r
Mine output	kt	1,340	1,354	1,481	1,530	1,571	1,598	1,649	3.5
Refined output	kt	418	450	480	492	492	492	492	2.8
Export volume									
– ore and concentrate ^b	kt	2,556	2,201	2,574	2,680	2,766	2,825	2,936	2.3
– refined	kt	390	406	380	392	391	391	391	0.1
– total metallic content	kt	1,530	1,419	1,569	1,629	1,669	1,696	1,747	2.2
Export value									
– nominal	A\$m	3,592	3,444	3,389	3,492	3,667	3,795	3,969	1.7
– real ^c	A\$m	3,630	3,444	3,334	3,364	3,446	3,478	3,548	-0.4

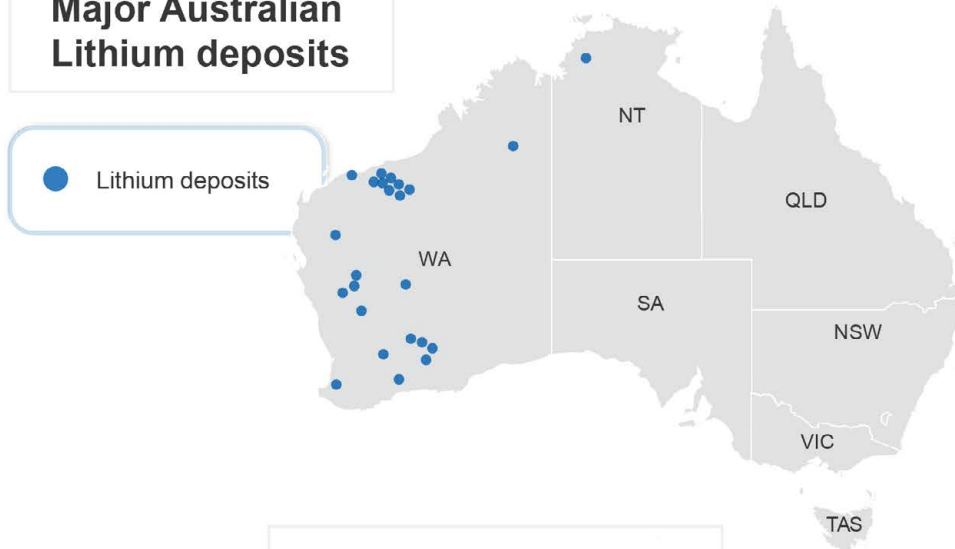
Notes: **a** In 2021 US dollars; **b** Quantities refer to gross weight of all ores and concentrates; **c** In 2020–21 Australian dollars; **f** Forecasts; **r** Compound annual growth rate; **z** Projection.

Source: ABS (2021) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Science, Energy and Resources (2021); International Lead Zinc Study Group (2021); LME (2021); World Bureau of Metal Statistics (2021)




Lithium


Major Australian Lithium deposits




Lithium facts



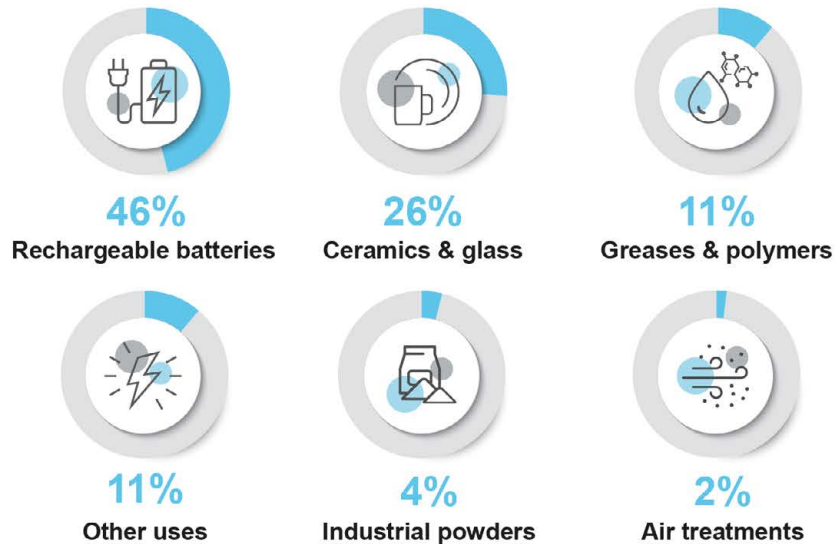
 **Electric vehicle sales** are expected to increase from 3m to 26m by 2030

 Lithium exports were A\$1.1b in 2019-20

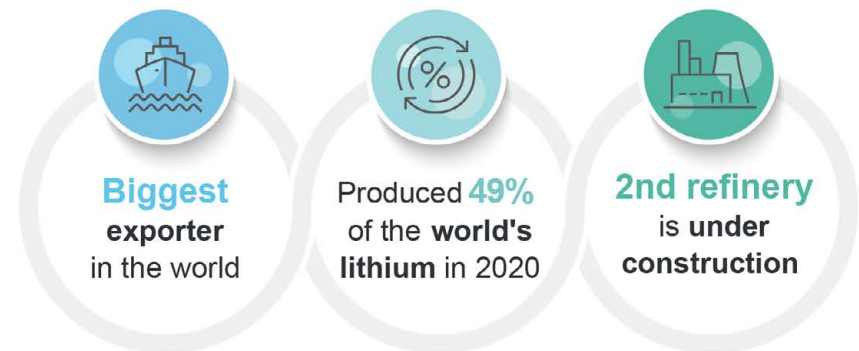
 Australian lithium exports are tipped to rise to 3.9m tonnes in 2025-26

 Australia's production of lithium is recovering from a downturn

World consumption



Australia's lithium



15.1 Summary

- Spodumene prices (in real terms) are projected to rise from an average of US\$445 a tonne in 2020 to US\$710 a tonne in 2026, driven by higher demand for batteries used in electric vehicles. Lithium hydroxide prices are projected to rise from US\$7,790 a tonne in 2020 to US\$11,800 a tonne in 2026 (in real terms).
- Australia's lithium production is projected to rise from 233,000 tonnes in 2019–20 to 571,000 tonnes in 2025–26 (see [Australia section](#)).
- Australia's lithium export earnings (in real terms) are projected to increase from \$1.1 billion in 2019–20 to \$5.4 billion in 2025–26.

15.2 World demand

Lithium demand increasing strongly

World demand for lithium is estimated to increase from 305,000 tonnes lithium carbonate equivalent (LCE) in 2020 to 426,000 tonnes in 2021 (Table 15.1). Demand is then forecast to exceed half a million tonnes in 2022, and more than 1.0 million tonnes by 2026 as global electric vehicle (EV) uptake rises further (Figure 15.1). The strong demand increase in 2021 is based on increasing EV uptake, driven by lower vehicle prices, government measures and increased model choice. There is considerable diversity of opinion regarding demand out to 2026, and this projection has upside risk. Lithium demand usually leads consumption by around one year, due to the lead times required in battery manufacturing. This lead time may get shorter in the future, as production is streamlined.

The annual growth for lithium demand over the outlook period is almost 23%, and recycling currently supplies around 1.7% of lithium per year. However, recycling may need to increase towards 15% by the close of the outlook period if demand is not to outstrip supply; moreover, recycling has yet to be established on a large scale.

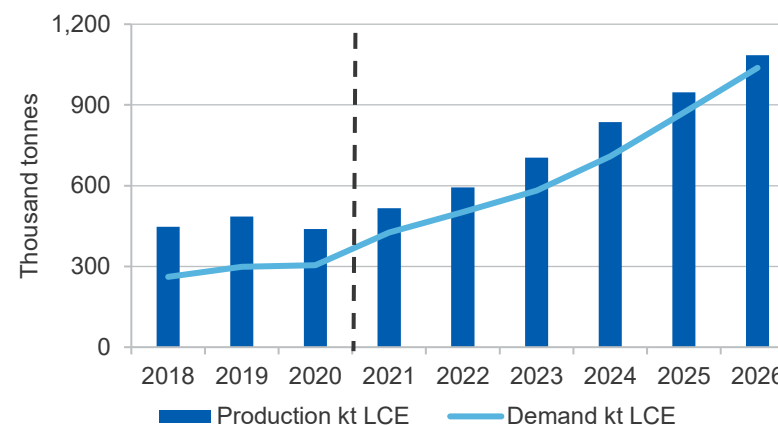
Lithium trade is growing rapidly in Asia

China's lithium trade increased substantially over the December 2020 quarter with lithium hydroxide exports increasing 45% quarter-on-quarter.

Lithium carbonate imports increased by 81% quarter-on-quarter. South Korea's lithium hydroxide imports increased by 64% quarter-on-quarter, while lithium carbonate imports increased by 33%. In Japan, lithium hydroxide imports increased by 23% quarter-on-quarter in December, while lithium carbonate imports decreased by 9%.

Increasing trade in both lithium hydroxide and lithium carbonate suggest firming market conditions. There has been some increase in lithium carbonate trade, due to increased output of lithium iron phosphate batteries (LFP). This potentially puts Australian producers, who produce spodumene which is more easily converted into lithium hydroxide, at a disadvantage. However, recent announcements by companies regarding commitments to lithium hydroxide production, suggests that both refined products have strong underlying demand over the outlook period.

Figure 15.1: World lithium production and demand



Source: Roskill (2021); BloombergNEF (2021); Department of Industry, Science, Energy and Resources (2021)

Lithium hydroxide is generally used in 'ternary' batteries. Ternary batteries are composed of nickel plus two other metals; often cobalt plus manganese or aluminium. On average, these batteries have a longer driving range than LFP batteries.

Electric vehicle trends

Chinese EV makers' adoption of LFP batteries was for the purpose of short commutes. However, Chinese automaker BYD now claims a driving range in excess of 600 kilometres for its Han vehicle. Improvements of these sorts in EV performance have driven strong demand for electric vehicles in China. However, European production is geared towards ternary batteries supporting lithium hydroxide demand.

European EV sales in 2020 were driven by emissions regulations along with the release of Volkswagen's ID3. China's sales were driven by subsidies requiring minimum driving range, which precipitated a move to LFP batteries with cell to pack technology. However, Mercedes have an LFP option, as does Tesla.

Commitments by the Biden Administration to implement mass purchasing of electric vehicles by the US Government could add half a million to electric car sales, though the timing remains unclear at the time of writing. In Australia, the government of the state of South Australia has introduced an ambitious target for all car sales to be electric by 2035, mirroring similar plans announced by the UK government.

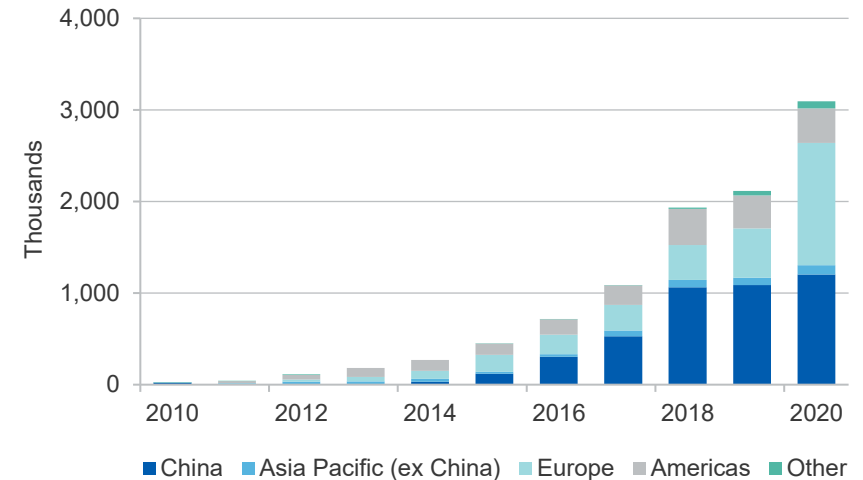
Electric vehicle sales for December quarter 2020 up strongly

EV sales increased 55% quarter-on-quarter in December, exceeding expectations. Growth was particularly strong in China and Europe, which together now comprise over 85% of the market. Sales exceeded 3 million units in 2020, and growth is unlikely to abate in 2021 (Figure 15.2). Longer term, demand is projected to rise strongly with about 26 million EVs projected to be sold annually by 2030 (Figure 15.3).

Lithium iron phosphate batteries versus ternary batteries

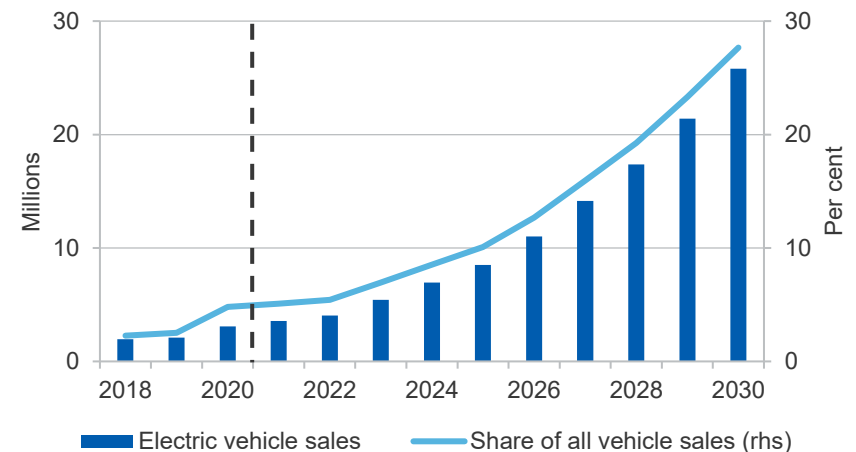
Battery technology continues to evolve rapidly, with LFP batteries potentially shifting towards increased use of nickel as a way to improve charging times while avoiding risks of flammability. Nickel is used in a foil in the battery to transfer heat and thereby reducing charging times.

Figure 15.2: Electric vehicle sales by country



Source: BloombergNEF (2021)

Figure 15.3: Long-term electric vehicle sales projection



Source: Department of Industry, Science, Energy and Resources (2021); International Energy Agency (2021); BloombergNEF (2021)

LFP battery usage has risen dramatically in China, in response to subsidies that require a minimum driving range and a maximum price point. This led manufacturers to quickly adopt a cell to pack layout (CTP), facilitating an increase in driving range that meets the necessary price point. Tesla and CATL also plan further improvements in CTC (cell to chassis) technology — similar to those recently introduced for CTP technology. However, Tesla's version of CTC may use ternary batteries.

Although manufacturing of LFP batteries (cobalt-free) has increased dramatically over the past 12 months, the market dominance of LFP batteries over 'ternary batteries' has yet to be established. In addition to LFP, Tesla is also going into the continuous production of their tab-less 4680 battery using nickel (a ternary battery), which is reliant on lithium hydroxide as an input. Tesla's production is being undertaken in conjunction with its battery manufacturing partners in North America (see the *nickel* chapter). The 4680 ternary battery potentially offers much higher performance than LFP batteries (see December 2020 *Resources and Energy Quarterly*, *lithium* chapter). Tesla has submitted an application to establish a battery production facility in Indonesia that may potentially leverage local nickel supply and population size. This may present an opportunity for Australian lithium producers.

[Solid state batteries are getting closer](#)

Solid state batteries are likely to be the next frontier for battery technology. Solid state technology has the potential to offer a driving range of about 1,000 kilometres. Feedstock for this type of battery can come from a number of sources, including lithium brine and spodumene. Both Contemporary Amperex Technology Limited (CATL) and Toyota are set to launch solid state batteries towards the end of the outlook period (2026). However, US start-up, Quantum Scape, may also have a pilot plant producing solid state batteries for Volkswagen and various others in 2024.

[Fast charging technology is improving](#)

Fast charging — another obstacle to large scale adoption of EVs — is being addressed by numerous companies. These include Israel's StoreDot

(supported by British Petroleum), with silicon anodes via nanotechnology. Commercialisation is understood to be a few years away. Japanese researchers are also pursuing nanotechnology with silicon anodes. An advantage of silicon over graphite is its ability to store 50% more lithium ions in a single charge. However, silicon tends to expand and crack with the increasing charge. Nanotechnology is being used to create structures in the silicon anode that alleviate these issues.

[Cobalt-free batteries](#)

Finally, China-based SVOLT have produced some cobalt-free ternary batteries, avoiding expensive inputs and environmental issues. SVOLT supplies batteries to Great Wall Motors. These batteries use 75% nickel and 25% manganese to boost performance.

[Recycling](#)

Volkswagen has opened a plant for recycling lithium batteries in Salzgitter, Germany. The plant is small scale but will be used to develop and scale up technology in this area, as large lithium batteries become available for end-of-life recycling towards the end of the outlook period.

[Electric vehicles demand may accelerate](#)

Volkswagen's 'Power Day' on 15 March 2021 revealed that from 2022 their cars will provide bidirectional charging technology — allowing the charge accumulated in the car to be used by the grid as well. Hyundai, Kia and Nissan announced this feature for 2021. This is in contrast to Tesla, who do not currently offer this feature.

The grid charging option has the potential to accelerate demand for EVs and thus Australian produced lithium products. It is worth noting that Volkswagen released some ID4 cars (electric version of the Tiguan) to the US last year, which sold out within eight hours.

Additionally, earth moving equipment manufacturer, Komatsu, has recently partnered with electric bus manufacturer Proterra to develop heavy duty electric earth moving equipment, also potentially accelerating demand.

15.3 World production

Security of supply being sought, as world demand lifts

World lithium production was stronger than anticipated in 2020, driven in response to increasing EV demand. Output in 2020 is estimated at 439,000 tonnes LCE. Production is forecast at 516,000 tonnes LCE in 2021, and projected to be 1,084,000 tonnes by 2026. At this stage, supply may fall short of demand unless significant recycling is undertaken, or mine and brine operations are expanded beyond initial projections.

'Green' stimulus packages and tightening emissions standards in Europe, are changing the nature of a previously oversupplied market. As a result, the gap between supply and demand is narrowing. Stockpiles still exist, but their size is difficult to determine — with some suggestions of 4-8 weeks for spodumene. Additionally, offtake and equity investments continue, suggesting security of supply may be an issue going forward.

Project development is accelerating

Chile's Sociedad Quimica y Minera de Chile (SQM) is positioning itself to more than double production over the next few years. It plans to raise Chilean production from 70,000 tonnes per annum of lithium carbonate equivalent to 180,000 tonnes per annum by 2023, with lithium hydroxide increasing from 13,500 to 30,000 tonnes per annum over a similar timeframe. Additionally, SQM and Wesfarmers have updated the feasibility study on the Mt Holland Deposit and its associated Kwinana lithium hydroxide refinery, both in Western Australia. This project is expected to reach a committed stage upon environmental approval. The plant could come online in late 2024, with potential to value-add spodumene into lithium hydroxide, producing 45,000 tonnes per annum. These expansions anchor both SQM and Wesfarmers firmly in lithium hydroxide production.

Albemarle are expanding with their La Negra III and IV projects in Chile, with an additional 40,000 tonnes per annum of lithium carbonate equivalent of capacity due for completion in 2021–22. Mineral Resources' and Albemarle's Kemerton lithium refinery in Western Australia is due to come online in 2021–22, ramping up towards 50,000 tonnes per annum of

lithium hydroxide. Albemarle restarted its US lithium hydroxide refinery in late 2020, and the company plans to double the capacity of its Silver Peak mine in the US to produce 10,000 tonnes per annum LCE towards the end of the outlook period.

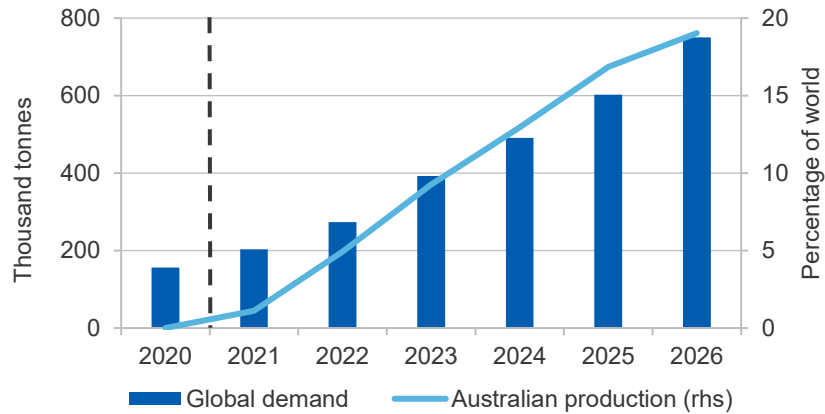
Lithium output currently comes from two sources: hard rock spodumene such as is produced in Australia, or from brines typically produced in South America. Standard Lithium are studying lithium extraction from brines in Arkansas in the US. The brines are extracted from earlier drilled oil wells; this could see development fast-tracked, with permitting already in place that would simply require amendments. Production may be low cost, and provide locally-sourced lithium for North American battery production. The first phase of production is mooted to ramp up to 21,000 tonnes per year of lithium carbonate equivalent over 2022 and 2023. The brine field is understood to extend into Texas. Previous examination of brine production in other US states failed to demonstrate commercial viability. Rio Tinto is examining lithium production from tailings water at their Boron mine in the US. These expansions will be needed to meet a potential supply shortfall towards the end of the outlook period.

Water-efficient direct lithium extraction (DLE) is being further trialled by ASX listed Lake Resources in Argentina, in order to advance its Kachi project. DLE lithium carbonate is being processed into battery test cells by ASX listed Novonix for Lake Resources. Further development of DLE, along with other water saving techniques, may need to be rolled out to sustainably manage brine expansion. ASX listed Vulcan Energy Resources has reached agreement with DuPont to test and scale up its DLE, after a positive outcome from its pre-feasibility study and successful capital raising for its German zero carbon lithium project.

ASX listed Piedmont Lithium commenced a definitive feasibility study in the US on their North Carolina deposit after making a spodumene supply agreement with Tesla. Permitting is underway for the Kings Mountain lithium hydroxide refinery, also in North Carolina. Piedmont is also expanding its lithium footprint in Canada via Sayona Mining. In Africa, ASX listed AVZ Minerals is undertaking offtake agreements with Gangfeng as

well as financing discussions for the project, situated in the Democratic Republic of Congo. Yibin Tianqi currently holds about 8% of the company's stock. Production is initially projected at 700,000 tonnes per year of spodumene concentrate followed by lithium sulphate production.

Figure 15.4: World demand and Australian lithium hydroxide output as a percent of world



Notes: Lithium hydroxide projections are subject to uncertainty due to construction disruption from the COVID-19 pandemic

Source: BloombergNEF (2021); Department of Industry, Science, Energy and Resources (2021)

Outlook positive for battery grade lithium products

Battery-grade lithium hydroxide is in increasing demand. Production expertise is focused in Albemarle and SQM, along with Chinese producers. Albemarle has operations in China and Chile. Albemarle are constructing the Kemerton lithium hydroxide refinery in Western Australia, with first product due 2021–22. The recommissioning of Tianqi's Kwinana lithium refinery is due to commence in 2021. Ramp-up for these facilities could take 12 months. If this occurs, then Australia may be ramping up lithium hydroxide production sharply in 2023 (Figure 15.4). SQM's existing lithium hydroxide production experience may be utilised in the upcoming development of Mt Holland and its associated Kwinana refinery.

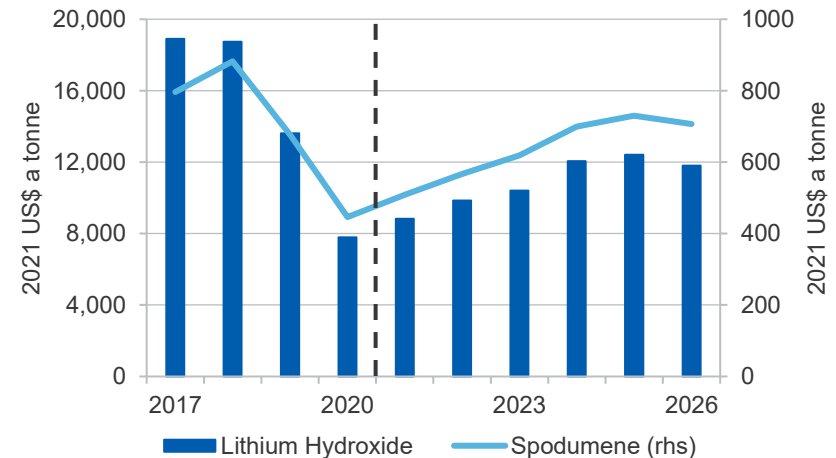
15.4 Prices

Lithium market evolves with lithium hydroxide LME debut in 2021

Spot lithium hydroxide prices (delivered to China) rose by 43% to US\$10,041 a tonne for the 3 months to end of February, to be 29% higher year-on-year. This compared with a price rise of 15% into Europe (to US\$9,250 a tonne delivered) for the same period and an 8% decline year-on-year. Lithium hydroxide may commence trading on the London Metals Exchange (LME) on 14 June 2021, subject to regulatory approvals. This would be the first openly traded lithium commodity on an exchange. However, market liquidity may take some time to become established.

Spot spodumene prices (delivered to China) rose by 13% to US\$445 a tonne over the three months to February, but declined 9.2% year-on-year. Spodumene prices are expected to increase in 2021 and 2022, driven by 'green' government stimulus packages and rising EV production (Figure 15.5).

Figure 15.5: Prices of spodumene concentrate and lithium hydroxide



Notes: Lithium hydroxide price is for lower priced technical grade

Source: Roskill (2021); Department of Industry, Science, Energy and Resources (2021)

In contrast to the more transparent spot market, movements on the contract market are harder to determine. It is estimated that the contract market is currently trading at a premium of around 11% to spot. However, contract pricing can operate at a discount or a premium to spot pricing, depending on market conditions. In order to qualify for contract pricing, an extensive quality verification process — that can take 12 months — is required. The quality verification process is aimed at, among other things, eliminating impurities that can contribute to fires. Product that has not yet fully qualified for contract pricing can instead be sold on a spot basis. In the current market conditions, Albemarle is considering more flexible pricing for some of its contracts. It is unclear what mechanisms for flexibility maybe utilised as yet.

15.5 Australia

Exports forecast to recover

Exports of lithium were around \$1.1 billion in 2019–20. Low spodumene prices early in the financial year may see revenue fall to \$1.0 billion in 2020–21. However, higher production and prices, and the start of local spodumene refining into lithium hydroxide, is projected to raise lithium export earnings to \$5.4 billion by 2025–26. The projection assumes less than one third of spodumene will be value added to lithium hydroxide by the end of the outlook period.

Production has stabilised

Australia's spodumene production and shipping stabilised in the December 2020 quarter, with production equalling shipping. Pilbara Minerals' output rose by 2.1%, but sales rose by 62%, reducing stockpiles. The company also took over the neighbouring operations of Altura Resources. The Altura side of the consolidated operation is not currently producing lithium, and is unlikely to return to production unless there is sufficient market support. It may however, yield significant operational flexibility and synergy for Pilbara Minerals; allowing expansion without the need for construction. Pilbara's production may increase by 10-15% over the next six months via a series of process improvements.

Meanwhile, production at Galaxy Resources' Mt Cattlin operation in Western Australia increased by 11%, while sales increased by 350%, drawing down stockpiles noticeably. Strong contract pricing (US\$480 per tonne) is driving the company towards ramping up operations by 20-30% over 2021.

Greenbushes, currently owned by Tianqi and Albemarle, had estimated production of over 80,000 tonnes LCE of spodumene concentrate in 2020 and may reach over 200,000 tonnes LCE by the end of the outlook period.

Project development is on the rise

Independence Group (ASX Listed) is in the process of acquiring a 25% stake in Greenbushes and a 49% stake in its associated Kwinana lithium refinery. The transaction is due to crystallise in mid-2021, and will continue IGO's expansion in the battery minerals space.

Core Lithium, an Australian company, is in the process of completing resource calculations and a definitive feasibility study for its Finniss deposit, close to Darwin, with a view to rapid development. The company currently has an offtake agreement with Sichuan Yahua International (Yahua) based in China. Yahua, in turn, has an offtake agreement with Tesla for lithium hydroxide.

Capital raising is occurring for both Vulcan Energy and Core Lithium, indicating a significant turn-around in market sentiment and therefore potentially increasing supply of lithium just as the price begins to rise. ASX listed, Argosy Minerals raised around \$30m for its Argentina and US-based lithium brine development projects.

Elsewhere, ASX listed Orocobre is nearing completion of construction for its Naraha lithium hydroxide facility in Argentina. ASX listed Piedmont Lithium has started feasibility studies on spodumene development in North Carolina, and is in the process of permitting for a lithium hydroxide refinery in the same area. Piedmont already has offtake arrangements with Tesla. Wodgina remains on care and maintenance, but rising demand may see its return during the outlook period.

Australian production forecast to rise over the outlook period

Australian production is now expected to rise over the outlook period, from 244,000 tonnes LCE in 2020–21 to 571,000 tonnes LCE in 2025–26, maintaining around 50% of world output. Spodumene exports are projected to increase from 1.6 million tonnes in 2020–21 to 3.9 million tonnes in 2025–26 (Figure 15.6).

Lithium hydroxide production is mooted for both Kwinana and Kemerton refineries in 2021–22. A positive feasibility study for Mt Holland (owned by SQM and Wesfarmers) with its associated lithium hydroxide plant is also a positive sign for Australia’s future lithium refinery capacity. The investment decision is subject to completion of environmental approvals, with production potentially commencing in 2024.

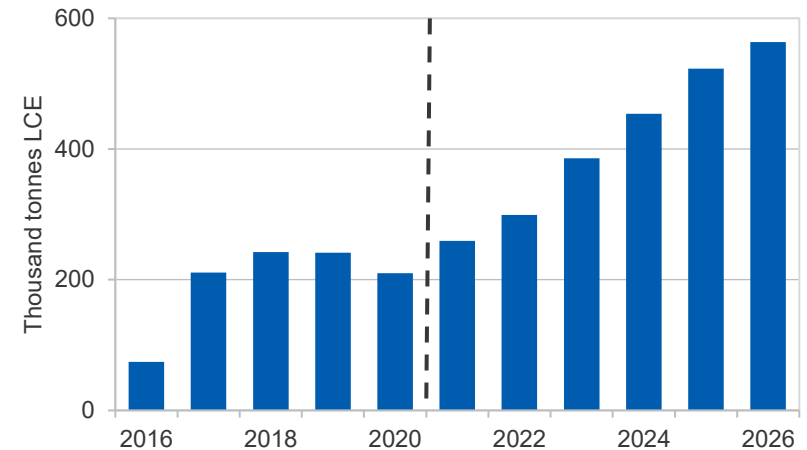
Lithium export earnings (in real terms) are projected at \$5.4 billion by 2025–26, up from \$1.1 billion in 2019–20 (Figure 15.7). The projection is based on less than one third of spodumene being value added to lithium hydroxide by the end of the outlook period.

Revisions to the outlook

Australia’s lithium export earnings are forecast at \$1.0 billion for 2020–21 and \$1.4 billion in 2021–22 (nominal terms), unchanged for 2020–21 and up \$0.1 billion for 2021–22 from those contained in the December 2020 *Resources and Energy Quarterly*. The increase in earnings in 2021–22 is based on appreciating spodumene prices.

Compared to the March 2020 forecast of \$0.6 billion (in real terms), earnings are now more robust in 2020–21, due to a faster than anticipated recovery in volumes in the lithium market (due to surging electric vehicle demand). The forecast for 2021–22 is \$0.1 billion higher (in real terms) based largely on appreciating spodumene prices.

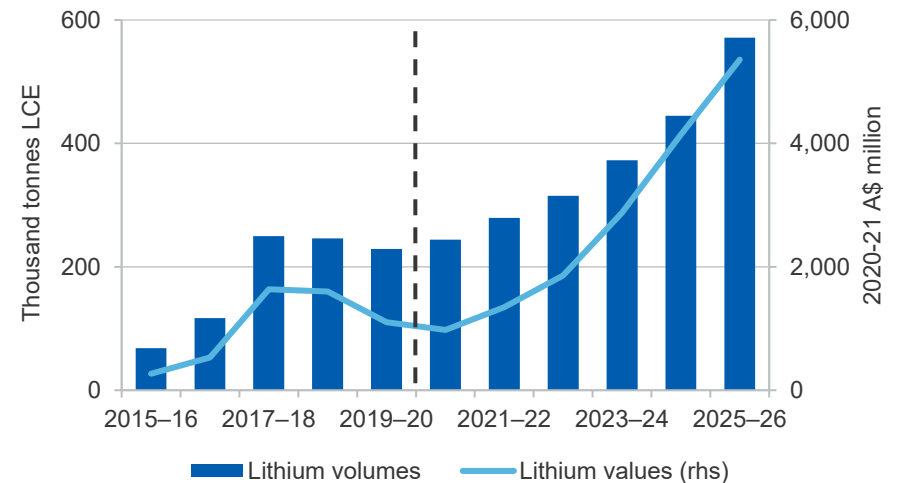
Figure 15.6: Australia’s spodumene concentrate production



Notes: Lithium hydroxide is not included.

Source: Company reports; Roskill (2021); Department of Industry, Science, Energy and Resources (2021)

Figure 15.7: Australia’s lithium exports



Notes: Income figures include lithium hydroxide and spodumene volumes contain hydroxide.

Source: Company reports; Roskill (2021); Department of Industry, Science, Energy and Resources (2021)

Table 15.1: Lithium Outlook

World	Unit	2020	2021 ^f	2022 ^f	2023 ^z	2024 ^z	2025 ^z	2026 ^z	CAGR ^r
Lithium production ^a	kt	439	516	594	704	836	947	1,084	16.3
Demand ^b	kt	305	426	502	582	709	872	1,038	22.6
Stocks ^c	kt	120	144	171	204	242	285	335	18.6
–weeks of consumption	kt	20.5	17.6	17.7	18.2	17.8	17.0	16.8	–3.3
Spodumene price									
–nominal	US\$/t	437	508	579	646	747	798	790	10.4
–real ^d	US\$/t	446	508	567	619	700	730	707	8.0
Lithium hydroxide price									
–nominal	US\$/t	7,637	8,838	10,053	10,866	12,884	13,571	13,193	9.5
–real ^d	US\$/t	7,790	8,838	9,847	10,403	12,060	12,419	11,804	7.2
Australia	Unit	2019–20	2020–21 ^f	2021–22 ^f	2022–23 ^z	2023–24 ^z	2024–25 ^z	2025–26 ^z	CAGR ^r
Mine production ^a	kt	233	244	280	315	373	445	571	16.1
Spodumene export volume ^e	kt	1,503	1,647	1,886	2,126	2,515	3,003	3,855	17.0
Export value									
–nominal ^g	A\$m	1,091	977	1,368	1,932	3,061	4,520	5,996	32.9
–real ^h	A\$m	1,102	977	1,345	1,861	2,877	4,143	5,359	30.2

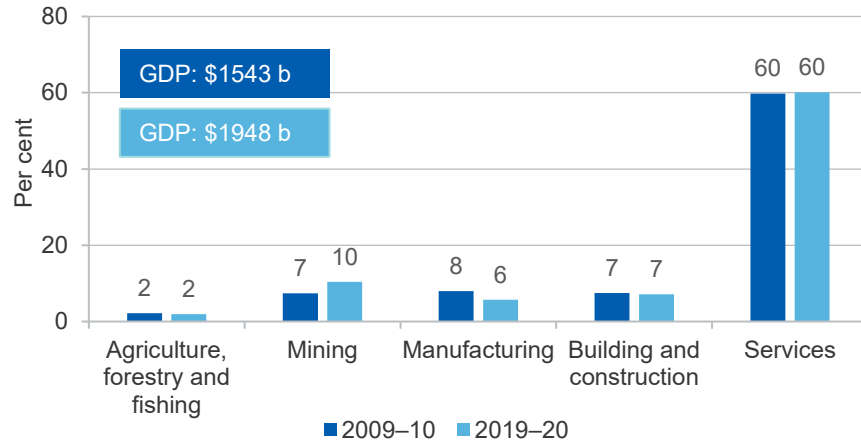
Notes: **a** Lithium Carbonate Equivalent: This is a measure of the quantity of refined product; **b** Demand is ahead of consumption by approximately 12 months due to the lead time required in battery manufacturing; **c** Stockpile estimates possibly inaccurate due to increasing product purity specifications. Calculated from residual after losses from refining and allowing for lead time in battery manufacturing; **d** In 2021 US dollars; **e** Spodumene concentrates: 2018–19 products include direct ship ore, 4 per cent Li₂O concentrate and 6 per cent concentrate, thereafter mostly 6 per cent Li₂O concentrate, stockpiles run down in 2019–20; **f** Forecast; **g** revenue from spodumene concentrate as well as lithium hydroxide; **h** In 2020–21 Australian dollars; **r** Compound annual growth rate; **s** Estimate; **z** Projection.

Source: Company reports; Department of Industry, Science, Energy and Resources (2021); Roskill (2021); Government of Western Australia Department of Mines, Industry Regulation and Safety (2021)

Trade summary charts and tables

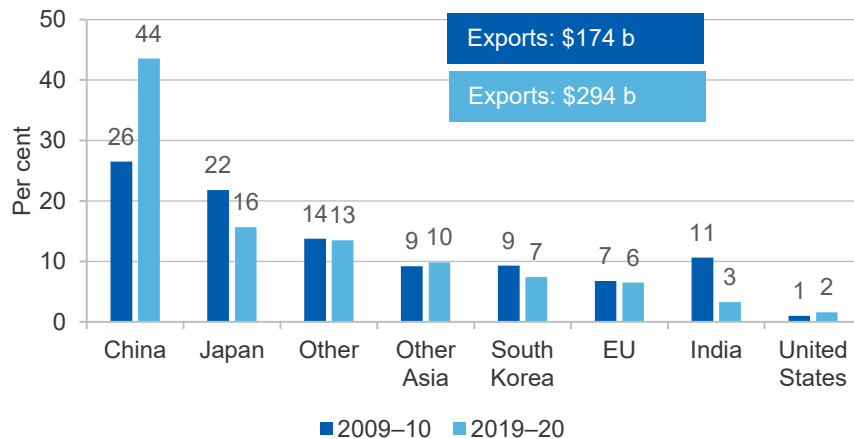
An aerial photograph of a mining operation, showing several large yellow haul trucks parked in a dirt area. The image is overlaid with a semi-transparent white rectangular box containing the text 'Trade summary charts and tables'. The background is a blue-tinted aerial view of the quarry.

Figure 16.1: Industry shares of GDP



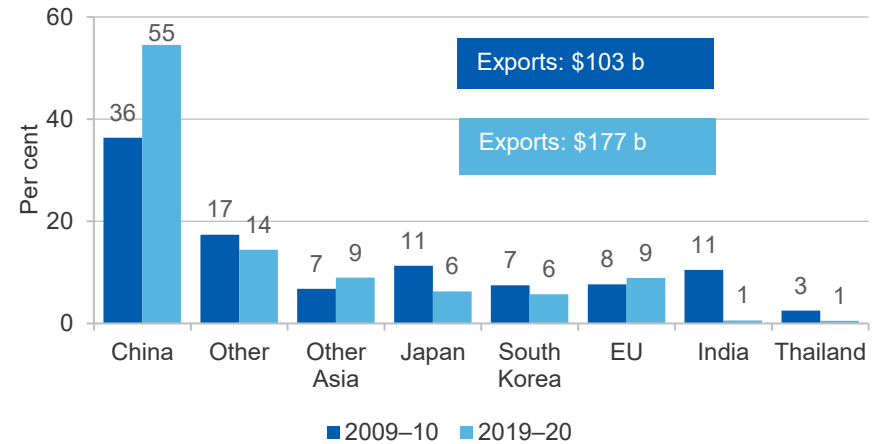
Source: ABS (2021) Australian National Accounts, National Income, Expenditure & Production, 5204.0

Figure 16.2: Principal markets for Australia's resources and energy exports, 2020-21 dollars



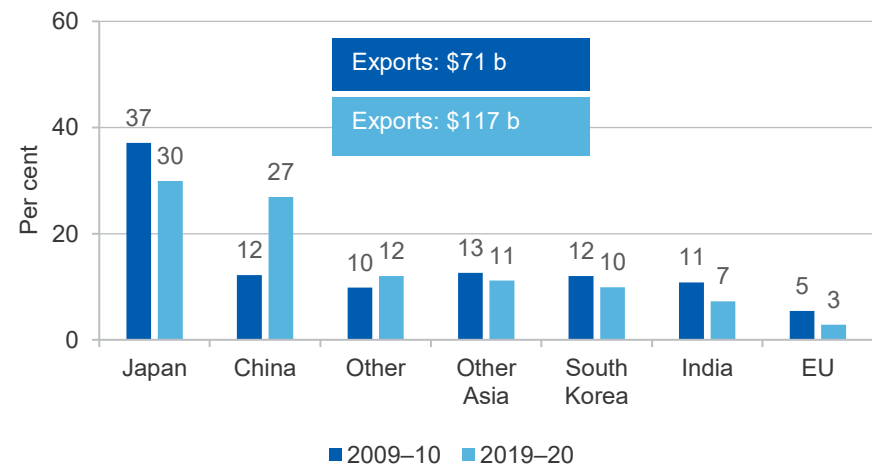
Source: ABS (2021) International Trade in Goods and Services, 5368.0

Figure 16.3: Principal markets for Australia's resources exports, 2020-21 dollars



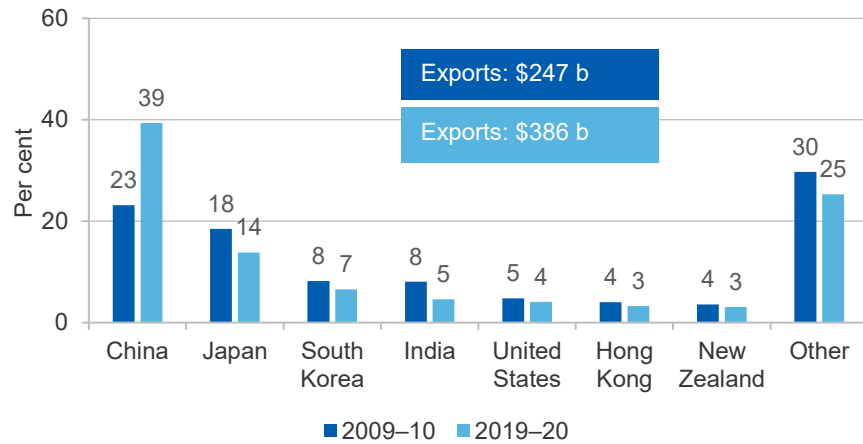
Source: ABS (2021) International Trade in Goods and Services, 5368.0

Figure 16.4: Principal markets for Australia's energy exports, 2020-21 dollars



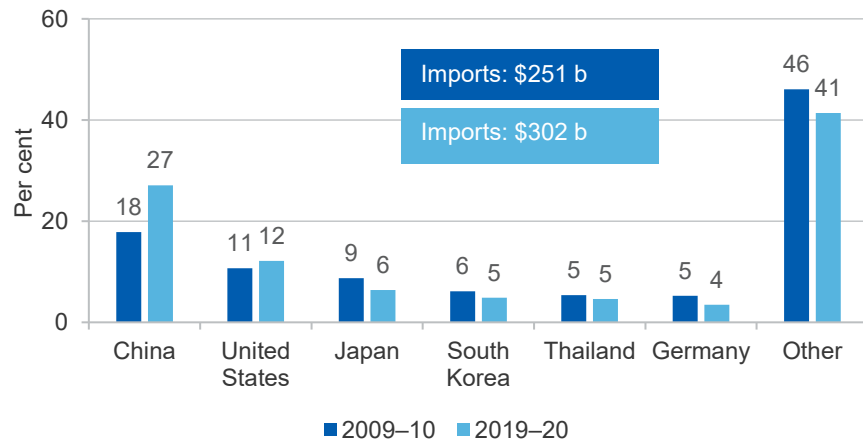
Source: ABS (2021) International Trade in Goods and Services, 5368.0

Figure 16.5: Principal markets for Australia's total exports, 2020–21 dollars



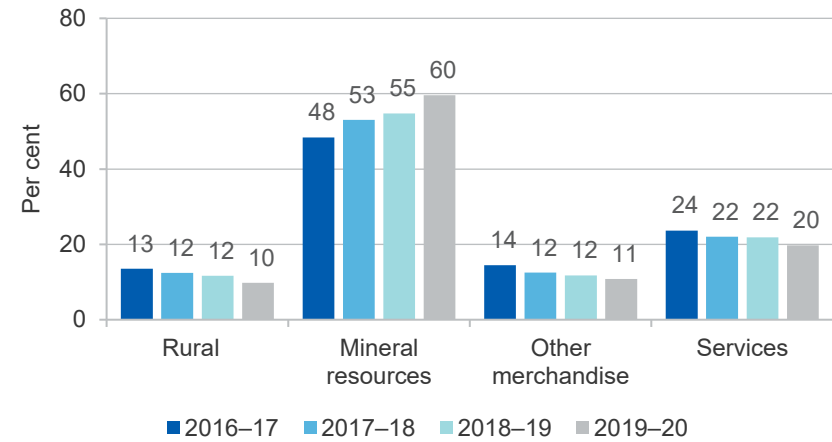
Source: ABS (2021) International Trade in Goods and Services, 5368.0

Figure 16.6: Australia's total imports by country of origin, 2020–21 dollars



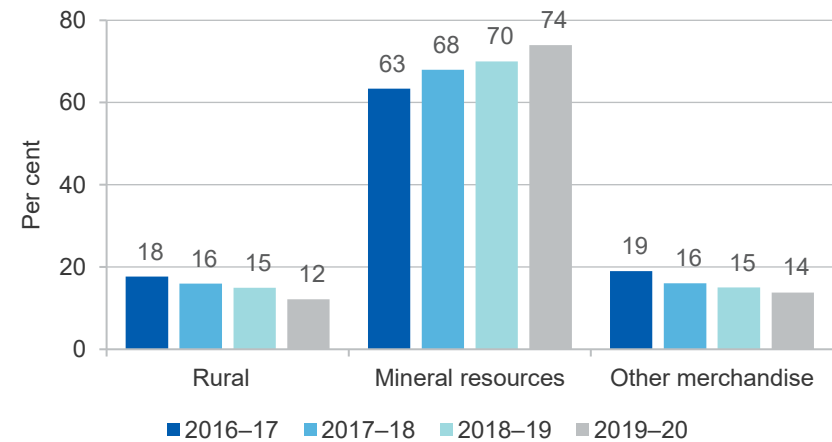
Source: ABS (2021) International Trade in Goods and Services, 5368.0

Figure 16.7: Proportion of goods and services exports by sector



Source: ABS (2021) Balance of Payments and International Investment Position, 5302.0

Figure 16.8: Proportion of merchandise exports by sector



Source: ABS (2021) Balance of Payments and International Investment Position, 5302.0

Table 16.1: Principal markets for Australia's thermal coal exports, 2020–21 dollars

	Unit	2015–16	2016–17	2017–18	2018–19	2019–20
Japan	\$m	7,383	8,737	10,240	11,910	8,435
China	\$m	1,870	3,721	4,932	4,332	3,971
South Korea	\$m	2,722	2,720	3,093	3,904	2,873
Taiwan	\$m	1,700	2,397	2,676	3,238	2,411
Vietnam	\$m	107	155	133	680	1,052
Malaysia	\$m	530	683	778	926	540
Total	\$m	15,919	20,055	23,511	26,584	20,591

Source: ABS (2021) International Trade in Goods and Services, 5368.0

Table 16.2: Principal markets for Australia's metallurgical coal exports, 2020–21 dollars

	Unit	2015–16	2016–17	2017–18	2018–19	2019–20
China	\$m	4,182	8,121	8,720	10,128	9,881
India	\$m	4,977	8,880	9,871	11,513	7,569
Japan	\$m	4,706	7,362	7,561	7,842	6,148
South Korea	\$m	2,253	3,914	3,818	4,120	3,065
Taiwan	\$m	1,049	1,933	2,012	2,660	2,014
Netherlands	\$m	987	2,002	1,865	1,835	1,255
Total	\$m	21,357	37,492	39,341	44,688	34,607

Source: ABS (2021) International Trade in Goods and Services, 5368.0

Table 16.3: Principal markets for Australia's crude oil and refinery feedstocks exports, 2020–21 dollars

	Unit	2015–16	2016–17	2017–18	2018–19	2019–20
Singapore	\$m	679	1,074	1,222	1,993	1,374
China	\$m	761	750	656	1,032	1,044
Malaysia	\$m	156	453	610	1,680	1,024
Indonesia	\$m	382	974	1,362	664	769
Thailand	\$m	749	598	1,200	1,147	625
South Korea	\$m	485	477	720	711	341
Total	\$m	5,875	5,810	7,243	9,290	9,104

Note: Some country details have been confidentialised by the Australian Bureau of Statistics.

Source: ABS (2021) International Trade in Goods and Services, 5368.0

Table 16.4: Principal markets for Australia's LNG exports, 2020–21 dollars

	Unit	2015–16	2016–17	2017–18	2018–19	2019–20
Japan	\$m	11,366	12,002	15,106	21,721	20,144
China	\$m	3,172	6,052	9,952	17,903	16,454
South Korea	\$m	1,811	2,711	3,838	5,435	5,218
Taiwan	\$m	173	269	778	2,400	2,621
Malaysia	\$m	203	222	378	893	1,472
Singapore	\$m	429	1,518	1,182	1,266	1,050
Total	\$m	17,888	23,670	32,173	50,925	48,028

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

Source: ABS (2021) International Trade in Goods and Services, 5368.0; International Trade Centre (2021) International Trade Statistics

Table 16.5: Principal markets for Australia's iron ore exports, 2020–21 dollars

	Unit	2015–16	2016–17	2017–18	2018–19	2019–20
China	\$m	41,846	54,683	52,171	64,996	85,684
Japan	\$m	5,053	5,716	5,550	5,896	7,112
South Korea	\$m	3,295	4,146	3,754	4,779	6,288
Taiwan	\$m	1,102	1,519	1,285	1,810	1,896
Indonesia	\$m	59	46	46	45	28
India	\$m	7	6	312	243	21
Total	\$m	51,583	66,440	63,907	79,421	103,950

Source: ABS (2021) International Trade in Goods and Services, 5368.0

Table 16.6: Principal markets for Australia's aluminium exports, 2020–21 dollars

	Unit	2015–16	2016–17	2017–18	2018–19	2019–20
South Korea	\$m	1,204	786	878	786	1,150
Japan	\$m	752	989	1,430	1,351	1,027
Taiwan	\$m	322	219	340	300	364
Thailand	\$m	290	326	389	401	293
United States	\$m	20	135	193	861	249
Indonesia	\$m	102	161	190	123	96
Total	\$m	3,498	3,360	4,178	4,266	3,731

Source: ABS (2021) International Trade in Goods and Services, 5368.0

Table 16.7: Principal markets for Australia's copper exports, 2020–21 dollars

	Unit	2015–16	2016–17	2017–18	2018–19	2019–20
China	\$m	3,871	2,863	3,921	3,693	3,827
Japan	\$m	1,541	1,439	1,588	1,877	2,149
Malaysia	\$m	666	912	906	1,271	833
South Korea	\$m	529	473	302	699	658
India	\$m	554	725	872	455	468
Philippines	\$m	237	421	174	626	364
Total	\$m	8,752	8,031	8,797	10,005	10,316

Source: ABS (2021) International Trade in Goods and Services, 5368.0

Table 16.8: Principal markets for Australia's gold exports, 2020–21 dollars

	Unit	2015–16	2016–17	2017–18	2018–19	2019–20
United Kingdom	\$m	4,250	4,152	3,403	4,421	12,841
Hong Kong	\$m	2,787	10,202	8,374	4,476	3,376
United States	\$m	159	156	77	130	3,112
Switzerland	\$m	775	1,005	1,139	1,189	1,919
Singapore	\$m	1,291	324	1,205	1,628	1,438
China	\$m	7,065	2,461	3,059	5,194	832
Total	\$m	17,898	20,137	20,083	19,321	24,652

Source: ABS (2021) International Trade in Goods and Services, 5368.0

Appendices



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 Australian and US consumer price indexes (CPI). The Australian and US CPI forecasts are based on the median of economic forecasters at the time that the report was prepared. The source is the Bloomberg survey of economic forecasters.

A.3 Time periods

The terms ‘estimate’, ‘forecast’ and ‘projection’ refer to different time periods in this report. Estimate refers to a time period that has passed, but for which full historical data is not yet available, while ‘forecast’ and ‘projection’ refer to different periods in the future. It is important to distinguish between different future 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 Department of Industry, Science, Energy and Resources’ Office of the Chief Economist (DISER OCE) uses different terminology to distinguish between short-term forecasts and medium to long-term projections, as outlined in *Table A2*.

Table A1: OCE terminology for different time periods/horizons

Period	Years	Terminology
Historical	Time period has passed but complete for data for the period is not yet available	Estimate
Short-term	1 to 2 years	Forecast
Medium-term	3 to 5 years	Projection
Long-term	Beyond 5 years	n/a

Source: Department of Industry, Science, Energy and Resources (2020)

A.4 Commodity classifications

The DISER 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 A2*. In estimating a total for Australia's resources and energy exports, the remaining commodities, defined as 'other resources' and 'other energy', are forecast as a group.

Table A2: Resources and energy commodities groupings and definitions

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

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

Source: Department of Industry, Science, Energy and Resources (2020)

Appendix B Glossary

Term	Description
A\$	Australian dollar
ABS	Australian Bureau of Statistics
AHECC	Australian Harmonized Export Commodity Classification
AISC	All-In Sustaining Cost — an extension of existing cash cost metrics and incorporates costs related to sustaining production.
Base metals	A common metal that is not considered precious (includes aluminium, copper, lead, nickel, tin, zinc)
Bbl	Barrel
Bcm	Billion cubic metres
Benchmark	A standard specification used to price commodities.
BF and BOF	Blast furnace and basic oxygen furnace — used in an integrated steelmaking process that uses iron ore and coal.
Bulks	Non-liquid and non-gaseous commodities shipped in mass and loose (iron ore, coal, bauxite)
CAGR	Compound annual growth rate
Capex	Capital expenditure
CFR	Cost and freight — Seller clears exports, and pays freight.
CIF	Cost, Insurance, and Freight
Coal Seam Gas (CSG)	Natural gas found in coal seams. Also known as Coal Bed Methane (CBM)
Coke	Made by heating coal at high temperatures without oxygen, and used to reduce iron ore to molten iron saturated with carbon, called hot metal

Conventional gas	Natural gas that can be produced from reservoirs using traditional techniques. Contrasts with unconventional gas.
COVID-19	2019 Novel Coronavirus
CPB	CPB Netherlands Bureau for Economic Policy Analysis
CPI	Consumer Price Index — measures quarterly changes in the price of a basket of goods and services which account for a high proportion of expenditure by the CPI population group (i.e. metropolitan households).
Crude steel	Steel in the first solid state after melting, suitable for further processing or for sale.
DES	Delivered Ex Ship — price of LNG including shipping and insurance.
DISER	Department of Industry, Science, Energy and Resources
DMO	Domestic Market Obligation — a policy to reserve energy commodities for domestic usage
DRC	Democratic Republic of the Congo
ECB	European Central Bank
Economic growth	An increase in the capacity of an economy to produce goods and services, compared from one period of time to another. It is measured in nominal or real gross domestic product (GDP).
EIA	The United States Energy Information Administration
EAF	Electric arc furnace — a furnace that melts steel scrap using the heat generated by a high power electric arc.
ETF	Exchange Traded Fund — an exchange traded fund that allows investors to invest in gold on the exchange.
EUV	Export unit value — export value/volumes exported
EV	Electric vehicle
f	Forecast — a two year outlook
FEED	Front end engineering design
FID	Final investment decision

FOB	Free on board — seller clears export, buyer pays freight.
GAD	Gross air dried basis — For measuring coal quality.
GAR	Gross as received basis — For measuring coal quality.
GBP	Great Britain Pounds
GDP	Gross Domestic Product — measures the value of economic activity within a country/group.
GFC	Global Financial Crisis — the period of extreme stress in global financial markets and banking systems between mid-2007 and early 2009.
GJ	Gigajoule
GST	Goods and Services Tax — a value-added tax levied on most goods and services sold for domestic consumption.
HCC	Hard coking coal — The best grade of metallurgical coal used in the steel production process. Australian hard coking coal is regarded as the industry benchmark.
IEA	International Energy Agency
IMF	International Monetary Fund — an international organisation that promotes international financial stability and monetary cooperation.
IMO	International Maritime Organisation
IP	Industrial Production — measures the output of the industrial sector that comprises mining, manufacturing, utilities and construction.
IPO	Initial public offering — a process of offering shares of a private corporation to the public in a new stock issuance.
ISM	US Institute for Supply Management
ISM	Institute of Supply Management
JCC	Japan Customs-cleared Crude (or Japan Crude Cocktail) — average price of crude oil imported by Japan and a common price index in long-term LNG contracts.
JFY	Japanese fiscal year
kcal/kg	Kilocalories per kilogram

kt	Thousand tonnes
ktpa	Kilotonnes per annum
LBMA	London Bullion Market Association
LCE	Lithium Content Equivalent
Li OH	Lithium Hydroxide
LME	London Metal Exchange
LNG	Liquefied natural gas
LNy	Lunar New Year
LPG	Liquefied petroleum gas
LVPCI	Low volatile pulverised coal injection — a type of low volatile coal used in the PCI process
m	Million
MMbtu	Million British thermal units
Mt	Million tonnes
mtpa	Million tonnes per annum
MW	Megawatts
Nameplate capacity	The theoretical maximum annual production capacity
NAR	Net as received basis — For measuring coal quality
NDRC	China's National Development and Reform Commission
NEV	New energy vehicle — term used for plug-in electric vehicles eligible for public subsidies (battery electric vehicles and plug-in hybrid vehicles)

OCE	Office of the Chief Economist
OECD	Organisation for Economic Co-operation and Development
OPEC	Organisation of Petroleum Exporting Countries, a formal alliance of 14 countries to collaborate to manage the world oil market
OPEC+	Informal term for agreements between OPEC and ten other oil-producing countries (which are not members of OPEC)
Oz	Ounce
PCE	Personal Consumption Expenditure — a measure of the changes in price of consumer services and goods.
PCI	Pulverised coal injection — PCI coal is used for its heat value and injected directly into blast furnaces as a supplementary fuel, which reduces the amount of coke required.
PCI	Pulverised coal injection — a process used in blast furnace operations
PM	The afternoon price of gold set at 3.00pm each business day at the London Bullion Market Association
PMI	Purchasing Managers Index — an indicator of economic health for manufacturing and service sectors.
PPP	Purchasing Power Parity — a way of measuring economic variables in different countries that equalise the purchasing power of different currencies
RoW	Rest of world
s	Estimate — Incomplete data or subject to revision
Shale gas	Natural gas found in shales
SDR	Special drawing right
SHFE	Shanghai Futures Exchange
SSCC	Semi-soft coking coal — A type of metallurgical coal used in the steel production process alongside hard coking coal, but results in a lower coke quality and more impurities.
Tariff	A tax on imports or exports that is used by governments to generate revenue or to protect domestic industries from competition.
Tight gas	Natural gas found in low quality reservoirs

TWI	Trade Weighted Index — a measure of the foreign exchange value of the US dollar against a basket of major foreign currencies.
U3O8	Triuranium octoxide — a compound of uranium.
UAE	United Arab Emirates
UK	United Kingdom
Unconventional gas	Natural gas that is more difficult to extract, including coal seam gas, shale gas and tight gas. Contrasts with conventional gas.
US	United States
US\$	United States dollar
WEO	The International Energy Agency's World Energy Outlook
WTI	West Texas Intermediate crude oil price
z	Projection a five year outlook