



Australian Government
Department of Industry,
Science and Resources

Office of the
Chief Economist

Resources and Energy Quarterly

June 2022

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Acknowledgements

The authors would like to acknowledge the contributions of:

Stan Bucifal, Russell Campbell, Silvia Gong, James Hutson, Jeewantha Karunarathna and Razib Tuhin.

Cover image source: Rob Young

ISSN 1839-5007

Vol. 12, no. 2

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Foreword

Australia's resource and energy export earnings are estimated at \$405 billion in 2021–22, and forecast to rise to \$419 billion in 2022–23, delivering two successive record years. As world supply responds to high prices and commodity demand moderates, earnings are forecast to fall below \$338 billion in 2023–24, still the third highest ever.

Driving the sharp surge in energy and base metal prices has been a post-COVID recovery in demand, production disruptions and the impact of the potential loss and diversion of some Russian exports from markets. Coming on top of already low inventories for many commodities, the bullish demand and supply factors have pushed many commodity prices to new records. Unfortunately, this has exacerbated price pressures in other areas of economic activity. With the economic impacts of the COVID-19 pandemic now beginning to wane over the projection period, central banks are now tightening monetary policies.

Western developed nations have imposed further sanctions on Russia, the latest being a European Union ban on seaborne oil and oil product imports from Russia. This means about 90% of Russia's oil exports to the 27-nation bloc will end in 2022. Some of the oil and other fossil fuels that Russian normally exports to Western countries is being diverted to nations such as China and India, but transport and infrastructure constraints will likely prevent a full diversion.

In recent months, China has relaxed macroeconomic policy further, in order to support economic growth. The economy has been impacted by COVID-19 lockdowns in some major cities, and the authorities are likely to take further measures to strive to achieve the 2022 growth target of 5.5%.

The La Niña weather pattern has ended — at least for now — but there are now forecasts of a strongly negative Indian Ocean Dipole reading in H2 2022. This could see wet weather continue in Australia, with risks of an adverse impact on Australian thermal and metallurgical coal supply. With inventories of energy in the Northern Hemisphere well below normal, any supply disruptions will result in more price surges.

The OECD forecasts world GDP growth of 3.0% in 2022 and 2.8% in 2023. China's GDP is forecast to grow by 4.4% in 2022, rising to 4.9% in 2023. Hopefully, the rise in inflation in most major economies will peak over coming months, with inflation gradually settling back over the next 12–18 months as central banks navigate the challenge of managing inflation containment with ongoing growth in GDP and employment.

Since the March 2022 *Resources and Energy Quarterly*, coal prices have been pushed to record highs. The outlook is for the prices of energy commodities to remain strong for longer than previously forecast, as Western nations look for alternatives to Russian energy supplies. However, while these high prices will persist for longer, they are likely to further accelerate the push towards renewable energy in the medium-term.

Australian iron ore earnings are forecast to decline further from the extraordinary levels seen in 2020–21 and 2021–22. The price has steadied in a US\$110–140 a tonne range in recent months, as China's government continues to support economic activity. However, the ongoing recovery in Brazilian supply, and gains in output elsewhere, are set to push iron ore prices down over the outlook period.

Global efforts to build energy/transport systems based on low emission technologies are likely to keep base metal and critical mineral prices high. This will partly offset the impact of energy exports coming off their highs, as the sanctions on Russia sees world trade in fossil fuels re-organise.

The risks to the forecast for Australia's export earnings in 2022–23 and 2023–24 are skewed modestly to the downside. Markets appear to have largely priced in the loss of some Russian resource and energy commodity output from world supply. New outbreaks of vaccine-resistant COVID-19 strains also pose risks to the outlook. Especially so if they occur in China, where small outbreaks are currently being met with aggressive suppression measures: through direct impacts on global commodity demand, and via global supply chains and economic growth.

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 alterations to the forecasts/projections by estimating the impact on Australian producers and the value of their exports.

The *Resources and Energy Quarterly* publication normally uses IMF economic growth forecasts as the basis of its world growth forecasts. However, in this edition, the more recent OECD forecasts are used to provide more timely estimates of the impacts on world growth from the Russian invasion of Ukraine.

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

Unless otherwise stated, all Australian and US dollar figures in this report are in nominal terms. Inflation and exchange rate assumptions are provided in tables 2.1 and 2.2 in the *Macroeconomic outlook* chapter.

Information in this edition of the *Resources and Energy Quarterly* is current as of 24 June 2022.

Resources and Energy Quarterly publication schedule

Publication	Expected release date	Outlook period final year
September 2022	4 October 2022	Australian data: 2023–24 World data: 2024
December 2022	19 December 2022	Australian data: 2023–24 World data: 2024
March 2023	3 April 2023	Australian data: 2027–28 World data: 2028
June 2023	3 July 2023	Australian data: 2024–25 World data: 2025

Source: Department of Industry, Science and Resources (2022)

Overview

Australia's mining sector



Contributes to around **10% of GDP**

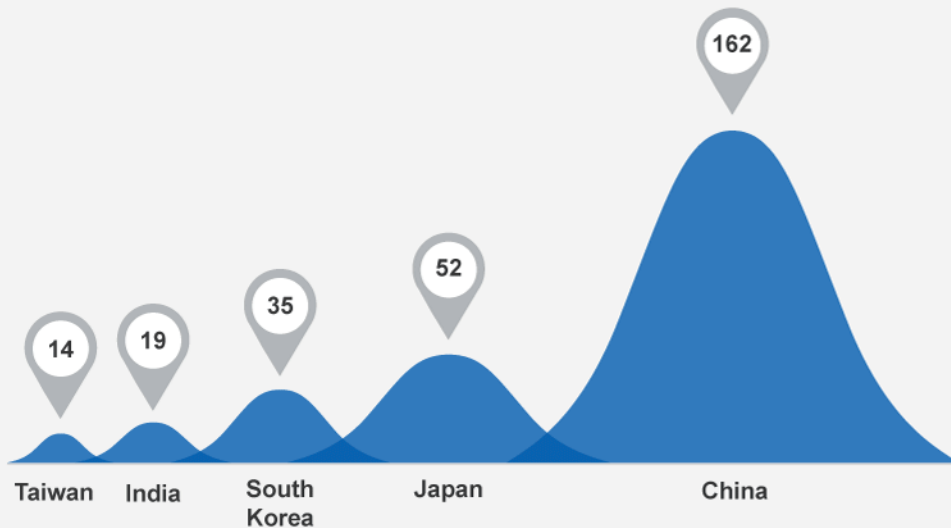


Over **two-thirds** of Australia's total merchandise exports

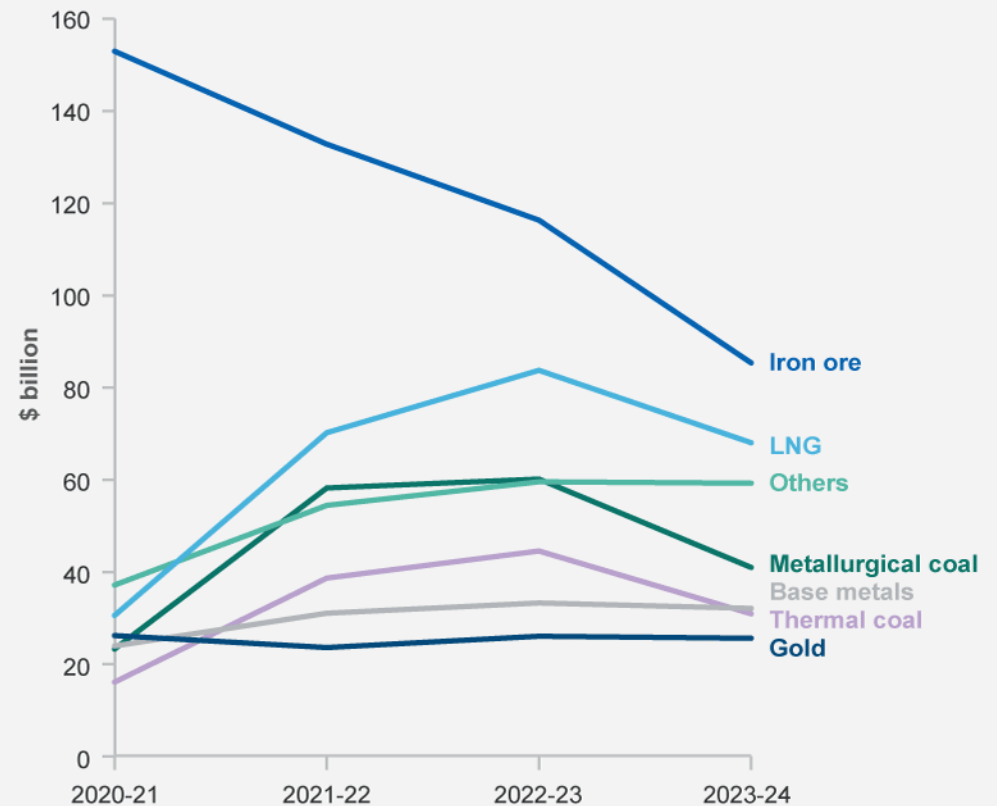


Directly employs **more than a quarter of a million people**

Major markets for Australia's resources and energy exports in 2021, A\$billion



Australia's resources and energy exports



1.1 Summary

- The outlook for Australia's mineral exports remains strong, as the world economy rebounds from the impact of the COVID-19 pandemic and energy shortages persist. High prices, good volume growth and a weak Australian dollar are driving a surge in export earnings. Some decline in prices is likely in 2023, as supply rises and demand growth moderates.
- Export earnings are estimated at a record \$405 billion in 2021–22, and forecast to be \$419 billion in 2022–23 and \$338 billion in 2023–24.
- Energy prices remain elevated, as the fallout from the Russian invasion of Ukraine exacerbates existing energy shortages. Commodity prices will likely fall in 2023 and 2024, as world supply recovers and demand cools.

1.2 Export values

Australia's export values are estimated at \$405 billion in 2021–22

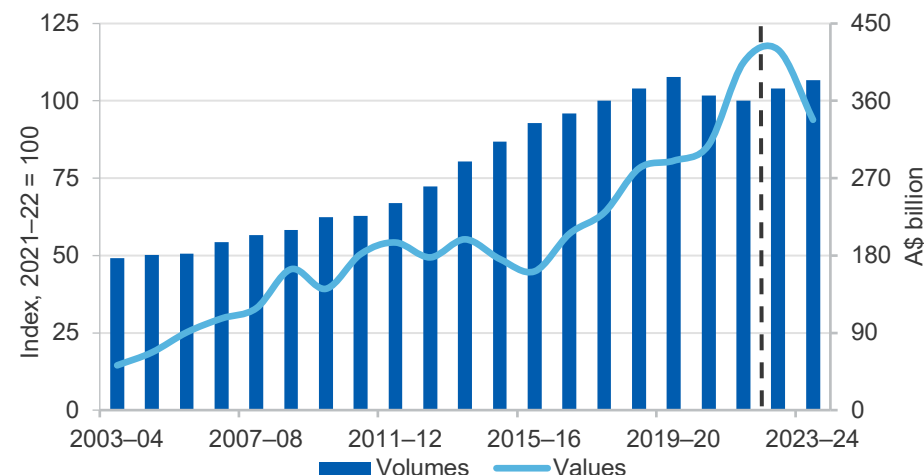
In the June quarter 2022, the Office of the Chief Economist's (OCE) Resources and Energy Export Values Index rose 23% from the June quarter 2021; a 0.4% rise in volumes added to a 22% gain in prices.

After an estimated \$405 billion of resource and energy exports in 2021–22, the coming financial year is likely to be even stronger, at \$419 billion (Figure 1.1). Exports are forecast to fall to \$338 billion in 2023–24, as the loss of some Russian fossil fuels and base metals from world markets is filled by other suppliers, cutting prices. Price, rather than volume-changes are forecast to drive most of the move in future earnings (Figure 1.2).

Energy shortages and supply deficit concerns to help boost earnings

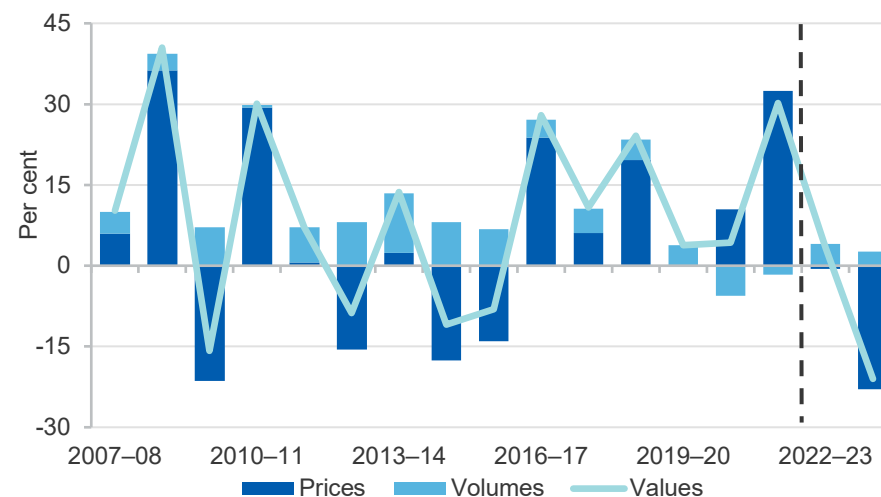
In Australian dollar terms, the OCE's Resources and Energy Commodity Price Index rose by 7% (preliminary estimate) in the June quarter 2022, and was up 22% on a year ago. In US dollar terms, the index rose by 7% in the quarter, and was 14% higher than a year ago. The index of prices for resource (mainly metals) commodity exports (Australian dollar terms) fell by 20% in the year to the June quarter 2022. Energy commodity prices rose by 131% (Figure 1.3) from the June quarter 2021, as the looming loss of some Russian supply intensified existing market shortages.

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



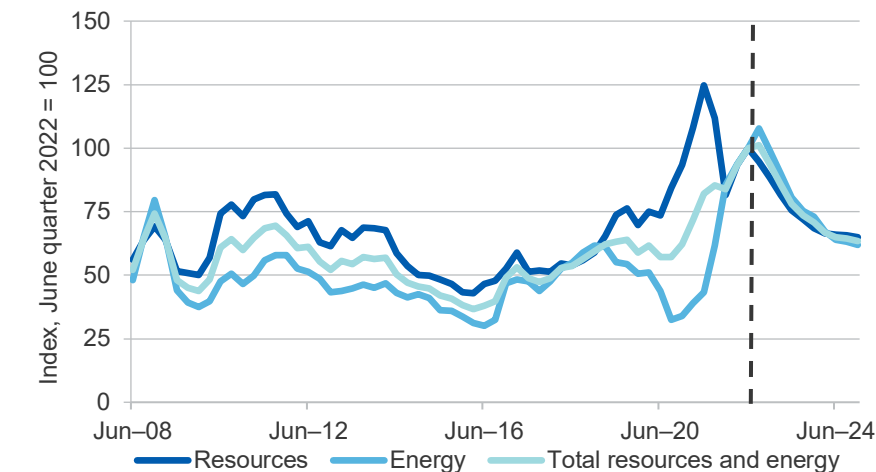
Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022)

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



Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022)

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 (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022)

1.3 Macroeconomic, policy, trade and other factors

World economic activity is being significantly hampered by high energy and food prices, and by COVID-19 outbreaks — especially in China. The former are mainly the result of the fallout from Russia's invasion of Ukraine: sanctions are now causing a scramble for substitutes to Russian energy exports. High energy/food prices are hurting consumer spending on other goods and services, and so impacting business profits adversely.

Beijing's 'zero COVID-19' policy is likely to continue to impact on economic activity in the second half of 2022, causing supply chain disruptions and constraining commodity demand. The Chinese Government is taking steps to boost growth in line with its target for 5.5% growth in 2022: financial conditions have been eased and other measures taken to boost growth.

The Russian invasion of Ukraine has driven some consumers to switch from Russia as an energy supply source. Until reliable supply can be secured elsewhere, more, rather than less, thermal coal will be consumed

in Western nations unable to procure LNG/gas from other sources. Record metallurgical coal prices threaten steel production, with flow-ons to the construction, automotive and white goods sectors.

Global commodity trade can be expected to re-organise further over the next year, as new sanctions are imposed on Russia: as developed Western nations shun Russian commodities, some of those are being diverted to China and India. As a result, China and India are now buying fewer cargoes of non-Russian energy commodities, enabling them to be diverted to developed nations. High prices will prompt a supply response now that it seems Russian exports will be banned by the West for the foreseeable future. The strong rise in US LNG exports expected over the next few years is likely to displace Russian gas/LNG supply to the West.

The US Federal Reserve has signalled a move further towards a neutral monetary policy stance over the second half of 2022 and early 2023, in an attempt to contain a sharper than expected surge in US inflation. The pace at which the US Fed acts will depend partly on the extent of the fallout of the Russia invasion of Ukraine, and partly on the strength of the US dollar.

Prior to the Russian invasion of Ukraine, the outlook was for strong growth in the world economy in 2022 and 2023, as COVID-19 vaccination rates and infection medications improved and became more accessible. The prospects for 2022 are now much more uncertain: high energy and food prices are impacting on growth and inflation. The OECD forecasts world GDP growth of 3.0% in 2022 and 2.8% in 2023, with China forecast to grow by 4.4% in 2022, rising to 4.9% in 2023.

Australian coal and LNG exports should achieve relatively high prices, as the shunning of Russian exports sees energy shortages persist. As global coal and LNG supply lifts and demand growth moderates, prices are expected to decline but the short term risks are skewed to the upside. Resource and energy export earnings likely reached \$405 billion in 2021–22. Earnings are forecast to lift to \$419 billion in 2022–23, but fall back to \$338 billion in 2023–24. Higher global interest rates — in response to persistent inflation — pose a downside risk to global economic activity, and hence resource and energy export earnings.

1.4 Prices

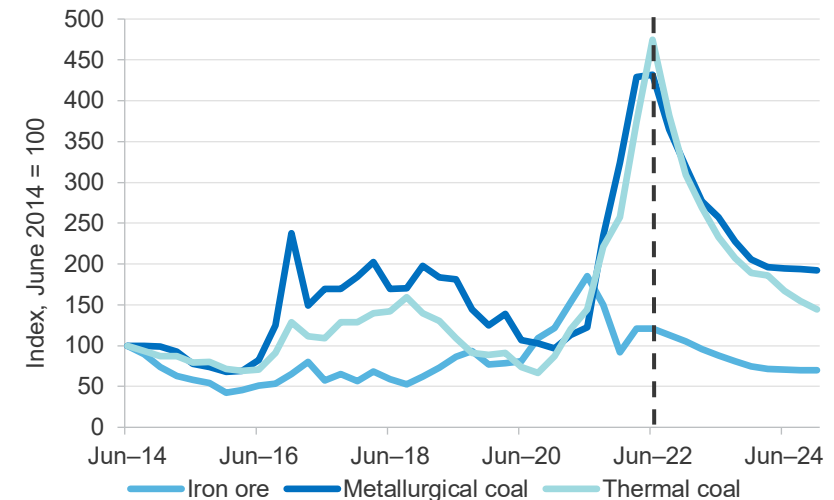
Since the March 2022 *Resources and Energy Quarterly*, the iron ore price has made modest further gains from the November 2021 cycle low, but is still well below mid-2021 levels. The prospect of improved Chinese demand (due to government stimulus measures) has added to the impact of weather and COVID-19 related supply problems in major exporting nations (Figure 1.4). Prices are likely to ease over the outlook period, as Brazilian supply slowly recovers and growth in world demand moderates.

Australian metallurgical coal prices are at record highs, as sanctions on Russian exports and bad weather in Australia and COVID-19 workforce impacts hit supply. Prices are expected to ease over the outlook period, as trade flows reorganise and supply recovers. Thermal coal prices are also at record levels: with rebounding economic activity and weather-related problems adding to the loss of some Russian supply from world markets. Prices are likely to drift down but average relatively high levels over the next year, as demand falls back and global supply rises (Figure 1.5).

Oil prices have surged to their highest level in a decade, as the market reacts to looming sanctions on exports of Russian oil and oil products by the EU. OPEC+ has moved to increase supply, but most of the group's members have limited scope to increase supply noticeably. The oil price is likely to fall back, as an improvement in global supply gradually outpaces the recovery in demand. Contract LNG prices are forecast to ease from high levels, as oil prices settle. Spot LNG is likely to be very high for some time, as the world struggles to replace reduced Russian gas/LNG exports.

The price of gold has eased back to around US\$1,800 an ounce, hurt by US dollar strength and rising bond yields. However, gold has been given some support by safe haven demand, as geopolitical tensions flare. The price is likely to fall in the next two years, as the withdrawal of widespread central bank stimulus lifts real bond yields. Base metal prices are relatively high, boosted by the prospect of stronger demand from China and the likely loss of some Russian supply (especially nickel and aluminium) from world markets. Inventories generally remain low. Prices should fall, as supply slowly catches up with demand and stockpiles build.

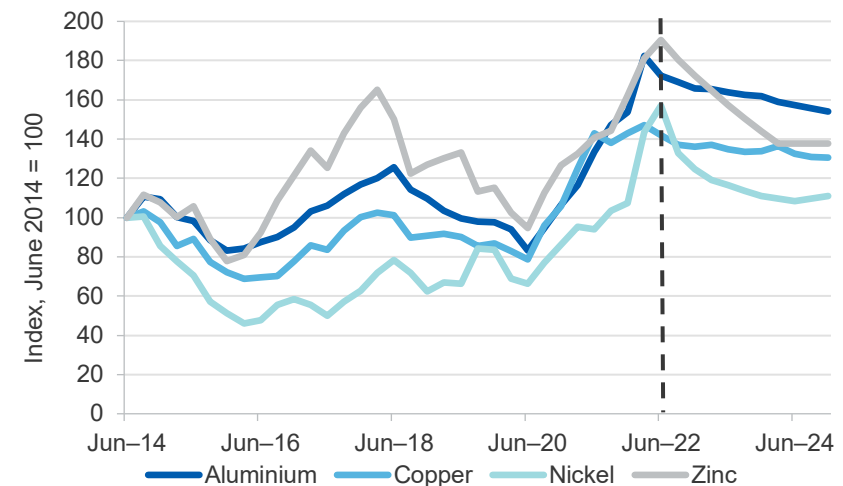
Figure 1.4: Bulk commodity prices



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

Source: Bloomberg (2021); Department of Industry, Science and Resources (2022)

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 and Resources (2022)

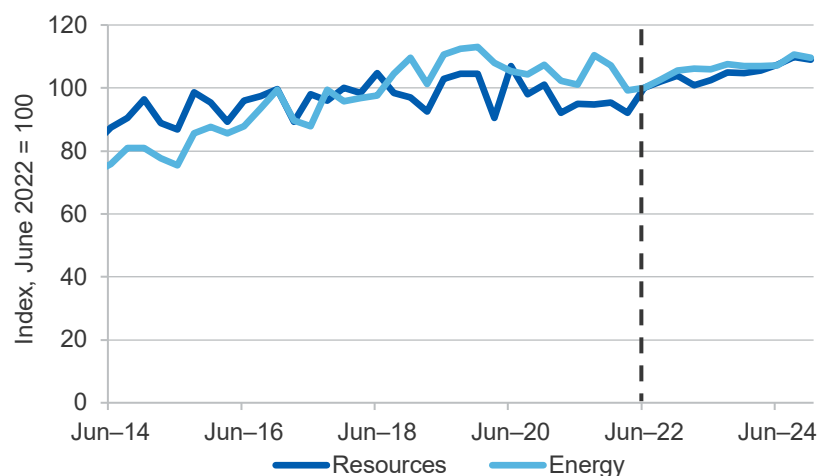
1.5 Export volumes

June quarter export volumes rose, driven by resource exports

The OCE's Resources and Energy Export Volumes Index (preliminary estimate) rose by 6% in the June quarter 2022 from the March quarter, and was 2% higher than a year before (Figure 1.6). Within this total, resource commodity volumes rose by 7% in the year to the June quarter 2022, while energy commodity volumes were flat. Energy exports were impacted by production problems: operational, weather and COVID-19 related workforce issues were central to these.

In volume terms, resource exports are likely to show further significant growth over the outlook period. Economic growth and industrial production continue to recover amongst our main trading partners, increasing the demand for Australia's ferrous and non-ferrous metals. The production of EVs and new energy technologies will see growing demand for metals such as copper, aluminium, lithium and nickel. The volume of energy exports is forecast to show similar growth during the outlook period. Supply constraints should ease, and high prices will encourage expansion.

Figure 1.6: Resource and energy export volumes



Source: Department of Industry, Science and Resources (2022)

1.6 Contribution to growth and investment

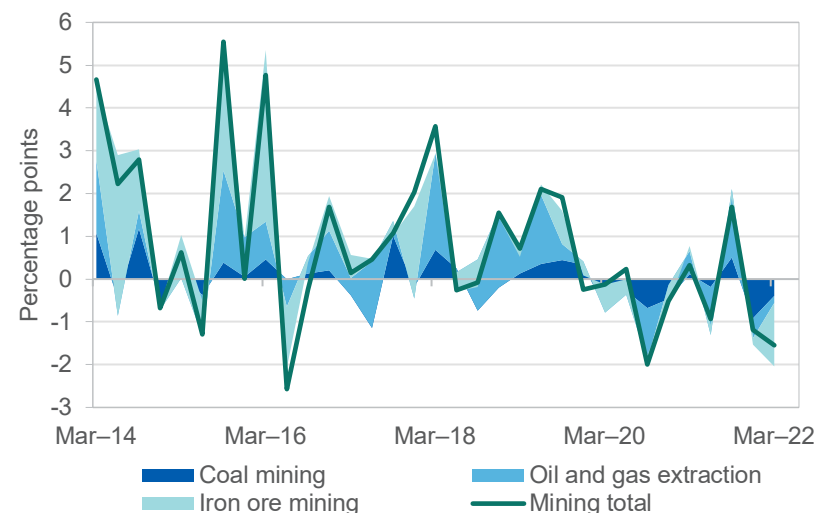
Mining industry contracted while the overall economy expanded

Australia's real Gross Domestic Product rose by 0.8% in the March quarter 2022, and was up 3.3% over the year since the March quarter 2021.

Mining value-added fell by 1.5% in the March quarter, and was down 2.0% over the previous twelve months (Figure 1.7). COVID-19 disruptions impacted most sectors to some extent, and coal and iron ore mining was also impacted by bad weather. The oil/gas sector had some operational problems, notably at Shell's Prelude FLNG facility (see Gas Chapter).

In the coming two years, it is likely that the resources and energy sectors will make a significant contribution to real GDP growth. In the short run, coal producers will lift output and exports in response to high prices and margins. Non-ferrous metal production should experience healthy growth, as the global energy transition gathers pace.

Figure 1.7: Contribution to quarterly growth, by sector

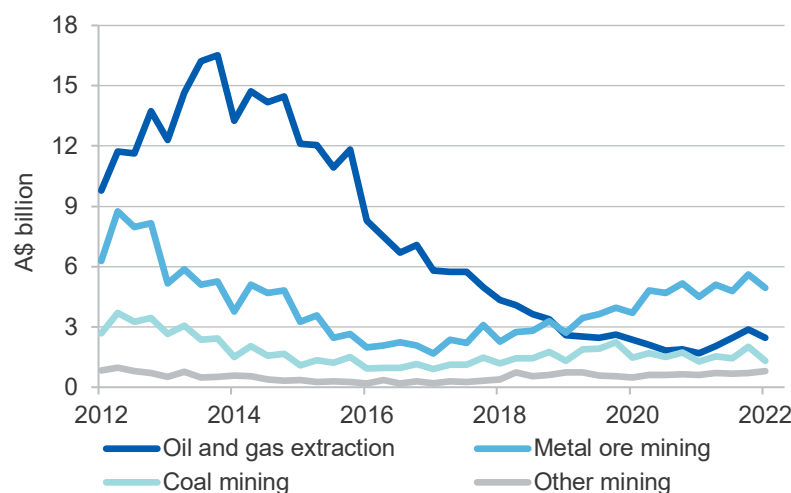


Source: ABS (2022) Australian National Accounts, 5206.0

Mining investment is picking up

The ABS Private New Capital Expenditure and Expected Expenditure survey for the March quarter 2022 shows that Australia's mining industry invested \$10.6 billion in the quarter. This was up by 2.1% in the quarter (seasonally adjusted), and up 18% from the March quarter 2021. Strong iron ore prices supported growth in investment by the 'metal ore' mining sector during 2021, though growth has now become more broadly based (Figure 1.8).

Figure 1.8: Mining capex by commodity, not seasonally adjusted

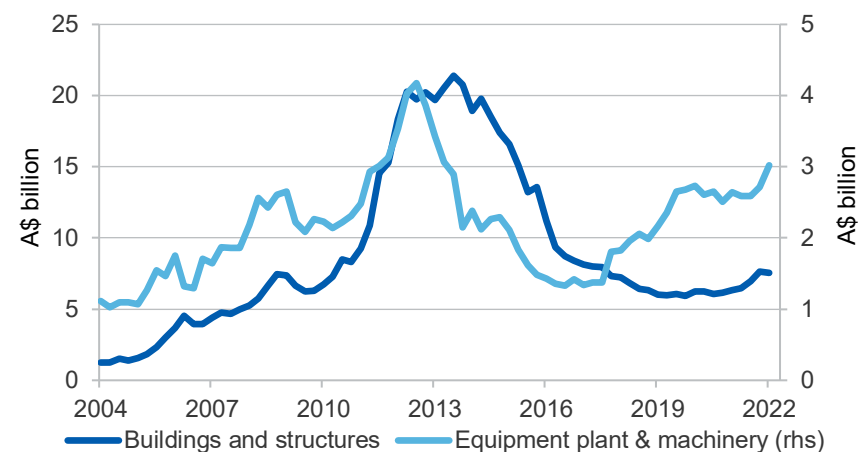


Notes: Other mining includes non-metallic mineral mining and quarrying and exploration and other mining support services; chart data is in nominal, original terms

Source: ABS (2022) Private New Capital Expenditure and Expected Expenditure, 5625.0

In the March quarter 2022, expenditure on equipment plant and machinery lifted strongly, while expenditure on buildings and structures levelled out (Figure 1.9). Spending in both categories has risen in recent quarters, and forward expectations suggest that investment in 2021–22 and 2022–23 will be slightly higher than in 2020–21 (Figure 1.10). Strong prices for gold and various minerals used in low-emissions energy generation have been leading to new investment plans, including the re-opening of mines.

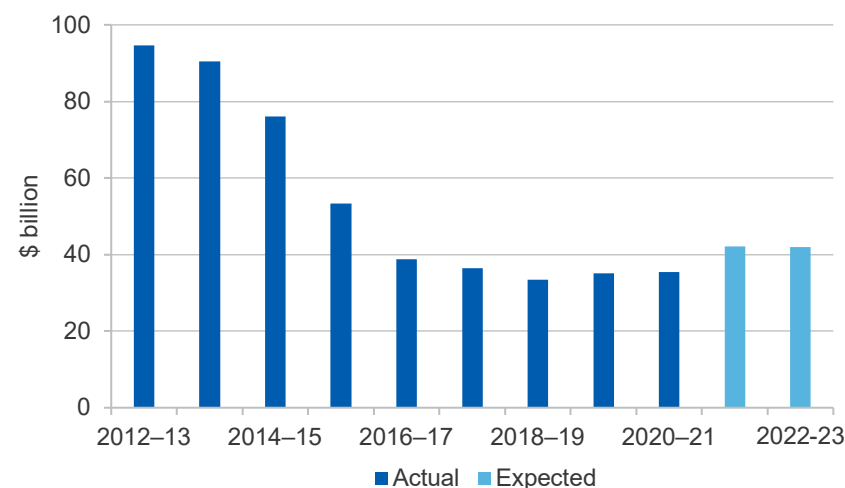
Figure 1.9: Mining industry capital expenditure by type, quarterly



Notes: Chart data is in nominal terms, seasonally adjusted.

Source: ABS (2022) Private New Capital Expenditure and Expected Expenditure, 5625.0

Figure 1.10: Mining industry capital expenditure, fiscal year

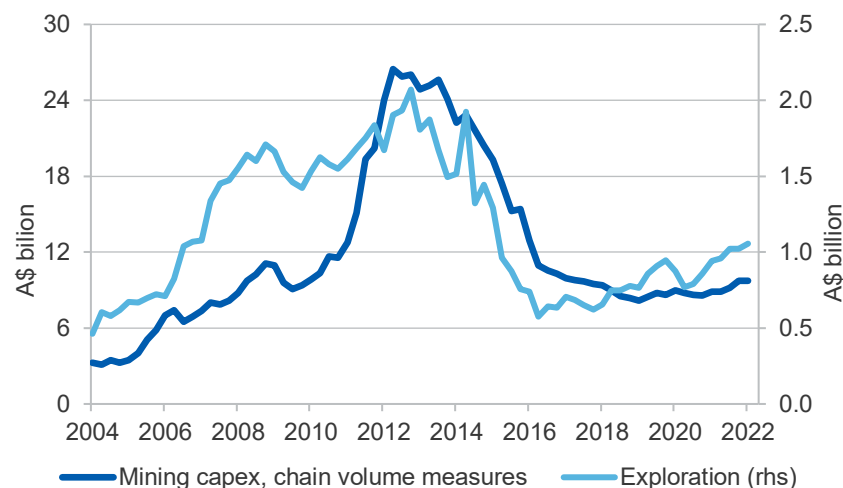


Notes: Chart data is in nominal terms

Source: ABS (2022) Private New Capital Expenditure and Expected Expenditure, 5625.0

Data on exploration spending suggests that mining capital expenditure continues to rise (Figure 1.11). Exploration spending (adjusted for inflation) edged up to \$1.1 billion in the March quarter. Exploration has risen for seven consecutive quarters, representing a sustained lift from the recent low of \$769 million in the June quarter 2020.

Figure 1.11: Mining capital expenditure vs exploration, quarterly



Source: ABS (2022) Private Capital Expenditure Survey, Chain Volume measure, 5625.0

1.7 Revisions to the outlook

At \$405 billion, the estimate for Australia's resources and energy exports in 2021–22 is \$20 billion lower than the forecast contained in the March quarter 2022 *Resources and Energy Quarterly*. Workforce problems (related to COVID-19) and bad weather, have continued to hurt Australian mine production and exports (especially coal) noticeably in recent months. The rise in prices that was partly caused by those lower export volumes has been insufficient to fill the gap.

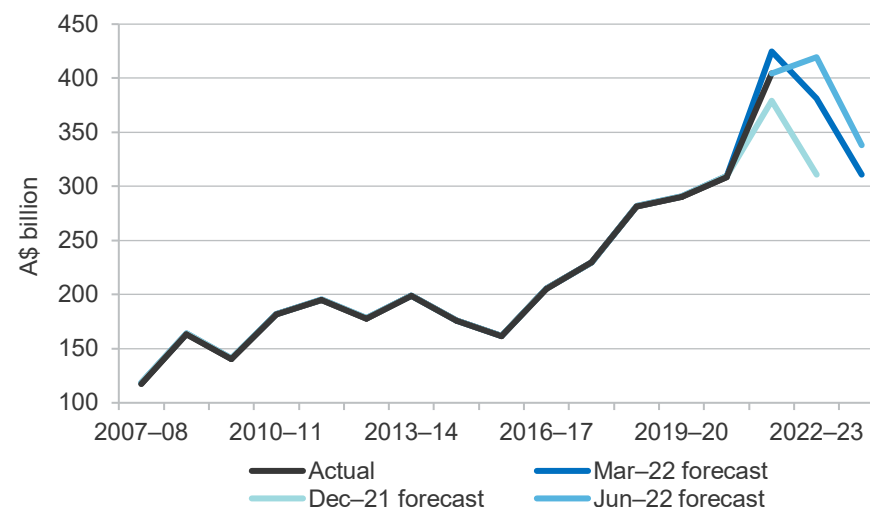
The forecast for \$419 billion in R&E export earnings in 2022–23 has risen \$38 billion from the March 2022 REQ, and the forecast for 2023–24 is up by about \$28 billion (Figure 1.12). The fallout from the Russian invasion of

Ukraine has been the main factor driving the upward revisions to the forecasts for 2022–23 and 2023–24. The likelihood is that energy prices will remain higher than expected, as the exclusion of a significant amount of Russian oil, gas and coal exports from the global market leaves noticeable shortages.

Iron ore earnings in 2022–23 have been revised up by \$8 billion: global supply is not rising as fast as expected — as bad weather and COVID-19 adversely affect mining and transport operations — and Chinese demand looks likely to rebound, as Beijing looks to (bring forward plans to) build more infrastructure to offset the impact of the COVID-19 lockdowns.

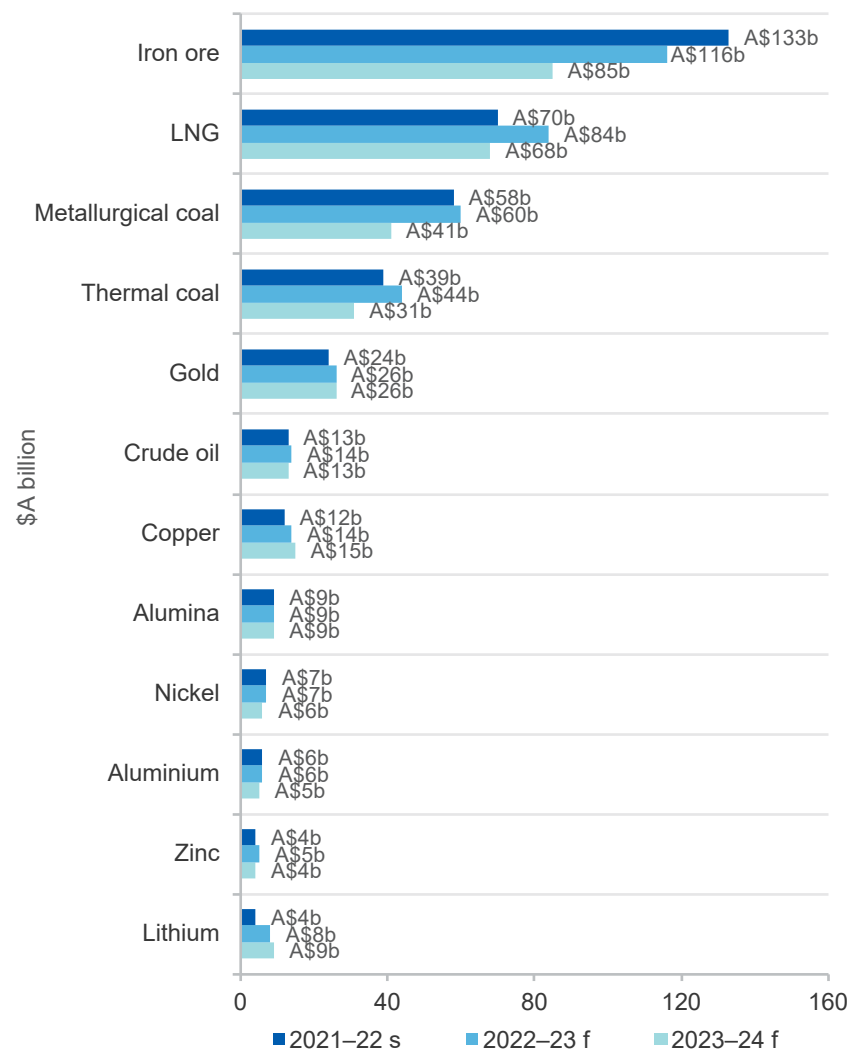
LNG earnings in 2022–23 and 2023–24 have been revised up by \$5 billion and \$6.5 billion, respectively. The revisions reflect the impact of forecast higher LNG prices.

Figure 1.12: Resource and energy exports, by forecast release



Source: Department of Industry, Science and Resources (2022)

Figure 1.13: Australia's major resources and energy commodity exports, nominal



Annual per cent change

2022-23 f			2023-24 f		
volume	EUV	value	volume	EUV	value
▲ 4	▼ -16	▼ -12	▲ 2	▼ -28	▼ -27
▼ -3	▲ 23	▲ 19	▲ 1	▼ -19	▼ -19
▲ 6	▼ -3	▲ 3	▲ 2	▼ -33	▼ -32
▲ 2	▲ 13	▲ 15	▲ 4	▼ -33	▼ -31
▲ 19	▼ -7	▲ 10	▲ 7	▼ -8	▼ -2
▼ -6	▲ 13	▲ 7	▲ 6	▼ -16	▼ -11
▲ 14	▼ -1	▲ 13	▲ 7	➡ 0	▲ 7
▲ 2	▲ 3	▲ 5	▲ 1	➡ 0	▲ 1
▲ 3	▼ -4	▼ -2	➡ 0	▼ -13	▼ -13
▲ 5	▼ -1	▲ 4	➡ 0	▼ -6	▼ -7
▲ 13	▼ -4	▲ 8	▲ 3	▼ -18	▼ -16
▲ 22	▲ 56	▲ 90	▲ 29	▼ -6	▲ 21

Notes: f forecast. EUV is export unit value.

Source: ABS (2021) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022)

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

Exports (A\$m)	2020–21	2021–22 ^s	2022–23 ^f	2023–24 ^f	Percentage change			
					2020–21	2021–22 ^s	2022–23 ^f	2023–24 ^f
Resources and energy	308,563	404,527	419,425	337,948	6.3	31.1	3.7	–19.4
– real ^b	321,935	404,527	400,663	312,527	4.6	25.7	–1.0	–22.0
Energy	81,229	185,936	208,643	157,702	–29.7	128.9	12.2	–24.4
– real ^b	84,749	185,936	199,310	145,840	–30.8	119.4	7.2	–26.8
Resources	227,334	218,591	210,782	180,246	30.1	–3.8	–3.6	–14.5
– real ^b	237,185	218,591	201,353	166,687	28.0	–7.8	–7.9	–17.2

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

Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022)

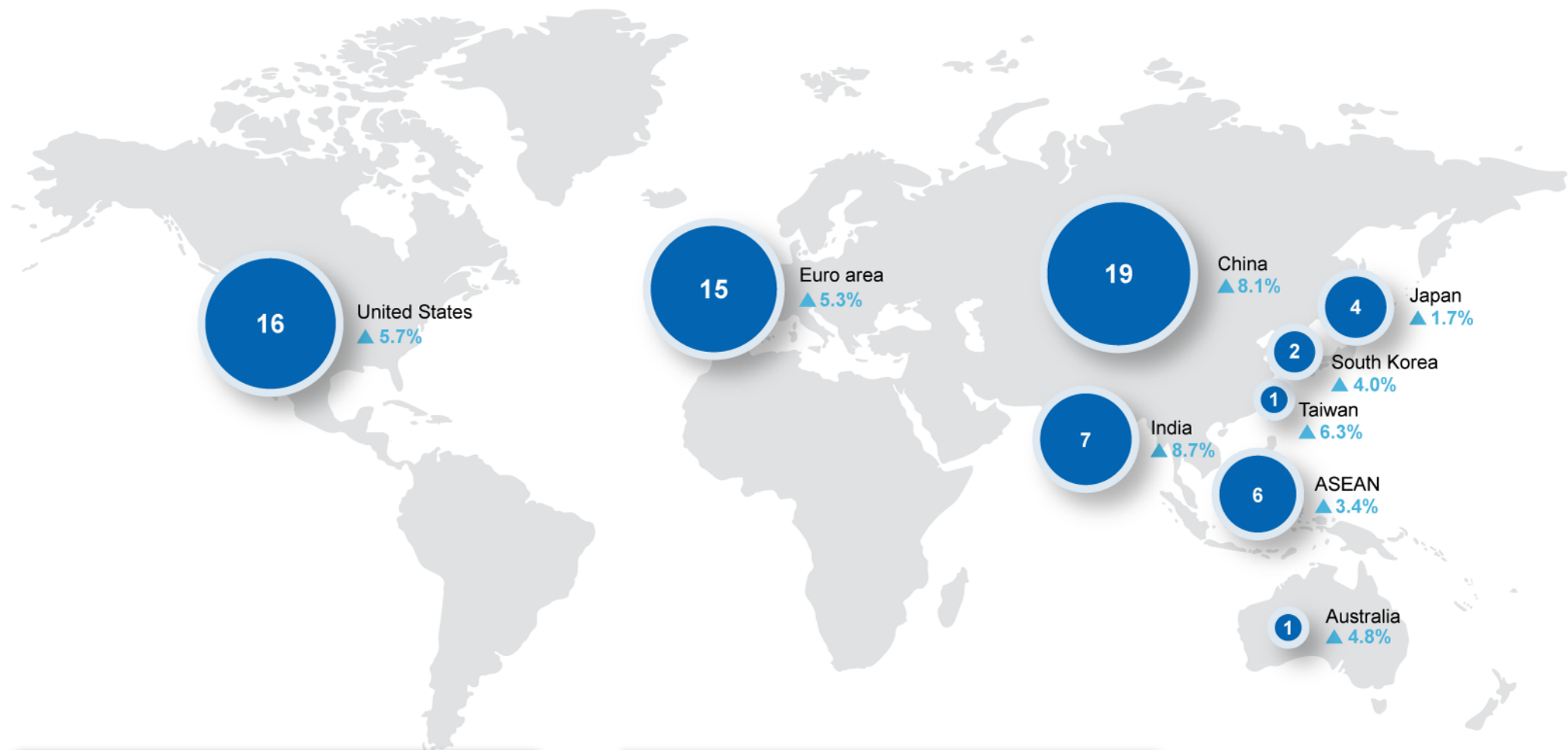
Table 1.2: Australia's resource and energy exports, selected commodities

	Unit	Prices			Unit	Export volumes			Export values, A\$b		
		2021–22 ^s	2022–23 ^f	2023–24 ^f		2021–22 ^s	2022–23 ^f	2023–24 ^f	2021–22 ^s	2022–23 ^f	2023–24 ^f
Iron ore	US\$/t	119	99	74	Mt	876	911	929	133	116	85
LNG	A\$/GJ	16.2	19.9	16.1	Mt	82	80	80	70	84	68
Metallurgical coal	US\$/t	400	343	232	Mt	161	171	174	58	60	41
Thermal Coal	US\$/t	241	216	136	Mt	195	199	207	39	44	31
Gold	US\$/oz	1,831	1,783	1,691	t	282	336	359	24	26	26
Crude oil	US\$/bbl	91	101	87	Kb/d	280	265	280	13	14	13
Copper	US\$/t	9,670	9,245	9,099	Kt	807	916	977	12	14	15
Alumina	US\$/t	384	379	362	Kt	17,792	18,188	18,280	8.9	9.4	9.4
Nickel	US\$/t	23,609	22,750	20,438	Kt	259	265	266	6.7	6.6	5.8
Aluminium	US\$/t	2,947	2,986	2,881	Kt	1,385	1,449	1,443	5.7	5.9	5.5
Zinc	US\$/t	3,515	3,498	2,953	Kt	1,211	1,367	1,403	4.2	4.6	3.8
Lithium	US\$/t	1,729	2,265	2,180	Kt	1,843	2,287	2,952	4.1	7.8	9.4
Uranium	US\$/lb	46	57	61	t	4,705	5,480	5,495	0.5	0.7	0.8

Notes: **a** Export data covers both crude oil and condensate; **f** forecast; **s** estimate. **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 (2022) 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 and Resources (2022)

Macroeconomic Outlook



In 2021, global economic activity increased by 5.8%. Growth is expected to slow to 3.0% in 2022 due to ongoing impacts from the Omicron variant of the COVID-19 pandemic as well as the persistence of supply chain disruptions.



Risks include the impacts of Russian invasion of Ukraine on global growth, the potential for new variants of the pandemic, as well as the persistence of supply chain disruptions through the year. Inflationary price pressures are also weighing heavily on markets through 2022.



= Per cent share of global GDP



= Economic growth in 2021



= Economic contraction in 2021

2.1 Summary

- The global macroeconomic environment is currently subject to an unusually high level of uncertainty. The confluence of supply shocks, slowing global growth and elevated inflation, is providing substantial policy challenges for governments across most major economies.
- The world economy is forecast by the OECD to grow by 3.0% in 2022 and 2.8% in 2023, a downward revision of 1.5 and 0.4 percentage points, respectively, since December 2021.
- The fallout from Russia's invasion of Ukraine and China's aggressive approach to suppressing COVID-19 outbreaks are slowing growth and adding to supply chain bottlenecks. These twin shocks are weighing heavily on markets as inflationary pressures mount, and monetary policy is being tightened.

2.2 World economic outlook

The pace of the global recovery continues to slow

In April, the IMF downgraded its forecasts for the global economy because of the Russian invasion of Ukraine, China's slowdown and global price shocks. However, in recent weeks the IMF has flagged a further downward revision to this forecast due to the rapidly shifting global economic environment in its next release in July — after the scheduled finalisation and release of this edition of *Resources and Energy Quarterly*.

On 8 June the OECD updated its growth forecasts and made further cuts to forecast growth citing the heavy price the world is paying for Russia's war in Ukraine as well as flow-on impacts from China's zero-COVID-19 policy. The *Resources and Energy Quarterly* publication usually uses IMF economic growth forecasts. However, in this edition, OECD forecasts are used to provide more timely estimates of the global economic outlook.

The global macroeconomic environment faces an unusually high level of uncertainty. The stronger growth evident in the recovery phase last year, driven by pent up demand built up during the pandemic recession, is now over. A combination of sharply slowing global growth, elevated inflation

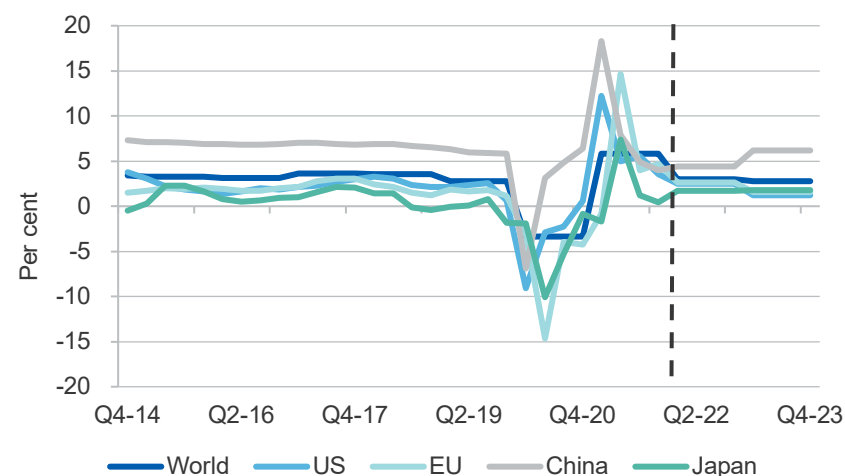
across most economies, and associated rising living costs — and limited fiscal space due to high public sector debt — is making for a difficult balancing act for governments across most major economies.

The OECD forecasts the world economy to slow from 5.8% real GDP growth last year to 3.0% in 2022 and 2.8% in 2023 (Figure 2.1). The growth forecast is 1.5 and 0.4 percentage points lower for 2022 and 2023 — from the December 2021 *Economic Outlook* — due to downward revisions across most economies.

The ongoing fallout from the Russian invasion of Ukraine continues to slow growth and add to inflation. The OECD warns the risks to its forecasts are biased to the downside, and if the war escalates or becomes more protracted, the outlook could worsen, particularly for low income countries and Europe.

Most economies, including the US, China, India, the Euro Area and the United Kingdom, have had their 2022 and 2023 growth projections revised down since the December 2021 Outlook.

Figure 2.1: GDP growth forecasts



Source: Bloomberg (2022); OECD (2022)

In recent quarters, the major central banks have tightened monetary policy in response to surging price pressures. Increased inflation has been driven by higher energy and commodity prices, and supply-demand imbalances resulting from the pandemic. The fallout from the Russian invasion of Ukraine has exacerbated supply shortages and added to these pressures, particularly in prices of food, energy and metals. As a result, the OECD expects inflation in advanced and emerging economies to remain elevated for longer than previously forecast.

Tighter monetary policy is expected to slow global economic growth in 2022 and 2023. Policymakers face difficult challenges in managing inflationary pressures without overshooting their targets. This reflects the current elevated levels of global uncertainty as well as the variable lag inherent in the transmission of monetary policy decisions to the real economy — in particular the response of business investment and consumer investment in durables and dwellings to changes in monetary policy. However, not all economies are experiencing high inflation, with China, in particular, continuing to record low rates of inflation, and maintaining expansionary monetary conditions to support growth.

Risks to the outlook have escalated sharply in recent months, with the IMF managing director stating that “(i)n a short period of time...the horizon has darkened”¹. Likely rapid further monetary tightening by most central banks, and slowing growth in China — resulting from already weak consumption and investment compounded by aggressive COVID-19 suppression measures, and the possibility of more lockdowns in the second half of 2022 — have added to the uncertainty flowing from the ongoing fallout from the Russian invasion of Ukraine.

The economic impacts of the invasion have been widespread, affecting global markets for energy, industrial metals and bulk commodities and food. Moreover, the invasion has added to broader risks associated with supply shortages, shipping and transport delays, and price pressures in

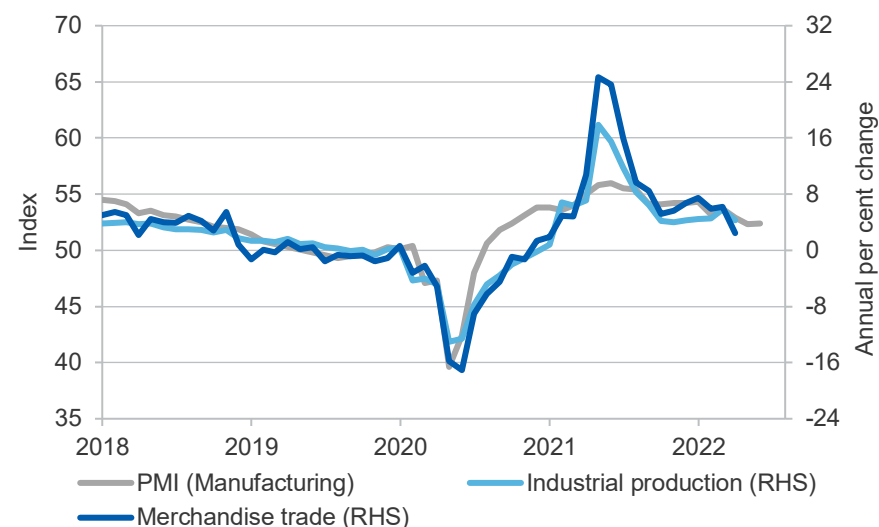
many countries, as sanctions and actions taken in response by major economies continue to grow.

Pressures (facing both developers and buyers) in China’s residential property market could also continue to constrain economic growth in China in 2022. This has implications for global resource and commodity markets in the first half of the early outlook period.

Global industrial production and trade likely softened in June quarter

Global industrial production and trade appear to be stabilising to more sustainable rates of growth following the record growth achieved at the height of the recovery last year. Global industrial output grew by 4.3% year-on-year in March (Figure 2.2), down from 5.8% in February and 4.5% in January 2022.

Figure 2.2: World industrial production, trade and PMI



Notes: PMI data is to April 2022; IP and trade data only available to February 2022

Source: IHS Markit (2022); CPB Netherlands Bureau for Economic Policy Analysis (2022)

¹ Giles C, 'IMF chief warns global economy faces 'biggest test since second world war'', *Financial Times*, May 2022.

Global goods trade slowed to 2.5% year on year in March, down from 6.2% in February, due to base effects and a flat March quarter 2022, and is forecast to grow by around 4.0% in 2022. The trade outlook for Australia's major trading partners remains positive, with GDP growth forecast to reach 4.4% in 2022².

However, manufacturing orders have been weakening in recent months, which points to lower industrial production and commodity demand in the second half of the June quarter. The Global Manufacturing Purchasing Managers Index (PMI) turned down sharply in March and April, with the Global PMI falling from 53.7 in February to 52.3 in April. Global manufacturing conditions in April were the weakest since August 2020 and remained largely unchanged in May (52.4).

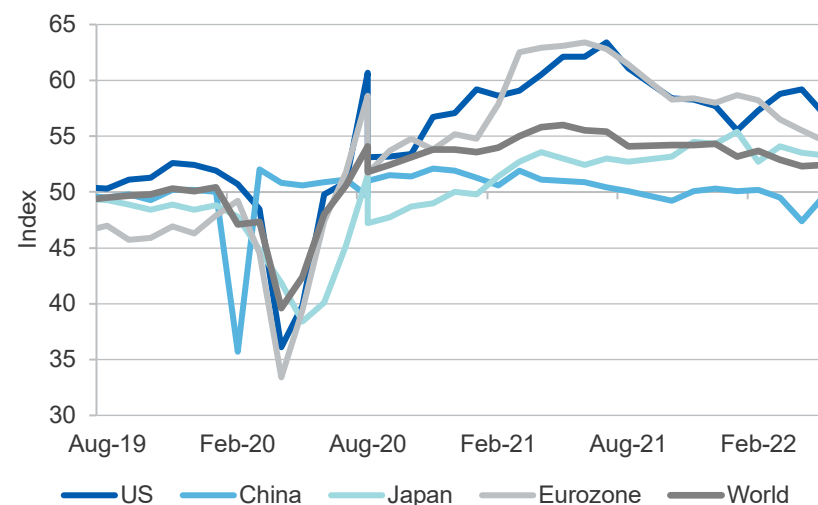
Falls in the global manufacturing PMI in recent months were evident in several economies, including the Eurozone and Japan (Figure 2.3). However, the global result was mainly driven by China, which recorded falls in both the official Chinese PMI and the Caixin China general manufacturing PMI — a broader-based survey of over 500 companies — both of which fell at the steepest rates in two years in April.

A major factor underlying the contraction in April was the reintroduction of stringent COVID-19 restrictions in many Chinese cities. Consequently, activity in the Chinese manufacturing and service sectors has contracted at the fastest pace since February 2020. However, for the rest of the world, global manufacturing output (ex-China) rose slightly in April.

Global manufacturing continues to experience elevated price pressures, with average purchase prices rising at near-record levels. Manufacturers have passed on these high input costs, resulting in output charges increasing at the highest rate on record in April. Capacity constraints and stretched global supply chains contributed to price pressures, with vendor lead times again lengthening to near record levels.

² RBA Statement on Monetary Policy – May 2022

Figure 2.3: Manufacturing PMIs — selected economies



Source: IHS Markit (2022).

The loss of momentum in global manufacturing was also evident in the other sectors. For example, global services trade growth slowed to a 3-month low in April 2022, as slower growth in the business and financial services sectors more than offset growth in consumer services. Underlying the slowdown in global services was a deceleration of new business growth, with business optimism at an 18 month low.

After easing in early 2022, supply chain pressures re-emerge

Pressure on global supply chains has been amplified by the twin supply shocks associated with the stringent COVID-19-related lockdown measures adopted in China and the fallout of the Russian invasion of Ukraine for supply chains in Europe.

After reaching its highest levels on record in December 2021, the Global Supply Chain Pressure Index — a composite measure of cross-border

transportation costs, delivery times, and order backlogs — eased in February-March. The lessening of supply chain pressures over this period was widespread across most indicators and global markets. However, the index increased sharply in April 2022 (Figure 2.4), driven predominantly by longer Chinese and Euro Area delivery times and, to a lesser extent, increases in airfreight costs between the United States and Asia.

Figure 2.4: Global Supply Chain Pressure Index



Source: Bloomberg (2022); New York Federal Reserve (2022)

Increased container shipping costs have been a major driver of global inflation. Recent research estimates that the inflationary impact of higher shipping costs is both large and sustained, and is likely to keep building through the end of 2022 — increasing global inflation by an estimated 1.5 percentage points for the year.³

Following the exceptionally steep increases in global freight rates in 2021 — when the price for shipping a container reached around US\$10,400 in September 2021, up from around US\$1,500 prior to the onset of the

pandemic — prices have since eased somewhat (to around US\$7,800 in April 2022), but remain at historically high levels.

Congestion in Chinese ports, as well as major destination ports in Europe and the US, and issues with onshore logistics networks, are adding to delivery delays and rising input costs. For example, Shanghai, which has the world's busiest port, was closed for around two months (due to COVID-19 shutdowns) resulting in extensive backlogs of both container and bulk vessels. Despite the gradual easing of lockdowns in Shanghai due to lower COVID-19 case numbers in late May, the logjam of container ships waiting at the port indicates continuing delays. As Chinese ports clear the backlog, this is likely to exacerbate longstanding delays in ports in the US and Europe, as manufacturers seek to clear their order books. The extent of the backlogs in global supply chains suggests that problems are unlikely to be resolved before the end of 2022.

As a consequence of the Chinese lockdowns, key industries such as automotive manufacturing have announced production cuts. In May, Tesla announced it had been forced to reduce vehicle production in its Shanghai factory, due to a shortage of parts. This follows reports of Tesla wait times for new purchasers stretching out to 2023. Toyota also announced it was halting production in its Japanese factories due to lockdowns, while Mazda, General Motors and Volkswagen have had to scale back production. In addition, semiconductor shortages, which dogged manufacturers of cars and electronics in 2021, are expected to continue to constrain production throughout 2022 and 2023.

Inflation now the central concern for many policy makers

Elevated inflation rates have become the central concern for policy makers across many major economies. Price pressures are becoming increasingly broad-based, with expectations that higher prices for energy and food will feed into consumer prices over the rest of 2022. For example, the US CPI was 8.6% in May, up from 8.3% in April and the highest reading since

³ Carrie-Swallow et al, 'Shipping Costs and Inflation', *IMF Working Papers*, March 25 2022.

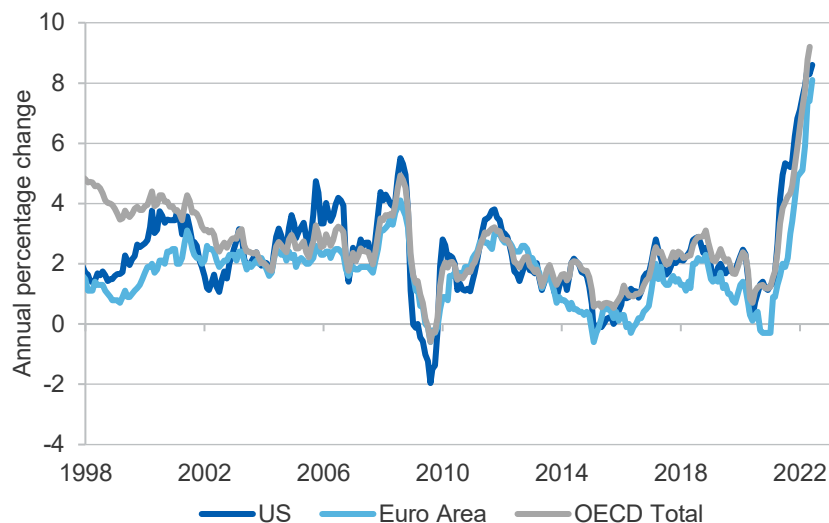
December 1981 (Figure 2.5). Euro area inflation was 8.1% in May, the highest on record, while inflation for the OECD reached 9.2% in April.

An indication of the strength of underlying price pressures is provided by industrial Producer Price Indices (PPIs), which measure average changes over time in prices received by producers. PPIs have been rising sharply in major economies since early 2021 (Figure 2.6).

Surging energy prices have been a key factor, driving up Eurozone industrial producer prices to a 37% year-on-year increase in April 2022, with shortages of oil and gas leading to multi-year energy price highs.

US manufacturing producer prices have also risen sharply, up 19% in the year to May 2022, with the PPI for finished goods rising at the fastest rate since 1974. Despite relatively modest CPI growth in China, producer prices remain elevated. In March 2022, the Chinese PPI increased 8.3% from a year earlier, down from the peak of late 2021, but still at relatively high levels.

Figure 2.5: Consumer Price Indices — US, Europe and OECD

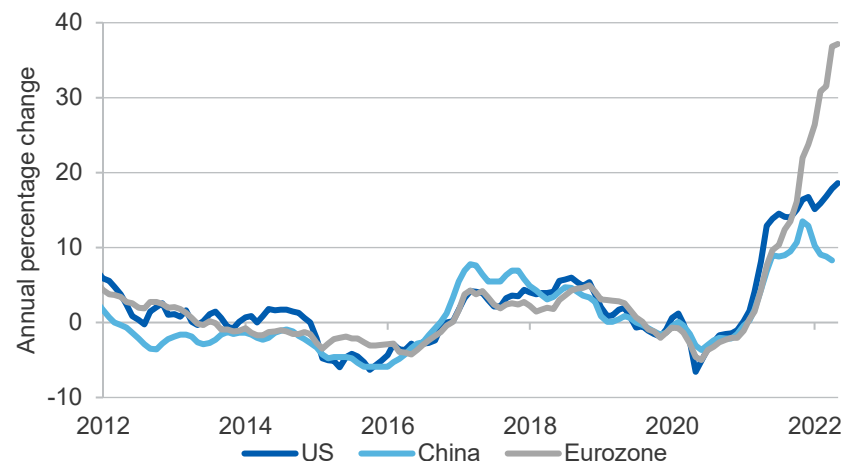


Source: Bloomberg (2022); Board of Governors of the Federal Reserve System (2022); U.S. Bureau of Economic Analysis (2022); OECD (2022).

In response, central banks in the US, Canada, the UK and the Eurozone, have implemented or signalled monetary tightening, despite concerns about slowing global economic growth. Bond yields have been rising, contributing to tighter financial conditions.

The US Fed has lifted interest rates at its past three meetings so far in 2022, which has helped push the US dollar to its highest level in almost two decades. The majority of Fed policymakers project that the Fed Funds rate will climb above 3.0% by the end of 2022. These interest rate increases followed the Fed's announcement in January 2022 of an end to its quantitative easing program.

Figure 2.6: Producer Price Indices — Industrial sector



Source: Eurostat (2022); Federal Reserve Bank of St Louis (2022); National Bureau of Statistics of China (2022).

Labour markets have tightened in some advanced nations, especially the US and the UK, raising nominal wage growth. But real wages have mostly fallen, eroding household purchasing power and consumer sentiment.

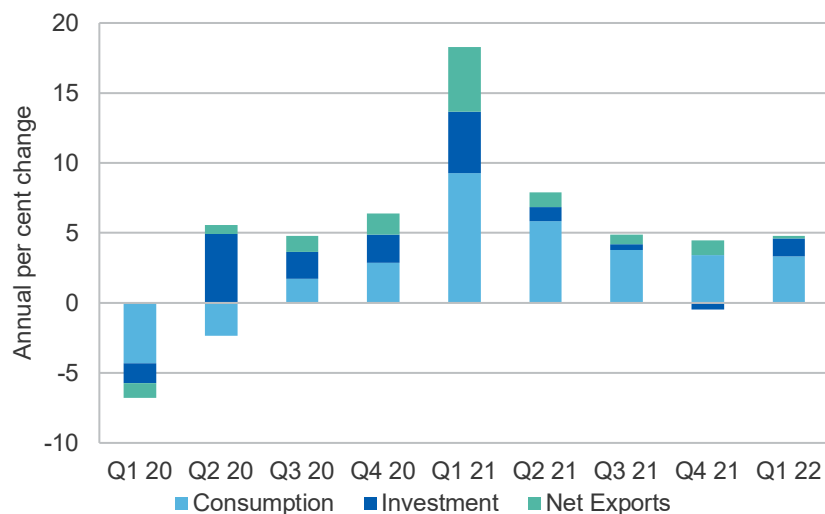
Financial market volatility has been evident in the US and other major economies. Global financial conditions have generally tightened due to expectations of tighter monetary policy and along with the war and related sanctions have lowered investors' risk appetites.

2.3 Major trading partners' economic outlook

China slows in the June quarter, as COVID-19 lockdowns hit production

China's economy grew by 4.8% year-on-year in the March quarter 2022 (Figure 2.7). The result was driven by growth in consumption and investment — the latter making its largest contribution to GDP in 12 months. In contrast, the contribution from net exports to GDP growth fell to 3.7% in the first quarter from 26.4% in the December quarter, its weakest contribution since the June quarter 2020.

Figure 2.7: China contributions to quarterly real GDP



Notes: Consumption is made up of both household and government sectors.

Source: Bloomberg (2022); National Bureau of Statistics of China (2022)

Monthly indicators, including retail sales, construction activity and the rising jobless rate in March and April, point to substantial weakness in the June quarter. Aggressive COVID-19 suppression measures in key manufacturing and trading hubs such as Shenzhen and Shanghai have hit Chinese economic activity hard, cutting manufacturing production and exports and disrupting supply chains. Production, consumption (retail sales) and several real estate related indicators fell in April, with some

respite in May. This is raising fears of a sharp economic slowdown in the June quarter, dragging down global growth.

As noted earlier, China's official and private manufacturing PMIs fell sharply in April, pointing to weakness for the remainder of the quarter. China's industrial output fell by 2.9% year-on-year in April, the first fall since March 2020. However, counter to market expectations industrial production picked up somewhat in May, increasing 0.7% year-on-year following a relaxation of COVID-19 restrictions in some cities.

Chinese vehicle production was hit particularly hard by lockdowns, with fewer than 1 million vehicles produced in April, down from 1.9 million in March. In April, Chinese vehicle sales almost halved as lockdowns impacted retail and service activity as businesses were shut and workers received reduced wages. However, vehicle sales rebounded strongly in May, up by more than two-thirds, as restrictions were eased.

To stabilise the economy and put downward pressure on the unemployment rate, policy makers have announced plans for a fiscal expansion equal to about 2.5% of GDP this year. So far, most of the support has come from fiscal policy. Infrastructure investment has been a major contributor to growth as central authorities have urged local governments to bring forward infrastructure projects, cut taxes and offered a range of supports for affected businesses

In late May/early June, the Government outlined a broad package of measures, including additional tax rebates and railway construction bonds to support businesses and stimulate demand. The Government also outlined policies aimed at stabilising industrial and supply chains through greater use of risk-based approaches to minimise impacts on production and labour mobility in the event of future COVID-19 outbreaks.

Chinese inflation remains low — and the central bank has twice cut policy rates to support growth, and in April, lowered the reserve requirement ratio to improve China's credit conditions.

The IMF notes that if the Chinese slowdown is prolonged it risks exposing structural weaknesses such as high local government liabilities, property

developer leverage, household debt, and a fragile banking system. China's residential property market remains a major risk to economic growth in 2022 as developers seek to deleverage and manage ongoing liquidity concerns. Consequently, new property starts continued to trend lower in April 2022 — 28% lower year-on-year. To support the property market, changes were made in May to allow families with three children to own a second property in more than a dozen cities.

In June, the OECD forecast Chinese growth of 4.4% in 2022, a downgrade of 0.7 percentage points from its December 2021 forecast. While a rebound in Chinese economic activity is likely in the second half of 2022, the strong potential for disruption due to new COVID-19 outbreaks in the second half of 2022 means achieving the Government's 5.5% target will be difficult. As disruptions ease, the OECD projects China's growth will rise to 4.9% in 2023.

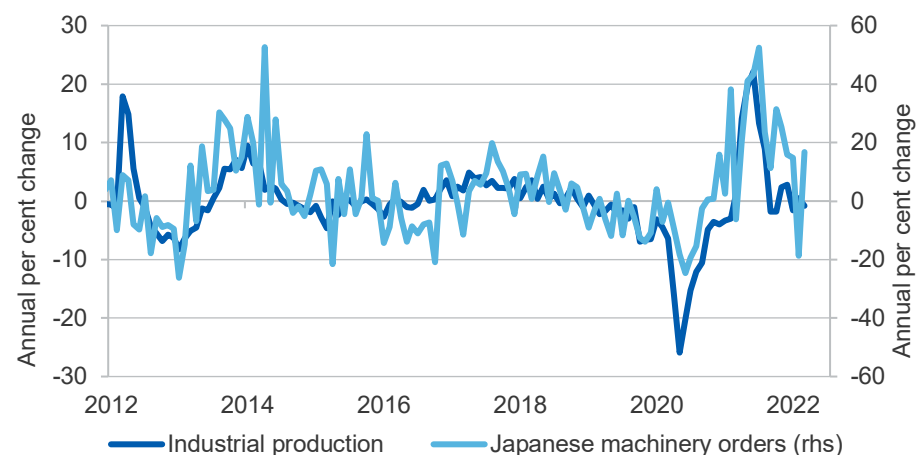
Japan's economy expected to improve after short-term headwinds

Japan's historically low economic growth has fared slightly better than expected despite recent COVID-19 containment measures. Nevertheless, Japan's GDP still fell by 0.1% year-on-year in the March 2022 quarter, as the COVID-19 restrictions hit the service sector, and the surge in commodity prices resulting from the Russian invasion of Ukraine affected consumers and businesses.

Japan's core inflation rose to 2.1% in April 2022, which is above the central bank's 2% target. The rise in inflation poses a challenge for the Japanese central bank which has retained a massive monetary stimulus.

Japan's industrial output fell by 0.8% year-on-year in March 2022 following a 0.5% rise in February 2022. However, machinery orders have bucked the trend over the period, with orders up nearly 17% year-on-year in the month of March 2022 (Figure 2.8). The Jibun Bank Manufacturing PMI for Japan slipped from 54.1 in March 2022 to 53.5 in April 2022. The decline was due to supply chain disruptions and the COVID-19 containment measures in China.

Figure 2.8: Japan industrial production and machinery orders



Notes: IP data is to March 2022; machinery orders data only available to February 2022

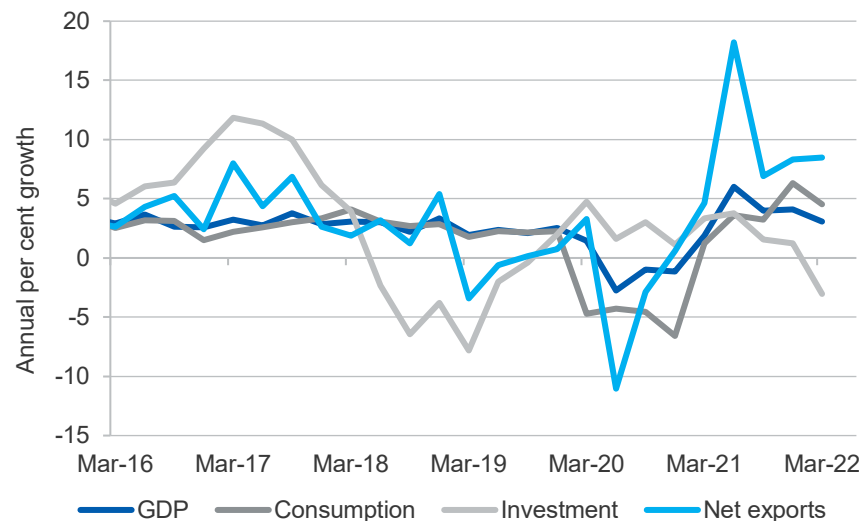
Source: Bloomberg (2022)

Going forward, it is expected the border controls will be relaxed — after Japan scrapped the COVID-19 tests for arrivals and eased some masking guidelines. This, as well as possible further stimulus, is expected to see economic activity pick up in the second half of 2022. The OECD now forecasts Japanese economic growth of 1.7% in 2022, half the 3.4% growth rate forecast in its December 2021 Outlook. However, the OECD has revised up its forecast for 2023 by 0.7 percentage points to 1.8% in 2023.

South Korea's economy grew at a slower pace in the March quarter 2022

South Korea's economic growth slowed from 4.1% year-on-year in the December 2021 quarter to 3.1% year-on-year in the March 2022 quarter, as the COVID-19 containment measures affected private consumption and investment. Over this period, private consumption fell by 1.8% year-on-year due to decreased expenditures on semi-durable goods and services. The fall in private investment (down by 4.2% year-on-year) was also a major contributor to slowing economic growth (Figure 2.9).

Figure 2.9: South Korea contributions to quarterly real GDP



Source: Bloomberg (2022)

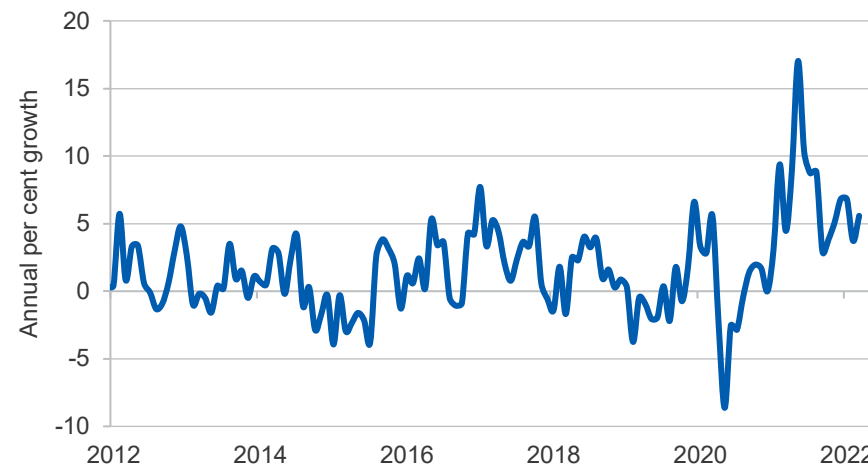
Despite facing supply chain issues, South Korea's industrial production has been resilient, growing 5.6% year-on-year in March 2022 (Figure 2.10). This growth marked 19 consecutive months of higher industrial production.

South Korea's manufacturing PMI reading in April 2022 of 52.1 also marked 19 consecutive months of expansion.

Led by a surge in energy prices, the inflation rate in South Korea increased to 4.8% year-on-year in April 2022 — the fastest increase in over 13 years. Rising inflation prompted the Bank of Korea to raise its benchmark interest rate by 25 basis points to 1.5% in April 2022. Given current debt levels, managing tighter monetary conditions while keeping robust economic growth presents a key challenge to South Korea over the outlook period. The nation also remains vulnerable to further global supply chain disruption, given its high dependency on exports.

In June 2022, the OECD lowered South Korea's forecast economic growth slightly to 2.7% in 2022 from its December 2021 outlook of 3.0%.

Figure 2.10: South Korea monthly industrial production



Source: Bloomberg (2022)

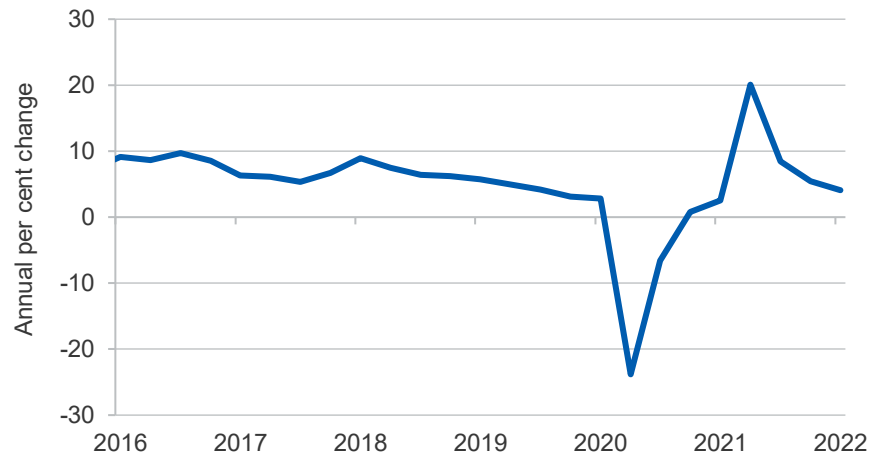
India's growth slows in the March quarter

India's growth slowed to 4.1% year-on-year in the March quarter 2022, down from 5.4% in the December quarter 2021. The result was well below market expectations of 6.1%, and was the slowest quarterly growth since the March quarter 2021 (Figure 2.11).

Output growth was recorded in all key sectors with the exception of manufacturing, which fell 0.2% following a rise of 0.3% in the December quarter. The weak manufacturing result was driven in part by the effect of COVID-19 lockdowns in several states. Agriculture continued its strong growth, up 4.1% while the mining and quarrying and construction sectors grew at 6.7% and 2.0% respectively.

Private consumption increased by 1.8% year-on-year in the March quarter 2022. The March result was also supported by increases in gross fixed capital formation and government final consumption expenditure of 5.1% and 4.8% respectively.

Figure 2.11: India quarterly GDP



Source: Bloomberg (2022)

India's manufacturing PMI showed improvement in April, rising to 54.7, up from 54.0 in March. The gain appears driven by reductions in COVID-19 restrictions (supporting expansions in new orders and production) and solid growth in exports. However, input prices increased at the fastest pace in five months, and output price growth reached 12-month highs, as manufacturers passed on additional costs to buyers.

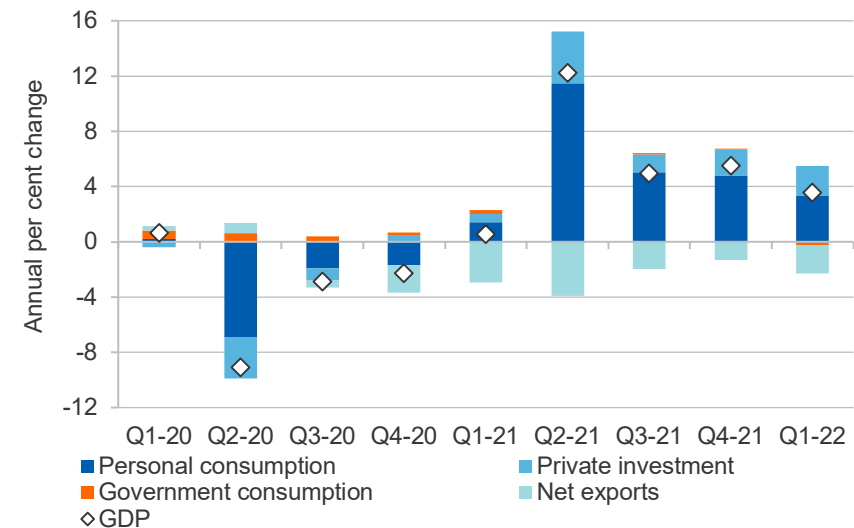
The OECD forecasts India's economic growth to slow to 6.9% in 2022, down from 8.7% in 2021 and a downward revision of 1.2 percentage points in 2022 from the December 2021 Outlook. In 2023, India's GDP is forecast to grow by 6.2%. The downward revision reflects, in part, weaker domestic demand — as higher oil prices are expected to weigh on private consumption and investment — and lower net exports. The Russian invasion of Ukraine is adversely affecting India's economy due to India's large reliance on imported energy, fertilisers and edible oils.

US GDP fell in the March quarter on rise in imports

In year-on-year terms, the US economy grew by 3.6% in the March quarter (Figure 2.12). The US economy fell by 0.4% quarter-on-quarter in the March quarter 2022 (a fall of 1.4% on an annualised basis). This was

primarily driven by a significant fall in net exports, with imports rising by 18% (both on an annualised basis) in the quarter, and the US trade deficit reaching a record \$109.8 billion in March.

Figure 2.12: US contributions to quarterly real GDP

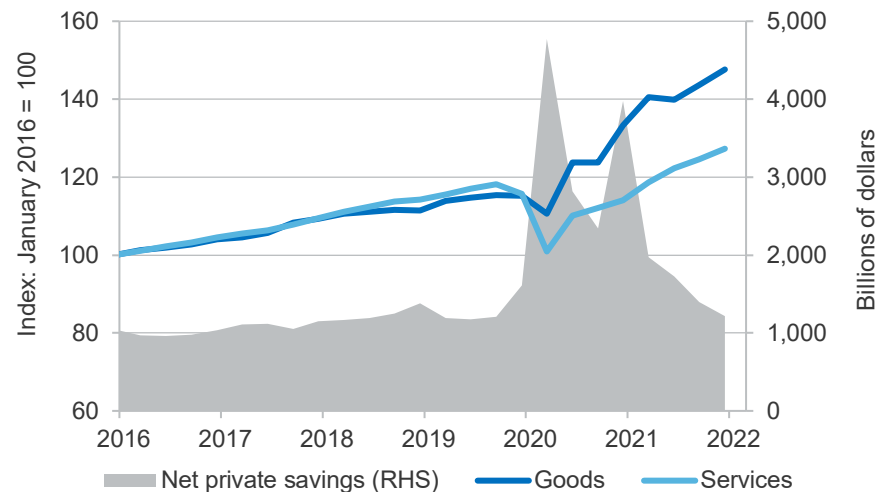


Source: Bloomberg (2022)

The rise in the trade deficit so far in 2022 reflects continued strength in US household consumption, with total imports (in real terms) of consumer goods rising by 12% and automotive vehicles by 8.3%. Imports of capital goods (such as ICT equipment and industrial machinery) also rose by 6.5% (in real terms) in the March quarter. Supply chain disruptions and the drawdown of household savings through 2021 are expected to see a slowing of this trend throughout 2022 (Figure 2.13).

US industrial production grew by 6.4% in April, up from a low of 3.7% in December last year. The US Manufacturing PMI index remained strongly in expansionary territory in April (59.2), with a surge in output and new orders suggesting a stronger pace of economic growth in the June quarter. However, firms continue to report input price inflation at near-record levels, indicating inflationary pressures may persist in coming months.

Figure 2.13: US personal consumption and net private savings



Notes: Personal Consumption Expenditures; seasonally adjusted data; January 2016 =100
Source: U.S. Bureau of Economic Analysis (2022)

Supply chain disruptions seen throughout 2021 continue to be a concern. While US port congestion has eased in recent months, shutdowns of Chinese ports (in response to COVID-19 outbreaks) could see further exacerbation of these challenges in the second half of 2022. By early May, shipping delays between China and major US and European ports had already quadrupled (compared with late March).

Monetary conditions are expected to tighten further, with the US Federal Reserve raising the Fed Funds rate by a further 75 basis points (bps) at its June meeting. It also stated that it will continue reducing its balance sheet (undertaking quantitative tightening). With US CPI at 40-year highs (8.6%) in May, reigning in inflation is a critical priority for the Federal Reserve, with Fed members' expectations pointing to further substantial rate hikes this year. The Fed also downgraded its growth forecasts for the US economy, projecting growth to be just 1.7% this year, down from the 2.8% forecast in March.

Earlier in June, the OECD downgraded its forecast for US economic growth in 2022 (from 3.7% in December) to 2.5%. The lower forecast reflects supply shortages, exacerbated by the Russian invasion of Ukraine and the new COVID-19 outbreaks in China, and the impact both are expected to have on global growth and inflationary pressures this year.

Europe growth slides as inflation grows

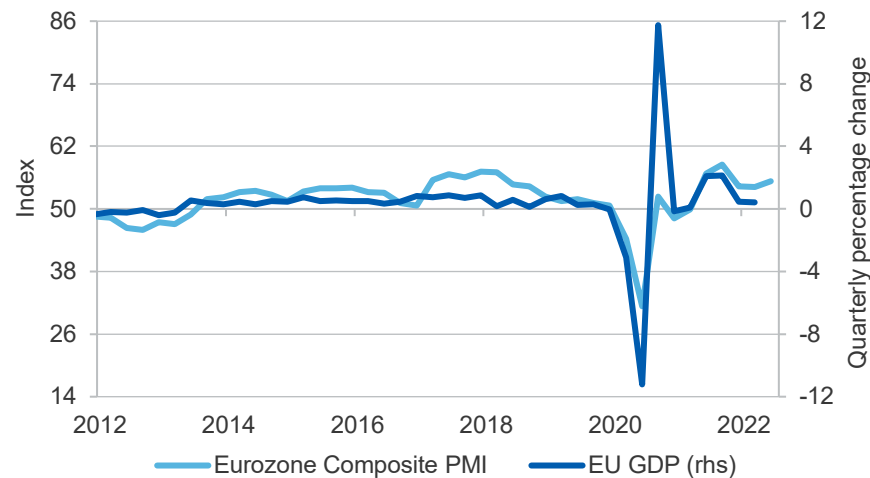
The EU economy grew by 5.2% year-on-year in the March quarter 2022. The growth rate was 0.4% higher quarter-on-quarter, representing a considerable easing from the 2.2% growth seen for the September 2021 quarter (Figure 2.14). This slowdown reflects the impacts of supply chain disruptions and energy shortages from 2021 compounded by the Russian invasion of Ukraine.

In March, industrial production in the Eurozone fell 0.8% compared with March 2021, a substantial downturn relative to the February result, which increased by 2.0% year on year. The March result was driven by falls in capital and intermediate goods and energy, with substantial falls in industrial output in Germany.

The Eurozone Composite Output Index rose to 55.8 in April, up from 54.9 in March, the strongest rise since September 2021. The improvement in the headline figure masked widely divergent trends at the sector level, with data revealing sharp services activity growth as demand continued to be buoyed by fewer COVID-19 restrictions, but the slowest growth in manufacturing output in almost two years. Despite resilience in the service sector the index fell to a four-month low of 54.8 in May, which, while indicating a continuation of economic growth, also highlighted a loss of momentum across the Eurozone.

Headline inflation in the Eurozone reached 7.4% (year-on-year) in April 2022 — equalling the March record. High inflation has raised expectations of monetary tightening in Europe in 2022. In May, the European Central Bank signalled its intention to raise interest rates from their current level of minus 0.5% into positive territory, starting in July when the quantitative easing is scheduled to end.

Figure 2.14: Eurozone GDP and Composite PMI (quarterly)



Notes: June quarter 2022 Eurozone Composite PMI is an estimate based on April and May 2022 results.

Source: Bloomberg (2022)

The Russian invasion of Ukraine remains the largest risk to Europe's outlook over the rest of 2022. Alongside energy price volatility, the prospect of further sanctions and actions by major economies — that could further impact trade and economic activity throughout Europe — continues to weigh on the outlook.

In its June 2022 Outlook, the OECD forecast the Eurozone economy to grow by 2.6% in 2022. This is a 1.7 percentage point reduction from the December 2021 outlook, with the largest downgrades in economies such as Germany and Italy — with relatively large manufacturing sectors and greater dependence on energy imports from Russia. The OECD also revised down the United Kingdom's forecast growth by 1.1 percentage point in 2022, before the economy stagnates in 2023. The OECD forecasts weaker consumption, as rising prices erode households' income, and weaker investment due to tighter financial conditions.

Table 2.1: Key OECD GDP assumptions

	2021	2022 ^a	2023 ^a
Economic growth^a			
OECD economies	5.5	2.7	1.6
Australia	4.8	4.2	2.5
Eurozone	5.3	2.6	1.6
France	6.8	2.4	1.4
Germany	2.9	1.9	1.7
Japan	1.7	1.7	1.8
New Zealand	5.0	3.0	2.0
South Korea	4.0	2.7	2.5
United Kingdom	7.4	3.6	0.0
United States	5.7	2.5	1.2
Non-OECD economies	6.1	3.3	3.8
China ^b	8.1	4.4	4.9
India	8.7	6.9	6.2
Indonesia	3.7	4.7	4.7
Brazil	5.0	0.6	1.2
Russia	4.7	-10.0	-4.1
World ^c	5.8	3.0	2.8

Notes: **a** Year-on-year change. India projections are based on fiscal years, starting in April; **b** Excludes Hong Kong; **c** Calculated by the OECD using purchasing power parity (PPP) weights for nominal country gross domestic product.

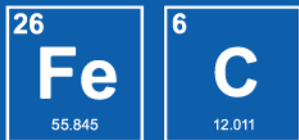
Sources: Bloomberg (2022); OECD (2022).

Table 2.2: Exchange rate and inflation assumptions

	2021	2022 ^a	2023 ^a
AUD/USD exchange rate	0.75	0.72	0.76
Inflation rate ^b			
United States	4.7	7.7	2.9
	2020–21	2021–22 ^a	2022–23 ^a
Australia ^c	1.6	4.3	4.7

Notes: a Assumption; b Average of daily rates; c Change from previous period.

Sources: ABS (2022) Consumer Price Index, 6401.0; Bloomberg (2022); Department of Industry, Science, Energy and Resources; RBA (2022); IMF (2022).

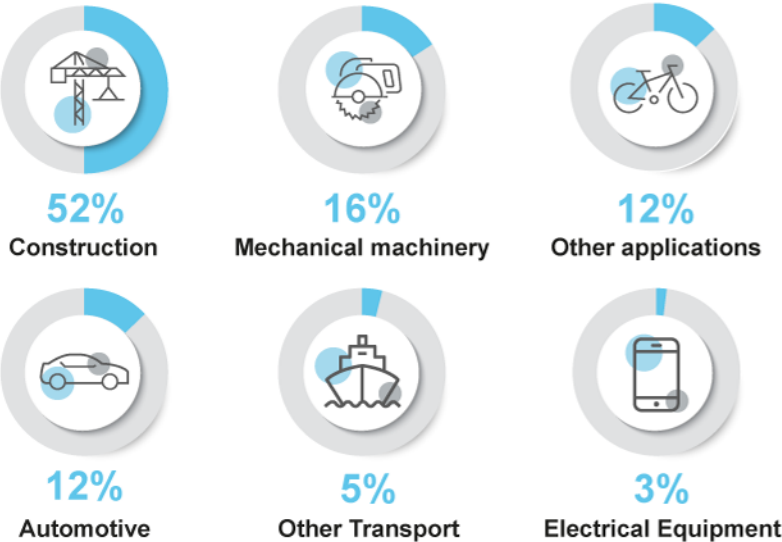


Steel

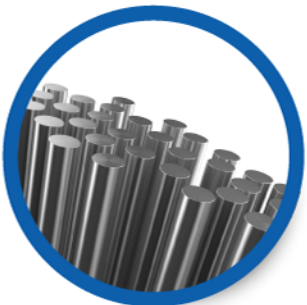
Australian steel refineries



World consumption



Steel facts



Made in specialised blast furnaces, mainly out of **iron and carbon**



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



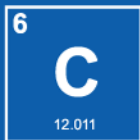
Pure steel is **1,000 times stronger** than iron



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

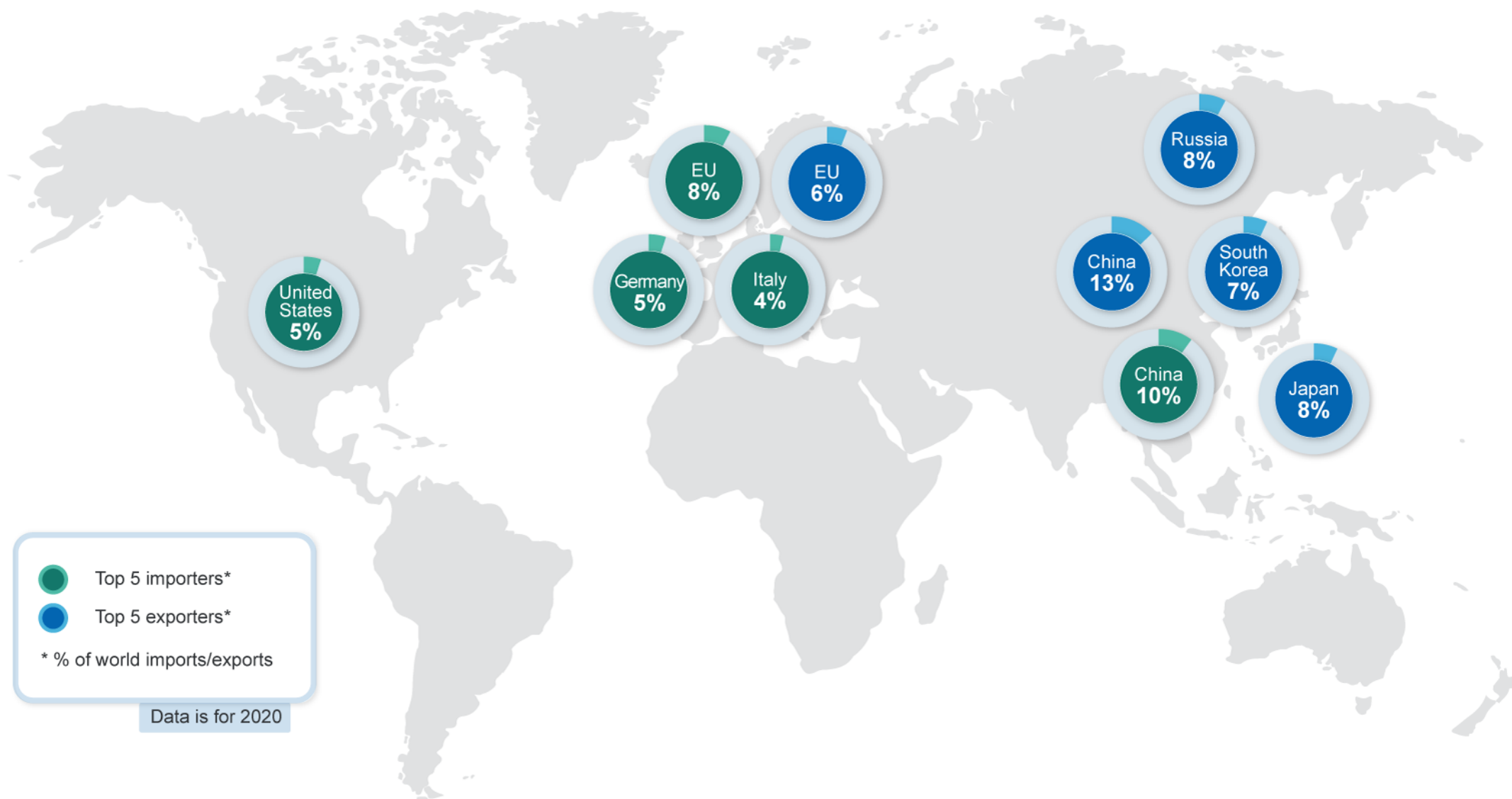
Australia's steel





Steel

Trade map | June 2022



3.1 Summary

- World steel production is now forecast to grow by 0.6% in 2022 — a significant (1.6 percentage point) downward revision from the March *Resources and Energy Quarterly* (REQ). This follows recent outbreaks of the COVID-19 pandemic in China, as well as impacts to major steel markets and global supply chains from current energy shortages and Russia's invasion of Ukraine.
- Global construction activity is expected to drive modest growth in world steel demand in 2022, with large infrastructure rollouts, and rising non-residential construction. However, this will be partially offset by further cuts to global auto production and subdued residential construction.
- Over the outlook period, global steel output is expected to grow by 1.3% in 2023 and by 1.1% in 2024. China is expected to record lower steel output (as part of its aim for peak steel), with the EU/Japan to stay at current levels, and India/Brazil to see annual growth of 4-6% to 2024.

3.2 World consumption and production

Steel output in 2022 facing weakened demand, and supply disruptions

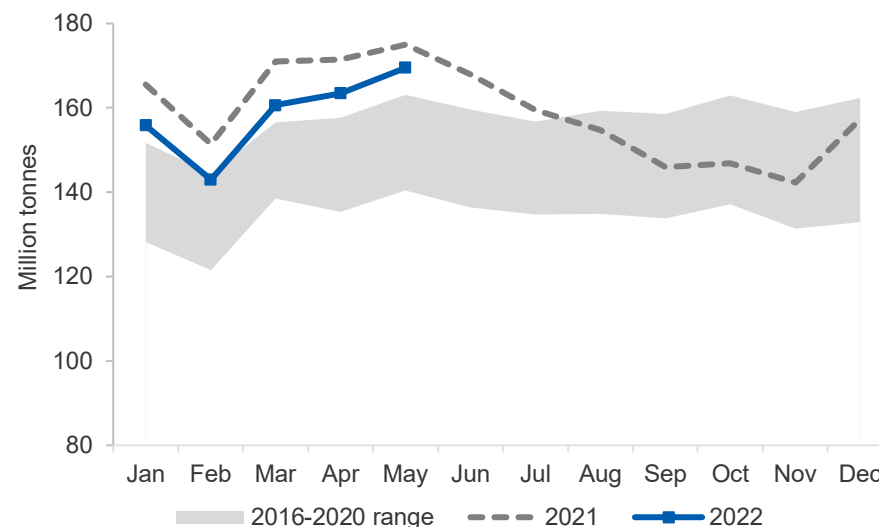
Global steel production in the five months to May 2022 was around 792 million tonnes. This was 5.0% lower compared with 2021, but 2.4% above the average output for the period from 2016 to 2020 (Figure 3.1).

Following an impressive recovery in the global economy through 2021, world industrial production is forecast to see solid (but lower) growth in 2022, as economies continue to emerge from the pandemic and ease toward longer-run growth trajectories. At the start of this year, this growth was expected to see a comparable rise in global steel production in 2022 of 2.2%.

However, critical shocks to the global economy and supply chains so far in 2022 have inhibited industrial production in recent months, and are expected to weigh on global steel demand and production over the remainder of 2022 (Figure 3.2).

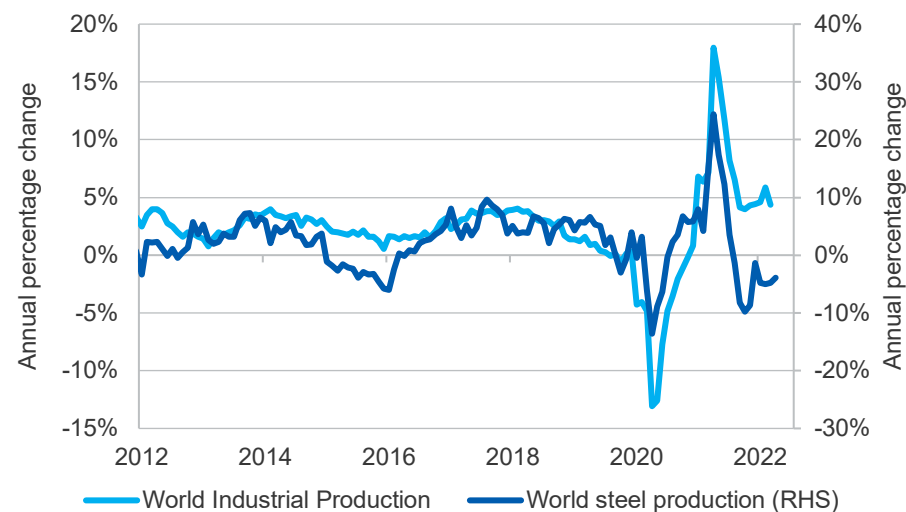
The impacts of a slowing residential property sector in China have been exacerbated by new outbreaks of the COVID-19 pandemic from March.

Figure 3.1: Global monthly steel production



Source: World Steel Association (2022)

Figure 3.2: World industrial production and steel output



Source: World Steel Association (2022); Bloomberg (2022); CPB (2022)

Russia's invasion of Ukraine is also expected to lead directly to cuts to steel production this year, as well as more significant indirect impacts to major steel producers such as the EU, US and Asia. This is due to their ongoing reliance on Russian energy, and other critical components for steel-intensive products (palladium and neon in the production of automobiles for example) sourced from both Russia and Ukraine.

Amongst the major producers, China is expected to see a slight fall in steel output in 2022, while Japan, the US and South Korea are all expected to see modest growth. Ongoing power shortages (see *Thermal Coal chapter*) present growing risks to the 5 million tonnes additional steel production capacity forecast for India. And given current energy shortages, the EU is now expected to see a 3.3% drop in total steel output in 2022.

Over the outlook period to the end of 2024, stimulus-related infrastructure and a rebound in industrial production from current obstacles are expected to see growth in steel demand continue, but at more modest levels. World steel production is projected to grow by 1.3% in 2023 to reach 1.99 billion tonnes, and by 1.1% in 2024 to reach 2.01 billion tonnes. However, a worsening of supply chain disruptions and inflationary pressures carry the potential of curtailing or reversing this growth over the outlook period.

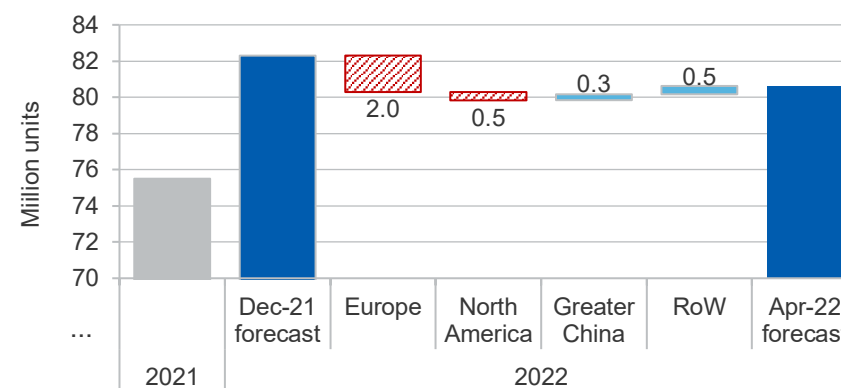
Construction to spur steel demand in 2022, offsetting auto production cuts

Global steel consumption is forecast to grow by 0.5% in 2022 — a 1.8 percentage point reduction from the March 2022 REQ.

In early June, the OECD downgraded its 2022 forecast for global growth (from 4.5%) to 3.0%. This reduction was based on intensified impacts from the Russian invasion of Ukraine (as well as from related sanctions), continued global price pressures, and recent outbreaks of the COVID-19 pandemic in China (see *Macroeconomic Outlook chapter*).

Despite the cut to forecast world growth, global construction activity is expected to rise by about 2.2% in 2022, and remain robust over the period to 2024. This will be driven by infrastructure-related stimulus — especially in the US and Asia. Non-residential construction activity in Europe (as part of the Next Generation EU "Renovation Wave") and the Middle East (as part of its Vision 2030 strategic framework), are also forecast to lift activity.

Figure 3.3: S&P Global 2022 light vehicle production forecasts



Notes: Forecast released 20 April 2022

Source: S&P Global IHS Markit (2022)

Rising input costs and supply shortages are expected to continue to subdue residential construction activity, with comparatively weaker growth expectations over the outlook period. Price pressures and raw material shortages also carry the potential to spill over into other construction activity (infrastructure and non-residential) over this time.

Following a severely impacted 2021, the automotive sector had been expected to see improved conditions this year. However, the ongoing semiconductor chip shortage has been further aggravated by the Russian invasion of Ukraine, and China's current COVID-19 outbreaks. These disruptions are now expected to persist through to 2023.

Ukraine and Russia are the world's largest producers of neon and palladium, respectively — both critical inputs to semiconductor chips and catalytic converters. This, and other shortages, had already seen major producers in Europe announce production cuts in March. Revised forecasts from S&P Global and IHS Markit as of late April now expect 1.7 million less light vehicles to be produced globally (compared with its December 2021 forecasts) in both 2022 and 2023 (Figure 3.3). New outbreaks of the COVID-19 pandemic starting in March 2022 saw new vehicle sales in China fall 48% year-on-year in the month of April.

The global manufacturing sector has also been hindered by high energy prices and raw materials shortages so far in 2022. The JPMorgan Global Manufacturing PMI was 52.4 in May, only marginally above the 20 month low (of 52.3) reached in April. New orders and international trade volumes remained subdued in May, while reported input cost increases continued to stay at near-record levels, suggesting global inflationary pressures are likely to persist in the near-term.

Over the outlook period, global steel consumption is expected to grow by 1.1% in 2023 and 2024, as COVID-related containment measures are removed, and global supply chains adjust. The slight downgrade in growth compared with the March 2022 REQ reflects the expectation that energy and supply chain shortages are likely to persist in the short term.

China targeting a fall in total steel output in 2022

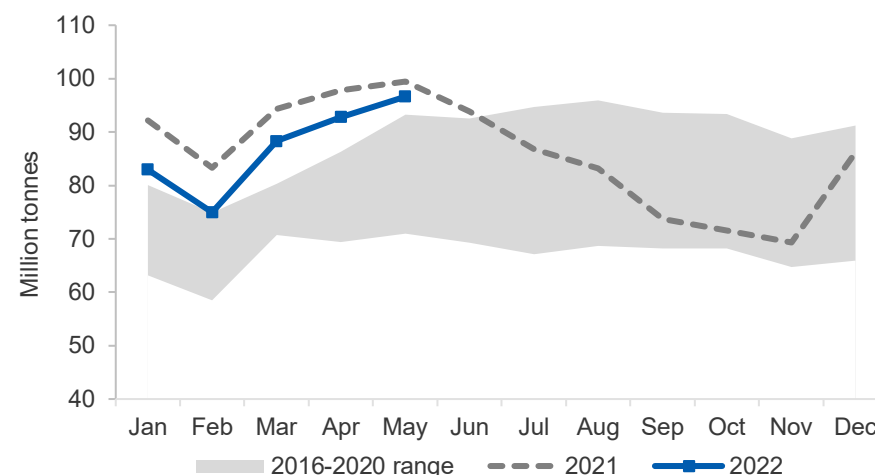
China's total steel production was around 436 million tonnes in the five months to May 2022. This was 6.7% lower than previous year, though remained 5.0% higher than the year-to-May average for the period 2016 to 2020. (Figure 3.4).

The year-on-year fall reflected a range of factors, including winter production curbs in place from 1 January to 15 March. These curbs — intended to mitigate pollution levels in many northern provinces — required mills to maintain output around 30% below 2021 levels. Steel output in January and February was also impacted by efforts of China's Government to limit industrial activity and ensure reduced air pollution (and blue skies) for the Beijing Winter Olympics. Renewed COVID-19 lockdowns in the city of Tangshan — China's largest steel producing city — in both March and April, are also likely to have impacted total output over the period.

In April, a number of China's key government agencies reiterated the aim to reduce total steel output in 2022. This is part of the country's efforts to achieve peak steel emissions by 2030 and net zero emissions by 2060.

This goal also reflects China's longer-term aim to deleverage certain parts of its economy, and to shift away from investment and export-driven growth toward a more consumption-oriented growth model.

Figure 3.4: China monthly steel production



Source: Bloomberg (2022); World Steel Association (2022)

China's demand for steel to be bolstered by new infrastructure...

However, China will need to manage this longer-term transition alongside its stated priority for 2022 of economic stability. With China's year-on-year GDP growth below 5% for three consecutive quarters (to March quarter 2022), as well as the recent COVID-19 outbreaks, the government is still expected to act to substantially boost infrastructure-related construction activity — which typically represents around 20-25% of the country's total consumption of steel — further in the second half of 2022.

Infrastructure investment has already seen a significant ramp up this year, with the central government front loading issuance of around RMB 1.25 trillion (US\$200 billion) in local government special purpose bonds for project construction by the end of March. The government plans to issue around RMB 3.65 trillion (US\$550 billion) in special purpose bonds for the full year 2022, which will be further bolstered by carryover of unallocated bonds from last year. In May, total infrastructure investment was 8.0% higher compared with 2021 (Figure 3.5). In early June, the Central Government also instructed state-owned policy banks to increase the credit line by another RMB 800 billion (US\$120 billion) to provide financial support for infrastructure building.

Figure 3.5: China's infrastructure investment



Notes: *Infrastructure investment* year-on-year change based on a 3 month moving average
Source: NBS (2022); Bloomberg (2022)

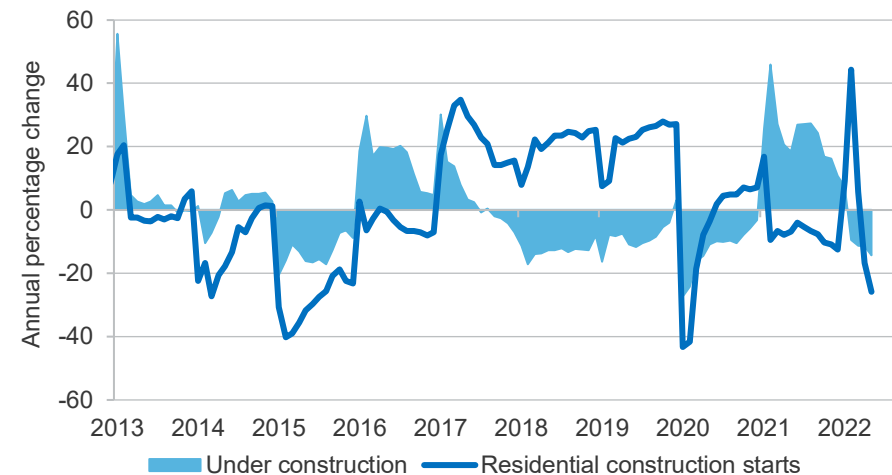
...but China's property and manufacturing sectors face headwinds

Further weakness in China's residential property sector — which typically accounts for around 35-40% of China's total steel consumption — carries the potential to curtail the strength of the rise in the country's total construction activity in 2022.

China's property sector continues to experience liquidity pressures, with the country's third largest developer, Sunac, missing interest payments on dollar-denominated notes due in April. New construction starts and total construction activity have been very weak so far in 2022, falling 26% and 14% year-on-year, respectively, in the year to May (Figure 3.6).

Weakness in the property sector has also been further exacerbated by the breakout of new COVID cases across China from March. It is estimated that as many as 87 cities had some sort of restrictions in place in May, impacting close to 400 million people. This includes major hubs such as Shanghai, Beijing and Guangzhou.

Figure 3.6: China's residential property sector



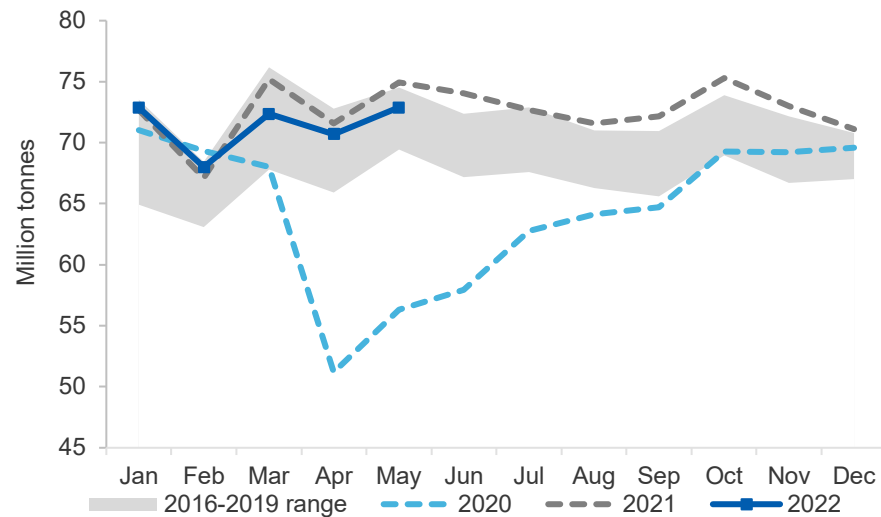
Notes: Measured by cumulative million square metres in each calendar year.
Source: Bloomberg (2022); Department of Industry, Science and Resources (2022)

Total new home sales in the five months to May for China's top 100 developers have fallen by half, while new land sales in the top 50 cities were down 20% year-on-year in April. This carries broader implications for China's economy and government spending over the outlook, with land sales typically accounting for a large share of local government revenue.

The Chinese Government has continued to take steps to stabilise the sector and ensure the completion of existing projects, including loosening its 'Three Red Lines' policy to improve fund availability for developers to finish existing projects. Credit conditions have also been eased further, with a cut to the bank Reserve Ratio Requirement (RRR) in April, and the five-year loan prime rate — the benchmark rate for mortgages — in May.

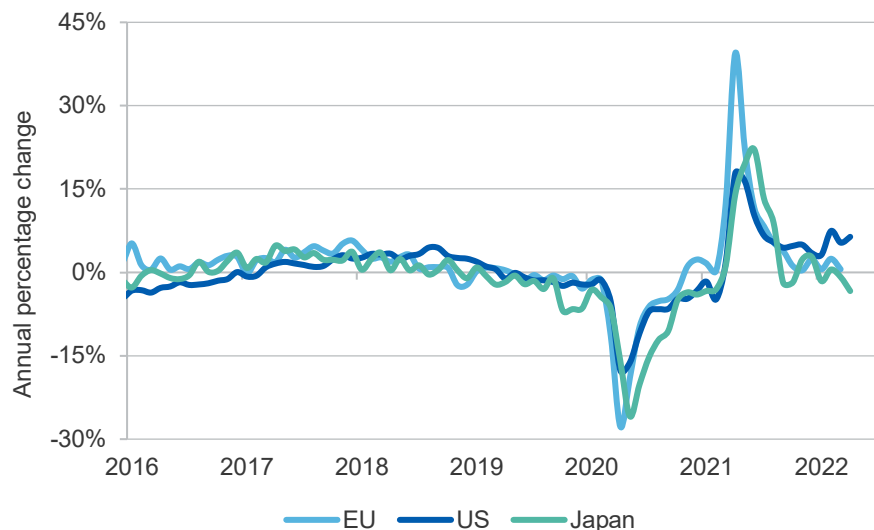
China's central bank is also taking steps to respond to the fallout from the recent Covid-19 outbreaks, rolling out 23 new measures to stabilise the economy. This includes increased incentives for banks to lend to small and micro businesses, mortgage relief for those impact by COVID-19 quarantine conditions, and further financing (particularly to local government financing vehicles) for major infrastructure projects.

Figure 3.7: Monthly steel production – Global (exc. China)



Source: World Steel Association (2022)

Figure 3.8: Monthly industrial production — EU, US and Japan



Source: Bloomberg (2022)

However, recent COVID-19 outbreaks are expected to constrain China's manufacturing sector in the short term, with the official manufacturing PMI recording three consecutive months of contraction to May (including a reading of 47.4 in April, the weakest since March 2020). With the US (as well as other major economies) expected to continue to tighten monetary conditions in 2022, this sector remains exposed to a potential weakening in global demand for China's exports over the outlook.

Russia-Ukraine conflict to lead to supply cuts, with further downside risks

Russia's invasion of Ukraine is expected to further constrain global steel supply in 2022. The capture of eastern provinces of Ukraine by Russian forces — where a significant proportion of the country's steel mill capacity resides — will see a substantial reduction in steel production from Ukraine this year and potentially beyond.

In early March, the EU agreed a fourth package of restrictive measures against Russia that included an import ban on Russian exports of steel (which totalled around 3.2 million tonnes in 2020). Sanctions against Russia are also expected to impact critical inputs to steel for major markets, with the loss of iron ore pellets to Europe (around 8 million tonnes in 2021) expected to impact the region's Electric Arc Furnace (EAF) steelmaking. Loss of Russian pig iron exports (an intermediate product in the steelmaking process) could also lead to some shortages of inputs for US-based steelmakers (which imported around 1 million tonnes of Russian pig iron in 2021).

While Russian producers are expected to seek alternative markets for these products, logistical constraints remain a key barrier to a full reallocation in the short term. Over the outlook period, the rising impact of sanctions on Russia's industrial activity and access to financing and capital investment, carry further downside risks to Russian steel output.

Other major producers impacted by energy and supply chain disruptions

Energy shortages and other supply chain disruptions have continued to impact manufacturing activity across major economies so far in 2022, with industrial production in the EU, US and Japan all continuing to trend lower in recent months (Figure 3.8).

In the five months to May 2022, world steel output (excluding China) was 357 million tonnes. This was 1.3% lower than 2021, and 2.4% lower than the year-to-May average for the period 2016 to 2019. (Figure 3.7).

Steel production in the EU — the world's second largest steel-producer — fell by 4.3% year-on-year for the five months to May 2022 (and was also 3.1% below 2019 levels) to reach around 58 million tonnes. After a rapid recovery in economic activity in the first half of 2021, industrial production in the EU has since softened (Figure 3.8). After reaching a low of zero growth (year-on-year) in January, activity has remained weak, rising just 0.6% year-on-year in March.

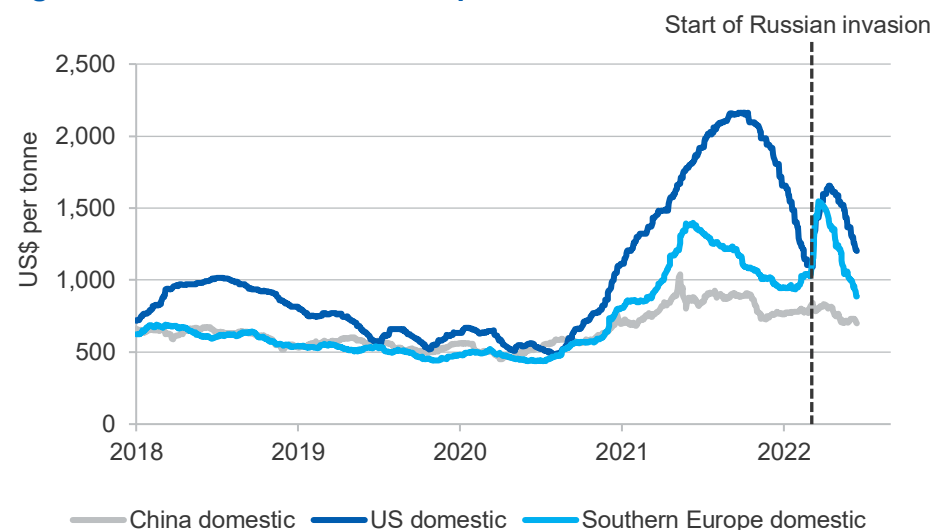
This softness follows a further wave of the COVID-19 pandemic (Omicron variant) through their winter period, as well as acute global supply chain disruptions. These issues have seen rising price pressures throughout Europe, with the Eurozone Producer Price Index rising 37% year-on-year in April and the Consumer Price Index rising 8.1% year-on-year in May — the highest level since the creation of the Euro.

Europe's natural gas supplies remain at risk of further shortages, due to Russia's invasion of Ukraine (and subsequent sanctions). This has seen Russia halt gas exports to some EU members in April and May (see *Gas chapter*). Europe's Steel Association (Eurofer) now projects EU steel demand to fall 1.9% in 2022 (in February it forecast growth of 3.2%).

With more than 40% of European steel produced through the EAF process — where electricity is the primary energy source — high energy prices have seen a number of EAF mills curtailing or stopping production in response to price pressures. This includes one of Europe's largest steel producers, ThyssenKrupp, announcing reduced working hours for its 1,300 steel workers from mid-April.

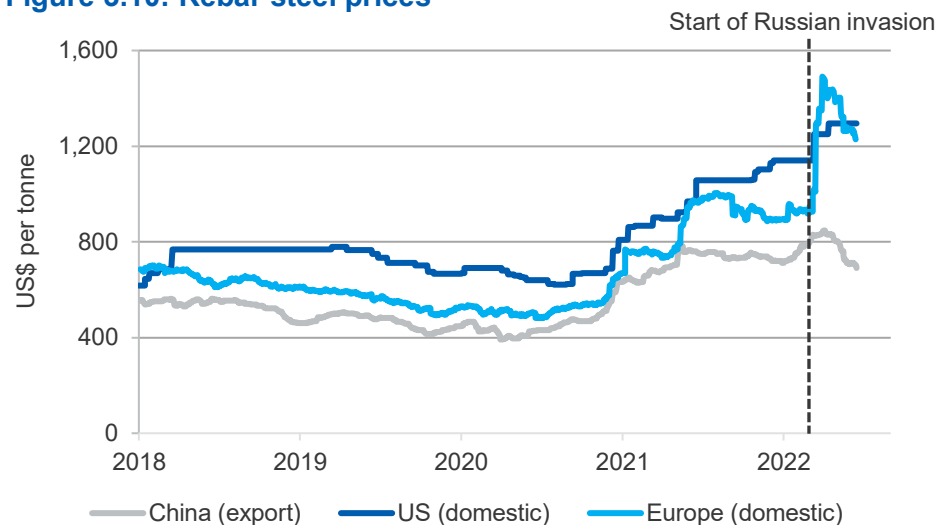
The conflict led to a substantial rise in European steel prices in March (Figures 3.9 and 3.10). While Hot-Rolled Coil (HRC) prices have eased in recent weeks, rebar prices remain elevated, and could constrain construction and activity in the region during H2 2022. Alongside energy price volatility, the conflict could also lead to further sanctions and actions by major economies, disrupting trade and economic activity in Europe.

Figure 3.9: Hot-Rolled Coil steel prices



Source: S&P Global Platts (2022)

Figure 3.10: Rebar steel prices



Source: S&P Global Platts (2022)

The Euro area continues to be heavily affected by the global semiconductor shortage, with the conflict in Ukraine — where 50% of the world's supply of neon is sourced — likely to further impact semiconductor manufacturing through to 2023. New shortages of critical components are also continuing to emerge as a result of Russia's invasion of Ukraine. Companies such as Porsche and BMW were forced to idle some production from March this year, given a shortage of wire harnesses typically supplied from Ukraine. Collectively, these issues are expected to see around 2 million less cars produced in Europe in 2022 (compared with forecasts from December last year), a reduction of more than 10%.

The Eurozone is now forecast to experience a 3.3% fall in total steel production in 2022 to reach 147 million tonnes. Over the outlook period to 2024, steel output is forecast to rise to 151 million tonnes in 2023 and 153 million tonnes in 2024 (Figure 3.11).

US steel production fell by 1.6% year-on-year in the five months to May 2022, and remained around 7.4% lower than the same period in 2019.

Following an easing in US HRC prices from record highs in September last year, Russia's invasion of Ukraine again tightened supply and led to a significant rise in prices (particularly long products) from March (Figure 3.9). Domestic mill capacity utilisation rates have fallen slightly since the start of 2022, to reach over 80% in June. US imports of semi-finished steel products from both Russia (due to unofficial sanctions) and Brazil (due to quota agreements) have fallen sharply (down 30% year-on-year in the year to May). At the same time, there has also been a growing shift to imports of finished steel products (up 36% year-on-year in the year to May) from major producers such as Canada and Mexico.

US supply chain disruptions — such as the semiconductor shortage — look set to continue into the second half of 2022. As a consequence of the disruptions, in April, IHS Markit forecast around 500,000 less units to be produced in the US compared with expectations in December last year. This includes a recent announcement by Toyota (in May) of a further 30,000 unit cut to its North American production (bringing its total 2022 estimate for lost production to between 177,000 to 192,000 units).

US steel production is now forecast to grow just 1.2% in 2022. Despite the short term challenges, the US is expected to maintain growth of around 2.3% annually over the rest of the outlook period to 2024. This will support implementation of the US\$1.2 trillion Bipartisan Infrastructure Framework (BIF), which includes US\$550 billion in new federal government investment in roads and bridges, rail, water and electrical infrastructure.

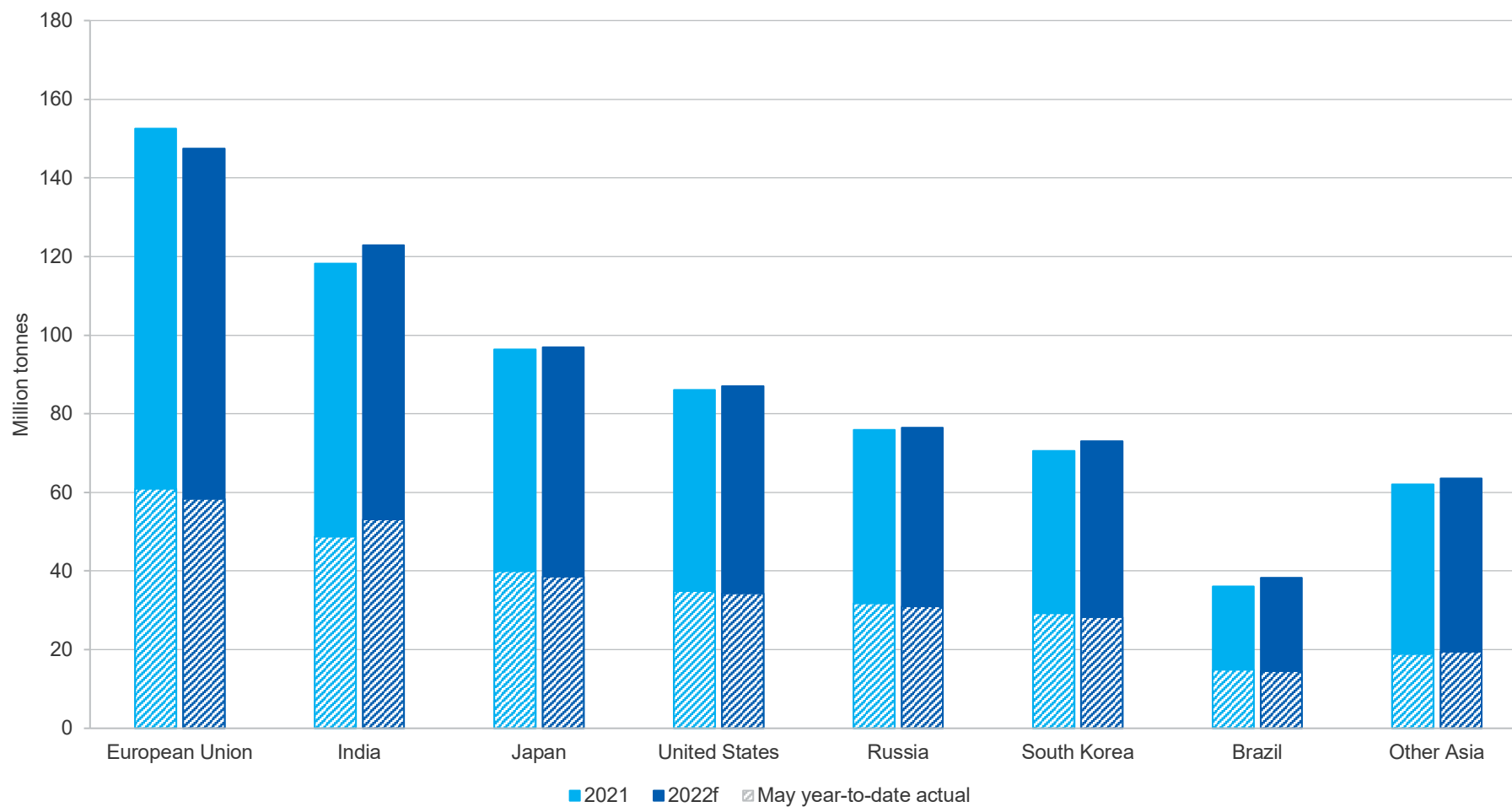
Indian steel output was about 53 million tonnes in the five months to May 2022, 9.1% higher year-on-year and 12% higher than the comparable period in 2019. Indian steel output is forecast to grow by 4.0% in 2022 (to 123 million tonnes), as part of the Indian Government's target to double national steel production capacity to 300 million tonnes by 2030–31 (from 144 million tonnes now).

However, India's coal shortages and recent heatwaves present a growing risk to this outlook. Thermal coal accounts for around 70-75% of India's total power demands, and high import prices have led to dwindling stockpiles at India's power plants this year. With manufacturing firms having already experienced power cuts since April, the country's steel industry remains vulnerable to cuts in output for the rest of 2022.

Over the outlook period to 2024, India is projected to grow its steel output by around 5.0% annually. This is expected to be led by a significant increase in infrastructure spending in 2022, as part of the country's \$1.5 trillion National Infrastructure Pipeline to 2025. This is to include around US\$500 billion in the next financial year (starting April 1) for projects that include 25,000km of new national highway, 400 new trains and 100 cargo terminals. Construction is also forecast to grow at a double digit pace in India's 2022 fiscal year (April 2021 to March 2022), after a fall of 7.3% in fiscal year 2021.

Total steel production for South East Asian countries in the five months to May 2022 (19 million tonnes) was around 3.0% higher compared with 2021, and 19% higher compared with 2019. This region is expected to see strong growth in domestic demand for steel over the outlook, including from government-led infrastructure projects, and the continued development of export-oriented manufacturing capacity.

Figure 3.11: Steel production – other major producers



Notes: 2021 actual; f forecast

Source: World Steel Association (2022); Department of Industry, Science and Resources (2022)

Table 3.1: World steel consumption and production

Crude steel consumption	Million tonnes				Annual percentage change		
	2021	2022 ^f	2023 ^f	2024 ^f	2022 ^f	2023 ^f	2024 ^f
China	1,026	1,011	1,012	1,007	-1.4	0.1	-0.5
European Union	149	146	151	156	-1.9	3.1	3.1
United States	94	100	107	111	5.8	7.1	3.9
India	104	107	112	117	3.4	4.8	4.7
Japan	56	56	58	60	0.5	2.9	2.8
South Korea	51	52	53	54	1.5	3.0	1.1
Russia	49	49	51	53	0.5	3.1	3.1
Brazil	25	27	29	31	8.6	8.5	8.0
World steel consumption	1,959	1,968	1,990	2,012	0.5	1.1	1.1
Crude steel production	2021	2022 ^f	2023 ^f	2024 ^f	2022 ^f	2023 ^f	2024 ^f
China	1,033	1,028	1,026	1,018	-0.4	-0.3	-0.8
European Union	153	147	151	153	-3.3	2.6	1.1
India	118	123	130	137	4.0	6.2	4.9
Japan	96	97	97	96	0.6	0.3	-1.0
United States	86	87	90	92	1.2	3.6	2.2
Russia	76	76	76	76	0.6	0.0	-0.2
South Korea	71	73	75	77	3.5	2.7	2.4
Brazil	36	38	40	41	6.2	3.9	3.6
World steel production	1,951	1,962	1,988	2,010	0.6	1.3	1.1

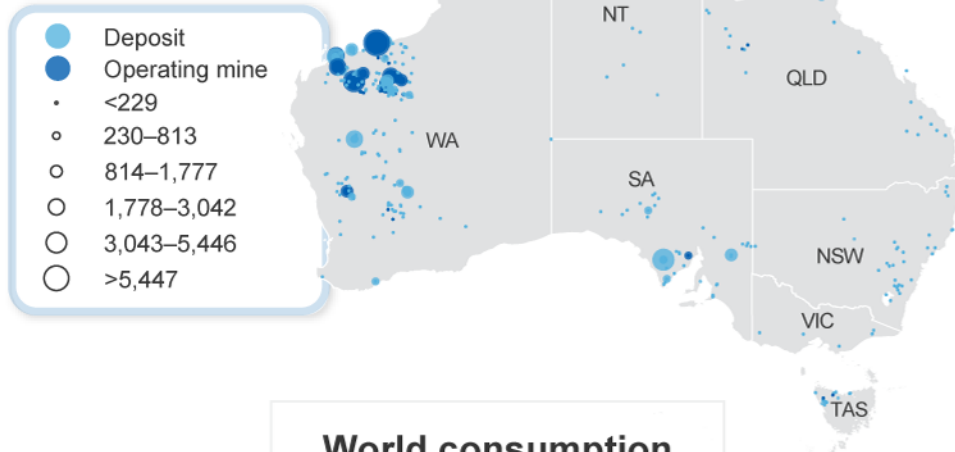
Notes: ^e Estimate; ^f Forecast; ^r Compound annual growth rate

Source: World Steel Association (2022); Department of Industry, Science and Resources (2022)

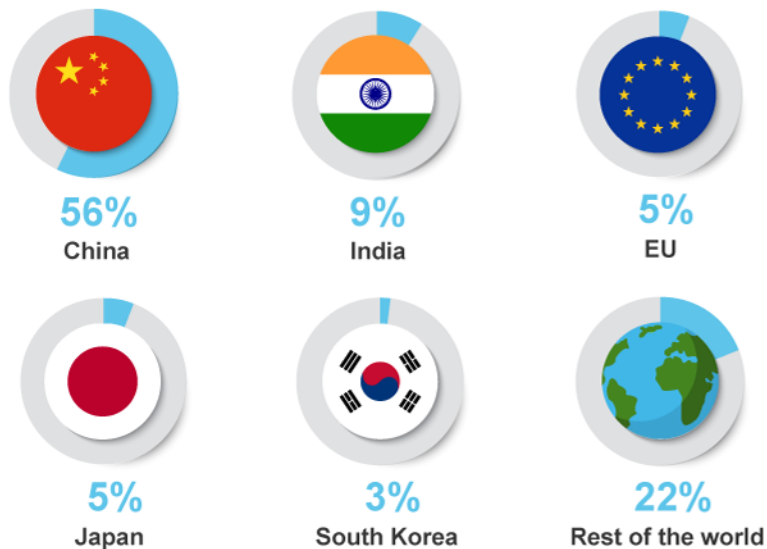


Iron Ore

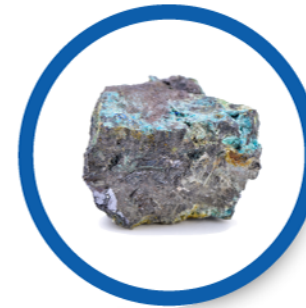
Major Australian iron ore deposits, Mt



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**

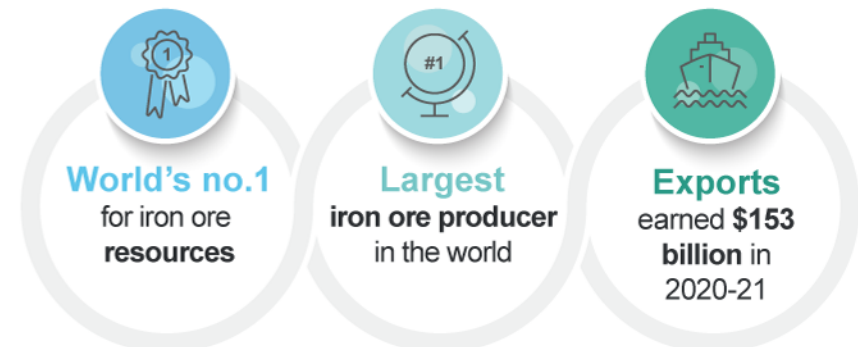


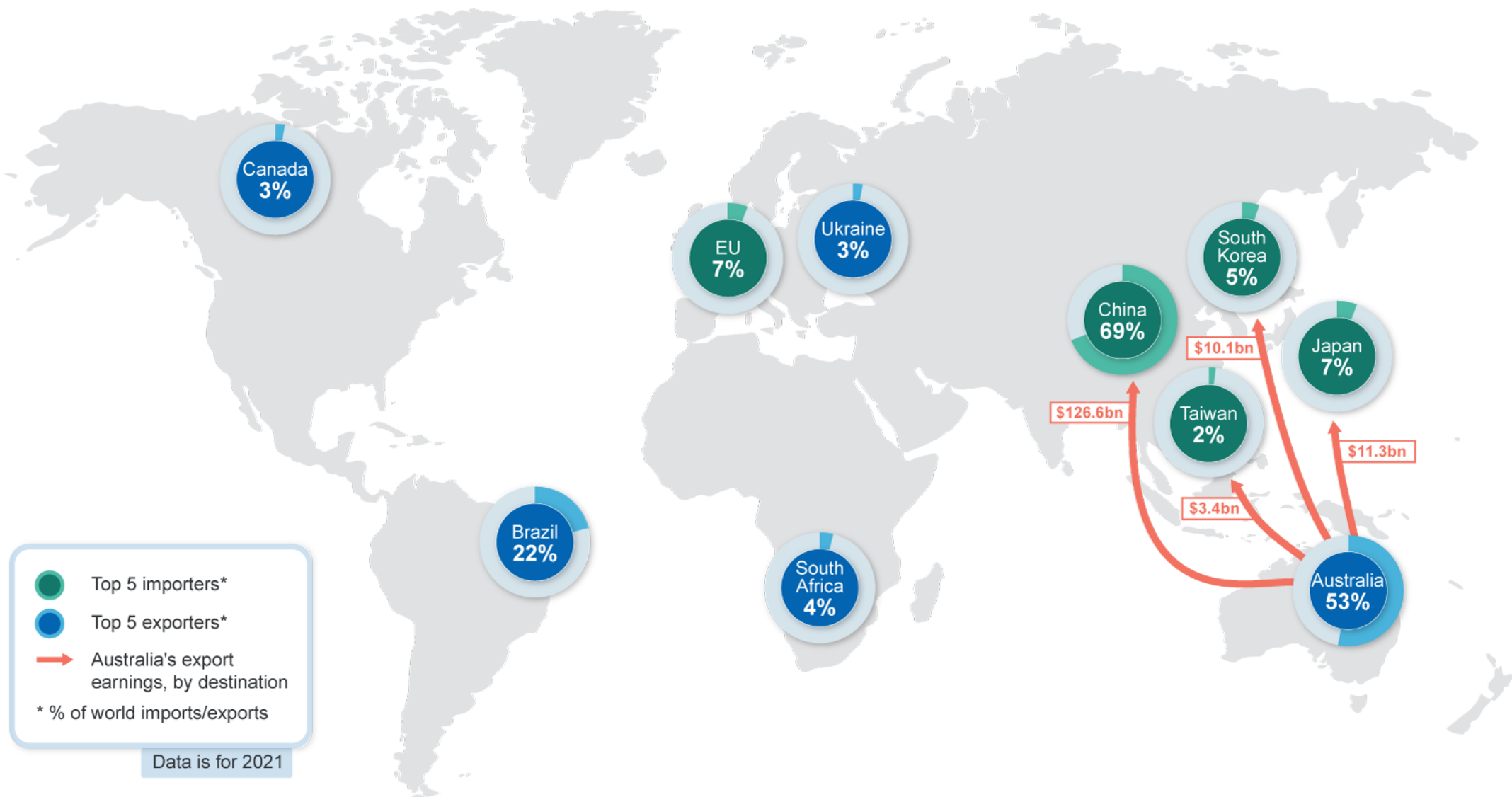
Humans have been working with iron for at least **5,000 years**



Iron was central to the **industrial revolution**

Australia's iron ore





4.1 Summary

- Iron ore prices have remained relatively stable in the June quarter 2022, and are expected to average around US\$130 a tonne (CFR).
- While China is still expected to ramp up infrastructure-related construction activity (raising its steel and iron ore demand) in 2022, recent outbreaks of the COVID-19 pandemic are delaying this upswing.
- Australian export volumes are estimated to have grown (by 8 million tonnes) to 876 million tonnes in 2021–22, with new supply coming online. Exports are forecast to rise to 929 million tonnes by 2023–24.
- Australia's iron ore export earnings are projected to ease from \$133 billion in 2021–22 to \$116 billion in 2022–23, and fall to \$85 billion by 2023–24. This reflects moderating prices expected over the outlook.

4.2 Prices

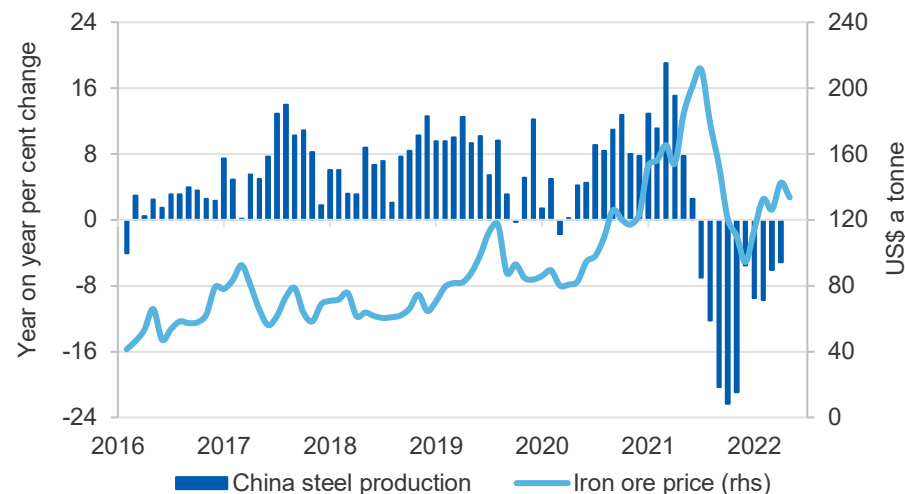
Iron ore prices maintain 2022 rebound in the June quarter

Following a volatile 2021, the benchmark iron ore spot price (62% Fe fines CFR Qingdao) has steadily trended up so far in 2022. Up to end May, the monthly averages have been about US\$120-140 a tonne. This marks a rebound from the lows of US\$80 a tonne, reached in November 2021, as China sought to cut steel output in the second half of 2021 (Figure 4.1).

The rebound in prices in 2022 follows a partial improvement in monthly steel output in China, as well as the expectation of a substantial boost in infrastructure-related construction activity this year. With China's GDP growth (year-on-year) below 5% for the last three quarters (to March quarter 2022), China's authorities are expected to introduce further stimulatory fiscal and monetary policies in the second half of 2022 — with an emphasis on infrastructure-related stimulus (see *Steel chapter*).

Industrial activity and steel output were expected to ramp up from the June quarter 2022, in response to this infrastructure investment surge, as winter emissions curbs were withdrawn. However, new COVID-19 outbreaks and related containment measures across many of China's provinces from March, appear likely to delay this upturn until the second half of 2022.

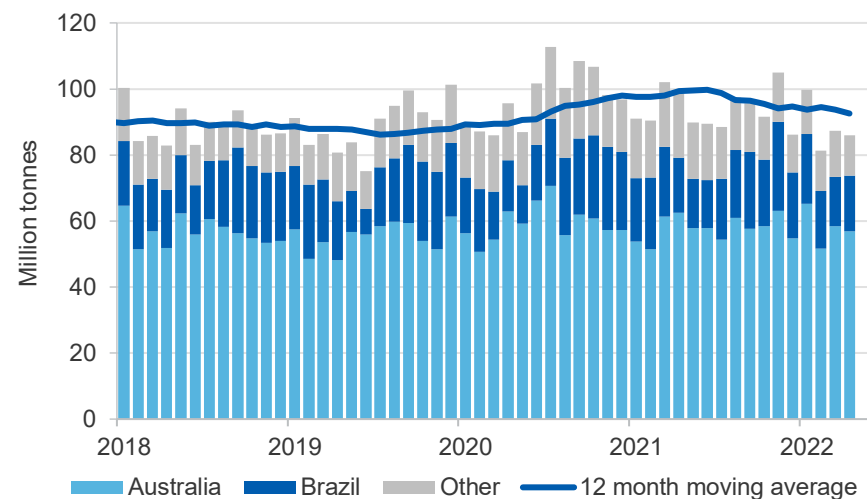
Figure 4.1: Iron ore price and China steel production, monthly



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

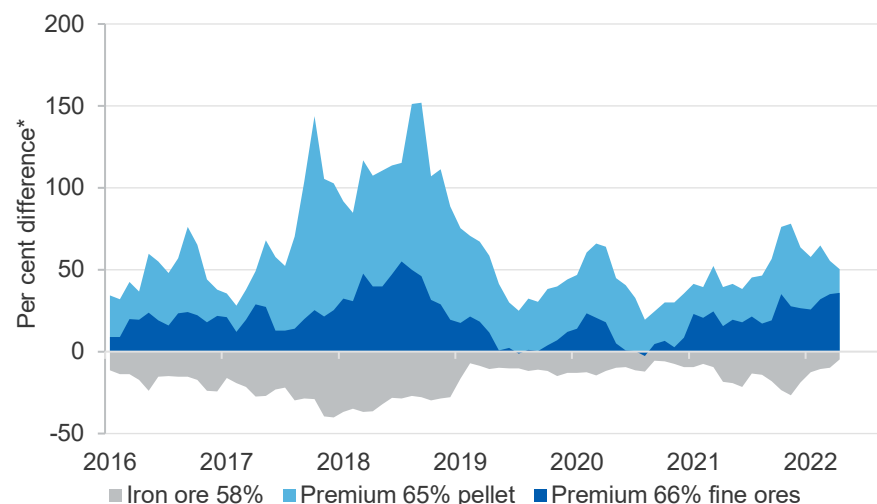
Source: Bloomberg (2022) China import prices; World Steel Association (2022)

Figure 4.2: China's monthly iron ore imports



Source: Bloomberg (2022)

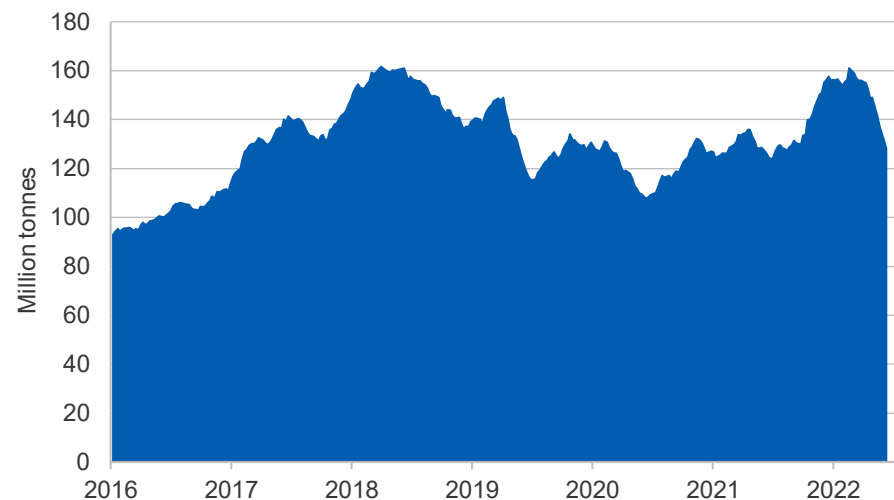
Figure 4.3: Iron ore price spread between grades



Notes: *Difference to benchmark of 62% iron fines CFR

Source: Bloomberg (2022); China import prices

Figure 4.4: China's weekly iron ore port stocks



Source: Bloomberg (2022)

China's total imports of iron ore have slowed considerably so far in 2022, with total volumes in January-April of 354 million tonnes. This is 7.3% lower year-on-year, and 1.1% less than the same period in 2020. Broken down by major supplier, this includes a fall of 11% year-on-year for Chinese imports of Brazilian iron ore over the period (Figure 4.2), while imports of Australian iron ore were 1.4% higher year-on-year.

Weather disruptions appear to have affected Brazilian production in the early part of this year, with heavy rains in Vale's Southern and South-Eastern systems, as well as CSN's Casa de Pedra mine. The bad weather coincided with higher freight rates for the shipping route between Brazil and China — up about 25% in early May compared to the start of the year. Both remain key risks to Chinese import volumes in the near term.

In recent months, global iron ore markets have been further disrupted by the fallout of the Russian invasion of Ukraine. This conflict is now projected to cause a loss of some seaborne iron ore supply in the short term, though iron ore and steel markets will likely reorganise over the outlook period (see *World Trade section*).

By grade, weakened demand for steel in China — and the suppressing effect this has had on steel mill margins — appears to have interrupted the ongoing rise in premiums for 65% and 66% grade ores seen since 2020. However, the partial loss of Ukrainian pellet supply from seaborne markets, and persistently tight supply of 66% (particularly Carajás) fines in recent months is likely to limit any fall. The removal of winter sintering restrictions in March has also seen a narrowing of the 58% Fe discount, as mills look to keep production costs low (Figure 4.3)

Following a run up of portside inventory to multiyear highs (of around 160 million tonnes) in February, iron ore stocks have declined in recent months to reach around 130 million tonnes by mid-June (Figure 4.4). The accumulation of portside stocks from mid-last year remains expected to provide a buffer for steel mills as they ramp up steel production for the rest of the year, mitigating the potential risk of tightening seaborne iron ore supply similar to that seen in the first half of 2021.

Iron ore prices remain vulnerable to supply shocks in 2022

Combined exports for the world's two largest iron ore producers — Australia and Brazil — were 279 million tonnes in the March quarter 2022. This was a 2.3% fall quarter-on-quarter, reflecting the impact of seasonal rainfall that tends to affect both nations in the first half of each year.

Following a comparatively dry March quarter 2022 in Australia, severe weather in the Pilbara in May saw record rainfall for the month. And the current negative phase of the Indian Ocean Dipole — an event that tends to bring more rainfall to northern Australia — could see further disruptions to production and exports in coming months. Australian producers have also cited ongoing impacts from labour supply shortages in recent months, at both existing operations and bringing replacement capacity online.

The Russian invasion of Ukraine is also expected to tighten seaborne iron ore markets over the rest of 2022. In 2021, combined exports for both countries were estimated at around 70 million tonnes (equivalent to around one month's export volumes for Australia), with major export destinations including China, the EU and Asia. This included around 30 million tonnes (or 20% of global supply) of agglomerated iron ore products, such as higher iron-content pellets and briquettes.

And in May this year, the Indian government announced a new 50% tax on exports of iron ore and concentrates. The move is seen as part of the government's efforts to substantially boost domestic steel output over the next few years (see *Steel chapter*). India exported around 36 million tonnes of iron ore in 2021, with around 85% of it going to China.

Weaker demand growth and more supply to push prices lower to 2024

The boost in new infrastructure investment and easier credit conditions in China this year, is expected to provide some support to prices for the rest of 2022. However, this is likely to be offset by further weakness in China's residential property sector, with new housing starts and home sales continuing to fall by double digits year-on-year in May (see *Steel chapter*).

The mixed demand picture comes alongside new supply which continues to come online from major producers in Australia, as well as an expected

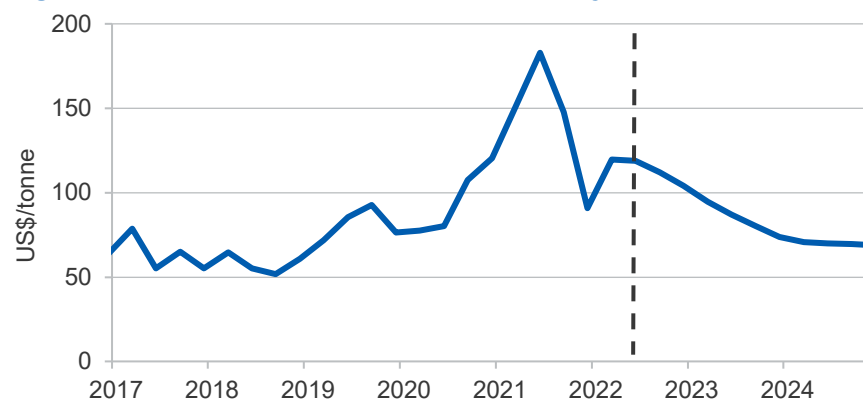
recovery in Brazilian supply for the rest of this year following recent weakness. The spot price for 62% Fe iron ore fines (FOB) for calendar 2022 is now forecast to average US\$115 per tonne in 2022.

Over the rest of the outlook period to 2024, iron ore prices are forecast to decline to lower long-run levels. This follows more modest growth in blast-furnace steelmaking (compared with the past decade) from major producers such as the EU, US and China, as the world undergoes a transition to a low emissions environment. This softer demand will also take place alongside growing supply from Australia and Brazil.

Earlier this year, the Chinese government announced a plan to further consolidate its steel industry, with an aim for the top 10 steel companies to account for 60% of the nation's steel output by 2025. Reports in June also suggested China's government is considering establishing a centralised iron ore purchasing platform. These developments would likely enhance Chinese producers' negotiating power in the seaborne iron ore market, and could put downward pressure on prices over the outlook period.

From a forecast average price of around US\$115 per tonne (FOB) in 2022, the benchmark iron ore price is projected to average US\$85 per tonne in 2023 and around US\$70 per tonne in 2024 (Figure 4.5).

Figure 4.5: Iron ore price outlook, quarterly



Notes: China import iron ore fines 62% Fe spot (FOB)

Source: Bloomberg (2022); Department of Industry, Science and Resources (2022)

4.3 World trade

Global iron ore supply falls slightly in the March quarter 2022

In the March quarter 2022, combined shipments for Australia, Brazil, South Africa and Canada — representing more than 80% of global seaborne supply — were estimated at around 305 million. This was a 3.1% fall year-on-year, and 0.6% lower than 2018 — the last full year of unaffected global supply prior to the 2019 Brumadinho tailings dam collapse in Brazil.

The total volume of iron ore exported from Australia in the March quarter 2022 was around 207 million tonnes. This was 1.1% higher compared with the March quarter 2021, and follows a comparatively dry start to 2022. The result also reflects a ramp up of major brownfield and greenfield projects for Rio Tinto, BHP and Fortescue in 2022, with further increases expected for the remainder of the year (see Australia section).

Total Australian exports are forecast to reach 894 million tonnes in 2022, an increase of 2.5% year-on-year. Over the outlook period, Australia's iron ore exports are projected to rise at an average annual rate of 2.8%, to reach around 950 million tonnes by 2024 (Figure 4.7).

Total shipments of iron ore from Brazil — the world's second largest exporter behind Australia — were around 72 million tonnes in the March quarter 2022. This was a fall of 21% (or 19 million tonnes) quarter-on-quarter, and 11% less than the same period in 2021.

Brazil's largest producer, Vale, had total production of 64 million tonnes in the March quarter 2022, a fall of 6.0% year-on-year. This followed a temporary halt to its Southern and South-eastern Systems operations in January due to rainfall (typical in the March quarter each year), and licensing and plant delays in its Northern System operations.

For 2022, Vale has retained its guidance at 320 to 335 million tonnes. The company expects to finalise the installation of new loaders and crushing plants in its Northern System, which should see its S11D project ramp up to 80 million tonnes per annum capacity through the year.

Over the outlook period, Vale is expecting to complete the first stages of raising its Itabiruçu dam (by the December quarter 2022). This dam forms part of the Itabira complex — with 40 million tonnes annual production capacity — and was shut down in 2019, in response to the Brumadinho tailings dam collapse. Its reopening is seen as a crucial step in the company's plan to return to 400 million tonnes per annum of production. Vale's aim also incorporates bringing its Serra Sul 120 project — with 20 million tonnes of additional capacity — into production by 2024.

Total Brazilian exports are forecast to reach 373 million tonnes in 2022, a rise of around 4.5% compared with 2021. Over the outlook period, Brazil's total iron ore export volumes are projected to grow by around 5.8% annually, to reach around 420 million tonnes by 2024 (Figure 4.7).

In 2022, combined exports from other major producers South Africa, Canada and India are forecast to fall by 7.5% to reach 147 million tonnes. This is primarily due to a projected fall (of around 20%) in Indian exports. While India's iron ore exports rose in 2021 — in response to strong Chinese demand — India is expected to continue boosting its domestic steelmaking capacity. This will involve securing greater domestic supply of raw materials, such as iron ore.

Canada is forecast to record a modest (3.7% or 2 million tonne) increase in iron ore exports in 2022. This incorporates Champion iron completing its first shipment of high-grade 66.2% iron concentrate from its Bloom Lake Phase II project in May. The company anticipates the expansion of the project's commercial production capacity (15 million tonnes per annum combined with the Phase I project) towards the end of 2022.

Over the outlook period to 2024, world iron ore exports (exc. Australia and Brazil) are projected to decline modestly, with most new supply expected to replace depleting projects.

Conflict in Ukraine expected to see restructuring of ferrous markets

The Russian invasion of Ukraine is now projected to see a reorganisation of iron ore and steel exports for both countries over the remainder of 2022 (and likely beyond). This is expected to see some loss of iron ore supply in

global seaborne trade, though this should be mitigated by the redirection of products to new markets.

Ukraine exported 44 million tonnes of iron ore in 2021 (around 2.7% of global supply). With the majority of Ukraine's iron ore mines based in areas outside major conflict zones, key producers have been able to maintain partial production and exports in recent months. This has involved the use of rail and river barges to circumvent the closure of the country's primary export hub at the port of Pivdennyi. Reduced demand from domestic steel mills — with many located in Russian-held or contested territory — has also seen some reallocation of iron ore supply toward export markets.

In 2021, Russia exported around 25 million tonnes of iron ore, with major markets including the EU (41% or 10.4 million tonnes) and China (39% or 9.7 million tonnes). In addition to iron and steel import bans (see *Steel chapter*), a number of major European steelmakers have announced the removal of Russian materials (such as iron ore) from their steel supply chains. While Russia temporarily suspended publication of trade data in late April, reports suggest a fall of as much as 30% month-on-month in March for iron ore exports (and a similar fall for ferrous products).

Over time, Russia is expected to seek new markets for displaced export volumes previously sent to Europe. However, this reorganisation may be constrained by logistical issues in shipping to regions such as Asia, as well as ongoing self-sanctioning by other non-European steel producers.

China continuing to develop iron ore supply sources in Africa

In March this year, the China Iron and Steel Association announced a new 'cornerstone plan' to diversify the country's iron ore supply chain: Australia currently accounts for over 60% of the nation's iron ore imports. The plan includes an aim to increase equity output from overseas mines (from 120 million tonnes in 2020) to 220 million tonnes by 2025.

The most notable prospect is the Simandou iron ore mine, located in Guinea, with a potential production capacity of 200 million tonnes per year (around 15-20% of output currently produced in the Pilbara region of

Western Australia). The project requires significant investment in mining-related and transport infrastructure to get minerals to market, including the development of a new port and 650 kilometres of new railway, which got underway in 2021.

Following a full halt of the project by Guinea's ruling junta at the start of March this year, a new agreement has now been signed with Rio Tinto and partners (who own blocks 3 and 4 of the project) and a Chinese-backed consortium SMB Winning (who own blocks 1 and 2). The deal includes strict timelines, including all port and rail infrastructure to be finished by 2024, and commercial production to begin by 31 March 2025.

A number of smaller mines in Africa also remain under development. In May this year, Chinese steel producer Sinosteel signed a 50 year contract with the Cameroonian government to mine the Lobe mine, with an expected production of around 4 million tonnes of high grade ore per year.

The global seaborne iron ore market is expected to remain relatively balanced over the outlook period, with growth in exports from both Australia and Brazil over the next few years. However, the persistence of supply chain disruptions and inflationary pressures presents a growing risk to steel demand growth over the outlook, which has repercussions for iron ore demand over the period.

4.4 Australia

Rise in export volumes in 2022 lessens fall in prices from first half of 2021

Australia's total iron ore export earnings in the March quarter 2022 were \$31 billion, a 20% (or \$7.5 billion) fall year-on-year. The decrease primarily reflects the lower price for iron ore in 2022, with the unit export price for March quarter averaging around \$154 per tonne, 31% lower compared with the same period in 2021.

Australia exported 207 million tonnes of iron ore in the March quarter 2022. While this was 8.6% (or 19 million tonnes) lower quarter-on-quarter, it reflects the typical seasonal pattern for Australian iron ore exports, where wet weather in the northern part of the country impacts the March quarter most intensely each year (Figure 4.6). Compared with the same

period last year, export volumes for the March quarter 2022 were 1.1% higher. This follows the ongoing ramp up of projects for Rio Tinto, BHP and Fortescue (Gudai Darri, South Flank and Eliwana respectively) so far in 2022, with further production gains expected over the rest of 2022.

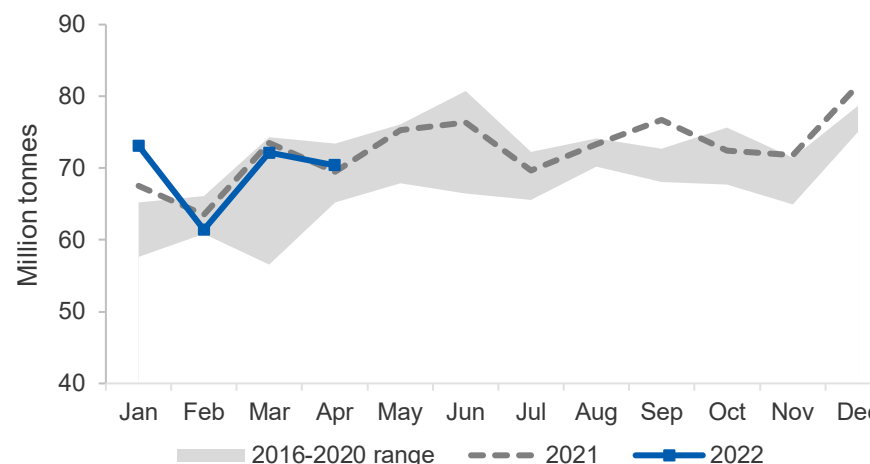
However, despite the improvement, major producers continued to identify supply and labour shortages, compounded by the COVID-19 border restrictions in place until March this year. This, is in addition to the outbreak of record rainfall in the Pilbara in May, and a negative Indian Ocean Dipole that could see further disruptions to production and exports in the June and September quarters.

Iron ore exports to China reached close to \$26 billion in the March quarter 2022, around 83% of Australia's total iron ore export earnings. By value, Australia's exports to China in the March quarter 2022 were 21% lower year-on-year, while volumes (171 million tonnes) were 1.6% higher.

Rio Tinto shipped 72 million tonnes of iron ore in the March quarter 2022. This was a fall of 15% quarter-on-quarter, and 8% lower than the same period in 2021. The company has cited the continuing impact of resource shortages and supply chain quality issues through 2022. Despite these issues, the company expects a continued lift in production volumes for these projects over the remainder of 2022, and have left their full year (2022) guidance steady at 320-335 million tonnes. This includes its new 43 million tonne per annum greenfield project Gudai Darri, which delivered its first ore in June this year.

BHP's iron ore output was nearly 60 million tonnes in the March quarter 2022. This was a fall of 10% quarter-on-quarter, but was flat compared with the same period in 2021. The company acknowledged the substantial impact that temporary labour constraints (related to COVID-19) have had, notably with train driver shortages. BHP also flagged maintenance work undertaken — for both rail and port infrastructure — during the quarter, as having had an impact on overall volumes. BHP has retained 2021–22 financial year guidance at 249-259 million tonnes. This includes a ramp up of its South Flank project, which achieved an average production rate of 58 million tonnes per annum in the March quarter 2022.

Figure 4.6: Australian monthly iron ore export volumes



Source: ABS (2022) *International Trade, Australia*, 5368.0; Department of Industry, Science and Resources (2022)

Fortescue's total iron ore exports were 47 million tonnes in the March quarter 2022. This was a fall of 2% quarter-on-quarter, but a 10% rise compared with the same period in 2021. Total shipments of 140 million tonnes for the nine months to March 2022 also represented a new record for the company. The strong result was underpinned by the continued ramp up of the company's Eliwana project, which was already running at its nameplate production capacity of 30 million tonnes per annum in April. The result was reflected a reduced impact from labour shortages, due to the company's use of autonomous haulage fleet. As a result, Fortescue has raised its 2021–22 fiscal year production guidance (from 180-185 million tonnes) to 185-188 million tonnes.

Fortescue is also continuing to develop its 22 million tonne per annum Iron Bridge Magnetite Project (with production ramp up expected over the next 12 to 18 months). This included the key milestones of the unloading of five module ships at Port Hedland, and advanced progress on the installation of a crusher in the March quarter.

In February this year, the Western Australian Government approved the development plan to increase Port Hedland's export capacity to 660 million tonnes of iron ore per year (previously 495 million tonnes per annum). This plan includes a substantial increase in allocation for BHP, Fortescue and Roy Hill. The WA Government has provided funding as part of its 2022–23 Budget for road infrastructure to the port, as well as dredging of the port. The WA Government expects final approvals by mid-2022.

Export values to ease over outlook on moderating prices

Higher production volumes and stable prices are estimated to have led to Australia's iron ore export earnings reaching around \$133 billion in 2021–22. Lower prices are forecast to lead to lower earnings for iron ore over the outlook period, with total export value of \$116 billion in 2022–23, before falling to \$85 billion by 2023–24 (Figure 4.7).

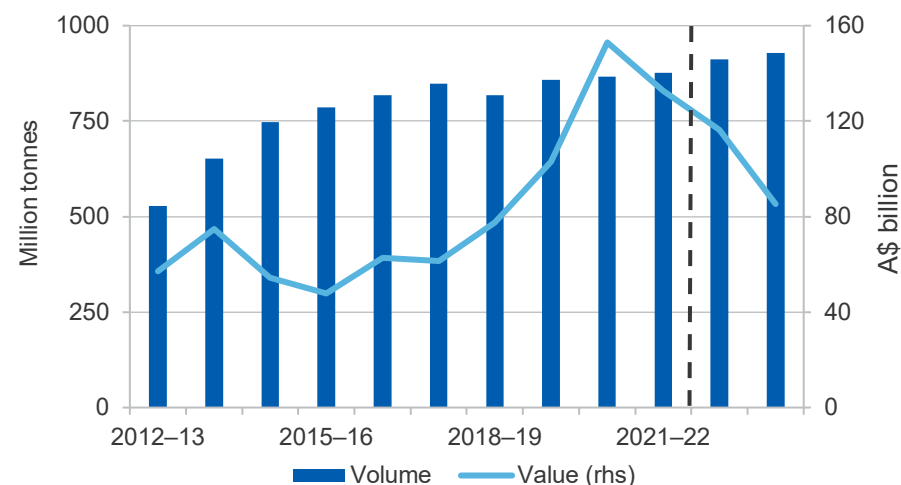
Iron ore exploration expenditure lifted in March quarter

A total of \$139 million was spent on iron ore exploration in the March quarter 2022 (Figure 4.8). This was an increase of 6.6% compared with the previous quarter, and 38% higher than the same quarter in 2021. Exploration has remained elevated in recent quarters following iron ore prices reaching historical highs in the first half of 2021.

Revisions

Forecast export earnings for 2021–22 (in nominal terms) have been revised downwards from \$135 billion in the March 2022 *Resources and Energy Quarterly* to \$133 billion in this edition, due to weather and COVID-19 related impacts to export volumes. Export earnings have been revised up (by around \$8 billion) to \$116 billion for 2022–23. This reflects an expectation of a slower fall in iron ore prices through 2023. Forecast export earnings for 2023–24 remain around \$85 billion.

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



Source: ABS (2022) International Trade, Australia, 5368.0; Department of Industry, Science and Resources (2022)

Figure 4.8: Australian iron ore exploration expenditure



Source: ABS (2022) Mineral and Petroleum Exploration, Catalogue 8412.0

Table 4.1: World trade in iron ore

	Million tonnes				Annual percentage change		
	2021	2022 ^f	2023 ^f	2024 ^f	2022 ^f	2023 ^f	2024 ^f
World trade	1,626	1,628	1,667	1,729	0.1	2.4	3.7
Iron ore imports							
China	1,126	1,124	1,118	1,107	-0.1	-0.6	-0.9
Japan	113	116	116	115	2.6	0.3	-1.0
European Union	94	86	88	91	-8.6	3.4	2.5
South Korea	74	79	81	83	6.1	2.6	2.3
Rest of Asia ^a	57	73	76	85	26.8	5.1	11.1
Iron ore exports							
Australia	872	894	915	948	2.5	2.3	3.6
Brazil	357	373	398	423	4.5	6.7	6.3
South Africa	68	69	70	71	1.5	1.4	1.4
Canada	54	56	57	57	3.7	1.8	0.0
Ukraine	44	28	29	30	-36.0	3.5	3.4

Notes: ^a Excludes China, Japan, South Korea, Taiwan and India; ^f Forecast; ^r Compound annual growth rate;

Source: World Steel Association (2022); International Trade Centre (2021); Department of Industry, Science and Resources (2022)

Table 4.2: Iron ore outlook

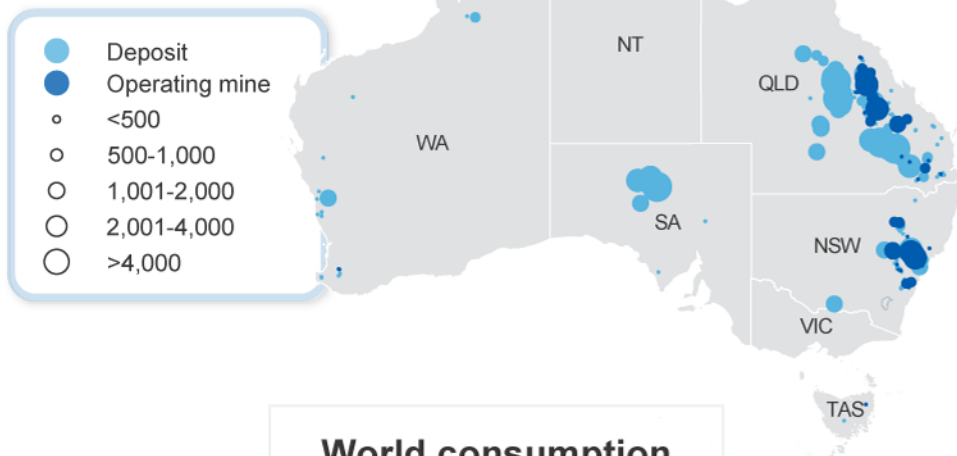
			Million tonnes			Annual percentage change		
World	Unit	2021	2022 ^f	2023 ^f	2024 ^f	2022 f	2023 f	2024 ^f
Prices ^a								
– nominal	US\$/t	143	114	84	70	-20.6	-26.2	-16.9
– real ^b	US\$/t	148	114	82	66	-23.3	-28.0	-19.1
Australia	Unit	2020–21	2021–22 ^f	2022–23 ^f	2023–24 ^f	2021–22 ^f	2022–23 ^f	2023–24 ^f
Production								
– Steel ^e	Mt	5.7	5.3	5.2	5.2	-7.3	-1.0	-0.4
– Iron ore	Mt	913	938	970	992	2.8	3.3	2.3
Exports								
Steel ^e	Mt	0.8	0.7	0.9	0.9	-7.7	24.9	-0.4
– nominal value	A\$m	773	857	811	807	10.8	-5.4	-0.4
– real value ^g	A\$m	794	883	909	892	11.2	2.9	-1.9
Iron ore	Mt	867	876	911	929	1.1	4.0	2.0
– nominal value	A\$m	152,975	132,798	116,295	85,311	-13.2	-12.4	-26.6
– real value ^g	A\$m	159.604	132.798	111.093	78.894	-16.8	-16.3	-29.0

Notes: **b** fob Australian basis; **c** Spot price, 62% iron content basis; **d** In 2021 US dollars; **e** In 2021–22 Australian dollars; **f** forecast; **h** Crude steel equivalent; Crude steel is defined as the first solid state of production after melting. In ABS Australian Harmonized Export Commodity Classification, crude steel equivalent includes most items from 7206 to 7307, excluding ferrous waste and scrap and ferroalloys; **i** In 2020–21 Australian dollars; **r** Compound annual growth rate; **s** estimate; **z** Projection

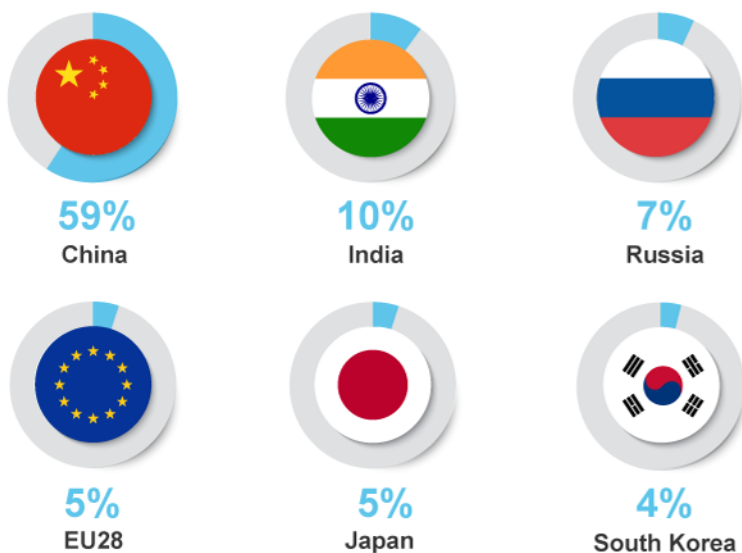
Source: ABS (2021) International Trade in Goods and Services, Australia, 5368.0; Bloomberg (2021) Metal Bulletin; World Steel Association (2021); AME Group (2021); Company Reports; Department of Industry, Science and Resources (2022)

Metallurgical coal

Major Australian coal deposits, Mt



World consumption



Metallurgical coal



Metallurgical coal is primarily used **to make steel**



Contains **more carbon and less ash & moisture** than thermal coal



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



Electric arc furnaces do not use met coal as a raw material

Australia's metallurgical coal



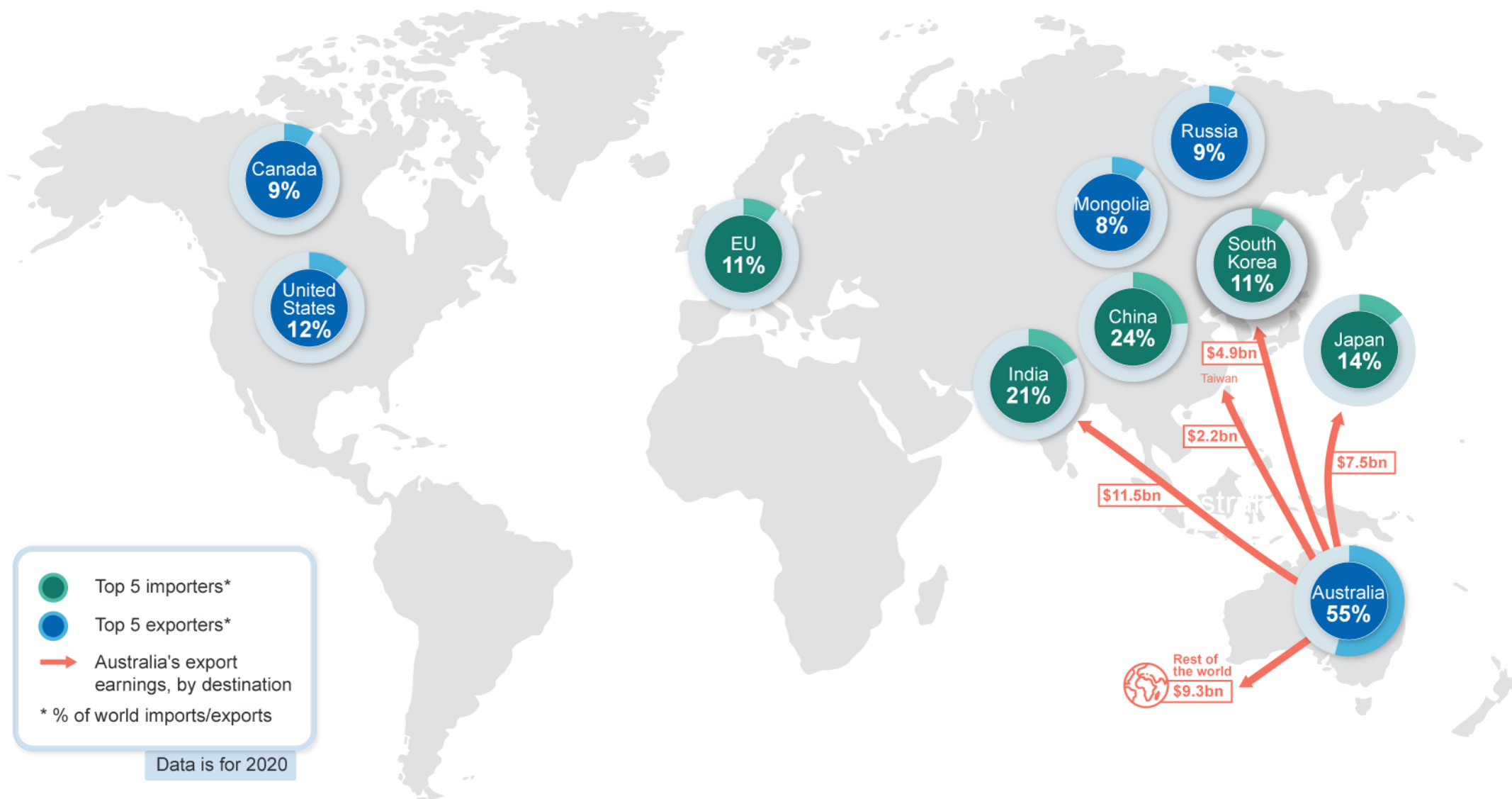
World's no.1 metallurgical coal exporter



170m tonnes of metallurgical coal exported each year



Almost all of Australia's production is **exported**



5.1 Summary

- Metallurgical coal prices remain at historic highs, pushed up by supply disruptions and market uncertainties as a result of fallout from the Russian invasion of Ukraine. The Australian premium hard coking coal price is forecast to average over US\$420 a tonne in 2022, but is expected to fall by almost half as supply conditions normalise. Prices are ultimately expected to reach around US\$220 a tonne by 2024.
- Higher production in NSW and Queensland is expected to push Australia's exports up from 171 million tonnes in 2020–21 to 174 million tonnes by 2023–24 (see [Australia section](#)).
- Australia's metallurgical coal export values are forecast to track with price movements, rebounding from \$23 billion in 2020–21 to peak above \$60 billion in 2022–23, before falling back to \$41 billion by 2023–24.

5.2 World trade

Conditions in metallurgical coal markets remained unstable in the June quarter, with disruptions continuing and prices becoming increasingly erratic. Average daily price moves were above US\$15 a tonne through April, well above the typical level of under \$1 per day. Inventories remain tight, and steelmaking remains subject to significant geopolitical uncertainties in Europe and COVID-induced shutdowns in China.

Australian supply recovered in April, but renewed rains in May disrupted operations in parts of NSW and Queensland. Producers in the US and Australia have previously pushed to expand output and restart paused mines, with some of this effort now paying off.

Russian coal continues to reach Europe, though with less reliability than before. This flow of metallurgical coal is expected to largely cease by August, when the full sweep of EU sanctions takes effect.

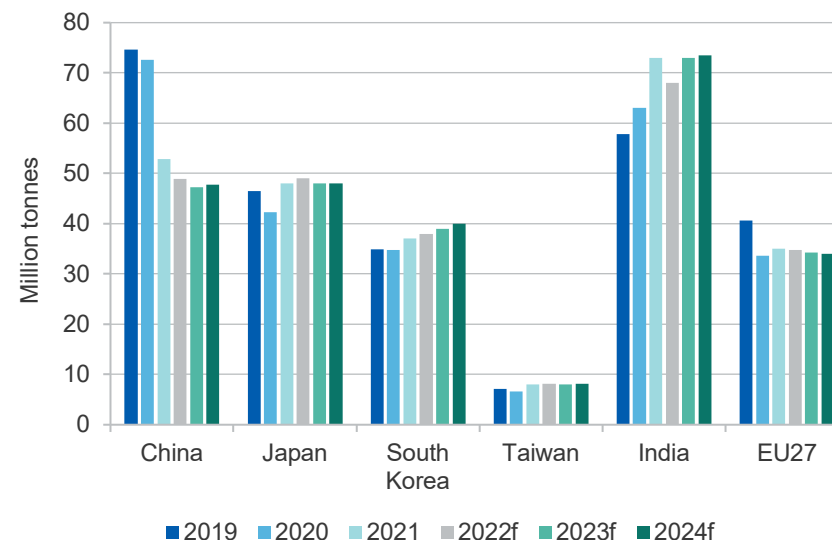
On the demand side, renewed outbreaks of the COVID-19 pandemic in China have reduced growth expectations for steel production and industrial activity. With lockdowns occurring unpredictably, there is potential for further impacts on steelmaking and manufacturing hubs.

Global automotive manufacturing appears to have flattened, most notably in Europe where disruptions to trade flows with Russia have flowed on to automotive supply chains. A sharp fall in output of Ukrainian automotive products (which include cables and control switches) has also affected automotive manufacturing. This development has exacerbated the impact of longer-term chip shortages, which were affecting global carmakers before the Russian invasion of Ukraine.

These disruptions are expected to cut steel demand in Europe and steel production in China, leading to falls in metallurgical coal imports in the last half of 2022. However, growth conditions are expected to return in 2023.

On balance, world metallurgical coal trade is forecast to increase from 317 million tonnes in 2021 to 331 million tonnes by 2024. The bulk of the growth in trade is expected in the 2023 and 2024, as global steelmaking and industrial activity pick up (Figure 5.1).

Figure 5.1: Metallurgical coal imports



Notes: f forecast

Source: IHS (2022); Department of Industry, Science and Resources (2022)

5.3 World imports

Chinese metallurgical coal imports are trending down

Chinese metallurgical coal imports edged back in the first half of 2022, constrained by falling construction activity and COVID-19 disruptions. After an earlier surge in dwelling construction and real estate speculation, China now appears to have excess capacity in parts of its residential property market, with substantial vacancy levels apparent in many cities. Real estate markets have softened in recent quarters, and dwelling construction is expected to remain relatively soft over the outlook period. The recent easing in dwelling construction has cut steel usage, exacerbated in recent months by repeated outbreaks of COVID-19. China has responded to such outbreaks with stringent containment measures that have shut down cities and industrial hubs, including Tangshan (a large steel making province).

Despite this, data suggest some growth in steel output over recent months, as winter production cuts ended. Many Chinese mills have also commenced restocking. Supply from Mongolia has lifted, following the completion of recent upgrades to transport infrastructure.

Responding to potential declines in its growth outlook, the Chinese Government has announced plans to invest in infrastructure as a stimulus measure. Details about the type and quantity of investment are yet to be released, but previous infrastructure packages have involved the high use of steel. Risks remain that future COVID-19 lockdowns could disrupt infrastructure rollouts, by shutting down construction zones or by paralysing the supply chains needed to support them.

Chinese steel production edged down by 3% in 2021; output was curbed by policy interventions intended to dampen steel production in line with energy consumption and environment/emissions controls, but also amidst record iron ore and metallurgical coal prices.

Chinese domestic metallurgical coal prices have fallen by around a third since the renewed wave of COVID-19 containment measures. However, import prices have remained high, and rising imports in March and May (following unusually low imports in January and February) contributed.

India's metallurgical coal imports are recovering

Indian steel production has been strong, with more than 10 million tonnes produced in each month of the March quarter of 2022. Recent growth in steel production has been largely met from domestic output of metallurgical coal, which was around one-third higher in the March quarter of 2022 relative to the same period in 2021. Supply disruptions linked to COVID-19 appear to have eased.

Imports of metallurgical coal have been largely steady, but there are signs of success in India's ongoing effort to diversify its supply sources. Australia accounted for almost three-quarters of Indian metallurgical coal imports in 2021, while import shares from Canada and the US slumped to 3% and 5%, respectively. However, heavy rainfall and COVID-19 issues disrupted Australian supply to India in the first half of 2022. Efforts are underway to source more metallurgical coal from Russia, and expansions in rail capacity between Russia and India continue to progress.

India's metallurgical coal needs are likely to grow over the next two years. Indian steelmakers have US\$11 billion worth of projects announced, some of which are timetabled for completion by the mid-2020s. Indian metallurgical coal imports — already the largest in the world — are expected to grow further over the outlook period (Figure 5.1). However, progress has also been made in recent efforts to unlock domestic coal supply.

Japanese imports are picking up faster

Japanese steelmaking has partly recovered from COVID-19 related declines, supported by strong consumer white goods sales. Imports rose in 2021 and are expected to grow again (marginally) in 2022. However, a gradual closure of steelmaking plants is likely to slow Japanese metallurgical coal demand over the longer term.

5.4 World exports

Global metallurgical coal supply is recovering as disruptions related to weather events and COVID-19 ease. However, the market continues to face elevated risk premiums and high freight costs. The EU ban on Russian coal may add further volatility from August, when the policy takes full effect.

COVID-19 impacts are hampering US efforts to capitalise on strong prices

US metallurgical coal exports have not managed to scale up significantly, despite several quarters of unusually high prices. Production has been affected by longwall moves and delays in bringing idled mines back into production. Labour issues have also affected US mining companies, though these effects are expected to ease somewhat in the second half of 2022, allowing exports to edge higher (Figure 5.2).

US transport infrastructure remains under high pressure, with rail networks still affected by maintenance issues and parts shortages. Several barges have also faced maintenance problems, further constraining inland coal transit. An explosion caused by accumulated coal dust severely affected CSX's Curtis Bay Piers in December 2021, with repairs yet to be finished.

Russia has maintained exports, but with a fall in prospect

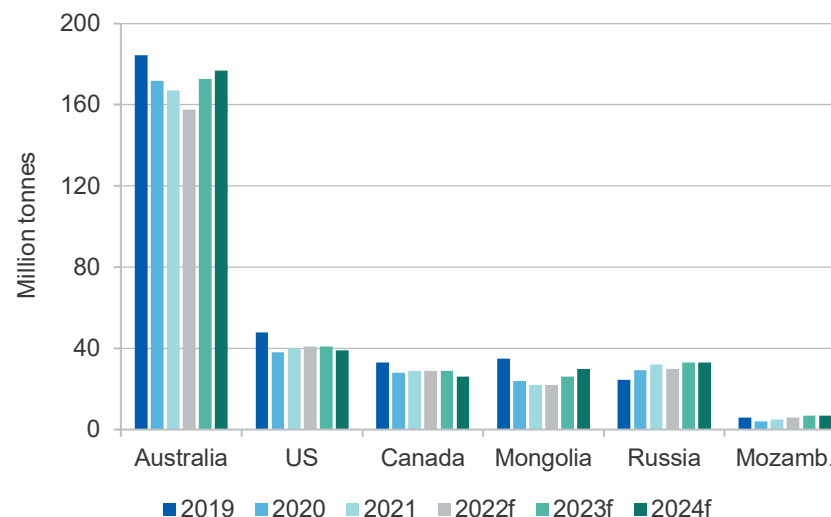
Russian exports remained steady at the time of writing, supported in part by increased interest from China, which has strong freight infrastructure connections with Russia. China may benefit from the price penalty beginning to accrue to Russian metallurgical coal following recent announcements by the EU of an impending ban.

Some Russian shipments to Europe have already been stalled or curbed by ad-hoc port closures and decisions by individual companies. However, the full formal ban is not yet in effect. There has been an increase in Russian imports to a number of European jurisdictions, which has helped build inventories ahead of the ban. Russia previously exported around 10 million tonnes of metallurgical coal to Ukraine every year, another 7 million tonnes to the EU, and 5 million tonnes to Japan. Flows to Ukraine have already halted, and flows to Europe are expected to cease by August. The

Japanese Government has also committed to a ban on Russian coal exports, but has not yet committed to a formal timetable. Imports from Russia are likely to fall towards zero as the ban comes into effect over subsequent quarters.

Redirection is not likely to absorb the full 22 million tonnes cut loose from European and Japanese markets. China has raised its Russian exports somewhat, but has also met some of its needs from higher domestic production. Further growth in metallurgical coal trade flows between the two countries is likely to be somewhat modest. India could draw in up to half of the displaced Russian supply, with Vietnam and other Asian countries potentially absorbing further flows. However, at least 5 million tonnes of Russian is expected to withdraw from the world market by mid 2023.

Figure 5.2: Metallurgical coal exports



Notes: f forecast

Source: IHS (2022); Department of Industry, Science and Resources (2022)

Mongolia's exports have stopped falling, as COVID-19 impacts peak

Mongolian exports are expected to expand over time (Figure 5.2), with Chinese investment helping to develop the previously minimal freight rail links between the two countries. Mongolian metallurgical coal exports have historically been dominated by truck shipments, but the launch of three railway lines in 2022 should underpin a more efficient and stable transportation system. Mongolian exports are forecast to increase by almost a third between 2021 and 2024.

Exports from Canada are set to rise, as a new mine ramps up

Canadian metallurgical coal exports are expected to lift slightly in 2022, driven by the restart of Canada Coal's Grand Cache mine (which has historically produced about 2 million tonnes of coal annually). The mine was shut down in 2020, after the outbreak of the COVID-19 pandemic. While the restart may take some time (given an eighteen month period of care and maintenance), it is expected to complete as 2023 begins.

The return of production at Grand Cache, and generally strong conditions for Canadian exporters, are expected to see exports remain solid through to the end of the outlook period (Figure 5.2).

Exports from Africa are recovering

Mozambique's exports fell sharply to 4 million tonnes in 2020, as low prices severely affected the nation's relatively high cost producers. Exports are forecast to recover to 7 million tonnes by 2024. This growth is expected to be driven by Vale's Moatize mine — where work has finished on a preparation plant upgrade — and by upgrades to the Nacala logistics corridor rail line and port. Higher output at the Moatize site may be temporarily affected by seasonal heavy rainfall, but growth to over 8 million tonnes of metallurgical coal (annually) is expected over the longer term.

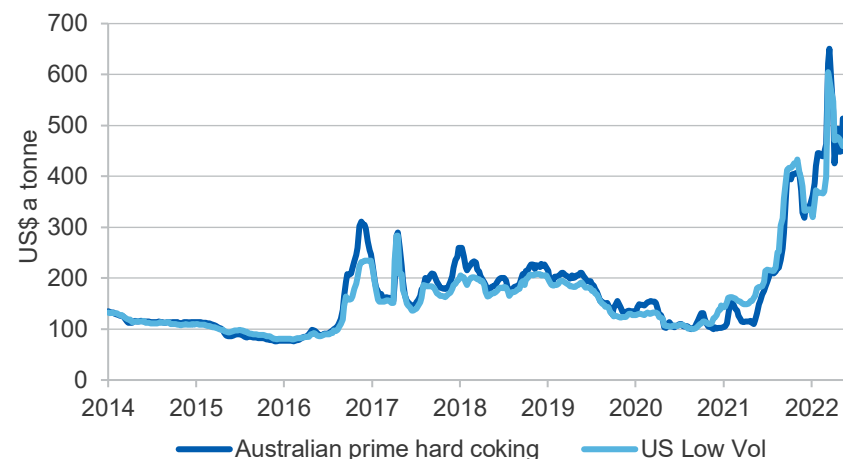
South African exports have been affected by repeated disruptions of rail transport, with the owners announcing that coal export production will not be fully transportable until the end of 2022. This has led to reduced output and rising stockpiles at some sites.

5.5 Prices

Metallurgical coal prices are expected to ease gradually

Metallurgical coal prices have risen by around US\$120 a tonne (to more than US\$520 a tonne) in the wake of the Russian invasion of Ukraine (Figure 5.3). Price pressures softened in April, as disruptive weather conditions in Australia eased momentarily, allowing some extra supply to enter markets. However, renewed flooding in May and June is affecting Australian coal output again.

Figure 5.3: Metallurgical coal prices – Australian Prime Hard vs US Low Vol, FOB



Source: IHS (2022). Low vol = low volatile coking coal.

Prices are expected to ease over the forecast period, with volatility also expected to decline. However, price and volatility are both likely to remain above typical levels through the outlook period. A range of factors (weather events, potential COVID disruptions, import bans from China and Europe, and the conflict in Ukraine) will all play out in unpredictable ways over the next two years. Risks remain mostly on the supply side, with low inventories likely to exacerbate the impact of any further supply disruptions in 2022.

5.6 Australia

Metallurgical coal export earnings have risen despite supply issues

Australian metallurgical coal exports and prices have lifted recently (Figures 5.4 and 5.5). The rise has been driven by strong growth in demand in several major markets, including Japan, Taiwan, and South Korea. Brazil, typically a minor market, has seen rapid growth in recent months. Exports to Europe rose by almost 25% in the year to March 2022.

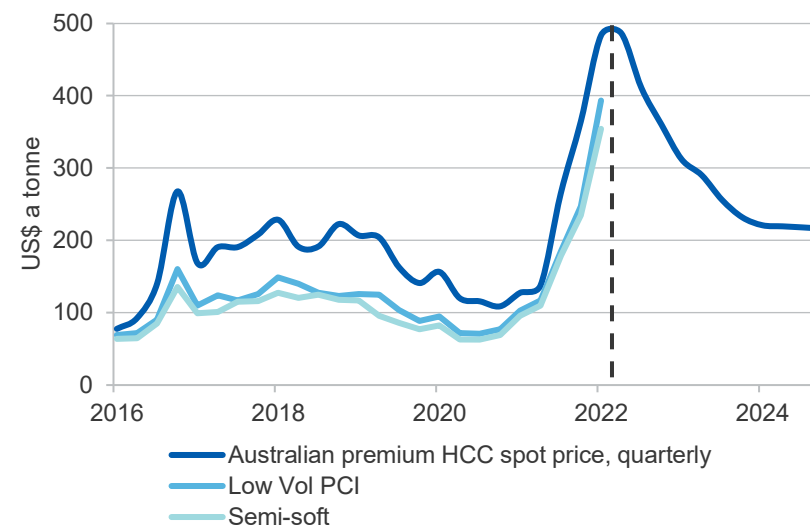
Work on unlocking additional capacity continues, with QCoal's Cook mine now operational. This mine is one of several small restarts and expansions, with most expected to take effect over coming months.

Weather conditions eased in April, as the La Niña period weakened. However, renewed floods in the Bowen Basin have again affected output, flooding several mines. Rains have exceeded 250mm in some mining pits, with pit owners currently assessing their options for resuming mining. At this stage, no declarations of force majeure have been made, though dewatering is expected to take several weeks. Flooding has also affected port and rail facilities, with the Abbot Point coal terminal reporting that moisture levels for their coal stockpiles are now near the maximum limit allowable for shipping.

Ongoing weather issues represent the primary risk to Australian production at present, with labour and shipping issues caused by the COVID-19 pandemic now easing. Over the longer term, renewed stimulus measures around the world are expected to offset some of the risk associated with potential further waves of the COVID-19 pandemic, though the timing of this remains unclear (see *Macroeconomic chapter*).

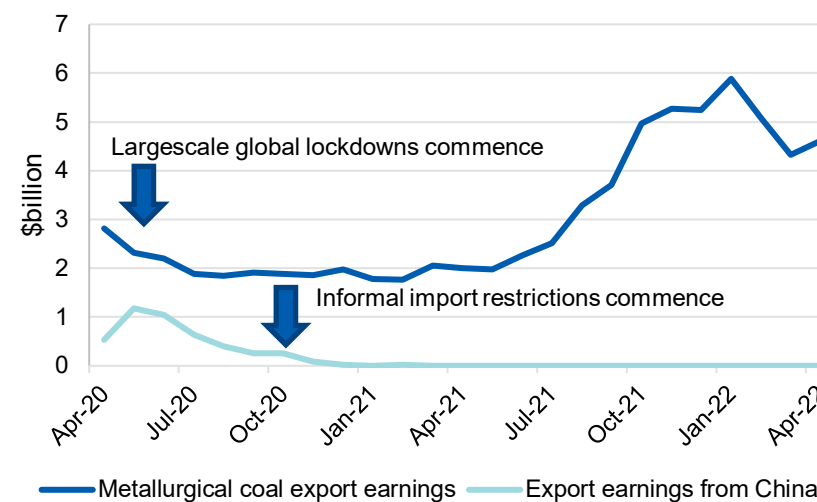
Changes in consumption patterns (as countries seek to reduce carbon emissions) could have unpredictable effects, with risks on the demand side. On balance, Australian export earnings are expected to remain well above pre-COVID levels through the early part of the outlook period, despite some short-term constraints on volumes. Higher demand from India is expected to support Australian exports, though buyers in Japan, South Korea and Taiwan have also expressed interest in higher supply.

Figure 5.4: Australian metallurgical coal spot price, quarterly



Source: Platts (2022); Department of Industry, Science and Resources (2022)

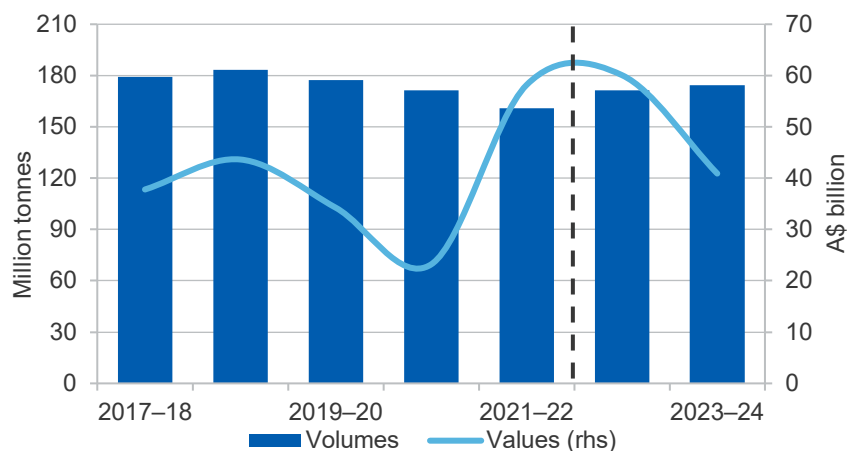
Figure 5.5: Australia's metallurgical coal export values, monthly



Source: ABS (2022) International Trade, Australia 5454.0

Metallurgical coal export earnings were \$23 billion in 2020–21 (Figure 5.6). Prices are set to deliver a large windfall to metallurgical coal producers in 2022–23, with export values estimated to rise to over \$60 billion. A decline to a (still-high) \$41 billion is expected by 2023–24, as seasonal and short-term supply issues pass and supply and demand come into balance.

Figure 5.6: Australia's metallurgical coal exports

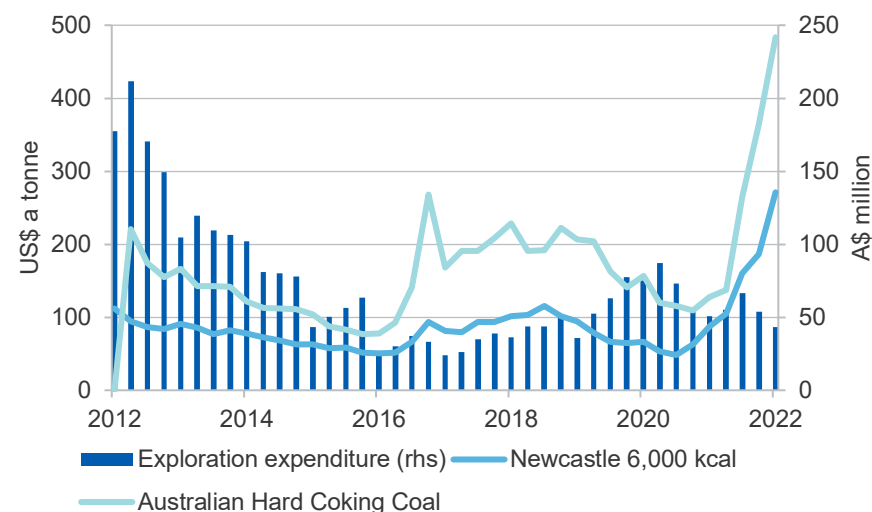


Source: ABS (2022) International Trade, Australia 5454.0; Department of Industry, Science and Resources (2022)

Coal exploration expenditure has declined

Australia's coal exploration expenditure decreased to \$43 million in the March quarter, to be 15% off the level of March 2021. Prices have risen markedly for Australian coal in recent months, but thermal coal producers face issues with finance, insurance and social licence. Exploration is thus likely to be dominated by metallurgical coal in future (Figure 5.7).

Figure 5.7: Australian coal exploration expenditure and prices



Source: ABS (2022); IHS (2022); Platts (2022)

Revisions to the outlook for Australian metallurgical coal exports

The forecast for export earnings has been revised up by around \$20 billion (nominal terms) in aggregate over the forecast period. Revisions reflect recent large price movements and growing disruptions linked to unusually severe weather events and the Russian invasion of Ukraine.

Table 5.1: World trade in metallurgical coal

	Unit	2021	2022	2023 ^f	2024 ^f	Annual percentage change		
						2022	2023 ^f	2024 ^f
World trade	Mt	317	306	330	331	-3.4	7.8	0.3
Metallurgical coal imports								
China	Mt	53	49	47	48	-7.5	-3.5	1.1
India	Mt	73	68	73	73	-6.8	7.3	0.7
Japan	Mt	48	49	48	48	2.1	-2.0	0.0
European Union 28	Mt	35	35	34	34	-0.6	-1.5	-0.8
South Korea	Mt	37	38	39	40	2.7	2.6	2.6
Metallurgical coal exports								
Australia	Mt	167	164	173	177	-1.8	5.5	2.2
United States	Mt	40	41	41	39	2.5	0.0	-4.9
Canada	Mt	29	29	29	26	0.0	0.0	-10.3
Russia	Mt	32	30	33	33	-6.3	10.0	0.0
Mongolia	Mt	22	22	26	30	0.0	18.2	15.4
Mozambique	Mt	5	6	7	7	20.0	16.7	0.0

Notes: ^f Forecast; ^s Estimate.

Source: IEA (2022) Coal Information; IHS (2022); Department of Industry, Science and Resources (2022)

Table 5.2: Metallurgical coal outlook

						Annual percentage change		
World	Unit	2021	2022	2023 ^f	2024 ^f	2022 ^f	2023 ^f	2024 ^f
Contract prices ^e								
– nominal	US\$/t	205	423	293	220	106.4	-33.1	-22.3
– real ^d	US\$/t	221	423	285	209	91.6	-34.9	-24.0
Spot prices ^g								
– nominal	US\$/t	224	435	273	219	94.6	-37.4	-19.7
– real ^d	US\$/t	241	435	265	208	80.6	-39.1	-21.5
Australia	Unit	2020–21	2021–22 ^s	2022–23 ^f	2023–24 ^f	2021–22 ^s	2022–23 ^f	2023–24 ^f
Production	Mt	171	170	184	186	-0.6	7.9	1.1
Export volume	Mt	171	161	171	174	-5.9	6.2	1.8
– nominal value	A\$m	23,187	58,151	60,090	40,896	150.8	3.3	-31.9
– real value ⁱ	A\$m	24,192	58,151	57,402	37,819	140.4	-1.3	-34.1

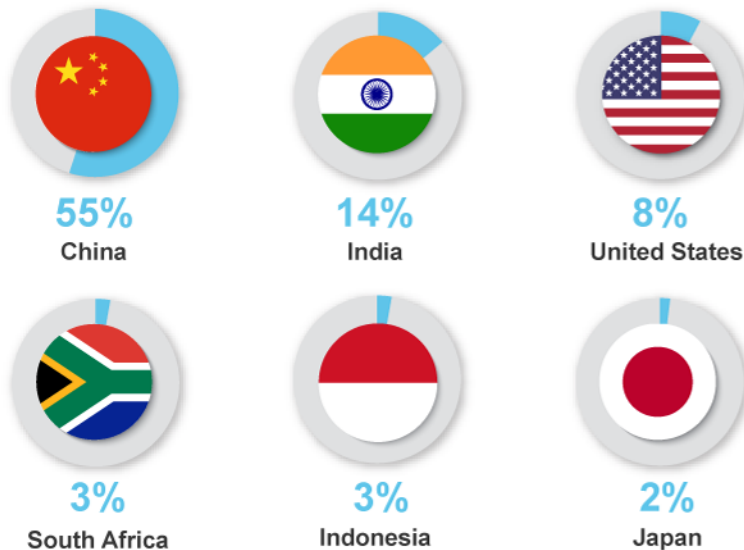
Notes: ^d In 2022 US dollars. ^e Contract price assessment for high-quality hard coking coal. ⁱ In 2021–22 Australian dollars. ^f Forecast. ^g Hard coking coal fob Australia east coast ports. ^s Estimate.
Source: ABS (2022) International Trade in Goods and Services, Australia, 5368.0; Department of Industry, Science and Resources (2022); Platts (2022)

Thermal coal

Major Australian coal deposits, Mt



World consumption



Thermal coal



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



Coal supplies **over one-third** of global electricity generation



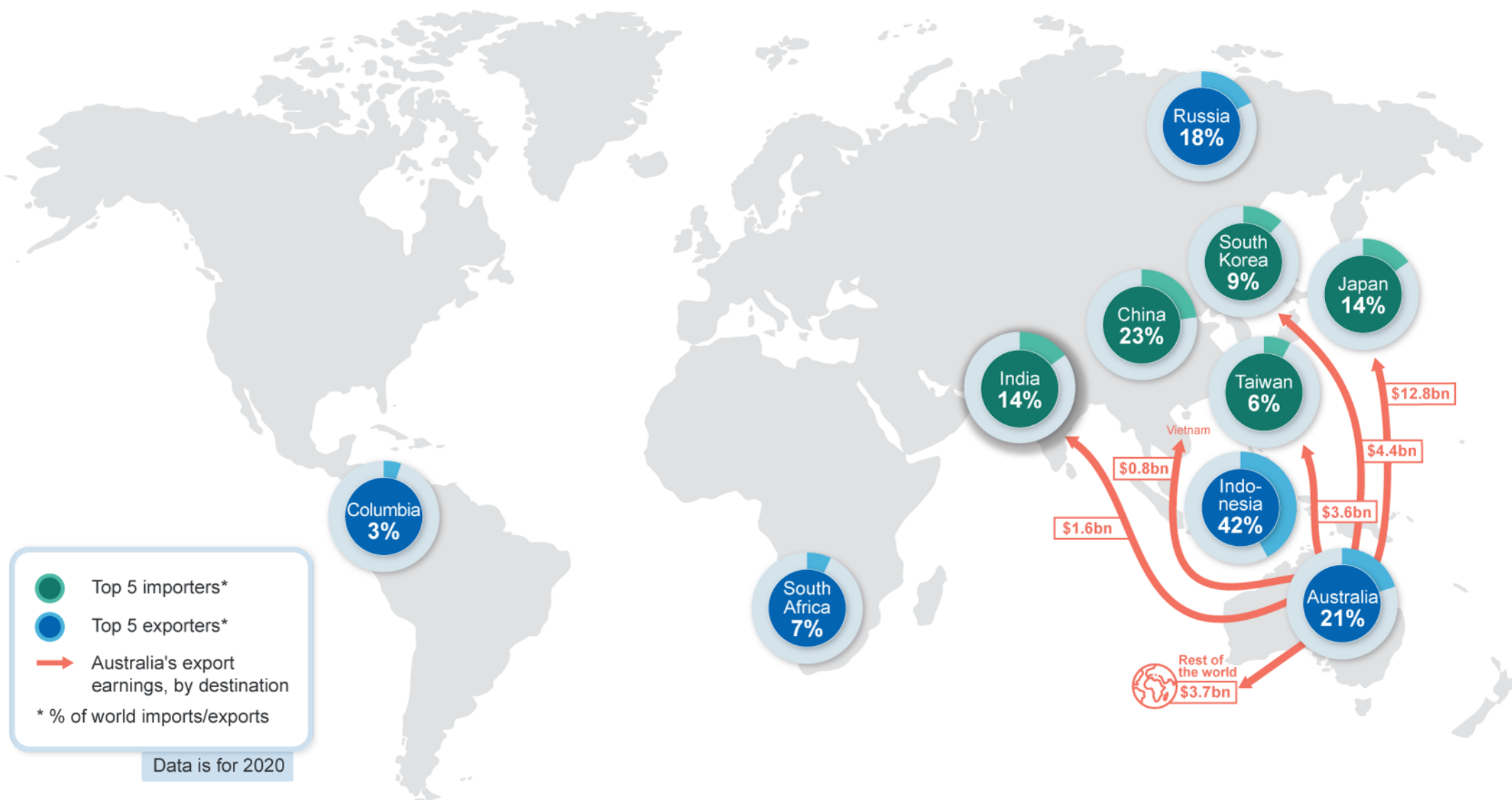
Mines are underground or open cut depending on the **deposit's geology**



Coal formation began 290-360 million years ago

Australia's thermal coal





6.1 Summary

- Thermal coal prices remain elevated, driven by extreme weather and COVID-19 disruptions, and market uncertainties linked to the fallout from the Russian invasion of Ukraine.
- As more normal conditions return, the Newcastle benchmark price is forecast to ease from an average of US\$280 a tonne in 2022, to around US\$115 over 2024 (still well above historical averages).
- A resolution of recent supply disruptions is expected to see Australian thermal coal exports increase from 192 million tonnes in 2020–21 to 207 million tonnes by the end of the forecast period (see [Australia section](#)).
- Record prices are expected to see export values reach \$39 billion in 2021–22, with a peak in 2022–23 and a subsequent (price-driven) easing to around \$31 billion by 2023–24.

6.2 World trade

Thermal coal markets have entered a sustained period of volatility, as global supply faces disruption from weather events, an outbreak of COVID-19 in China, and the fallout from the Russian invasion of Ukraine. Markets have faced successive restructuring due to China's cessation of purchases of Australian coal, followed by trade sanctions imposed on Russia. It is likely that COVID-19 and weather events will ease slightly in the near future, as the La Niña weather event passes and economies continue to adjust to the COVID-19 pandemic. However, other factors — such as sanctions targeting Russia — are expected to become more significant.

Russian coal continues to flow to Europe, despite recent announcements of an intention to sanction it. Coal shipments are expected to last through to August, when the EU ban takes full effect. Prices previously surged in the immediate aftermath of the Russian invasion of Ukraine, but eased when commodity exports were not immediately restricted. The imminent EU restrictions thus present a significant possibility of causing another price surge in the near future, with longer and less efficient freight routes adding to costs for importers.

The European Commission has noted that Europe's efforts to withdraw from using Russian gas may require a postponement of some coal plant closures in Europe. However, alternative gas supplies obtained through higher US LNG output are also expected to add 50 bcm annually, providing a partial replacement for Russian gas. Greater efforts to increase the take-up of renewable energy are also underway, with an agreement reached between Fortescue and E.ON in March to provide an additional 5 million tonnes per annum (Mtpa) of hydrogen by 2030. However, this measure (and others currently mooted) will have little effect in relieving supply pressures during the outlook period.

European coal demand is likely to lift slightly in mid-2022. However, recent announcements by Germany's government (which is seeking to eliminate Russian coal imports by the September quarter 2022) suggest that much of this demand will be met from domestic and non-Russian sources.

An easing in supply disruptions in Indonesia, Australia, Colombia and South Africa is expected to provide some modest relief to global markets over the rest of 2022 and into 2023. Imports and prices for seaborne thermal coal will remain sensitive to other factors, including the direct effects of the Russia-Ukraine conflict, the impact of any further COVID-19 lockdowns in China, and the global energy transition.

Domestic conditions in China are expected to be the primary swing factor over the rest of 2022. Further lockdowns and containment measures would likely take significant pressure off the seaborne market, potentially leading to price falls. Recent price controls mooted by the Chinese government may also present some downside risks to domestically produced coal prices over the rest of 2022.

Seaborne thermal coal volumes edged up to 1,059 million tonnes in 2021, but are expected to edge back as demand softens over the outlook period, to reach just over 1,000 million tonnes by 2024. Thermal coal supply is expected to largely track with demand from 2023.

6.3 World imports

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

China continues to face high prices in its domestic coal market, along with significant challenges in maintaining the strong domestic output growth of January and February. The Chinese authorities are undertaking more active measures to contain prices, through updated guidance and changes to import levies. In May, China's National Development and Reform Commission ordered power companies to build stocks as a buffer against future price surges. It also set a price ceiling of RMB770 a tonne for term contract prices of 5,500kc product, and imposed a cap of RMB1,155 a tonne on spot prices. Ok

Some provinces have also imposed their own price rules. The Hebei Provincial Development and Reform Commission has released guidance specifying that 5,500kc coal produced in Hebei should be priced at around 480-680 yuan per tonne, with power generators encouraged to 'sign as much as they should' at this price.

The Chinese Government has also announced that coal import duties (typically above 5% on thermal coal products) will be removed from May 2022 until the end of March 2023. The measure seeks to cut potential import barriers and reduce input prices for domestic energy suppliers. Indonesia, which has supplied the majority of Chinese coal imports following the imposition of restrictions on Australian coal, is already exempt from Chinese coal duties. The removal of duties will thus primarily affect higher quality coal imported from other sources, including Russia.

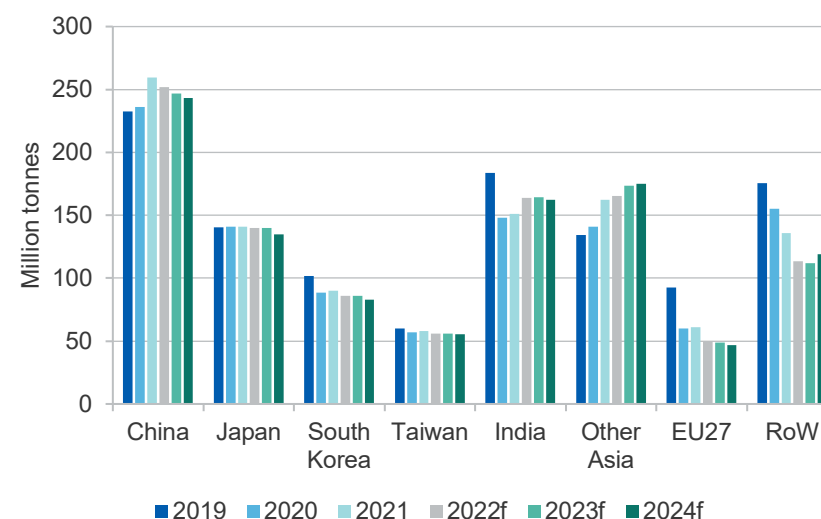
The Chinese Government is also attempting to increase domestic coal production by 300 million tonnes. This would build on around 200 million tonnes of capacity added in 2021 (around three-quarters of which is thermal coal). Infrastructure constraints are likely to hold the next phase of growth under 200 million tonnes in the absence of significant upgrades, but some growth appears to have been achieved in the early part of 2022.

Chinese imports showed signs of softening in the June quarter, as recent COVID-19 containment measures affected the economy. It is expected

that Chinese imports will remain soft early in the September quarter, but the Northern Hemisphere summer is likely to provide some upside to thermal coal demand over the subsequent months. However, the import falls could potentially outlast the effects of the northern summer, if COVID-19 containment measures persist or are expanded.

With strong pressure now being applied to increase domestic coal output, Chinese imports are expected to decline from around 260 million tonnes in 2021 to 245 million tonnes by 2024 (Figure 6.1).

Figure 6.1: Thermal coal imports



Note: e estimate; f Forecast

Source: IHS (2022); IEA (2022) Coal Market Report; Department of Industry, Science, and Resources (2022)

India's coal imports are expected to grow each year of the outlook period

Electricity demand in India rose by 3% over the year to March, placing greater pressure on coal prices. After months of easing, thermal coal imports surged in the March quarter (Figure 6.2). Electricity demand growth remains broad-based, driven by household consumption as well as

industrial activity. With domestic output unable to increase sufficiently, the resulting growth in coal use has been met by import markets. Indian thermal coal imports grew by more than a third in March, with the Indian Government instructing power plants to build inventories by importing at least 15% of their needs until October. Despite the high prices on offer, domestic coal supply stalled in the March quarter, and declined in the month of March. Domestic producers are facing infrastructure issues, with Indian Railways behind schedule with efforts to expand its coal transportation facility.

Demand and price pressure are likely to grow further as the Northern Hemisphere summer begins. If prices increase beyond an acceptable level, the Indian Government is expected to attempt to ease pressures on the power sector, potentially resulting in brownouts or power curbs for industrial users. State governments managing low inventories may also resort to power rationing over the next few months.

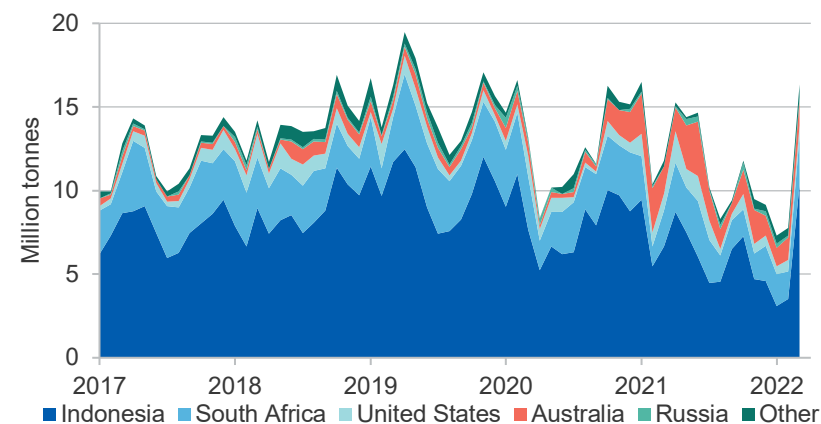
India may gain some relief by increasing imports of displaced Russian coal. However, Russian coal is of a generally higher calorific quality (and price) than the coal typically imported — which may restrain its utility given India's price sensitivity. India is traditionally only a minor importer of Russian product, but has some capacity to take up Russian exports within the limits imposed by costs, infrastructure and shipping constraints. At present, India appears to be more interested in drawing greater supply from Indonesia, in growing competition with China.

Imports to India from Australia fell by almost 10% between March and April, and by almost half since November 2021. Prices of Australian coal have surged since the Russian invasion of Ukraine, increasing its cost relative to Indonesian coal — which is of lower grade than Russian output. The Indian Government has stated it remains committed to diversifying its coal supply and reducing its dependency on Australian supply, which is relatively expensive and vulnerable to weather disruptions.

While electricity demand is expected to remain robust, high prices and potential power curbs will likely constrain demand somewhat over the outlook period. Indian thermal coal importers are typically highly price

sensitive, and are expected to flatten import levels somewhat in the rest of 2022. Growth previously expected this year is now forecast to occur in 2023 and 2024.

Figure 6.2: India's thermal coal imports, monthly



Source: IHS (2022)

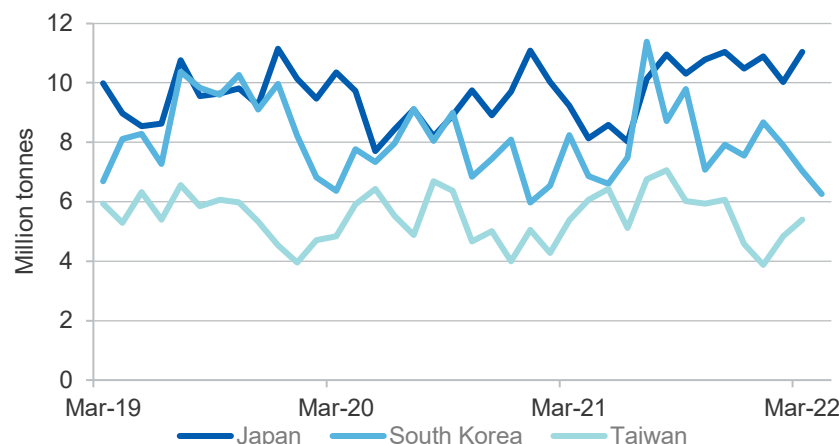
Japan's imports are expected to hold up over the outlook period

Japan faces complex conditions in its coal markets, with the authorities balancing 'net zero' commitments, attempts to reconnect nuclear power, and a proposed ban on Russian coal imports. These complexities have been further magnified by an earthquake in March which affected the country's north and led to interruptions and closures at several coal-fired plants. This is likely to reduce domestic coal demand for several months.

In April, the Japanese Government announced that it will phase out Russian coal imports in line with recent G7 proposals. However, at the time of writing, the Japanese commitment has not been detailed and timetabled to the same extent as the earlier European announcement. The ban is not expected to take effect until 2023, with around 16 million tonnes of Russian-sourced thermal coal imports needing to be sourced from other countries. The task of withdrawing from Russian suppliers will be hindered by the European policy, which takes effect earlier and will draw much of the available non-Russian product to Europe.

Japanese coal imports have levelled out in recent quarters (Figure 6.3), and are expected to ease slightly during the outlook period. Many factors are currently in play, with planned coal plant closures and the completion of the country's final coal-fired power plant constructions largely offsetting each other.

Figure 6.3: Japan, South Korea and Taiwan's thermal coal imports



Source: IHS (2022)

South Korean coal imports will face growing pressure

South Korea has begun diversifying away from Russian coal, with the state utility (Korea Electric Power Corp) announcing that orders for Russian coal have now halted. Previously, the company sourced about 10% of its imports from Russia. Other power generation firms in the nation are similarly seeking alternative suppliers, such as those from Australia. Overall South Korean imports from Russia declined by 6% to 1.5 million tonnes in April.

Gas plants, which have faced competitive disadvantages in recent years due to high contract prices, will not find much relief given the recent surge in gas prices. The conclusion of scheduled maintenance at several nuclear plants in 2022 and 2023 (and the completion of new ones over the outlook period) will reduce some pressure on coal imports.

Taiwan's imports are expected to start declining slowly

Taiwanese coal imports have risen in recent months, with the country importing 5 million tonnes of thermal coal in February. This was up by 17% over the year, and reflects higher imports from Indonesia and Australia. Growth was driven by strong industrial output, and there is considerable potential for demand to increase further during the upcoming Northern Hemisphere summer. However, coal demand will be somewhat constrained by the Government's abandonment of plans to upgrade its coal fleet, and to convert existing coal plants to use gas. Given the age of Taiwan's coal fleet, it is expected that coal imports will start to decline modestly over the next few years.

South East and South Asia imports are set to grow

Markets in South and South-East Asia remain the key growth centre for thermal coal (Figure 6.4). Plans for coal plant constructions across the region have been wound back, but a sizeable pipeline remains under construction. There is little sign that the fallout from the Russian invasion of Ukraine will change supply chains across the region, with countries showing little interest in trade or sanction policies targeting Russia. Nations in the region (excluding India) collectively import about 150 million tonnes of thermal coal each year, and this is expected to rise over the outlook period (Figure 6.4).

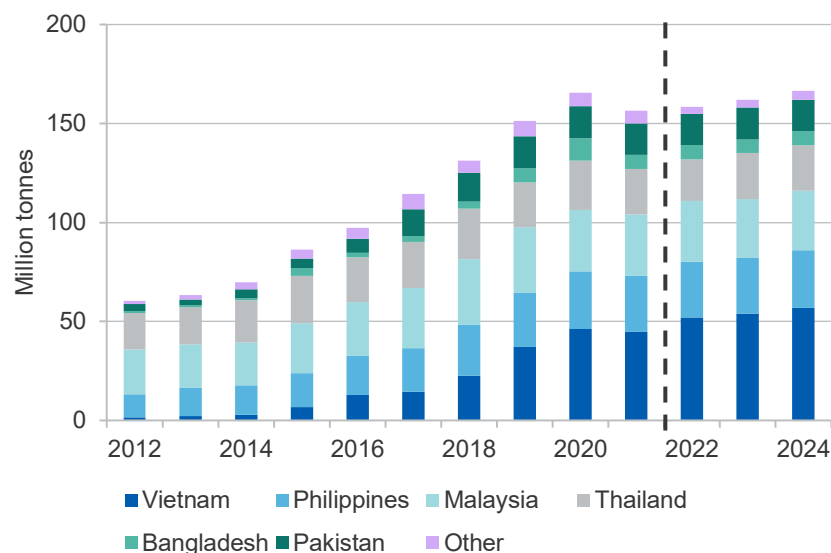
The Philippines is expected to require more coal over the next three years, with significant coal-fired capacity under construction. Steady import growth is forecast in every year of the outlook period, with coal consumption expected to double by the time of its peak around 2030.

Malaysia has large and modern coal-fired power plants, which have managed to out-compete gas-fired generation. Coal plants consolidated their advantage during the COVID-19 pandemic, as gas production was forced to cut back. Coal imports are expected to grow slightly over the outlook period.

Thailand's coal imports are rising in line with growing demand from the country's industrial sector, which has been led by a rapid expansion in

cement production. However, coal plant construction has largely come to a halt, with proposed plants cancelled in the Krabi and South Songkhla provinces. Official policy announcements support a reduction in coal use, but there is little sign of adjustment to the trajectory in recent times.

Figure 6.4: South and South East Asia thermal coal imports



Source: IEA (2022) Coal Information; Department of Industry, Science, and Resources (2022); IHS (2022)

Vietnam has scaled up coal imports over the last ten years, resulting in higher imports from Indonesia. Several new coal plants already under construction are expected to be grid connected during the outlook period. It is not expected that Vietnam will provide much support for Russian coal, given the distance and complexity of transport between the two countries. Import growth is instead likely to draw further on Indonesia and potentially Australian product.

6.4 World exports

Global supply chains are facing a second round of reorganisation, with Western sanctions against Russia following on from Chinese import restrictions against Australia. These policies have pushed prices up and forced rapid adjustments in shipping and transportation across the global market. They have also raised the distance — and thus the freight cost — of the thermal coal trade, reducing market efficiency. Over time, this may reduce the competitiveness of coal against other energy types. However, Australia remains somewhat insulated due to the high quality of its deposits, especially with a significant competitor in higher grade markets now locked out of parts of the market.

Indonesia's exports are rising despite temporary disruptions

Indonesian exports lifted in the early part of 2022, following the cessation of a temporary export ban in January. Heavy rainfall disrupted operations for key producers (including Bumi Resources and Adaro Energy in March), but subsequently eased to more manageable levels as the impact of La Niña lessened. Exports are expected to lift further in the coming months, as sustained high prices encourage more production. Indian demand in particular is likely to build over the outlook period, providing a stronger business case for greater investment among Indonesian suppliers.

With domestic inventories now relatively solid, no further export ban is expected over the outlook period. Stricter monitoring of domestic inventories is set to become a primary policy of the Indonesian authorities.

Indonesia retains a pipeline of coal fired power constructions, with several new plants expected to come online during the outlook period. This will not necessarily pressure exports, as Indonesia also has the potential to grow supply through large untapped deposits in the Kalimantan and Sumatra regions. The exclusion of Russia from sections of the global coal market will add pressure on global supply and create new opportunities for Indonesian exporters — though they may struggle to directly substitute for the higher grade Russian product. Exports are expected to hold up over the outlook period, with higher supply balancing higher domestic use.

Russia's exports face an uncertain time following the invasion of Ukraine

The fallout from the Russian invasion of Ukraine adds significantly to the risks affecting domestic coal suppliers, though, at the time of writing, the overall impact remains moderate. Coal production held up over the March quarter, despite a slight easing in the month of March. The rouble fell following the imposition of initial sanctions, but recovered when it became clear that energy exports would continue to provide significant income. Russian coal production remains highly profitable, and continues to be exported to Europe under pre-existing contracts.

The impact of sanctions on Russian coal is expected to increase over time. Thermal coal export flows to Europe (around 48 million tonnes in 2021, with Ukraine accounting for 10 million tonnes) are scheduled to halt by August as the full array of sanctions takes effect. Coal shipments from Baltic ports lifted early in the June quarter, but this was likely due to attempts to ship ahead of the commencement of sanctions. Efforts to divert supply to other markets will face capacity and infrastructure constraints affecting rail capacity in the country's east. Attempts to upgrade this capacity could also be hampered by the cessation of machinery and equipment exports to Russia. Exports to Ukraine have halted, but some offset will come as a result of lower Ukrainian demand.

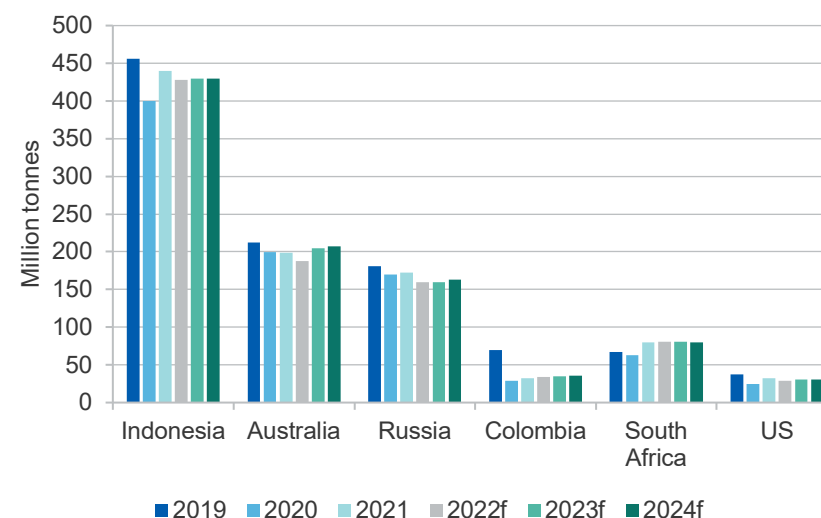
Given the uncertainty stemming from the Russian invasion of Ukraine, our analysis assumes its impacts continue for the foreseeable future, along with the sanctions deployed in response. Russia's importance as a global coal supplier means that these measures will add noticeably to volatility and price pressure on thermal coal markets. After a brief fall in March, coal prices surged again in April, as markets reacted to increasingly detailed and firm commitments from European governments seeking to reduce dependency on imported Russian energy.

Around 70% of European thermal coal imports are drawn from Russian sources. The high quality of Russian coal, and relatively stringent pollution and emission standards across Europe, will add to the difficulty of substitution. Many power plants across Europe require high-energy coal and would experience degraded performance (and potential mechanical

issues) if significant quantities of lower-calorie coal were included in their blends. It is thus expected that Russian supply chains will shift towards Australia over the outlook period.

Russian exporters will ultimately need to redirect about 48 million tonnes from the EU, and 16 million tonnes from Japan. Alternative buyers include China, India, and South and South-East Asia. However, Russian exports are expected to fall by at least 12 million tonnes in 2022, remaining somewhat constrained through the outlook period. The timetable for the overall redirection of Russian thermal coal remains highly unclear.

Figure 6.5: Thermal coal exports



Notes: f Forecast.

Source: IHS (2022); IEA (2022) Coal Information; ABS (2022); Department of Industry, Science, and Resources (2022)

US exports have picked up, but long-term cost challenges remain

US coal exports are ahead of their level of a year ago. But despite historically high prices since late 2021, US exports have not yet picked up substantially. This is likely due in part to hard limits on US capacity, with logistics and terminal storage space now fully allocated. Growth is likely to

remain constrained by difficulties in extracting and moving coal, with the issues most apparent for rail capacity. Beyond 2023, higher-cost US output is expected to become less competitive, as seaborne prices fall.

Colombian exports are not expected to recover fully

Colombian exports have faced tough conditions in recent times, largely due to the country's relatively high production cost and its reliance on the declining OECD market. Significant mines, including La Jagua and Calenturitas, have been taken offline following falls in regional demand, and are not expected to return to full operation in the foreseeable future. The country's large Cerrejón and Drummond mines remain in operation, but the former continues to face threats of disruption from protests among local indigenous communities and mine workers.

Some opportunities may open up, given efforts by many OECD countries to pivot off Russian exports. Exports have not yet risen significantly, but have the potential to grow modestly from 2022 (Figure 6.5). However, growth is not expected to restore the country's pre-pandemic export levels, as some capacity has closed for good.

Exports from other countries face mixed prospects

Small exporters, including South Africa and Canada, are expected to gain short-term opportunities, due to the withdrawal of some Russian production from global markets. However, long-term prospects for smaller coal producers remain clouded, given their lack of scale and the wide-spread adoption of net zero emissions targets.

South African exports continue to face disruptions from wet weather, rail issues (including derailments and cable thefts) and policy uncertainty.

Exports from Canada have risen, and are expected to lift further over the outlook period, as output ramps up at the Vista mine, which began production in 2019. Canadian exports are expected to shift toward Europe in the short-term. However, exports will also face growing pressure, due to the Government's COP-26 pledge to ban thermal coal exports by 2030.

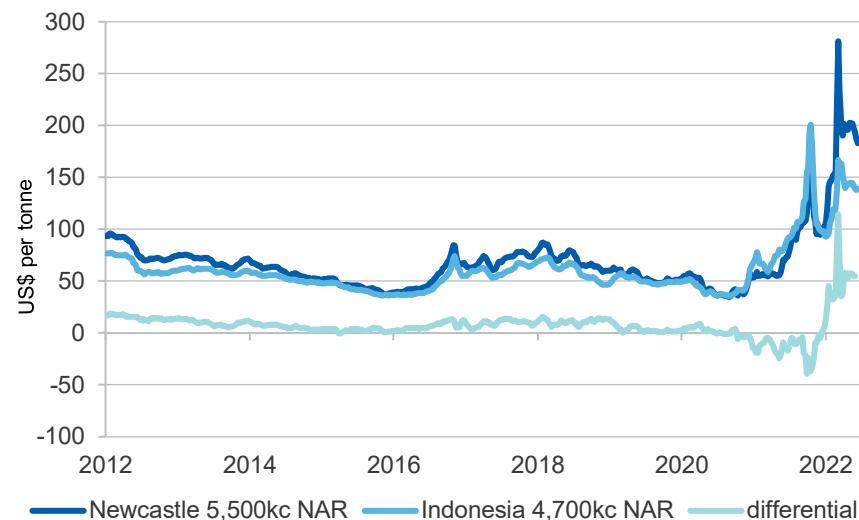
6.5 Prices

Prices are expected to continue to be relatively high and volatile

Thermal coal prices surged at the start of 2022, propelled by supply shortfalls against a backdrop of persistently low inventories. After peaking in late January, prices eased slightly in mid-February before rebounding again late in the month. Prices rose further in March, topping a record US\$375 a tonne by the middle of the month. Prices eased again in early April (Figure 6.6) and then rebounded late in the month, remaining above US\$400 a tonne at the time of writing.

Prices are not just high but highly volatile, with daily average swings far above their historical average during 2022. These fluctuations have become more self-reinforcing over time, with large swings drawing in speculators and increasing fears among some utilities of inventory shortages coinciding with peaking prices.

Figure 6.6: Thermal coal prices — Australian vs Indonesian



Source: IHS (2022). NAR = Net as received.

Some of the factors driving prices — La Niña-related weather disruptions, and COVID impacts on infrastructure and labour — are expected to ease during the second half of 2022. This may allow prices to moderate and stabilise somewhat in this period. However, other factors, such as the fallout from the Russian war on Ukraine, are likely to persist and intensify. The Indian Ocean Dipole may also present a risk of further weather disruptions. Prices are expected to trend down, but remain subject to high uncertainty, with a lack of investment in new coal resulting in a tenuous supply situation with the potential for further price surges in the event of any disruption. While recent events have seen nations — most notably in Europe — look to coal to address immediate energy shortages, the shift away from coal use is likely to continue in the background, adding to market uncertainty. Lockdowns in China, which have affected several significant industrial zones in that nation, should reduce thermal coal demand, potentially offsetting some of the impact of the Northern Hemisphere summer. However, prices are expected to remain elevated during the second half of 2022 and beyond.

6.6 Australia

Australian thermal coal exporters face volatile conditions in H2 2022

Australian coal supply is expected to pick up slowly over the outlook period, as a range of disruptions linked to weather and COVID-19 gradually pass. The La Niña weather event is fading, with previously disrupted shipping starting to catch up in late April and early May. However, other weather issues may emerge linked to the Indian Ocean Dipole.

Mines in the Hunter Valley are still affected by long periods of heavy rain, which flooded some mining pits. However, progress has been made in de-watering them. Recovery from weather disruptions may be hampered by renewed heavy rain in parts of Queensland and NSW, but weather disruptions may ease temporarily with the passing of the La Niña event.

Labour shortages, which have also affected exports in the March quarter, appear now to be gradually easing, though some companies still report

shortages of engineers. Rail maintenance, which has affected some shipments in the March quarter, has now been largely completed. Recent high wholesale power prices, have also added to input costs for some miners in the March quarter.

Among individual companies, BHP has continued to face labour shortages and flooding, with output in the March quarter falling to the lowest level for more than 10 years. Company guidance suggests some recovery through the rest of 2022 and into 2023, with output set to grow. The company has also announced that its Mt Arthur mine — the largest coal mine in NSW — will be closed in 2030 after the company failed to attract a buyer.

Heavy rainfall in the Hunter Valley has affected Yancoal and Glencore, which operate sizeable mines in the area. Flooding of several mine pits resulted in delays in production in April, as pits had to be de-watered. Peabody has faced similar issues, with flooding and labour shortages reducing output at its Wambo mine. A rebound appears to have occurred in the June quarter.

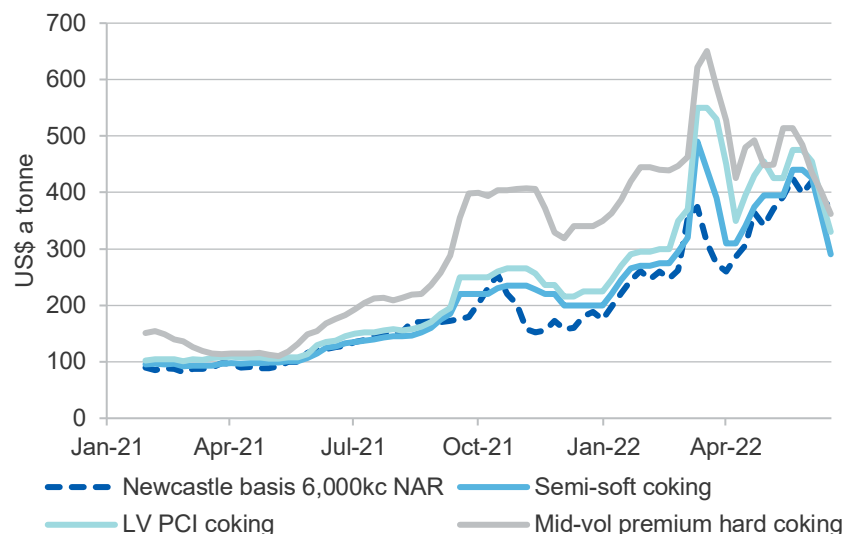
The passing of disruptive weather in the Gunnedah Basin has helped companies operating there, notably Whitehaven, which suggests a rebound in output over coming quarters. The company's Narrabri extension project has been approved by the Independent Planning Commission. In 2021–22, the company's output appeared little changed.

Two trial shipments have taken place from the Carmichael mine. The Adani group has announced that it will seek to build annual exports from the mine to more than 10 million tonnes annually from 2023, with the potential to increase above 15 million tonnes.

While supply difficulties are expected to linger over the short-term, an easing in weather and labour conditions should result in a small lift in export volumes over the second half of 2022. Australian coal remains in high demand in the wake of the Russian invasion of Ukraine, being the primary alternative supplier of higher coal grades. This has led to additional price pressure among the higher coal grades (Figure 6.7). It is likely that a larger share of Australian coal will be directed to Europe, while

Russian coal is diverted (in a smaller quantity) to Asian markets, resulting in a net fall in global supply and further upward price pressure from August.

Figure 6.7: Prices for thermal and low-grade coking coals

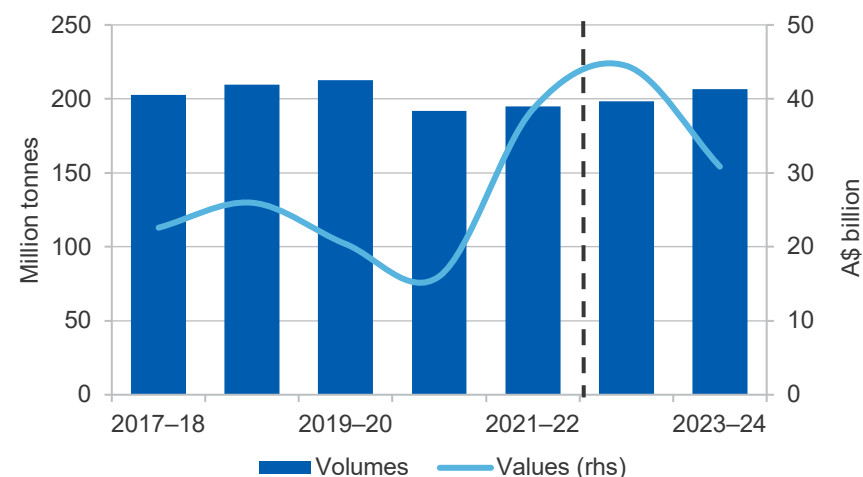


Source: IHS Markit (2022)

Japan and South Korea have also expressed interest in more imports of Australian coal, and may draw on contractual rights that would provide them with limited access ahead of European importers.

Export volumes are expected to hold largely steady over the outlook period (Figure 6.8). However, prices will likely remain subject to significant volatility, and a gradual ebbing in the huge growth that followed the Russian invasion of Ukraine. Export values are forecast to rise from \$16 billion in 2020–21 to \$39 billion in 2021–22, with a peak of \$44 billion in the following year and subsequent easing to \$31 billion by 2023–24. With global demand remaining solid, the primary swing factor for Australian export earnings will be the capacity for coal production to recover from lingering weather disruptions and labour shortages.

Figure 6.8: Australia's thermal coal exports



Source: ABS (2022); Department of Industry, Science and Resources (2022)

Revisions to the outlook for Australian thermal coal exports

The forecast for export earnings has been revised up by around \$7 billion (nominal terms) in 2022–23.

This reflects rapid changes to coal markets reflecting unusually severe weather disruptions, which have affected short-term export supply from Australia. The Russian invasion of Ukraine has added to price pressures over the medium term.

Table 6.1: World trade in thermal coal

	Unit	2021	2022 ^s	2023 ^f	2024 ^f	Annual percentage change		
						2022 ^s	2023 ^f	2024 ^f
World trade	Mt	1,059	1,029	1,031	1,023	-2.8	0.2	-0.7
Thermal coal imports								
Asia	Mt	865	865	869	857	0.1	0.5	-1.4
China	Mt	262	255	250	246	-3.0	-2.0	-1.4
India	Mt	151	164	164	163	8.3	0.3	-1.0
Japan	Mt	141	140	140	135	-0.7	0.0	-3.6
South Korea	Mt	90	86	86	83	-4.4	0.0	-3.5
Taiwan	Mt	58	56	56	55	-3.4	0.0	-1.3
Thermal coal exports								
Indonesia	Mt	440	428	430	430	-2.7	0.5	0.0
Australia	Mt	199	187	205	207	-5.7	9.3	0.9
Russia	Mt	172	160	160	163	-7.0	3.8	4.2
Colombia	Mt	32	34	35	36	6.3	2.9	2.9
South Africa	Mt	80	81	81	80	1.3	0.0	-1.2
United States	Mt	32	29	31	31	-9.4	6.9	-19.4

Notes: ^s Estimate ^f Forecast

Source: International Energy Agency (2022); IHS Markit (2022); Department of Industry, Science and Resources (2022)

Table 6.2: Thermal coal outlook

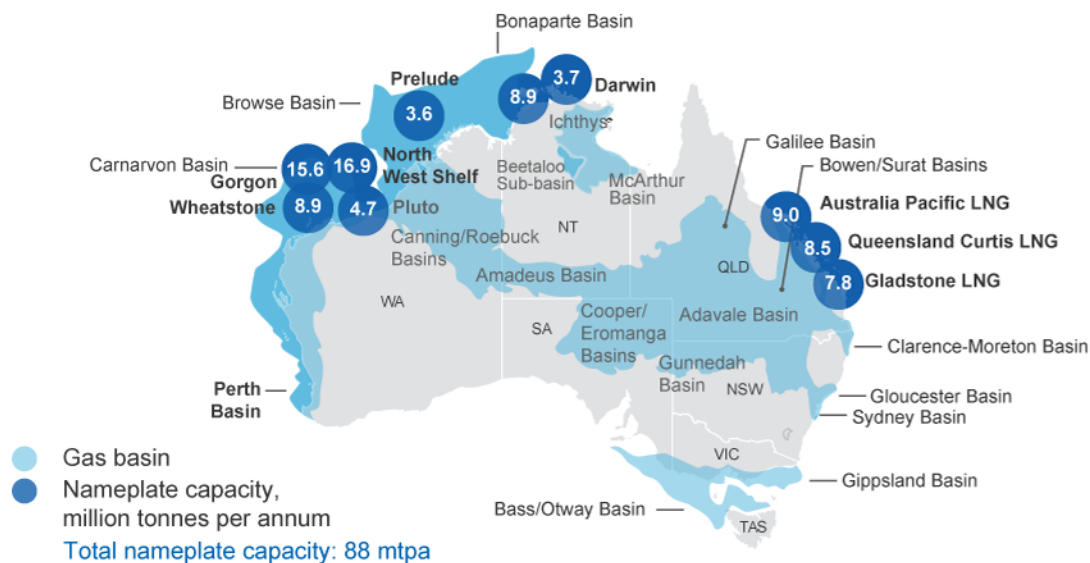
						Annual percentage change		
World	Unit	2021	2022 ^f	2023 ^f	2024 ^f	2022 ^s	2032 ^f	2024 ^f
Contract prices ^b								
– nominal	US\$/t	110	223	162	129	102.9	-32.9	-14.0
– real ^c	US\$/t	117	223	158	123	90.6	-34.7	-15.8
Spot prices ^d								
– nominal	US\$/t	135	279	163	118	107.3	-41.7	-27.3
– real ^e	US\$/t	145	279	158	112	92.4	-43.3	-28.9
Australia	Unit	2020–21	2021–22 ^s	2022–23 ^f	2023–24 ^f	2021–22 ^s	2022–23 ^f	2023–24 ^f
Production	Mt	228	256	256	257	12.1	0.3	0.2
Export volume	Mt	192	195	199	207	1.4	1.9	4.1
– nominal value	A\$m	16,009	38,585	44,467	30,840	141	15	-31
– real value ^h	A\$m	16,694	38,585	42,394	28,383	131	10	-33

Notes: ^b refers to benchmark Japanese Fiscal Year 6322kcal GAR thermal coal contract reference price; ^c In current JFY US dollars; ^d fob Newcastle 6000 kcal net as received; ^e In 2022 US dollars; ^f Forecast; ^h In 2021–22 Australian dollars; ^s estimate

Source: ABS (2022) International Trade in Goods and Services, Australia, Cat. No. 5368.0; IHS (2022); NSW Coal Services (2022); Queensland Department of Natural Resources and Mines (2022); Company Reports; Department of Industry, Science and Resources (2022)

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



Natural gas accounted for **23%** of the 2020 global electricity generation mix



Over 73% of global LNG demand came from Asia in 2021

Global gas use by sector



40%
Electricity



22%
Residential



20%
Industry



19%
Transport

Australia's LNG



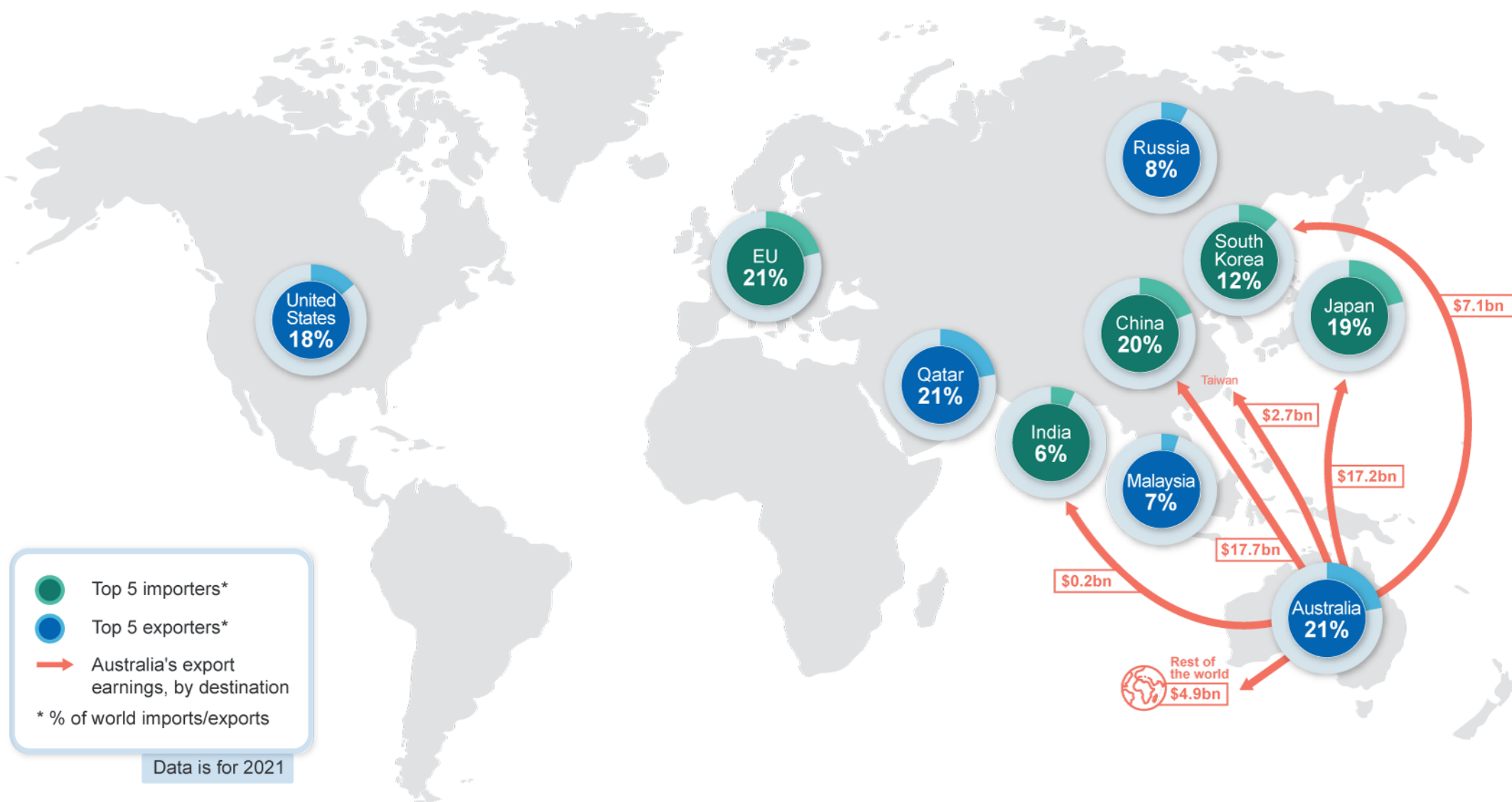
81m tonnes exported in 2021, valued at **\$50bn**



88m tonnes per annum **total LNG nameplate capacity**



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



7.1 Summary

- LNG prices are surging amidst a tight global market. Spot prices for Asian LNG are estimated to have averaged US\$28.38/MMBtu in 2021–22. Asian LNG prices are expected to decline modestly to average US\$25/MMBtu over 2024. Australia's LNG export earnings are forecast to rise from an estimated \$70 billion in 2021–22 to \$84 billion in 2022–23, driven by rising global energy prices. Earnings will likely then ease back to \$68 billion in 2023–24, as LNG and oil markets reorganise and prices start to decline.
- Australia's LNG export volumes are forecast to stabilise at around 79–80 million tonnes over the outlook period, after reaching 82.2 million tonnes in 2021–22.

7.2 World trade

Tightness to return sharply after temporary lull

Asian LNG imports generally declined in the first half of 2022. Rising gas prices have led to demand reductions in the Japanese and Korean electricity sectors, while a combination of high spot prices and ongoing COVID-19 lockdowns have reduced gas consumption in China.

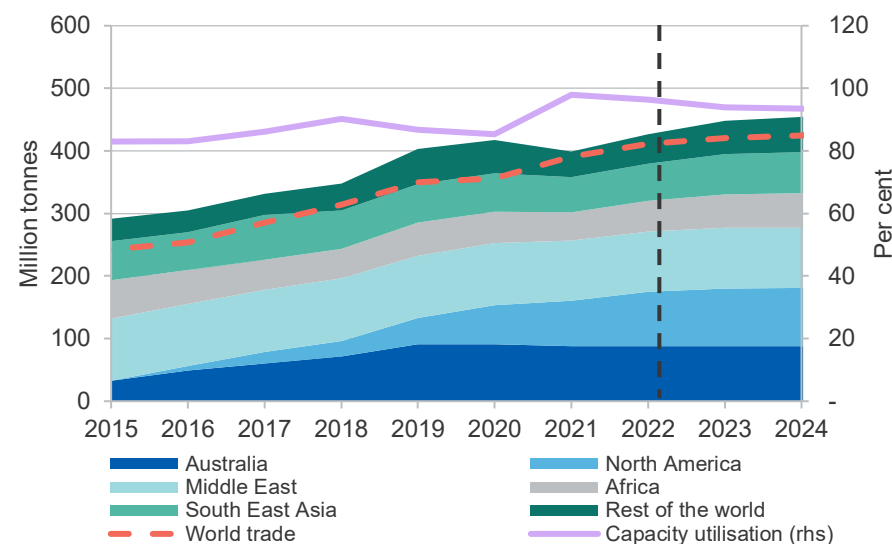
Europe has capitalised on the Asian slump, by importing larger LNG volumes to offset declining pipeline gas supply from Russia. As a result, Europe is forecast to import 116 million tonnes of LNG in 2022, up 54% from 2021. The United States appears to be facilitating the shift from Russian gas already, with roughly three-quarters of all US LNG exports destined for Europe between January and April 2022, compared to 38% in the same period in 2021.

LNG markets are expected to tighten considerably in the second half of 2022, as disruptions to US LNG facilities and Russian pipeline exports weigh heavily on global gas supply. Moreover, a recovery in Asian demand — due to the easing of lockdown restrictions in China or higher demand for gas-powered generation — could place further stress on global LNG markets later this year.

Asian LNG futures markets have priced in large increases in the December quarter 2022 (when the northern hemisphere winter sets in), with forward Asian spot prices reaching US\$35/MMBtu, up 15% from the September quarter 2022 (US\$30.5/MMBtu).

Further out, LNG markets are likely to be very tight through to 2024, as demand growth outpaces growth in supply (Figure 7.1).

Figure 7.1: LNG demand and world supply, 2018–2027



Source: Nexant (2022) World Gas Model; Department of Industry, Science and Resources (2022)

7.3 World imports

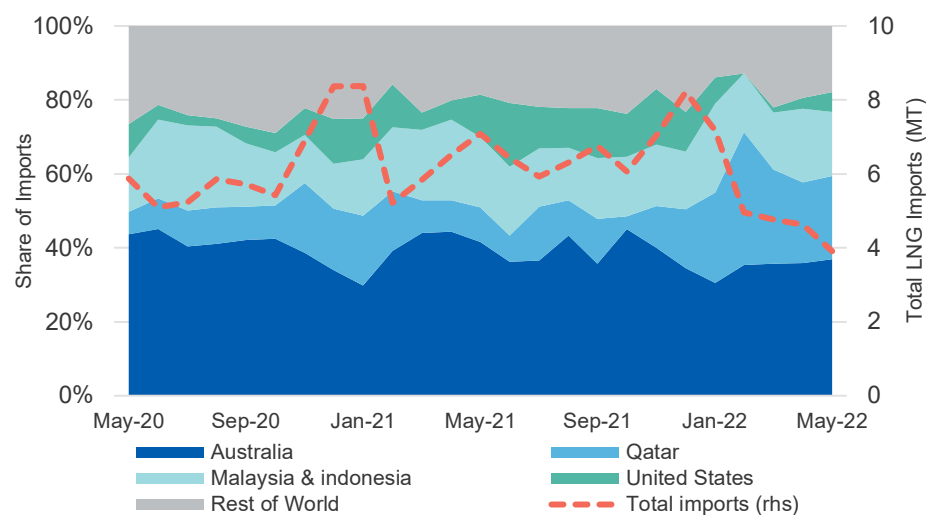
Chinese imports weighed down by high prices and lockdowns

Chinese LNG imports rose to 80 million tonnes in 2021, representing a 20% year-on-year increase. China now accounts for roughly 21% of global LNG imports, surpassing Japan as the world's largest LNG importer. However, ongoing COVID-19 lockdowns and higher LNG prices, have dampened demand over the first half of 2022.

On 6 May, President Xi Jinping reiterated the country's strict adherence to a general policy of "Dynamic Zero Covid". The remarks came amidst a total lockdown in Shanghai, where officials were working to stem a COVID-19 outbreak. If sporadic lockdowns continue to some degree in the second half of 2022, this will inevitably weaken Chinese gas demand, especially by industrial users. However, if lockdowns ease in the September and December quarters, Chinese gas demand could surprise on the upside, as manufacturers seek to offset lost production and the government seeks to support industrial activity to stimulate the economy.

According to shipping data, Chinese LNG imports fell by 13% to 16.9 million tonnes in the March quarter 2022, compared to 19.4 million tonnes in March quarter 2021. China also recorded its lowest level of LNG imports for April since 2019 (see Figure 7.2).

Figure 7.2: Chinese LNG imports by source, 2020-22



Notes: May 2022 data as of the 24 May

Source: Kpler (2022)

Australian LNG accounted for 39% of China's imports in 2021, with imports reaching approximately 30 million tonnes. However, imports from

Australia fell from 7.1 million tonnes in the March quarter 2021 to 5.6 million tonnes in the March quarter 2022. These figures represent a 21% reduction in Chinese imports of Australian LNG year-on-year.

However, the fall in imports from the US has been even more pronounced. Chinese imports of US LNG declined by 68% year-on-year (from 1.8 million tonnes) to 0.6 million tonnes in the March quarter 2022. Meanwhile, Chinese LNG imports from Russia rose by 77% in the three months following the invasion of Ukraine. Imports were 1.2 million tonnes between March and May 2022 compared to 0.7 million tonnes in 2021.

Shifting price differentials between Asian and European spot markets are largely driving the shift in US LNG exports. Since most US LNG exports are uncontracted, US LNG can quickly be redirected to the highest bidder.

A high degree of uncertainty surrounds the short-term outlook for Chinese gas demand in the second half of 2022, due to the persistence of COVID-19 outbreaks. However, further out, China's LNG demand is expected to grow to 84 million tonnes by 2024, up 6% from 2021 levels. At the same time, high LNG prices are expected to increase China's reliance on domestic production and pipeline imports.

Japanese imports show signs of easing

Japanese LNG imports were steady in 2021, at 75 million tonnes — or approximately 20% of global LNG imports. However, imports in the March quarter 2022 were down by 11% year-on-year to 20.6 million tonnes (imports were 23.3 million tonnes in March quarter 2021).

Falling Japanese imports can be attributed to the power sector, where rising nuclear and renewable generation is displacing gas-powered generators. According to figures from the Ministry of Economy, Trade and Industry (METI), Japan plans to reduce LNG's contribution to electricity generation from 38% in 2022 to 27% by 2030, while the nuclear share of generation is targeted to rise from 6.0% to 22%.

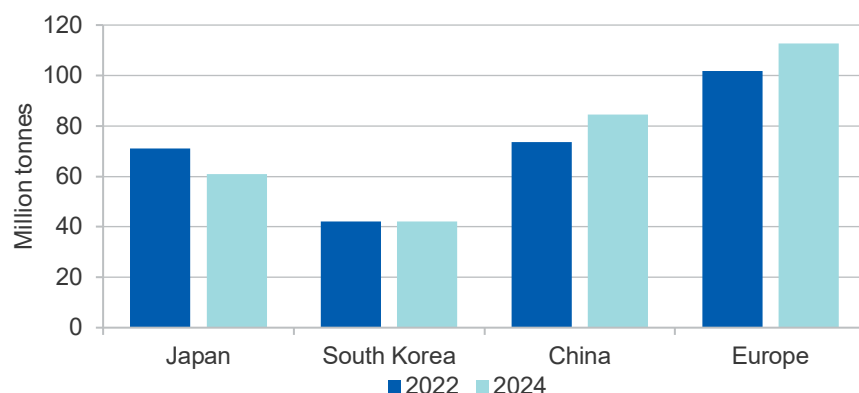
LNG imports are expected to fall to about 70 million tonnes in 2022 and 61 million tonnes by 2024, as the electricity sector shifts away from gas.

South Korean imports have begun to ease

South Korea's LNG usage reached record levels in 2021, at 46.7 million tonnes, up 13% from 2020. South Korea now accounts for approximately 13% of global LNG imports. However, imports fell by 4.6% year-on-year to 13.4 million tonnes in the March quarter 2022. The lower imports were driven by reduced gas-powered generation demand, as coal-fired power generators increased their output across the country. South Korea's Government had previously asked state-owned coal-fired generators to reduce their output, in order to curb the country's greenhouse gas emissions. However, the restrictions appear to have been lifted in April 2022, amidst record-high global LNG prices.

High gas prices and the construction of new nuclear facilities will restrain growth in South Korean LNG demand. South Korea will complete the construction of a new nuclear reactor (Shin-Hanul 1) and commence operations in the September quarter 2022. Moreover, two additional nuclear units will be constructed over the outlook period (Shin Kori 5 and Shin Hanul 2). These three units will increase South Korea's installed nuclear capacity by 4200 megawatts. As a result, growth in LNG imports is estimated to fall to 42 million tonnes by 2024 (see Figure 7.3).

Figure 7.3: World LNG demand forecasts



Notes: Emerging Asia includes India.

Source: Nexant (2022) World Gas Model; Department of Industry, Science and Resources (2022)

European imports surge amidst Russian invasion of Ukraine

European LNG imports surged by 61% year-on-year in the March quarter 2022, reaching a record 32 million tonnes. This followed weak imports in 2021 (78.8 million tonnes), as a result of LNG supply outages in Norway, Trinidad and Nigeria, and fierce competition from Asia for spot cargoes.

Rising imports in 2022 have been driven by European efforts to reduce dependence on Russian gas, and to refill gas storage inventories before next winter. Europe's vulnerability to Russian supply disruptions was amplified in the June quarter 2022, when Russia imposed a new payment mechanism on European gas buyers.

Several parties have disputed the legality of the new arrangement, arguing that it breaches existing contract conditions and could also violate European sanctions. So far, companies in the Netherlands, Poland, Bulgaria, Finland and Denmark have resisted the new payment mechanism, and Russia's Gazprom has subsequently suspended their contracts. While these suspensions may seem dire, it may technically be possible for these curtailed nations to obtain Russian gas via third-party nations which still access Russian pipeline gas supply.

Amidst such uncertainty, the EU is developing multiple proposals to bolster the regions's energy security and reduce reliance on Russia. The EU is currently drafting legislation to mandate minimum inventories for gas storage facilities before the European winter. The EU will likely require existing storage facilities to reach 90% of their capacity by 1 October each year.

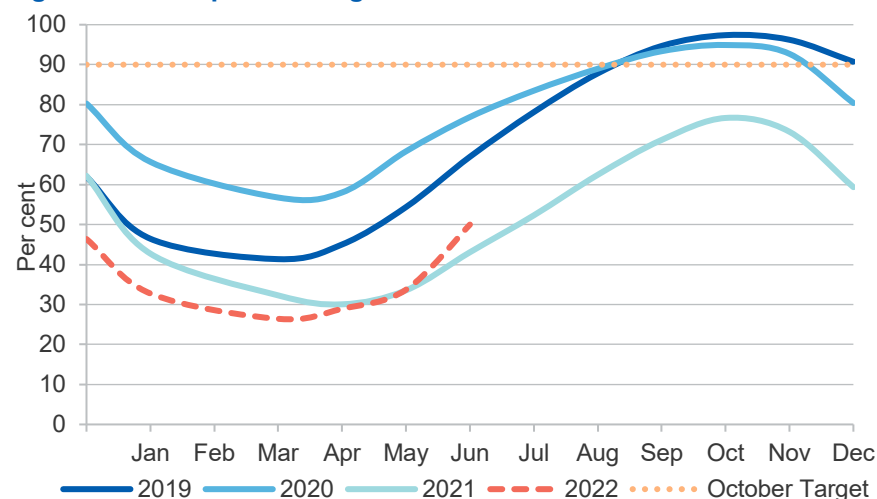
As of 13 June, European storage inventories were approximately 52.6% full (see Figure 7.4). Assuming no major Russian curtailments, Europe should have the ability to reach the 90% storage target before winter. Storage inventories also vary between different European countries, with Polish storage facilities already reaching 94% of capacity as of 31 May 2022 — which will further mitigate the risks associated with Russia's curtailment.

In conjunction with efforts to bolster winter storage, as a part of the region's RePowerEU proposal, the EU aims to cut Russian gas imports by two-thirds in 2022. Central to the proposal is a target to import an additional 36 million tonnes of LNG in 2022 alone.

However, efforts to simultaneously bolster gas inventories and reduce Russian imports face several challenges. Modelling done by the European Network of Transmission Systems Operators for Gas (ENTSO) in April 2022 suggests that most European nations will rely on Russian imports to reach the 80% or 90% storage level target by 1 October, with significant variation amongst Western and Eastern European nations.¹

According to ENTSOG's modelling, countries in Western Europe face almost no dependence on Russian gas to refill storage inventories; but in Central-Eastern Europe², Russia supplies up to about 85% of volumes needed to meet the 90% target.

Figure 7.4: European Storage Inventories



Source: Eurostat (2022)

¹ ENTSOG, Summer Outlook 2022, 11 April 2022

Central-Eastern Europe's dependence on Russian gas stems from infrastructure bottlenecks that limit gas flows from the West to the East, and from the Balkans to Central Europe. In May 2022, the EU announced a plan to tackle these constraints by investing nearly €10 billion over the next eight years in transmission and interconnector pipelines and LNG import facilities.

Infrastructure spending will target southern gas pipeline corridors running through Bulgaria and Romania, to give Central Europe access to gas from Turkey and Greece; an Iberian pipeline corridor that links Portuguese and Spanish LNG import terminals with Italian and German markets; and additional LNG import terminals along the Baltic, Aegean and North Seas.

As a result of the uncertainty over Russian pipeline imports, European LNG imports are forecast to rise by 43% year-on-year, reaching 109 million tonnes in 2022. Imports are expected to peak at 120 million tonnes by 2023, as infrastructure bottlenecks limit the continent's ability to absorb additional LNG imports.

Taiwanese imports remain stable

Taiwanese LNG imports rose to 19.8 million tonnes in 2021, on the back of extreme winter conditions. They now account for about 5.2% of global imports. Imports grew by 10% year-on-year to 4.8 million tonnes in the March quarter 2022. Unlike the rest of Asia, Taiwanese demand has been driven by solid growth in gas-powered generation.

In March 2022, Taiwan's electricity grid experienced a problem that required the temporary shut down of the nation's nuclear fleet. This resulted in a sharp rise in the demand for gas-powered generators. The outlook for gas powered generation in Taiwan remains strong since the Government aims to eliminate nuclear energy from the grid by 2025.

Taiwanese LNG imports are expected to stabilise at around 20 million tonnes per year over the outlook period. Beyond the outlook period, import

² Central-Eastern European countries include: Poland, Czechia, Slovakia, Hungary, Romania, Croatia and Serbia.

growth will be supported by three new import terminals, expected to come online between 2024 and 2026.

Latin American demand falls on rising rainfall

Latin American import volumes have continued to fall so far in 2022, as increased rainfall has filled hydro-electric dams, reducing demand for gas-powered generation. LNG imports came in at only 2.2 million tonnes in the first four months of 2022, down from 14.5 million tonnes in the whole of 2021.

The unexpected surge in imports in 2021 resulted from severe drought conditions that limited the filling of water reservoirs needed for hydroelectric generation. The lower hydro output forced South American power companies to purchase large amounts of LNG to fuel gas-powered generators to compensate for the loss.

The outlook for Latin American demand remains heavily dependent on weather conditions. While higher rainfall in the December quarter 2021 reduced the need for thermal generation in the first half of 2022, any worsening of drought conditions in the middle of 2022 could spike LNG demand once more.

India remains price sensitive

Indian LNG imports reached 24 million tonnes in 2021, representing about 6.5% of global LNG trade. However, Indian LNG imports fell by 21% year-on-year in the March quarter 2022, bottoming out at 4.98 million tonnes amidst record high LNG prices. Hot weather and a scarcity of coal, could boost LNG demand in the middle of 2022, as gas-powered generators seek additional fuel amidst a worsening electricity market outlook.

Nevertheless, Indian LNG imports are still forecast to rise from 24 million tonnes in 2021 to 26 million tonnes by 2024. Rising LNG demand is expected to be driven by industrial consumers, particularly fertilizer manufacturers, and city gas users.

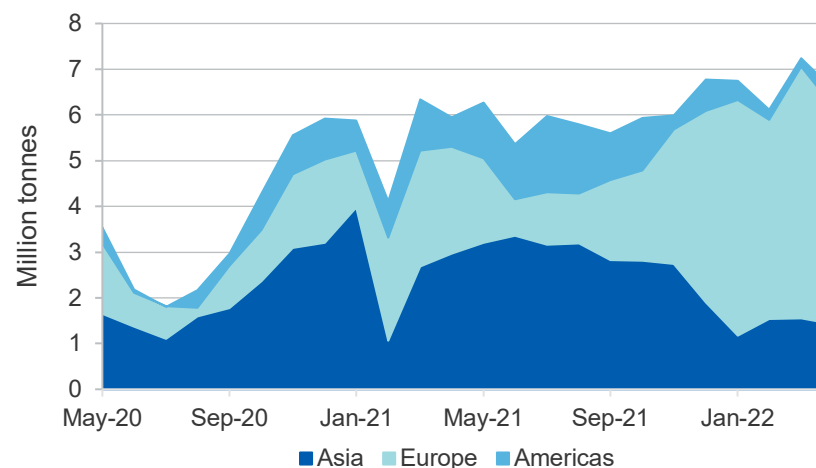
7.4 World exports

US LNG redirected to Europe amidst market reorganisation

United States' LNG exports reached 70 million tonnes in 2021, driven by the ramp-up of existing LNG projects and the commissioning of a sixth additional train at the Sabine Pass. The expansion represents a 46% rise in US LNG exports since 2020, when exports reached 49 million tonnes.

Only 34% of US LNG exports (about 20 million tonnes) were destined for Europe in 2021, with Asia receiving a 48% share (see Figure 7.5). The distribution partially reflects pricing dynamics in 2021, when Asian spot prices consistently achieved a premium over European markets. However, in the March quarter 2022, 74% of all US LNG exports (or around 20 million tonnes) were destined for Europe. These volumes are just below total US annual exports to Europe of 24 million tonnes in 2021. Only 21% of US exports have flowed to Asia over the same period. The reversal in LNG flows comes off the back of commitments by the US government to help lower Europe's dependency on Russian gas.

Figure 7.5: US LNG exports by destination, 2020-22



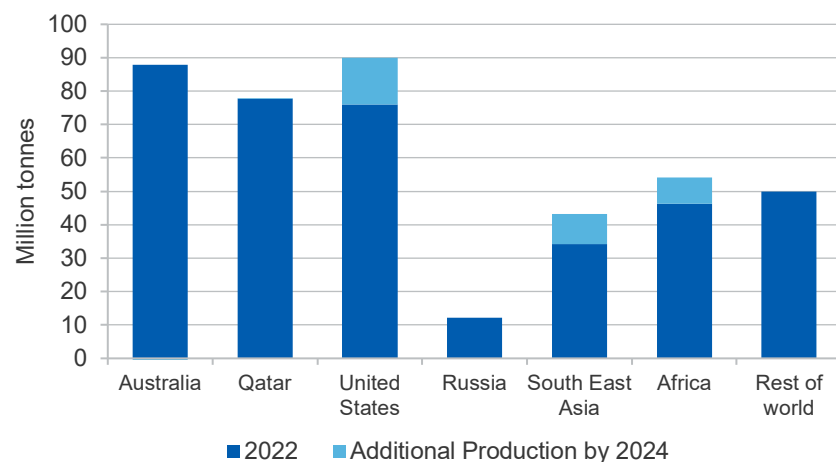
Source: Kpler (2022)

In March 2022, the US Administration agreed to supply Europe with an extra 11 million tonnes of LNG. Larger US exports to Europe have also been aided by record high European spot prices relative to Asia. However, an explosion at the Freeport LNG facility on 8 June 2022 is expected to weigh heavily on US exports in the second half of 2022. The facility, which can produce up to 15 million tonnes of LNG per annum, represents approximately 18% of total US LNG supply. The company is only targeting a partial resumption of operations by late-2022.

The United States is forecast to export 76 million tonnes of LNG in 2022. The fall in US LNG production from Freeport LNG will be partially offset by new facilities at Calcasieu and Sabine Pass. The two facilities are expected to add 12 million tonnes to the United States' nominal liquefaction capacity over the outlook period, which will help lift US LNG production to 90 million tonnes in 2023 and 2024.

No further additions to US LNG capacity are expected until trains at Golden Pass and Plaquemines come online, beyond the outlook period.

Figure 7.6: Global LNG supply forecasts



Source: Nexant (2022) World Gas Model; Department of Industry, Science and Resources (2022)

Qatar exports stabilise, but larger volumes are on the horizon

Qatari exports remained at 78 million tonnes in 2021, as the nation's LNG facilities continued to operate at peak capacity. Despite high prices and strong global demand for LNG, the Qatari Government has repeatedly stated that Qatar cannot boost supply noticeably in the short term. The volume of Qatari exports was stable in the March quarter 2022, at 19 million tonnes. Exports to Asia and Europe remained largely consistent with the December quarter 2021, with approximately 15.2 million tonnes exported to Asia and around 3.8 million tonnes exported to Europe.

Qatar is expected to expand its export capacity to 107 million tonnes per annum by 2026, facilitated by its North Field South project — which reached FID in late 2021. The LNG project will be the second largest in the world by capacity, and is expected to start commercial production in 2025. Qatar's LNG exports are not expected to rise over the outlook period.

Maintenance pressures ease in Nigeria, Trinidad and Norway

A large amount of world LNG capacity was offline in 2021, due to unplanned outages in Nigeria, Trinidad and Norway. These disruptions took about 12 million tonnes of contracted supply offline, and were felt acutely by European buyers — whom the contracts serviced. Alone, these incidents would likely pass without much impact on prices. However, in a very tight global LNG market, these outages acted to amplify price moves.

Trinidad's Atlantic Train 1 was closed indefinitely in mid-2021, due to a feed gas shortage. The shortage caused LNG capacity to fall from 13 to 8 million tonnes between 2020 and 2021. However, capacity is expected to rise to 14 million tonnes over the outlook period, as Shell and BP ramp up offshore operations. Feed gas issues also plagued Nigerian production at Bonny LNG. As a result, the facility's LNG output fell from 21 million tonnes in 2020 to 17.1 million tonnes in 2021. In 2022, LNG capacity is expected to rebound to 19 million tonnes and then gradually lift to 21.3 million tonnes by 2024. In late 2020, a fire at Norway's Hammerfest LNG plant halted production, lowering Norway's LNG capacity from 7 million tonnes in 2019 to zero in 2021. Hammerfest only resumed production in late May 2022, and is forecast to have its capacity fully restored by 2023.

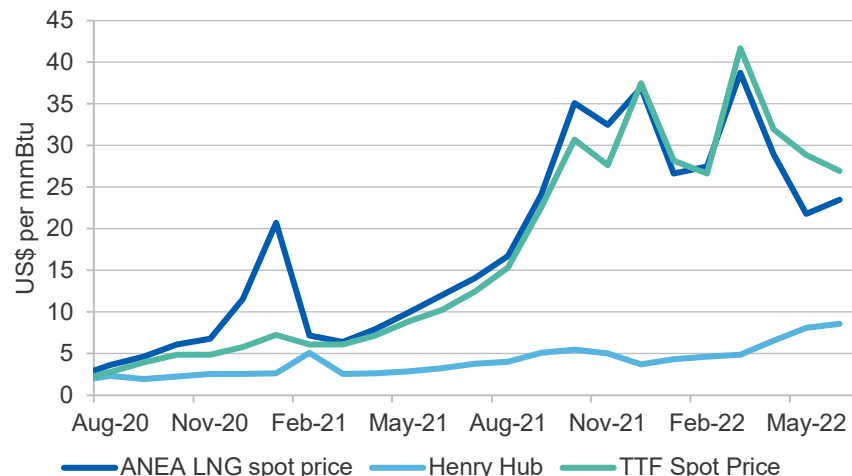
7.5 Prices

LNG spot prices remain volatile amidst global uncertainty

The outlook for Asian spot prices is subject to heightened uncertainty, due to the potential for further Chinese COVID-19 lockdowns and the risk of further curtailments in Russian gas exports to Europe. LNG spot prices were high and volatile in the March quarter 2022, as Asian buyers faced fierce competition from Europe. After averaging US\$26/MMBtu in February, prices spiked to US\$41/MMBtu in March before settling back to average around US\$24.80/MMBtu in the June quarter 2022.

However, a divergence emerged between Asian LNG and European gas prices in the second quarter (see Figure 7.7). For example, in May 2022, spot prices at the Dutch Title Transfer Facility averaged US\$30/MMBtu compared to Asian LNG spot prices of US\$22.24/MMBtu. The divergence can be attributed to a number of factors: price-driven demand destruction in Asia, Chinese COVID-19 lockdowns, and higher demand in Europe — due to the fallout from Russia's invasion of Ukraine.

Figure 7.7: Global gas and LNG prices, monthly



Notes: ANEA is the Argus Northeast Asia LNG spot price DES (Delivered Ex Ship), which include shipping and insurance. TTF is the Dutch Title Transfer Facility price.
Source: Argus (2022); Bloomberg (2022)

The price differential has facilitated the redirection of LNG cargoes away from Asia towards Europe, led predominantly by US LNG exporters (See *World Imports section*). Meanwhile, spot prices in the United States have risen to their highest levels since 2008. Between December 2021 and April 2022, prices at the Henry Hub surged by 76%, from US\$3.76/MMBtu to US\$6.60/MMBtu. The rising US prices come off the back of record LNG exports, and from expectations that natural gas storage levels will be below the five-year average over summer.

Over the outlook period, prices are expected to remain elevated and highly volatile relative to long-run averages. Prices are expected to spike to US\$35/MMBtu in the December 2022 quarter as winter heating demand increases the competition for LNG cargoes and disruptions at the Freeport LNG facility constrain supply. Furthermore, any Russian curtailments of gas exports to Europe will amplify the tight demand and supply balance.

Prices are forecast to remain above long-run averages for the rest of outlook period, as LNG demand outpaces supply. As a result, prices are expected to average US\$28/MMBtu and US\$25/MMBtu in 2023 and 2024, respectively.

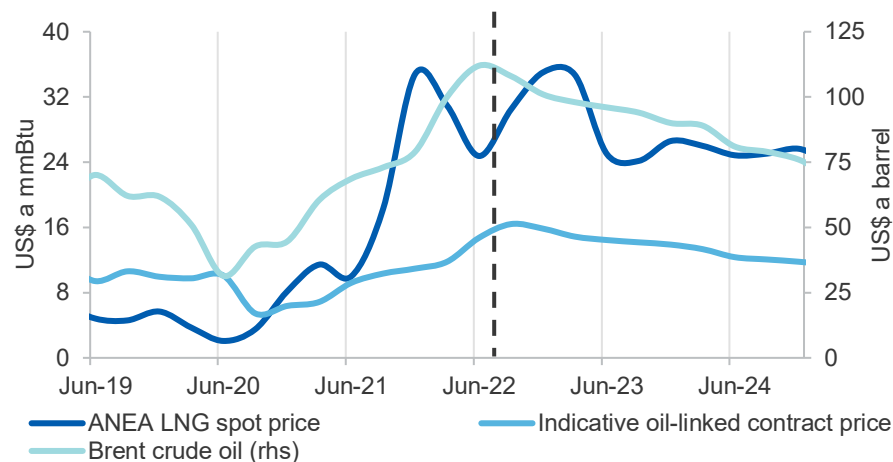
Spiking oil prices in Q1 2022 flow through to LNG contracts

High oil prices in the first quarter of 2022 will start flowing through to Australian LNG contracts in the June quarter. Around 80% of Australian LNG is sold via long-term contracts that link the price of LNG to the Japanese Customs Crude (JCC) oil price with a three to six month lag depending on contractual arrangements.

Oil prices reached record highs in the March quarter 2022, following the fallout of Russia's invasion of Ukraine, peaking at US\$134 a barrel on 8 March. (See *Oil chapter*). Brent Prices averaged \$US106 a barrel in April, \$US112 a barrel in May and \$120 a barrel in June (estimate) — with the June quarter average up 64% y-o-y

Over the outlook period, oil-price linked LNG contract prices are expected to peak at levels consistent with oil at US\$105 a barrel in 2022, before falling to US\$95 in 2023 and US\$80 a barrel in 2024 (see Figure 7.8).

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). The long-term oil-linked contract price is indicative and is estimated at 14% of the 3-month lagged JCC oil price plus shipping.
Source: Argus (2022); Bloomberg (2022); Department of Industry, Science, Energy and Resources (2022)

7.6 Australia

Australia's LNG earnings surge amidst global uncertainty

Australia is estimated to have exported a record \$70 billion of LNG in 2021–22, up from \$30 billion in 2020–21 (and still high compared to \$50 billion in 2018–19 and \$48 billion in 2019–20). In the March quarter 2022 alone, Australian LNG export earnings reached \$17.9 billion, up 114% compared to the March quarter 2021. Higher export earnings have been driven by surging prices, the result of low inventories and the global recovery from the COVID-19 pandemic. The latter has driven increased demand for energy commodities, especially LNG, on Asian spot markets.

In 2022–23, the value of Australia's LNG exports is expected to continue to surge, rising to around \$84 billion as high oil prices — due to the fallout from Russia's invasion of Ukraine — flow through to oil-price linked LNG contracts and as LNG spot prices surge (see Figure 7.9). However,

earnings are expected to ease to \$68 billion in 2023–24, as markets begin to reorganise.

Key sources of uncertainty over the outlook period include the persistence of Chinese lockdowns due to COVID-19 outbreaks — which could lead to lower demand for imported LNG — and the possibility of more Russian curtailments to Europe's gas supplies, further tightening global LNG markets.

Australia's LNG facilities producing record volumes

Australia exported an estimated 82.2 million tonnes of LNG in 2021–22, up by 4.7 million tonnes on 2020–21. This marks Australia's highest volume of LNG exports for any financial year. The results were largely driven by high LNG prices, which incentivised many LNG facilities to operate at or above capacity for the last 12 months.

Driving the increase has been higher production from the Gorgon LNG facility, which boosted LNG production from 11.3 million tonnes in 2020–21 to an estimated 15.9 million tonnes in 2021–22 (a 42% increase). This production level is over 100% of the facility's nominal nameplate capacity. Ichthys LNG production reached an estimated 9.1 million tonnes in 2021–22, up 18% from 2020–21 when LNG output was 7.7 million tonnes.

In the March quarter 2022, Australian LNG exports dipped to 19.2 million tonnes, down 10% quarter-on-quarter. The result was driven by the suspension of operations at the Prelude FLNG facility and lower output from the Darwin LNG facility — due to the ongoing depletion of the Bayu-Undan field.

On 2 December 2021, Shell's Prelude FLNG facility suffered a total power failure, resulting in a suspension of production. The power failure was triggered by an onboard fire in an electrical equipment area which forced the facility to run on backup diesel generators. After the incident, the off-shore regulator, NOPSEMA, directed Shell to halt all production until specific safety standards were met. The regulator allowed operations to recommence on 21 March 2022.

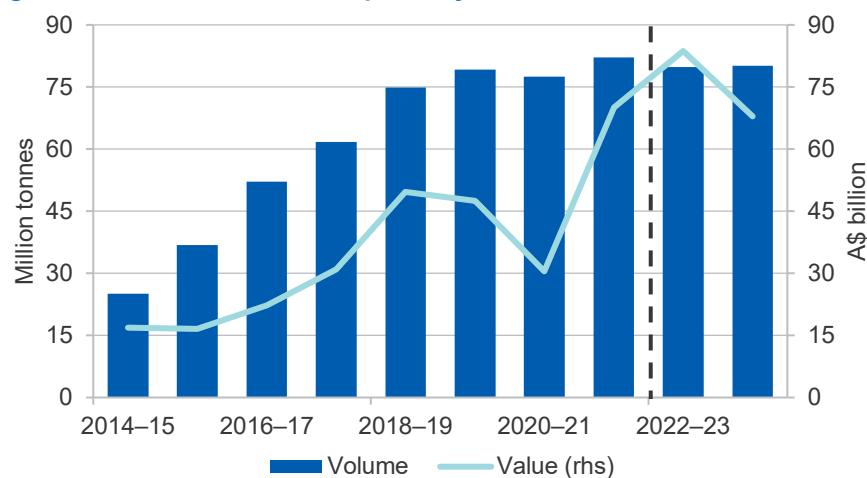
The Bayu-Undan field, which supplies the Darwin LNG plant, is also in terminal decline. Santos announced an FID for an infill drilling program in early 2021, and the program commenced in late July 2021, with initial outcomes better than expected. This program will likely extend output at the Darwin LNG facility until 2023. However, the field decline is beginning to weigh on Darwin's LNG production, with volumes falling by around 40% to 0.4 million tonnes in the March quarter 2022.

Export volumes to ease after record financial year

In 2022–23, Australia's LNG exports are expected to be 79.8 million tonnes. Several facilities are expected to be impacted by (delayed) maintenance activity, while the depletion of some gas basins will reduce gas supply to other facilities, particularly Darwin LNG.

Ichthys' LNG is expected to undertake scheduled maintenance on both of its LNG trains throughout July, dampening LNG production for the September quarter. It is estimated that Ichthys has operated at over 100% nameplate capacity in 2021–22, and will need to undergo maintenance to ensure the facility can continue to operate efficiently.

Figure 7.9: Australia's LNG exports by Value and Volume



Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022)

QCLNG is also expected to undertake scheduled maintenance on half a train or more between 16 June and 18 July. The maintenance could reduce QCLNG's output by either 0.2 or 0.4 million tonnes. APLNG will also undertake scheduled maintenance on a whole train between 28 July and 26 August 2022, which will similarly drag production down by an estimated 0.3 million tonnes over the September quarter 2022.

As previously mentioned, output from the Darwin LNG facility is also expected to fall to 1.7 million tonnes in 2022–23, due to field depletion; output is expected to fall even further to 0.5 million tonnes in 2023–24.

After 2022–23, LNG volumes are estimated to settle around 80 Mtpa for the remainder of the outlook period. Larger volumes are not expected to rise until 2026, when Woodside's Scarborough field and Pluto Train 2 projects come online.

Revisions to the outlook

Australia's nominal LNG export earnings for 2022–23 have been revised up by \$2.7 billion due to higher Asian LNG spot prices. Nominal earnings for 2023-24 have also been revised up by \$8 billion due to higher forecast oil prices and spot prices in 2023.

Table 7.1: Gas outlook

World	Unit	2021	2022 ^f	2023 ^f	2024 ^f
JCC oil price ^a					
– nominal	US\$/bbl	70.3	105.3	94.5	79.8
– real ^h	US\$/bbl	76.0	105.3	92.0	75.9
Asian LNG spot price ^g					
– nominal	US\$/MMBtu	18.6	30.3	27.6	25.4
– real ^h	US\$/MMBtu	19.9	30.3	26.9	24.1
Gas production ^s	Bcm	4,229	4,207	4,289	4,358
Gas consumption ^s	Bcm	4,246	4,262	4,323	4,404
LNG trade ^{ds}	Mt	391	411	421	425
Australia	Unit	2020–21	2021–22 ^f	2022–23 ^f	2023–24 ^f
Production ^b	Bcm	160	160	162	162
– Eastern market	Bcm	57.0	54.3	53.9	53.2
– Western market	Bcm	86.7	91.7	92.7	93.3
– Northern market ^c	Bcm	16.1	13.7	15.1	15.8
LNG export volume ^d	Mt	77.4	82.2	79.8	80.2
– nominal value	A\$m	30,477	70,150	83,698	67,982
– real value ^e	A\$m	31,782	70,150	80,832	62,565
LNG export unit value ^g					
– nominal value	A\$/GJ	7.5	16.2	18.7	14.5
– real value ^e	A\$/GJ	7.8	16.2	17.8	13.4
– nominal value	US\$/MMBtu	5.9	12.4	14.7	11.7
– real value ^e	US\$/MMBtu	6.1	12.4	14.0	10.8

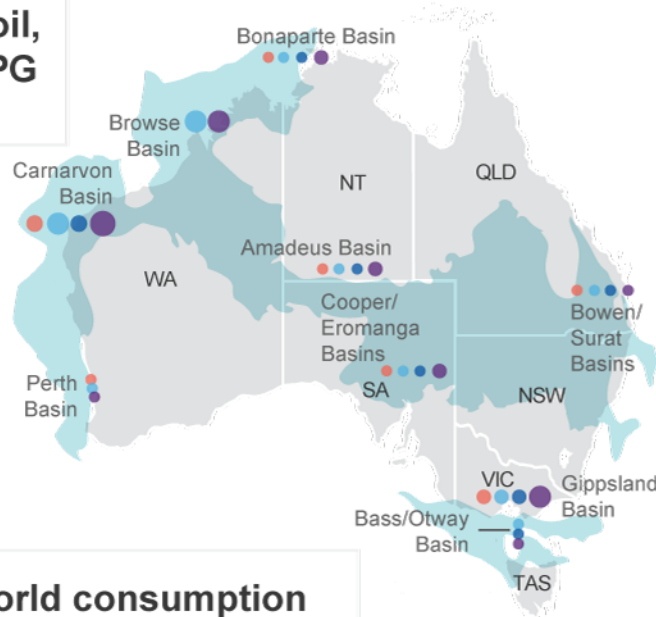
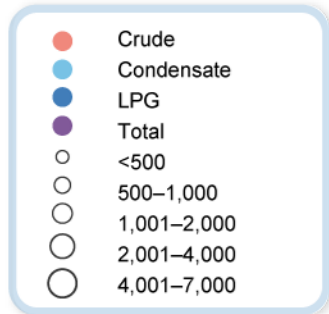
Notes: **a** JCC stands for Japan Customs-cleared Crude; **b** Production includes both sales gas and gas used in the production process (i.e. plant use) and ethane. Historical gas production data was revised in the June quarter 2017 to align with Australian Petroleum Statistics; **c** Gas production 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 2021–22 Australian dollars; **f** Forecast; **g** 1 MMBtu is equivalent to 1.055 GJ; **h** In 2022 US dollars; **r** Average annual growth between 2022 and 2024 or 2021–22 and 2023–24; **z** Projection.

Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2022); Company reports; Nexant (2022) World Gas Model.

Oil

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



Oil facts



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



The Brent spot price has ranged from **US\$17–134 a barrel** in the last 2 years



In 2021, around **28%** of refinery feedstock was domestically produced

World consumption



Australia's oil



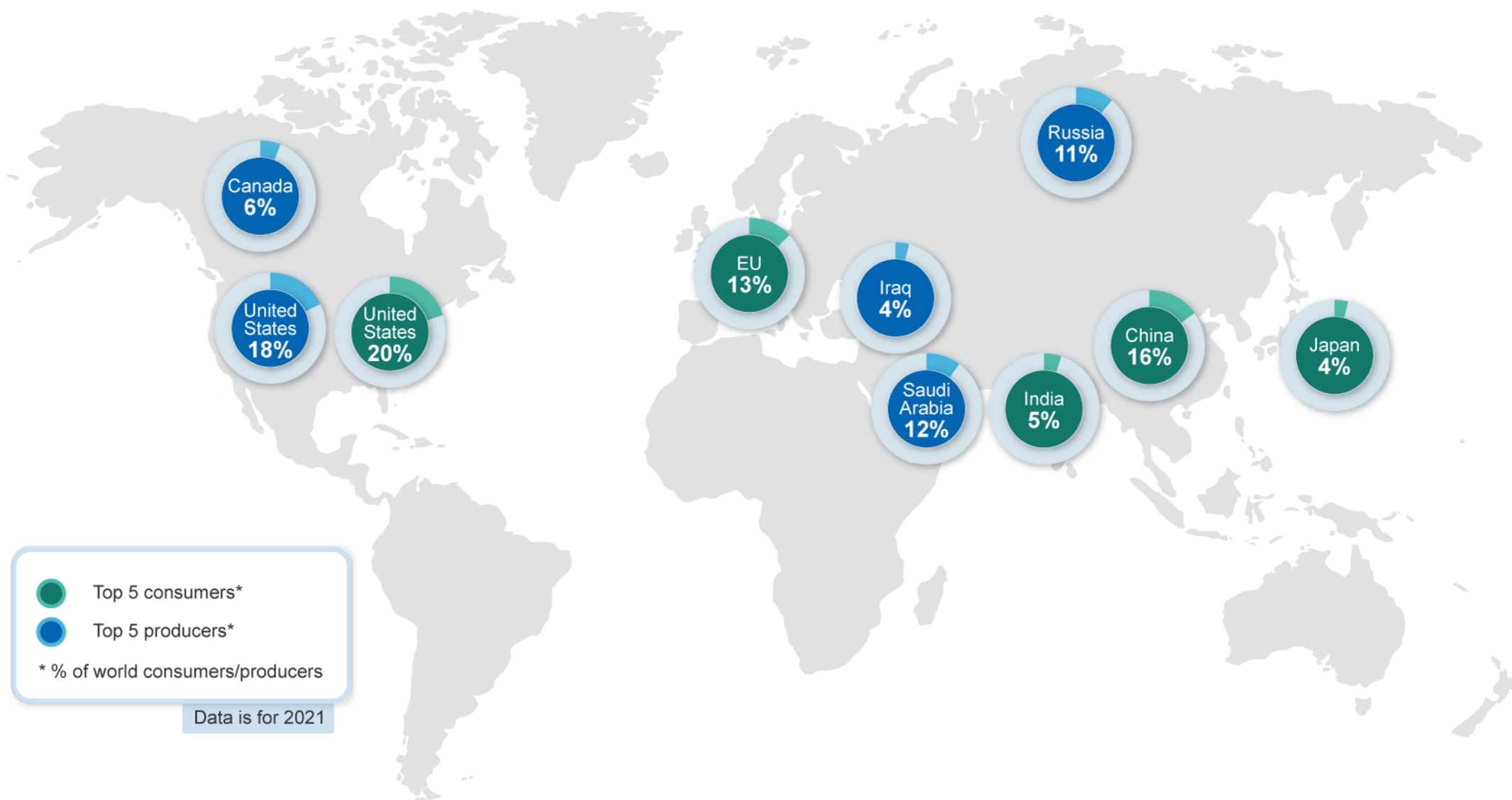
0.3% of the world's oil reserves held



\$7.4 billion worth of oil exports in 2020-21



0.5% of global production



8.1 Summary

- Significant uncertainty surrounds global oil markets, with the fallout of Russia's invasion of Ukraine dominating global supply concerns, and COVID-19 outbreaks in China weakening global demand prospects. Brent crude oil is forecast to average US\$105 a barrel in 2022, before declining over the rest of the forecast period.
- Australian crude oil and feedstock exports in 2021–22 are estimated to average 282,000 barrels a day, holding steady out to 2023–24.
- Elevated oil prices are expected to lift Australian oil export earnings by 81% to \$13.5 billion in 2021–22. Earnings are forecast to reach \$14.3 billion in 2022–23 before returning to \$12.6 billion in 2023–24, as oil prices fall from current highs.

8.2 World consumption

Demand growth to slow with geopolitical developments and lockdowns

In 2022, global oil consumption is predicted to rise, but growth could easily disappoint. In the March quarter 2022, world oil consumption grew steadily — with the easing of containment measures, re-opening of major international borders, and strong economic activity boosting demand. However, the pandemic, geopolitical developments and less rapid global economic growth, have all cast a shadow over the pace of oil demand. Severe COVID-19 lockdown measures in China, alongside the fallout from the Russian invasion of Ukraine, are estimated to have impacted global demand growth in the June quarter 2022, with impacts lasting potentially into the second half of the year. Global oil consumption is estimated to increase by 1.9% to 99 million barrels a day in 2022. Formal and 'self-sanctions' (independent corporate actions) imposed on imports of Russian oil are resulting in a rearrangement of global trade, and could shift demand patterns over time.

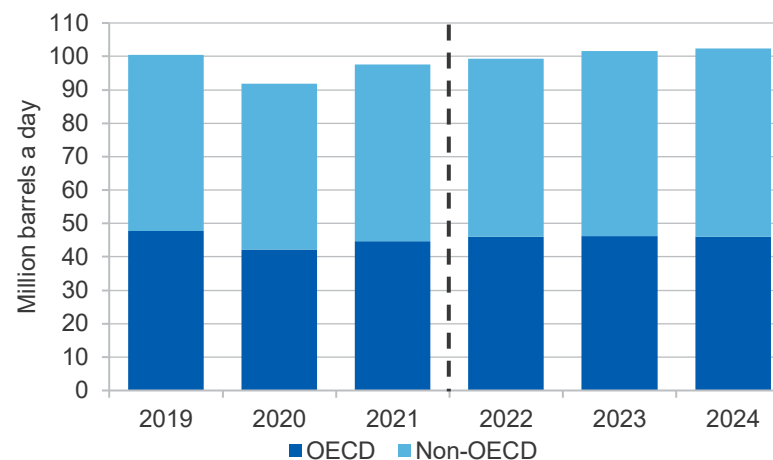
Demand for diesel and gasoline is expected to lead overall oil consumption gains this year, due to increasing global mobility and solid levels of industrial activity. Traffic volumes in major Western cities are approaching pre-COVID-19 levels. At the start of June, road traffic in major

European cities measured 95% of pre-pandemic levels. The increased mobility should propel high growth in transport fuel demand over the Northern Hemisphere summer vacation season (through to the end of the September quarter). Consumption of LPG/ethane and naphtha is also expected to build on 2021 levels — when they surpassed pre-COVID levels — with global petrochemical manufacturing remaining strong this year.

Total global air traffic for April 2022, was up 79% compared to April 2021 — but was still around 40% below pre-pandemic levels. The recovery in aviation in 2022 is forecast to be slower than anticipated, owing to COVID-19 mobility restrictions in China and sanctions affecting the Russian aviation sector. In China, air traffic fell from almost 11,000 daily flights in February to around 3,300 daily flights in April. The International Air Transport Association expects global traveller numbers to reach pre-COVID-19 levels by 2024.

Oil consumption is forecast to reach 102 million barrels a day by 2024, largely driven by rising global aviation demand (Figure 8.1).

Figure 8.1: Oil consumption, OECD and non-OECD



Source: Department of Industry, Science and Resources (2022); International Energy Agency (2022).

OECD consumption to rise with recovery in aviation

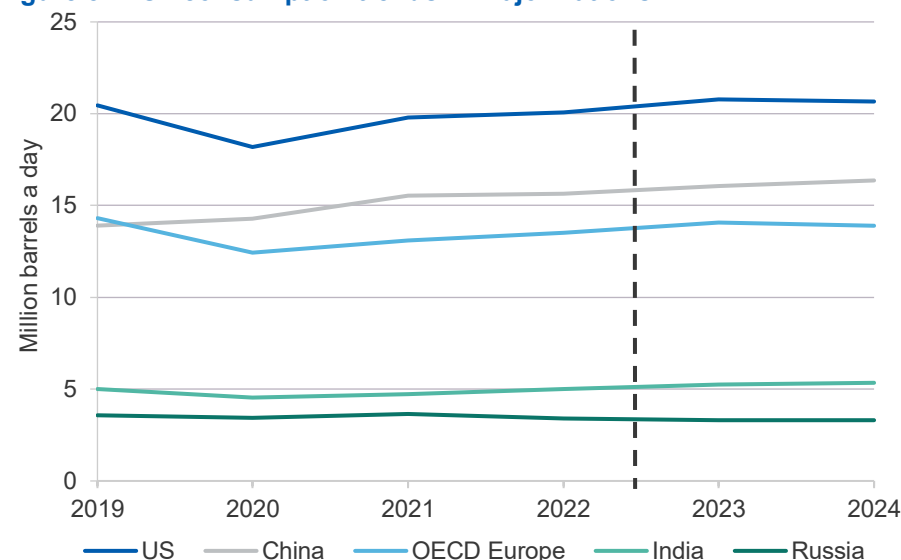
The impact of COVID-19 is fading in OECD nations, with cases of the Omicron variant having peaked. However, geopolitical developments around Russia's invasion of Ukraine will likely impact economic and oil demand growth in the second half of 2022, with major OECD nations committing to outright bans or phasing out imports of Russian oil. In 2022, OECD oil demand is expected to rise by 2.6% to 46 million barrels a day — still below 2019 levels.

While improved mobility and an ongoing rebound in jet fuel use should support overall gains in oil demand in Europe in 2022, the weakening of economic and trade ties with Russia may act as a partial offset. As part of a sixth round of sanctions on Russia, at the end of May the European Union (EU) agreed to ban the purchase of crude oil and petroleum products from Russia delivered to member states — by sea in six months and refined petroleum products in eight months' time. This package covers more than two-thirds of EU oil imports from Russia. With Germany and Poland confirming they will also ban Russian oil delivered by pipeline, the total effect could see 90% of crude oil sales to the EU blocked by end 2022. In 2021, 25-30% of Europe's oil imports were supplied by Russia, so the partial ban will see the EU look to oil supply outside of Russia.

Slowing economic activity and high fuel prices are expected to restrict growth in US oil demand to 1.4% in 2022 (Figure 8.2). However, rising mobility and the upcoming summer holiday season will boost demand for transportation fuels in the near term. The US announced a ban on Russian oil, gas and other energy imports on 8 March 2022. In 2021, the US imported around 672,000 barrels a day of crude oil and oil products from Russia (8% of US oil imports).

OECD consumption is forecast to increase by 0.8% in 2023, and then hold steady in 2024. The recovery in international travel will provide a boost to consumption over the forecast period. However, consumption may never return to 2019 levels, due to the continuing higher uptake of electric vehicles (see the *lithium* chapter and Figure 8.1).

Figure 8.1: Oil consumption trends in major nations



Source: Department of Industry, Science and Resources (2022); International Energy Agency (2022). China's zero-COVID strategy to slow non-OECD consumption growth

COVID-19 outbreaks in China (the world's second largest and fastest growing consumer of oil), as well as the impact of sanctions on Russia, are expected to have a significant impact on non-OECD consumption this year. While still estimated to grow 1.2% in 2022, and surpass 2019 levels, demand expectations have been significantly curtailed. Consumption is forecast to recover in 2023, rising 3.4% to 55 million barrels a day, and to continue rising to 56 million barrels a day by 2024.

China's dynamic zero-COVID policy has led to the introduction of severe containment restrictions over recent months, affecting hundreds of millions of people. The policies have visibly disrupted various forms of oil consumption — flights, freight and personal mobility. Heavy declines are estimated in the June quarter, however recovery is forecast later in the year, as major cities emerge from lockdowns.

While Chinese demand growth for 2022 is forecast at 0.13 million barrels a day (up 0.8% year-on-year), forecasts are subject to high uncertainty, due to the unpredictable path of the virus and the Chinese Government response (Figure 8.2).

Oil consumption forecasts for Russia also remain uncertain. Aviation consumption is expected to decline significantly, due to the banning of Russian airlines from many international routes and prohibition of Western airlines using Russian airports. As a result of the Russian invasion of Ukraine, oil demand is likely to be 'redistributed' throughout the year. Data for March 2022 suggests commercial flights from major Russian airports declined by 31%, while consumption of fuel by Russian military forces tripled from January 2022 levels.

A positive economic outlook, continuing demand by the manufacturing sector, and effective COVID-19 management are all supporting Indian oil consumption growth in 2022. Gasoline and diesel usage are expected to see major gains this year, due to increased mobility and flourishing industrial activity. After China, India is the second largest net oil importer, and typically imports around 85% of its oil. In 2021, less than 3% of India's crude imports came from Russia. However, in 2022, sanctions from other nations, emerging market gaps, and reports of significant discounts, have led to a strong increase in Russian oil exports to India — with the trend anticipated to continue. In 2022, Indian consumption is expected to grow a solid 6.3% year-on-year to 5 million barrels a day, reaching pre-pandemic levels (Figure 8.2).

8.3 World production

Global production set to rise overall, but Russia to see significant declines

As noted in the March 2022 *Resources and Energy Quarterly*, considerable uncertainty surrounds global oil production forecasts this year, with developments surrounding Russia's invasion of Ukraine having a significant impact. The trajectory of production in Russia — the world's third largest oil producer and largest exporter of oil to global markets — remains unknown amidst changing trade relationships and slowing

domestic consumption. In April 2022, total Russian oil output fell by 960,000 barrels a day month-on-month, largely due to weaker domestic demand from the refining sector. Russian seaborne exports of oil and oil products fell by around 330,000 barrels a day to 5.7 mb/d. With the EU's ban on Russian seaborne oil imports to take effect within coming months, alongside sanctions from other nations, further falls are expected. It is anticipated that Asian buyers will help to absorb some of the market gaps left by major buyers who have turned away from Russian oil. However, the extent of a full re-orientation of trade flows is uncertain, with flow-on effects to Russian production forecasts. The supply responses of OPEC+ and other major producers (including the US) remains similarly uncertain.

The disrupted supply environment prompted the US Government to announce the release of 1 mb/d of oil from the Strategic Petroleum Reserve (SPR) over six months, starting in early April. The International Energy Agency (IEA) also announced plans to move ahead with the largest stock release in IEA history — a collective oil stock release of 120 million barrels (which includes 60 million barrels contributed by the US). Combined releases will add around 240 million barrels to the global market over the next six months, but the overall impact of these coordinated releases remains uncertain.

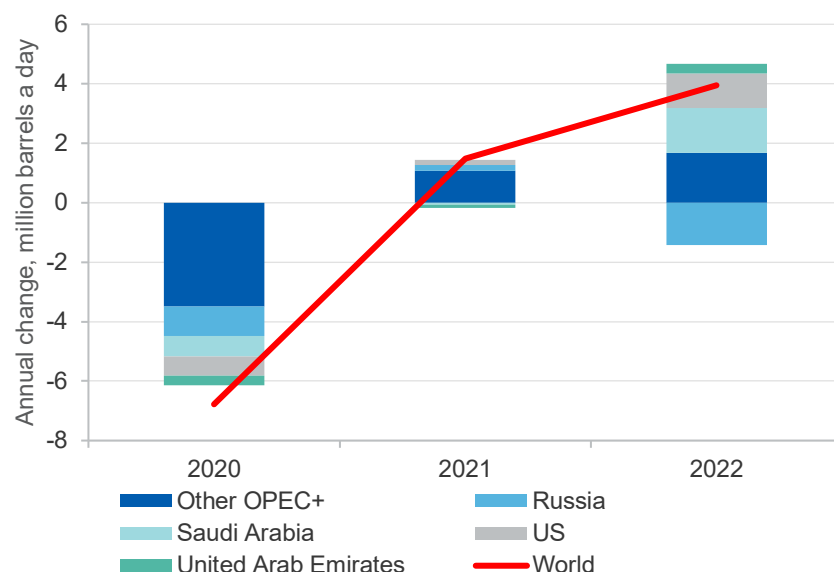
It is anticipated that overall global production will lift this year if OPEC+ continues with its announced policy. The US, Canada and Brazil are all expected to drive growth for non-OPEC+ producers. Global production is estimated to increase by 4.1% to average 99 million barrels a day in 2022, and 102 million barrels a day in 2023 (Figure 8.3).

OPEC+ supply progressively rising, but underperforming stated targets

So far, OPEC+ producers have stuck to their July 2021 decision to steadily wind back the (COVID-19 induced) production cuts of early 2020. The group agreed to increase production every month, commencing in August 2021, and meet monthly to reaffirm members' commitments and ensure market stability.

At their meeting on June 2, the alliance agreed to accelerate its production hikes through the Northern Hemisphere summer, amid signs of strong demand for transport fuels and as the EU embargo on Russian oil is scheduled to be phased in. The group agreed to increase its production target by 648,000 barrels a day in July and August, up from the 432,000 barrel a day rise in June.

Figure 8.3: Change in oil production by major producers



Source: Department of Industry, Science and Resources (2022); International Energy Agency (2022).

While sticking to its agreement, the group has struggled to hit production targets due to capacity constraints and technical issues. In April 2022, output fell by 840,000 barrels a day among the 19 members involved in the supply deal, compared to a planned 400,000 barrel a day increase. This was attributed in large part to declines from Russia. However, other countries including Nigeria and Angola, are also struggling to meet quotas due to lack of spare capacity and operational issues. Middle Eastern producers like Saudi Arabia, the UAE, Iraq and Kuwait, are tapping into

spare capacity to boost production; they added a combined 2.8 mb/d of crude oil production between January 2021 and April 2022. The group last met on June 30 (after this publication went to print). Production plans for September and beyond are likely to determine how tight the global oil market will be heading into 2023.

Adding to difficulties in the global supply situation, production in Libya has been impacted by shut-ins at several fields due to the ongoing political crisis. In the month of April, production fell by 200,000 barrels a day to 0.9 mb/d. Meanwhile, momentum to revive the Joint Comprehensive Agreement Plan of Action, which would potentially enable a full re-entry of Iranian oil into the global market, has slowed, with negotiations on hold since March. Early estimates had suggested an easing of sanctions on Iran could add up to 1.3 million barrels a day to global supply.

In 2022, OPEC+ output is expected to rise 4.3% to 51 million barrels a day. OPEC+ output is forecast at 48.5 million barrels a day in 2023 and 49.1 million barrels a day in 2024.

Non-OPEC+ production to rise and react to change in global trade flows

After a slow start to this year — which included freezing temperatures in major producing regions — US production is expected to rise steadily for the rest of 2022. Various sanctions on Russian crude, and elevated prices, have provided an opportunity for US producers to bring further supply online. According to Kpler shipping data from April, exports of US crude and products to Europe surged to their highest levels since 2016. The trend is set to continue as the EU partial ban on Russian oil imports takes effect. US production is expected to rise 6.9% to 18 million barrels a day in 2022 — a potential annual average record. However, investor support remains a key risk to US production and rate of ramp up.

Brazil, Canada and Norway are also expected to drive higher non-OPEC+ supply in 2022. In 2022, non-OPEC+ production is expected to surpass pre-COVID-19 levels, averaging 48 million barrels a day.

8.4 Prices

Fallout from Russia's invasion of Ukraine driving price surge this year

Oil prices have travelled a turbulent path so far in 2022. Prices rallied throughout January and February, on the back of low oil inventories and healthy consumption. Following Russia's invasion of Ukraine, prices broke the \$US100 a barrel mark in the first days of March and continued to soar. Brent prices peaked at \$US134 a barrel on 8 March 2022 — the highest levels since July 2008 — with the risk of sustained energy supply shocks, and sanctions on Russian oil, creating significant market uncertainties.

The US Government announcement of plans for a release of crude from the US Strategic Petroleum Reserve (SPR), and an IEA release from global crude stockpiles, saw WTI prices record their highest weekly drop since 2011 — falling \$US14 a barrel. The SPR release announcement came among surging fuel prices in the US, and aimed to bring some relief to consumers. Weakening demand prospects, with COVID-19 outbreaks in China, contributed to further falls in April. As a result, the April average dropped, after three consecutive months of rises.

Figure 8.4: Brent oil price, daily – 2020 to 2022



Source: Bloomberg (2022); Department of Industry, Science and Resources (2022).

Volatility persisted into May, as negotiations to impose EU sanctions on Russian oil proceeded. In early June, prices returned to early March levels as the market reacted to the EU's partial ban on Russian oil imports, and the supply decisions of OPEC+. Brent averaged \$US106 a barrel in April, \$US112 a barrel in May and \$120 a barrel in June (estimate) — with the June quarter average up 64% year-on-year (Figure 8.4).

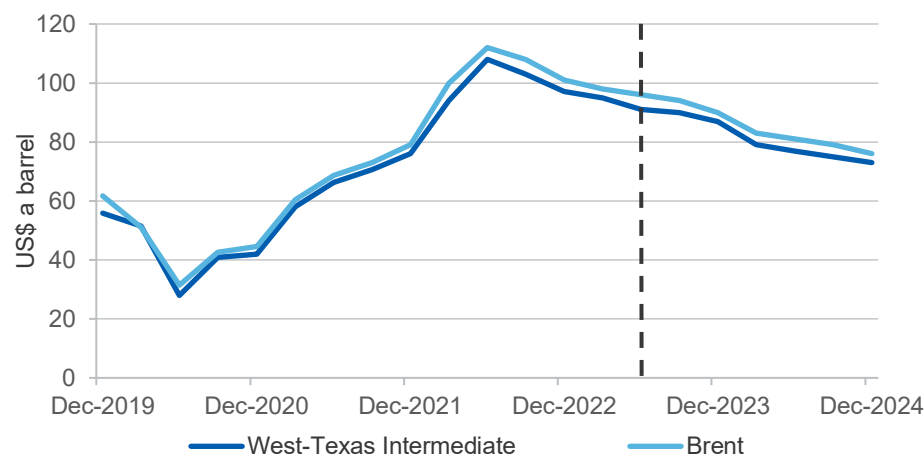
Prices to remain elevated, but see gradual decline

Price volatility is expected to continue in the near term, with fallout from the Russian invasion of Ukraine weighing against a shifting demand landscape. Prices are expected to remain elevated, but the forecasts are attached with more than usual uncertainty. Brent crude is forecast to average \$US108 a barrel in the September quarter 2022, and \$US101 in the December quarter — bringing the 2022 average to \$US105 a barrel. It is anticipated that scheduled hikes in OPEC+ output and rising output from other producers, and a softening in demand growth (with less rapid global economic growth), should put downward pressure on prices as 2022 ends and 2023 begins. The gradual decline is expected to continue during 2023 and 2024, as global trade flows re-shape. Brent crude is forecast to average \$US95 a barrel in 2023 and \$US80 a barrel in 2024 (Figure 8.5).

The ramifications of Russia's invasion of Ukraine will dominate the supply side uncertainty over the forecast period. As various bans on Russian oil and oil products take effect over the remainder of 2022, buyers who have imposed bans will be looking to ramp up imports from other sources — likely the US, Canada, and the Middle East. Meanwhile, it is anticipated that some Asian buyers will continue to ramp up Russian oil imports. The extent and pace of a re-orientation of global oil trade will significantly influence global prices. The decisions and actions of OPEC+ could add to supply uncertainty; with the group currently failing to meet its output target.

On the demand side, the COVID-19 situation in China, and any further lockdowns, is likely the biggest threat in near term. While it is anticipated that global demand will rise in 2022, the extent and longevity of containment restrictions in China — or other global responses to future virus strains — have strong potential to impact global demand growth.

Figure 8.5: Price outlook



Source: Bloomberg (2022); Department of Industry, Science and Resources (2022)

8.5 Australia

Anticipated final investment decisions to influence future oil production

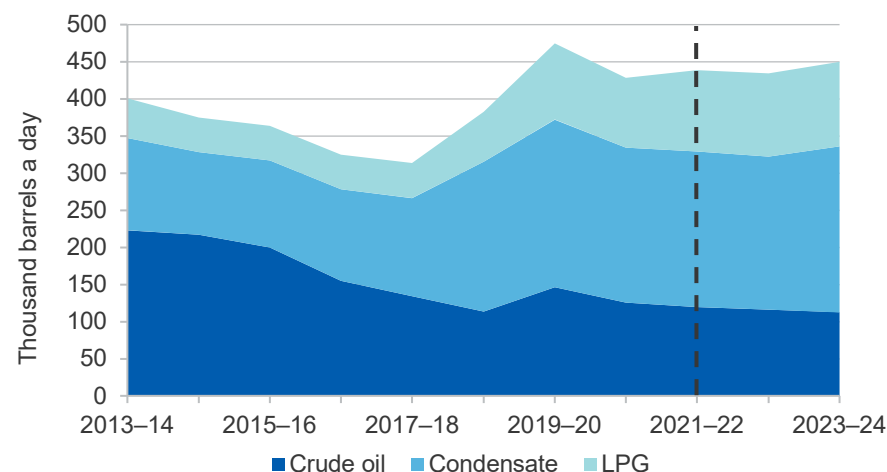
Australian crude and condensate production is estimated to have fallen slightly in 2021–22, to 329,000 barrels a day, as crude production rates declined. Since the majority of condensate is a by-product of gas, Australian condensate production is estimated to have lifted in tandem with record LNG production in 2021–22 (see Gas chapter). High levels of output at Ichthys, the NWS and Gorgon are estimated to have contributed to the production gains. Condensate production from Prelude tracked at record rates in the second half of 2021, but the site was shut in for Q1 2022 because of critical safety issues. Production resumed by the beginning of April, but the suspension impacted national condensate production for 2021–22.

Production is forecast to fall slightly in 2022–23, to 322,000 barrels a day, before returning to 336,000 barrels a day in 2023–24. Beyond the outlook, several potential and progressing projects will help to boost crude and condensate production, but will be met with the natural decline at existing fields. Santos and Carnarvon Energy are targeting their Dorado project to

be FID ready in the second half of 2022. According to their latest report, the Front-End Engineering and Design is progressing well.

In late March, Santos announced the Pavo-1 exploration well confirmed a significant oil discovery in the Bedout sub Basin, less than 50 km east of the Dorado field. The 2C continent resource at the Pavo site, assessed at 43 million barrels of oil, could thus add significant value to the Dorado project. Dorado has an estimated initial capacity of 75-100k barrels a day — nearly 25% of 2020–21 Australian crude oil and condensate output. In 2020–21, condensate accounted for 49% of Australian crude, condensate and LPG production. Crude oil accounted for 29% (Figure 8.6).

Figure 8.6: Composition of Australian oil production

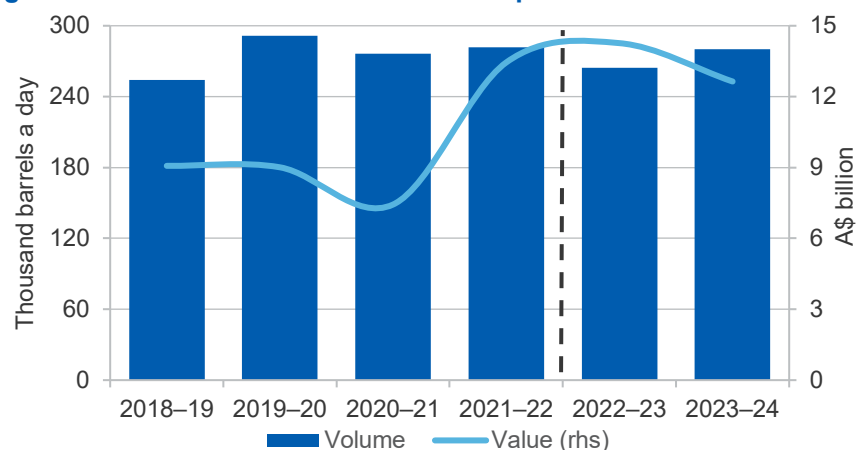


Source: Australian Petroleum Statistics (2022); Department of Industry, Science and Resources (2022)

Australian export earnings to lift with high oil prices

This year's jump in oil prices is expected to see revenue from Australian crude and condensate exports climb to record levels. In 2021–22, Australian export earnings are estimated to have reached \$13.5 billion — up 81% year-on-year. Export earnings are forecast to rise slightly in 2022–23, due to the higher oil prices forecast for 2022 and 2023, before dropping in 2023–24, as prices decline (Figure 8.7).

Figure 8.7: Australian oil and feedstock exports



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

Source: Australian Bureau of Statistics (2022); Department of Industry, Science and Resources (2022).

Domestic refinery production falling with refinery closures

The closure of the Kwinana (WA) and Altona (VIC) refineries in 2021 contributed to an estimated fall of one third in refinery output of petrol, diesel and jet fuel in 2021–22 from 2020–21 levels.

The two remaining refineries — Ampol's refinery in Lytton (Queensland) and Viva Energy's refinery in Geelong (Victoria) — have committed to continue to operate until at least mid-2027, with the offer of government support. In the 2021–22 Budget, as part of a new fuel security package, the Australian Government announced a suite of measures to help retain Australia's refining capacity.

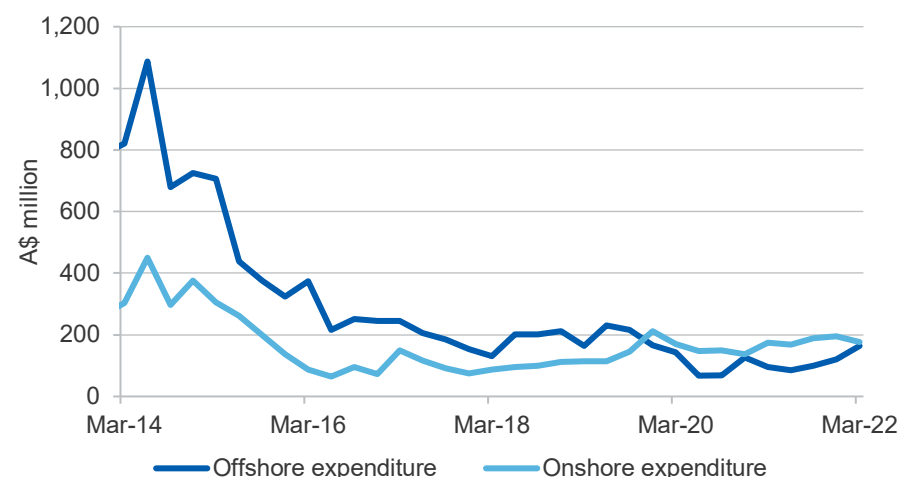
Australian oil consumption for 2021–22 is estimated to have lifted slightly (by 1.2%) from 2020–21, driven by stronger demand for transport fuels — as restrictions were lifted and State borders reopened in H1 2022. Sales of jet fuel for the March quarter 2022 were up 22% quarter-on-quarter (up 37% year-on-year), and demand for petrol and diesel has remained strong in the last six months. With Australia's borders now open, a sustained surge in aviation fuel demand is expected to see consumption continue to lift in 2022–23 and 2023–24.

Refined product imports for 2021–22 are expected to increase by 13%, driven by our reduced refining capacity. Meanwhile, imports of crude oil and other refinery feedstocks are expected to decrease by 24%, reflecting refinery closures.

Exploration

Australia's petroleum exploration expenditure was \$340 million in the March quarter 2022 (seasonally adjusted basis), a quarterly increase of \$23.9 million or 7.6%. This is 26% higher year-on-year. Onshore exploration fell 9.7% to \$176 million, while offshore exploration spending increased by 35% to \$164 million (Figure 8.8).

Figure 8.8: Australian petroleum exploration



Source: Australian Bureau of Statistics (2022) Mineral and Petroleum Exploration, 8412.0.

Revisions to forecasts

Australian export earnings have been revised down by \$0.4 billion in 2021–22 and revised up by \$0.3 billion in 2022–23 from the March 2022 REQ. Changes to export revenue forecasts have come from revised oil price forecasts.

Table 8.1: Oil Outlook

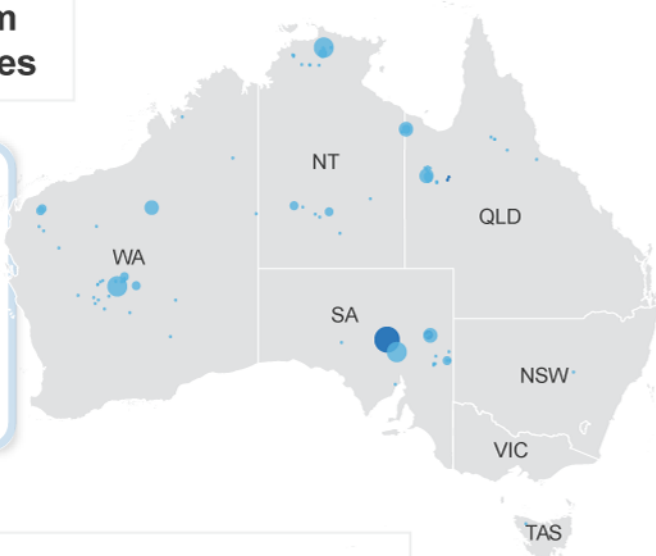
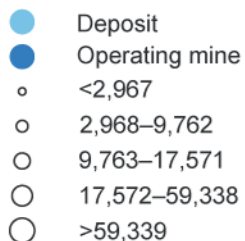
World	Unit	2021	2022	2023 ^f	2024 ^f	Annual percentage change		
						2022 ^s	2023 ^f	2024 ^f
Production ^a	mb/d	95	99	102	103	4.1	2.4	1.8
Consumption ^a	mb/d	98	99	102	102	1.8	2.2	0.9
WTI crude oil price								
– nominal	US\$/bbl	68	101	91	76	48.4	-9.7	-16.3
– real ^b	US\$/bbl	73	101	88	72	37.7	-12.2	-18.1
Brent crude oil price								
– nominal	US\$/bbl	70	105	95	80	49.7	-10.2	-15.6
– real ^b	US\$/bbl	76	105	92	76	39.0	-12.7	-17.5
Australia	Unit	2020–21	2021–22 ^s	2022–23 ^f	2023–24 ^f	2021–22 ^s	2022–23 ^f	2023–24 ^f
Crude and condensate								
Production ^{ac}	kb/d	335	329	322	336	-1.5	-2.2	4.3
Export volume ^a	kb/d	276	282	265	280	2.0	-6.1	5.9
– Nominal value	A\$m	7,434	13,448	14,264	12,641	80.9	6.1	-11.4
– Real value ^h	A\$m	7,753	13,448	13,599	11,633	73.5	1.1	-14.5
Imports ^a	kb/d	247	187	190	189	-24.1	1.5	-0.5
LPG production^{acd}	kb/d	94	109	112	114	16.6	2.5	1.8
Refined products								
– Refinery production ^a	kb/d	375	249	233	230	-33.4	-6.5	-1.2
– Export volume ^{ae}	kb/d	13	8	5	5	-42.2	-34.1	0.2
– Import volume ^a	kb/d	647	731	761	785	13.0	4.0	3.2
– Consumption ^{ag}	kb/d	913	924	956	977	1.2	3.5	2.2

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 2022 calendar year US dollars; **c** Historical production data was revised in the June quarter 2022 to align with the Australian Petroleum Statistics **d** Primary products sold as LPG; **e** Excludes LPG; **f** Forecast; **g** Domestic sales of marketable products, including imports; **h** In 2021-22 financial year Australian dollars; **s** estimate.

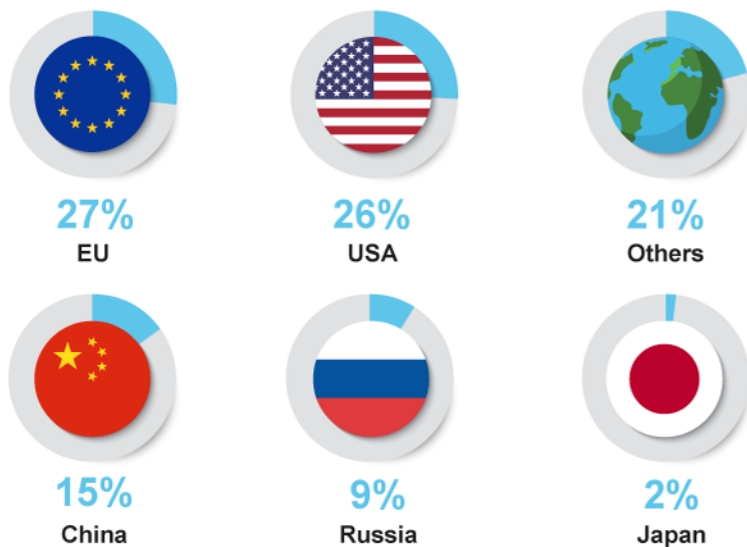
Source: ABS (2022) International Trade in Goods and Services, Australia, Cat. No. 5368.0; International Energy Agency (2022); EnergyQuest (2022); US Energy Information Administration (2022); Department of Industry, Science and Resources (2022).

Uranium

Major uranium deposits, tonnes



Consumer markets



Uranium facts



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



Nuclear plants can supply electricity to **4-5 million people on only 2km² land**

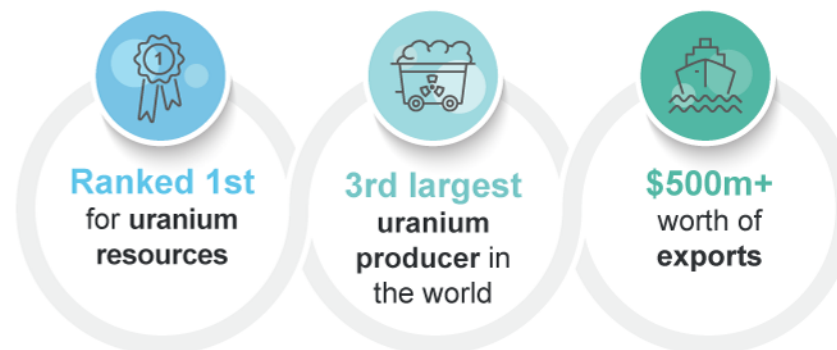


Uranium powers around **450 nuclear plants**, with **50 more under construction**



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

Australia's Uranium



9.1 Summary

- Uranium prices are forecast to lift from US\$53 a pound in 2022 to US\$61 a pound by 2024. Uranium shortfalls are becoming a prospect, following years of low prices and underinvestment.
- Australian exports are forecast to decline to 4,700 tonnes in 2021–22, following the closure of the Ranger mine. This is expected to rise to around 5,500 tonnes by 2023–24 (see [Australia section](#)).
- Price growth is expected to increase uranium export values from \$511 million in 2021–22 to \$815 million by 2023–24.

9.2 World consumption

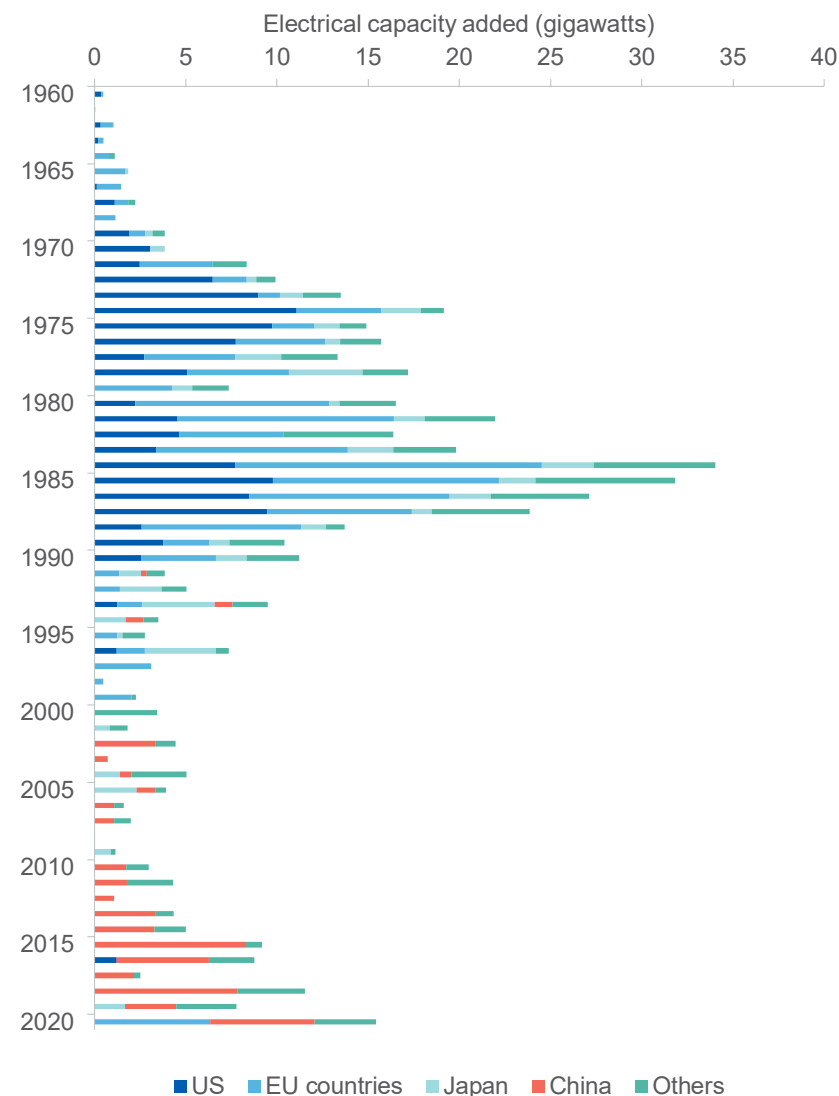
Market conditions have shifted as supply becomes tighter

Uranium markets are entering a new phase. Uranium prices have been relatively low since 2011, when radioactive material leaked from Japan's Fukushima plant. The Japanese nuclear industry was closed down after the incident, and other countries (notably Germany) followed with proposals to delay or withdraw from nuclear power. This contributed to a lull in nuclear development after 2011 (Figure 9.1). As prices fell and inventories built, mine projects were cancelled or placed in hiatus.

However, the market has recently shifted, with demand increasing rapidly relative to supply. Japan has restarted nine of its reactors, with a tenth (unit 2 at Chugoku Electric Power Company's Shimane nuclear power plant) now also approved for imminent restart. Other countries have accelerated their investment in nuclear power. Uranium inventories have declined, and paused mining projects in Africa, Australia and Kazakhstan are being revisited. Price rises that previously appeared tentative now appear to be solid. The twin demands of lower carbon emissions and reduced dependency on Russian gas may support further nuclear take-up.

The Russian invasion of Ukraine threatens to push up prices further. Russia supplies almost 15% of global uranium concentrates in addition to its enrichment facilities, and its exports have potential to be disrupted by sanctions and by cancellations of cargo insurance. A substantial supply effect is not yet evident, but the added risk may be pushing prices up.

Figure 9.1: Growth in world nuclear power generation



Source: International Energy Agency (2022); World Nuclear Association (2022); Department of Industry, Science and Resources (2022)

Uranium miners retain some unused capacity, which could be brought into markets relatively easily. However, it is not yet clear that this will be sufficient to meet demand over the next few years. Falling inventories have made uranium markets more vulnerable to supply shocks. Lack of investment over the past 10 years has affected all stages of the supply chain, from extraction to shipping, conversion, and enrichment. A larger share of the spot market is now being acquired by speculators, adding to potential price pressures faced by power plants. Demand is expected to continue to outstrip supply over the outlook period (Figure 9.2).

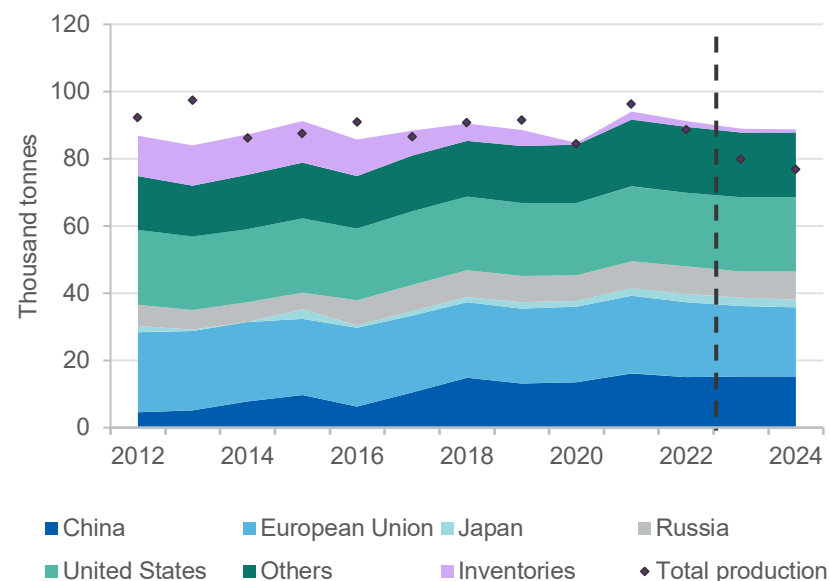
In China, Unit 6 of the Hongyanhe nuclear power plant has begun supplying power to the grid. The State Council has also approved the construction of six new reactors, with power stations at Sanmen, Haiyang and Lufeng each to gain two reactors.

The UK has released a new Energy Security Strategy, which calls for the construction of eight new reactors, supported by small modular reactors and totalling 24 GWe of capacity. If undertaken, construction on this scale could attain significant economies of scale, potentially building domestic construction capacity and reducing construction costs.

India is also seeking to develop economies of scale in its reactor development, announcing plans to start constructing reactors in fleet mode from 2024. Ten reactors are expected to be constructed under this process, all using an identical 700 MWe PHWR domestically developed design. The use of fleet mode and identical designs is intended to foster greater efficiency and economies of scale.

The newly elected South Korean government has dumped the previous government's nuclear phase-out policy. The new government has announced that 'reasonable' use of nuclear power will continue, citing its importance to net-zero targets. A recent poll suggests 72% of respondents support the ongoing use of nuclear power. South Korea has 24 nuclear reactors, and could also now resume construction of Shin-Hanul units 3 and 4. South Korean companies continue to progress a large reactor construction pipeline in the United Arab Emirates, where two plants have been grid connected, and a third (Barakah 3) is undergoing fuel loading.

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



Source: International Energy Agency (2022); World Nuclear Association (2022); Ux Consulting (2022)

9.3 World production

Large suppliers are restoring production, but slowly

In Canada, Cameco has announced that its production plans will remain unaltered, despite the recent tightening in the uranium market. The company has noted that 'Cameco does not intend to change its production plans despite the current geopolitical uncertainty ... we will not front-run demand with supply'.

The company is holding to its schedule in restarting production at the McArthur River mine in 2024. The mine has been in care and maintenance since 2018, when prices were at a near-record low. Output at Cigar Lake continues at a reduced rate, but with the potential to rise if prices increase further.

9.4 Prices

Prices are expected to rise steadily, and potentially rapidly

Uranium prices are lifting, and the rise is expected to sustain over time. Structural changes in uranium markets have reversed the conditions of the last 11 years, with years of deferrals of uranium projects closing the window on numerous potential avenues of supply. Uranium mines typically take a long time to obtain approvals, potentially drawing out any supply shortages over the longer term, and creating a baseline for structurally higher prices over the rest of the 2020s (Figure 9.3).

9.5 Australia

Higher prices should boost export earnings despite a recent fall in volumes

Production at Olympic Dam has recovered, following the completion of most maintenance at the site. Output is expected to lift in 2022 and sustain through the outlook period (Figure 9.4).

Two domestic uranium miners — Vimy Resources and Deep Yellow — have agreed to a merger, under which Deep Yellow acquires all of Vimy's shares. The combined entity will own the emerging Mulga Rock project in Western Australia, as well as the Tumas mine in Namibia. The sharing of capital may allow for more rapid development of the Mulga Rock deposit.

Boss Energy has approved its final investment decision, and released a plan for rebuilding the Honeymoon mine. The mine has been in care and maintenance for nine years. The company has announced that \$113 million will be used to refurbish the mine, with first output expected in late 2023. The mine is expected to ramp up to full production (2.45 million pounds per annum) by 2027.

Extra production and higher prices are expected to lift Australia's uranium export earnings from \$511 million in 2021–22 to \$815 million by 2023–24 (Table 1).

Revisions to the outlook

Export earnings forecasts for 2021–22 and 2022–23 have been revised up by around \$180 million (nominal terms) reflecting a stronger price forecast.

Figure 9.3: Uranium price outlook



Source: Cameco Corporation (2022) Uranium Spot Price; Ux Consulting (2022) Uranium Market Outlook

Figure 9.4: Australia's uranium exports



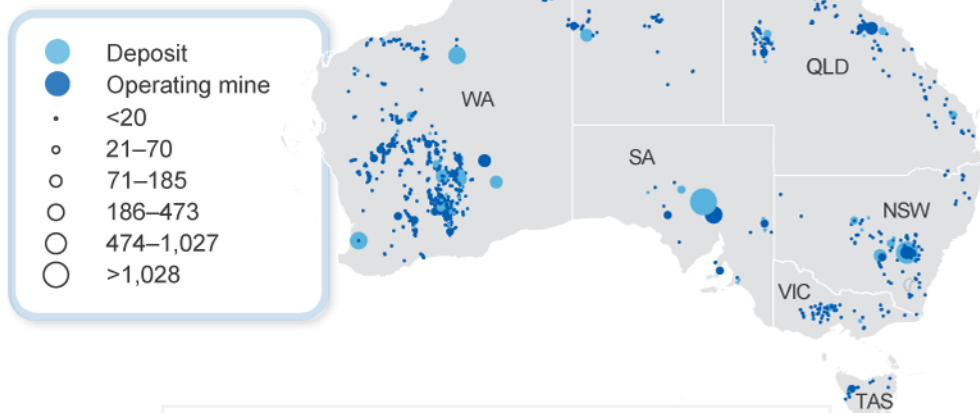
Source: Department of Industry, Science and Resources (2022)

Table 9.1 Uranium outlook

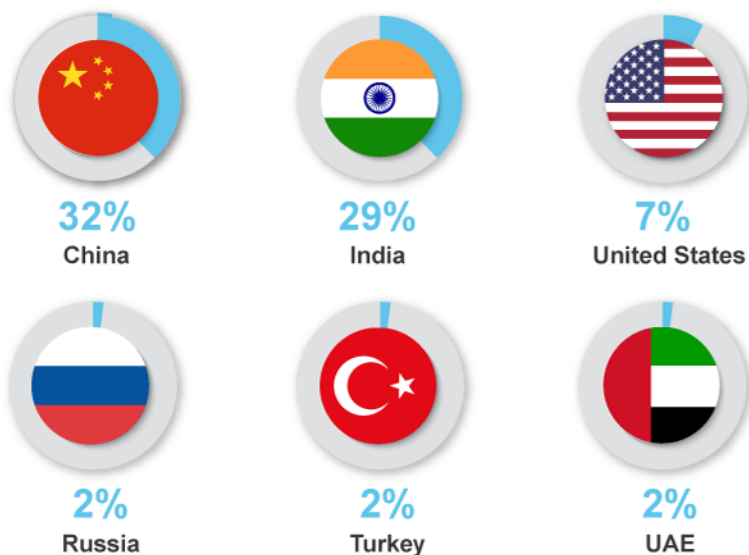
World	Unit	2021	2022 ^s	2023 ^f	2024 ^f	Annual percentage change		
						2022 ^s	2023 ^f	2024 ^f
Production	kt	54.2	56.9	59.3	61.6	5.0	4.2	4.0
Africa ^b	kt	9.3	9.2	10.1	10.5	-0.5	9.6	3.8
Canada	kt	5.5	6.8	7.1	6.4	23.0	5.0	-10.0
Kazakhstan	kt	25.8	25.9	26.1	28.3	0.6	0.5	8.6
Russia	kt	3.3	3.3	3.7	3.9	0.0	12.2	3.6
Consumption	kt	91.7	89.5	87.9	87.7	-2.4	-1.8	-0.2
China	kt	16.1	15.1	15.1	15.2	-6.3	0.4	0.6
European Union 27	kt	23.1	22.3	21.1	20.6	-3.8	-5.3	-2.4
Japan	kt	2.4	2.4	2.4	2.4	0.0	0.0	0.0
Russia	kt	7.9	8.2	7.8	8.2	3.2	-5.0	5.7
United States	kt	22.2	22.0	22.2	22.2	-0.6	0.7	0.0
Spot price	US\$/lb	35.3	52.9	59.7	61.4	50.0	12.8	2.9
real ^c	US\$/lb	38.0	52.9	58.0	58.4	39.2	9.6	0.6
Australia	Unit	2020–21	2021–22^{fs}	2022–23^f	2023–24^f	2021–22^s	2022–23^f	2023–24^f
Mine production	t	6,213	4,019	5,480	5,495	-35.3	36.4	0.3
Export volume	t	6,166	4,705	5,480	5,495	-23.7	16.5	0.3
– nominal value	A\$m	606	511	743	815	-15.7	45.5	9.7
– real value ^d	A\$m	633	511	710	754	-19.2	39.0	6.2
Average price	A\$/kg	98.3	109.3	135.6	148.3	11.2	24.1	9.3
– real ^d	A\$/kg	102.5	109.3	129.3	136.5	6.6	18.3	5.6

Notes: **b** Includes Niger, Namibia, South Africa, Malawi and Zambia; **c** In 2022 US dollars; **d** in 2021–22 Australian dollars; **s** estimate; **f** forecast; **r** Compound annual growth rate
Source: Department of Industry, Science and Resources (2022); Cameco Corporation (2022); Ux Consulting (2022) Uranium Market Outlook

Major Australian gold deposits, tonnes



World jewellery consumer markets



Gold



Gold is a critical component in **COVID-19 diagnostic tests**



The US holds the largest stockpile of gold reserves, at **8,133 tonnes**

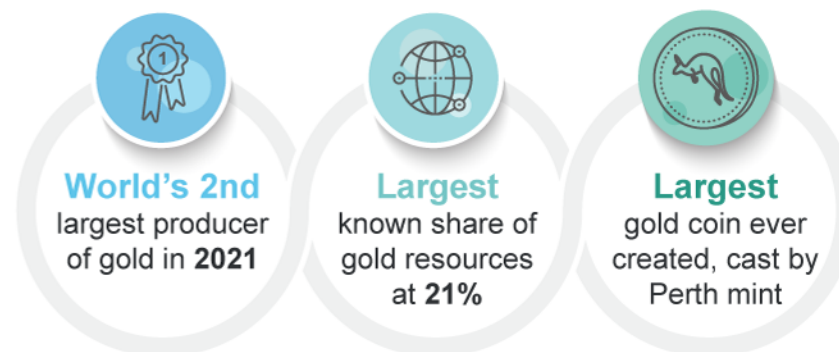


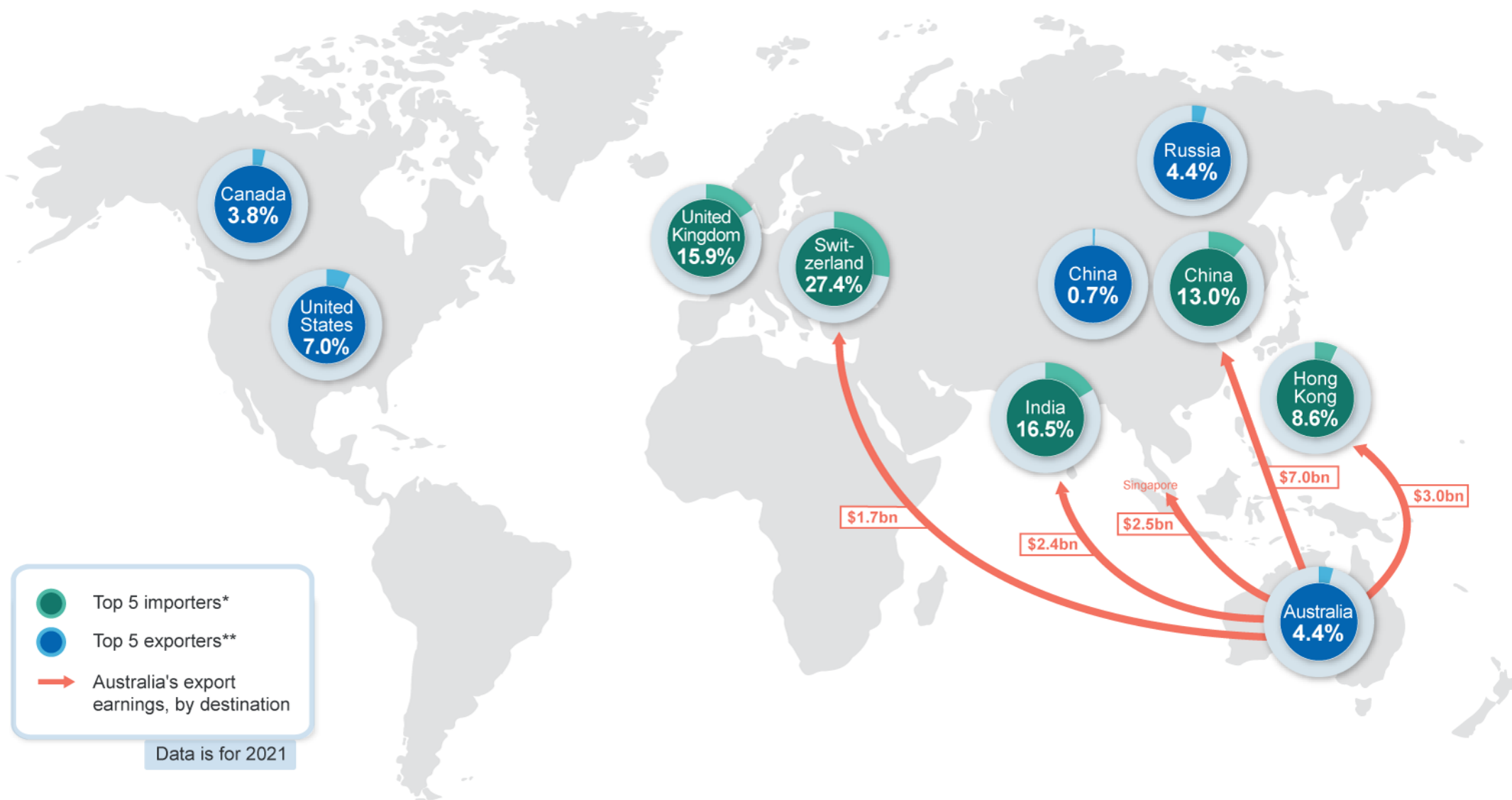
In 2021 jewellery fabrication made up **55% of global gold use**



Gold only makes up **3 parts per billion** of the Earth's outer layer

Australia's gold





* % of world imports (including ETFs and other investments)

** % of gold export from top 5 gold producing countries

10.1 Summary

- Gold prices averaged US\$1,880 an ounce in the first half of 2022, with prices generally falling from their 2022 peak of US\$2,051 in March. Driving the weakness has been US dollar strength and rising bond yields on the back of market expectations of aggressive US monetary tightening during the remainder of 2022.
- Labour and skill shortages affected Australian gold mine production in the March quarter 2022, however production still rose by 3.8% year-on-year (see Australia section).
- Gold earnings are forecast to rise from \$23.5 billion in 2021–22 to \$25.5 billion in 2023–24, as rising gold export volumes outweigh the forecast decline in gold prices.

10.2 World consumption

World gold consumption increased in the March quarter 2022

World gold demand increased by 34% year-on-year to 1,234 tonnes in the March quarter 2022. The increase was driven by strong inflows into gold-backed exchange-traded funds (ETFs), which gained 269 tonnes (worth US\$17 billion) over the quarter, compared with a net outflow of 173 tonnes during 2021. Heightened geopolitical risk, following Russia's invasion of Ukraine, drove investment flows into safe-haven assets (such as gold ETFs). Strong gold prices, weaker equity markets and mounting inflation concerns added to gold's appeal, driving investment demand in the March quarter 2022 to be almost three times higher year-on-year.

Official sector buying (central banks and other government financial institutions) fell by 29% year-on-year to 84 tonnes in the March quarter 2022. According to the World Gold Council, Egypt and Turkey were the largest purchasers, collectively purchasing 81 tonnes of gold during the quarter. Kazakhstan and Uzbekistan accounted for the majority of sales, collectively selling 59 tonnes of gold from their reserves.

Consumer demand for gold (jewellery, gold coins and bars) was significantly weaker during the March quarter 2022, partially offsetting

increases in investment demand. As a result, gold jewellery consumption declined by 7% year-on-year to 424 tonnes in the March quarter 2022, driven largely by weaker demand from China and India in response to the sharp rise in gold prices in late February. Jewellery consumption in India was 26% lower year-on-year, at 94 tonnes. Jewellery consumption in China fell by 8% year-on-year to 178 tonnes, with demand weakened further in March by the introduction of lockdowns in cities such as Shanghai and Shenzhen.

Retail investment in gold bars and coins was 20% weaker year-on-year during the March quarter 2022, with investors purchasing 282 tonnes of gold. The introduction of lockdown restrictions in China, and historically high local prices in Turkey, drove sharp declines in these countries. However, the significant year-on-year decrease was largely due to base effects, as March quarter 2021 investment was particularly strong.

Figure 10.1: World gold demand by sector



Notes: f Forecast. Jewellery fabrication includes jewellery consumption and the change in jewellery inventory. Investment includes ETFs, bars and coins. Technology includes gold used in the electronic, dentistry and other industrial sectors.

Source: World Gold Council (2022); Metals Focus (2022); Department of Industry, Science and Resources (2022)

Investment demand to push gold consumption higher in 2022

World gold consumption is forecast to increase by 6.1% to 4,265 tonnes in 2022, driven largely by stronger investment demand — rising by 28% year-on-year. Investment demand (gold-backed ETFs or bar & coin holdings) has been revised to 1,284 tonnes in 2022, 30% higher than forecast in the March 2022 *Resources and Energy Quarterly*. Investment demand in 2022 has been revised up as expectations of rising inflation and ongoing geopolitical uncertainty add to gold's appeal.

Jewellery consumption is expected to rise by only 1.2% in 2022 — lower than previously forecast — due to weaker than expected demand in China and India during the first half of 2022. Chinese consumption may be impacted by the ongoing impacts of measures to control the spread of the Omicron variant of the COVID-19 virus in many of the major cities in China.

Gold consumption expected to fall in 2023 and recover in 2024

World gold consumption is forecast to decrease by 1.9% to 4,183 tonnes in 2023, as investment demand eases from relatively strong levels in 2022. Gains in real bond yields should slow in 2023, as the major central banks largely complete the withdrawal of stimulatory monetary policy.

Jewellery consumption is expected to grow by 6.9% year-on-year in 2023, as lower prices support purchases in key consuming countries such as China and India.

World gold consumption is forecast to increase by 6.9% in 2024 to 4,470 tonnes, driven largely by continued growth in global jewellery consumption. The ongoing economic recovery in developed nations should boost consumption. Rising income growth and the forecast decline in gold prices, are expected to support demand from price-sensitive consumers in China and India.

10.3 World production

World supply increased in March quarter 2022

World gold supply increased by 4.3% year-on-year to 1,156 tonnes in the March quarter 2022. The increased supply was driven by a 2.6% rise in global mine production and a 15% increase in gold recycling. Stronger gold recycling activity in the quarter largely reflected higher US dollar gold prices, with increases achieved despite the introduction of lockdowns in China.

Global mine production rose to 856.5 tonnes during the March quarter 2022, driven primarily by increased production in China and Australia.

Production in China — the world's largest gold producing country — increased by 5% year-on-year as most mines in Shandong province resumed production in the March quarter 2022. Shandong's provincial government halted operations in 2021, as safety inspections took place.

Production in Australia — the world's second-largest gold producing country — increased by 3.8% year-on-year in the March quarter, to 77.0 tonnes (see Section 10.5 Australia's exports and production).

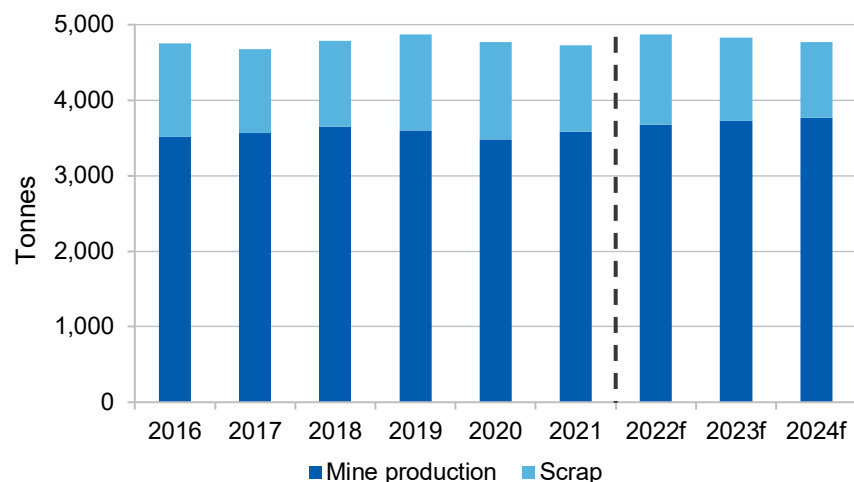
Production in the United States rose by 4% in the March quarter 2022, due to the extraction of higher-grade ores and increased output from the Carlin mines of Nevada. In West Africa, production in Mauritania rose by 54% year-on-year, as the first phase of the Tasiast expansion project was ramping up through the quarter.

World supply expected to fall as recycling activity eases

In 2022, global gold supply is forecast to increase by 3.5% to 4,868 tonnes, driven mainly by higher gold mine production and gold recycling. World gold mine production is forecast to rise by 2.5% in 2022 to 3,671 tonnes, led by increases in China, Australia, North America and West Africa.

High gold prices are also expected to support greater recycling activity, with recycling volumes forecast to rise by 4.6% to 1,196 tonnes.

Figure 10.2: World gold supply



Notes: s Estimate. f Forecast. Net producer hedging is not included.

Source: Department of Industry, Science and Resources (2022); Metals Focus (2022); World Gold Council (2022).

World gold supply is forecast to decline by 0.4% in 2023 and by 1.0% in 2024, as lower recycling activity offsets increases in mine production.

Gold mine production is expected to increase as new projects come online in Canada, Chile, Brazil and Argentina. Production in Australia is forecast to rise during 2023 and 2024, driven by new projects and expansions of existing projects. Continued environmental regulations and industry consolidation in China will see production fall over the medium-term.

10.4 Prices

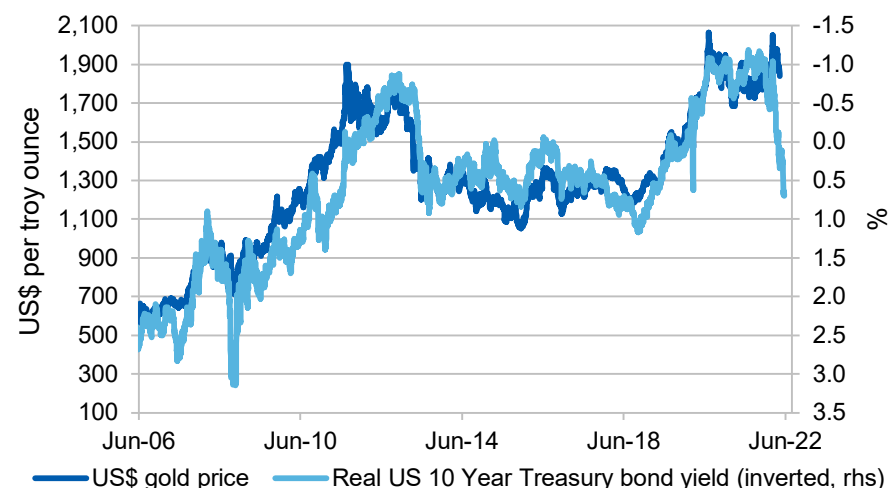
Gold prices have fallen from their peak in March 2022

The London Bullion Market Association (LBMA) gold price retreated to a low of about US\$1,810 an ounce during the June quarter 2022, driven by rising real bond yields and a strengthening US dollar. The price fall came after gold prices averaged US\$1,945 an ounce over March and April 2022

due to strong safe-haven demand amid the Russian invasion of Ukraine and increasing inflation in advanced economies.

Higher than expected inflation in advanced economies has resulted in most central banks commencing interest rate hikes — and signalling further hikes — during the remainder of the year. On 15 June 2022, the US Federal Reserve lifted the target for the fed funds rate by 75 basis points to 1.50%-1.75%, and markets are now pricing in a Fed Funds rate of about 3.6% by the end of the year — 172 basis points higher than expected at the time of the release of the March 2022 *Resources and Energy Quarterly*.

Figure 10.3: Gold price and real US 10-Year Treasury yield



Source: Bloomberg (2022)

As a result of the central bank action, real bond yields have lifted sharply in recent months, now consistently sitting above 0% for the first time since the beginning of the pandemic in 2020. Rising bond yields tend to undermine gold's appeal to institutional and retail investors as a secure asset to hedge against risks or inflation. This is because increases in the yield of a US (or other credible government) Treasury bond raises the so-called market "risk-free rate", and increases the opportunity cost of holding

gold. However, the relationship between gold prices and real bond yields has weakened significantly since the beginning of the Russian invasion of Ukraine, due to additional safe-haven demand for gold.

Gold prices to fall over the short and medium term

Gold prices are projected to fall at an average annual rate of 3.3% over the outlook period, from about US\$1,850 an ounce in 2022 to US\$1,665 an ounce in 2024. Driving the fall in 2023 will be rising interest rates — as central banks in advanced economies tighten monetary policy in response to surging inflation. Lower safe haven demand will do less to ameliorate the impact of higher interest rates on gold demand.

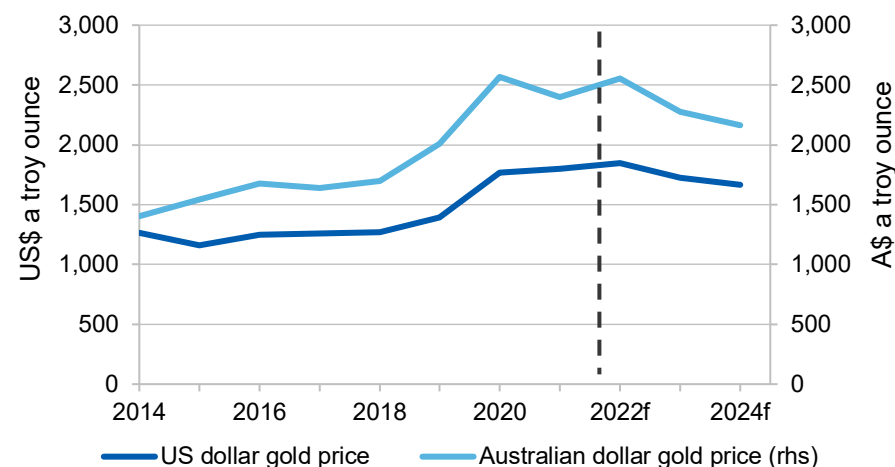
In combination with forecast appreciation in the Australian dollar, the lower US dollar gold price is expected to lower the Australian dollar gold price from A\$2,556 an ounce in 2022 to A\$2,162 an ounce in 2024.

There are several risks to the gold price assessment in the second half of 2022, including the arrival of any new COVID-19 variants and the extent to which COVID-19 lockdowns and control measures persist in China. Persistent outbreaks could dampen future gold demand from one of the largest importers and consumers of gold.

A further risk to the price assessment is the continued fallout from Russia's invasion of Ukraine. Any escalation (or de-escalation) in the conflict is likely to have a pronounced impact on the safe-haven premium of gold over the forecast period.

Finally, the path of official interest rates — and partly by extension, real bond yields — over the forecast period, is highly uncertain and subject to central bank assessments of economic conditions. A faster than expected rise in real bond yields could lead to a steeper than forecast fall in gold prices, as the opportunity cost of holding gold increases. On the other hand, a slower tightening of monetary policy would likely result in a slower than forecast decline in gold prices, as real bond yields could be expected to rise more slowly.

Figure 10.4: US and Australian dollar gold prices



Note: f Forecast.

Source: Department of Industry, Science and Resources (2022); LBMA (2022) Gold price PM

In the first two months of the June quarter 2022, global equity markets responded negatively to rising bond yields, strength in the US dollar, and pessimism over the global economic outlook. As a result, weakness in equity markets will support gold's appeal to investors looking for safe-haven assets. However, the extent to which this supports gold prices will also depend on bond yields.

10.5 Australia's trade, production and exploration

Australian gold exports fell in March quarter 2022

Australian gold export earnings fell by 21% year-on-year to \$5.4 billion in the March quarter 2022, driven by lower gold prices (22% lower year-on-year).

Australia exported \$2.5 billion to China (excluding Hong Kong) in March quarter 2022, significantly higher than the \$218 million in gold exports in the March quarter 2021 — which was impacted by bans imposed by Beijing when COVID-19 hit.

Gold exports to India were worth \$243 million in the March quarter 2022, significantly lower than the \$1.2 billion of exports in the March quarter 2021. Indian demand has declined due to the COVID-19 lockdowns.

Australian exports to the financial hubs (United States, United Kingdom, Hong Kong and Singapore) were collectively worth \$1.7 billion in the March quarter, 52% lower year-on-year.

Australia's gold exports are estimated to have fallen by 10% to \$23.5 billion in 2021–22, largely driven by lower Australian dollar gold prices and, to a lesser extent, lower export volumes.

Australian gold exports to increase in 2022–23 and 2023–24

Australian gold export earnings in 2022–23 are forecast to increase by 10% to \$26.0 billion in 2022–23, before falling to \$25.5 billion in 2023–24. Increasing gold production is expected to drive higher export volumes over the next two years, while the forecast decline in export values in 2023–24 is expected to be driven by lower US and Australian dollar gold prices (see the *Prices* section).

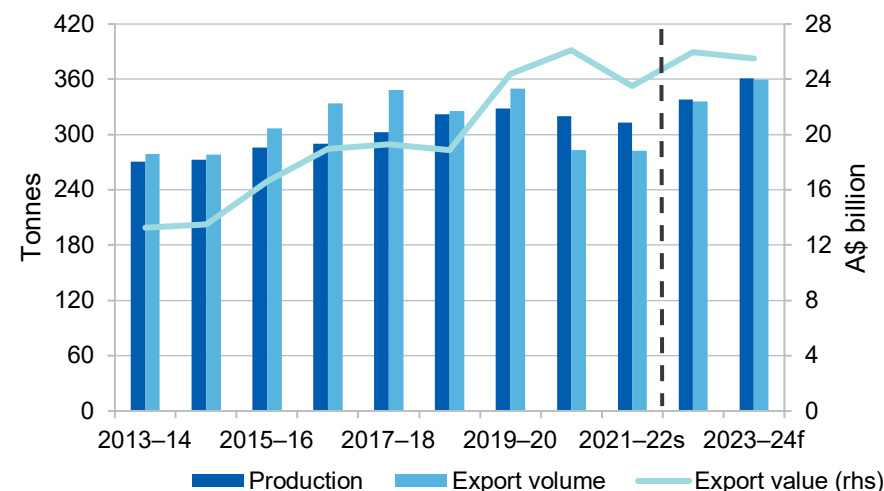
Australian gold mine production rose in March quarter 2022

Australia's gold production rose by 3.8% year-on-year in the March quarter 2022 to 77.0 tonnes, despite the ongoing impacts of state border closures and COVID-19 related labour shortages. Several miners cited wet weather impacts in Western Australia (WA) and New South Wales (NSW) as having an impact on production over the quarter, while others pointed to supply chain delays — road haulage, for example — and pressures from input prices.

Australian gold output is estimated to have fallen by 2.1% to 313 tonnes in 2021–22, due to the impacts of COVID-19 related labour shortages and supply chain issues.

Production at Newcrest's Cadia mine in NSW decreased by 17% year-on-year in the March quarter 2022. However, production was 30% higher compared with December quarter 2021, as the SAG mill returned to full capacity after its replacement and upgrade.

Figure 10.5: Australian gold exports



Notes: s Estimate. f Forecast. Export volume contains ash, waste and scrap gold, of which the gold content is unknown.

Sources: ABS (2022); Department of Industry, Science and Resources (2022).

Production at Agnico Eagle's Fosterville gold operation in Victoria rose by 17% year-on-year. The company stated that while mine production was affected by lower workforce availability (related to COVID-19), lower than forecast ore tonnage was offset by a higher than anticipated grade.

Production at Northern Star's Super Pit gold operations in WA in the March quarter was 8.3% higher year-on-year, due to increased ore tonnage from underground and open-pit mining. Ore processed was lower than in December quarter 2021 due to a planned shutdown. However, this was offset by increased head grade and recovery efficiency. Production from Northern Star's Kalgoorlie operations was 35% lower year-on-year, due to a significant mill downtime event impacting available milling time in South Kalgoorlie.

Australian gold mine production to increase in 2022–23 and 2023–24

Australian gold production is forecast to rise at an average annual rate of 7.7% during 2022–23 and 2023–24.

Production is forecast to reach 338 tonnes in 2022–23, propelled by production from new mines and existing mine expansions. Red 5's 6.2 tonnes per year King of the Hills gold project in WA should start production in the September quarter 2022. First gold is expected from Calidus Resources' 4.3 tonnes per year Warrawoona gold project in WA in May 2022. Heritage Minerals plans to open the 1.6 tonnes per year Mount Morgan tailings project in Queensland in 2023.

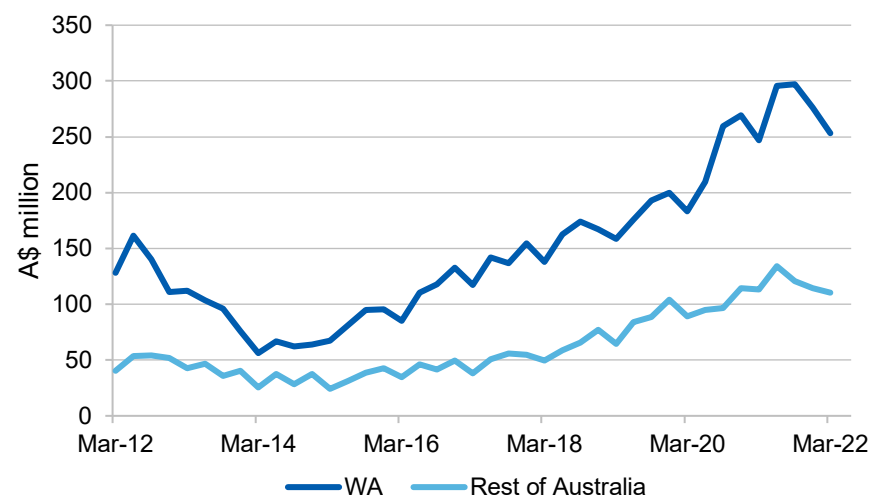
Production is then forecast to reach 361 tonnes in 2023–24, as Newmont's Tanami Expansion 2 is completed in early 2024, Bellevue Gold's 5.7 tonnes per year Bellevue gold mine in WA comes online in June quarter 2023, and Vista Gold's 11 tonnes per year Mt Todd project in the Northern Territory comes online in March quarter 2024.

The primary risk to the Australian gold production forecast is the extent to which supply chain issues and labour or skills shortages continue in the short term for Australian gold producers. For example, Silver Lake Resources withdrew their 2021–22 production guidance after the March quarter 2022, due to COVID-19 related labour shortages and supply chain interruptions.

Australian gold exploration expenditure has continued to rise

In the March quarter 2022, Australia's gold exploration expenditure was \$363.5 million, down by 7.0% from \$390.8 million in the December quarter 2021. Western Australia continued to be the focus of gold exploration activity in Australia, accounting for about 70% of total Australian gold exploration expenditure. Gold's share of exploration expenditure across all minerals fell to 42.8% in March quarter 2022, down from 49.0% in March quarter 2021. This was largely due to higher expenditure in base metals and iron ore exploration, as gold exploration growth was flat year-on-year.

Figure 10.6: Australian gold exploration expenditure



Source: ABS (2022)

Revisions to the outlook

Australia's estimated gold export earnings for 2021–22 have been revised down to \$23.5 billion — a fall of 3.8% from the March 2022 *Resources and Energy Quarterly*, mostly reflecting lower than expected export unit values in March quarter 2022. Forecasts for Australian gold exports in 2022–23 and 2023–24 have been revised up by 6.5% and 1.7%, respectively, reflecting an upward revision to export volumes and an upward revision made to US dollar and Australian dollar gold prices in those years.

Table 10.1: Gold outlook

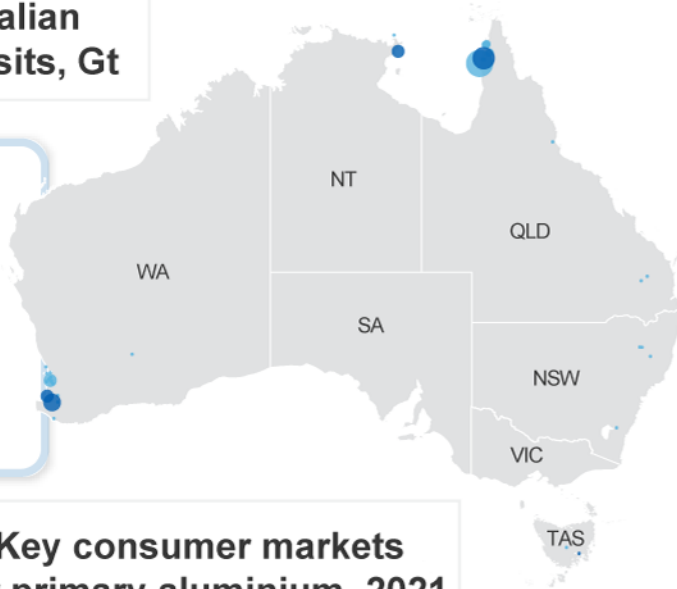
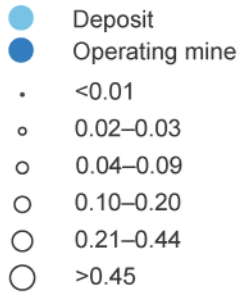
World	Unit	2021	2022 ^f	2023 ^f	2024 ^f	Annual percentage change		
						2022 ^f	2023 ^f	2024 ^f
Total demand	tonnes	4,022	4,265	4,183	4,470	6.1	-1.9	6.9
Fabrication consumption ^b	tonnes	2,560	2,540	2,652	2,890	-0.7	4.4	9.0
Mine production	tonnes	3,581	3,671	3,729	3,767	2.5	1.6	1.0
Price ^c								
– nominal	US\$/oz	1,800	1,847	1,724	1,665	2.6	-6.7	-3.4
– real ^d	US\$/oz	1,939	1,847	1,676	1,583	-4.7	-9.3	-5.6
Australia	Unit	2020–21	2021–22 ^s	2022–23 ^f	2023–24 ^f	2021–22 ^s	2022–23 ^f	2023–24 ^f
Mine production	tonnes	320	313	338	361	-2.3	8.0	6.9
Exports								
– volume	tonnes	283	282	336	359	-0.3	19.1	6.9
– nominal value	A\$m	26,105	23,503	25,960	25,518	-10.0	10.5	-1.7
– real value ^e	A\$m	27,236	23,503	24,799	23,599	-13.7	5.5	-4.8
Price								
– nominal	A\$/oz	2,481	2,521	2,421	2,224	1.6	-4.0	-8.1
– real ^g	A\$/oz	2,589	2,521	2,312	2,057	-2.6	-8.3	-11.0

Notes: ^b includes jewellery consumption and industrial applications; ^c London Bullion Market Association PM price; ^d In 2022 US dollars; ^e In 2021–22 Australian dollars; ^s Estimate; ^f Forecast. Gold export volume contains ash, waste and scrap gold, of which the metal content is unknown.

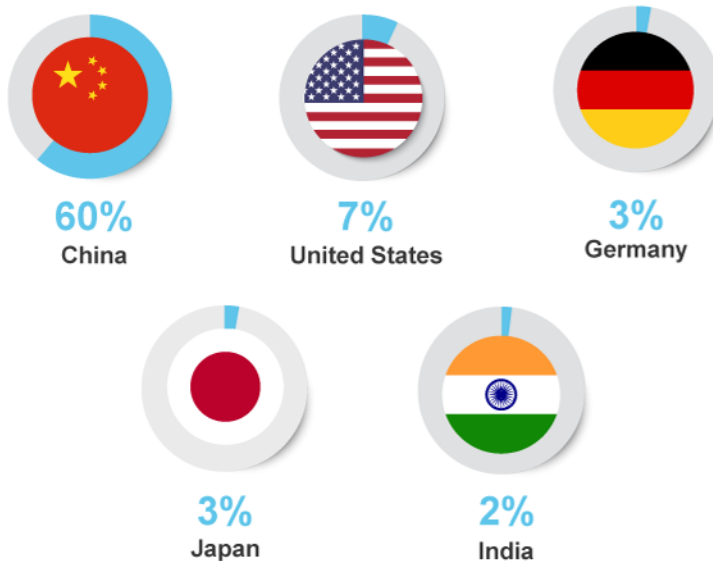
Source: ABS (2022) International Trade, 5464.0; London Bullion Market Association (2022) gold price PM; World Gold Council (2022); S&P Market Intelligence (2022); Department of Industry, Science and Resources (2022).

Aluminium

Major Australian bauxite deposits, Gt



Key consumer markets for primary aluminium, 2021



Aluminium



Bauxite ore is refined to recover alumina, smelted to make aluminium



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



China is the **largest producer and consumer** of primary aluminium



Each electric vehicle contains **0.25 tonne** of aluminium

Australia's aluminium



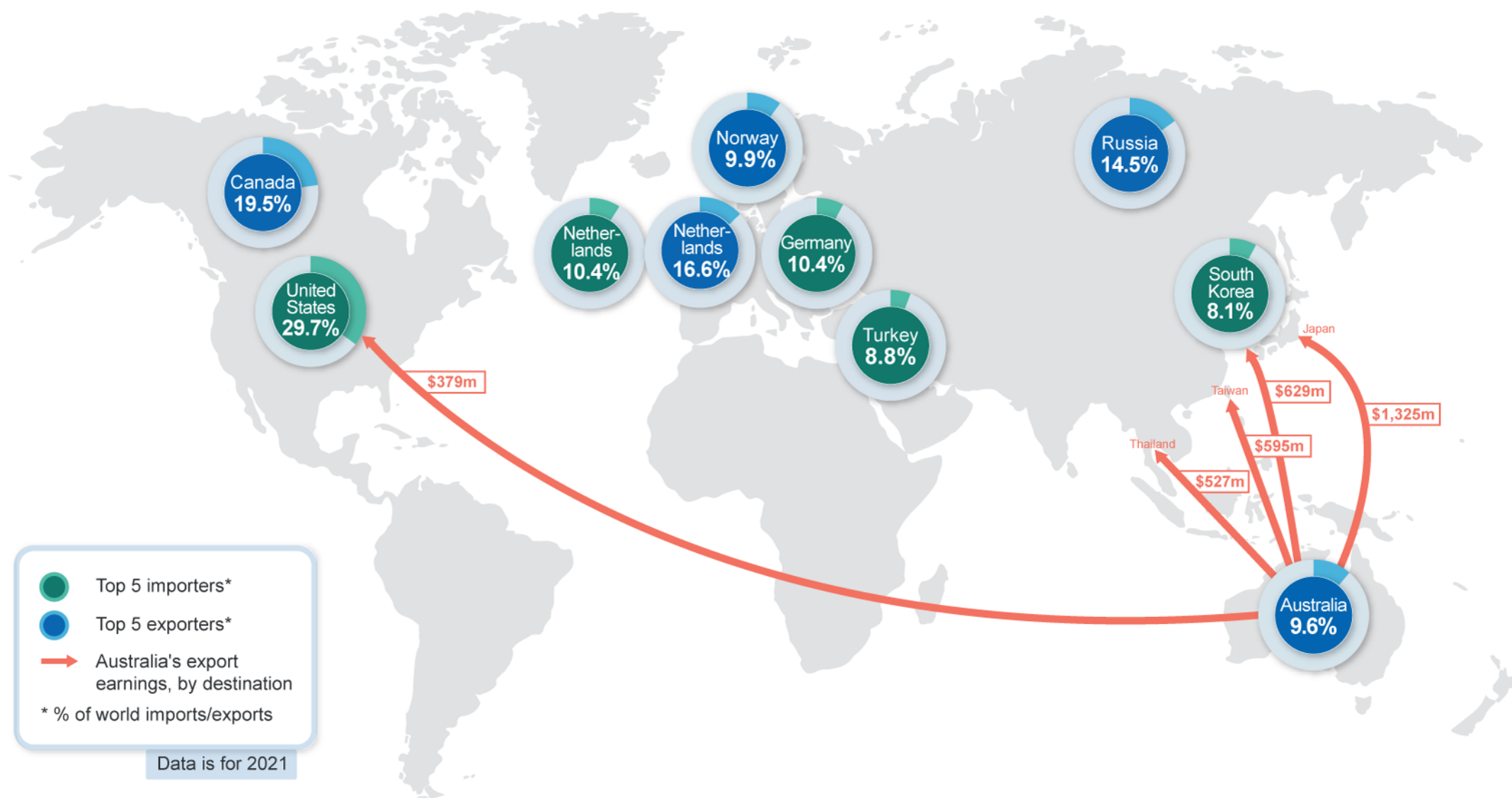
World's 1st largest **bauxite** producing nation in 2021



Largest alumina exporter, **18m tonnes** in 2021



2nd largest alumina producer, **20m tonnes** in 2021



11.1 Summary

- The fallout from the Russian invasion of Ukraine is expected to keep primary aluminium prices at high levels in 2022, averaging US\$3,100 a tonne. While prices are forecast to drift down from current highs through the rest of the forecast period, averaging US\$2,815 a tonne in 2024, prices will be supported by growing demand for new, energy-efficient cars and technologies.
- Annual Australian output is expected to be broadly steady over the outlook period, remaining at around 1.6 million tonnes of primary aluminium and 21 million tonnes of alumina (see [Australia section](#)).
- Australia's aluminium, alumina and bauxite export earnings are estimated to increase by 31% to \$16 billion in 2021–22 and remain at this level by the end of the outlook period.

11.2 World consumption

China led lower aluminium consumption in the March quarter 2022

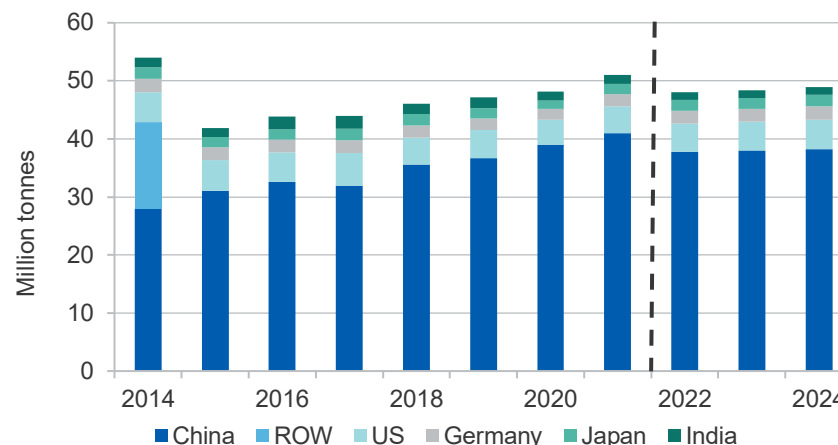
Global primary aluminium consumption fell by 4.3% year-on-year to 16 million tonnes in the March quarter 2022, due to a 6.7% year-on-year fall in aluminium consumption in China — the world's largest aluminium consuming nation.

Weaker Chinese demand was mainly due to strict COVID-19 containment measures in several key manufacturing hubs such as Shanghai, Guangdong and Jilin in lockdown. These cities are among China's top car producing hubs, accounting for more than 30% of China's automotive production. Chinese automotive sales fell by 51% year-on-year in April 2022 to around 1.2 million units — the lowest level in over a decade.

Primary aluminium consumption fell in many parts of the world in the March quarter 2022, as high primary aluminium prices and supply constraints reduced construction and automotive demand. Aluminium consumption in Germany dropped by 7.2% year-on-year, Spain (down by 22% year-on-year), and Brazil (down by 38% year-on-year).

World alumina usage increased by 2.7% year-on-year in the March quarter 2022 to nearly 34 million tonnes, driven by higher global aluminium

Figure 11.1: World primary aluminium consumption



Source: World Bureau of Metals Statistics (2022); Macquarie (2022); Department of Industry, Science and Resources (2022)

production, which was up by 1.7% year-on-year in the same period. China remains the world's largest alumina consuming country, accounting for 57% of global alumina consumption. In the March quarter 2022, a 1.0% rise in Chinese primary aluminium production drove a 2.7% rise in global alumina consumption.

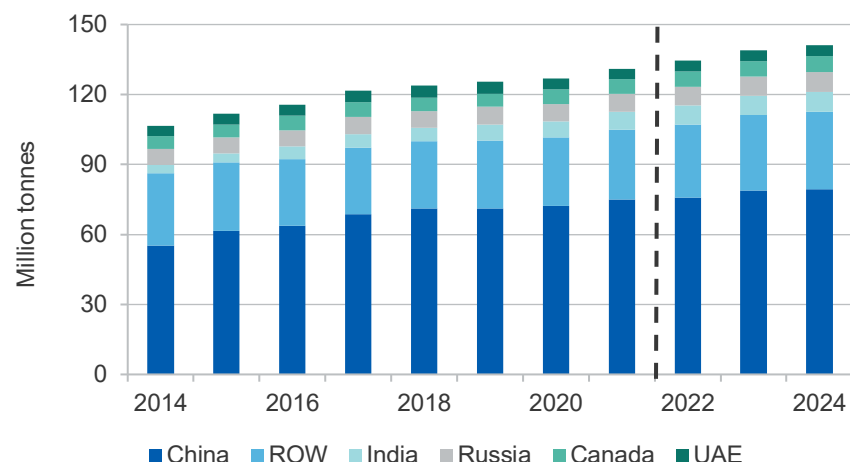
Outside of China, alumina consumption in India and the UAE rose by 7.1% and 7.2%, to reach 2.0 and 1.2 million tonnes in the March quarter 2022, respectively.

World bauxite usage fell by 0.3% year-on-year in the March quarter 2022 to 88 million tonnes due to a fall in global alumina production (down 0.2% in the March quarter 2022). China remained the world's largest bauxite consuming country, accounting for 51% of global bauxite consumption.

COVID-19 lockdowns in China slow global primary aluminium consumption

Slowing global economic growth and China's COVID-19 containment measures are likely to affect world primary aluminium consumption in the second half of 2022.

Figure 11.2: World alumina consumption



Notes: ROW: Rest of the world

Source: Department of Industry, Science and Resources (2022)

In China, aluminium demand in the consumer goods sector has been affected by the lockdowns, with Chinese consumers becoming more cautious in their spending. The Chinese construction sector is expected to remain subdued, despite the Chinese Government's relaxation of house resale constraints, home buying restrictions and reduction in down payment ratios. However, the RMB 60 billion tax cut on passenger car purchases announced on 23 May 2022 is likely to provide some support for the Chinese automotive industry.

Outside of China, the European automotive industry is feeling the impacts of supply chain problems. German car production fell by 12% year-on-year in the March quarter 2022. The German Automotive Industry Association has downgraded its car production growth forecast for 2022 from 13% to just 7.0% (or 3.3 million vehicles).

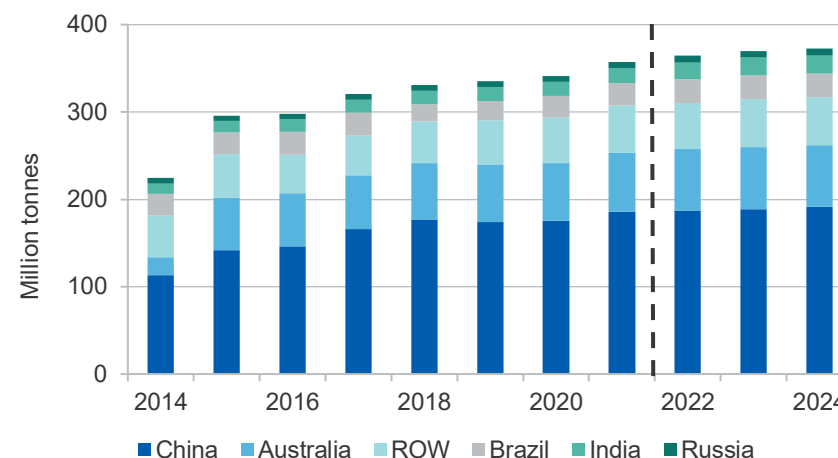
The US economy continues to face supply chain problems and labour shortages. There are growing signs that a slowdown in the construction activity in the US is likely in the second half of 2022.

Global primary aluminium consumption is estimated to decrease by 3.5% in 2022, to 66 million tonnes (Figure 11.1).

World alumina usage is estimated to increase by 2.8% in 2022 to nearly 135 million tonnes (Figure 11.2). An expected 1.8% rise in global primary aluminium production in 2022 is likely to lift global alumina demand. China is expected to contribute strongly to the growth in global alumina demand, with an estimated 1.8% rise in primary aluminium production in 2022.

World bauxite usage is estimated to grow by 1.7% in 2022 to 364 million tonnes (Figure 11.3). The gains are expected to be driven by higher alumina output from Australia, India and Jamaica.

Figure 11.3: World bauxite consumption



Notes: ROW: Rest of the world

Source: Department of Industry, Science and Resources (2022)

Beyond 2022, world primary aluminium consumption is forecast to grow at an annual average rate of 1.6%, to reach 68 million tonnes by 2024 (Figure 11.1). A significant driver of aluminium demand is expected to come from cars, particularly energy-efficient vehicles and electric vehicles (EVs) — which contain a higher proportion of aluminium. It is estimated that EV sales will rise from 6.6 million units in 2021 to 16.2 million units in

2024. With an estimated average aluminium content of 250 kilograms per electric vehicle, aluminium usage in EVs is forecast to increase from 1.6 million tonnes in 2021 to about 4.1 million tonnes in 2024.

World alumina usage is forecast to rise at an average annual rate of 2.5% over the outlook period, reaching 141 million tonnes by 2024 (Figure 11.2). Alumina demand is driven by primary aluminium production, which is forecast to lift by an average of 3.0% a year between 2023 and 2024.

World bauxite usage is forecast to grow at an average annual rate of 0.9% over the outlook period to 370 million tonnes in 2024 (Figure 11.3). The gains are expected to be largely driven by higher alumina output from existing refinery capacities in China and India.

11.3 World production

Aluminium and bauxite output grew, but March quarter alumina output fell

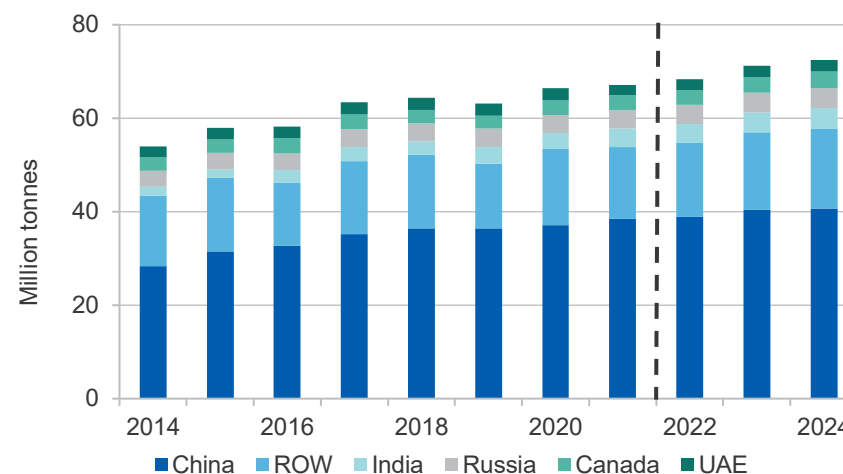
World primary aluminium production increased by 1.7% year-on-year to 17 million tonnes in the March quarter 2022, propelled by higher output in China — the world's largest aluminium producer. China produced nearly 9.9 million tonnes of primary aluminium in the March quarter 2022, up by 1.0% year-on-year, driven by higher aluminium prices and a removal of restrictions on power consumption.

Primary aluminium production in Canada grew by 2.0% year-on-year to 818,000 tonnes in the March quarter 2022. The growth was driven by the ramp up of production at the Alouette aluminium smelter (600,000 tonnes a year).

World primary aluminium output is estimated to grow by 1.8% year-on-year to 68 million tonnes in 2022 (Figure 11.4). The gain is expected to be driven by higher output from China, India and Australia.

China's primary aluminium output is forecast to reach 39 million tonnes in 2022, up 1.0% year-on-year, driven by improved power availability. Most aluminium smelters in Yunnan province have resumed their capacity following the power restrictions in 2021.

Figure 11.4: World primary aluminium production



Notes: ROW: Rest of the world

Source: World Bureau of Metals Statistics (2022); Macquarie (2022); Department of Industry, Science and Resources (2022)

Yunnan Aluminium's 500,000 tonnes a year Wenshan aluminium smelter has resumed operation (at 450,000 tonnes a year) in April 2022, and is expected to reach full capacity in May 2022. The 1.0 million tonnes a year Yunnan Hongtai aluminium smelter reached 600,000 tonnes a year capacity in April 2022, and is expected to reach full capacity in the second half of 2022. Baise Mining's 300,000 tonnes a year Xinshan and 200,000 tonnes a year Suyuan aluminium smelters are expected to resume full operations by September 2022 following COVID-19 related closures in February 2022.

Outside of China, primary aluminium production in India is forecast to increase by 2.0% year-on-year to reach 4.0 million tonnes in 2022.

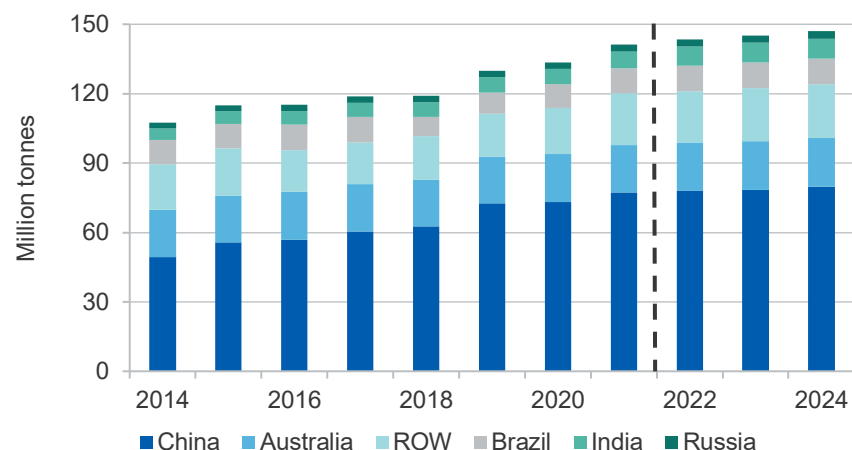
In Australia, Alcoa Corporation is scheduled to restart idled capacity at its 35,000 tonnes a year Portland Aluminium smelter in Victoria from the September quarter 2022. The reactivated capacity is expected to raise Australian primary aluminium output to 1.6 million tonnes a year.

World alumina supply fell by 0.2% year-on-year in the March quarter 2022 to nearly 35 million tonnes, as China's COVID-19 containment measures affected that nation's alumina refinery output. Over this period, production in China — the world's largest alumina producer — fell by 3.2% year-on-year to nearly 19 million tonnes.

World alumina output is estimated to grow by 1.4% year-on-year to 143 million tonnes in 2022, driven by rising output from the restart of existing refineries in Jamaica and India (Figure 11.5).

Production at General Alumina Jamaica and Noble's 1.4 million tonnes a year Mt Jamalco refinery in Jamaica is expected to restart in late 2022, after a fire incident in August 2021 caused extensive damage.

Figure 11.5: World alumina production

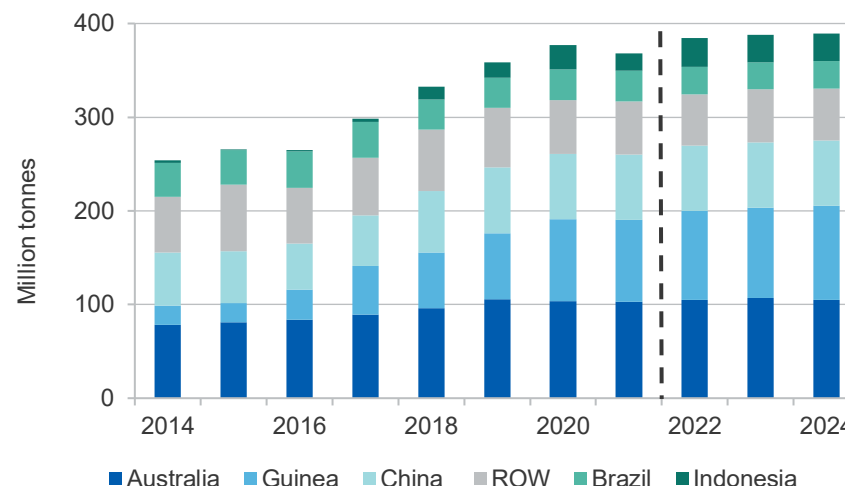


Notes: ROW: Rest of the world

Source: World Bureau of Metals Statistics (2022); Macquarie (2022); Department of Industry, Science and Resources (2022)

India's alumina output is forecast to rise by 18% year-on-year to 8.2 million tonnes in 2022. Hindalco's Utkal Alumina Refinery has fully ramped up its production to 2.1 million tonnes a year in the March quarter 2022, with an additional 350,000 tonnes expansion underway via debottlenecking.

Figure 11.6: World bauxite production



Notes: ROW: Rest of the world

Source: World Bureau of Metals Statistics (2022); Department of Industry, Science and Resources (2022)

World bauxite supply increased by 8.8% year-on-year in the March quarter 2022, to nearly 99 million tonnes, driven by higher output in Australia and Guinea — the world's two largest bauxite producing countries. Over this period, production in Australia rose by 0.9% year-on-year to 25 million tonnes, propelled by higher output at the Northern Territory's Gove mine.

Over this period, bauxite production in Guinea increased by 14% year-on-year to 27 million tonnes, as the ramp up of production continued.

World bauxite supply is estimated to rise by 4.2% to 384 million tonnes in 2022, driven by higher production in Guinea (up 9.1% to 95 million tonnes) (Figure 11.6).

In Guinea, the Compagnie des Bauxites de Guinée mine is due to expand further to 28 million tonnes by the end of 2022, after expanding from 13 to 18 million tonnes a year in 2019. Emirates Global Aluminium is also ramping up output at its 12 million tonnes a year bauxite mine in Guinea.

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

World primary aluminium production is forecast to increase at an average annual rate of 3.0% in 2023 and 2024, to reach 72 million tonnes by 2024 (Figure 11.4). The gains are expected to be driven by increased aluminium output from China and Indonesia. After a 1.0% gain in 2022, China's primary aluminium output is forecast to expand by 4.0% in 2023 to over 40 million tonnes, followed by a further 0.5% growth in 2024.

In Indonesia, the first phase (500,000 tonnes) of the 1 million tonnes a year Huaqing aluminium project in the Qingshan Industrial Park on Sulawesi Island is expected to come online by the end of 2022. The completion date of the 500,000 tonnes a year second phase is uncertain.

World alumina output is forecast to increase by 1.4% a year over the outlook period, reaching 147 million tonnes by 2024 (Figure 11.5). The gains are forecast to be driven by China, Australia, India, Indonesia, and other small alumina refining nations.

China Aluminium Company and the Indonesian joint-venture partners' 2 million tonnes a year Mempawah alumina refinery in Indonesia is expected to come online in 2024.

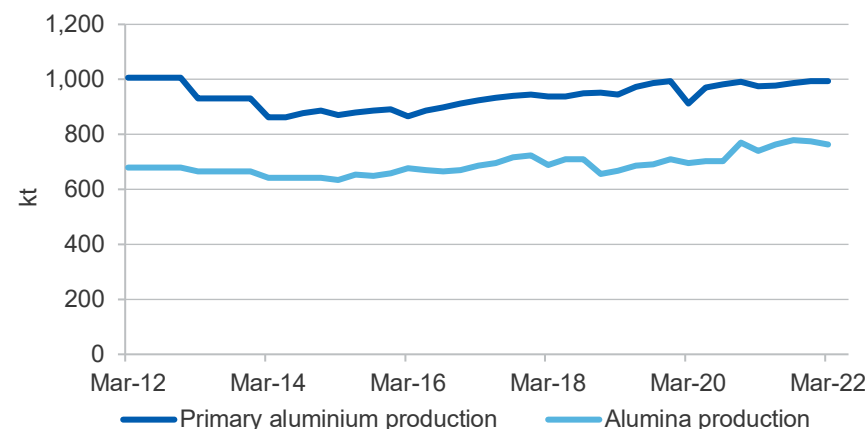
After 2022, world bauxite production is forecast to increase by 0.7% a year over the outlook period, reaching 389 million tonnes by 2024 (Figure 11.6). Australia and Guinea are expected to contribute most to this rise.

Russian aluminium and alumina production rose in the March quarter 2022

In the March quarter 2022, Russian primary aluminium and alumina output rose by 2.0% and 3.1% year-on-year to 994,000 and 763,000 tonnes, respectively (Figure 11.7). The gradual commissioning of Rusal's 429,000 tonnes a year Taishet aluminium smelter was the driver of the increased aluminium production.

Chinese alumina traders ramped up sales of alumina to Russia in the June quarter 2022. Around 30,000 tonnes of alumina were shipped from China to Russia in March, and sales could reach as much as 200,000 tonnes of alumina for April and May.

Figure 11.7: Russian aluminium and alumina output



Source: World Bureau of Metals Statistics (2022)

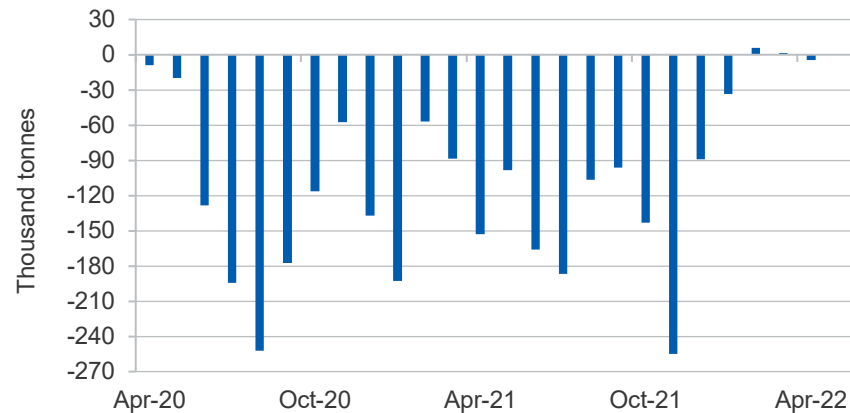
China has become a net exporter of primary aluminium

International sanctions against Russia and COVID-19 containment measures in China, appear to have changed China's status from being a net importer to a net exporter of primary aluminium. In February and March 2022, China's net exports of primary aluminium were 5,665 and 1,343 tonnes, respectively (Figure 11.8).

With China's domestic primary aluminium demand taking a hit — due to COVID-19 containment measures in major cities — the nation's surplus aluminium was exported into a tight world market (Figure 11.9). This included increased shipments to Europe, where primary aluminium production has been adversely impacted by high power prices — with many aluminium smelters operating at reduced capacity. In April 2022, China exported 2,720 tonnes of primary aluminium to the Netherlands.

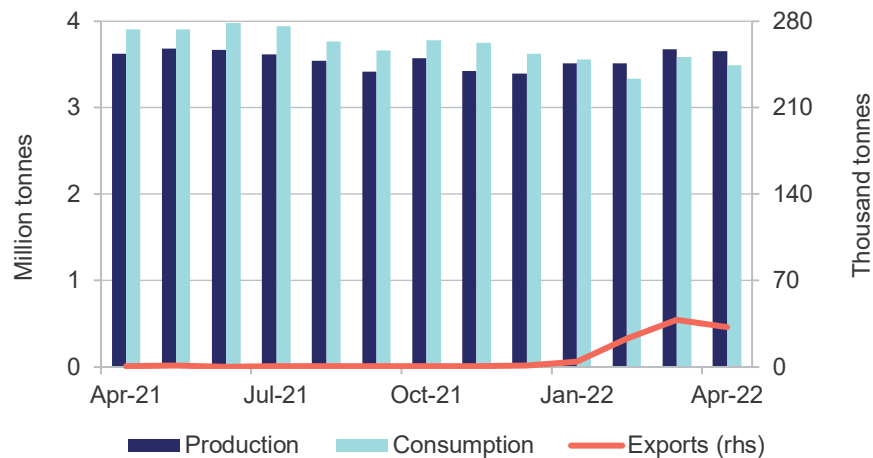
In March 2022, China exported 38,203 tonnes of primary aluminium to the world, of which 18,860 tonnes (49%) were exported to the Netherlands. In February 2022, China exported 17,926 tonnes of primary aluminium to Montenegro and 3,791 tonnes of primary aluminium to Italy.

Figure 11.8: China's net imports/exports of primary aluminium



Notes: Monthly data. Negative means net imports. Positive means net exports.
Source: China Customs (2022); Department of Industry, Science and Resources (2022).

Figure 11.9: China's primary aluminium production, consumption and exports



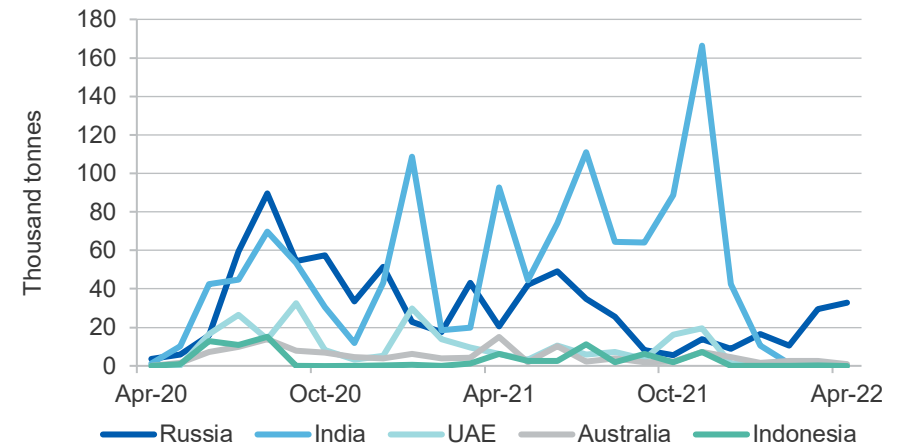
Notes: Monthly data
Source: China Customs (2022); World Bureau of Metals Statistics (2022); Department of Industry, Science and Resources (2022).

China traditionally imports primary aluminium from over 30 countries to meet its domestic primary aluminium demand. Russia, India, the UAE, Australia and Indonesia are the major suppliers of primary aluminium to China.

In the first four months of 2022, China imported 13,004 tonnes of primary aluminium from India — compared to 361,693 tonnes in the last four months of 2021. China imported 7,741 tonnes of primary aluminium from Australia — compared to 15,669 tonnes in the last four months of 2021. Over this period, primary aluminium imports from the UAE and Indonesia also fell sharply (Figure 11.10).

China's imports of Russian primary aluminium have increased significantly so far in 2022: from 36,800 tonnes in the last four months of 2021, imports rose to 89,369 tonnes in the first four months of 2022 (Figure 11.10). The imports are likely to rise further over the forecast period, as the OECD ceases buying Russian aluminium.

Figure 11.10: China's primary aluminium import sources



Notes: Monthly data
Source: China Customs (2022); Department of Industry, Science and Resources (2022)

11.4 Prices

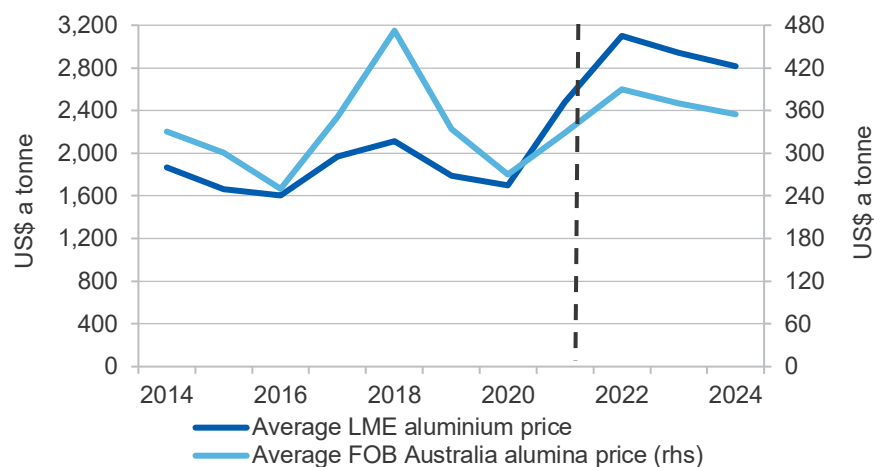
Russia's invasion of Ukraine pushed aluminium prices to a 34-year high

The London Metal Exchange (LME) spot price for primary aluminium reached a 34-year high of US\$3,985 a tonne on 7 March 2022, as the market reacted to the Russian invasion of Ukraine. Russia is the world's third largest primary aluminium producer and the world's third largest primary aluminium exporter.

The price has since fallen sharply due to growing concerns about the impacts of China's ongoing COVID-19 containment measures. China is the world's largest consumer of primary aluminium. At US\$2,520 a tonne on 21 June 2022, the LME aluminium spot price has decreased by 11% so far in 2022, compared to an average of US\$2,705 a tonne in H2 2021.

LME stocks reached a 24-year low in May 2022, at 458,875 tonnes, and remained low at 395,575 tonnes in June 2022. Shanghai Futures Exchange stocks fell to a 5-month low in May 2022, at 285,567 tonnes, and remained low at 267,337 tonnes in June 2022 (Figure 11.12).

Figure 11.11: World primary aluminium and alumina prices



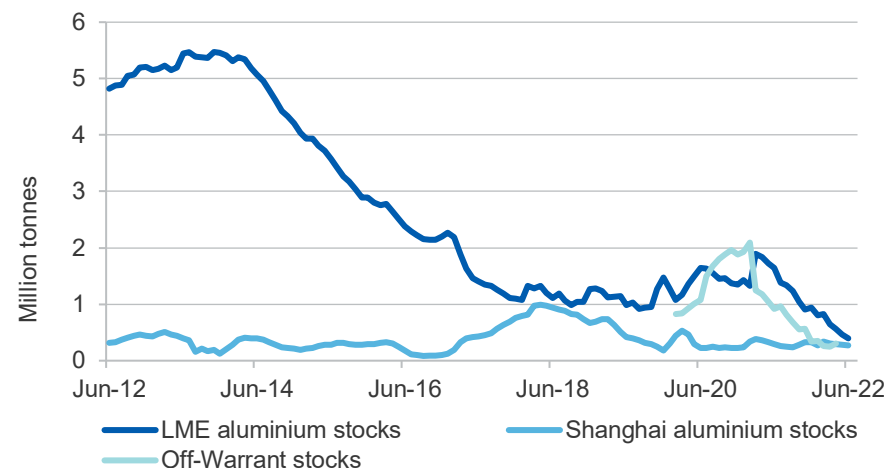
Source: LME (2022); Bloomberg (2022); Department of Industry, Science and Resources

In March 2022, LME off-warrant stocks fell to their lowest level since the data was first released in early 2020, at just 247,756 tonnes (Figure 11.12).

In 2022, the LME aluminium spot price is estimated to average US\$3,100 a tonne, a rise of 25% year-on-year (Figure 11.10). Russia's decision to halt gas supplies to Poland and Bulgaria in April 2022 has fuelled fresh concerns that the supply cut will be applied to other European countries. This would create risks of further cuts to European aluminium smelting production and push up primary aluminium prices.

China's demand for primary aluminium is expected to rise in the second half of 2022, on the back of an expected easing of COVID-19 restrictions. On 29 April 2022, in a meeting of the Communist Party's Politburo, the Chinese Government pledged to deliver more economic stimulus with a CNY 4.0 trillion infrastructure program. The Chinese Government has also relaxed regulations on the housing market and lowered interest rates for first home buyers. These decisions are likely to provide support to primary aluminium prices.

Figure 11.12: Exchange aluminium stocks



Source: London Metal Exchange (2022); Bloomberg (2022)

Inflation, rising interest rates and weakening global economic growth remain risks to aluminium prices over the outlook period. Higher inflation rates have forced central banks around the world to increase interest rates, which are likely to have dampened effects on economic activities.

The free on board (FOB) Australian alumina price has increased 5.8% so far in 2022, at US\$365 a tonne on 22 June 2022 — compared to an average of US\$367 a tonne in the second half of 2021. The rise in alumina prices has been driven by higher demand in China. In southern China, the commissioning of a new aluminium smelting capacity in Yunnan province has led to strong demand for alumina.

The FOB Australian alumina price is estimated to increase by 19% year-on-year to average US\$390 a tonne in 2022, driven by increased aluminium production in China (Figure 11.10).

Primary aluminium and alumina prices to fall in 2023 and 2024

After 2022, the LME aluminium price is forecast to drift down to an average of US\$2,940 and US\$2,815 a tonne in 2023 and 2024, respectively (Figure 11.10). Despite this fall, primary aluminium prices are expected to remain at relatively high levels, as growing demand for new, energy-efficient cars and technologies supports aluminium usage. As a result, the FOB Australian alumina price is forecast to fall to US\$355 a tonne in 2024 (Figure 11.10).

11.5 Australia's exports and production

Higher aluminium prices drove exports in the March quarter 2022

Australia's aluminium, alumina and bauxite (AAB) exports increased by 33% year-on-year in the March quarter 2022 to \$3.8 billion, driven by higher primary aluminium prices. A 56% year-on-year rise in the LME aluminium price in the March quarter 2022 helped boost Australian primary aluminium export values by 60% year-on-year to \$1.4 billion in the March quarter 2022. Over this period, primary aluminium exports to Japan and South Korea rose by 79% and 122% year-on-year to \$409 million and \$295 million, respectively, as more energy efficient car models require higher aluminium content.

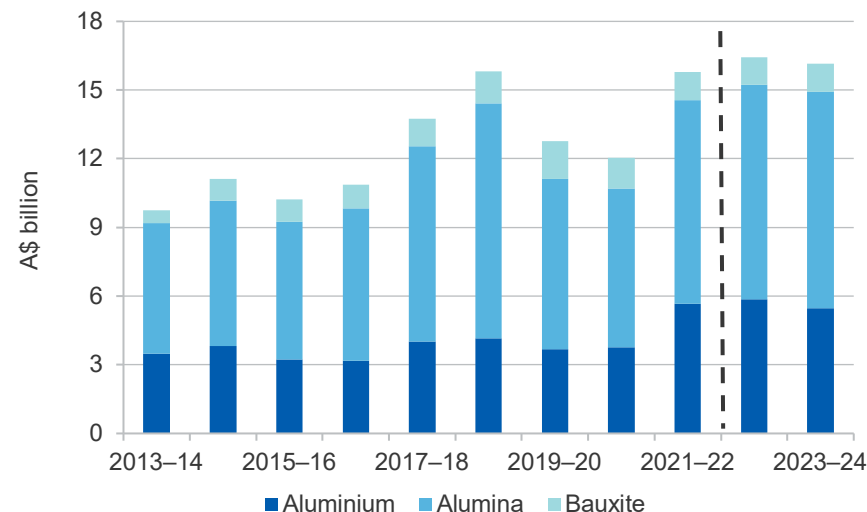
Australian alumina export values rose by 29% year-on-year to nearly \$2.2 billion in the March quarter 2022, driven by a 33% year-on-year rise in alumina prices in the March quarter 2022. Alumina export volumes were down by 5.9% year-on-year to 4.1 million tonnes in the March quarter 2022.

Australian bauxite export values decreased by 18% year-on-year to \$253 million in the March quarter 2022, despite a 4.9% year-on-year rise in bauxite export volumes.

A strong earning year for Australia's AAB exports in 2021–22

An expected gain in average aluminium and alumina prices in 2022 is likely to provide additional earnings for Australian aluminium smelters, alumina refiners and bauxite miners. Australia's AAB exports are estimated to have increased by 31% in 2021–22 to nearly \$16 billion (Figure 11.13).

Figure 11.13: Australian aluminium/alumina/bauxite exports



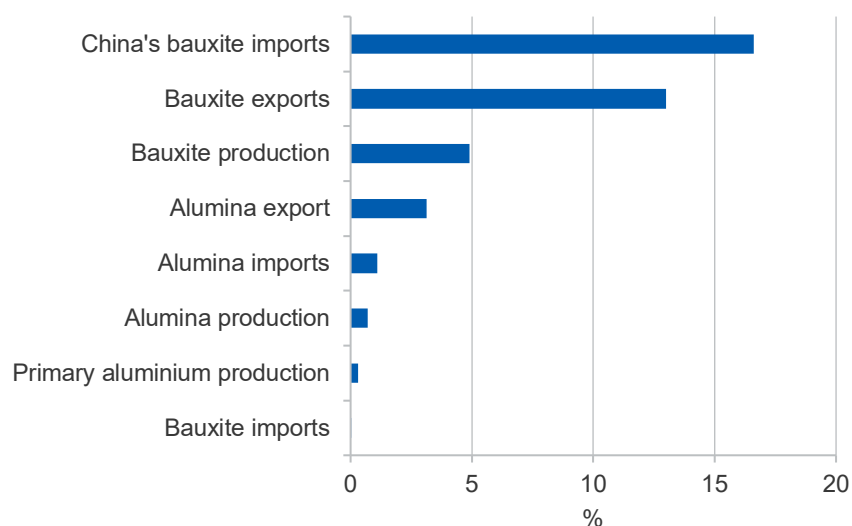
Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources.

Steady alumina, aluminium and bauxite export earnings after 2021–22

Over the outlook period, Australia's AAB exports are forecast to be steady, at \$16 billion a year, with the prices of primary aluminium forecast to remain relatively high over the outlook period (Figure 11.14).

The Indonesian Government has indicated that its bauxite export ban will commence in the second half of 2022 — though the exact timing of this is unknown. The move is likely to provide Australian bauxite exporters with greater opportunities to fill the gap in the Chinese bauxite market, with Indonesia being China's third largest bauxite import source, accounting for nearly 17% of China's total bauxite imports (Figure 11.14).

Figure 11.14: Indonesia's share of global primary aluminium, alumina and bauxite production, exports and imports



Notes: Indonesia's primary aluminium exports and imports are not available.

Source: World Bureau of Metals Statistics (2022); Bloomberg (2022)

Australia's alumina/aluminium/bauxite production fell in the March quarter

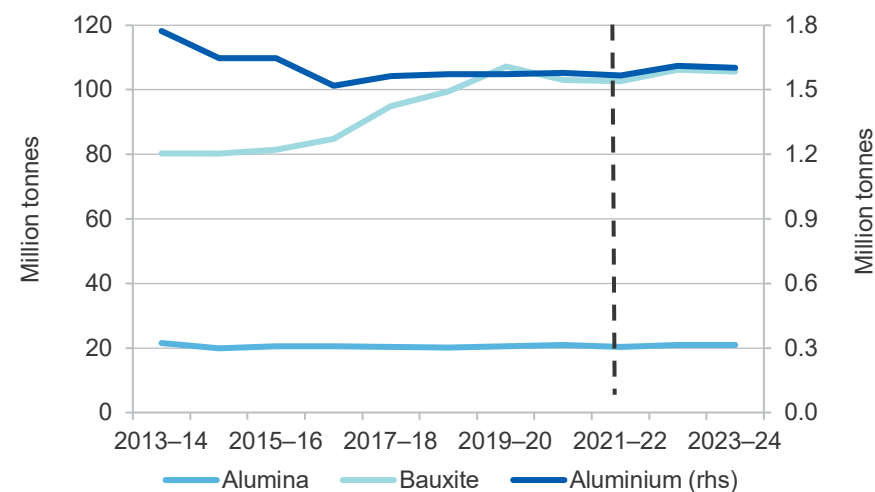
Australia's primary aluminium production fell by 2.0% year-on-year in the March quarter 2022 to 381,000 tonnes, due to lower production at Portland Aluminium. Australia's alumina output fell by 3.1% year-on-year in the March quarter 2022 to 4.9 million tonnes. The fall was due to the unplanned outages at Rio Tinto's refining operations in Queensland.

Australia's bauxite production fell by 0.4% year-on-year in the March quarter 2022 to 25 million tonnes due to lower production at Boddington bauxite mine in WA and Weipa bauxite mine in Queensland.

Steady aluminium, alumina and bauxite output over the outlook period

On 7 November 2021, Alcoa announced a restart of 35,000 tonnes a year idled capacity at its Portland Aluminium smelter in Victoria. The reactivated capacity is expected to come online in the September quarter 2022, and will bring Australia's primary aluminium output to 1.6 million tonnes a year from 2022–23 and beyond (Figure 11.15).

Figure 11.15: Australian alumina/aluminium/bauxite output



Source: Department of Industry, Science and Resources (2022)

No expansions or major disruptions are expected at existing alumina operations in Australia over the outlook period. Australia's alumina output is forecast to remain at about 21 million tonnes a year over this time. Australia's bauxite output is forecast to increase at 1.0% a year between 2022–23 and 2023–24, reaching 106 million tonnes in 2023–24 (Figure 11.15).

High levels of rainfall over the rest of 2022 pose some downside risk to forecast AAB volumes. In its March 2022 quarterly report, Rio Tinto advised that the bauxite production remains subject to severe weather conditions.

On 20 February 2022, Rio Tinto entered into a partnership with the Tasmanian Government to progress an initiative to accelerate the decarbonisation of its Bell Bay aluminium smelter in Tasmania.

On 9 June 2022, Rio Tinto called for proposals to develop large scale wind and solar power in central and southern Queensland to power its Boyne aluminium smelter, Yarwun alumina refinery and Queensland alumina refinery. Despite it being early in the process, the initiative is likely to help Rio Tinto to meet its climate change commitments.

It was announced in March 2021 that Mitsubishi would buy a 30% stake in Glencore's Aurukun bauxite project in Queensland. The project has long been postponed after initially receiving mining rights in the 1970s. A final investment decision to develop the project is expected to be made in the second half of 2022.

Revisions to the outlook

The forecast for Australia's AAB export earnings has been revised down from the March 2022 *Resources and Energy Quarterly* — by \$653 million in 2021–22. The revision reflects larger than expected impacts of China's COVID-19 containment measures on Australian primary aluminium and bauxite exports in the March quarter 2022. We now expect 2022–23 earnings to be \$16.4 billion, compared to \$16.6 billion in the March 2022 *Resources and Energy Quarterly*. The change is due to lower AAB export earnings.

Table 11.1: Aluminium, alumina and bauxite outlook

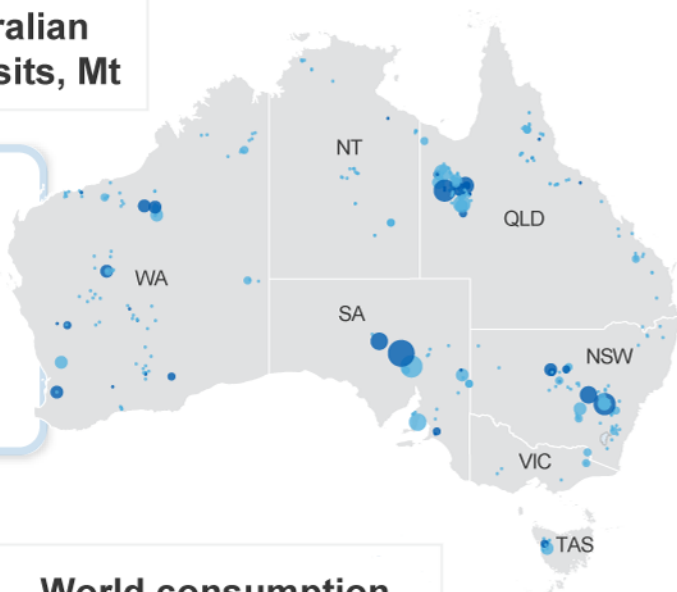
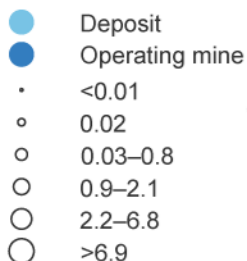
						Annual percentage change			
World	Unit	2021	2022 ^f	2023 ^f	2024 ^f	2022 ^f	2023 ^f	2024 ^f	
Primary aluminium									
Production	kt	67,126	68,309	71,190	72,415		1.8	4.2	1.7
Consumption	kt	68,387	65,969	66,891	68,038		-3.5	1.4	1.7
Prices aluminium ^c									
- nominal	US\$/t	2,477	3,100	2,940	2,815		25.2	-5.2	-4.3
- real ^d	US\$/t	2,669	3,100	2,858	2,676		16.2	-7.8	-6.4
Prices alumina spot									
- nominal	US\$/t	328	390	370	355		18.8	-5.0	-4.2
- real ^d	US\$/t	354	390	360	337		10.2	-7.6	-6.3
Australia	Unit	2020–21	2021–22 ^s	2022–23 ^f	2023–24 ^f	2021–22 ^s	2022–23 ^f	2023–24 ^f	
Production									
Primary aluminium	kt	1,579	1,565	1,610	1,603		-0.9	2.9	-0.4
Alumina	kt	20,949	20,364	20,906	21,011		-2.8	2.7	0.5
Bauxite	Mt	103.0	102.6	106.2	105.7		-0.4	3.5	-0.4
Consumption									
Primary aluminium	kt	284	255	209	208		-9.9	-18.2	-0.3
Exports									
Primary aluminium	kt	1,357	1,385	1,449	1,443		2.0	4.7	-0.4
- nominal value	A\$m	3,763	5,672	5,872	5,470		50.7	3.5	-6.8
- real value ^e	A\$m	3,926	5,672	5,609	5,059		44.5	-1.1	-9.8
Alumina	kt	18,600	17,792	18,188	18,280		-4.3	2.2	0.5
- nominal value	A\$m	6,948	8,893	9,356	9,450		28.0	5.2	1.0
- real value ^e	A\$m	7,249	8,893	8,938	8,739		22.7	0.5	-2.2
Bauxite	kt	35,782	35,627	35,128	34,971		-0.4	-1.4	-0.4
- nominal value	A\$m	1,339	1,212	1,211	1,219		-9.5	0.0	0.6
- real value ^e	A\$m	1,397	1,212	1,157	1,127		-13.3	-4.5	-2.6
Total value									
- nominal value	A\$m	12,050	15,777	16,440	16,139		30.9	4.2	-1.8
- real value ^e	A\$m	12,573	15,777	15,704	14,925		25.5	-0.5	-5.0

Notes: ^c LME cash prices for primary aluminium; ^d In 2022 calendar year US dollars; ^e In 2021–22 financial year Australian dollars; ^f Forecast; ^s Estimate

Source: ABS (2022) International Trade in Goods and Services, 5464.0; LME (2022); Department of Industry, Science and Resources (2022); World Bureau of Metal Statistics (2022).

Copper

Major Australian copper deposits, Mt



World consumption



31%
Equipment



30%
Building Construction



15%
Infrastructure



12%
Transport



12%
Industrial

Copper facts



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



Being 100% recyclable, nearly 80% of copper produced is **still in use**



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



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

Australia's copper



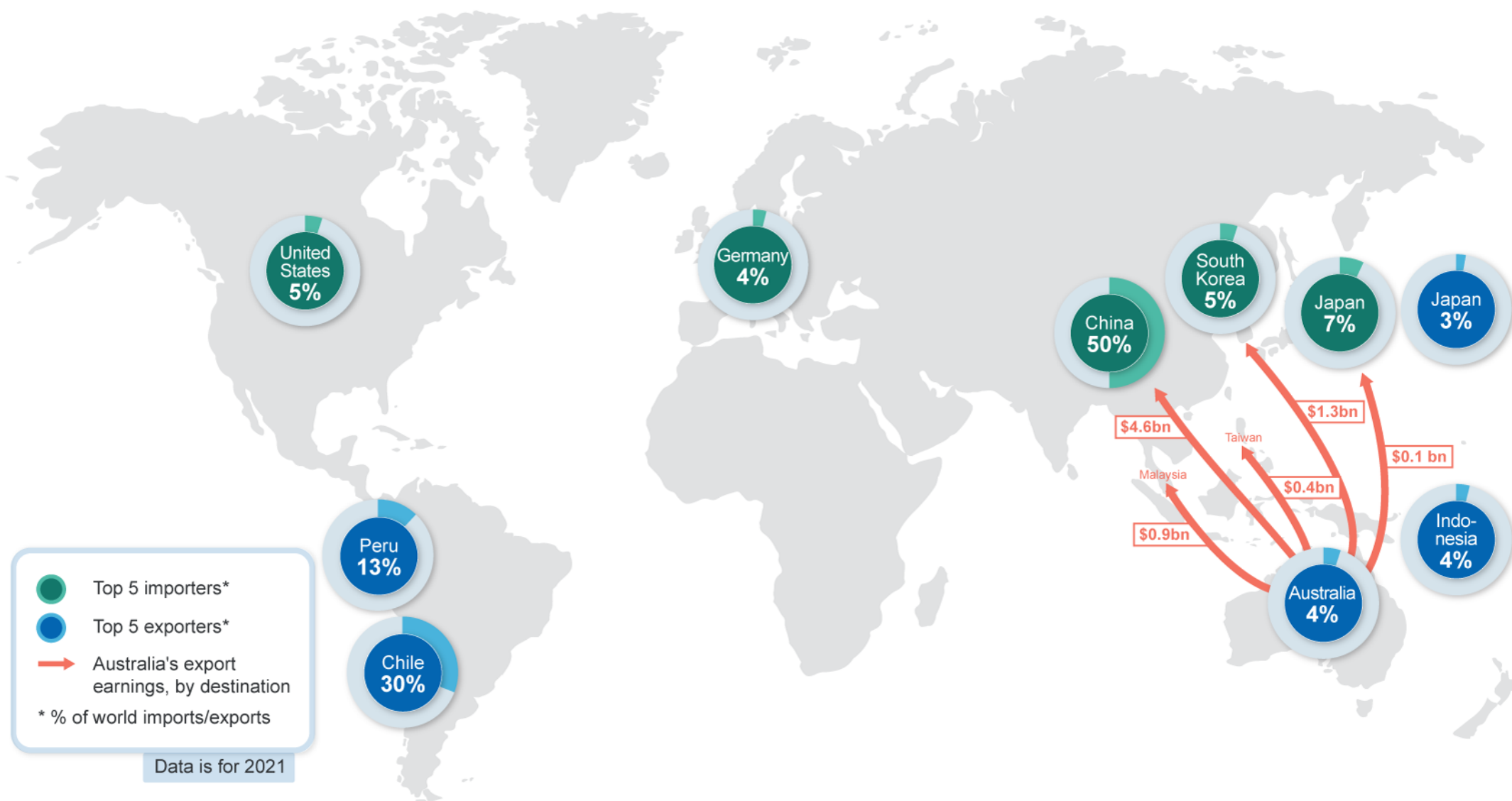
Ranked 2nd
for copper resources



6th largest
mined copper producer in the world



\$12 billion
estimated Copper exports in 2021-22



12.1 Summary

- Copper prices increased 51% to US\$9,300 in 2021 as global industrial activity recovered from COVID-19. Prices are expected to average US\$9,500 in 2022 after a strong start, but will fall back to US\$9,000 a tonne in 2024 as surpluses grow.
- Australia's copper exports are projected to fall to 807,000 tonnes in 2021–22 as scheduled maintenance is completed. Copper exports are expected to grow to 977,000 tonnes by 2023–24 as production from new mines and mine expansions come online (see [Australia section](#)).
- As output and export volumes grow, Australia's copper export earnings are projected to lift from \$11 billion in 2020–21 to \$15 billion in 2023–24, up an average 9.3% a year.

12.2 World consumption

Consumption starts strong, but China lockdown likely to weigh on growth

In the March quarter 2022, global refined copper consumption was 4.3% higher year-on-year (Figure 12.1). There was a modest increase in China (up 3.1%), but much stronger gains were recorded in Taiwan (35%) and Europe (20%). Some major copper consumers saw declines in copper consumption year-on-year, including the US (down 8.1%) and Japan (down 11%).

However, lockdowns in response to an outbreak of COVID-19 in several Chinese cities appears to have weighed on copper demand over the June quarter. Chinese PMIs slumped to 47.4 (NBS) and 46.0 (Caixin) in April — the lowest seen since February 2020 — as several significant industrial hubs faced strict containment measures. While both indices improved in May (49.6 for NBS, 49.1 for Caixin), they remain in contractionary territory.

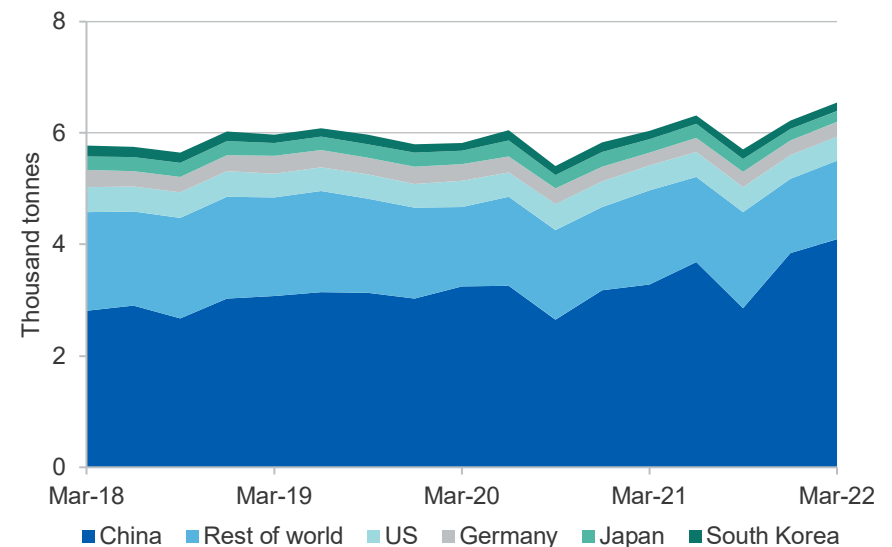
Shanghai is one of the major manufacturing hubs for electronics, semiconductors, and automobiles. Containment measures in the city forced manufacturers to halt operations, with Tesla and Volkswagen Group suspending production at their Shanghai factories on several occasions due to parts shortages. Toyota has also cited the Shanghai

lockdowns as a causal factor for cutting May production by 50,000 vehicles in its Japanese operations.

The Chinese Government has announced more accommodative monetary and fiscal policy measures in order to reach its growth targets, but such policies are unlikely to have much of an effect until well into the second half of 2022. Further, risks remain that the spread of COVID-19 and subsequent containment measures will continue into the September quarter 2022 and possibly even further.

Assuming that China can contain the impact of its COVID-19 outbreak, growth in copper consumption is expected to be positive. Copper consumption is forecast to increase by 1.4% in 2022 — equal to the growth rate of consumption recorded in 2021.

Figure 12.1: Refined Copper Consumption



Source: World Bureau of Metal Statistics (2022); Department of Industry, Science and Resources (2022)

The Russia-Ukraine conflict and inflation present downside risks

The fallout from the Russian invasion of Ukraine is a key consumption risk over the outlook period. Russia is a key exporter of oil, gas and coal; all these commodities have seen price spikes following the invasion. Rising energy prices will inevitably flow through to production, forcing manufacturers to either raise prices or cut their output (and, as a result, their demand for base metals).

The conflict is also impacting raw materials and supply chains. Ukraine is a major supplier of wiring harnesses for European automakers, and the cessation of Ukrainian supply has disrupted several connected parts of the automotive supply chain. Car manufacturers are exploring alternate avenues of supply, but this will take several months to resolve.

Inflationary pressures are also mounting in advanced nations, in some cases reaching levels not seen since the early 1980s. This has caused many central banks to start raising interest rates, including a 50 basis point hike by the US Federal Reserve in early May. Excessive monetary policy tightening by central banks could potentially cause a bigger than expected adverse impact on GDP and thus hurt base metal demand.

But the outlook is positive

Copper consumption is expected to strengthen over the outlook period, rebounding from the fallout from the Russian invasion of Ukraine and the Chinese COVID-19 lockdowns. Growth for 2023 is forecast at 3.4%, falling slightly to 2.8% in 2024 — when total consumption is forecast to reach 27 million tonnes.

The demand for copper is expected to be supported by the continuing trend towards decarbonising the global energy sector. While the Russian invasion of Ukraine presents short term challenges, copper consumption may benefit in the medium term, as nations look to hasten their trajectory towards renewable energy, in order to wean themselves off fossil fuel exports (Russian or not).

12.3 World production

Chile and Peru to lead production growth, but disruption risks apparent

Mine production in Chile fell by 6.9% compared to the March quarter 2021. BHP has revised its guidance for its Escondida operations down due to the impact of increased COVID-19 cases, as well as the road blockades. Water availability issues have affected production at both Anglo American and Antofagasta mines, with the issue increasingly exacerbated by the longstanding drought conditions.

Mine production in Peru fell 11% in the March quarter, but was up by 4.2% from the March quarter 2021. Ongoing disruptions over social unrest present a major downside risk for Peruvian output in the short and medium term. Southern Copper Corporation's Cuajone mine was affected by a 50-day closure in the March quarter, while MMG's Las Bambas mine is still plagued by bouts of protest activity.

First Quantum Minerals approved the stage 3 expansion of the Kansanshi copper mine in Zambia. The \$1.2 billion project will add a new processing plant and a new larger mining fleet that will boost Kansanshi's total annual copper output to 250,000 tonnes per year for the remaining mine life to 2044.

Indonesian copper production (and exports) have grown over the March quarter, benefiting from the recovery in output at Freeport's Grasberg mine. Total copper ore and concentrate production for the March quarter 2022 was up by 23% from the March quarter 2021.

Global mine production is expected to reach 22 million tonnes in 2022 (up 6.9% year-on-year), however project delays could push much of this growth out to 2024. Mine production is expected to increase further to 24 tonnes in 2024 (Figure 12.2). Chile, Peru and the Democratic Republic of Congo are the largest drivers of mined production growth, with over half of the increase in production in 2024 represented by these countries.

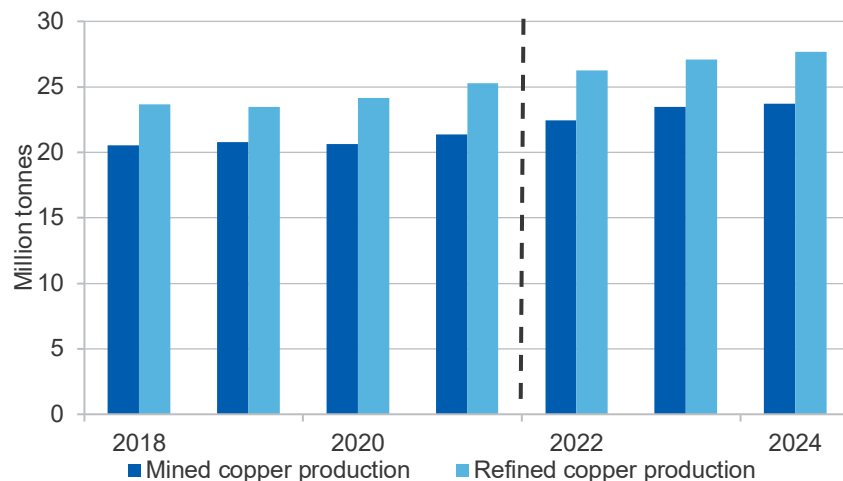
Strong momentum in refined production growth

After increasing by 4.8% in 2021, refined copper production is forecast to grow by a further 4.3% in 2022, reaching 26 million tonnes (Figure 12.2). Chinese refined production experienced a slight decrease quarter-on-quarter — a combination of a seasonal decrease associated with the Lunar New Year holiday and the recent lockdowns — but still showed a 1.6% gain compared to the March quarter 2021.

The Russian invasion of Ukraine is not expected to have a large effect on world refined copper production. Russia typically accounts for 4.0% of the global refined market, with most of this exported to China and Europe. Any material traditionally exported to Europe could be absorbed by China in the event of sanctions.

Refined production growth is expected to moderate over the outlook period. Growth is forecast at 3.1% in 2023 and 2.1% in 2024, when refined production will reach over 27 million tonnes (Figure 12.2).

Figure 12.2: Annual production of mined and refined copper



Source: World Bureau of Metal Statistics (2022); Department of Industry, Science and Resources (2022)

12.4 Prices

China lockdowns affecting demand

Copper prices remained stubbornly high at the beginning of 2022. The copper price peaked at US\$10,730 a tonne in March — an all-time record — and averaged almost US\$10,000 a tonne in the March quarter 2022. This reflects an increase of 3.0% quarter-on-quarter, and 18% when compared to the March quarter of 2021.

While copper prices traded around US\$10,200 in April, news of softening Chinese industrial production (due to the COVID-19 lockdowns) saw the copper price fall to just above US\$9,000 a tonne in mid-May. Despite a brief rebound, the price broke below US\$8,500 a tonne towards the end of June (Figure 12.3). European demand has also faced headwinds in recent months, with Germany's industrial output contracting beyond market expectations in April. A strong US dollar is also weighing on demand, as copper becomes more expensive against local currencies. Further rate hikes by the US Federal Reserve are likely to soften demand.

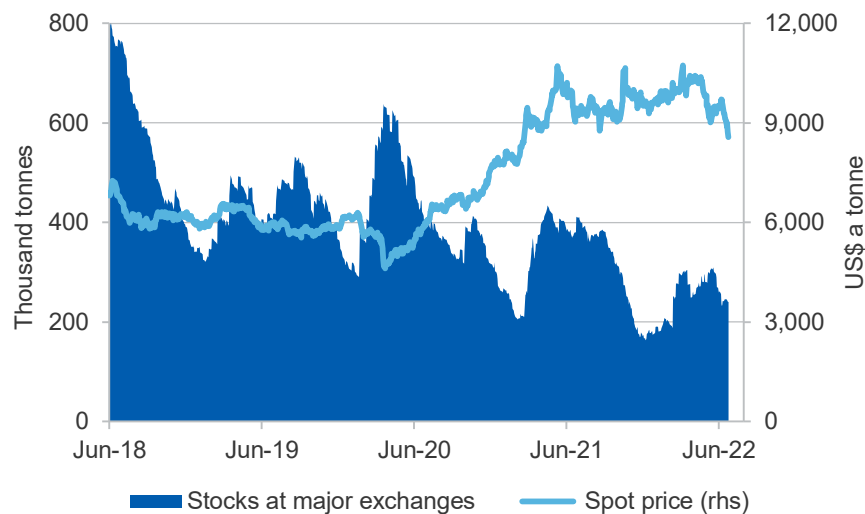
The copper price is likely to average around US\$9,700 in the June quarter 2022, before gradually declining over the second half of the year. The copper price is forecast to average US\$9,500 in 2022, as a recovery in Chinese industrial production offsets a softening in prices from increased warehouse inventories.

Recovery of stockpiles to cool prices

In late 2021, warehouse inventories were drawn down to their lowest levels since 2014 (for the SHFE) and 2005 (for the LME). Concerns around a shortage of copper meant that prices were already high prior to the Russian invasion of Ukraine, which then saw the price peak at US\$10,730 a tonne.

A rise in inventories noted in the March 2022 REQ persisted into the June quarter. Total exchange stocks have risen by approximately 60% since the start of 2022, with inventories showing gains at both LME and SHFE warehouses.

Figure 12.3: Copper exchange inventories and spot price



Source: LME (2022) official cash price; Bloomberg (2022)

The main risk to the short term price forecast is the extent to which COVID-19 containment measures in China affect copper supply. China accounts for over 40% of world refined copper supply, so a reduction in Chinese metal supply will provide support for prices around their current levels. However, if the production of refined copper is able to continue at normal levels, exchange warehouses and other market participants will be able to build inventories to levels that are more consistent with historical averages.

The global copper market is forecast to trend into a modest surplus over the outlook period, putting downward pressure on prices. As a result, the price of copper is forecast to decline to average US\$9,100 a tonne in 2023 and US\$9,000 a tonne in 2024. However, potential supply disruptions in Chile and Peru pose upside risks.

12.5 Australia

COVID absences and weather events affect production

Oz Mineral's Prominent Hill mine has been impacted by COVID-19 related absences and rainfall induced supply disruptions. The company's Carrapateena operations also suffered from these problems, but higher than average ore grades helped to offset some of the effects.

Newcrest completed the SAG mill motor upgrade at the Cadia mine in the December quarter, with March 2022 production returning to full capacity.

Total mined copper output is estimated at 784,000 tonnes in 2021–22, 11% lower than the previous year. Refined copper is estimated to have decreased by 20% year-on-year in 2021–22, to 361,000 tonnes.

But production set to increase...

Several major projects are due to be delivered over the forecast period, while production is set to recover at most existing projects. The Nifty reactivation project (Cyprium) is expected to produce in 2023, while final investment decisions are expected for several other mines — including Oz Mineral's West Musgrave project — later in 2022.

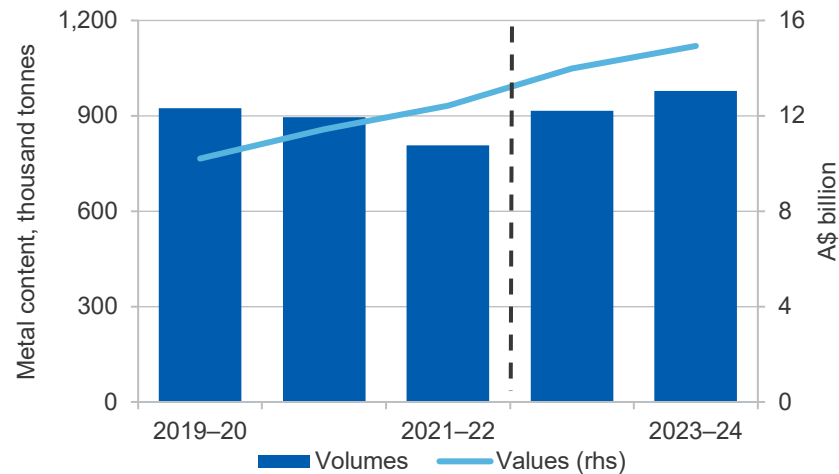
Mined copper output is forecast at 903,000 tonnes in 2022–23, growing to 964,000 tonnes in 2023–24. Refined copper is set to grow to 448,000 tonnes in 2023–24.

...bringing higher exports as a result

Total export volumes are estimated at 807,000 tonnes in 2021–22, due to lower production (Figure 12.4). Total export volumes are down from 897,000 tonnes in 2020–21. Exports are expected to grow to 916,000 tonnes in 2022–23. Growth is expected to continue in 2023–24, with total exports expected to reach 977,000 tonnes.

Growth in export volumes will keep export revenue strong, despite the copper price easing slightly. Export earnings are forecast to grow from \$12 billion in 2021–22 to almost \$15 billion in 2023–24.

Figure 12.4: Australia's copper export volumes and values



Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022)

Copper exploration falls, but still historically high

Copper exploration was \$115 million in the March quarter 2022, which was 33% lower than seen in the December quarter 2021 (Figure 12.5). That said, it is still higher than exploration expenditure for the corresponding quarter in 2021 (\$103 million).

Figure 12.5: Australian copper exploration expenditure



Source: ABS (2022)

Revisions to the outlook

Since the March 2022 *Resources and Energy Quarterly*, the forecast for Australia's copper export earnings in 2021-22 has been revised down by \$0.8 billion. The forecast for copper export earnings for 2022-23 has been revised down by \$0.3 billion. This is largely due to a downward revision in the price received by copper ores and concentrates.

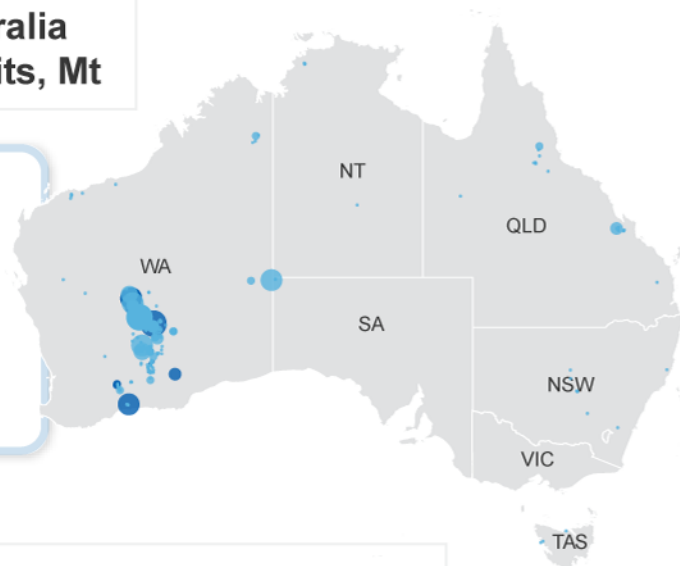
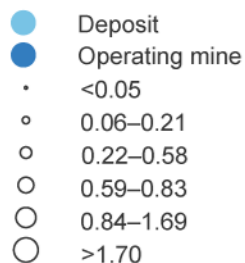
Table 12.1: Copper outlook

						Annual percentage change					
World	Unit	2021	2022 ^f	2023 ^f	2024 ^f	2022 ^f	2023 ^f	2024 ^f			
Production											
– mine	kt	21,005	22,446	23,479	23,690				6.9	4.6	0.9
– refined	kt	25,183	26,270	27,084	27,653				4.3	3.1	2.1
Consumption	kt	25,387	25,689	26,559	27,298				1.2	3.4	2.8
Closing stocks	kt	1 148	942	1 348	1 595				-18	43	18
– weeks of consumption		2.4	1.9	2.6	3.0				-19	38	15
Prices LME											
– nominal	US\$/t	9,315	9,537	9,146	8,998				2.4	-4.1	-1.6
	USc/lb	423	433	415	408				2.4	-4.1	-1.6
– real ^b	US\$/t	10,038	9,537	8,892	8,555				-5.0	-6.8	-3.8
	USc/lb	455	433	403	388	-5.0	-6.8	-3.8			
Australia	Unit	2020–21	2021–22 ^s	2022–23 ^f	2023–24 ^f	2021–22 ^s	2022–23 ^f	2023–24 ^f			
Mine output	kt	878	784	903	964	-11	15	6.8			
Refined output	kt	452	361	444	448	-20	23	0.8			
Exports											
– ores and concs ^c	kt	1,672	1,637	1,796	2,021				-2.1	9.7	13
– refined	kt	420	343	412	416				-18	20	0.8
– total metallic content	kt	896	807	916	977				-9.9	14	6.6
Export value											
– nominal	A\$m	11,440	12,416	13,985	14,930				8.5	13	6.8
– real ^d	A\$m	11,936	12,416	13,360	13,807				4.0	7.6	3.3

Notes: **b** In 2022 calendar year US dollars; **c** Quantities refer to gross weight of all ores and concentrates; **d** In 2021–22 financial year Australian dollars; **f** Forecast; **r** Average annual growth between 2021 and 2027 or 2020–21 and 2026–27; **z** Projection.

Source: ABS (2022) International Trade, 5465.0; LME (2022) spot price; World Bureau of Metal Statistics (2022) World Metal Statistics; Department of Industry, Science and Resources (2022)

Major Australia nickel deposits, Mt



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



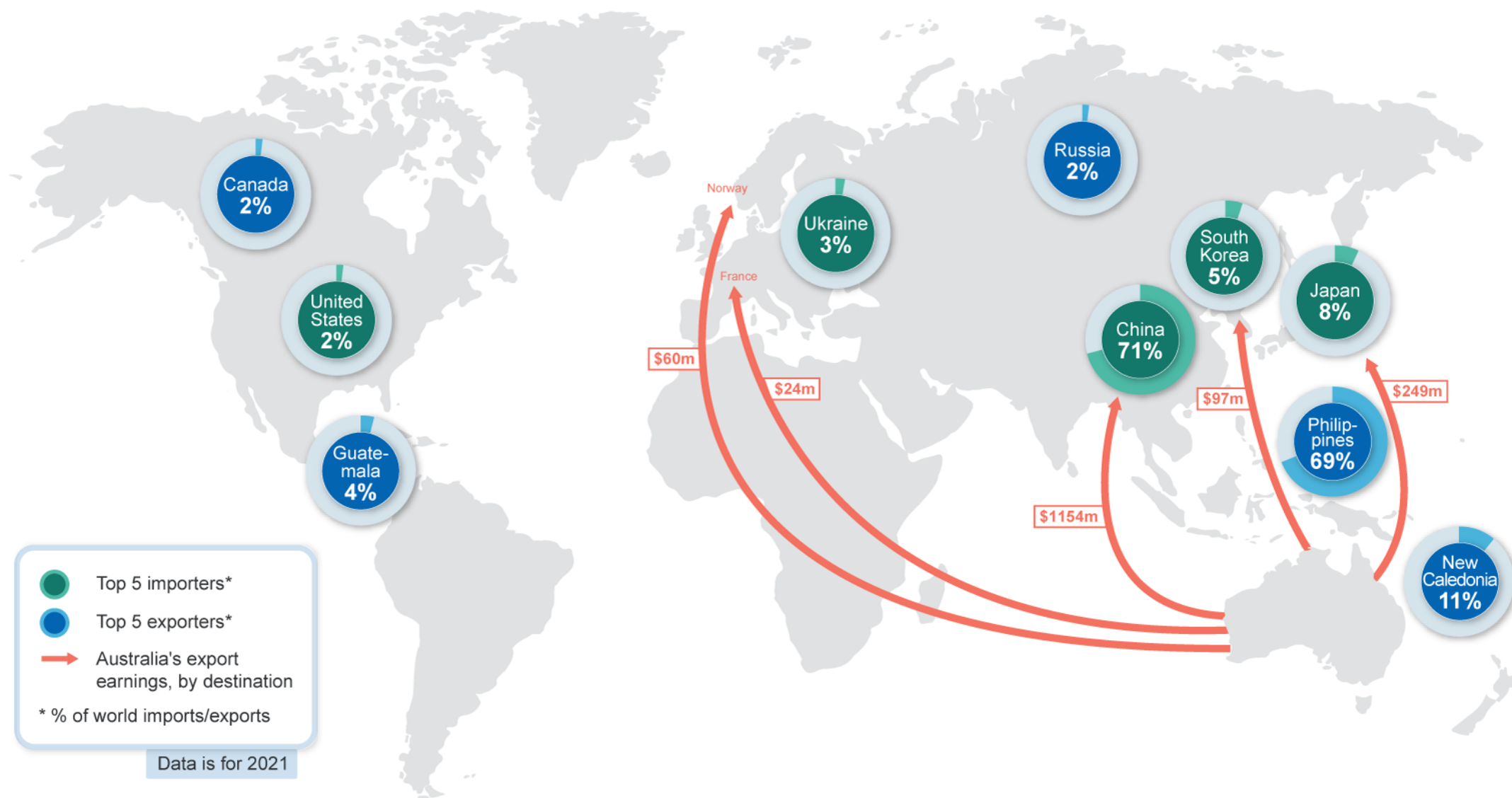
22%
of world
nickel
resources



200,000 tonnes
typically
produced over
a year



\$3.8+ billion
contributed to
the **economy**
last year



13.1 Summary

- Nickel prices are expected to average US\$25,700 a tonne in 2022, boosted by declining stocks of battery grade material and the fallout from the Russian invasion of Ukraine. Prices are expected to ease over the outlook period, as a result of increased Indonesian production and improving liquidity in the LME market.
- Australia's export volumes are estimated to have increased to 259,000 tonnes in 2021–22. Over the outlook period, higher nickel prices may incentivise further expansion in nickel production to capitalise on the movement towards low-emission technologies.
- Export earnings have strengthened as a result of high prices following the Russian invasion of Ukraine. Australia's export earnings are estimated at \$6.7 billion in 2021–22, but are expected to ease to \$5.8 billion in 2023–24.

13.2 World consumption

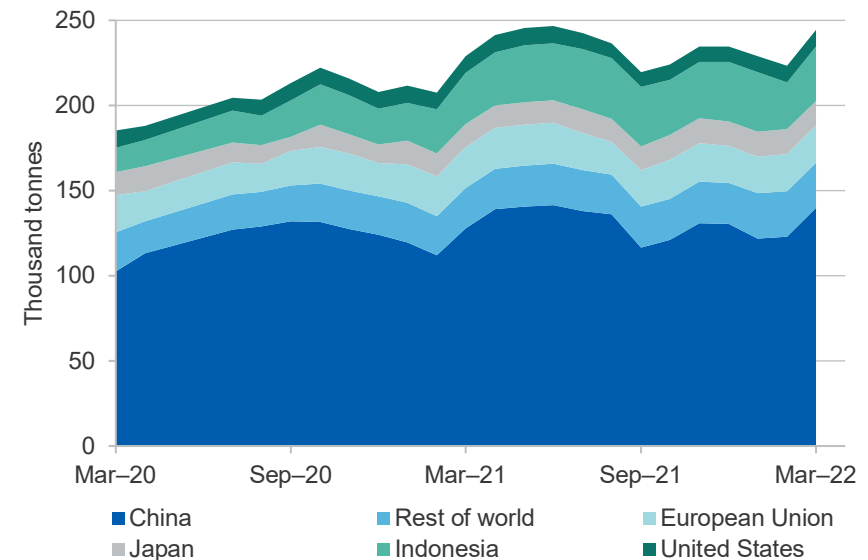
Economic recovery leads nickel demand higher

2021 saw strong growth in global nickel consumption as the world recovered from the economic effects of COVID-19. Strong infrastructure spending — which increased the demand for nickel in stainless steel — and a shift to electric vehicles (EVs) saw world consumption grow to almost 2.8 million tonnes last year, up 16% year-on-year. Consumption for stainless steel grew by 10% last year, while consumption in battery precursors grew an impressive 60%.

In the March quarter 2022, global nickel usage grew by 7.5% compared to the March quarter 2021 (Figure 13.1). However, China's strict COVID-19 containment measures are now producing headwinds for nickel demand. General manufacturing activity declined in April, with the NBS PMI slumping to 47.4, while the Caixin PMI saw its lowest result since February 2020, registering just 46.0. With over half of the world's stainless steel production and refined nickel consumption accounted for by China, a manufacturing downturn would be a significant hit to world nickel demand.

If China can limit the widespread use of COVID-19 containment measures (and the associated impact on manufacturing) to the June quarter 2022, nickel demand is still likely to be in positive territory for 2022. However, a protracted downturn into the September quarter risks global nickel demand growth being flat, or even declining.

Figure 13.1: Composition of world nickel consumption



Source: International Nickel Study Group (INSG); Wood Mackenzie; Department of Industry, Science and Resources (2022)

In 2022, global finished nickel demand is expected to grow by 4.9% to reach 2.9 million tonnes. Demand is expected to continue to grow over the outlook period, and is forecast to total almost 3.2 million tonnes in 2024.

However, there is considerable uncertainty over the forecasts: while nickel demand for battery precursors is forecast to grow at over 20% annually over the outlook period, there continues to be significant uncertainty arising from a burst in global inflation and the impact on world growth from the fallout from the Russian invasion of Ukraine.

Decarbonisation will be a boon for nickel

The US is continuing to pledge support towards the decarbonisation movement, with positive benefits for nickel demand. In May, the US Administration announced a US\$3 billion package to support domestic advanced battery manufacturing in both the EV and stationary storage space. The package will award grants for production of key battery materials including lithium, cobalt and nickel, and reduce US dependence on China for these materials.

Vale SA signed a long-term contract to supply US electric vehicle maker Tesla with nickel produced in Canada. Vale said the agreement is part of its plan to lift sales of its low-carbon, high-purity nickel to the EV market.

Nickel usage in batteries is accelerating, with EVs driving much of this demand. The proportion of refined nickel used for battery materials increased to 11% in 2021, and is forecast to surpass 17% in 2024.

But will automotive supply chain issues constrain nickel demand?

Persistent supply chain issues in the automotive industry are hampering the production and uptake of EVs, with adverse effects for nickel demand. These issues are largely as a result of a shortage of semiconductor chips, as well as additional time and expense in global logistics. Lockdowns in China, as well as the Russian invasion of Ukraine (which accounts for the majority of the neon used in semiconductor chips) are now adding to these issues. The prospect of energy shortages and price hikes — as the EU introduces a ban on Russian energy exports — are also key risk factors. In May, Volkswagen noted that electric vehicles were ‘sold out’ in Europe and the US — and that 300,000 EVs were on back order for Europe alone. The upshot of this is that demand for EVs will continue to be strong over the outlook period, as manufacturers seek to fill an order backlog.

However, with such high prices, demand destruction is possible. High lithium and nickel prices have meant that battery pack prices are rising in 2022. Stainless steel is also a key input into automotive manufacturing, and any manufacturing delays will also affect nickel demand for internal combustion engine vehicle production.

13.3 World production

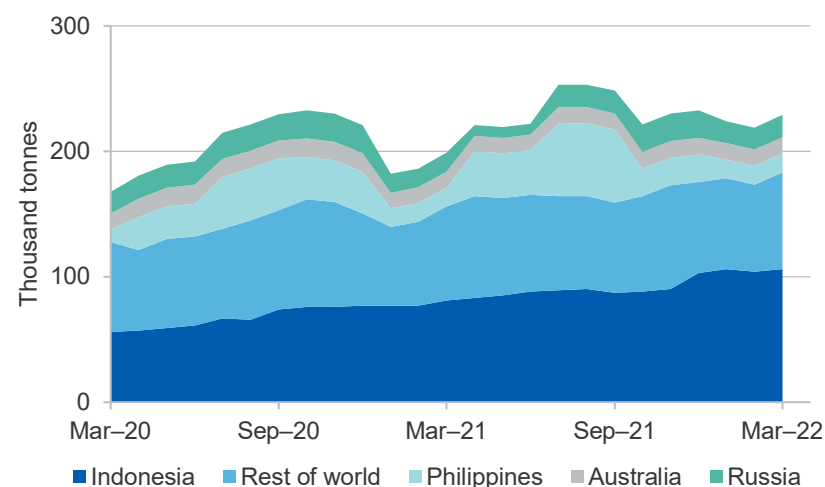
Indonesia extends its lead in mine production

Indonesian mined production increased to 1.0 million tonnes in 2021, up by over one third from the previous year (Figure 13.2). The increase in mined production was largely driven by a need to feed domestic NPI production (which is then used domestically or exported to China for stainless steel production).

Mined nickel production in New Caledonia was up 50% year-on-year in the March quarter 2022, while Russian mine production was up 16% year-on-year. Production in the Philippines — the world’s second largest nickel mining country — showed only a marginal improvement against the March quarter 2021.

Global mine production is expected to increase from 2.7 million tonnes in 2021 to over 3.0 million tonnes in 2022, with 90% of this growth accounted for by Indonesian production. By 2024, mined nickel production is expected to grow to 3.4 million tonnes.

Figure 13.2: Composition of world mined nickel production



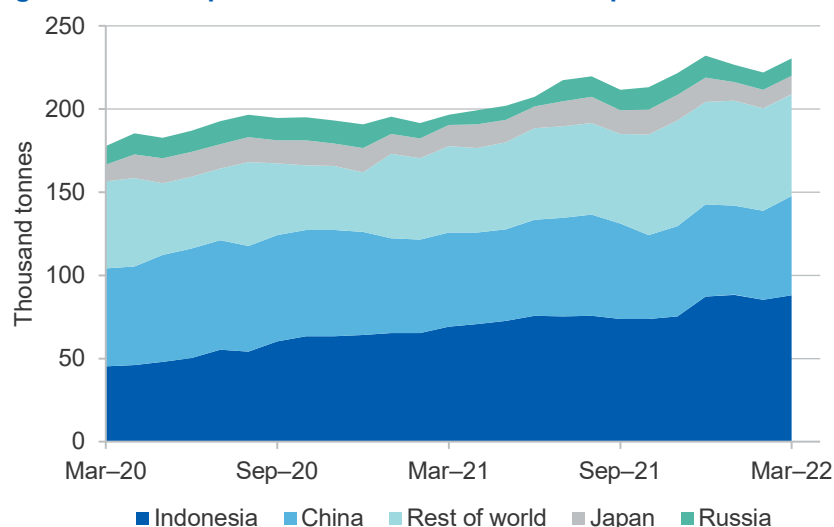
Source: International Nickel Study Group; Department of Industry, Science and Resources (2022)

Indonesia bests China for top spot in refined production

The imposition of an export ban in Indonesia in recent years has proven effective in boosting domestic refined production capability at the expense of Chinese refined production capability. In 2021, Indonesia overtook China to be the world's leading producer of refined nickel (Figure 13.3). Indonesian refined production is expected to ramp up to around 1.1 million tonnes in 2022, and is forecast to grow to around 1.4 million tonnes in 2024.

Intermediate products of nickel (ferronickel, NPI and nickel matte) have also seen a strong boost recently, with exports of these products up by 54% year to date on the same period in 2021. A total of 31 furnaces have come online since the start of 2021, bringing online 300,000 tonnes a year of new nickel production capacity. Another 50 furnaces are due for commissioning between now and the end of the year, which is slated to add another 500,000 tonnes of nickel production capacity.

Figure 13.3: Composition of world refined nickel production



Source: International Nickel Study Group; Department of Industry, Science and Resources (2022)

Global refined nickel production will grow as a result, increasing 11% year-on-year to 2.9 million tonnes in 2022. Refined nickel production is expected to grow 8.3% a year on average to 2024, hitting 3.4 million tonnes. However, with growth heavily dependent on growth in Indonesian supply, risks are skewed to the downside. Firstly, there are reports of supply infrastructure bottlenecks emerging for nickel ores. Secondly, since Indonesian nickel output largely serves the Chinese market, lower end-use demand (due to the COVID-19 outbreaks) will likely induce producers to ease back on planned supply growth.

13.4 Prices

Spectacular short squeeze unwinds

A 'big short' event in March 2022 — the result of the Russian invasion of Ukraine — saw the LME nickel prices rise spectacularly (to above US\$100,000 a tonne in intraday trading). The LME suspended nickel trading for 12 days. The *March 2022 REQ* forecast that nickel prices would fall to around pre-Russian invasion levels by the June quarter. The price was forecast to keep declining as Tsingshan (the large LME short) made a deal to swap its intermediate products with LME-deliverable products — a total of 4,000 tonnes a month from 2 unnamed companies.

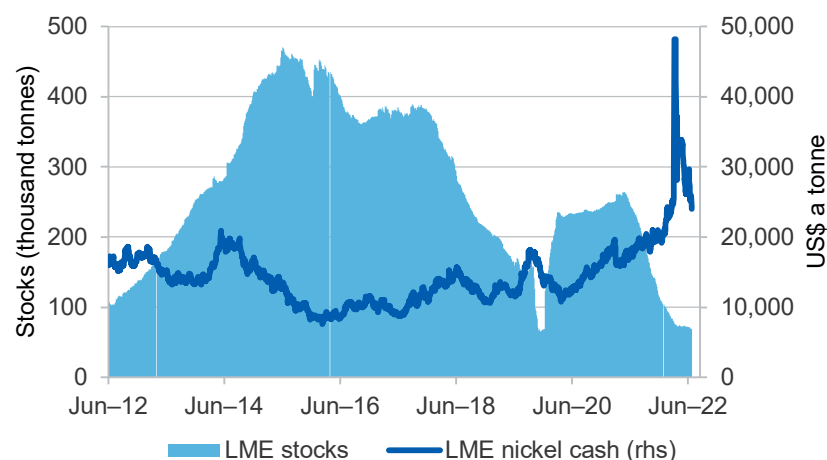
The nickel price averaged above US\$33,000 in April 2022 (Figure 13.4). However, the COVID-19 outbreak and containment measures in China have since seen demand fall off sharply, causing prices to drop sharply as a result. The nickel price has exhibited extraordinary volatility since then — plummeting to as low as US\$26,107 in mid-May, jumping up to US\$29,627 in early June, before sliding again to US\$23,994 towards the end of June.

With sanctions on Russian worrying the market, volatility is likely to be a feature of the nickel market over the rest of 2022. LME Open Interest (the number of open futures contracts) has shrunk — as traders seek to reduce their exposure — reducing liquidity in the LME market. The price of nickel is expected to continue to trend down over the course of the outlook period, as liquidity improves and the market trends to surplus over 2023

and 2024. The nickel price is forecast to average US\$25,700 a tonne in 2022, before moderating to US\$20,200 a tonne in 2024.

Significant downside risks are apparent though, given the substantial increase in Indonesian nickel intermediates (MHP and matte) that could displace class 1 nickel in the battery supply chain. Further, it is yet to be seen how the Tsingshan swap deal affects the nickel market — additional nickel landing in LME warehouses could see prices come down faster.

Figure 13.4 Nickel spot price and stock at exchanges



Source: Bloomberg (2022); Department of Industry, Science and Resources (2022)

Uncertainty around Chinese lockdowns and Russian supply

China's commitment to its zero COVID policy is another contributory factor to current heightened uncertainty in the nickel market. Nickel (and other base metal) prices declined in May, with demand from both the stainless steel and battery sectors affected by China's COVID-19 lockdowns.

However, such disruptions can also affect the supply side of the market. The *December 2021 REQ* noted that episodes of power rationing in China disrupted nickel production which outweighed the impact of demand disruption. A surge in power prices in China could threaten the viability of some nickel refiners.

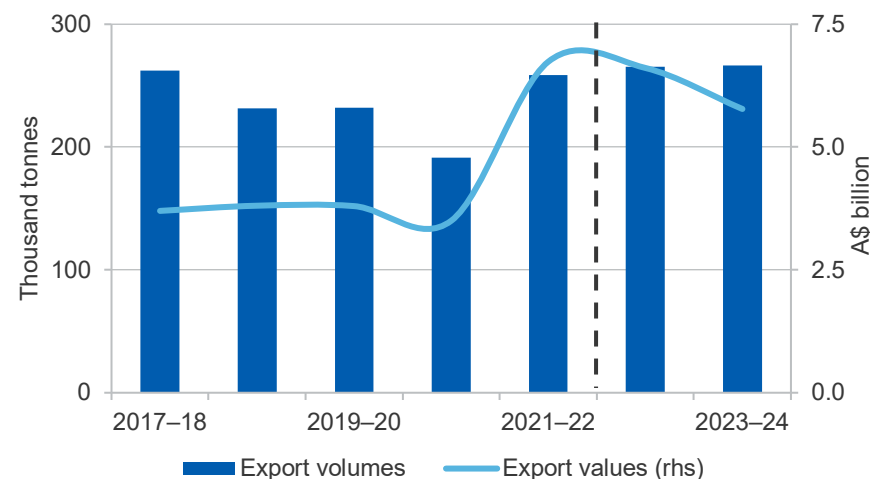
13.5 Australia

Record export earnings will ease once prices fall

2021–22 export earnings are forecast to grow to \$6.7 billion — a rise of 92% year-on-year (Figure 13.5). While prices have been significantly higher than in 2021, export volumes have strengthened from a resumption to production at nameplate capacity following COVID-19 disruptions.

Export earnings are forecast to fall to \$5.8 billion in 2023–24, as prices ease over the outlook period. Export volumes are expected to increase slightly (to 266,000) by 2023–24, which will help counteract the impact of the forecast fall in the price of nickel.

Figure 13.5: Australia's exports stable over the outlook period



Source: Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2022)

Australia's production set to expand as new production comes online

BHP's Nickel West operations have been affected by COVID-19 absenteeism, workforce shortages and planned maintenance. BHP has reduced their 2021–22 guidance to between 80,000 to 85,000 tonnes (down from 85,000 to 95,000 tonnes).

Australia's mined nickel production is estimated to have grown modestly in 2021–22, up to 165,000 tonnes from 162,000 tonnes in 2020–21. Strong prospects for nickel consumption in EV battery manufacturing and recent high prices are forecast to push production to 232,000 tonnes in 2023–24.

Outlook for Australia's refined nickel production

Nickel sulphate production continues to ramp up at BHP's Nickel West project. Production nearly doubled in the March quarter 2022, despite a decrease in total refined output associated with workforce shortages. Once ramp up is complete, Nickel West is expected to produce 100,000 tonnes of nickel sulphate annually.

Australia's refined output is forecast to be steady over the outlook period, at 105,000 tonnes in both 2022–23 and 2023–24. However, increases in refined nickel production may occur, if nickel prices are higher than expected over the outlook period.

Exploration expenditure eases from nine year high

Compared to the December quarter 2021, nickel and cobalt exploration expenditure decreased 8.4% to \$63 million in the March quarter 2022 (Figure 13.6). However, this result is still strong historically, and is 37% higher than exploration in the March quarter 2021 — where exploration was affected by COVID-19 containment measures across Australia.

Figure 13.6: Nickel and cobalt exploration still strong



Source: Source: ABS (2022) *International Trade in Goods and Services*, 5368.0

Revisions to the outlook

The forecast for Australia's nickel export earnings have been revised lower since the March 2022 *Resources and Energy Quarterly*, due to a downward revision in export volumes. Export earnings are down by \$0.3 billion (to an estimated \$6.7 billion) for 2021–22, down by \$0.8 billion (to a forecast \$6.6 billion) for 2022–23 and down by \$0.9 billion (to a forecast \$5.8 billion) for 2023–24.

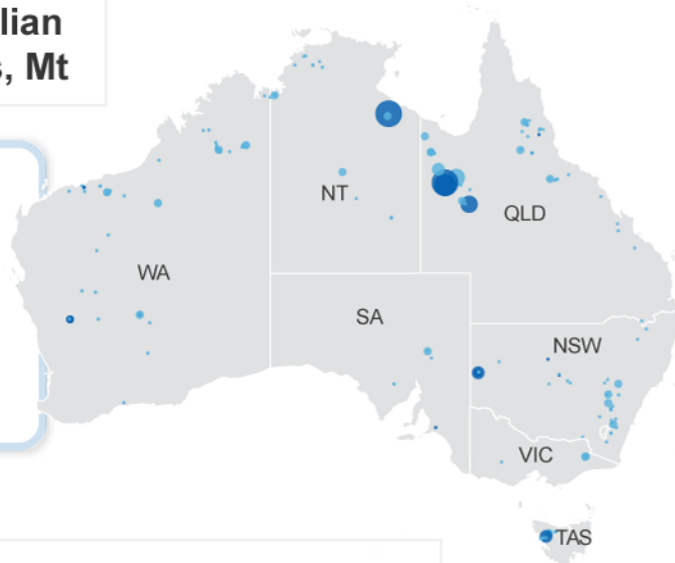
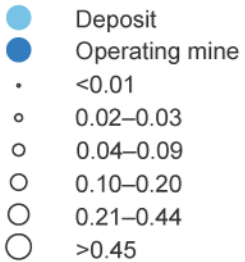
Table 13.1: Nickel outlook

						Annual percentage change			
World	Unit	2021	2022 ^f	2023 ^f	2024 ^f	2022 ^f	2023 ^f	2024 ^f	
Production									
– mine	kt	2,684	3,057	3,284	3,431		13.9	7.4	4.5
– refined	kt	2,607	2,902	3,158	3,402		11.3	8.8	7.7
Consumption	kt	2,772	2,907	3,061	3,188		5	5.3	4.2
Closing stocks	kt	594	589	686	901		-0.8	16.5	31.3
– weeks of consumption		11.1	10.5	11.7	14.7		-5	10.7	26.0
Prices LME									
– nominal	US\$/t	18,468	25,748	21,250	20,250		39.4	-17.5	-4.7
	USc/lb	838	1 168	964	919		39.4	-17.5	-4.7
– real ^b	US\$/t	19,902	25,748	20,660	19,253		29.4	-19.8	-6.8
	USc/lb	903	1 168	937	873	29.4	-19.8	-6.8	
Australia	Unit	2020–21	2021–22 ^s	2022–23 ^f	2023–24 ^f	2021–22 ^s	2022–23 ^f	2023–24 ^f	
Production									
– mine ^c	kt	162	165	223	232		1.6	35.8	4.0
– refined	kt	105	101	105	105		-3.3	3.2	0.0
– intermediate		29	25	28	30		-13.2	10.2	5.2
Export volume ^d	kt	191	259	265	266		35	2.6	0.4
Export value									
– nominal value	A\$m	3,500	6,737	6,611	5,775		92.5	-1.9	-12.6
– real value ^e	A\$m	3,652	6,737	6,315	5,341		84.5	-6.3	-15.4

Notes: ^b In 2022 calendar year US dollars; ^c Quantities refer to gross weight of all ores and concentrates; ^d In 2021–22 financial year Australian dollars; ^f Forecast; ^r Average annual growth between 2021 and 2027 or 2020–21 and 2026–27.

Source: ABS (2022) International Trade, 5465.0; LME (2022) spot price; World Bureau of Metal Statistics (2022) World Metal Statistics; Department of Industry, Science, Energy and Resources (2022)

Major Australian zinc deposits, Mt



World consumption



50%
Galvanise steel



17%
Diecasting



17%
Brass & bronze alloys



6%
Rolled zinc



6%
Chemicals



4%
Other

Zinc facts



Zinc ore was used in ancient Greece to produce brass



Zinc **fight**s infection in our bodies and is used in wound-care & sunscreen



World consumption per capita is **2kg**



Zinc is an **emerging battery mineral**

Australia's zinc



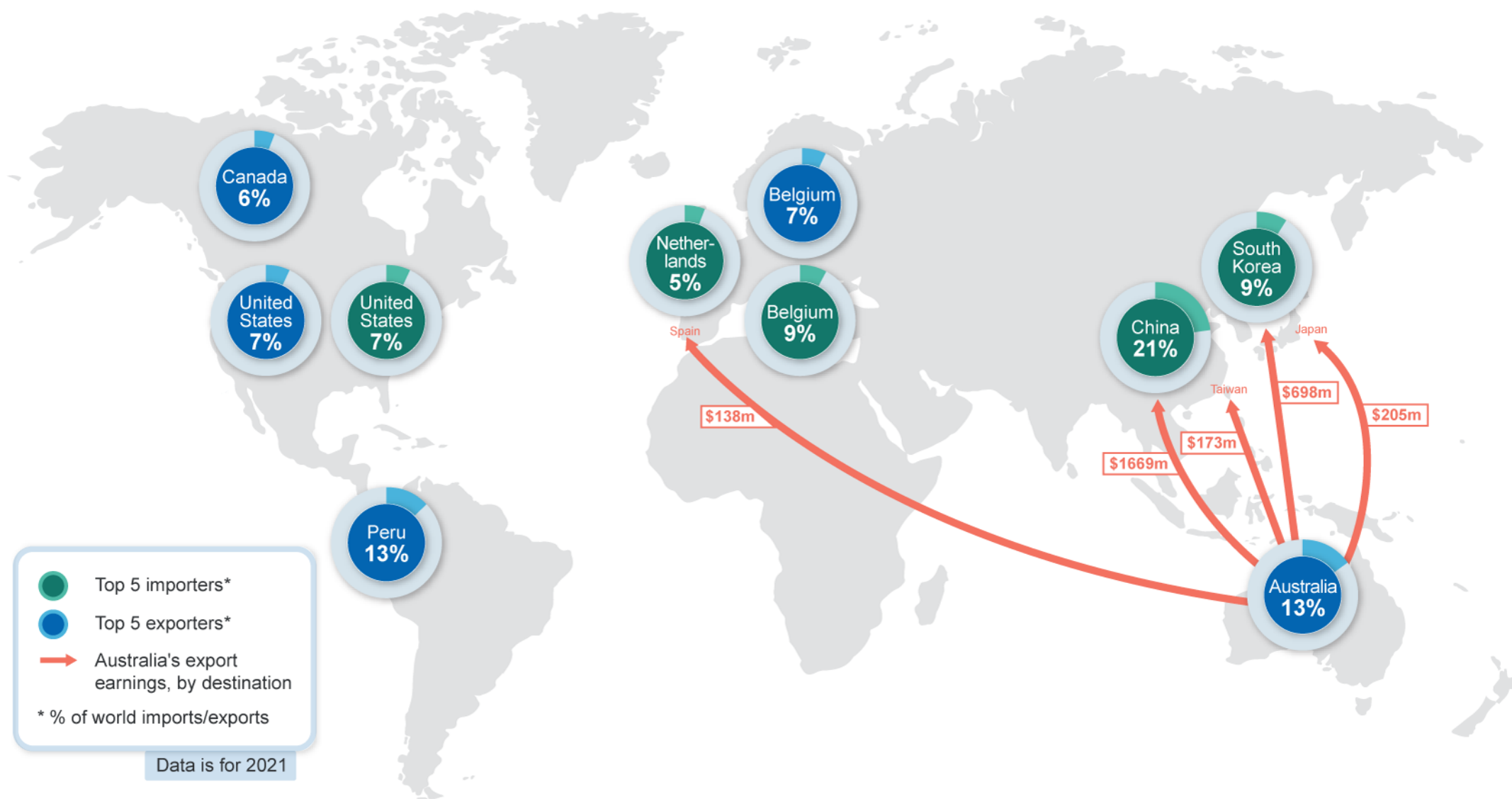
3rd largest producer in the world in 2021



29% of world's known **zinc resources** held



2nd largest exporter in the world in 2021



14.1 Summary

- The LME zinc spot price is forecast to average around US\$3,750 a tonne in 2022, driven by robust global construction activity and continued refined supply shortages in Europe. Prices are forecast to ease over the outlook to around US\$2,900 a tonne by 2024, as global supply rises and consumption growth normalises.
- Australia's zinc production is estimated to be around 1.3 million tonnes in 2021–22, and is forecast to rise by 4.9% per year to around 1.4 million tonnes by 2023–24 (see [Australia section](#)).
- Australia's zinc export earnings are estimated to increase to \$4.2 billion in 2021–22. Earnings are forecast to peak at \$4.6 billion in 2022–23 before easing in 2023–24 to \$3.8 billion.

14.2 World consumption

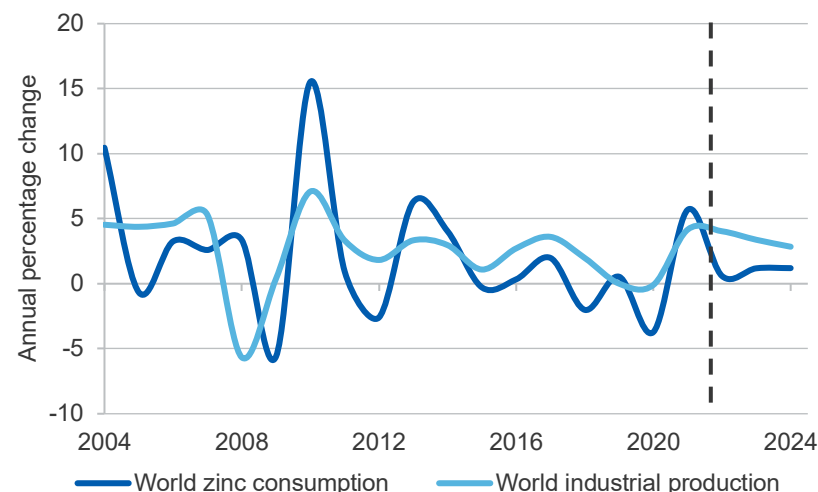
Infrastructure spending supports world zinc demand

World refined zinc consumption increased by 1.4% year-on-year in the March quarter 2022, helped by strong industrial activity. Year-on-year consumption rose in ex-China Asia (up 8.5%), the EU (1.2%) and China (0.1%), but fell by 2.1% in the United States. Zinc consumption tends to follow the world industrial production cycle, given its primary role in galvanising steel (Figures 14.1 and 14.2).

However, the outlook for industrial growth has weakened since the March 2022 REQ (see *Macroeconomic Outlook* chapter), and this will weigh on zinc demand. Lockdowns in China have suppressed demand and disrupted supply chains, while the fallout from the Ukraine-Russia conflict has also pushed up the cost of refining zinc — due to higher global energy prices.

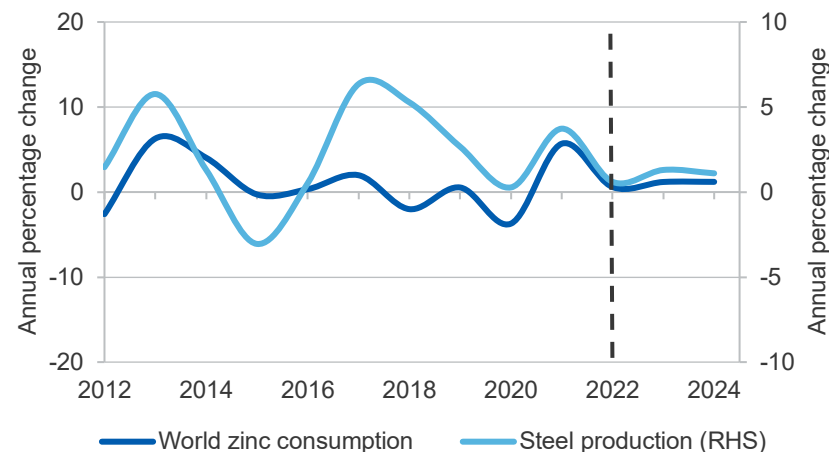
Global vehicle sales fell 24% year-on-year in the March quarter 2022, as the industry continues to be impacted by the ongoing shortage of semiconductor chips; additional semiconductor production capacity is only expected to become available by the end of 2022.

Figure 14.1: World zinc consumption vs industrial production



Source: International Lead Zinc Study Group (2022); CPB Netherlands Bureau for Economic Policy Analysis (2022); Department of Industry, Science and Resources (2022).

Figure 14.2: Steel production vs world zinc consumption



Source: International Lead Zinc Study Group (2022); World Steel Association (2022); Department of Industry, Science and Resources (2022).

The Russian-Ukraine conflict could slow chip production further as 2022 progresses: it has disrupted the world supply of neon gas — a key component of semi-conductor manufacturing. Disruptions to other parts of the supply chain — due to the China lockdowns and the Russian-Ukraine conflict — will also constrain automotive production over the rest of 2022.

However, demand for zinc from infrastructure spending is expected to offset falls in consumer demand. China has announced plans to boost infrastructure spending, in response to the economic impacts of the recent lockdowns. The US Bipartisan Infrastructure Law and the EU Next Generation package is also expected to provide additional funding for infrastructure. The US spending is spread out over many different types of projects, while the EU package is targeted towards digital and green investments.

Over the outlook period, world zinc usage is forecast to grow an average of 1.2% per year, from 14.0 million tonnes in 2021 to 14.5 million tonnes in 2024 (Table 14.1). Demand growth will be driven by higher infrastructure spending and by the global transition to low emissions technology.

14.3 World production

Global mine production faces short term disruptions

World mine zinc production fell 0.4% year-on-year in the March quarter 2022, driven by disruptions to production in Peru and Australia. Peru's mined production fell by 12% year-on-year in the March quarter 2022. Road blockades by protestors have disrupted operations at a number of mines this quarter, including at the Cerro Lindo and Cuajone mines. Australia's mined zinc production fell by 8.9% year-on-year in the March quarter 2022. Increased COVID-19 cases from the Omicron variant and COVID-19 suppression measures created labour shortages, impacting on production this quarter.

China's mined zinc production rose 5.9% in the March quarter 2022. Production is still recovering from the downturn triggered by the COVID-19 pandemic in 2020, and remains 5.3% below March quarter 2019 levels.

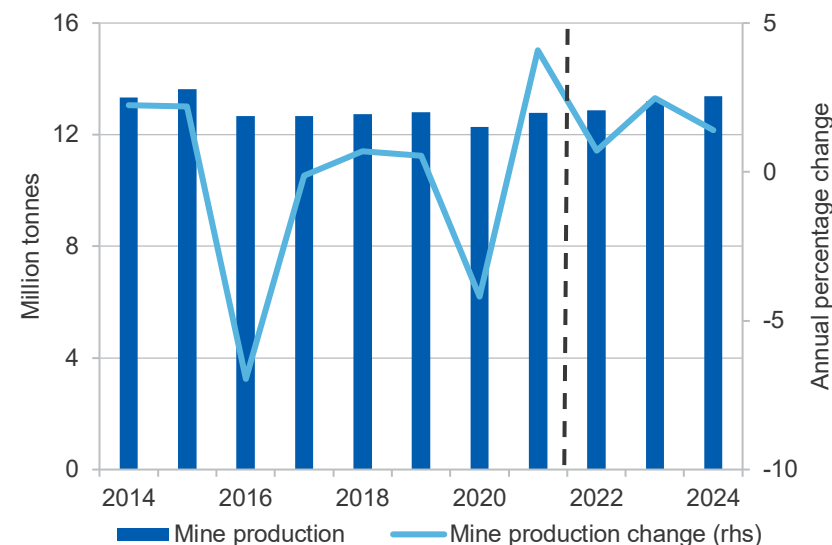
Mine production is expected to rise over the outlook period

World mine output is forecast to reach 12.9 million tonnes in 2022. Beyond 2022, mine output is forecast to rise by an average of 1.9% per year to 13.4 million tonnes by 2024, as miners respond to elevated zinc prices and face fewer operational disruptions from COVID-19 suppression measures (Figure 14.3). Global mine production capacity is expected to increase over the outlook period, as new mines and mine expansions come online.

The largest new projects expected to add to mining production capacity over the outlook period are located in Kazakhstan, Portugal, Mexico, South Africa, and Australia. China, the world's largest producer of zinc ore, is also expected to expand production across smaller mines.

Glencore's Zhairem in Kazakhstan began operating in 2021, and produced 27,000 tonnes of zinc over the year. The mine is expected to ramp up to its nameplate capacity of 160,000 tonnes of zinc per year by 2023.

Figure 14.3: World zinc mine production, metallic content



Source: International Lead Zinc Study Group (2022); Wood Mackenzie (2022); Department of Industry, Science and Resources (2022).

Lundin Mining's Neves Corvo mine in Portugal began an expansion project in 2017 to increase mine capacity from 70,000 tonnes to 150,000 tonnes of zinc per year, with production expected to ramp up towards full capacity over 2022 and 2023.

Grupo Mexico's Buenavista mine in Mexico is expected to begin operating in 2023, ramping up to its maximum capacity of 120,000 tonnes of zinc per year by 2025.

Vedanta Zinc's Gamsberg mine in South Africa began operating in 2019, and produced 170,000 tonnes of zinc in 2021. Production is expected to ramp up, with a Stage 1 capacity of 250,000 tonnes per year by 2023.

New Century Resources' Century mine in Australia restarted in 2018, and has since produced 120,000 tonnes of zinc per year. An expansion project is underway to raise output over 2022 and 2023. The proposed expansion will boost production to 230,000 tonnes of zinc per year.

World refinery production falls as energy price rises

World zinc refined production fell by 1.5% year-on-year and 1.7% quarter-on-quarter in the March quarter 2022. China, the largest zinc refiner, recorded a 0.7% year-on-year increase in production. However, year-on-year production fell for European producers, as high energy prices increased costs for smelters. The Auby smelter in France closed in January 2022 before resuming at reduced capacity on March 2022. The Portovesme smelter in Italy temporarily closed in November 2021, and Glencore stated that operations will resume when there is "a meaningful change in power market prices".

In 2022, refined output is forecast to grow by 1.2% to reach 14.0 million tonnes. While energy prices are likely to remain high, due to the fallout from the Russian-Ukraine conflict, zinc demand is expected to remain strong, and disruptions to mine production is expected to be resolved.

Refined production from primary and secondary sources is expected to increase by 1.9% a year over the outlook period, reaching 14.6 million tonnes in 2024.

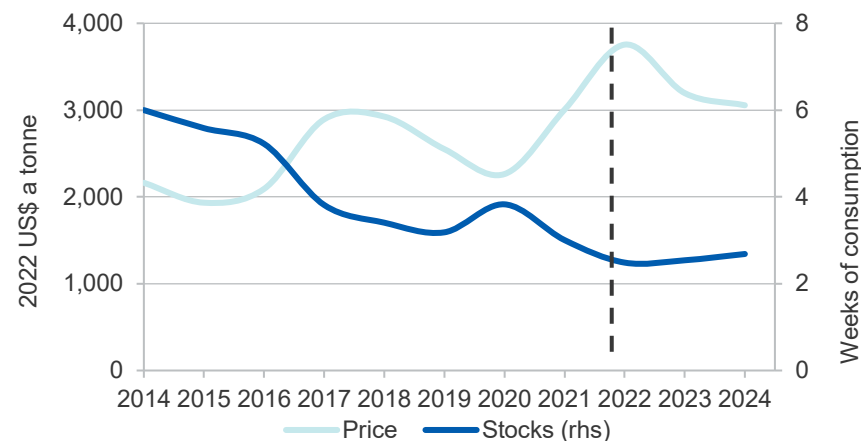
14.4 Prices

Improved supply to drive price moderation

The London Metal Exchange (LME) spot zinc price rose to US\$3,950 a tonne in early June, after averaging US\$3,754 a tonne during the March quarter 2022. Rising prices were driven primarily by supply constraints, as high energy prices raised the cost of refining, and as the COVID-19 pandemic disrupted supply at several major zinc mines (Figure 14.4).

Benchmark treatment costs of zinc concentrates rose to \$230 a tonne in the March quarter 2022 from \$159 a tonne in 2021. While demand remains strong, treatment costs may rise further as energy costs lift.

Figure 14.4: Zinc prices and stocks



Source: LME (2022); Department of Industry, Science and Resources (2022).

LME stocks fell below 90,000 tonnes in early June, from 142,000 tonnes at the end of the March quarter 2022. Strong demand and disruptions to production contributed to the reduction in stocks.

The LME zinc spot price is forecast to average US\$3,750 a tonne in 2022. The price is forecast to fall to \$2,900 a tonne by 2024. Prices are expected to decline from the current high levels, as short-run disruptions to mining production are resolved, and more production capacity comes online.

14.5 Australia's exports and production

High prices to drive export earnings until 2023–24

Australia's zinc export earnings for both concentrates and refined metal are estimated to have reached \$4.2 billion in 2021–22. Higher zinc prices in the March quarter 2022 have boosted export earnings.

Over the outlook period, Australia's export earnings are forecast to increase to around \$4.6 billion in 2022–23 due to high prices and increased production, before falling to around \$3.8 billion in 2023–24, as improving zinc supply on the global market pushes down prices.

Australia's mine production falls due to COVID workforce disruptions

COVID cases resulted in workforce disruptions in several of mines over the March quarter 2022. As a result, Australia's mined zinc output fell by 8.9% year-on-year in the March quarter 2022.

Production at Glencore's Australian operations, including Mt Isa in Queensland and McArthur River in the Northern Territory, fell 9.0% year-on-year to 135,000 tonnes in the March quarter 2022. The fall was mainly due to Mt Isa reporting a drop in production due to COVID-related workforce disruptions. McArthur River reported a small year-on-year output gain.

Production for MMG's Australian operations, including Dugald River in Queensland and Rosebery in Tasmania, fell 27% year-on-year to 350,000 tonnes over the March quarter 2022. The declines were attributed to COVID-related workforce disruptions and lower ore grades.

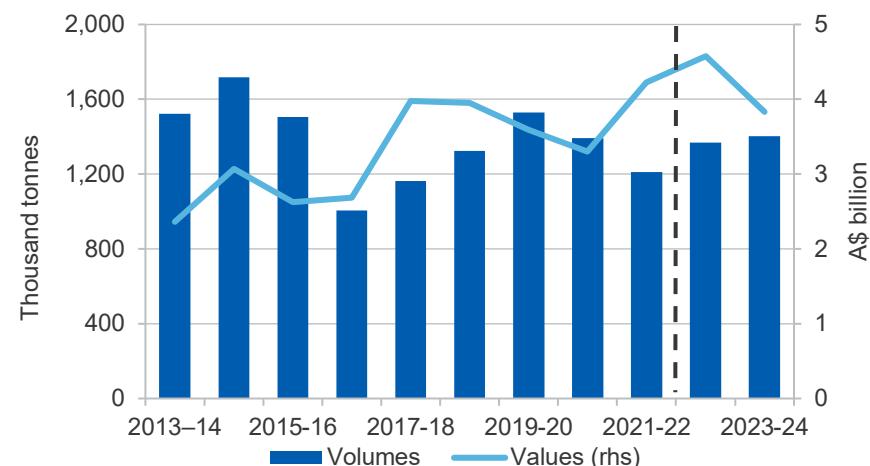
Production at New Century's Century Tailings Reprocessing fell 10% year-on-year to 27,000 tonnes in the March quarter 2022. Production in the March quarter continued to be impacted by the ball mill bypass with New Century repairing the ball mill motor in late February.

COVID-related workforce disruptions also impacted production at Cannington. As a result, South32's Cannington operation in Queensland fell 7.7% year-on-year to 16,000 tonnes in the March quarter 2022.

Concentrate exports rose while refined exports declined

In the March quarter 2022, Australia's zinc concentrate export volume rose 8.4% year-on-year to 258,000 tonnes, and refined zinc export volumes decreased by 38% year-on-year to 45,000 tonnes (Figure 14.5). Zinc concentrate export earnings rose 64% year on year to \$861 million, and zinc refined export value fell 17% year-on-year to \$218 million.

Figure 14.5: Australia's zinc exports, metallic content



Source: ABS (2022) *International Trade in Goods and Services*, 5368.0; Wood Mackenzie (2022); Department of Industry, Science and Resources (2022).

China is the largest market for Australian zinc concentrate and refined zinc exports. The value of Australia's concentrate exports to China rose by 79% year-on-year in the March quarter 2022 to reach \$413 million, as a result of high zinc prices. However, a reduction in Chinese imports of refined zinc led to a 79% fall year-on-year in export value to \$21 million.

Australia's mine production is expected to increase over the outlook period

Australia's output is expected to grow over the outlook period, with mine output forecast to lift from 1.3 million tonnes in 2021–22 to 1.4 million tonnes in 2023–24. The gains will be driven by higher production from the McArthur River operation, Golden Grove operation, and the Century mine.

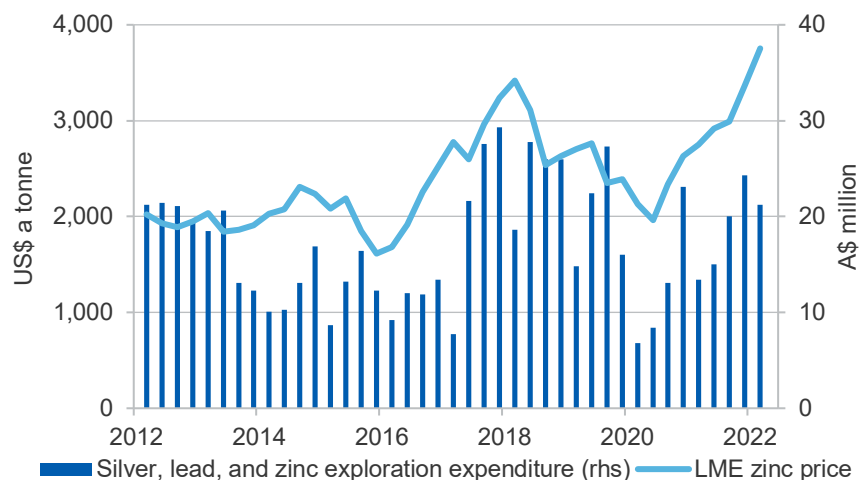
Project development

New Century is examining several hard rock resources beyond the current tailings retreatment operation, which is due to end in 2027. New Century believes hard rock resources have the potential to increase mine life to 2030, and are mostly contained on the existing mining lease. Century Zinc earlier reported positive results from their feasibility study of potential operations at Silver King and East Fault Block. The company is targeting a financial investment decision (FID) in the second half of 2022, and possible first production in the second half of 2023. They estimate additional zinc production of 22,000 tonnes a year.

Exploration expenditure increased significantly in 2021

Exploration expenditure for silver, lead and zinc rose 58% year-on-year in the March quarter 2022 (Figure 14.6). Exploration expenditure slumped in 2020 — due to the COVID pandemic — but recovered as zinc prices rose over 2021 and 2022. Exploration expenditure is expected to see continued strength with zinc prices expected to remain high over 2022 and 2023.

Figure 14.6: Quarterly exploration expenditure and zinc price



Source: ABS (2022) Mineral and Petroleum Exploration, Australia, 8412.0; Company reports; Department of Industry, Science and Resources (2022).

Revisions to the outlook

Compared with the March 2022 *Resources and Energy Quarterly*, forecasts for export revenue are down 1.2% to \$4.2 billion in 2021–22, and up 14.9% to \$4.6 billion in 2022–23. Export earnings in 2023–24 are expected to be \$3.8 billion, up \$0.6 billion from forecasts in the March 2022 *Resources and Energy Quarterly*. The increases in the forecast for 2022–23 is due to prices being higher than previously expected.

Table 14.1: Zinc outlook

						Annual percentage change			
World	Unit	2021	2022 ^f	2023 ^f	2024 ^f	2022 ^f	2023 ^f	2024 ^f	
Production									
– mine	kt	12,778	12,868	13,188	13,373		0.7	2.5	1.4
– refined ^a	kt	13,841	13,980	14,306	14,502		1.0	2.3	1.4
Consumption	kt	14,033	14,116	14,283	14,454		0.6	1.2	1.2
Closing stocks	kt	809	673	696	744		-16.8	3.4	7.0
– weeks of consumption		3.0	2.5	2.5	2.7		-17.3	2.2	5.7
Price									
– nominal	US\$/t	3,005	3,755	3,196	2,854		24.9	-14.9	-10.7
	USc/lb	136	170	145	129		24.9	-14.9	-10.7
– real ^b	US\$/t	3,239	3,755	3,107	2,713		15.9	-17.2	-12.7
	USc/lb	147	170	141	123	15.9	-17.2	-12.7	
Australia	Unit	2020–21	2021–22 ^s	2022–23 ^f	2023–24 ^f	2021–22 ^s	2022–23 ^f	2023–24 ^f	
Mine output	kt	1,330	1,278	1,370	1,405	-3.9	7.2	2.6	
Refined output	kt	458	490	501	501	7.0	2.3	0.0	
Export volume									
– ore and concentrate ^c	kt	2,118	2,094	2,163	2,242		-1.1	3.3	3.7
– refined	kt	408	248	372	371		-39.3	50.0	0.0
– total metallic content	kt	1,392	1,211	1,367	1,403		-13.0	12.9	2.6
Export value									
– nominal	A\$m	3,301	4,229	4,576	3,833		28.1	8.2	-16.24
– real ^d	A\$m	3,444	4,229	4,371	3,545		22.8	3.4	-18.9

Notes: **a** Includes secondary refined zinc; **b** In 2022 US dollars; **c** Quantities refer to the gross weight of all ores and concentrates; **d** In 2021–22 Australian dollars; **f** Forecast; **s** Estimate.

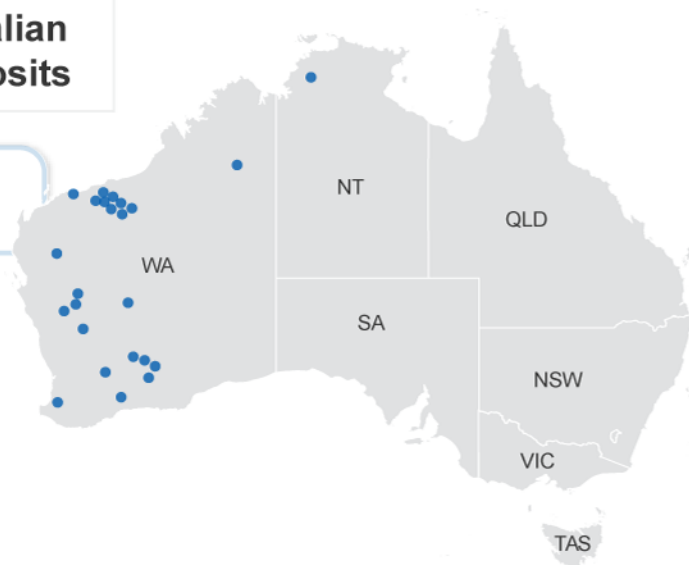
Source: ABS (2021) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Science and Resources (2021); International Lead Zinc Study Group (2021); Wood Mackenzie (2021); LME (2021).



Lithium

Major Australian Lithium deposits

● Lithium deposits



Lithium facts



Lithium metal is **so light** it floats on water



Electric vehicle sales are expected to grow tenfold by 2030

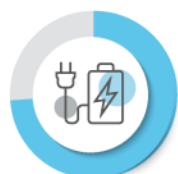


Australian lithium exports will more than double over the next 5 years



In August 2021 Australia began **producing lithium hydroxide**

World consumption



74%
Rechargeable batteries



9%
Other uses



13%
Ceramics & glass



4%
Greases & polymers

Australia's lithium



Biggest exporter in the world



46% of world's lithium production, 2020



In 2022/23 production ramp up planned for 2 refineries

15.1 Summary

- Spodumene prices are forecast to rise from an average US\$675 a tonne in 2021 to US\$2,235 a tonne in 2022, before easing to about US\$1800 a tonne in 2024. Lithium hydroxide prices are forecast to rise from US\$17,370 a tonne in 2021 to US\$35,570 a tonne in 2022, before easing to about US\$28,810 by 2024.
- Australia's lithium production is forecast to rise by more than half over the outlook period, rising from 278,000 tonnes of lithium carbonate equivalent (LCE) in 2021–22 to 438,000 tonnes of LCE in 2023–24.
- Australia's lithium export earnings are projected to more than double over the outlook period, from \$4.1 billion in 2021–22 to \$9.4 billion in 2023–24 (see [Australia section](#)).

15.2 World demand

Electric vehicles continue to increase global market share

In the March quarter 2022, global light electric vehicle (EV) sales fell slightly (down 1%) from record sales in the December quarter 2021, but were up 44% from the March quarter 2021. Global EV production and sales were also down in April; there were lower sales in China, Europe and the US, resulting from a combination of macroeconomic challenges, vehicle delivery delays and production cutbacks in China (due to COVID lockdowns and restrictions). However, EV sales in China rebounded strongly in May, with major producers, including BVM and Tesla, reporting strong growth as supply chains recovered and demand improved.

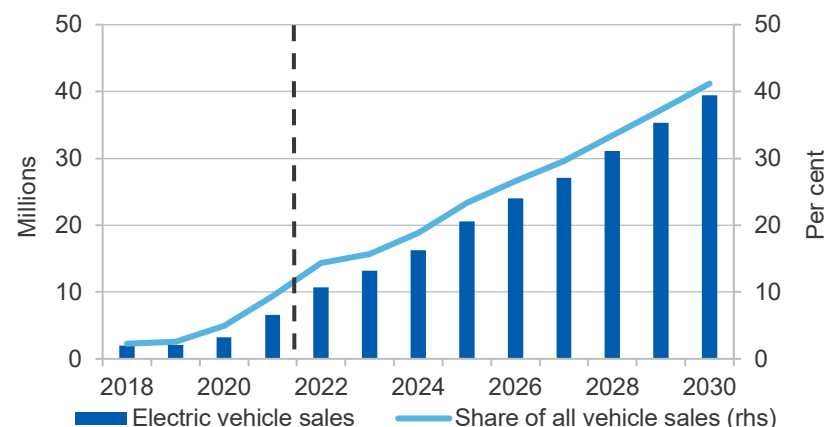
Despite these setbacks, global passenger EV sales are expected to continue to grow strongly, albeit at slower rates than the record growth in 2021 — when passenger EV sales more than doubled to an estimated 6.6 million vehicles. EV sales are expected to reach 10.7 million in 2022 and 13.2 million in 2023 (Figure 15.1).

The global market share for passenger EVs has quadrupled since 2019, with EV sales representing about 9% of the car market in 2021 (Figure 15.2). Strong underlying demand and EV manufacturers' declarations of

further increases in production, imply that EV sales could reach up to 40% of vehicle sales annually by 2030.

In addition to a growing choice of models, EV uptake is also being driven by falling EV prices and ongoing government measures — though government incentives are being wound back in some nations. Over the past year, many global automakers announced plans to accelerate the transition to electric vehicles by developing new product lines and converting existing manufacturing capacity. For example, in April Honda announced an investment of US\$40 billion over the next decade to deliver 30 EV models worldwide, with a goal of 100% electric sales by 2040.

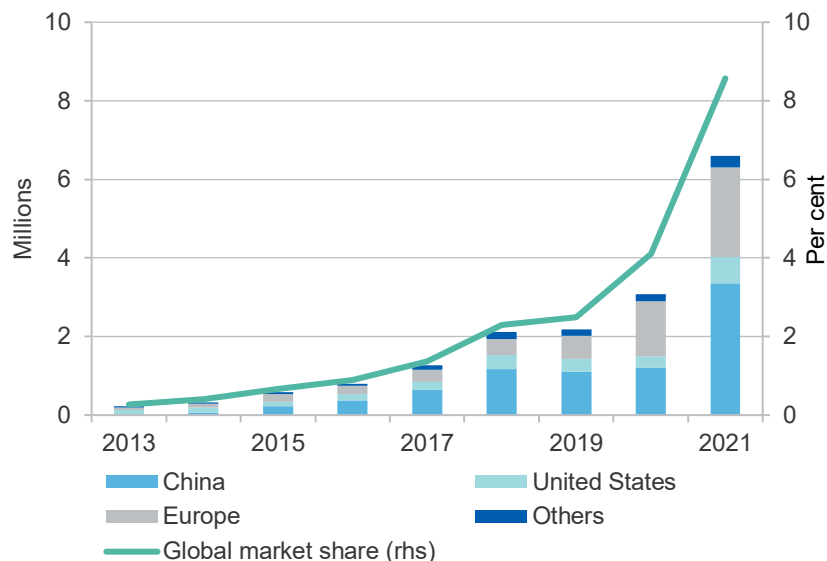
Figure 15.1: Long term electric vehicle sales projections



Note: Projections reflect an assumed long run EV demand profile based on the IEA Announced Pledges Scenario with adjustments to take into account expected higher EV uptake rates associated with increased demand and the 2050 net-zero trajectory. Source: Department of Industry, Science and Resources (2022); Wood Mackenzie (2022); BloombergNEF (2022); IEA (2022).

World demand for lithium is estimated to increase from 555,000 tonnes of lithium carbonate equivalent (LCE) in 2021 to 677,000 tonnes in 2022 (Table 15.1). Over the following two years, demand is forecast to rise by over 40%, reaching 947,000 tonnes by 2024. Asia remains the major source of demand for lithium, despite the spread of new battery manufacturing capacity into Europe and the US.

Figure 15.2: Electric vehicle sales by country



Source: IEA (2022).

Cuts to China's EV subsidy program for passenger vehicles earlier this year present a potential downside risk to EV forecast growth. The program was originally scheduled to expire in 2022, however it has been reported that the Government is now considering extending the incentives to next year.

Another issue affecting the outlook is the challenging supply chain environment facing auto makers. A number of EV makers have publicly announced they are experiencing supply chain issues, with reports that delivery timeframes for key models, such as Tesla's Model Y Long Range, have been pushed well into 2023. Higher prices for lithium as well as other key battery materials (such as nickel, graphite and cobalt) are putting pressure on battery costs.

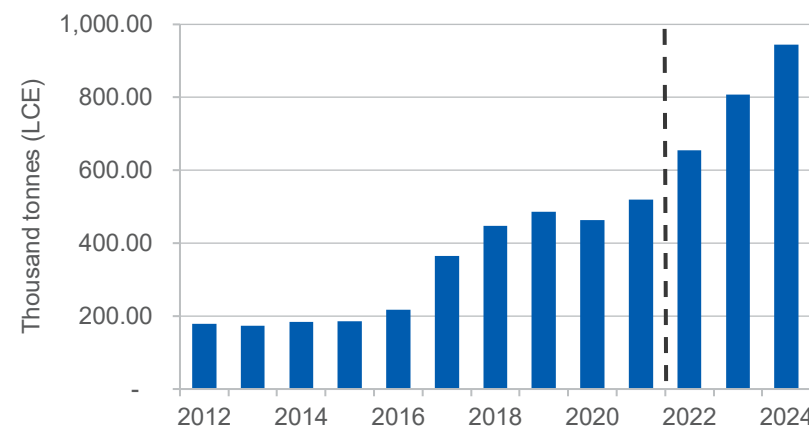
15.3 World production

Security of supply concerns continue to plague processors

World output is estimated at 520,000 tonnes LCE in 2021, and is forecast to reach 655,000 tonnes in 2022 and 944,000 tonnes in 2024 (Figure 15.3). This rapid growth — of around 80% in three years — is forecast to be met by gains in output by Australia (see section below), Chile (via expansions to Albemarle and SQM operations) and Argentina (via new and expanded brine operations by Livent, Allkem and Minera Exar).

Total supply from mine and brine operations is currently insufficient to meet demand. While project development is underway, it will take time to close the supply gap. Stockpile size is hard to ascertain, with some estimates of 4-8 weeks for spodumene. Ongoing tight supply conditions and ongoing concerns about supply chain bottlenecks are forcing lithium processors and battery makers to pay record prices to secure supply.

Figure 15.3: Global lithium production



Source: Department of Industry, Science and Resources (2022); Wood Mackenzie (2022).

Project development is underway, but supply gap will take time to close

The stronger and more mature demand outlook for lithium chemicals is attracting large capital allocations to build global supply. Estimates by Benchmark Mineral Intelligence indicate that as much as US\$42 billion in investment will be needed by 2030 to meet demand for lithium.

A number of expansions and new projects have been announced in recent months. Europe and North America are looking to reduce their dependency on Chinese imports and develop their own lithium production. The US Government is providing more than US\$3 billion in grants to help process critical minerals — including lithium — to accelerate production of key battery metals. Canada has also earmarked up to C\$3.8 billion to build a domestic critical metals supply chain.

Argentina, the world's 4th biggest lithium exporter, has over 20 lithium projects at various stages of development, and is expecting to receive US\$4.2 billion in investment over the next 5 years. Among these, Chinese mining firm Zijin Mining Group has announced it will construct a 20,000 tonne capacity lithium carbonate plant, with a goal of subsequently doubling production in the medium term. Albemarle has announced plans to restart exploration in the Salar de Antofalla, while Posco Holdings is investing US\$830 million in a lithium hydroxide plant. In March, Rio Tinto completed the acquisition of the Rincon lithium project in Salta, which holds reserves of almost 2 million tonnes of LCE.

Chilean state-owned mining firm Codelco has commenced exploration in the Salar de Maricunga, and drilling is expected to be completed in early 2023. The Democratic Republic of Congo's state-owned firm La Congolaise d'Exploitation Minière has announced it is launching a lithium exploration project in partnership with Zijin Mining Group.

Interest in recycling continues to rise, with recycling projects announced in many countries across Europe and other parts of the world. However, large scale operations will take time to be established. Stronger lithium prices, combined with increasing volumes of end-of-life electric vehicle batteries, should improve the economics of recycling projects.

15.4 Prices

Hydroxide prices soften, while spodumene prices set new records

Shortages of spodumene, lithium hydroxide and lithium carbonate continue to push spot prices to new records. Surging demand and low inventories saw spot spodumene trade as high as US\$7,000 a tonne in June 2022. Spot spodumene concentrate averaged about US\$3,950 per tonne in May 2022. This was up from US\$3,107 in April, representing a nine-fold increase from the US\$418 a tonne recorded in January 2021.

Spot prices for lithium hydroxide (delivered to China) averaged US\$68,900 a tonne in May 2022, down slightly from the April average of US\$74,688, but still more than eight times the US\$7,984 average of January 2021.

As most Australian producers have historically utilised long term contracts, prices received take time to adjust to shifts in spot prices. High average realised prices reported by Australian producers indicate spot prices are now flowing more rapidly into contract prices. Anecdotes suggest that contract prices for spodumene have increased strongly so far in 2022, as processors seek to ensure supply is sufficient to meet expected demand.

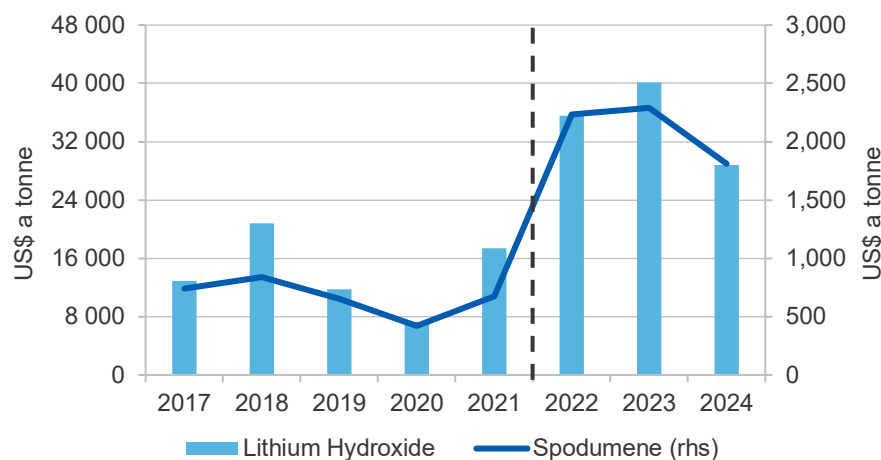
Spodumene prices are forecast to rise from an average of US\$675 a tonne in 2021 to about US\$2,235 a tonne in 2022, as spot and contract prices are renegotiated (Figure 15.4). Prices are expected to moderate to about US\$1,800 a tonne by 2024.

Lithium hydroxide prices are forecast to rise from US\$17,370 a tonne in 2021 to US\$35,570 a tonne in 2022. As global supply steadily rises over the outlook period, prices should moderate to around US\$28,810 in 2024.

Considerable uncertainty exists, given recent rapid price movements and the general immaturity of the market. Risks to the lithium price forecasts are balanced over the outlook period. While expansions to production are already underway in Australia and overseas, long lead times for lithium mine and brine operations, and the potential for delays in bringing such large volumes of lithium into production, mean risks remain of supply shortages persisting over the next few years. However, one of the drivers

of recent high spot prices is a push by refiners and battery producers to build up stocks, due to concerns about global supply chains. If these concerns ease, prices could moderate more rapidly over the next couple of years. A slowdown in global economic growth would adversely affect demand and ease the pressure on prices.

Figure 15.4: Spodumene concentrate/lithium hydroxide prices



Notes: Lithium hydroxide price is for higher-priced battery grade product.

Source: Wood Mackenzie (2022); Department of Industry, Science and Resources (2022).

15.5 Australia

Export values forecast to grow strongly as production ramps up

Record spodumene prices are estimated to have lifted export revenue from \$1.1 billion in 2020–21 to \$4.1 billion in 2021–22. Production from lithium hydroxide refineries is forecast to steadily add to earnings over the outlook period, lifting total annual lithium export revenue to \$9.4 billion by 2023–24 (Figure 15.5).

Australian production is now expected to grow strongly over the outlook. Expected annual growth of over 20% a year will see production rise from 218,000 tonnes of LCE in 2020–21 to 278,000 tonnes of LCE in 2021–22,

growing to 438,000 tonnes in 2023–24 (Figure 15.5). Accordingly, export volumes of spodumene concentrate are forecast to increase from 1.7 million tonnes in 2020–21 to around 3 million tonnes in 2023–24.

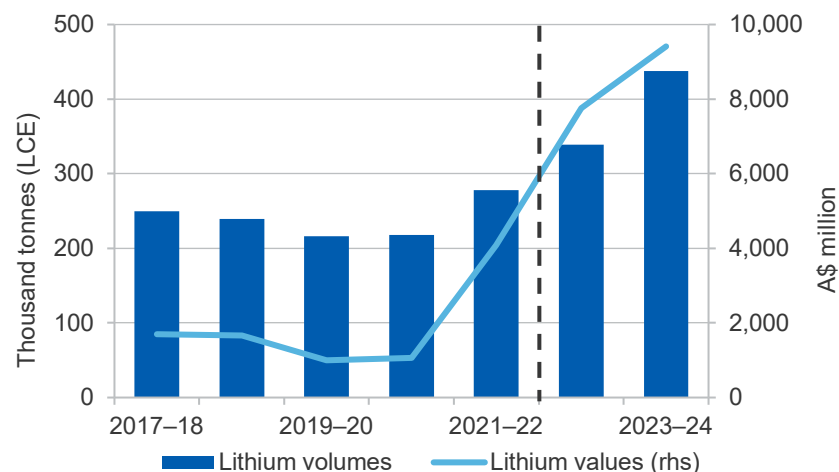
Strong price signals drive production increases

Pilbara Minerals' spodumene concentrate output in the March quarter 2022 was 81,431 dry metric tonnes (dmt), down 2.5% compared with the December quarter 2021 (83,476). March quarter 2022 production was affected by resourcing shortfalls, due to COVID-19 impacts and the tight labour market. With the Pilgan Plant Improvement Project now successfully commissioned, installed production capacity has been re-rated from 330 kilotonnes per annum (ktpa) to 360–380 ktpa. The staged restart of the Ngungaju Plant is underway, with load commissioning of the fines flotation circuit commencing in April. Once the Ngungaju Plant is fully operational, annual production is expected to be 540,000–580,000 dmt for the combined Pilgangoora operation. FID for an incremental 100ktpa capacity increase for the Pilgan plant remains targeted for the June 2022 quarter.

Pilbara Minerals stated that the average spodumene sales price achieved in the March quarter 2022 was US\$2,650 per tonne, more than double the US\$1,250 average price achieved for the second half of 2021. However, prices of US\$6,250 and US\$7,017 were achieved in April and June respectively for cargos sold under auction at the Battery Metal Exchange (BMX). The company expects a significant step up in the spodumene offtake price achieved in the June quarter. Auctions will be held more regularly, as Ngungaju output ramps up and more uncommitted tonnes become available.

Finally, Pilbara Minerals has partnered with Calix to develop a demonstration-scale chemicals facility to process fine, lower-grade spodumene concentrate from the Pilgangoora project to create a low-carbon, concentrated lithium salt using renewable energy. The project is being supported through an Australian Government grant under the Modern Manufacturing Initiative.

Figure 15.5: Australia's exports of lithium



Notes: Export values include revenue from spodumene concentrate and lithium hydroxide. Lithium volumes include total exports of spodumene concentrate and lithium hydroxide converted to LCE.

Source: Company reports; Wood Mackenzie (2022); Department of Industry, Science and Resources (2022).

Output from Mt Marion (owned 50% by Mineral Resources and 50% by Jiangxi Ganfeng Lithium Co. Limited) totalled 104,000 dmt of spodumene concentrate in the March quarter 2022, with an average realised price of US\$1,952 a tonne (up about 70% on the December quarter). In April 2022, the joint venture announced a decision to lift spodumene production at Mt Marion from 450,000 to 600,000 tonnes per annum of mixed-grade concentrate, targeting an annual plant capacity of 900,000 tonnes by end 2022 (equal to 600,000 tonnes of 6% spodumene concentrate).

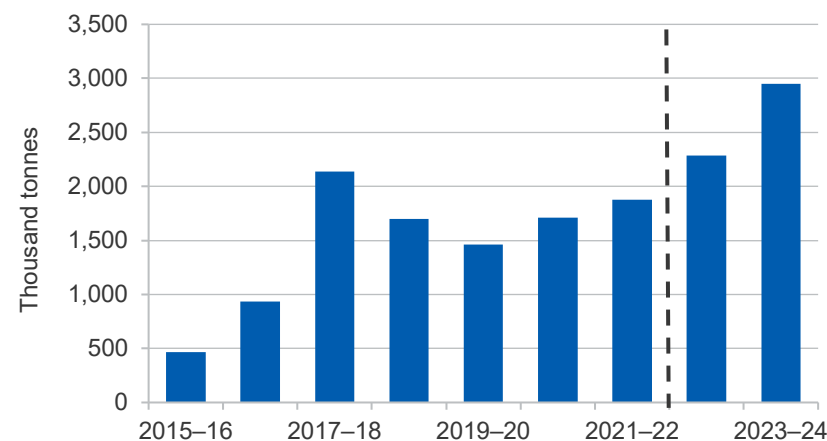
Mineral Resources and Albemarle have announced an acceleration to the restart of the Wodgina mine. Wodgina Train 1 achieved production of first new spodumene concentrate in the June quarter 2022, following two years in care and maintenance. An accelerated resumption of operations at Train 2 is expected to see first production in July 2022.

The three operational plants at Greenbushes operated by the Talison Joint Venture produced a combined total of 270,000 tonnes of spodumene

concentrate in the March quarter 2022, a 5% rise on the December quarter 2021. Construction of the Tailings Retreatment Plant was also completed, and commissioning is underway. In addition, construction of a chemical grade plant (CGP2) has been commissioned, with CGP3 committed. Independence Group expects construction to be completed by early 2025.

High spot prices have seen the contract price for chemical grade spodumene reset to US\$1,770 a tonne from January 2022, an increase of almost 300% on the US\$592 a tonne average price in H2 2021. IGO believes the price of US\$1,770 applied in the June quarter 2022.

Figure 15.6: Spodumene exports



Source: Wood Mackenzie (2022); Department of Industry, Science and Resources (2022).

Australia's hydroxide refineries on verge of commercial production

Trial production at the Kwinana lithium refinery (51% Tianqi and 49% IGO) continued in the June quarter 2022. In May, the company announced the first consistent production of battery grade lithium hydroxide. The qualification process with offtake customers is expected to commence following the completion of independent verification. Construction of Train 2 has been partially completed, with the decision for the full recommencement of construction to be made in H2 2022. Each Train has a capacity of 24,000 tonnes a year.

Spodumene ore has now been introduced into the Kemerton hydroxide plant, and production expected to commence in the June quarter 2022. Mechanical completion and commencement of production at Kemerton's Stage 2 — which will produce an additional 25,000 tonnes a year — is targeted for the December quarter 2022.

Pilbara Minerals' joint venture with POSCO for the production of lithium hydroxide in South Korea was completed in April, with major construction scheduled for the June quarter 2022. The joint venture plans to source 315,000 tonnes a year of spodumene concentrate from the Pilgangoora operations, based on existing production capacity.

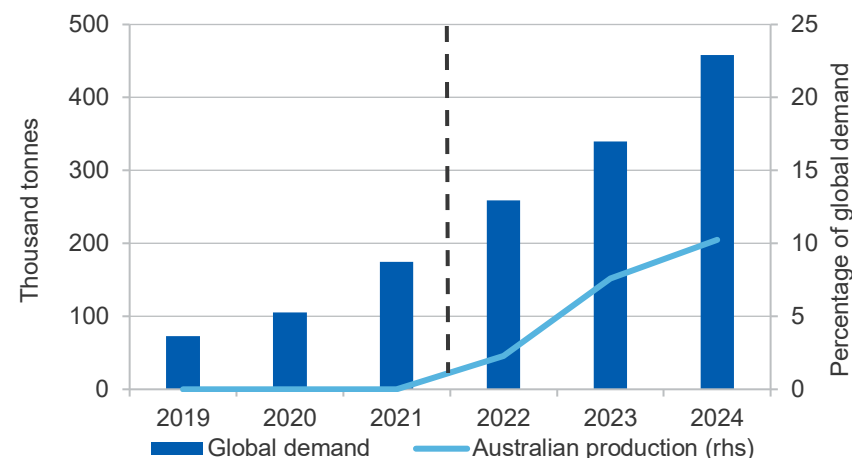
Construction of the Kwinana lithium hydroxide refinery progressed in H1 2022. The refinery will source spodumene from Mt Holland, and is forecast to start in 2024 — making 50,000 tonnes of lithium hydroxide a year.

Liontown's Kathleen Valley deposit near Kalgoorlie is scheduled for FID in the June quarter 2022. The project is expected to deliver 500,000 tonnes a year of spodumene concentrate in the first year, rising to about 700,000 tonnes a year by year 6. Production is expected to commence in the first half of 2024. Offtakes are in place with tier-1 customers, including Tesla, for more than 50% of production over the first five years.

Site construction continues at Core Lithium's Finiss Project near Darwin, and environmental approval for the BP33 underground mine was granted in May. Commissioning of the plant and first production of lithium concentrate are scheduled for the end of 2022. Investigations are also underway exploring the long-term potential for additional downstream processing. Offtake agreements have been made with Ganfeng and Yahua for 80% of the first 4 years of production, amounting to 75,000 tonnes of spodumene concentrate a year supplied to each company.

Australian businesses are expected to continue their expansion into higher value-added activities over the outlook period. Potential avenues include growth up the battery value chain, from mining and refining into precursor chemicals for cathodes, electrolyte production battery anode plants, battery cell research/production, and battery manufacturing (Figure 15.8).

Figure 15.7: World and Australian lithium hydroxide output



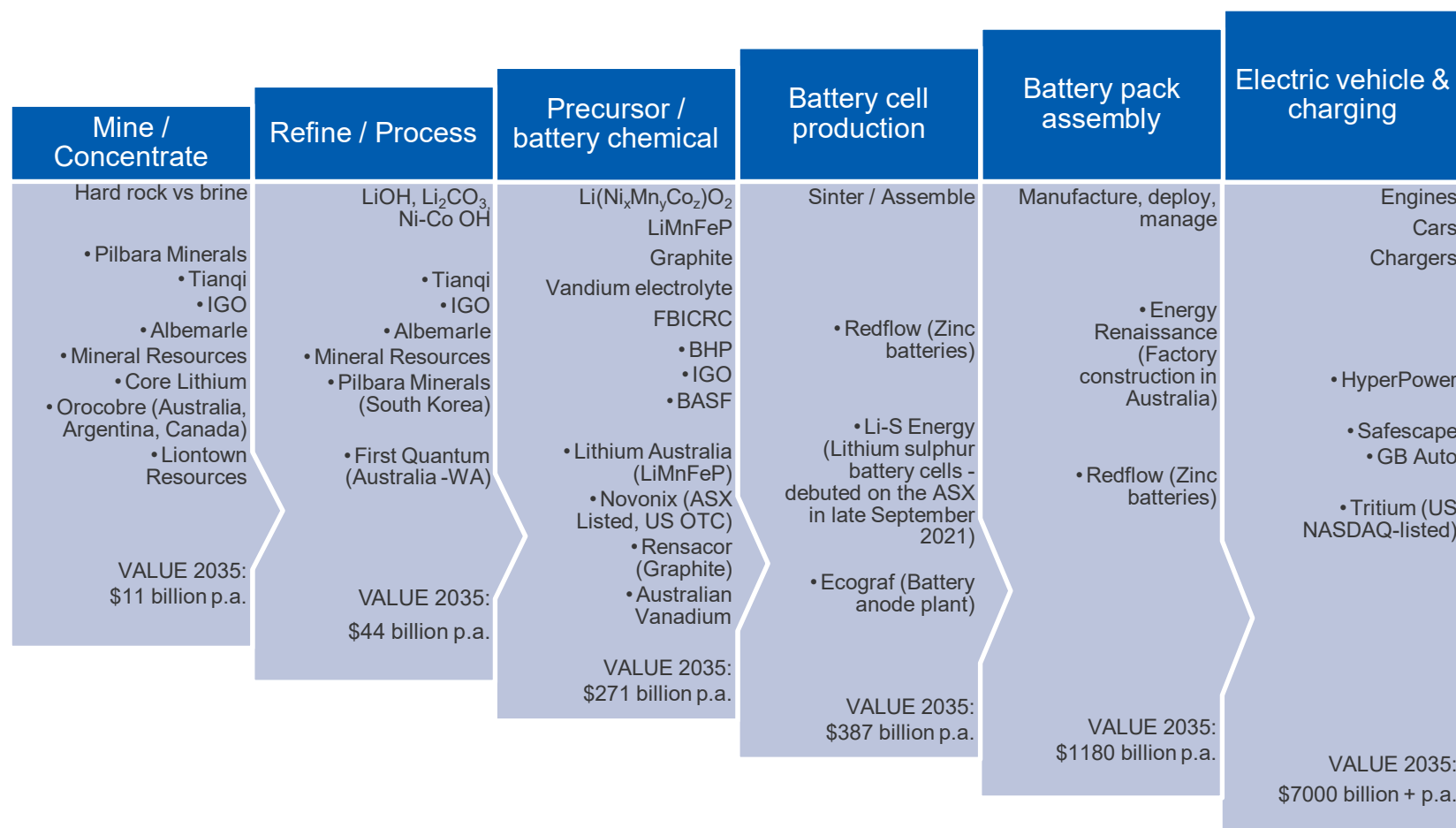
Source: BloombergNEF (2022); Dept of Industry, Science and Resources (2022)

By 2024, Australia may have about 10% of global lithium hydroxide refining capacity (Figure 15.7), rising to about 20% of global lithium refining by 2027. The robust forecast growth for Australian lithium production and revenue over the outlook is subject to a number of risks. Delays to approval and construction of new mine and processing plants, as well as difficulties achieving ramp up to full output, would see slower growth in spodumene output volumes and export values. Similarly, for Australia's nascent lithium hydroxide refining sector, more unanticipated delays or technical challenges associated with achieving required product grade, purity and consistency, could delay forecast output and exports.

Revisions to the outlook

Forecast export revenue over the outlook has been revised up substantially. This reflects a combination of sustained record spodumene prices, faster than expected pass-through of spot prices to contract prices and new production and trade data. Estimated export revenue in 2021–22 has been revised up, from \$2.8 billion in the March 2022 *Resources and Energy Quarterly* to \$4.1 billion. Further out, 2022–23 has been lifted from \$4.6 billion to \$7.8 billion, and 2023–24 from \$5.3 billion to \$9.4 billion.

Figure 15.8: Projected global value of lithium-ion battery value chain (+ zinc and vanadium batteries for large scale storage)



Notes: Redflow is ASX listed and is currently producing zinc batteries offshore. Zinc and vanadium batteries are suitable for large scale storage.

Source: BloombergNEF (2021), Australasian Institute of Mining and Metallurgy: Thought leadership conference, September 2021; Future Battery Industry Co-operative Research Centre (2021).

Table 15.1: Lithium Outlook

World	Unit	2021	2022 ^s	2023 ^f	2024 ^f	Annual percentage change		
						2022 ^s	2023 ^f	2024 ^f
Lithium production ^a	kt	520	655	808	944	26.2	23.4	17.0
Lithium demand	kt	555	677	817	947	21.8	20.7	16.0
Spodumene price								
– nominal	US\$/t	675	2,235	2,290	1,810	230.9	2.5	-21.0
– real ^b	US\$/t	728	2,235	2,226	1,721	207.1	-0.4	-22.7
Lithium hydroxide price								
– nominal	US\$/t	17,370	35,570	40,100	28,810	104.8	12.7	-28.2
– real ^b	US\$/t	18,717	35,570	38,987	27,389	90.1	9.6	-29.7
Australia	Unit	2020–21	2021–22 ^s	2022–23 ^f	2023–24 ^f	2021–22 ^s	2022–23 ^f	2023–24 ^f
Mine production ^a	kt	218	278	339	438	27.5	21.8	29.1
Spodumene export volume ^c	kt	1,711	1,878	2,287	2,952	9.8	21.8	29.1
Export value								
– nominal value ^d	A\$m	1,055	4,082	7,759	9,413	287.0	90.1	21.3
– real value ^e	A\$m	1,100	4,082	7,412	8,705	270.9	81.6	17.4

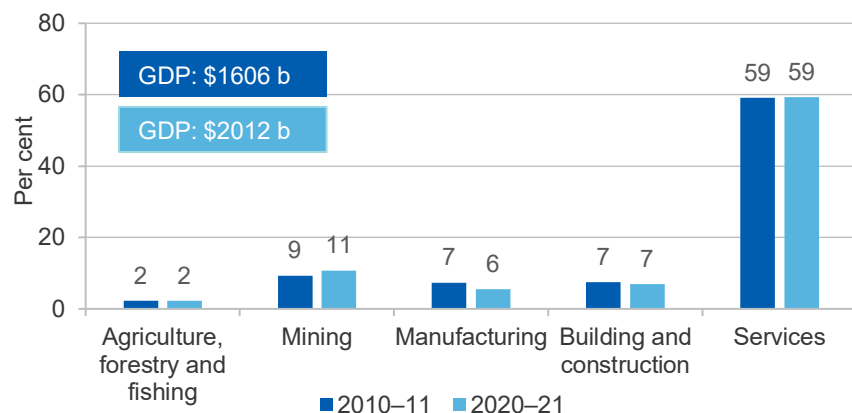
Notes: **a** Lithium Carbonate Equivalent (LCE) — a measure of the quantity of refined product; **b** In 2022 US dollars; **c** Includes spodumene concentrates exported — mostly 6 per cent Li₂O concentrate — plus spodumene concentrate used to produce lithium hydroxide for export; **f** Forecast; **d** Revenue from spodumene concentrate as well as lithium hydroxide; **e** In 2021–22 Australian dollars; **s** Estimate.

Source: Company reports; Department of Industry, Science and Resources (2022); Wood Mackenzie (2022); BloombergNEF (2022); Government of Western Australia Department of Mines, Industry Regulation and Safety (2022).

Trade summary charts and tables

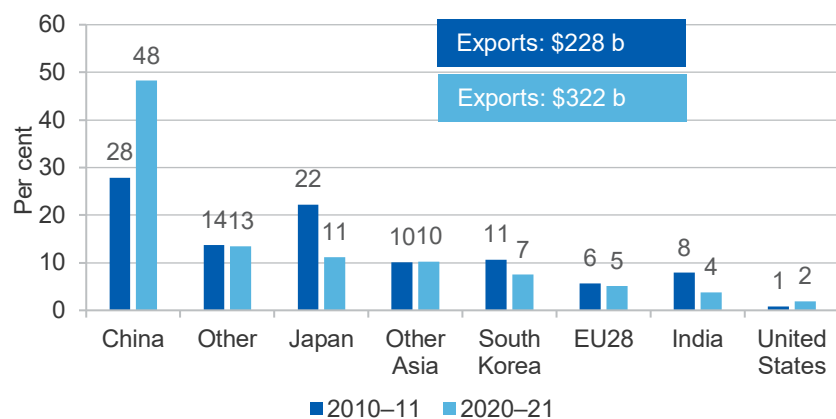


Figure 16.1: Industry shares of GDP



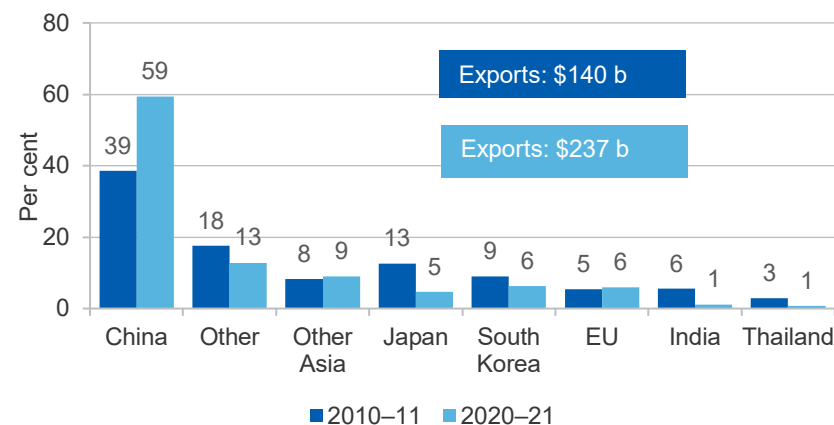
Source: ABS (2021) Australian National Accounts, National Income, Expenditure & Production, 5204.0

Figure 16.2: Principal markets for Australia's resources and energy exports, 2021-22 dollars



Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.3: Principal markets for Australia's resources exports, 2021-22 dollars



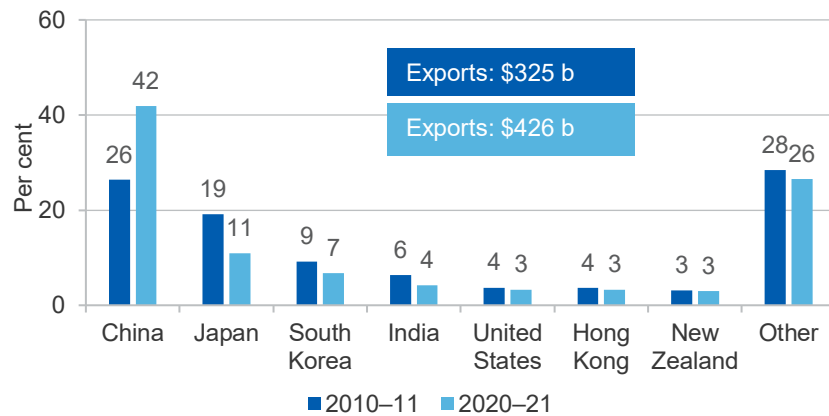
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.4: Principal markets for Australia's energy exports, 2021-22 dollars



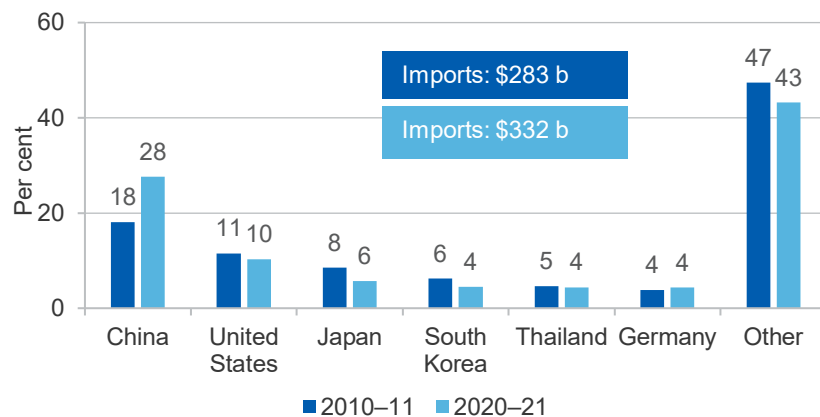
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.5: Principal markets for Australia's total exports, 2021–22 dollars



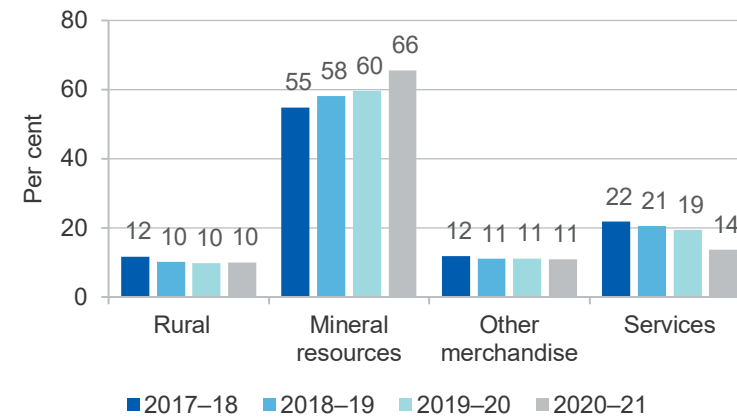
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.6: Australia's total imports by country of origin, 2021–22 dollars



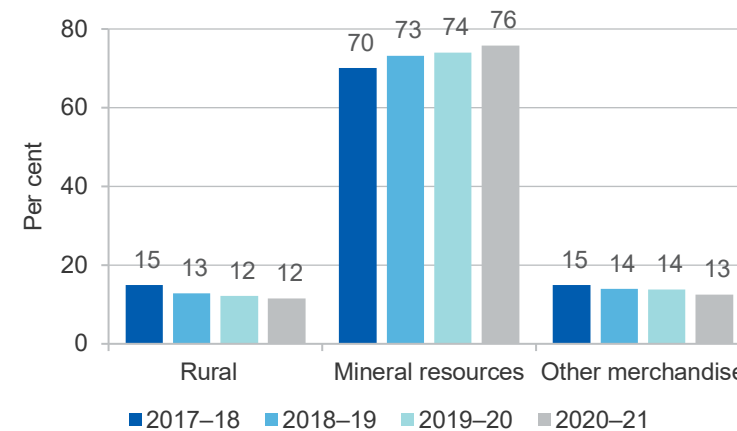
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.7: Proportion of goods and services exports by sector



Source: ABS (2022) Balance of Payments and International Investment Position, 5302.0

Figure 16.8: Proportion of merchandise exports by sector



Source: ABS (2022) Balance of Payments and International Investment Position, 5302.0

Table 16.1: Principal markets for Australia's thermal coal exports, 2021–22 dollars

	Unit	2016–17	2017–18	2018–19	2019–20	2020–21
Japan	\$m	9,167	10,744	12,495	8,850	7,313
South Korea	\$m	2,854	3,245	4,096	3,014	2,679
Taiwan	\$m	2,515	2,807	3,397	2,530	2,150
Vietnam	\$m	162	139	714	1,104	742
Malaysia	\$m	717	816	972	567	584
Thailand	\$m	324	405	430	458	541
Total	\$m	21,041	24,667	27,890	21,603	16,694

Source: ABS (2022) International Trade in Goods and Services, 5368.0

Table 16.2: Principal markets for Australia's metallurgical coal exports, 2021–22 dollars

	Unit	2016–17	2017–18	2018–19	2019–20	2020–21
India	\$m	9,316	10,356	12,079	7,941	7,908
Japan	\$m	7,724	7,933	8,227	6,451	4,949
South Korea	\$m	4,107	4,005	4,323	3,216	2,850
China	\$m	8,520	9,148	10,625	10,366	1,741
Taiwan	\$m	2,028	2,111	2,790	2,113	1,390
Netherlands	\$m	2,100	1,956	1,925	1,316	924
Total	\$m	39,334	41,274	46,884	36,308	24,192

Source: ABS (2022) International Trade in Goods and Services, 5368.0

Table 16.3: Principal markets for Australia's crude oil and refinery feedstocks exports, 2021–22 dollars

	Unit	2016–17	2017–18	2018–19	2019–20	2020–21
Singapore	\$m	1,127	1,282	2,091	1,442	1,733
Malaysia	\$m	475	639	1,762	1,074	686
Indonesia	\$m	1,022	1,429	697	807	643
Thailand	\$m	627	1,259	1,203	656	380
China	\$m	787	688	1,083	1,095	168
Japan	\$m	396	393	323	145	95
Total	\$m	6,095	7,599	9,746	9,552	7,756

Note: Some country details have been confidentialised by the Australian Bureau of Statistics.

Source: ABS (2022) International Trade in Goods and Services, 5368.0

Table 16.4: Principal markets for Australia's LNG exports, 2021–22 dollars

	Unit	2016–17	2017–18	2018–19	2019–20	2020–21
Japan	\$m	12,592	15,848	22,789	21,128	12,179
China	\$m	6,349	10,441	18,783	17,257	11,879
South Korea	\$m	2,844	4,027	5,702	5,472	3,495
Taiwan	\$m	283	816	2,518	2,749	2,339
Singapore	\$m	1,592	1,240	1,329	1,102	861
Malaysia	\$m	233	397	937	1,543	521
Total	\$m	24,833	33,754	53,428	50,388	31,782

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

Source: ABS (2022) International Trade in Goods and Services, 5368.0; International Trade Centre (2022) International Trade Statistics

Table 16.5: Principal markets for Australia's iron ore exports, 2021–22 dollars

	Unit	2016–17	2017–18	2018–19	2019–20	2020–21
China	\$m	57,370	54,736	68,190	89,895	130,229
Japan	\$m	5,997	5,823	6,185	7,462	9,474
South Korea	\$m	4,350	3,939	5,014	6,597	9,424
Taiwan	\$m	1,594	1,348	1,899	1,989	3,203
Indonesia	\$m	48	49	47	29	42
India	\$m	6	327	255	22	10
Total	\$m	69,705	67,048	83,325	109,059	159,604

Source: ABS (2022) International Trade in Goods and Services, 5368.0

Table 16.6: Principal markets for Australia's aluminium exports, 2021–22 dollars

	Unit	2016–17	2017–18	2018–19	2019–20	2020–21
Japan	\$m	1,038	1,500	1,418	1,077	997
South Korea	\$m	825	922	825	1,207	945
Taiwan	\$m	230	357	315	382	435
Thailand	\$m	342	409	421	307	364
United States	\$m	142	202	904	262	267
China	\$m	56	37	18	31	123
Total	\$m	3,525	4,383	4,476	3,914	3,926

Source: ABS (2022) International Trade in Goods and Services, 5368.0

Table 16.7: Principal markets for Australia's copper exports, 2021–22 dollars

	Unit	2016–17	2017–18	2018–19	2019–20	2020–21
China	\$m	3,003	4,114	3,875	4,015	2,866
South Korea	\$m	497	317	734	690	1,372
Malaysia	\$m	957	951	1,333	874	887
India	\$m	760	915	477	491	653
Japan	\$m	1,510	1,666	1,970	2,254	18
Philippines	\$m	442	182	657	382	-
Total	\$m	8,425	9,229	10,497	10,823	11,936

Source: ABS (2022) International Trade in Goods and Services, 5368.0

Table 16.8: Principal markets for Australia's gold exports, 2021–22 dollars

	Unit	2016–17	2017–18	2018–19	2019–20	2020–21
United Kingdom	\$m	4,356	3,570	4,639	13,472	9,321
United States	\$m	163	81	137	3,265	4,108
Singapore	\$m	340	1,264	1,708	1,509	3,060
China	\$m	2,582	3,209	5,449	873	2,116
Switzerland	\$m	1,054	1,195	1,247	2,013	1,971
India	\$m	456	799	621	70	1,538
Total	\$m	21,127	21,070	20,271	25,864	27,236

Source: ABS (2022) 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 and Resources' Office of the Chief Economist (DISR 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 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 and Resources (2022)

A.4 Commodity classifications

The DISR 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 and Resources (2022)

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.
DISR	Department of Industry, Science 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