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Oil

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Foreword

Despite a sharp slowing in world economic growth during 2022, Australia's resource and energy export earnings are forecast to set a new record of \$459 billion in 2022–23. But earnings are forecast to fall to \$391 billion in 2023–24 (still the third highest level of earnings on record), as tepid world demand and an easing in supply disruptions reduce commodity prices.

Energy commodity prices have declined but generally remain above levels reached just prior to the Russian invasion of Ukraine. Markets have become less concerned about a drop in exports of gas, coal and oil by Russia, one of the world's largest energy exporters: Northern Hemisphere nations have been successful in building up energy stockpiles for winter. Weak Chinese energy demand (largely due to COVID lockdowns) has made it easier for Western European countries to fill gas storage.

High energy commodity prices have seen energy-intensive metal smelting and refining activity curbed, especially in Western Europe. These output cuts have partly offset the impact of weaker metal demand (induced by a sharp rise in energy costs on consumers and slower global GDP growth).

Bans on Russian exports of oil and other fossil fuels by most advanced Western countries are progressively taking effect. By early 2023, the market for Russian exports will likely have shrunk noticeably: transport and infrastructure constraints will likely prevent a full diversion of Russian energy commodities to countries without sanctions in place. The net result is a drop in world energy supply, as some Russian output becomes stranded. We thus expect the prices of energy commodities to remain relatively high over the outlook period.

Earnings from LNG are forecast to be \$90 billion in 2022–23, as high prices more than offset the impact of weaker LNG export volumes. Thermal coal exports should exceed \$75 billion this financial year, up from \$46 billion in 2021–22. After 2023–24, earnings from these commodities are likely to fall back towards pre-COVID-19 levels, as gains in world supply bring down prices.

Lithium product exports are expected to exceed \$16 billion in 2022–23, up from \$5 billion in 2021–22. This will make lithium the sixth largest export of Australia's resource and energy commodities.

Since our last report, the Chinese Government has taken further action to support the property market and economic growth. COVID restrictions have eased significantly in China, and the Chinese authorities have facilitated an improvement in funds going to the residential property sector. Further easings of COVID restrictions in China would help the commodity outlook, given China's huge share of world usage. China's low inflation also provides the Government with more scope to use fiscal levers to stimulate its economy.

The IMF forecasts world GDP growth of 3.2% in 2022 and 2.7% in 2023, with China forecast to grow by 3.2% in 2022, rising to 4.4% in 2023. It is possible that inflation has peaked in most major economies; if core inflation rates fall back noticeably, monetary action may taper over 2023.

The La Niña weather pattern is forecast to fade in early 2023, and the Indian Ocean Dipole appears to be normalising. Together, this reduces the chances of wetter-than-normal conditions in eastern Australia in autumn/winter, easing concerns about disruptions to mining operations and rail transportation.

The risks to the forecast for Australia's export earnings in 2022–23 and 2023–24 are fairly evenly skewed. Markets have priced in weaker world economic growth and the loss of some Russian resource and energy commodity output from world supply in 2023. Should world economic growth (especially in China) hold up better than expected and/or non-Russian commodity supply fails to rise as expected, our export earnings could exceed current forecasts. If Russia cuts exports of oil and oil products in response to the imposition of price caps, oil prices could lift sharply. Higher oil prices would lift Australia's LNG revenues — since most LNG sales are linked to the price of oil — but would adversely impact world economic growth. A substantial widening in COVID lockdowns in China poses a downside risk to Australia's export earnings, especially our exports of base and ferrous metals.

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 uses IMF economic growth forecasts as the basis of its world growth forecasts.

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 12 December 2022.

Resources and Energy Quarterly publication schedule

Publication	Expected release date	Outlook period final year
March 2023	3 April 2023	Australian data: 2027–28 World data: 2028
June 2023	3 July 2023	Australian data: 2024–25 World data: 2025
September 2023	3 October 2023	Australian data: 2024–25 World data: 2025
December 2023	18 December 2023	Australian data: 2024–25 World data: 2025

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

Overview



Australia's mining sector



Contributes to around
13.7% of GDP








Makes up more than **two-thirds** of Australia's total merchandise exports

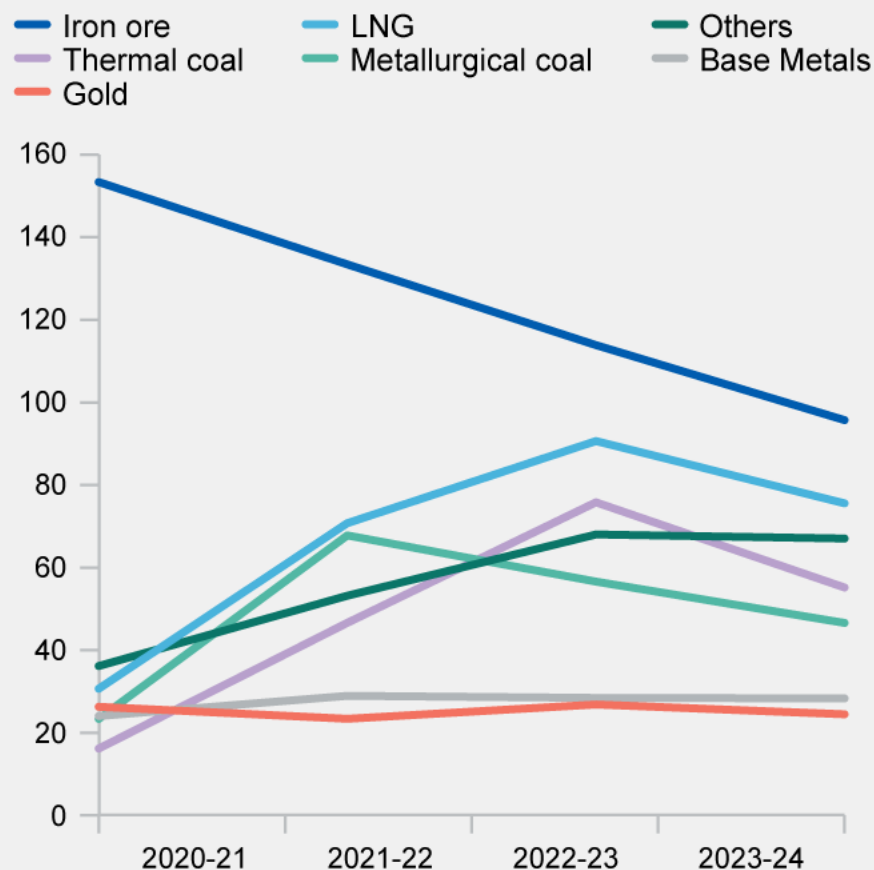


Directly employs **over a quarter of a million people**

Major markets for Australia's resources and energy exports in 2021-22, A\$billion

	China	140
	Japan	54
	South Korea	33
	India	27
	Taiwan	16

Australia's resource and energy exports, A\$billion



1.1 Summary

- Energy commodity prices have fallen from record highs, on easing fears of Northern Hemisphere winter shortages, but will likely stay above pre-war levels in 2023, as some Russian energy supply becomes stranded.
- High energy commodity prices and strength in the US dollar are driving a surge in export earnings. After a record \$422 billion in 2021–22, resource and energy export earnings are forecast to lift to \$459 billion in 2022–23, before falling back to \$391 billion in 2023–24.
- Lithium exports are set to earn \$16 billion in 2022–23, becoming our sixth largest resource and energy export.

1.2 Export values

Australia's export values are forecast at \$459 billion in 2022–23

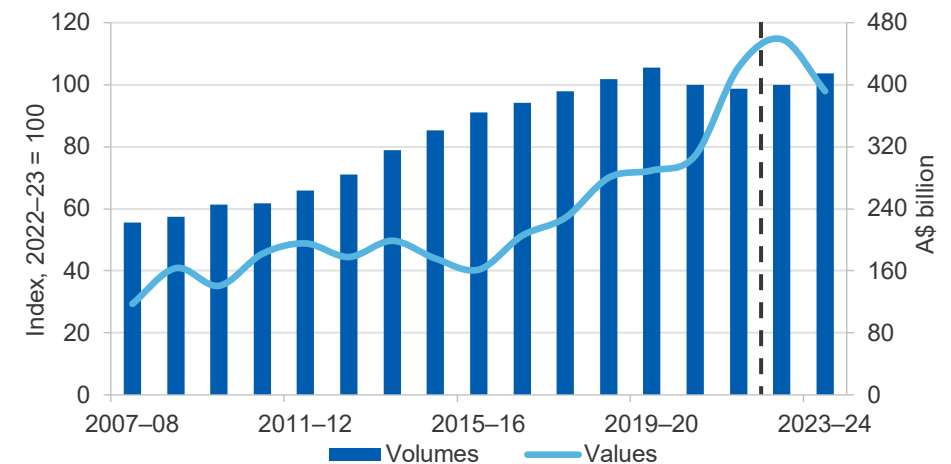
In the December quarter 2022, the Office of the Chief Economist's (OCE) Resources and Energy Export Values Index rose 26% from the December quarter 2021; a 3% rise in volumes added to a 20% gain in prices.

Despite a slowing world economy, resource and energy exports of \$459 billion in 2022–23 are set to easily break last year's record of \$422 billion (Figure 1.1). However, exports are forecast to fall to \$391 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. The resulting fall in earnings in 2023–24 would be the first fall in seven years (Figure 1.2).

Energy shortages and the low exchange rate are boosting earnings

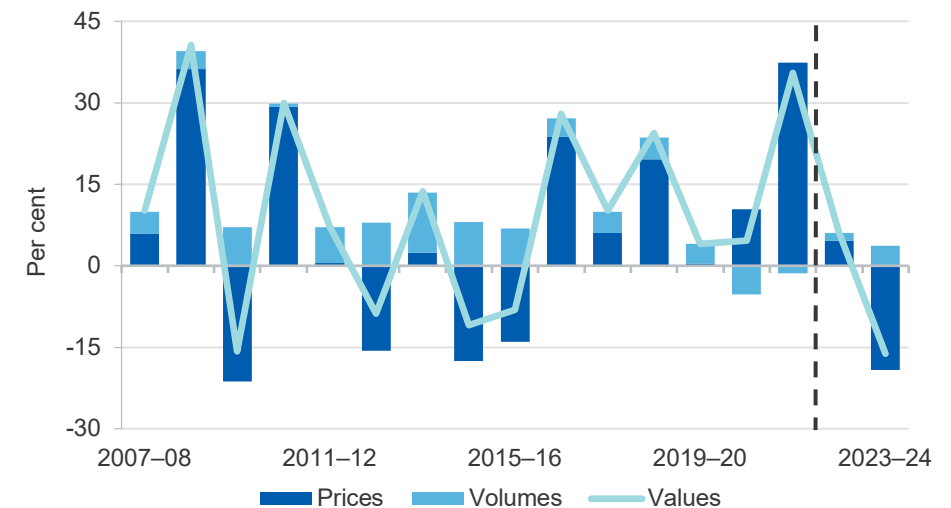
In Australian dollar terms, the OCE's Resources and Energy Commodity Price Index fell by 6% (preliminary estimate) in the December quarter 2022, but was up 19% on a year ago. In US dollar terms, the index rose by 16% in the quarter, but was 6% higher than a year ago. The prices of resource exports (Australian dollar terms) rose by 10% in the year to the December quarter 2022. Energy commodity prices rose by 30% in the year to the December quarter 2022 (Figure 1.3); having sanctioned Russia for its invasion of Ukraine, many Western nations then had to race to fill energy storages ahead of the Northern Hemisphere winter.

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



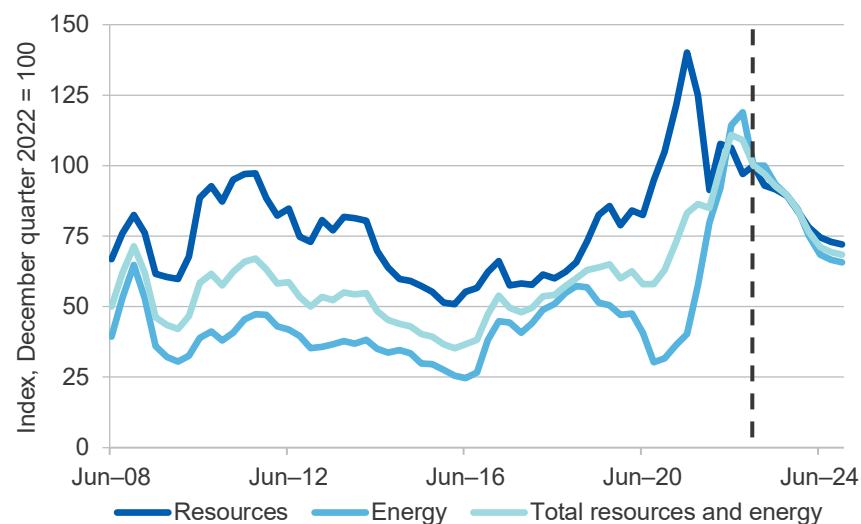
Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022)

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 growth has continued to slow in recent months. High energy commodity prices in the September quarter, and tighter financial conditions in the major Western economies, have had a major impact. Added to these have been the effects of China's ongoing struggle with COVID-19 and still disrupted supply chains. However, global gas prices have declined sharply in the past few months, and there are signs that the surge in headline inflation in most Western nations has peaked. If a meaningful slowing in core inflation allows the major Western central banks to ease monetary tightening soon, and if Chinese economic growth stabilises, the world economy may only slow modestly further.

Chinese economic growth remains sluggish, largely due to a weak property market and COVID-19 outbreaks and restrictions. In the second

half of November, the authorities took a number of measures to lessen the impact of these factors. China's low inflation rate means the authorities are less constrained in adopting further measures to support growth. Such measures would help support resource and energy commodity prices.

Economic growth has slowed sharply in many European nations, hurt by extremely high energy commodity prices resulting from fallout from the Russian invasion of Ukraine. EU gas storage is now full, after a six month drive to ensure that the cessation of energy imports from Russia in late 2022 would not leave the region short in the winter peak usage period. The fallout from China's COVID-19 lockdowns has helped free up some gas/LNG to flow to Western Europe, taking pressure off gas prices.

Since the September 2022 *Resources and Energy Quarterly*, the US Federal Reserve has raised official interest rates further, in an effort to contain US inflation. With US economic growth slowing and US inflation likely having passed its cyclical peak, the bulk of the Federal Reserve's monetary tightening seems done.

The IMF forecasts world GDP growth of 3.2% in 2022 and 2.7% in 2023, with Chinese growth of 3.2% in 2022 and 4.4% in 2023.

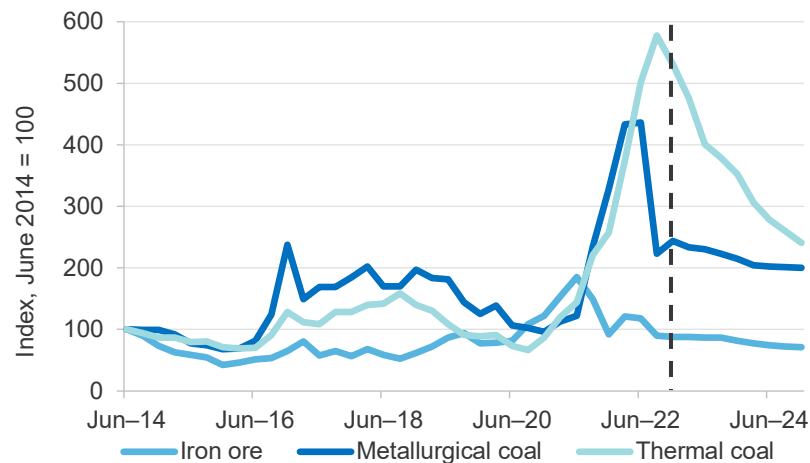
Global resource and energy commodity trade continues to re-organise, as Western sanctions imposed on Russia ramp up further. China, India and Turkey are taking Russian cargoes (at heavy price discounts) shunned by the West. As a result, China and India are now buying fewer cargoes of non-Russian commodities. Starting on 5 December, some Western nations have applied price caps to Russian oil exports, with a price cap on oil products due to start on 5 February 2023. Unless Russia chooses to stop exporting to nations who enforce the price cap, oil prices should fall: the replacement of bans with price caps cuts the likelihood of some Russian oil output being stranded. Capacity constraints on Russian coal exports to the East will likely limit world supply, holding coal prices higher than otherwise.

Higher global interest rates and new China lockdowns pose a downside risk to global economic activity and Australian mineral exports.

1.4 Prices

Since the September 2022 *Resources and Energy Quarterly*, the iron ore price has steadied, and remains well above the November 2021 cycle low. Weak Chinese demand has added to the impact of improved supply in major exporting nations (Figure 1.4). Prices are likely to ease further over the outlook period, as world supply gains faster than world demand.

Figure 1.4: Bulk commodity prices



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

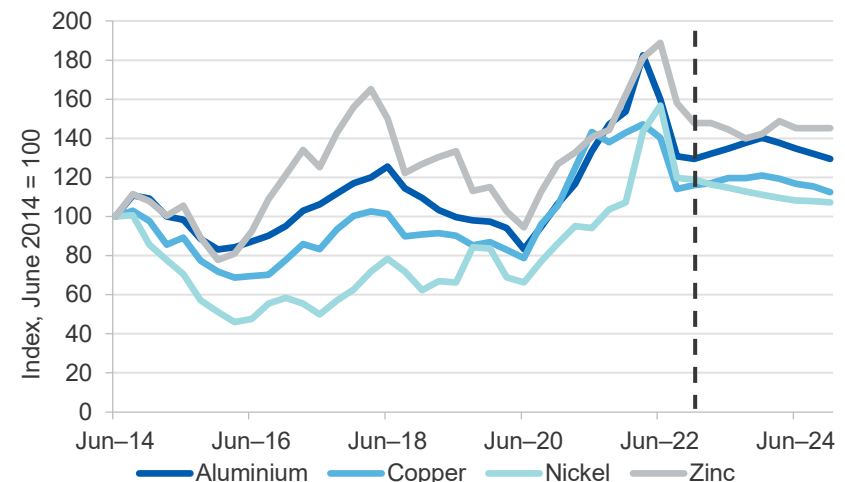
Source: Bloomberg (2022); Department of Industry, Science and Resources (2022)

Australian thermal coal prices have declined from record levels, but remain high historically. Flooding and bad weather in major producing regions has added to the impact of solid demand: customers have been scrambling to build stockpiles ahead of peak Northern Hemisphere winter, as sanctions on Russian exports take full effect. Some Russian coal production will likely be stranded from export markets. Prices are expected to ease over the outlook period, as trade flows re-organise further and export supply lifts. Metallurgical coal prices have steadied, due to supply problems and signs that Chinese steel output has ceased declining: the Chinese government's efforts to underpin economic activity should boost steel usage. Prices are likely to drift down over 2023, as supply recovers.

Oil prices have steadied below the US\$90 a barrel mark, as weak demand more than offsets the impact of supply cuts. The market is likely to tighten if Russia carries through with its threat to withhold supply from nations supporting the price cap. Chinese COVID waves may contribute to lower world usage, but OPEC+ cutbacks will limit price declines. Spot LNG prices have fallen, as a warmer-than-normal Northern Hemisphere autumn lowered heating demand and helped inventories rise. Prices are likely to stay well above pre-war levels, as some Russian gas output is stranded.

The price of gold has rebounded, boosted by falling US bond yields and associated weakness in the US dollar. The price is likely to fall modestly in the next two years, as real bond yields hold their gains. Base metal prices have pushed up, as hopes of a soft landing in the world economy add to the pressure of low inventories. The loss of some Russian supply (especially nickel and aluminium) from world markets would give support to prices (Figure 1.5). Prices should be flat over the outlook period, as supply slowly catches up with demand and stockpiles stop falling.

Figure 1.5: Base metal prices



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

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

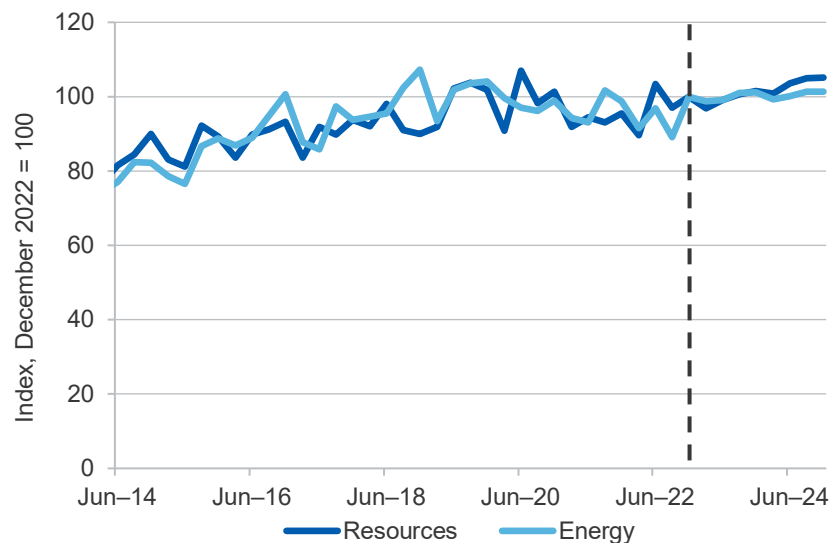
1.5 Export volumes

December quarter export volumes rose, driven by resource exports

The OCE's Resources and Energy Export Volumes Index (preliminary estimate) rose 8% in the December quarter 2022 from the September quarter, and was 3% higher than a year before. Within this total, resource commodity volumes rose by 5% in the year to the December quarter 2022, while energy commodity volumes rose 1% (Figure 1.6). Energy exports were impacted by production/transport problems: operational, weather and COVID-19 related workforce issues were central to these disruptions.

In volume terms, resource exports are likely to show further significant growth over the outlook period, particularly in 2024. The volume of energy exports has been constrained by weather conditions and problems associated with the pandemic. High prices will likely cause some demand destruction in the outlook period.

Figure 1.6: Resource and energy export volumes



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

1.6 Contribution to growth and investment

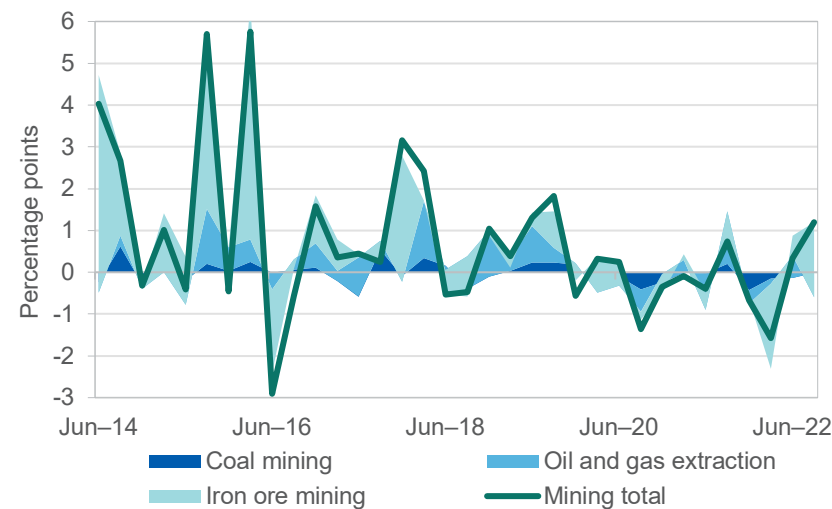
Mining industry contracted while the overall economy expanded

Australia's real Gross Domestic Product rose by 0.6% in the September quarter 2022, to be up 5.9% from the September quarter 2021.

Mining value-added rose by 1.2% in the September quarter, but was down 0.7% over the previous twelve months (Figure 1.7). COVID-19-related problems have eased, but some mining operations have been impacted by flooding and bad weather.

In the coming two years, it is likely that the resource and energy sectors will make a significant contribution to real GDP growth. The disruptions to production of the past few years — due to the COVID-19 pandemic and weather-related issues — are likely set to ease. Coal producers will seek to lift output and exports, in response to record high prices and margins. Non-ferrous metal production should experience healthy growth; Northern Hemisphere smelters are closing/cutting back production because of high energy prices, allowing Australian producers to pick up market share.

Figure 1.7: Contribution to quarterly growth, by sector

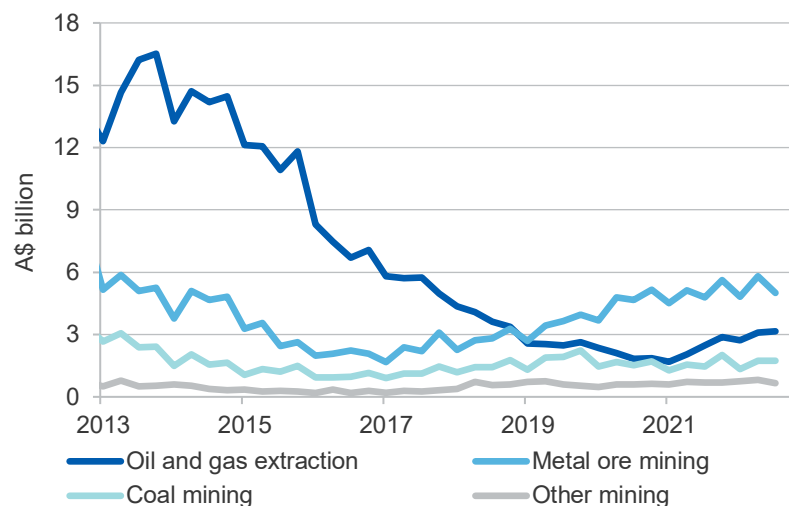


Source: ABS (2022) Australian National Accounts, 5206.0

Mining investment is picking up

The ABS Private New Capital Expenditure and Expected Expenditure survey for the September quarter 2022 shows that Australia's resources industry invested \$10.5 billion in the quarter. This was up 12% from the September quarter 2021. In quarterly terms, investment in coal and gas edged up, while investment in metals and other resources lost ground (Figure 1.8).

Figure 1.8: Mining capex by commodity, not seasonally adjusted

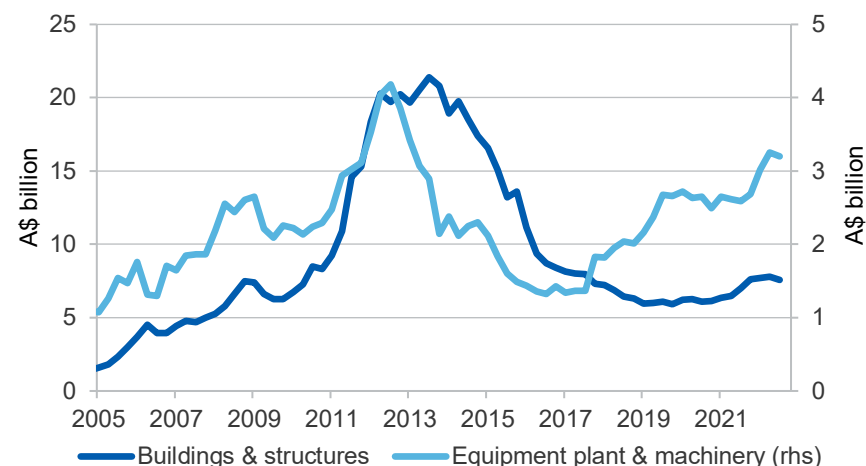


Notes: Other mining includes non-metallic mineral mining and quarrying and exploration and other mining support services; chart data is in nominal, original terms

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

Expenditure in both measured categories (equipment plant and machinery buildings and structures) largely held their recent gains in the September quarter, though both edged back marginally (Figure 1.9). Spending has risen across the board in recent quarters, and forward expectations suggest that investment in 2022–23 will be slightly higher than in 2021–22 (Figure 1.10). Strong prices for gold and various minerals used in low-emissions energy generation are leading to new investment plans, including the re-opening of mines.

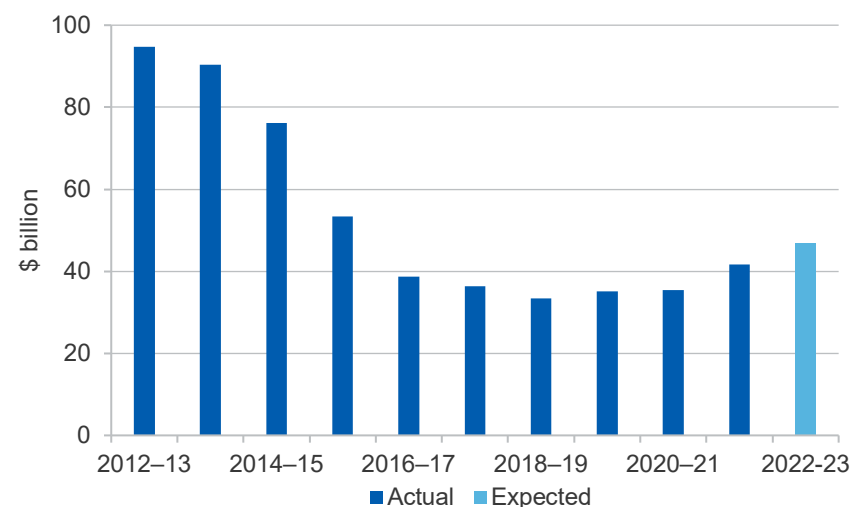
Figure 1.9: Mining industry capital expenditure by type, quarterly



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

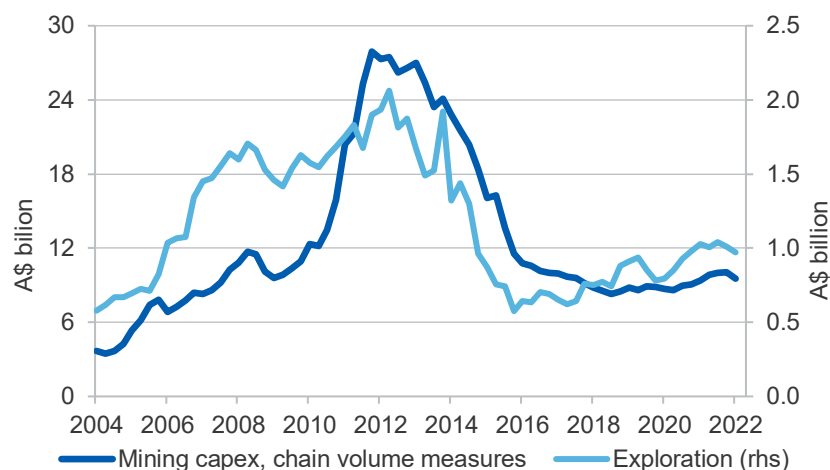


Notes: Chart data is in nominal terms

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

Exploration expenditure (adjusted for inflation) edged down to \$970 million in the September quarter. Exploration has now been trending off for two consecutive quarters, but remains well above the recent low of \$783 million in the June quarter 2020. The generally positive trend is consistent with growth in capital expenditure since 2018–19 (Figure 1.11) and reflects a solid outlook for minerals used in low emission technologies.

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



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

1.7 Revisions to the outlook

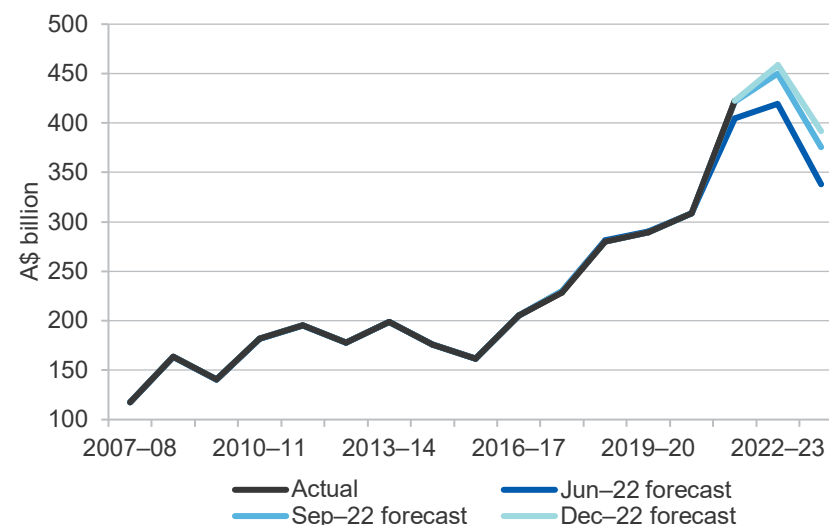
At \$459 billion, the estimate for Australia's resources and energy exports in 2022–23 is \$9 billion higher than the forecast contained in the September quarter 2022 *Resources and Energy Quarterly*. The forecast for 2023–24 is up by \$16 billion from the September 2022 *Resources and Energy Quarterly* (Figure 1.12).

A lift in forecast thermal coal prices and a weaker than expected exchange rate against the US dollar (AUD/USD) have driven the revisions. Many Western nations are having to pay substantially more for energy, on the high chance that sanctions on Russia will see some Russian production — particularly gas and coal — become stranded from world markets.

Thermal coal earnings in 2022–23 and 2023–24 have been revised up by \$13 and \$17 billion, respectively. Weather problems in major producing nations have hurt supply and helped keep the price of thermal coal (especially high quality grades) very high. Gas/LNG shortages are causing some Northern Hemisphere nations to seek thermal coal to generate power for heating during winter; many Western European nations need high quality thermal coal for their coal-fired power stations. Australian coal is likely to take the place of some lost Russian contracts. LNG earnings in 2022–23 have been revised up by \$1 billion, but down by \$2 billion in 2023–24. The 2023–24 revisions reflect the impact of forecast lower LNG prices in 2023–24.

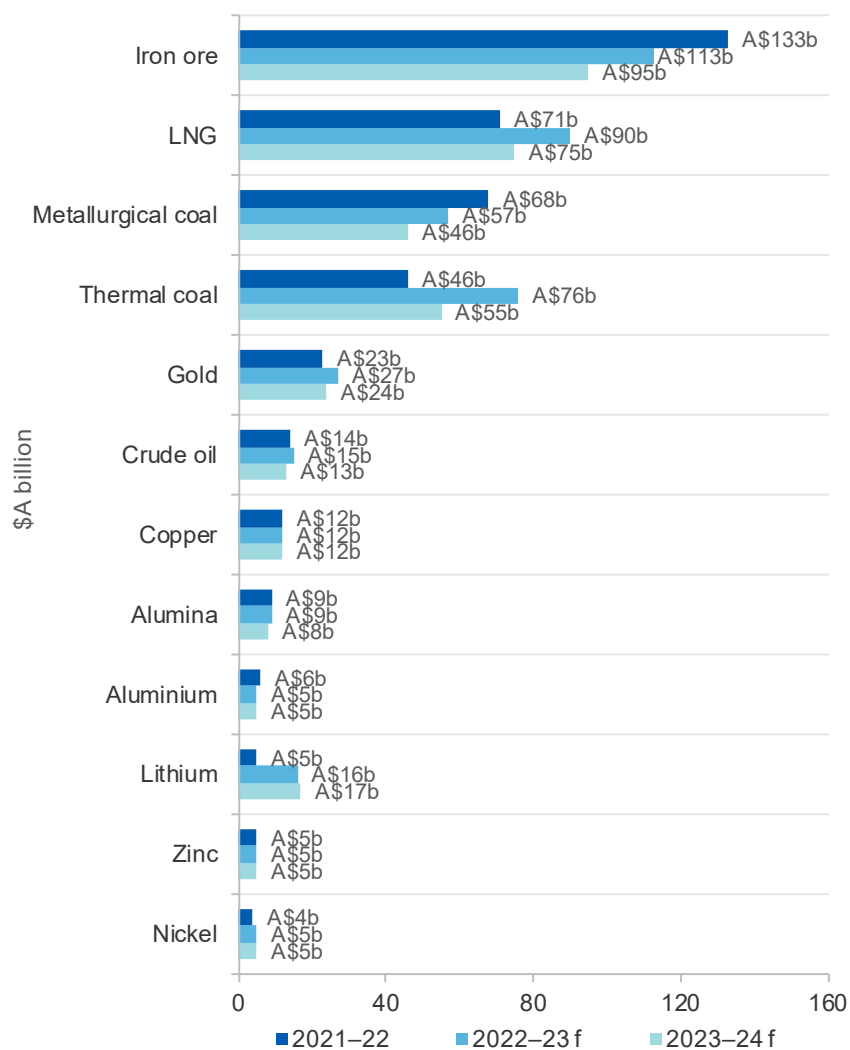
Iron ore earnings in 2022–23 have been revised down by \$5 billion, but are virtually unchanged in 2023–24. The revisions reflect forecasts of a shallower fall in prices than envisioned in the September 2022 REQ. World iron ore demand in 2023 is likely to be weaker than previously expected.

Figure 1.12: Resource and energy exports, by forecast release



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

Figure 1.14: 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
▲ 3	▼ -17	▼ -14	▲ 3	▼ -18	▼ -16
▼ -2	▲ 31	▲ 28	→ 0	▼ -16	▼ -17
▲ 7	▼ -21	▼ -15	▲ 5	▼ -23	▼ -19
▼ -3	▲ 69	▲ 63	▲ 7	▼ -32	▼ -27
▲ 23	▼ -7	▲ 15	▲ 8	▼ -16	▼ -9
▼ -7	▲ 18	▲ 9	▲ 7	▼ -18	▼ -13
▲ 2	▼ -6	▼ -4	▲ 8	▼ -2	▲ 6
▲ 1	▼ -2	▼ -1	▲ 2	▼ -9	▼ -7
▲ 5	▼ -13	▼ -9	▲ 1	▼ -5	▼ -4
▲ 19	▲ 176	▲ 228	▲ 18	▼ -10	▲ 6
▲ 14	▼ -8	▲ 5	▲ 8	▼ -10	▼ -3
▲ 12	▲ 4	▲ 17	▲ 7	▼ -16	▼ -11

Notes: f forecast. EUV is export unit value.

Source: ABS (2022) 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	2022–23 ^f	2023–24 ^f	Percentage change			
					2020–21	2021–22	2022–23 ^f	2023–24 ^f
Resources and energy	308,589	421,855	459,217	391,371	6.6	36.7	8.9	–14.8
– real ^b	345,266	451,903	459,217	373,692	4.9	30.9	1.6	–18.6
Energy	81,229	204,072	244,597	195,491	–29.7	151.2	19.9	–20.1
– real ^b	90,883	218,608	244,597	186,660	–30.8	140.5	11.9	–23.7
Resources	227,360	217,783	214,620	195,880	30.7	–4.2	–1.5	–8.7
– real ^b	254,383	233,295	214,620	187,032	28.6	–8.3	–8.0	–12.9

Notes: ^b In 2022–23 Australian dollars; ^f forecast.

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	2022–23 ^f	2023–24 ^f		2021–22	2022–23 ^f	2023–24 ^f	2021–22	2022–23 ^f	2023–24 ^f
Iron ore	US\$/t	119	86	79	Mt	874	896	920	133	113	95
LNG	A\$/GJ	16.1	21.1	17.6	Mt	83	81	81	71	90	75
Metallurgical coal	US\$/t	404	262	238	Mt	163	174	183	68	57	46
Thermal Coal	US\$/t	245	360	239	Mt	196	190	203	46	76	55
Gold	US\$/oz	1,832	1,726	1,661	t	248	304	329	23	27	24
Crude oil ^a	US\$/bbl	91	98	87	Kb/d	290	269	287	14	15	13
Copper	US\$/t	9,645	7,923	8,084	Kt	810	827	895	12	12	12
Alumina	US\$/t	381	333	326	Kt	17,739	17,889	18,246	9.0	8.8	8.2
Aluminium	US\$/t	2,891	2,372	2,473	Kt	1,368	1,431	1,451	5.7	5.2	5.0
Lithium	US\$/t	1,470	3,813	3,579	Kt	2,264	2,693	3,173	4.9	16.1	17.0
Zinc	US\$/t	3,506	3,100	2,985	Kt	1,220	1,386	1,497	4.5	4.7	4.6
Nickel	US\$/t	23,594	22,415	20,688	Kt	157	176	188	4.4	5.1	4.6
Uranium	US\$/lb	45	54	59	t	4,933	5,697	5,855	0.6	0.8	0.9

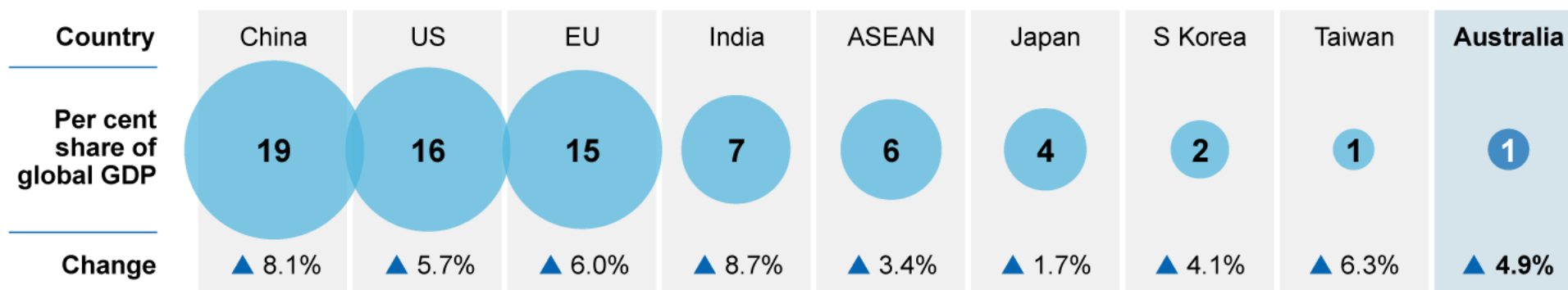
Notes: ^a Export data covers both crude oil and condensate; ^f forecast. **Price information:** Iron ore fob (free-on-board) at 62 per cent iron content estimated netback from Western Australia to Qingdao China; Metallurgical coal premium hard coking coal fob East Coast Australia; Thermal coal fob Newcastle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

Source: ABS (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



Global GDP and economic change in 2021



Global overview

- In 2021, global economic activity **increased by 6.0%**.
- Growth is expected to **slow to 3.2% in 2022** and **2.7% in 2023**.
- Spiralling energy costs and problems with **COVID-19 outbreaks and containment measures** (particularly in China) are weighing heavily on global growth.



Global risks

There are significant downside risks to the global outlook for 2023.

- Heightened levels of global economic uncertainty triggered by the fallout from **Russia's invasion of Ukraine** are set to continue into 2023.
- The **most rapid synchronised global tightening of monetary policy** seen in decades triggered by **record inflation** in many countries, is weighing heavily on markets.



2.1 Summary

- The world macroeconomic environment has weakened further over the latter half of 2022, as headwinds from war, inflation and COVID-19 outbreaks continued to weigh on global economic growth.
- Tighter fiscal and monetary conditions in most major economies — due to strong and persistent inflation, driven by higher energy and food prices — are increasing pessimism about global growth prospects for 2023.
- In October 2022, the IMF forecast the world economy to grow by 3.2% in 2022 and 2.7% in 2023, down from 6.0% in 2021. The 2023 forecast represented a downward revision of 0.2 percentage points from the previous forecast (published in July 2022).

2.2 World economic outlook

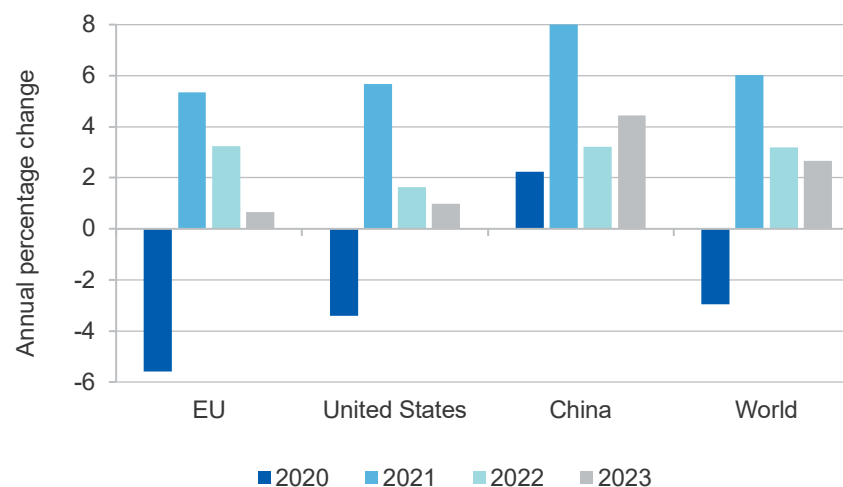
Global outlook for 2023 weakens as growth momentum slows

The International Monetary Fund (IMF) forecasts the world economy to grow by 2.7% in 2023, after growth of 3.2% in 2022 (Figure 2.1). This represents a downward revision of 0.2 percentage points in 2023 from the July 2022 World Economic Outlook (and an unchanged forecast for 2022). The lower forecast growth for 2023 was broadly based, with downward revisions to forecast growth for most advanced nations.

The heightened levels of global economic uncertainty triggered by the fallout from Russia's invasion of Ukraine are set to continue into 2023. The energy crisis in Europe continues to burden businesses and households, and is putting heavy pressure on government finances. Record inflation in many economies has resulted in the most rapid, synchronised global tightening of monetary policy seen in decades. Policymakers are focussed on ensuring the current high rates of inflation do not become entrenched in wage and price expectations of households and businesses. However, the policy challenges are rising as global growth continues to slow.

Additional challenges are posed by the lingering effects from the pandemic, including supply chain problems, concerns about the impact of COVID-related disruptions on Chinese growth as authorities seek a pathway out of zero-COVID and China's weak property sector. In view of these headwinds, the IMF states that there is a significant downside risk that global growth could fall below 2% in 2023, noting that “for many people 2023 will feel like a recession.”¹

Figure 2.1: GDP growth forecasts



Source: IMF (2022)

Forecasts in the November 2022 OECD Economic Outlook point to an even sharper loss of momentum, with world GDP growth forecast to slow to 2.2% in 2023 (down from 3.2% previously). High energy prices are proving a significant drag on growth, with OECD nations spending almost 18% of GDP on electricity, natural gas, oil and coal in 2022, up from about 10% in 2021.

¹ IMF WEO — October 2022.

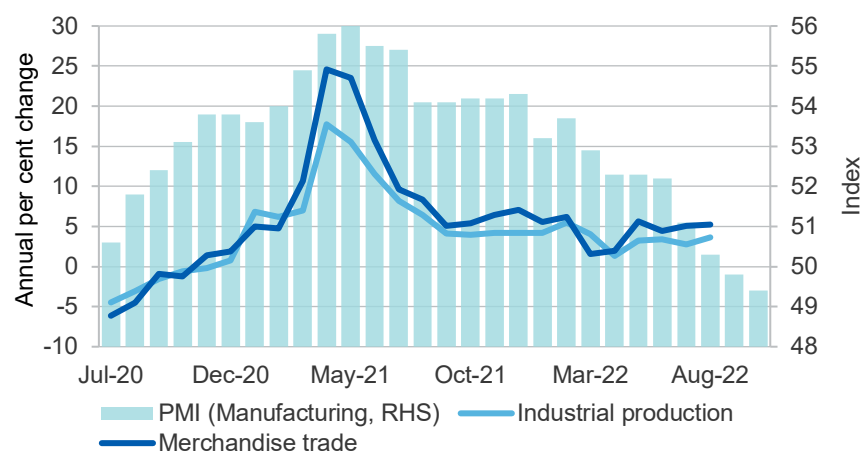
However, labour markets in many economies remain resilient, with near full employment conditions persisting in a number of nations, including, crucially, the US. This has been critical for households facing pressures from higher prices while servicing historically high debts.

Another positive sign has been the steady easing in supply chain pressures in recent months. While this points to further relief in global price pressures in coming months, it is also a reflection of weaker global consumer demand flowing through into a slowdown in new orders as volumes of shipped goods decline.

Global industrial production stabilises but forward orders stall

Growth in global industrial production and trade has levelled out after the strong recovery in the first half of 2021. Growth dipped in March/April 2022, due to COVID-related shutdowns in China. Global industrial output grew by 3.6% year-on-year in August 2022 (Figure 2.2).

Figure 2.2: World industrial production, trade and PMI



Notes: PMI data is to October 2022; IP and trade data only available to August 2022.
Source: IHS Markit (2022); CPB Netherlands Bureau for Economic Policy Analysis (2022)

² RBA Statement on Monetary Policy — November 2022.

Global merchandise trade remained steady to be up 5.3% year-on-year in August 2022, up slightly from 5.1% in July 2022.

However, forward indicators of manufacturing activity have continued to weaken. The global manufacturing Purchasing Managers Index (PMI) has declined steadily since the start of the year, driven by falls in the US, Eurozone and China. The PMI slipped into negative territory (signalling contraction) in September 2022 (49.8) and deteriorated further in October 2022 (49.4). Results for individual countries are discussed below.

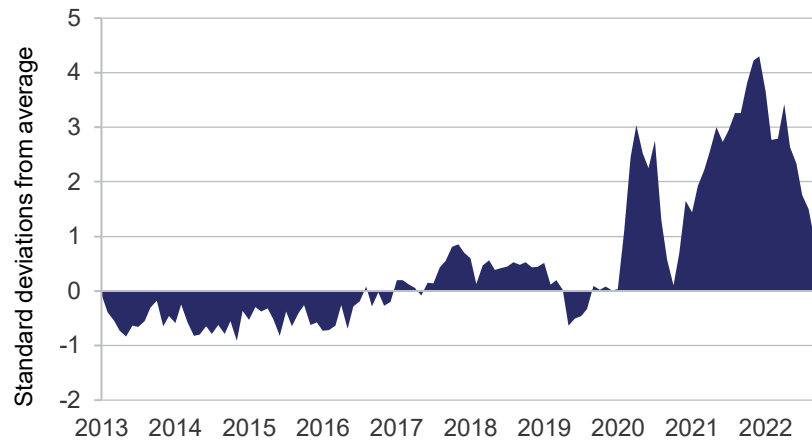
The outlook for Australia's major trading partners remains weak, with GDP growth in 2022 and 2023 forecast by the RBA to be around 3.5%, a full percentage point below its pre-pandemic decade average of 4.5%.²

Supply chain pressures fall as global consumption slows

Global supply chain pressures continue to fall. The Global Supply Chain Pressure Index — a composite measure of cross-border transportation costs, delivery times, and order backlogs — increased slightly in October 2022, but remained more than 75% below the December 2021 peak (Figure 2.3).

Global freight cost reductions have accelerated since August 2022, with the average price for a 40-foot shipping container (Drewry's composite World Container Index) falling to around US\$2,770 in November 2022, down almost three-quarters from a peak of US\$10,400 in late 2021. While this indicates that prices are returning to historic levels, container rates have yet to reach pre-pandemic rates, which averaged around US\$1,400 a container in 2019. These falls signal a decline in demand for containers in recent months with reports of container depots — used to house containers after they are unloaded — either filling up or full. This, along with reports of increasing cancellations of sailings by shipping companies, confirms weaker global consumption demand is leading to lower demand for freight and cargo.

Figure 2.3: Global supply chain pressure index



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

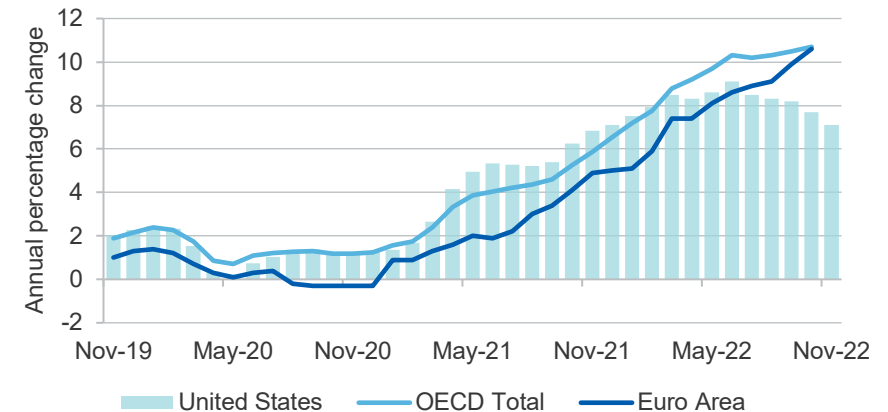
Headline inflation likely peaked in some markets, rising in others

With inflation rates remaining well above central bank targets in most economies, reining in inflation continues to be the major concern for most policy makers. In October 2022, the IMF revised up its forecast of global inflation for 2022 to 7.2% in advanced economies and 9.9% in emerging market and developing economies — upward revisions of 0.6 and 0.4 of a percentage point, respectively.

However, reductions in energy prices, and the easing in lingering supply-demand imbalances and supply chain bottlenecks, suggest headline inflation may have peaked in some economies. US CPI, for example, fell to 7.1% in November 2022, down from 7.7% in October 2022, the fifth monthly fall since the peak of 9.1% in June 2022 (Figure 2.4). US core inflation — which excludes food and energy — also fell to 6.0%, down from 6.3% in October 2022. High-frequency forward looking indicators such as apartment rents indicate housing costs, a major component on US CPI, recorded their slowest year-on-year growth in 18 months in October, with month-on-month falls in many cities.

³ RBA *Statement on Monetary Policy* — November 2022.

Figure 2.4: 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)

By contrast, Euro Area inflation has continued to rise, reaching 10.6% in October 2022 — the highest since the start of the monetary union — and UK inflation hit 11.1% in October 2022. The energy crisis saw Eurozone industrial producer prices rise by 41.9% year-on-year in September 2022. For the OECD as a whole, September 2022 inflation was 10.5%.

In contrast to easing goods inflation in many economies, services inflation — particularly discretionary services like air travel and recreation — has increased in many economies.³

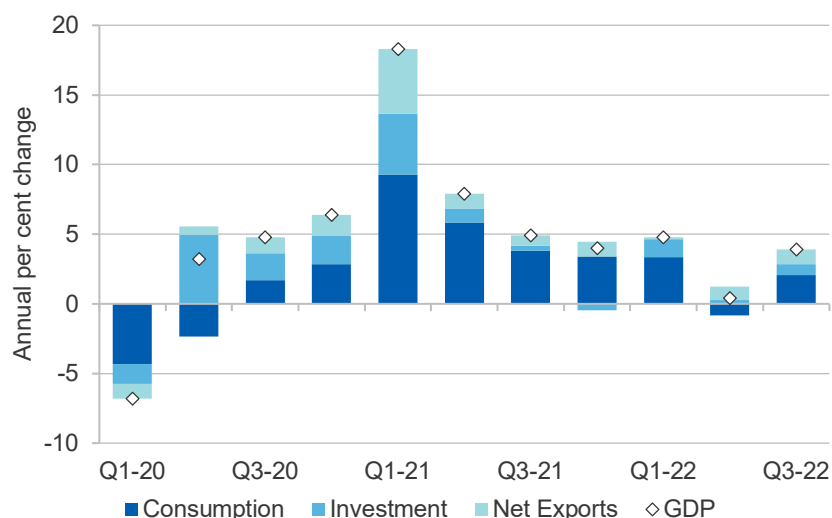
Monetary policy tightening by central banks has accelerated in recent months. The US Federal Reserve lifted rates at its November meeting, the sixth time this year, for a cumulative increase in its benchmark overnight interest rate of 375 points. The European Central Bank raised its key policy rates by a cumulative 150 basis points at its September and October 2022 meetings, following a 50 basis points increase in July. Most central banks have signalled further tightening will be required, and market expectations are that rates will peak around mid-2023.

2.3 Major trading partners' economic outlook

Chinese GDP recovers in September quarter

China's economy grew by 3.9% year-on-year in the September quarter 2022 (Figure 2.5). This was a substantial turnaround from the COVID-affected June quarter result, which saw GDP rise by only 0.4% year-on-year and fall by 2.7% quarter-on-quarter. The stronger September quarter result exceeded market forecasts; it reflected a turnaround in consumption which added to positive contributions from investment and net exports.

Figure 2.5: 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)

China's property sector weakness continues to weigh on economic growth, with lower consumption and investment in real estate. Household and business sentiment remains subdued, and property demand continues to fall. In the year to October 2022, the value of sales of residential buildings was down 23%, with new house prices falling for the 6th consecutive month in October (year-on-year). In volume terms (measured in square metres of

floor space) newly-started residential property was down 39% in the year to October, and residential building sales were down 26%.

Continued weakness in property-related lending saw the People's Bank of China (PBoC) ease monetary policy in August by lowering its key policy rates by 10 basis points. In response, the 5-year Loan Prime Rate, the benchmark lending rate for most mortgages, fell by 15 basis points. The PBoC announced a 25bp cut in the Reserve Requirement Ratio, for the second time this year. While the cut provides some additional loanable funds to banks, of greater importance is the signal it gives to markets confirming policy easing.

The Chinese government is providing more fiscal support for the property sector, with more than RMB 5 trillion in special purpose bonds issued in 2022, the majority directed to infrastructure investment. This will be supported by RMB1.4 trillion in new lending for infrastructure projects from China's three major policy banks.

In November 2022, following the Communist Party Congress, the PBoC and the China Banking and Insurance Regulatory Commission (CBIRC) provided a 16-point plan to financial institutions to support the real estate sector by ensuring financially healthy developers are able to borrow. The plan reportedly included a mix of measures encouraging financial institutions to provide more flexibility to real estate companies on loan repayments, expanded access to finance and reducing down-payment and mortgage rates for homebuyers.

At the same time the National Health Commission released a 20-point plan to reduce the economic and social impacts of future COVID containment measures. New measures included cutting the quarantine period for close contacts and inbound travellers and no longer identifying secondary close contacts. Subsequent to the release of the plan authorities have continued to adjust policies to optimise the approach to containing COVID to minimise economic disruption and strengthen growth prospects for 2023.

Following the lockdown-induced plunge in China's Caixin General Manufacturing PMI in May, and subsequent recovery in June 2022, the

index has since weakened. The PMI was 49.4 in November 2022, a slight increase from October result, but the fourth consecutive deterioration in manufacturing sector conditions. China's industrial output increased by 5.0% year-on-year in October, down from 6.3% in September. Manufacturer survey responses suggest the slowdown was linked to softer demand conditions, particularly in external markets. COVID-19 containment measures continue to be a key concern for Chinese companies, weighing on both output and demand.

Passenger vehicle production and sales continue to grow strongly, averaging over 2 million vehicles produced a month since June, reaching 2.4 million vehicles produced in September. Vehicle sales have closely matched production. This pick up in vehicle production and sales is being supported by policy measures, including subsidies for the purchase of conventional and electric vehicles.

China's weakening economic outlook over the course of 2022 has seen downward revisions to forecast growth by a range of analysts and market commentators, including the RBA and Treasury. In October, the IMF forecast Chinese GDP growth of 3.2% in 2022, a downward revision of 0.1 percentage points, following the 1.1 percentage point downgrade in July. The IMF also downgraded China's GDP growth for 2023 by 0.2 percentage points to 4.4%.

Japan's GDP stalls as yen weakness drives input costs

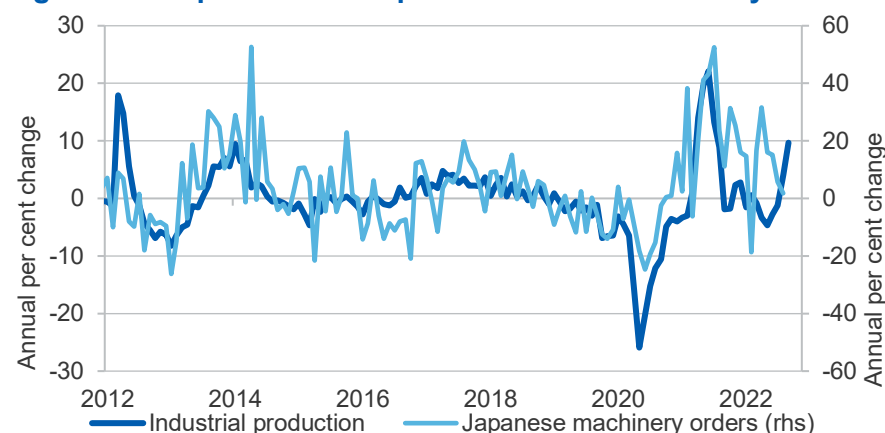
Contrary to market expectations, Japan's GDP fell by 0.2% in the September quarter 2022, but was 1.5% higher year-on-year. Weighing on growth were net exports — due to surging imports — and housing investment declines, as construction costs continued to rise.

Downside risks for the Japanese economy remain, due to slowing growth in Japan's major trading partners and higher inflation. Japan's core inflation — which excludes fresh food but includes fuel costs — was 3.6% in October 2022, exceeding the Bank of Japan (BoJ) inflation target of 2.0% for the seventh month in a row.

Inflationary pressures are being driven by higher raw material costs, particularly for imported materials in the context of a weak Yen. The Yen has lost almost 30% of its value since the start of the year, reaching 150 against the US dollar in October. The Yen weakness has been driven by the growing interest rate differential between Japan and its trading partners.

Rapid currency depreciation saw Japanese authorities intervene to support the Yen in September and October, the first intervention in over two decades. The BoJ continues to maintain its accommodative monetary policy. It continues to hold the 10-year Japanese government bond yield near zero, and in October it announced that it would carry out emergency bond-buying operations to rein in surging yields.

Figure 2.6: Japan industrial production and machinery orders



Notes: IP data are to September 2022 and machinery orders data are to August 2022.

Source: Bloomberg (2022)

Japan's industrial output increased by 9.6% year-on-year in September 2022. This was largely driven by base effects, due to lower output in September 2021 resulting from COVID related disruptions. In month-on-month seasonally adjusted terms industrial production fell in September. Machinery orders have also weakened, with orders up only 1.8% year-on-year in August 2022, down from 32% growth in April (Figure 2.6).

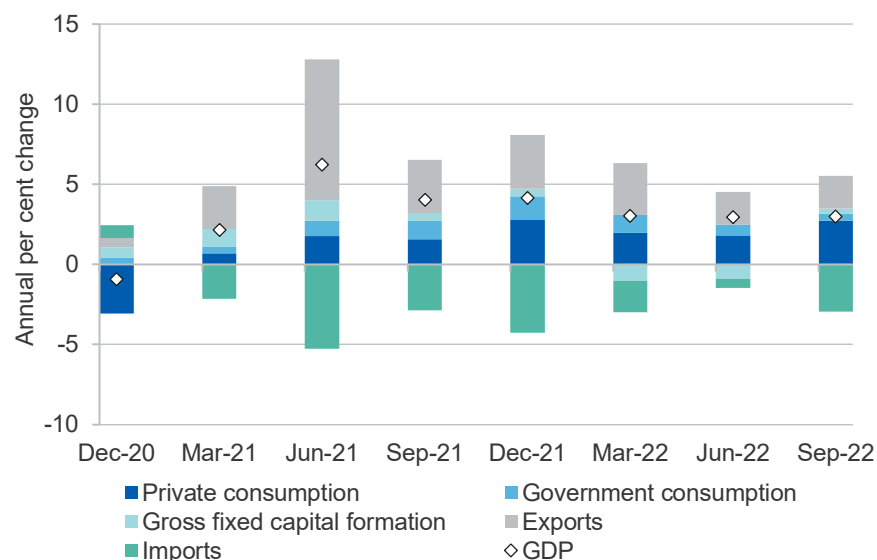
The Jibun Bank Japanese Manufacturing PMI was 50.7 in October 2022, down slightly from September's result of 50.8. While this represented the 21st consecutive month of positive (above 50) readings, the index has been falling steadily over the past year. Contributing to the weakness was falling international demand for Japanese manufacturers, with October marking the eighth consecutive monthly fall in new export orders.

Looking ahead, the IMF October 2022 forecasts were for Japanese economic growth of 1.6% in 2023 (after 1.7% in 2022), a downward revision of 0.1 percentage points for 2023 from the July 2022 forecast.

South Korea's economy slows in September quarter

South Korea's GDP increased by 3.1% year-on-year in the September quarter 2022. A recovery in consumer spending was the major driver of growth, while a surge in imports weighed on growth in the quarter (Figure 2.7).

Figure 2.7: South Korea contributions to quarterly real GDP



Source: Bloomberg (2022)

South Korea's industrial production growth slowed sharply to 0.8% year-on-year in September 2022: down from 1.5% in August and well down from the 7.5% growth in May. South Korea's manufacturing PMI improved slightly in October, but remained in contraction territory for the fourth consecutive month, with a reading of 48.2, up from 47.3 in September. The negative October result was due to falls in both output and new orders, with respondents citing subdued global economic demand and inflationary pressures.

South Korean inflation increased at 5.0% year-on-year in November 2022, down from 5.7% in October and well below the peak of 6.3% in July. High inflation prompted the Bank of Korea to raise its benchmark interest rate by an additional 25 basis points to 3.25% in November, an increase of 2.75 percentage points since August 2021. Given current debt levels, managing tighter monetary conditions while maintaining economic growth presents a key challenge to South Korea over the outlook period.

In October 2022, the IMF lowered its forecast of South Korean economic growth to 2.0% in 2023 (down from 2.6% in 2022), a minor downward revision of 0.1 percentage points.

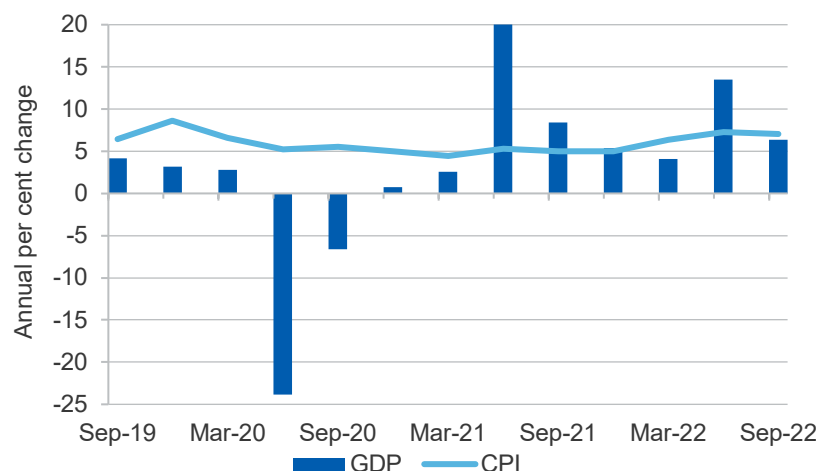
India's manufacturing and mining output falls

India's GDP growth slowed to 6.3% year-on-year in the September quarter 2022, down from 13.5% in the June quarter (Figure 2.8). The growth was slightly above market expectations (6.2%) and was supported by growth in services, public administration, construction and real estate. Falls in manufacturing and mining weighed on growth.

India's manufacturing PMI strengthened in November 2022, to 55.7 from 55.3 in October, the strongest improvement in 3 months. The healthy result was accompanied by increases in employment and the second-strongest growth in new export orders since May 2022. Price pressures faced by manufacturers were subdued, with the November 2022 result the joint-weakest in more than two years. India's retail price inflation eased to 6.8% in October due to slower growth in food prices, but remained above the Central Bank's target range (2–6%).

The IMF forecasts Indian economic growth to slow to 6.1% in 2023, down from 6.8% in 2022. The forecast for 2022 — a downward revision of 0.6 percentage points from the July estimate — reflects softer external demand (due to slower global growth).

Figure 2.8: India quarterly GDP and CPI



Source: Bloomberg (2022)

US consumption spending continues to slow

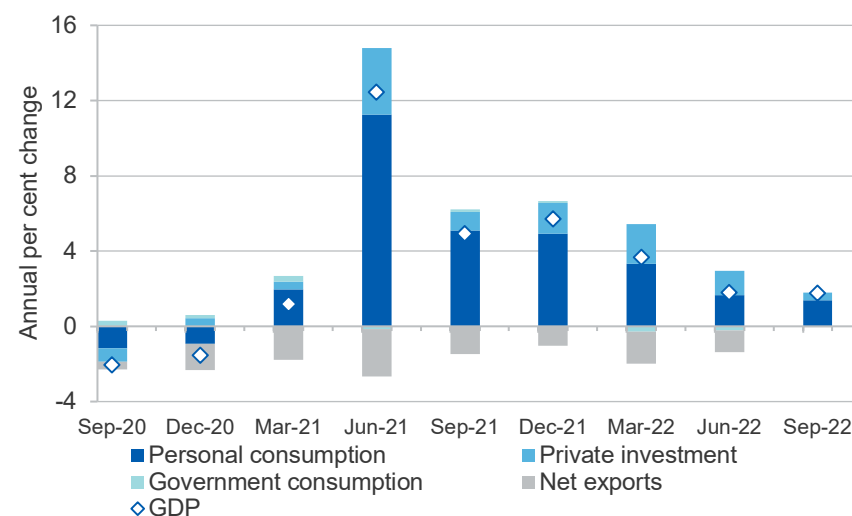
In year-on-year terms, the US economy grew by 1.9% in the September quarter 2022. This growth was driven primarily by personal consumption, with the weakest contribution from private investment in two years. Faster growth in US exports, combined with slower growth in imports, meant that net exports did not detract from overall GDP growth (q/q) for the first time in over two years (Figure 2.9). In quarter-on-quarter terms, US GDP increased 0.6% in the September quarter 2022, a welcome return to growth following the falls in the March and June quarters.

The US labour market remains tight, with nonfarm payroll employment rising by 261,000 in October 2022. Monthly job growth has averaged 407,000 in 2022. While unemployment increased to 3.7% in October from 3.5% in September, it remains close to 50-year lows. Despite downwards

revisions in recent months, US corporate profits remain at the highest levels in decades.

Growth in personal consumption spending — which has driven GDP growth over the past year — also slowed to 2.1% year-on-year in the September quarter 2022. This was down from 4.8% in the March quarter, and well below the high growth rates achieved in 2021. The slowdown was particularly evident for goods purchases. While rapid price increases over the past year have seen total nominal spending on goods continue to rise, the volume of goods purchased by US consumers has fallen, with inflation-adjusted spending on goods falling 0.4% year-on-year in September 2022. US housing demand has also weakened, with home sales around 20–30% lower than at the start of the year.

Figure 2.9: US contributions to quarterly real GDP



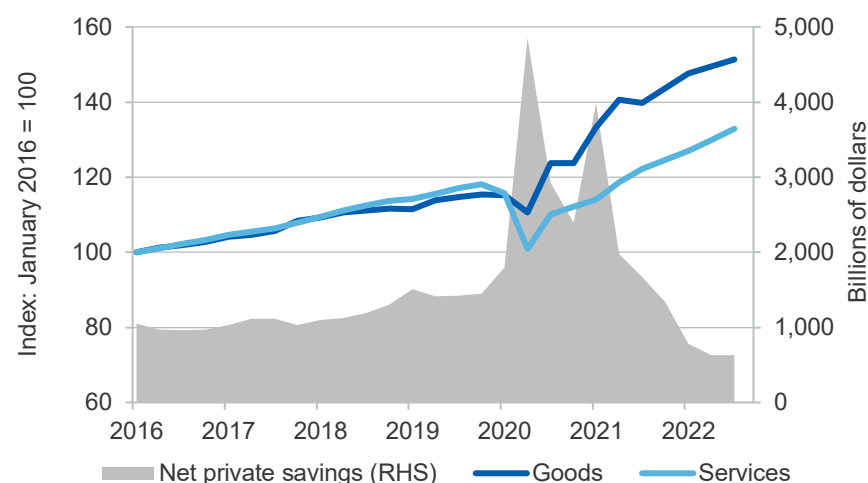
Source: Bloomberg (2022)

The US net private saving rate has fallen sharply from the record rates achieved during the pandemic. Revised US Bureau of Economic Analysis data indicate the saving rate has fallen substantially over 2022, dropping to just over US\$600 million per year in the June and September quarters

(Figure 2.10). This is the lowest savings rate since the declines during the global financial crisis in 2009.

Researchers at the US Federal Reserve estimate that US households accumulated about \$2.3 trillion in excess savings in 2020 and 2021. Drawdowns since then are estimated to have reduced the savings stock by around one-quarter (as at June 2022). Households across the income distribution are estimated to continue to hold a buffer of excess savings, which could help them navigate higher prices and the tightening cycle. However, around four-fifths of total excess savings are estimated to be held by households in the top half of the income distribution.⁴

Figure 2.10: US personal consumption and net private savings



Notes: Personal Consumption Expenditures; seasonally adjusted data; January 2016 =100; Net Private Savings: seasonally adjusted annual rate (quarterly data).

Source: FRED Economic Data (2022)

US industrial production grew by 3.3% year-on-year in October 2022, down from 5.0% in September. However, the US Manufacturing PMI for November 2022 dropped into contractionary territory, the first contraction since June 2020. The decline was driven by falls in output and new orders.

⁴ The Federal Reserve, *Excess Savings during the COVID-19 Pandemic*, October 2022.

Manufacturing output increased for the second consecutive month, reportedly due to easing supply bottlenecks contributing to the subdued conditions, which reflected weaker demand, as new orders fell for the third month in a row. However new orders fell at the fastest rate since mid-2020 signalling subdued demand conditions. The survey found prices paid by manufacturers continued to increase in October 2022 due to higher material and transportation costs, however this was the slowest increase in input costs since late 2020.

As noted earlier, the US Federal Reserve lifted rates in its November 2022 meeting, the sixth time this year, taking the cumulative rise in its benchmark overnight interest rate to 375 basis points. In a policy statement after the October 2022 increase the Fed stated that in determining the pace of future increases it would take into account the 'cumulative' impact of rate rises and the need to consider lags in activity. With US inflation still near 40-year highs, curbing price pressures remains a critical priority for the Federal Reserve. In August, the Government also passed the Inflation Reduction Act, which includes a range of measures designed to provide relief to households from rising prices and promote energy transition (see *Resources and Energy Quarterly* September 2022)

In October 2022, the IMF downgraded its forecast for US economic growth for 2022 by 0.7 percentage points to 1.6%, with growth of only 1.0% forecast for 2023. This builds on the major downward revisions in July 2022 following the negative March and June quarter 2022 GDP results, due to weakening momentum in private consumption, as household purchasing power is eroded and monetary tightening continues.

Eurozone economies resilient in 2022, but face bleak 2023

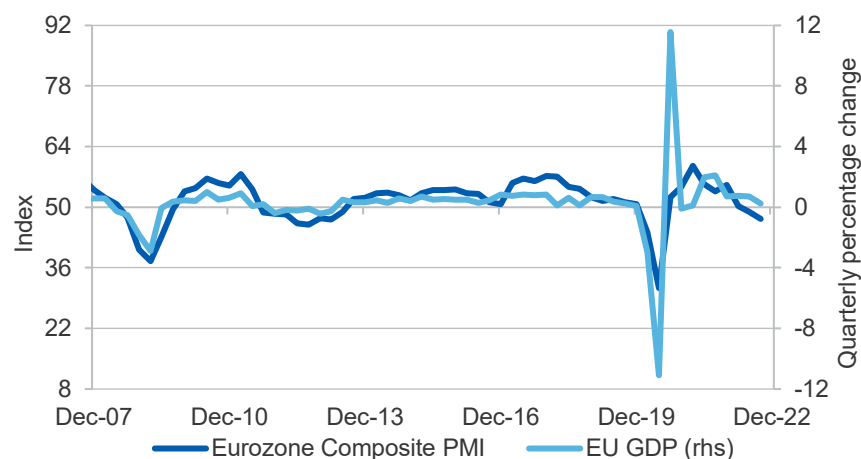
Following the surprisingly robust Eurozone GDP growth in the June quarter, growth weakened in the September quarter 2022, up only 0.3 per cent year-on year. (Figure 2.11).

German GDP expanded 1.3% year-on-year in the September quarter 2022, down from 1.6% in the June quarter, as manufacturers continued to

struggle due to their exposure to high gas prices. The loss of competitiveness of German manufacturers is resulting in industrial closures and restructuring, and the IMF is now forecasting negative annual growth for Germany in 2023.

In response to the energy crisis, governments in the European Union and the United Kingdom announced substantial fiscal support packages in September 2022 which are the equivalent of 3.5-4.5% of GDP. These measures include caps on prices paid by households and businesses for electricity and gas as well as support for vulnerable groups. The EU will fund these measures through a combination of debt and new taxes on profits of non-gas electricity generators.

Figure 2.11: Eurozone GDP and Composite PMI (quarterly)



Source: Bloomberg (2022)

Industrial production in the Euro Area increased by 4.9% year-on-year in September 2022, up from 2.8% growth in August. This was higher than expected, and was due largely to strong growth in the output of capital goods and non-durable consumer goods. Some economic commentators believe that the stronger growth in September may be partly due to manufacturers bringing forward some production ahead of expected winter energy-related disruptions.

Leading indicators point to a weak 2023. In November 2022, the Eurozone Composite PMI Index recorded its fifth successive negative (below 50) result at 47.8, up from 47.3 in September. This reflected falls in manufacturing production and services output due to weaker customer demand and challenging global economic conditions.

In October 2022, the Eurozone manufacturing PMI recorded its sharpest monthly fall since the COVID recession in 2022. Declines in output and new orders were among the steepest on record as export demand plunged due to uncertainty, inflation and weaker global economic conditions.

As noted earlier, the European Central Bank (ECB) has raised interest rates in recent months, in response to record inflation. In October, the ECB stated that it expects inflation will stay above its target for an extended period, but it would be unhelpful to provide forward guidance — with further changes to interest rates to be decided on a “meeting-by-meeting approach.”

Ongoing flow-on impacts from the Russian invasion of Ukraine continue to present the largest risk to Europe’s outlook. Soaring energy prices, weaker consumer confidence — both domestically and in export markets — and slower momentum in manufacturing, are expected to drag the Eurozone and most European economies into recession in 2023 (European Commission).

In October, the IMF lifted its forecast of European growth in 2022 by 0.5 percentage points to 1.2%. This reflected stronger-than-expected growth in the June quarter, driven by tourism-dependent economies including France, Italy and Spain — which are benefiting from the gradual recovery in the sector following the easing of pandemic restrictions. However, the IMF more than halved its growth forecast for 2023, from 1.2% to 0.5%. This reflects flow-on effects from the Russian invasion of Ukraine — particularly in economies most exposed to cuts in Russian gas supply, including Germany — as well as tighter financial conditions as the ECB continues to raise policy rates.

Table 2.1: Key IMF GDP assumptions

	2021	2022 ^a	2023 ^a
Economic growth^b			
Advanced economies	5.2	2.4	1.1
Australia	4.9	3.8	1.9
Euro area	5.2	3.1	0.5
France	6.8	2.5	0.7
Germany	2.6	1.5	-0.3
Japan	1.7	1.7	1.6
New Zealand	5.6	2.3	1.9
South Korea	4.1	2.6	2.0
United Kingdom	7.4	3.6	0.3
United States	5.7	1.6	1.0
Emerging economies	6.6	3.7	3.7
ASEAN-5 ^d	3.4	5.3	4.9
China ^e	8.1	3.2	4.4
India	8.7	6.8	6.1
Latin America	6.9	3.5	1.7
Middle East	2.8	2.8	2.8
World^c	6.0	3.2	2.7

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

Sources: IMF (2022) World Economic Outlook; Bloomberg (2022).

Table 2.2: Exchange rate and inflation assumptions

	2021	2022 ^a	2023 ^a
AUD/USD exchange rate	0.75	0.70	0.69
Inflation rate ^b			
United States	4.7	8.1	3.5
	2020–21	2021–22 ^a	2022–23 ^a
Australia	4.4	7.1	4.7

Notes: **a** Assumption; **b** Average.

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

Steel



Australia's steel sector



5m+ tonnes
produced
each year



100,000+
employed in
steelmaking

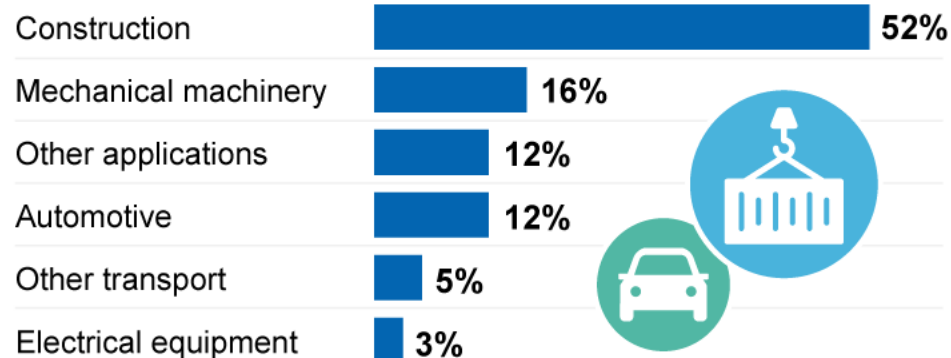


Significant
export markets

- China
- Japan
- South Korea
- Taiwan
- India



World consumption, 2019



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

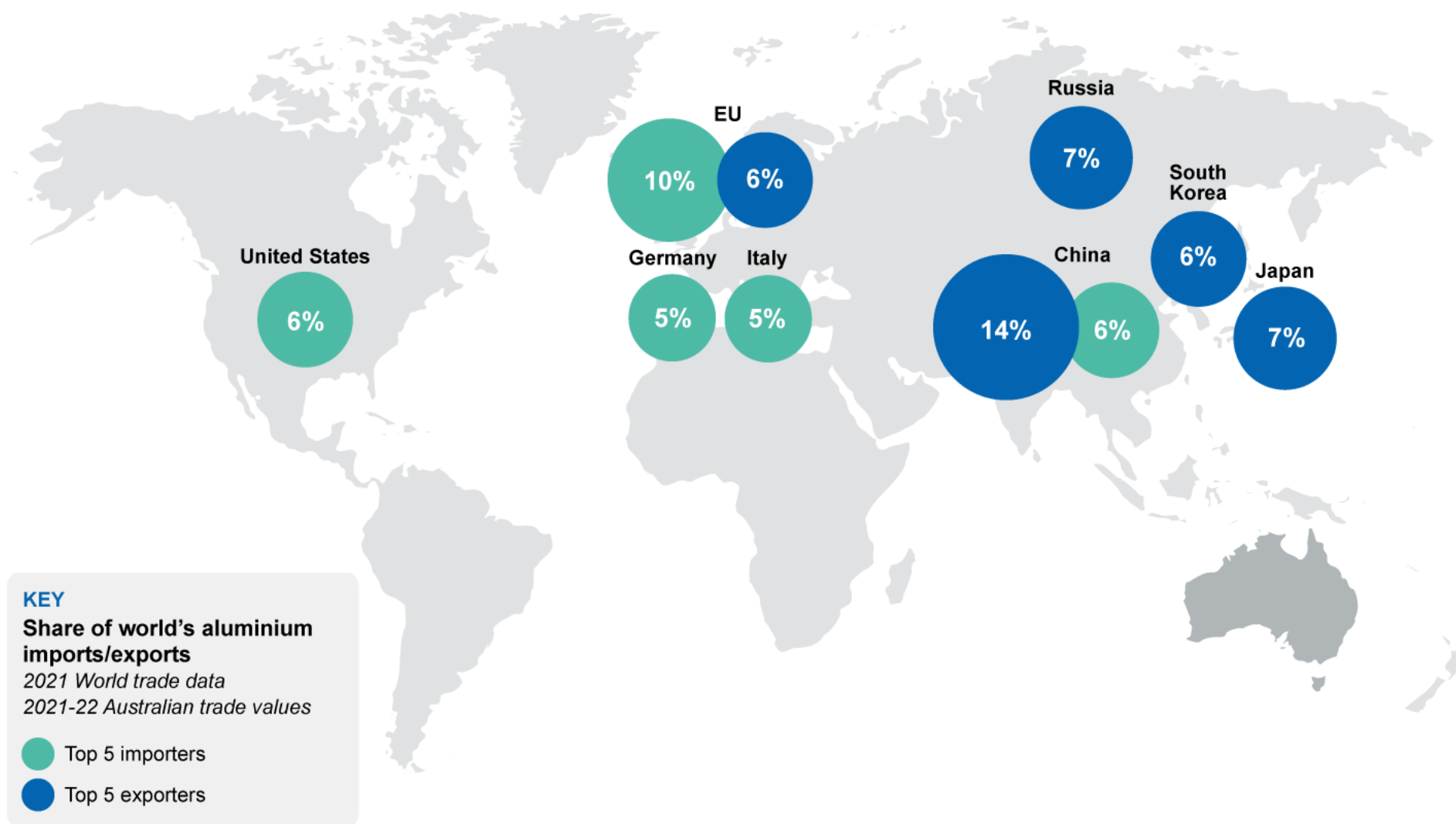


Pure steel is **1,000**
times stronger
than iron



Steel is the world's
2nd largest
industry

Steel TRADE MAP



3.1 Summary

- World steel output fell 8.7% (quarter-on-quarter) in the September quarter 2022. Further outbreaks of the pandemic in China have continued to restrain economic growth, compounding frailty in the nation's property sector. Energy and raw materials shortages have also impacted other major steel producers' output in recent months.
- With global economic growth slowing down, major economies are expected to see weaker industrial production and steel demand as we head into 2023. Large infrastructure rollouts across major economies should provide some support for steel demand over the latter half of the outlook period.
- After a fall of 2.0% in 2022, global steel output is forecast to rise by a little over 1% in 2023 and 2024.

3.2 World production and consumption

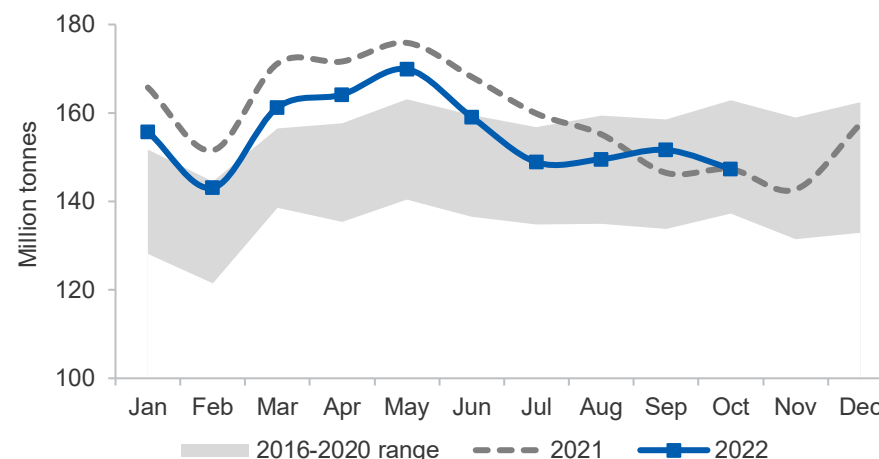
Low demand and high energy prices hurt output in the September quarter

In the September quarter 2022, global steel output was 450 million tonnes. This was a fall of 8.7% from the previous quarter, and 2.5% lower than the same period in 2021. Over the first nine months of 2022, total steel output totalled 1.4 billion tonnes, 4.3% lower year-on-year (Figure 3.1).

Global economic conditions have continued to deteriorate through 2022. Persistent inflationary pressures have seen tightening monetary policy across most major economies, leading to slowing industrial output and a significant weakening in global steel demand. This has been further compounded by ongoing outbreaks of the COVID-19 pandemic in China, which in combination with the country's dynamic COVID-zero policy saw GDP growth in the June quarter at its lowest level since early 2020.

Russia's invasion of Ukraine continues to impact steel production amongst other major producers, particularly the EU. This is due to the region's heavy reliance on Russian energy. High energy prices and forced production cuts are expected to see steel output in the EU (the world's second largest producer) fall by more than 10% in 2022.

Figure 3.1: Global monthly steel production



Source: World Steel Association (2022)

The world economy is forecast to slow from growth of 6.0% in 2021 to 3.2% in 2022 and 2.7% in 2023. This is expected to see a comparable slowdown in global industrial production over the period, with global steel production expected to fall by 2.0% in 2022, before rebounding to growth of 1.1% in 2023.

Among the major producers, China is expected to see a minor fall in steel output this year, a consequence of weaker domestic demand due to COVID-related lockdowns and property sector weakness. A minor fall is also in line with central government production limits set at the start of the year. Other major steelmakers, such as the EU, Japan and South Korea, are all also expected to register falls in steel output in 2022, owing to high energy prices and slowing demand. However, Indian output is expected to rise by around 5.6% in 2022, with healthy growth in its construction sector.

Over the outlook period to 2024, stimulus-related infrastructure projects and a recovery in industrial production are expected to see growth in steel demand rebound, though at more modest levels than 2021. World steel production is projected to grow by 1.1% in both 2023 and 2024 to reach 1.95 billion tonnes by the end of the outlook period.

Figure 3.2: World manufacturing PMI and industrial output



Notes: JPMorgan Global Manufacturing Index; a reading above 50 indicating an overall increase compared to the previous month, and below 50 an overall decrease

Source: World Steel Association (2022); S&P Global (2022); Bloomberg (2022)

Global demand outlook reflects slackening construction and manufacturing

Global steel consumption is now estimated to fall by 2.3% in 2022 — a significant reduction from the September 2022 REQ forecast. In October, the IMF released its current World Economic Outlook, with forecast global growth of 3.2% in 2022 and 2.7% in 2023. The more sombre outlook was based on three major forces continuing to challenge the global economy: Russia's invasion of Ukraine, persistent and broadening inflationary forces, and the economic slowdown in China.

Global construction activity continued to moderate in the September quarter, with weaker residential and commercial activity, particularly in Europe and the Asia Pacific region. This follows tightening financial conditions (due to inflation), and weaker demand from mounting economic headwinds. High input costs also continue to be a significant restraining factor. The outlook for infrastructure remains more upbeat than other sub-sectors, particularly in regions such as the Americas, the Middle East and Africa, though sentiment has softened from earlier this year.

After a buoyant 2021, global manufacturing activity has continued to slow through 2022. Supply chain disruptions and input shortages contributed to decelerating growth in previous quarters, however, weakening global demand is now becoming a more prevalent factor. The JPMorgan Global Manufacturing PMI — a broad measure of conditions in global manufacturing — fell into contraction territory in September (49.4) for the first time in over two years (Figure 3.2) and has since fallen further (to 48.8 in November). The 'new orders' and 'output' subcomponents weakened further, signalling a likely contraction in industrial activity and steel output in coming months.

Global auto production has continued to face challenging conditions through 2022, with COVID-related supply chain shortages intensified by energy shortages and weakening demand. Revised forecasts for 2022 from S&P Global Mobility in October showed little change in global output, but a mixed story across regions. This included a stronger outlook for China and South Asia (revised up 2.4% and 1.2% respectively), but deteriorating conditions for Japan & Korea, Europe and North America (revised down 1.4%, 1.0% and 0.7% respectively). Demand destruction (due to growing global economic headwinds) is expected to play a more significant role in the weaker outlook for 2023.

Over the outlook period, global steel usage is expected to grow by 0.9% in 2023 and 1.1% in 2024. A global slowdown in industrial output is expected to hamper growth in 2023. However, steel demand should rebound as global construction recovers — particularly infrastructure-related activity — and global supply chains improve in the latter part of the outlook period.

China's steel demand curbed by lockdowns and property sector weakness

In the September quarter 2022, China's steel production was around 252 million tonnes. This was down 9.9% from the previous quarter, but up 3.2% compared with the same period in 2021. Over the first nine months of 2022, total steel output reached 779 million tonnes, 3.4% lower than the comparable period in 2021 (Figure 3.3).

Further outbreaks of the COVID-19 pandemic in China — combined with the nation's dynamic COVID-zero policy — have seen weak economic

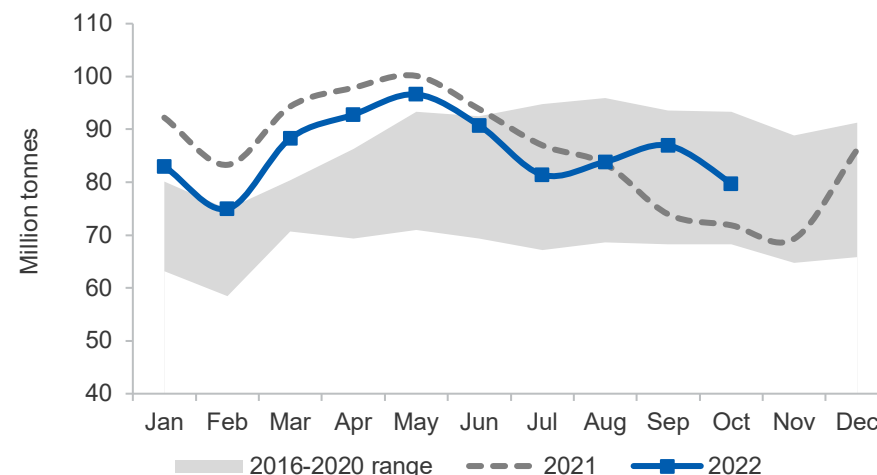
conditions persist in recent months. In early October, the IMF revised down its forecast of China's 2022 GDP growth for a third consecutive time this year. Reported COVID-19 cases have also continued to rise, reaching a six-month high in early December with sizeable outbreaks in Guangdong, Beijing and Chongqing. China now appears to be moving away from its dynamic COVID-zero policy. However, with surging case numbers across the country and pandemic control measures in a state of flux, the economic and industrial activity impact is yet to be assessed fully.

The slowdown has also exacerbated issues in China's deteriorating property sector, which accounts for around 35-40% of the country's total steel consumption. Housing starts in the year-to-October were down 38% year-on-year (Figure 3.4), while new home sales for China's top 100 developers were around 25% lower year-on-year in the month of November. This carries further risks for the sector, given the significant contribution pre-sales tend to make to Chinese developers' total funding.

Developers continued to face liquidity pressures, stalled projects and weaker sentiment heading in the second half of 2022. Fixed asset investment (FAI) in real estate for the year-to October fell 7.3% compared with the same period in 2021 (Figure 3.5). Frailty in the sector saw the emergence of a mortgage boycott movement in August, with as many as 320 projects in 100 cities reporting homeowners threatening to withhold mortgage payments from banks. Reports also indicate more than a dozen Chinese developers have now defaulted on offshore debt, prompting further ratings downgrades in recent months.

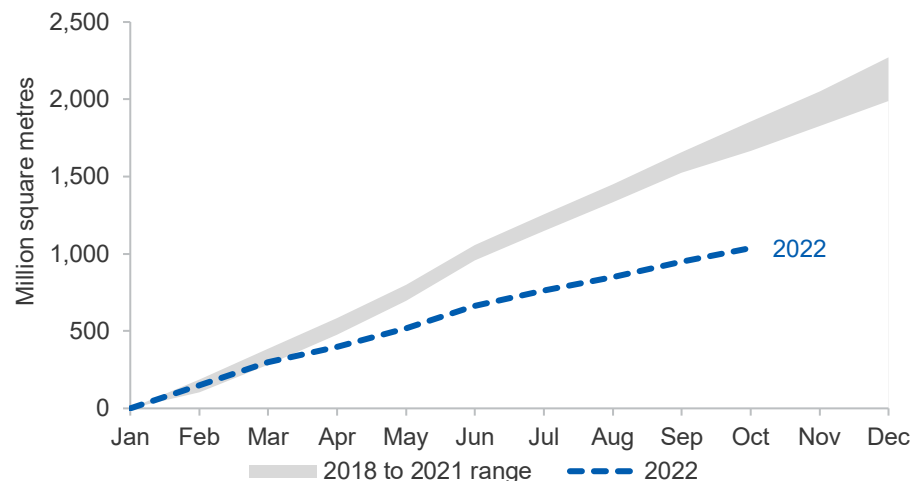
China's manufacturing sector — another major steel user — also faces near-term downside risks. Continued outbreaks of the pandemic and subsequent lockdowns, have stifled domestic consumption in recent months (with retail sales falling 0.5% year-on-year in October). China's official manufacturing PMI saw a second straight month in contractionary territory in November (with a reading of 49.4), while the Caixin-Markit PMI remained in contraction territory for a fourth consecutive month.

Figure 3.3: Chinese steel production, monthly



Source: World Steel Association (2022)

Figure 3.4: China new housing starts



Notes: * Floor space reported on a cumulative calendar year basis in million squares metres. China's property data combines Jan and February monthly data (reported in February)

Source: NBS (2022); Bloomberg (2022)

China responding with infrastructure stimulus and looser credit conditions

The Chinese government continues to take steps to ensure the stability of its property sector and the broader economy. This includes substantial levels of new fiscal stimulus. Reports indicate more than RMB5 trillion (US\$700 billion) in local government special purpose bonds will be issued in 2022, with the majority directed toward new infrastructure investment.

The government has also instructed its various policy banks (the Agricultural Development Bank of China, China Development Bank, and the Export-Import Bank of China) to increase lending for infrastructure projects, with around RMB1.4 trillion (US\$200 billion) in new funding being announced in recent months. In October, China's infrastructure investment (3 month average) was around 15% higher year-on-year (Figure 3.5).

In November, the Chinese government announced 16 new policy measures to help support its property sector. These appeared to include extending existing developers' loans, reducing down-payment and mortgage rates for homebuyers, and ensuring the delivery of existing projects. Added to this is a 20 point plan, introduced earlier in the month, to ease its strict COVID-zero policies, including shortened quarantine periods and ceasing tracing of secondary contacts.

The People's Bank of China (PBoC) has also sought to address weakness in China's property sector, announcing plans in July to establish a real estate fund to provide as much as RMB 200 billion (US\$28 billion) in low interest loans to complete stalled developments. These funds will be issued to commercial banks with the option to leverage as much as RMB 1 trillion (US\$140 billion) in lending to embattled developers for completion of existing projects.

The PBoC has eased broader monetary conditions in recent months. In August, the PBoC cut the Medium-Term Lending Facility Rate, leading to falls in both the one- and five-year Loan Prime Rates. And in November, the PBoC announced a further cut (for the second time this year) of 25 basis points to its Reserve Requirement Ratio for banks. However, new lending and Total Social Financing has remained weak (as of October),

Figure 3.5: China's infrastructure and real estate investment



Notes: * China Infrastructure Investment Y-o-Y 3-Month Moving Average; **China Fixed Asset Investment Real Estate Cumulative

Source: NBS (2022); Bloomberg (2022)

signalling borrowing sentiment in the broader economy remains hesitant despite a recent easing of lending conditions.

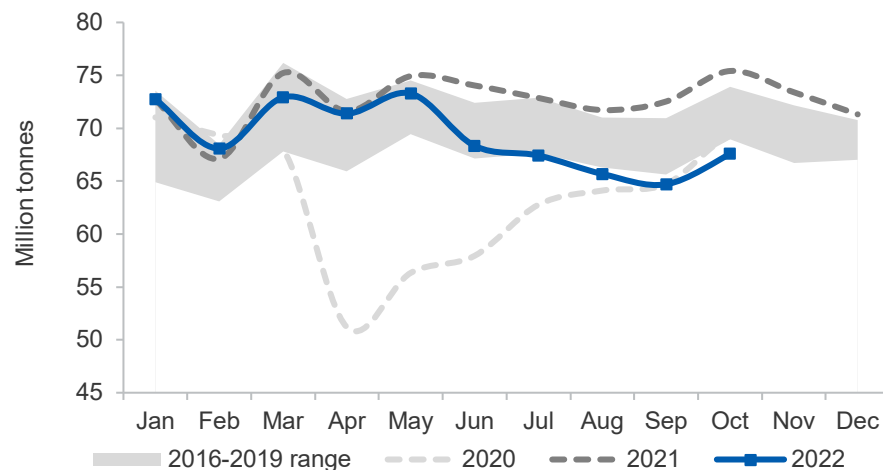
China's total steel production is forecast to reach around 1.02 billion tonnes in 2022. This equates to a fall of around 1.0% in year-on-year terms — in part due to base effects from China's significant production caps in the second half of 2021. Over the outlook period, steel output is forecast to fall by 0.5% in 2023, and by 0.8% in 2024 to reach around 1.01 billion tonnes.

Russia/Ukraine conflict continues to see supply cuts and trade diversion

In the first nine months of 2022, Ukraine's steel production was 5.5 million tonnes. This represents a fall of around 66% from the comparable period in 2021. Ukraine steel production is forecast to fall by about 14 million tonnes in 2022, to reach around 7.5 million tonnes.

Despite recent Ukrainian counteroffensives, a significant share of the country's steelmaking capacity remains in contested territory. Russia's

Figure 3.6: Monthly steel production – ex China Global



Notes: Monthly production reporting provides data on 61 countries (excluding China) and accounted for approximately 98% of total world crude steel production in 2021.

Source: World Steel Association (2022)

Figure 3.7: Industrial production — EU, US and Japan



Source: Bloomberg (2022)

control of the Black Sea has also restricted the export capability of major Ukrainian steel producers. And from October, Russian drone attacks on Ukrainian energy infrastructure have seen electricity outages in provinces including Dnipropetrovsk, one of Ukraine's major steelmaking hubs.

Russian total steel production in the first nine months of 2022 was around 55 million tonnes, down 3.4 million tonnes (6.1%) year-on-year.

With EU sanctions taking effect in March this year, Russia has been diverting exports of iron ore and steel to Asia, attracting potential buyers with heavy price discounts. This includes China, with iron ore and steel imports from Russia in the nine months to September 2022 more than double (in value terms) the same period in 2021. Indian imports of iron ore and steel from Russia have risen 40% over the same period.

However, the rising impact of the broader sanctions on Russia appears to be driving weaker domestic economic activity. Russia's industrial output fell for a sixth consecutive month in September (down 2.6% year-on-year), and new auto sales — a major end user of steel — fell by more than 60% year-on-year in the month of October.

Falls in ex-China steelmaking due to energy shortages and weak demand

Global steel production (excluding China) was around 198 million tonnes in the September quarter 2022. This represented a fall of 7.1% from the previous quarter and was 8.9% lower than the comparable period in 2021. Over the first nine months of 2022, total steel output reached around 624 million tonnes, a 4.3% fall in year-on-year terms (Figure 3.6).

Energy and raw material shortages have continued to impact manufacturing activity across many major economies so far in 2022, with demand destruction having a greater effect in recent months. This has seen industrial production — particularly in the EU and Japan — continue to trend lower over the year (Figure 3.7). The weakening global outlook in recent months has also seen a marked drop in steel prices across major markets, particularly flat steel products such as HRC (Figures 3.8 and 3.9).

Significant cuts to EU steel output in 2022 follows critical energy shortages

Steel output in the EU — the world's second largest steel-producing region — was about 29 million tonnes in the September quarter 2022. This was a fall of 16% (6 million tonnes) from the June quarter, and 14% lower than the same period in 2021. Over the first nine months of 2022, steel production was about 99 million tonnes, a 7.9% fall in year-on-year.

Europe has continued to experience supply chain disruptions and high energy prices this year, contributing to rising inflation pressures in the region. This has impacted steel-intensive industries in Europe, including the construction and automotive sectors. The S&P Global Eurozone Construction Total Activity Index posted a seventh straight month of contraction in November, with a reading of 43.6. This was led by weakness in Germany and France, with the region's residential sector seeing its most pronounced fall in activity since May 2020. Firms continue to experience widespread supply chain disruptions, as well as severe cost pressures that saw producer price inflation peak at 42% in September.

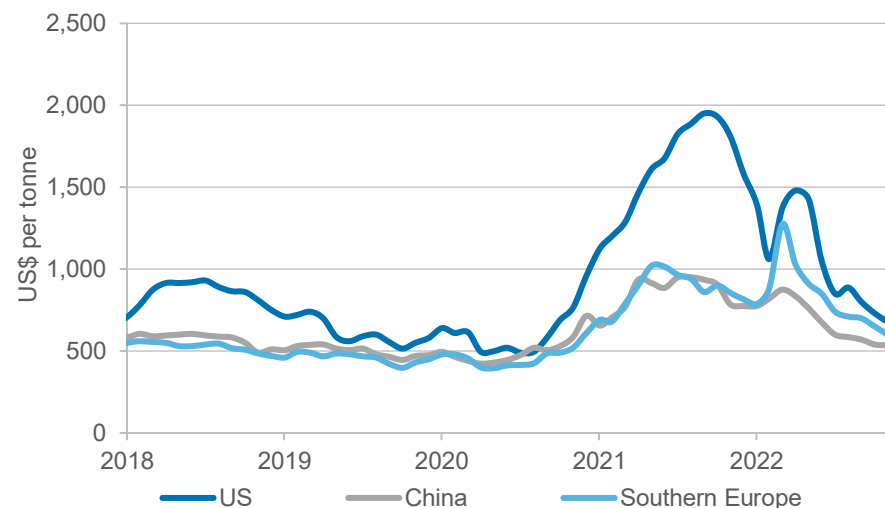
European auto production has continued to face challenging conditions in recent months, with high energy prices and weakening demand continuing to impact manufacturers. Revised forecasts for 2022 from S&P Global Mobility in October included a further 1.0% (163,000 units) cut in European production, with total units for calendar year 2022 now forecast to reach around 15.6 million. This was around 5.2% (or 860,000 units) lower than projected by S&P Global in April 2022.

EU steel production is forecast to fall by 13% in 2022 to total 132 million tonnes. Over the outlook period, steel output is forecast to see a rebound, growing by 4.9% in 2023, and by 1.8% in 2024.

Indian steel output still expected to see strong growth in 2022

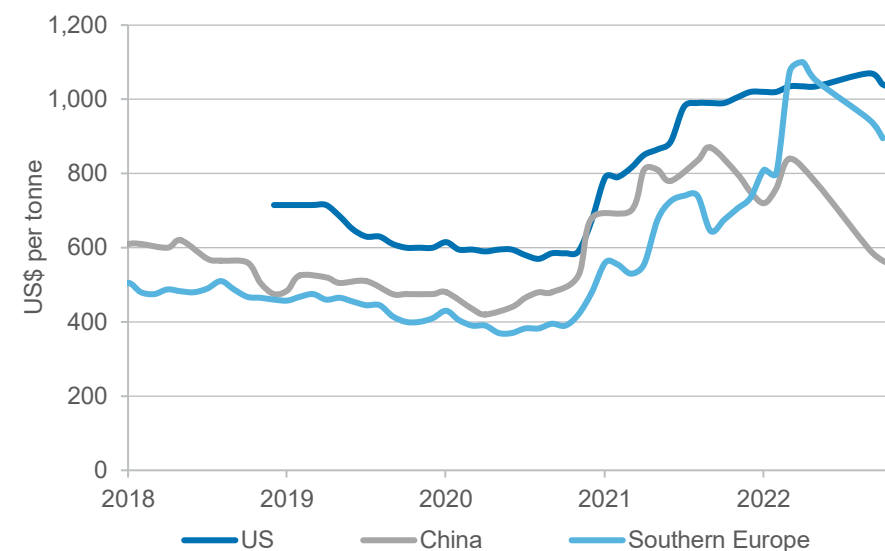
Indian steel production reached 30 million tonnes in the September quarter 2022, a fall of 3.2% compared with the previous quarter. Over the first nine months of 2022, India's total steel output reached around 93 million tonnes. This was 6.4% higher year-on-year. Total production is forecast to grow 5.6% in 2022 (to 125 million tonnes), in line with India's target to double production capacity to 300 million tonnes by 2030–31.

Figure 3.8: HRC steel prices



Source: Bloomberg (2022)

Figure 3.9: Rebar steel prices



Source: Bloomberg (2022)

In contrast with many other major economies, India's construction activity across all three sectors (residential, commercial and infrastructure) remained buoyant in the September quarter 2022. This was despite monsoonal rains typical in the September quarter, as well as rising inflationary pressures and tightening financial conditions through 2022.

Over the outlook period (to end 2024), India is projected to grow its steel output by around 5.5% annually. This will be led by healthy growth in residential and commercial construction, as well as a significant increase in infrastructure spending, as part of the country's \$1.5 trillion National Infrastructure Pipeline to 2025.

Japan steel production facing reduced demand heading into 2023

Japanese steel output was about 18 million tonnes in the September quarter 2022. This was a fall of 6.9% from the previous quarter, and 3.1% from the same period in 2021. Over the first nine months of 2022, total steel output was about 55 million tonnes, a 6.0% fall in year-on-year terms.

The Japanese economy contracted at an annualised rate of 1.2% in the September quarter, with a continued depreciation of the yen contributing to a deterioration in the country's balance of trade. Japan has also seen a weakening of its manufacturing sector in recent months, with industrial production falling 1.6% month-on-month (in seasonally adjusted terms) in October. This includes a significant drop in Japanese vehicle production, which fell 12% over the same period. Revised 2022 forecasts from S&P Global Mobility in October included a further 1.4% (151,000 units) cut in forecast production for Japan and Korea, and has flagged demand destruction as a fundamental risk in 2023.

Japanese steel production is expected to fall by 6.2% in 2022 to 90 million tonnes. Over the outlook, Japan's steel output is projected to remain relatively flat through to 2024.

Outlook for US infrastructure and manufacturing remains constructive

US steel production was around 20 million tonnes in the September quarter 2022. This was a fall of 1.9% from the previous quarter, and 7.7%

from the same period in 2021. Over the first nine months of 2022, steel output reached about 61 million tonnes, a 4.3% fall in year-on-year terms.

Rebar prices in the US continue to hold at multi-year highs, reflecting strong activity in the country's infrastructure and non-residential construction sectors. However, tightening monetary conditions appear to have checked growth in the US' residential sector. High labour and material costs, as well as higher interest rates, could all constrain overall activity heading into 2023.

US manufacturing has continued its recovery, with industrial production for the sector growing 2.7% year-on-year in October. The outlook for US steel demand in 2023 remains positive, with supply chain constraints on automotive production expected to continue to ease; and new government initiatives such as the *CHIPS Act* and *Inflation Reduction Act* expected to boost domestic manufacturing. However, demand destruction — due to the global economic slowdown — remains a critical risk in the near term.

US steel production is now estimated to fall by 3.7% in 2022. Despite the short-term challenges, US steel production is expected to grow by 3.5% in 2023 and by 2.3% in 2024. This will be driven by the US\$1.2 trillion *Infrastructure and Jobs Act*, which includes US\$550 billion in new federal government investment.

Table 3.1: World steel consumption and production

Crude steel consumption	Million tonnes				Annual percentage change ^f		
	2021	2022 ^s	2023 ^f	2024 ^f	2022 ^s	2023 ^f	2024 ^f
China	1,046	1,022	1,016	1,011	-2.3	-0.6	-0.5
European Union	155	141	144	149	-8.8	2.3	3.2
United States	94	99	106	110	5.1	7.0	3.9
India	104	109	114	119	5.4	4.6	4.6
Japan	56	55	56	58	-2.3	2.7	2.9
South Korea	51	50	52	52	-1.3	2.9	1.1
Russia	49	46	45	43	-6.4	-3.4	-3.4
Brazil	25	26	28	31	5.8	8.5	8.1
World steel consumption	1,959	1,913	1,931	1,952	-2.3	0.9	1.1
Crude steel production	2021	2022 ^s	2023 ^f	2024 ^f	2022 ^s	2023 ^f	2024 ^f
China	1,033	1,022	1,017	1,010	-1.0	-0.5	-0.8
European Union	153	132	139	141	-13	4.9	1.8
India	118	125	132	139	5.6	5.9	4.9
Japan	96	90	92	92	-6.2	1.7	0.6
United States	86	83	86	88	-3.7	3.5	2.3
Russia	76	72	71	71	-4.6	-1.7	-0.3
South Korea	71	69	71	73	-2.0	2.5	2.5
Brazil	36	35	37	38	-2.0	3.9	3.8
World steel production	1,951	1,912	1,933	1,954	-2.0	1.1	1.1

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

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

Iron Ore



Australia's iron ore sector



World's no.1
for iron ore
resources

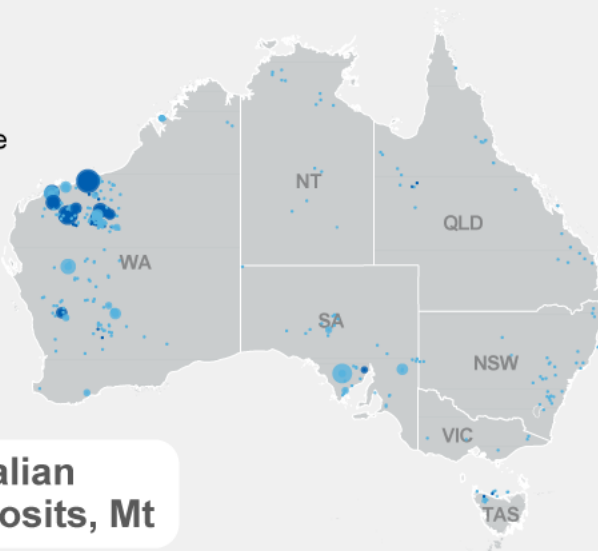


Largest
iron ore producer
in the world



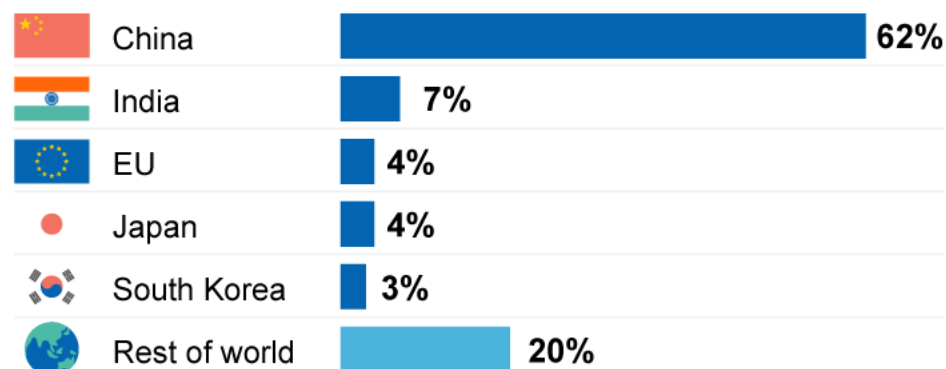
\$133 billion
earned in exports
in 2021-2022

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



**Major Australian
iron ore deposits, Mt**

World consumption



Iron ore facts



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



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

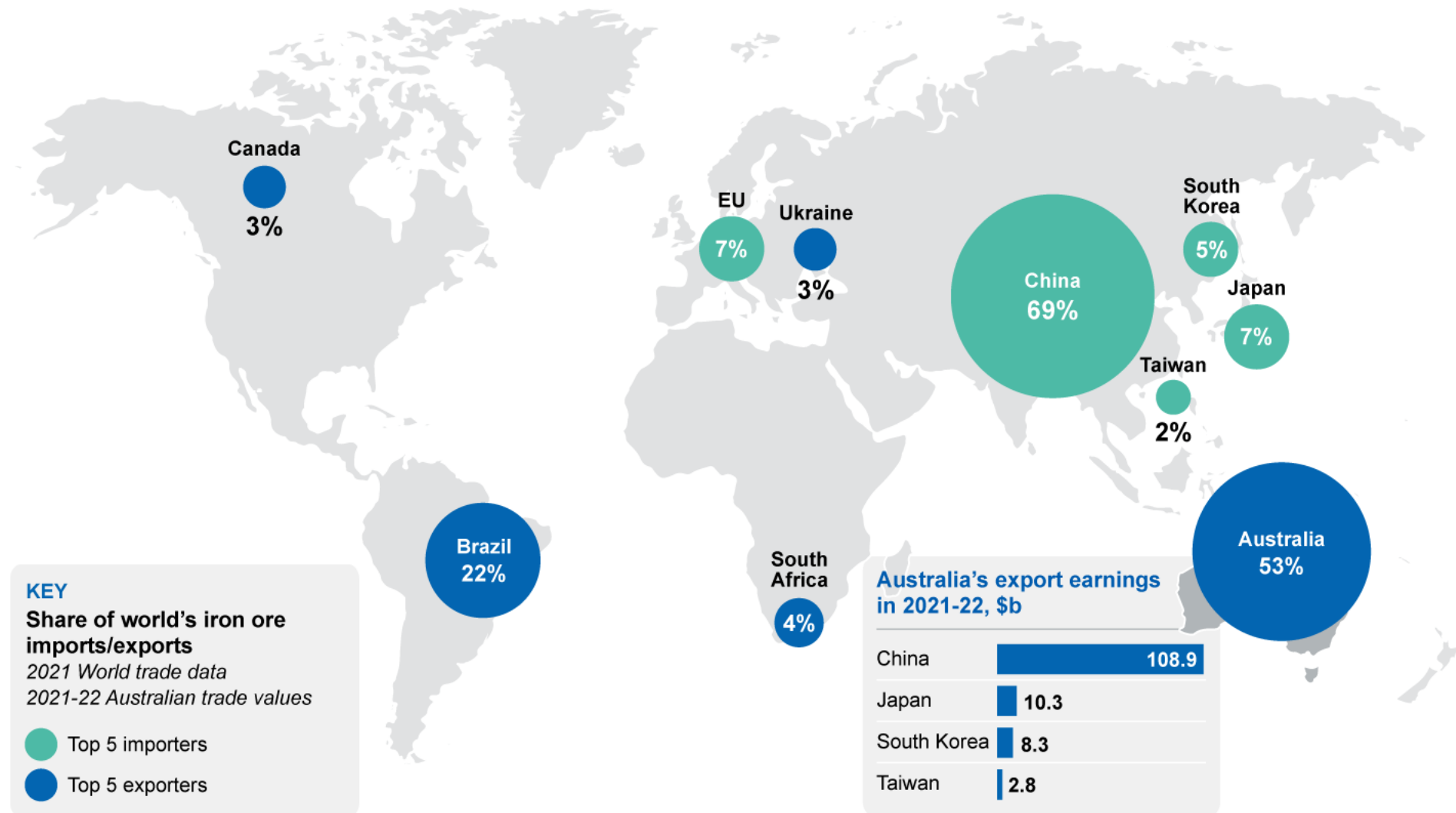


Humans have been working with iron for at least **5,000 years**



Iron was central to the **industrial revolution**

Iron Ore TRADE MAP



4.1 Summary

- The average iron ore price has fallen slightly in the December quarter 2022. Further outbreaks of COVID-19 in China have continued to weaken domestic demand, adding to pressures from the country's residential property market. Ex-China world demand has also waned in recent months, as global construction and industrial activity has slowed.
- Australian export volumes rose by 1.2% year-on-year in the September quarter 2022, with greenfield supply continuing to come online from major producers. Exports are forecast to increase by 2.5% in 2022–23 to 896 million tonnes, and by 2.7% to 920 million tonnes in 2023–24.
- Lower prices over the outlook period are expected to see Australia's iron ore export earnings ease from \$133 billion in 2021–22 to \$113 billion in 2022–23, and then to \$95 billion in 2023–24.

4.2 Prices

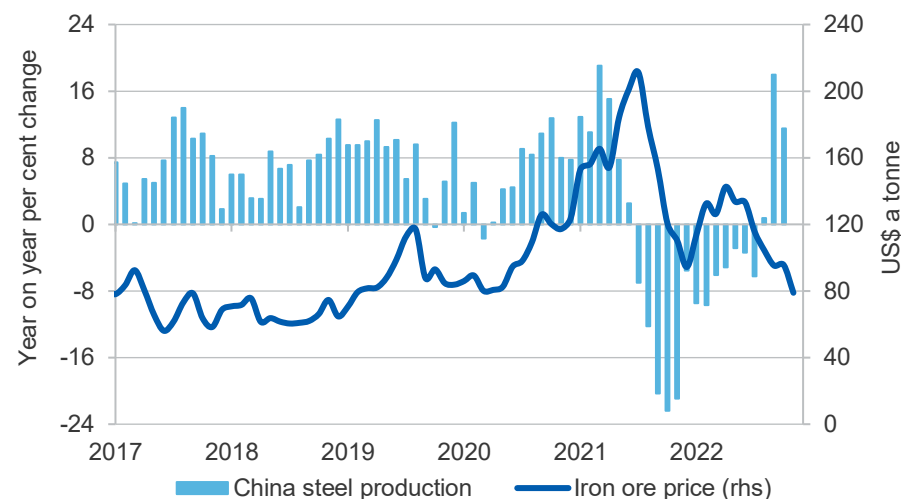
Iron ore stymied in recent months by China lockdowns and property sector

Despite a solid recovery in iron ore prices in the first half of this year, the benchmark iron ore spot price (62% Fe fines CFR Qingdao) has continued to fall in recent months, averaging just over US\$90 a tonne in the December quarter 2022 (Figure 4.1).

Continued outbreaks of COVID-19 in China from March — in combination with the country's now-defunct 'dynamic zero' COVID policy — have seen economic conditions remain weak throughout 2022. This has compounded weakness in China's residential property market, with new residential housing starts and new home sales continuing to fall at a double digit rates (year-on-year) in the first 10 months of 2022. This has seen lower construction activity (and steel and iron ore demand) over the period.

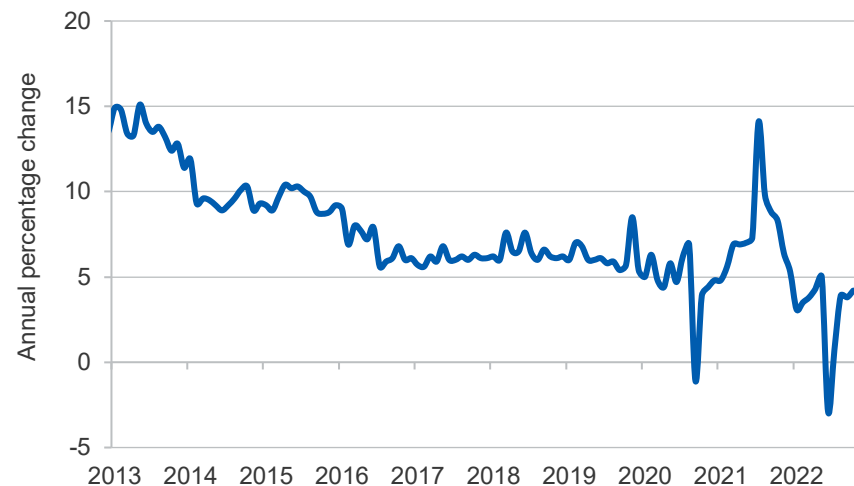
Chinese manufacturing activity has also been hampered by the COVID-related slowdown through 2022, with stronger-than-expected exports offset by weak domestic demand. While growth in manufacturing production has recovered from the 2.9% contraction year-on-year it registered in June, growth of 4.2% year-on-year in October remains well below levels averaged over the past decade (Figure 4.2).

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



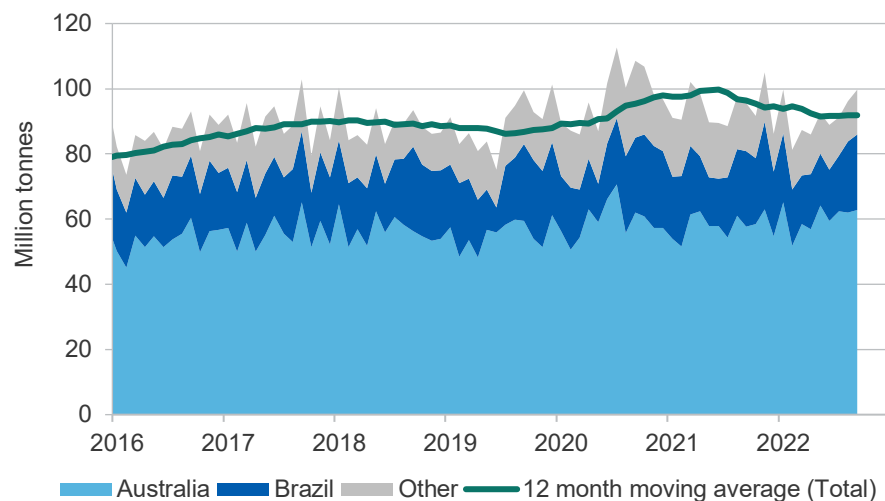
Notes: China import Iron ore fines 62% Fe spot (CFR Tianjin port)
Source: Bloomberg (2022) China import prices; World Steel Association (2022)

Figure 4.2: China's manufacturing output



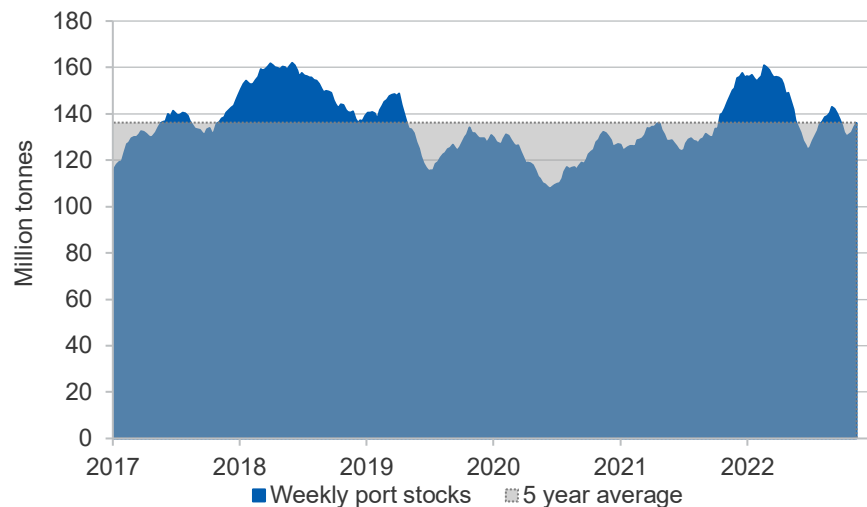
Source: Bloomberg (2022); NBS (2022)

Figure 4.3: China's iron ore imports, monthly



Source: Bloomberg (2022)

Figure 4.4: China's weekly iron ore port stocks



Source: Bloomberg (2022)

Despite subdued domestic conditions, China's iron ore imports rose in the September quarter 2022, reaching 287 million tonnes. This was 7.3% higher than the previous quarter (and a 2.0% rise compared with the same period in 2021). The rise included a significant increase in imports from Brazil (up 14 million tonnes or 28% quarter-on-quarter) and a modest increase in Australian iron ore (up 7 million tonnes or 3.7% quarter-on-quarter). Imports from other producers fell by 1.7% over the same period (Figure 4.3).

Following large declines in China's iron ore inventories in the first half of 2022, portside stocks have recovered and stabilised. In early December, inventories were around 135 million tonnes, in line with the five year average (Figure 4.4). However, reported iron ore inventories at steel mills remain low compared with recent years, and planned purchases by mills have persisted at subdued levels in recent months.

This is likely to reflect deteriorating Chinese steel mill margins, driven by high costs for energy and other raw materials, and falling steel prices. In early November, reported margins for both hot-rolled coil and rebar were around minus RMB30-35/tonne. This contributed to a narrowing in the discount for 58% Fe fines (to around US\$10 a tonne in October), as mills seek to reduce operating costs (Figure 4.5). However, winter output cuts expected from mid-November may see a recovery in demand for higher grade ores, as mills seek to maximise output yield.

Outside China, the global supply balance is estimated to have improved in the September quarter 2022. Falls in steel production amongst a number of major producers has seen weakened demand for iron ore imports, while over the same period, global supply has improved due to improved volumes from Brazil and Canada (see [World Trade section](#)).

The spot price for 62% Fe iron ore fines (FOB) for calendar 2022 is estimated to average around US\$100 per tonne (Figure 4.6).

Price outlook in 2023 relies on China's fiscal stimulus and property market

Throughout 2022, China has continued to turn to fiscal stimulus in order to support its economy through current challenges. China is now expected to

allocate more than RMB 5 trillion (US\$700 billion) in special purpose bonds in 2022, with the majority intended for new infrastructure investment. This will be bolstered by RMB1.4 trillion (US\$200 billion) in new lending from China's three major policy banks for infrastructure projects. In October, China's infrastructure investment (3 month average) was around 15% higher year-on-year, and is expected to boost construction activity, and steel and iron ore demand through 2023.

In recent months, China's government and central bank have also continued to implement measures aimed at stabilising its residential property sector. In November, the Chinese government announced 16 new policy measures intended to support the property sector. This is expected to include measures such as extending existing developers' loans and reducing down-payment and mortgage rates for homebuyers.

The PBoC has also eased broader monetary conditions in recent months, cutting the Reserve Requirement Ratio in December, and announcing plans in July to create a fund to provide up to RMB 200 billion (US\$28 billion) in low interest loans to finish stalled real estate projects.

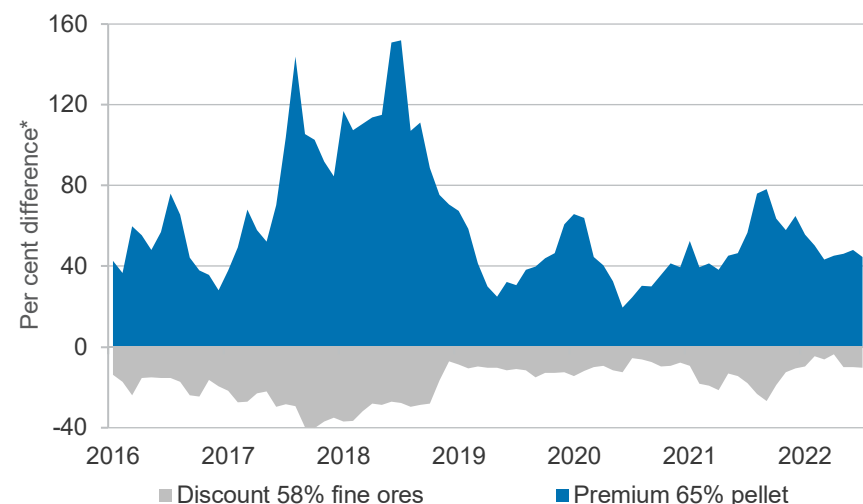
On the supply side, the world's two largest producers — Australia and Brazil — are expected to continue to collectively grow export volumes by around 38 million tonnes (3.1%) in 2023. This follows a ramp up of greenfield projects for major Australian miners, new supply from Vale's Northern system and remediation work associated with its South-eastern system.

A stabilisation of China's real estate sector, in combination with the country's substantial infrastructure stimulus and only modest supply growth from Australia and Brazil, is expected to provide support to steel and iron ore prices over the outlook period. The spot price for 62% Fe iron ore fines (FOB) is forecast to average US\$85 a tonne in 2023 (Figure 4.6).

Moderating demand and more supply to push prices lower to 2024

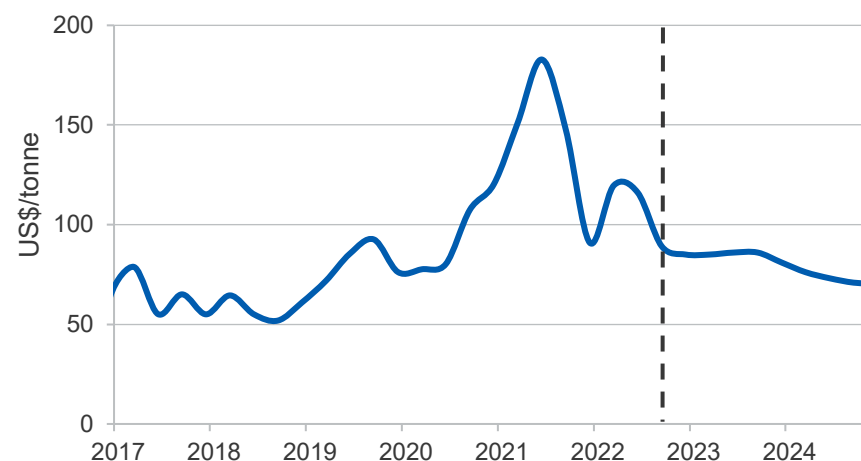
In 2024, iron ore prices are projected to decline toward (lower) longer-run levels. This follows more modest growth in blast-furnace steelmaking (compared with the past decade) from major producers such as the EU, US and China, as the world undergoes a transition to a low emissions

Figure 4.5: Iron ore price spread between grades



Notes: *Difference to 62% benchmark iron fines CFR; all grades reflect Chinese import prices
Source: Bloomberg (2022)

Figure 4.6: 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)

environment. Slower growth in blast furnace steelmaking capacity will take place alongside rising supply from Australia and Brazil.

A fall into global recession presents a downside risk to iron ore prices over the outlook period. While slowing industrial production seen in recent months may hamper growth heading into 2023, large infrastructure rollouts (including many new energy projects) across major economies are expected to provide support for steel (and iron ore) demand over the latter half of the outlook period.

From an estimated average price of around US\$100 per tonne (FOB) in 2022, the benchmark iron ore price is projected to average around US\$75 per tonne in 2024 (Figure 4.6).

4.3 World trade

Global iron ore market remained relatively balanced in September quarter

Global iron ore demand in the September quarter increased by around 3.9% compared with the previous quarter. This included a significant increase in Chinese imports (up 7.3% over the period) which offset the impact of falls in steel production (and thus iron ore demand) amongst major producers such as the EU, Japan, South Korea and Taiwan.

In the September quarter 2022, global iron ore supply improved by around 13 million tonnes (+3.6%) compared with the June quarter. Combined shipments for the world's four largest producers — Australia, Brazil, South Africa and Canada — are estimated to have reached around 355 million tonnes in the September quarter 2022. This was 6.7% higher quarter-on-quarter, largely reflecting improved export volumes during Brazil's dry season (particularly in the northern provinces), and the typical seasonal ramp up in Canada during the Northern Hemisphere summer.

Australian iron ore exports in September quarter 2022 were about 222 million tonnes. This was 1.2% higher year-on-year, and was driven by the ramp up of major brownfield and greenfield projects for Rio Tinto, BHP and Fortescue this year (see [Australia section](#)).

Australian exports are expected to reach 885 million tonnes in 2022, an increase of 1.6% year-on-year. This includes the continued ramp up of projects such as Gudai-Darri (Rio Tinto), South Flank (BHP) and Eliwana (Fortescue), expected to produce more than 50 million tonnes in the full year 2022. Over the outlook period, Australia's iron ore exports are projected to rise at an average annual rate of 2.7%, to reach around 933 million tonnes by 2024.

Total iron ore shipments from Brazil were around 101 million tonnes in the September quarter 2022. This was 23% higher compared with the previous quarter and 1.7% higher year-on-year. Brazil's largest producer, Vale, had production of around 90 million tonnes in the September quarter 2022, which was 21% higher than previous quarter. This reflected the start of the dry season in Brazil (particularly in its northern operations) and improved output rates and third-party purchases in its Southern system. Output was 1.1% higher compared with the same quarter in 2021.

For 2022, Vale has maintained guidance at 310-320 million tonnes (around what it produced in 2021). This is expected to include first production from the company's Gelado sustaining project. This project will recover iron ore from the tailings dam of its existing Carajas mining complex, to feed its São Luis plant (to produce high grade DR pellets).

Total Brazilian exports are forecast to reach 347 million tonnes in 2022, a fall of 2.8% compared with 2021. The result reflects heavy rains as well as tie-in and licensing issues experienced through the first half of 2022. Over the outlook period, Brazil's total iron ore export volumes are projected to grow by around 2.7% annually, to reach about 390 million tonnes by 2024.

In 2022, combined exports from other significant producers South Africa, Canada and India are forecast to fall by 12% to 140 million tonnes. This is primarily due to a projected fall (of around 50%) in Indian exports.

Over the outlook period to 2024, iron ore exports ex Australia and Brazil are projected to grow modestly. New supply from Canada (from Champion Iron's Bloom Lake Phase 2 expansion) and recovering supply from Ukraine are expected to offset depleting projects of other major producers.

Russian invasion of Ukraine expected to lead to a regional shortfall

The Russian invasion of Ukraine has continued to see some loss of iron ore supply and redirected exports through 2022. In the first 8 months of 2022, Ukraine's iron ore production has fallen by around 11 million tonnes (40%) compared with the same period in 2021. Most of Ukraine's iron ore mines are located outside major conflict zones, allowing Ukrainian producers — through an improvised rail and barge supply chain through Romania and Poland — to maintain a reasonably high level of exports through the early months of the invasion.

However, with rising energy costs and Russian strikes on this improvised logistics network in June, exports have declined in recent months, and are expected to remain weak during the December quarter. Major iron ore producers such as Metinvest and ArcelorMittal suspended a number of operations from July, however in late October ArcelorMittal announced a resumption of its Kryviy Rih operations.

Ukraine's iron ore exports are forecast to fall by around 36% in 2022 to reach 28 million tonnes. This will result in a loss of around 4% of the global iron ore trade pellet trade from the global market in 2022, and is expected to have a considerable impact on European steelmakers, and particularly Electric Arc Furnace (EAF)-based steelmaking in the region.

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 ore 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 iron ore exports in March (and a similar fall for ferrous products).

Russia is expected to seek new markets for displaced export volumes previously sent to Europe, including countries in Central Asia and the Middle East. However, this reorganisation may be constrained by logistical issues in shipping to these regions, as well as ongoing self-sanctioning by other non-European steel producers.

China Mineral Resources Group signs agreements with Australian miners

In July, China established a new state-backed entity, China Mineral Resources Group (CMRG), with the official business registration citing responsibilities including the import and export of commodities, sales, iron ore mining, processing, and supply chain management services. The move is seen as an effort by the Chinese government to guarantee the supply of important mineral resources, and may include the establishment of a single, central purchasing platform for iron ore. In 2021, China is estimated to have imported around 80% of its total iron ore consumption. Further detail on the company is expected in the coming months.

Development of Guinea's Simandou project back on track

Following a halt to the Simandou iron ore mine project in June, July saw a new company established — La Compagnie du TransGuinée (CTG) — to restore the development's progress. The new company — a joint venture between Winning Consortium (WCS), Rio Tinto and the Guinean Government — will now oversee the mine's construction and the delivery of a new port and other transport infrastructure required to bring the mine to production and export.

Delivery is expected to be bound to the requirements set by the Guinean Government in March, with all infrastructure (which will include more than 650 kilometres of railway and development of a new deep-water port) to be finished by 2024, and commercial production to begin by the second quarter of 2025.

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 offsetting falls from mid-tier exporters such as India and Ukraine. However, growing macroeconomic headwinds — such as weakening global growth, high energy prices and further COVID-19 outbreaks — present a mounting risk to growth in world steel demand over the outlook period, which would have significant repercussions for iron ore demand.

4.4 Australia

Rising export volumes in 2022 (partially) offset fall in prices

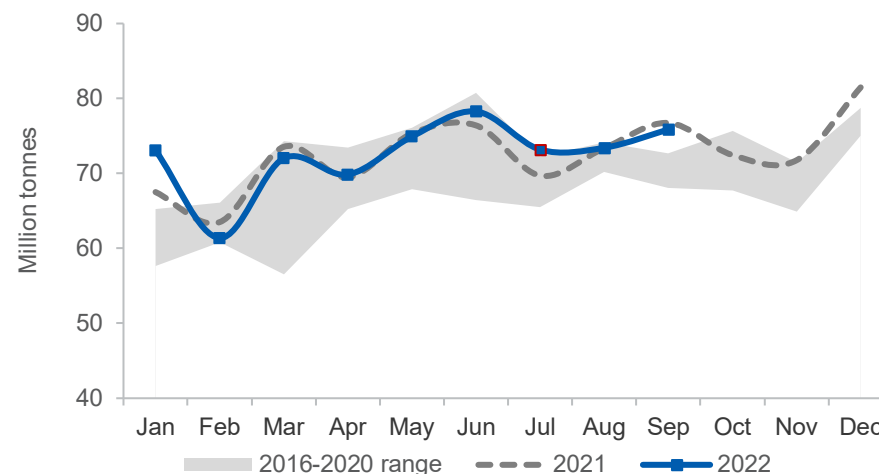
Australia's iron ore export earnings were \$29 billion in the September quarter 2022, a 17% fall year-on-year. The decline reflects the lower iron ore price, with the unit export price for September quarter averaging about US\$89 a tonne, 40% lower compared with the same period in 2021. Australia exported 222 million tonnes of iron ore in the September quarter 2022. This was 1.2% (or 2.7 million tonnes) higher than the same period in 2021, reflecting the ongoing ramp up of projects for Rio Tinto (Gudai Darri), BHP (South Flank) and Fortescue (Eliwana) (Figure 4.7).

Rio Tinto shipped around 83 million tonnes of iron ore in the September quarter 2022. This was a rise of 4% quarter-on-quarter, but was 1% below the same period in 2021. This followed two unplanned rail outages, including a derailment at its new Gudai Darri line. Despite those issues, Rio Tinto continues to expect Gudai Darri — which delivered its first ore in June 2022 — to reach full capacity during 2023.

The company has retained calendar year 2022 guidance of 320–335 million tonnes, however now expects to be at the lower end of this range. In September, Rio Tinto announced it will be developing its Western Range project in partnership with China Baowu Group. This project is intended to sustain production from its existing Paraburdoo hub, and is expected to produce 25 million tonnes per year. Construction is forecast to begin in early 2023, with first production by 2025. The company also initiated an Order of Magnitude study to consider the Rhodes Ridge prospect (in a Joint Venture with Wright Prospecting) in the East Pilbara region. The study will consider an initial plant capacity of up to 40 million tonnes per annum, with potential first output toward the end of this decade.

BHP's iron ore output was around 65 million tonnes in the September quarter 2022. This was 1% higher quarter-on-quarter, and 3% higher year-on-year. This reflected improved supply chain performance and reduced COVID-related impacts, as well as the ongoing ramp up of its new South Flank mine, which reached an average production capacity rate of 67 million tonnes per annum in the June quarter 2022.

Figure 4.7: Australian monthly iron ore export volumes



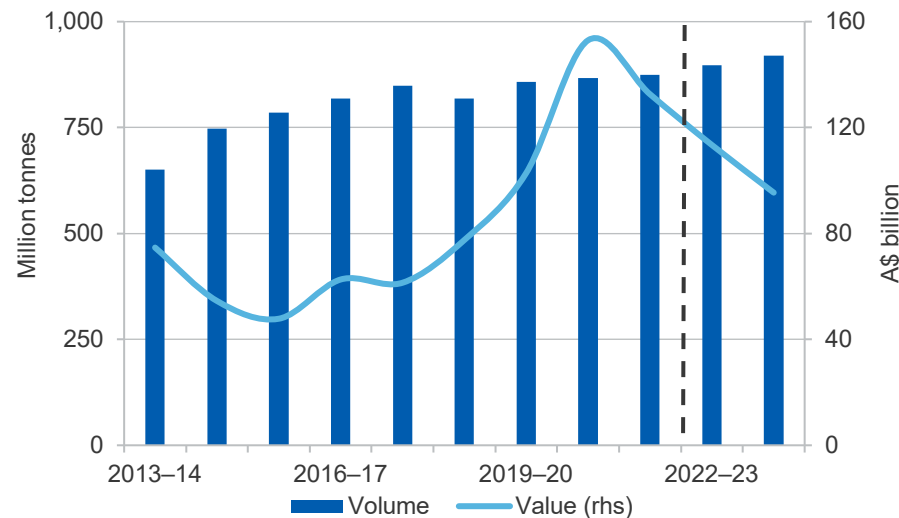
Source: ABS (2022) International Trade, Australia, 5368.0; Department of Industry, Science and Resources (2022)

The company left its 2022–23 production guidance unchanged at 246–256 million tonnes. This includes the further ramp up of South Flank, which the company expects to reach full 80 million tonne per annum capacity by the end of 2023, as well as its port debottlenecking project (PDP1). Through these two projects, the company expects to reach (and exceed) annual shipments of 300 million tonnes over the next few years.

Fortescue's total iron ore exports were 48 million tonnes in the September quarter 2022 — the highest September quarter on the company's record. While this was a 4% lower quarter-on-quarter, it was 4% higher than the comparable period in 2021. The result was underpinned by the continued ramp up of its Eliwana project, which ran at nameplate production capacity of 30 million tonnes per annum in April.

Fortescue has retained its 2022–23 fiscal year production guidance at 187–192 million tonnes. This is expected to include first production of its 22 million tonnes per annum Iron Bridge Magnetite project in the March 2023 quarter, which will deliver high grade 67% Fe magnetite.

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



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

Lower prices to see Australian export earnings fall over the outlook period

Higher production volumes and stable prices saw Australia's iron ore export earnings reach around \$133 billion in 2021–22. Weaker prices are forecast to lead to lower earnings for iron ore over the outlook period, with total export value of \$113 billion in 2022–23, falling to \$95 billion by 2023–24 (Figure 4.8).

Exploration expenditure remains near decade-highs in September quarter

A total of \$200 million was spent on iron ore exploration in the September quarter 2022 (Figure 4.9). This was 14% higher compared with 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.

Figure 4.9: Australian iron ore exploration expenditure



Source: ABS Catalogue 8412.0

Revisions

Forecast export earnings for 2022–23 (in nominal terms) have been revised down from \$119 billion in the September 2022 *Resources and Energy Quarterly* to \$113 billion in this edition, due to changes in price expectations and slightly lower volumes. Export earnings remain unchanged at \$95 billion for 2023–24.

Table 4.1: World trade in iron ore

	Million tonnes				Annual percentage change ^f		
	2021	2022 ^s	2023 ^f	2024 ^f	2022 ^s	2023 ^f	2024 ^f
World trade	1,626	1,591	1,623	1,679	-2.2	2.1	3.4
Iron ore imports							
China	1,126	1,108	1,131	1,121	-1.6	2.1	-0.9
Japan	113	108	110	111	-4.4	1.7	0.6
European Union	94	74	79	82	-21	6.5	3.7
South Korea	74	75	77	78	0.7	2.4	2.4
Rest of Asia ^a	57	73	76	85	27	4.9	11
Iron ore exports							
Australia	871	885	908	933	1.6	2.6	2.8
Brazil	357	347	362	387	-2.8	4.3	6.9
South Africa	68	62	63	64	-8.8	1.6	1.6
Canada	54	56	58	60	3.7	3.6	3.5
Ukraine	44	28	29	30	-36	3.5	3.4

Notes: ^a Excludes China, Japan, South Korea, Taiwan and India; ^s Estimate; ^f Forecast.

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

Table 4.2: Iron ore outlook

			Million tonnes			Annual percentage change ^f		
World	Unit	2021	2022 ^s	2023 ^f	2024 ^f	2022 ^s	2023 ^f	2024 ^f
Prices ^a								
– nominal	US\$/t	143	102	85	73	-28	-18	-14
– real ^b	US\$/t	155	103	82	69	-34	-21	-16
Australia	Unit	2020–21	2021–22	2022–23 ^f	2023–24 ^f	2021–22	2022–23 ^f	2023–24 ^f
Production								
– Steel ^c	Mt	5.7	5.8	5.7	5.8	2.0	-0.8	0.9
– Iron ore ^g	Mt	912	929	976	1,000	1.8	5.0	2.5
Exports								
Steel ^c	Mt	0.78	0.81	0.88	0.85	4.6	8.3	-3.7
– nominal value	A\$m	773	1 005	949	926	30	-5.6	-2.4
– real value ⁱ	A\$m	865	1,077	949	884	24	-12	-6.8
Iron ore ^h	Mt	867	874	896	920	0.8	2.5	2.6
– nominal value	A\$m	152,975	132,584	113,424	95,424	-13	-14	-16
– real value ⁱ	A\$m	171,156	142,028	113,424	91,113	-17	-20	-20

Notes: **a** Spot price, 62% iron content, fob Australian basis; **b** In 2022 US dollars; **c** 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; **f** forecast; **g** In wet metric tonnes; **h** In dry metric tonnes; **i** In 2022–23 Australian dollars; **s** Estimate

Source: ABS (2022) International Trade in Goods and Services, Australia, 5368.0; Bloomberg (2022); World Steel Association (2022); company reports; Department of Industry, Science and Resources (2022)

Metallurgical Coal



Australia's metallurgical coal sector



World's no.1
metallurgical coal
exporter

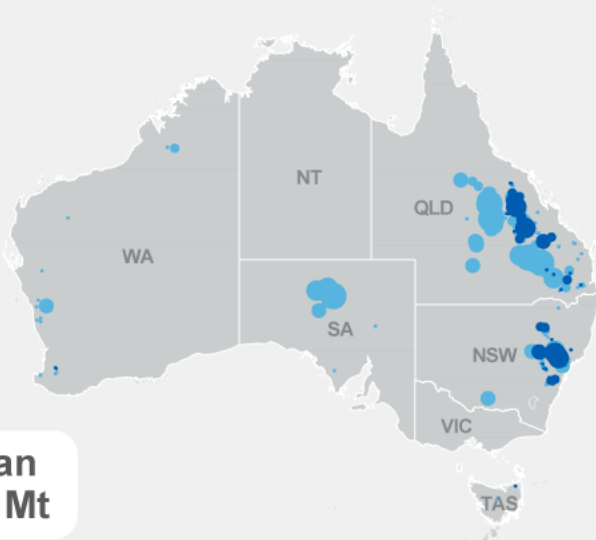


170m tonnes
exported each
year



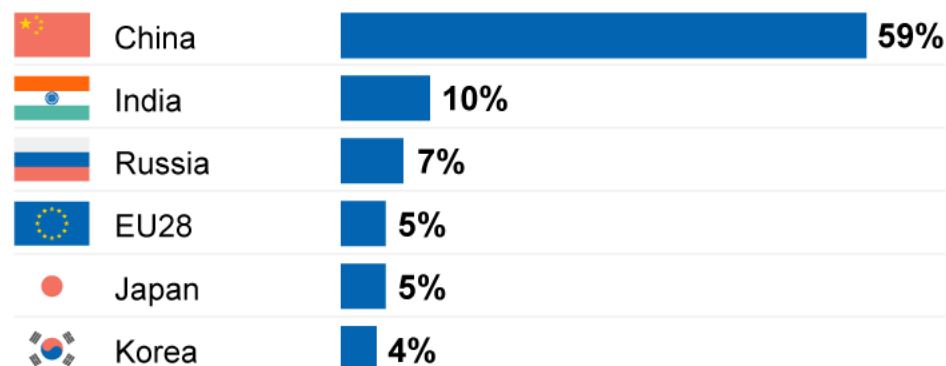
Almost all
of Australia's
production is
exported

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



**Major Australian
coal deposits, Mt**

World consumption



Metallurgical coal facts



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



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

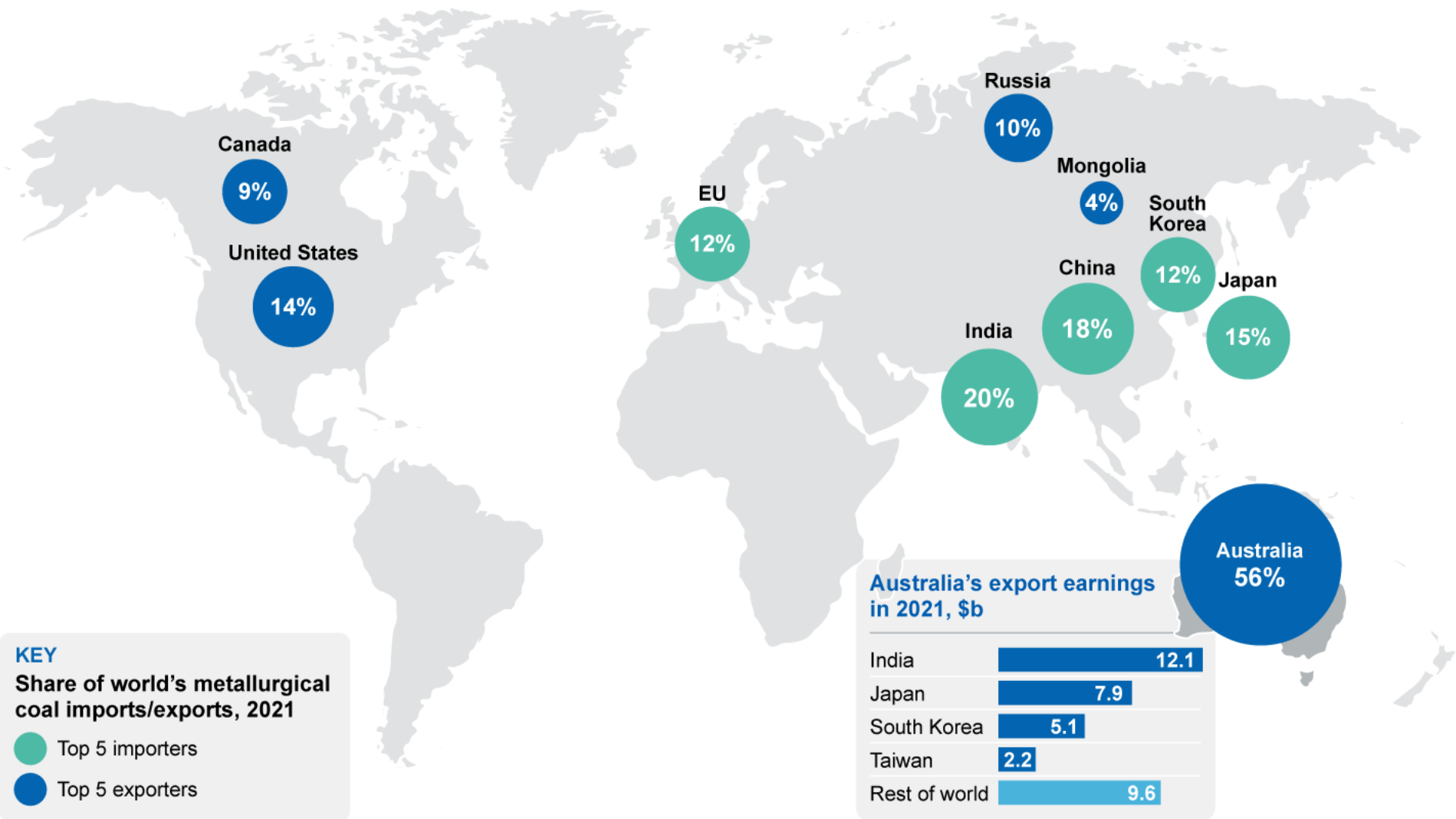


1 tonne of steel
made in a blast
furnace uses
780kg of met coal



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

Metallurgical Coal **TRADE MAP**



5.1 Summary

- Metallurgical coal prices have lifted since early August, but remain well below levels reached in the March-June 2022 period. The Australian premium hard coking coal price is estimated to average US\$377 a tonne in 2022, but is forecast to fall to around US\$230 a tonne by 2024.
- Higher production is expected to lift Australia's exports, from 163 million tonnes in 2021–22 to 183 million tonnes by 2023–24 (see [Australia section](#)).
- Australia's metallurgical coal export earnings are forecast to track with price movements, peaking at \$68 billion in 2021–22 before falling back to \$46 billion in 2023–24.

5.2 World trade

After hitting record levels in the wake of the Russian invasion of Ukraine, metallurgical coal prices fell sharply in early July, amidst a slowdown in global steelmaking. The market then found support at the US\$200 a tonne mark in early August, and has since risen modestly in net terms. The recent lift is largely due to supply disruptions, most notably the extended La Niña effects of persistent flooding in NSW and above average rainfall in Queensland, which have resulted in further downgrades to production guidance for several companies.

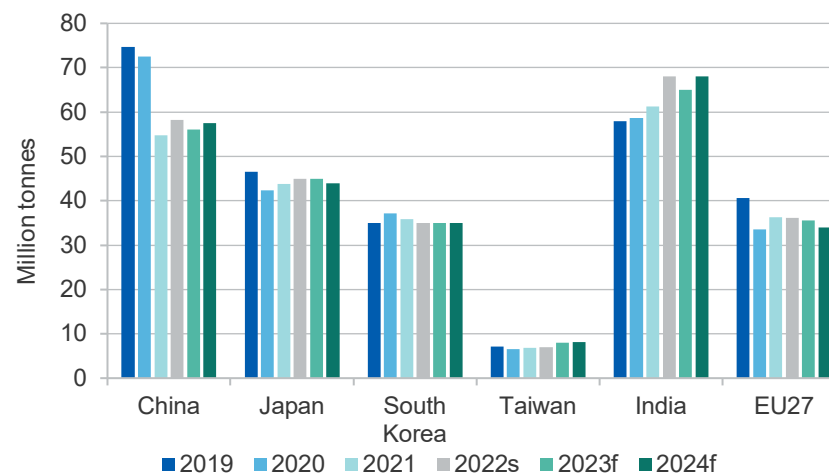
In recent months, steelmaking has been affected by high energy prices and a general downturn in the global economic outlook. The IMF has repeatedly cut its estimates for global GDP growth in 2022, and the downturn in the economic and industrial environment has flowed through to metallurgical coal markets. Under current conditions, it is not expected that recent metallurgical coal price gains will be sustained for long. Further weather events pose an ongoing risk to supply, but lower demand and higher inventories should prevent any significant price shocks.

Metallurgical coal supply is expected to match or exceed demand over the outlook period, with steelmaking remaining patchy and some supply disruptions likely to ease. Global automotive manufacturing, construction and other steel-using industries have all faced downward revisions in their

expected steel requirements. Lower global demand will allow some metallurgical coal to keep flowing to thermal coal markets, which remain in some shortfall.

On balance, world metallurgical coal trade is forecast to increase from 311 million tonnes in 2022 to 323 million tonnes by 2024 (Figure 5.1). The bulk of the growth in trade is expected in 2023, but the softening global outlook presents risks to this forecast.

Figure 5.1: Metallurgical coal imports



Notes: f forecast s estimate

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

5.3 World imports

Chinese metallurgical coal imports have picked up

Chinese GDP growth remains heavily reliant on infrastructure spending, with growth in consumer spending weakening further (from an already modest level) in October. China's sizeable infrastructure plans (worth over US\$1 trillion) are underway, and should continue to drive construction activity in the short-term. The outlook may turn again if the Chinese Government decides to ramp up stimulus spending in response to further COVID-19 outbreaks or other setbacks.

Real estate construction in China remains subject to significant risks, with high indebtedness and growing efforts underway from the Government to manage China's housing market. Weakness in the real estate sector is not likely to be fully offset by (modest) strength in China's automotive sector, though recent trends for the automotive sector have been more positive. China's regulators have released a 16-point plan aimed at boosting the real estate market. Policies include injecting more liquidity and easing deposit requirements for potential buyers.

Chinese imports are expected to remain modest into the start of 2023, with potential to rise more strongly later in the year if the global economy outperforms expectations.

India's metallurgical coal imports are recovering

Indian steelmaking was temporarily suppressed by a surge in metallurgical coal prices early in 2022. The subsequent easing of these prices (alongside some pent up consumer demand) has subsequently pushed up steel demand, making India a likely growth source for metallurgical coal imports as 2022 ends. The Indian government continues to place a high priority on developing its domestic steel industry, and has lifted its export duty on steel in order to increase India's role as a global supplier. Growth in Indian steel production has been strong, with more than 10 million tonnes produced in most months of 2022. Recent growth in Indian steel production has been largely met from domestic metallurgical coal supply, with Indian imports little changed over most of 2022.

India's merchant coke production picked up sharply in September. This is expected to edge back again in late 2022 and early 2023, with recent growth in seaborne metallurgical coal prices acting as a substitute. India's metallurgical coal needs are likely to grow, with steelmakers pressing ahead with US\$11 billion worth of projects, some of which are scheduled 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, Indian steelmaking remains highly connected to the global economy, and would likely trend down if global steelmaking eased more than expected.

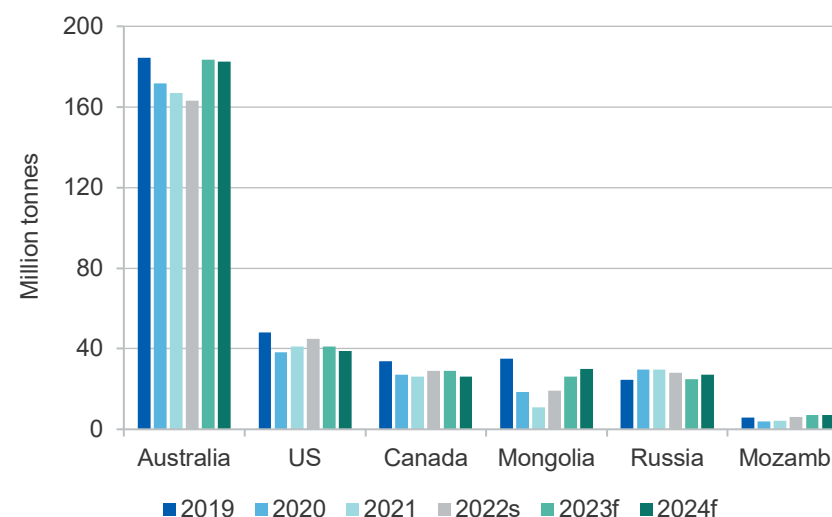
5.4 World exports

Global exports of metallurgical coal have been constrained in recent months, but lower global demand and improved inventories have muffled much of the impact on prices. It is not clear that metallurgical coal now faces any structural shortfall, and may soon be in a widening surplus as supply conditions pick up again, with demand continuing to ebb amidst weakening global economic conditions.

Output in the US has been affected by infrastructure issues

US metallurgical coal exports were not able to scale up significantly during the boom price period of early 2022 (Figure 5.2), largely due to infrastructure constraints. It appears that the opportunity to capitalise on record prices has now passed, potentially flattening investment levels over the longer term.

Figure 5.2: Metallurgical coal exports



Notes: f forecast s estimate

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

Most US freight rail and barge networks have belatedly recovered following a series of maintenance problems and parts shortages. Among the affected sites was CSX's Curtis Bay Piers, which was severely affected by an explosion caused by accumulated coal dust in December 2021. Repairs on this (alongside other rail and barge networks) have now mostly concluded. However, US metallurgical coal exports remain high-cost, and export levels ultimately increased only moderately (and less than originally expected) following the price boom of early 2022.

Over the outlook period, US exports are expected to edge back as prices fall further and some marginal or cost-sensitive exporters withdraw from the seaborne market.

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), production is expected to recommence in early 2023.

Strong recent profits and a solid price outlook for Canadian exporters should see exports remain solid through to the end of the outlook period (Figure 5.2).

Exports from Africa are recovering

Mozambique's exports fell in 2020 and 2021, as low prices forced much of the nation's high cost production out of the market. Exports are forecast to recover to 7 million tonnes by 2024. This growth is expected to be driven by Vulcan Resources' 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.

Russian exporters face a difficult outlook

Russian metallurgical coal exports fell in September, as European sanctions took their full effect. Sanctions have denied Russian coal producers access to many markets, but have also cut Russia off from machinery and equipment that is needed (typically in large quantities) to maintain Russia's vast rail and supply chain networks.

Rail in the eastern parts of Russia remains bottlenecked, hampering the country's ability to redirect to new markets in the wake of European sanctions. The 2023 shipping quota for Kuzbass — a key metallurgical coal exporting region — appears to have been downgraded from 63 million tonnes to 56 million tonnes of metallurgical coal. The owners of the Elga project are seeking to expand their private rail capacity, but will have to manage reduced access to imported equipment, and gain permissions from the Russian government in order to proceed.

Limited rail capacity allocation into 2023 (amidst a preference for higher value cargo) will act as a general curb in Russian coal exports, with prospects for any additional allocations for metallurgical coal likely to be limited. Russian government decisions in this area will likely have considerable implications for coal exports (and ability to ship coal cargoes to Asia) over 2023.

Russian exports face a prolonged period of structural weakness through the outlook period and likely beyond. Growth in exports to China, India and other South Asian nations is not expected to absorb the loss of markets in Europe, Japan, or South Korea. A substantial minority of Russian exports are likely to be stranded in the immediate future. Ultimately, around 5 million tonnes annually is expected to be pushed out of global markets.

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

Mongolian coal exports have typically been dominated by truck shipments, but the launch of three railway lines in 2022 (due to Chinese investment) should underpin a more efficient and stable transport system. Mongolian exports are forecast to rise by over 30% between 2021 and 2024 (Figure 5.2).

5.5 Prices

Recent growth in metallurgical coal prices is expected to unwind

While metallurgical coal prices have lifted in recent months, it is not expected that this rise will be sustained for long. The lift was largely driven by temporary supply disruptions as opposed to market fundamentals, and demand remains relatively constrained with global steelmaking output likely facing a period of softness. Supply disruptions are expected to ease somewhat (but not to pass entirely) with the potential end of the La Niña cycle in the March quarter 2023.

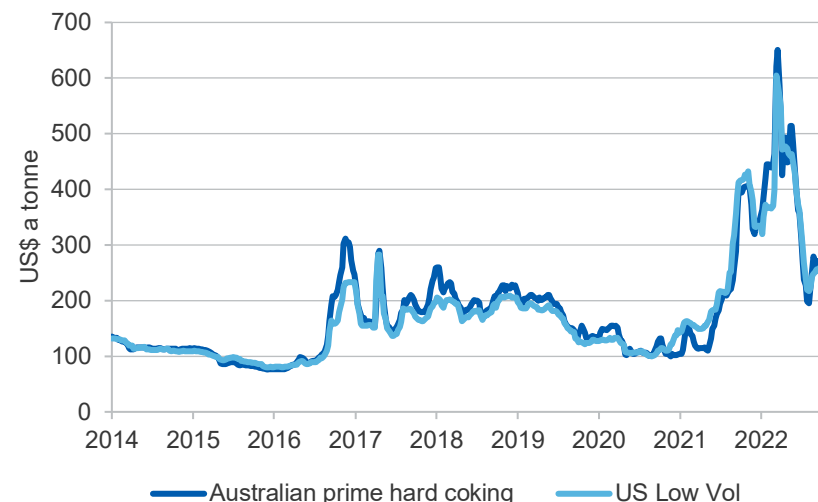
Prices are expected to face small declines over the outlook period, but with significant risks in either direction. Any further deterioration in the global economic outlook would bring prices down through weaker demand. However, further flooding (which has already persisted on-and-off for two years in some areas) would likely hold prices up for longer. Oceanic temperatures are also an emerging issue: oceans remained heated for longer than usual following the last La Niña, resulting in higher rainfall persisting for longer than is traditionally the case. A repeat of this phenomena would present a new long-term risk factor for metallurgical coal supply. However, supply-driven price surges are expected to be relatively modest in the short-term given the build-up of inventories and the current outlook for global demand.

High thermal coal prices have incentivised producers of semi-soft metallurgical coal to divert product into thermal coal markets, placing a price floor under lower grade metallurgical coal. However, this has been limited in its effect, due to the need of many European power plants for specific grades of thermal coal, which cannot be easily substituted. Opportunities for redirection between markets are expected to keep narrowing with the closing price gap between thermal and metallurgical coal.

On balance, it is expected that supply disruptions will continue through the end of the La Niña pattern, with prices holding up briefly but falling from the March quarter 2023. Indian demand has risen recently, and is expected to remain strong unless prices rise rapidly. Chinese demand remains difficult to predict, presenting a sizeable uncertainty for prices.

Supply and demand both remain subject to many risks in either direction. On balance, prices for Australian hard coking coal are expected to decrease from US\$377 a tonne in 2022 to around US\$230 a tonne in 2024 (Figure 5.3).

Figure 5.3: Metallurgical coal prices – Australian vs US, FOB



Notes: 'Low Vol' is low volatility coking coal.

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

5.6 Australia

Metallurgical coal export earnings have risen despite supply issues

Australian metallurgical coal export earnings remain reasonably strong in the final quarter of 2022 (Figures 5.4 and 5.5), boosted by higher demand from Europe, Japan, Taiwan, and South Korea. Exports benefited somewhat from higher prices in late 2022, but were constrained by supply disruptions among Australian operators (though these disruptions were also a driver of price growth).

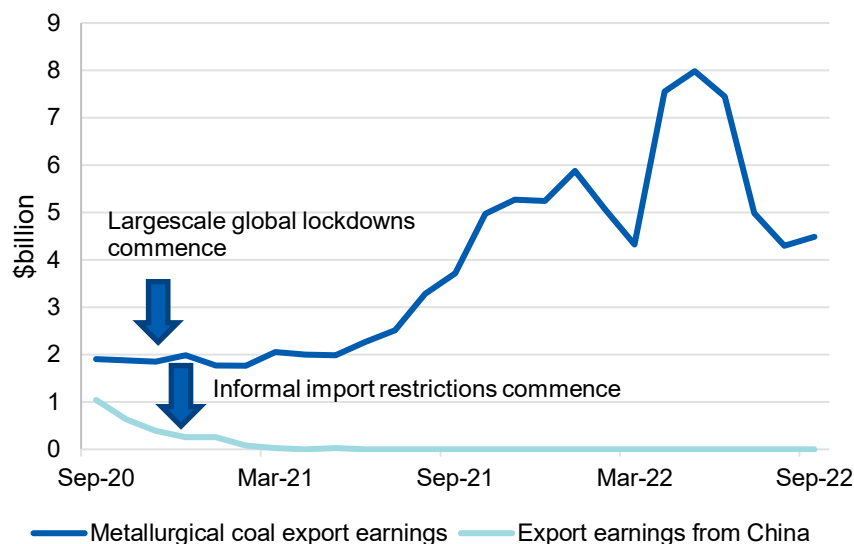
Weather disruptions continue to affect output. In recent weeks, rainfall in the NSW Hunter Valley has delayed mining and shipments, with dewatering in a number of NSW mines set back by the renewed deluge.

The Port of Gladstone in Queensland also saw a fall in output due to heavy rainfall causing a mechanical outage to RG Tanna Terminal's Shiploader 1, coinciding with a scheduled maintenance outage of their Shiploader 2.

These effects may be exacerbated by strikes at BHP operations, including Goonyella, Saraji, Blackwater and Riverside. The mines have a significant combined output, and disruptions could affect prices and supply over coming months. Labour shortages across the resources industry have also been a consistent issue in recent quarters. However, BHP has left its production guidance (at 58-64 million tonnes) unchanged for the present.

Output from Anglo American was flat over the first nine months of 2022 (compared to the corresponding period in 2021). However, very recent data shows a rise from July, as longwall operations at Grosvenor and Aquila ramped up.

Figure 5.4: Australia's metallurgical coal export values, monthly



Source: ABS (2022) International Trade, Australia 5454.0

Peabody has announced that it will invest US\$140 million (with a further US\$240 million in store) to reopen its North Goonyella mine, which has been closed since 2018. Production at the site is not expected to be significant during the outlook period, with the company's provisional timetable suggesting first production in 2024, and full output taking a further 2-3 years. The company also faces industrial action at its Helensburgh wash plant, but has not revised its production guidance in response.

The Australia-India Economic Cooperation and Trade Agreement (ECTA), which enters into force on 29 December 2022, will eliminate tariffs of 2.5% on Australian metallurgical coal exports to India. While Australia may not be the only country to have duties eliminated, the agreement removes the risk that Australian metallurgical coal will be disadvantaged in the Indian market. The duty elimination also extends to lines of thermal coal, except for bituminous coal. The 2.5% duty on bituminous coal will be eliminated over 5 equal annual instalments.

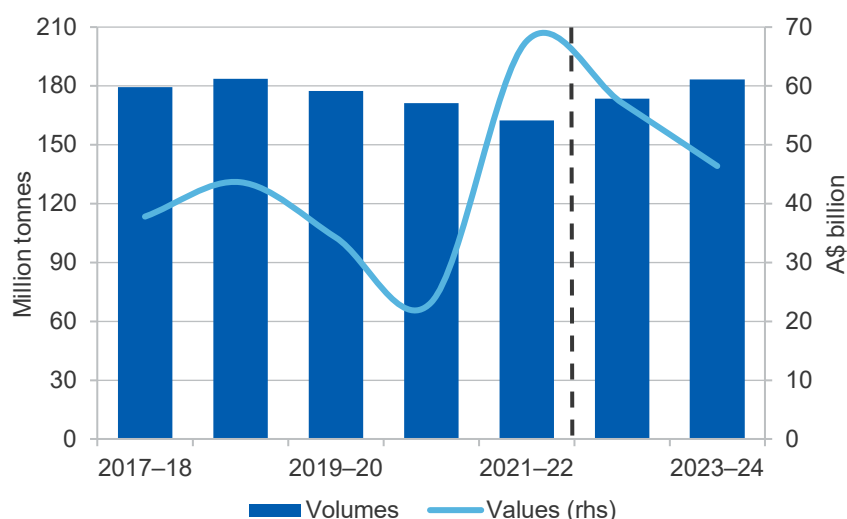
Overall, Australian metallurgical coal output fell by around 6% over the first nine months of 2022 (relative to 2021), from an already disrupted level in 2021. Output of semi-soft metallurgical coal fell even more sharply in 2022, despite the opportunities to place surplus product in thermal coal markets.

Export earnings should be supported in the short-term by small increases in contract prices. Contract negotiations between Foxleigh and Nippon steel concluded with a modest increase in the December quarter price to US\$255 a tonne, up from US\$243 a tonne in the September quarter. This rise implies a small lift in underlying price pressures in the quarter, but the contract price remains well below the spot price, which topped US\$300 a tonne during parts of the December quarter.

With prices now expected to fall only slowly, the primary risk to Australian export earnings has shifted to volume shortfalls, which may occur due to ongoing weather issues. As previously noted, the La Niña weather pattern is likely to persist until March 2023, and rainfall may even persist beyond this given the apparent slowdown in the oceanic cooling rate.

On balance, long term factors for metallurgical coal output remain largely positive. Higher production in New South Wales and (especially) Queensland is expected to lift Australia's exports, from 163 million tonnes in 2021–22 to 183 million tonnes by 2023–24. Metallurgical coal export earnings were \$23 billion in 2020–21 (Figure 5.5), but surged to \$68 billion in 2021–22. Prices are now easing, as seasonal and short-term supply issues pass and demand edges back. This should see earnings fall moderately over the outlook period, with export values eventually easing to a (still-high) \$46 billion by 2023–24.

Figure 5.5: Australia's metallurgical coal exports

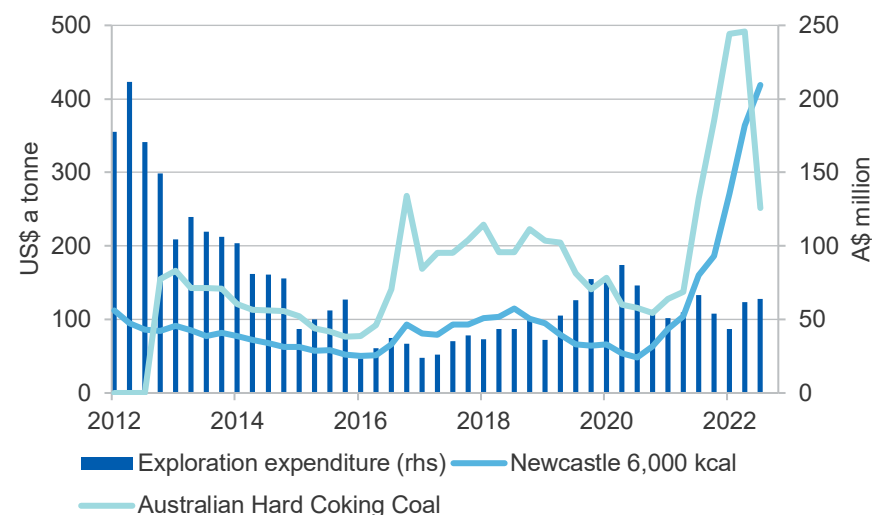


Source: ABS (2022) International Trade, Australia 5454.0; Department of Industry, Science and Resources (2022)

Coal exploration expenditure has increased

Australia's coal exploration expenditure increased to \$64 million in the September quarter, to be 4% lower through the year. Prices have risen markedly for Australian coal, but thermal coal face challenges with finance, insurance and long-term global demand. Recent growth in exploration is thus likely to have been dominated by metallurgical coal (Figure 5.6).

Figure 5.6: 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 aggregate export earnings over the outlook period has been revised up by around US\$3 billion in total. Revisions reflect wetter than normal conditions in Australia — including the persistence of the La Niña weather pattern, which is expected to last longer than previously expected.

Table 5.1: World trade in metallurgical coal

	Unit	2021	2022 ^s	2023 ^f	2024 ^f	Annual percentage change		
						2022 ^s	2023 ^f	2024 ^f
World trade	Mt	296	311	324	323	5.2	4.0	-0.2
Metallurgical coal imports								
China	Mt	55	58	56	57	6.4	-3.8	2.6
India	Mt	61	68	65	68	10.9	-4.4	4.6
Japan	Mt	44	45	45	44	2.7	0.0	-2.2
European Union 28	Mt	36	36	36	34	-0.5	-1.4	-4.5
South Korea	Mt	36	35	35	35	-2.6	0.0	0.0
Metallurgical coal exports								
Australia	Mt	167	163	183	183	-2.4	12.6	-0.5
United States	Mt	41	45	41	39	9.4	-8.9	-4.9
Canada	Mt	26	29	29	26	10.7	0.0	-10.3
Russia	Mt	30	28	25	27	-5.4	-10.7	8.0
Mongolia	Mt	11	19	26	30	72.2	36.8	15.4
Mozambique	Mt	4	6	7	7	37.0	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 ^s	2023 ^f	2024 ^f	2022 ^s	2023 ^f	2024 ^f
Contract prices ^e								
– nominal	US\$/t	205	377	257	229	84.0	-31.9	-10.9
– real ^d	US\$/t	222	377	248	216	70.3	-34.2	-12.8
Spot prices ^g								
– nominal	US\$/t	225	377	254	228	67.5	-32.5	-10.5
– real ^d	US\$/t	243	377	246	215	55.0	-34.8	-12.4
Australia	Unit	2020–21	2021–22	2022–23 ^f	2023–24 ^f	2021–22	2022–23 ^f	2023–24 ^f
Production	Mt	171	172	185	189	0.8	7.4	2.3
Export volume	Mt	171	163	174	183	-5.1	7.0	5.3
– nominal value	A\$m	23,187	67,588	57,131	46,387	191.5	-15.5	-18.8
– real value ⁱ	A\$m	25,943	72,402	57,131	44,292	179.1	-21.1	-22.5

Notes: ^d In 2022 US dollars. ^e Contract price assessment for high-quality hard coking coal. ⁱ In 2022–23 Australian dollars. ^s Estimate ^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



Australia's thermal coal sector



World's 2nd
largest thermal
coal **exporter**

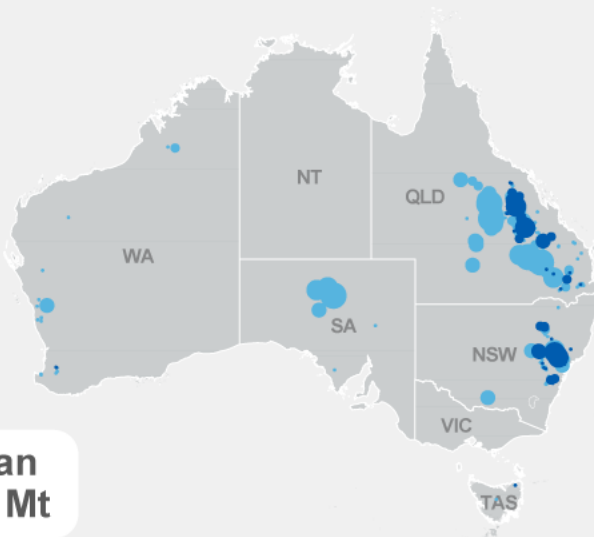


World's 4th
largest **black**
coal resources



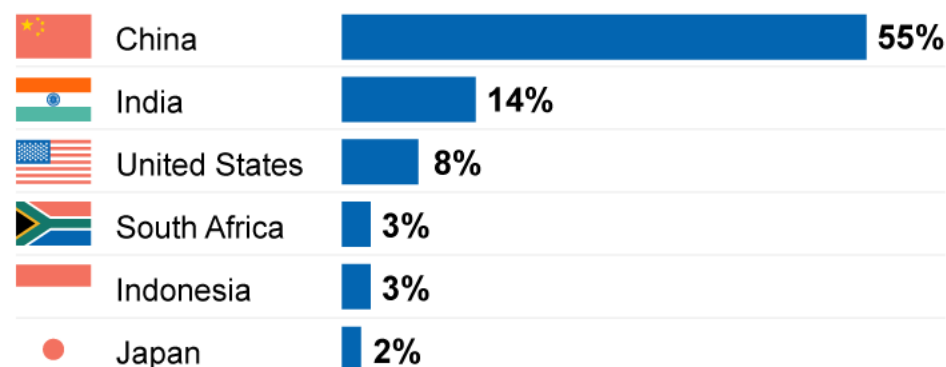
75-80%
of Australia's
thermal coal is
exported

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



**Major Australian
coal deposits, Mt**

World consumption



Thermal coal facts



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



Coal supplies
over one-third of
global electricity
generation

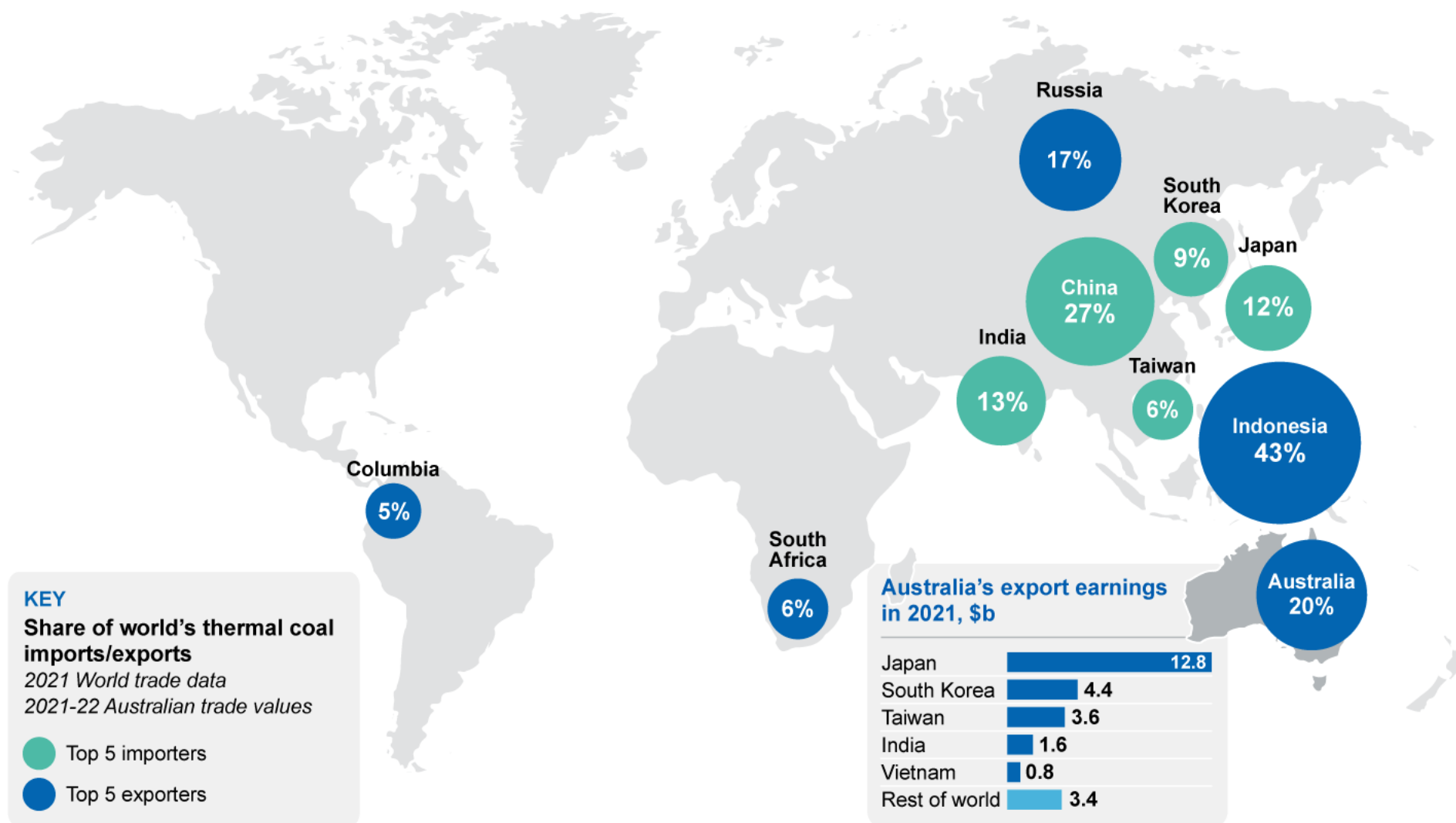


Mines are **open cut**
or underground
depending on the
deposit's geology



Coal formation
began **290-360**
million years ago

Thermal Coal TRADE MAP



6.1 Summary

- Thermal coal prices remain elevated amidst ongoing weather disruptions and issues with access to finance/insurance. As weather conditions normalise, the Newcastle benchmark price (6,000 kcal) is forecast to fall from an average of US\$360 a tonne in 2022, to around US\$200 in 2024 (still well above historical averages).
- A gradual recovery from recent supply outages is expected to see Australian thermal coal exports rise from 196 million tonnes in 2021–22 to 203 million tonnes in 2023–24 (see [Australia section](#)).
- Export values are forecast to rise from \$46 billion in 2021–22 to more than \$75 billion in 2022–23, easing to around \$55 billion by 2023–24.

6.2 World trade

Thermal coal prices remain highly volatile. They weakened sharply in November — unwinding some of the spectacular gains that followed the Russian invasion of Ukraine — but then recovered some of that loss in December. Thermal coal demand has softened slightly as European coal inventories and gas storage levels have risen. European gas storage is near full capacity — and more than double the level of 9 months ago.

Peak seasonal demand over the winter season will test these inventories — as will lingering supply issues, which include flooding in Australia and Indonesia, as well as renewed waves of the COVID-19 pandemic in China. The most recent COVID-19 outbreak in China delayed coal shipments on the Daqin rail network, affecting several of China's northern provinces. Potentially offsetting this, temperatures in Europe have recently been warmer than usual.

Despite the recent declines, thermal coal prices remain at historic highs. Trade volumes are expected to largely hold steady just below their pre-COVID level, with investment shortfalls and peaking demand constraining output. Seaborne trade is forecast to edge down from 1,056 million tonnes in 2021, to around 1,050 million tonnes by 2024. Thermal coal supply is forecast to largely track with demand from 2023.

6.3 World imports

[Higher domestic production has eased price pressure in China](#)

Chinese domestic coal output has grown rapidly over the last two years, and much of the increase appears to have been sustained and not temporary. China successfully added more than 60 million tonnes to its coal production capacity in the September quarter, and monthly coal output in September 2022 was 12% higher than in September 2021. A total of 39 new coal mines have been approved just in Inner Mongolia since July. Coal stockpiles at Chinese major power plants have risen to be higher than 170 million tonnes since September, with the Government ordering generators to prepare for the northern winter when electricity demand typically rises.

China's domestic coal outlook thus remains strong, despite lingering lockdowns in various mining regions and COVID-19-related disruptions to the Daqin rail network. Rail disruptions on the network began when around 200 train drivers in Datong tested positive to COVID-19, forcing many others into quarantine and delaying coal shipments to parts of China's north. The Daqin network also underwent sections of its annual maintenance cycle in October, but the installation of better railings is expected to improve coal transportation over the longer term, reducing some import pressure in China's northern ports.

The growing likelihood of a warm winter period presents a potential downside to Chinese imports, which are already significantly below the level of a year ago. However, disruptions (including those at the Daqin network) have kept coal stocks in northern and western regions of China below normal levels, leaving those areas somewhat vulnerable to cold weather during the winter period. Even a warm winter period would likely see some increase in Chinese demand over the next few months, offsetting the loss caused by COVID-19 containment measures.

Imported thermal coal volumes are estimated to fall by almost 50 million tonnes in 2022, and are expected to keep falling through the outlook period. The Chinese Government previously announced a target of an additional 300 million tonnes of coal from domestic assets in 2022, on top

of 200 million tonnes of capacity added in 2021. Around three-quarters of the additional output is thermal coal, and it is likely that most of the 2022 target will be reached. The government has maintained pressure on domestic coal mines to speed up output, but should warmer than normal weather persist into winter, an upside for coal demand during summer may become a downside to demand over the winter months.

On balance, Chinese imports are expected to decline from 284 million tonnes in 2021 to 222 million tonnes by 2024 (Figure 6.1).

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

Indian coal imports are lifting, on the back of rising domestic electricity demand (which grew by 12% through the year to September). Growth in electricity demand was driven largely by industrial users, with most forms of manufacturing activity expanding in H2 2022. Gas-based electricity generation declined in mid-2022 following a surge in gas prices, resulting in an enhanced role for coal generation over recent months. This trend may reverse should gas prices continue to fall more rapidly than coal prices. Hydro power is also likely to decline as the monsoon season ebbs.

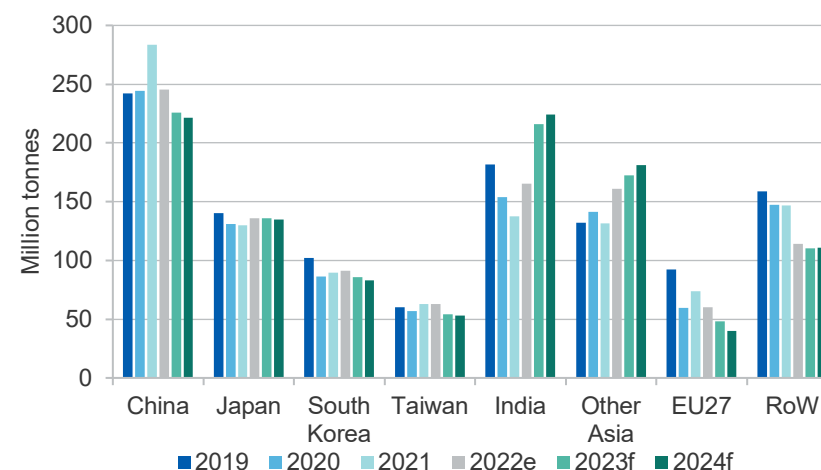
Power demand appears to have grown in the December quarter: partly due to weather and partly due to seasonal festivities. Coal imports are expected to grow in the December quarter and hold there in the March quarter 2023, before building further over subsequent years (Figures 6.1 and 6.2). Given the winter season in India correlates with high demand and low output from some renewable sources, there is potential for demand shocks over the next few months.

Indian thermal coal importers are typically very price sensitive, and will seek first to meet requirements using Indonesian imports. However, a requirement for higher quality in some generator blends (and a further easing in prices) may encourage importers to consider alternative suppliers such as Australia and South Africa.

Japan's coal imports remain elevated due to the closure of nuclear plants

The closure of 54 nuclear reactors in Japan after the Fukushima accident has forced Japan into a structurally greater reliance on coal, and this

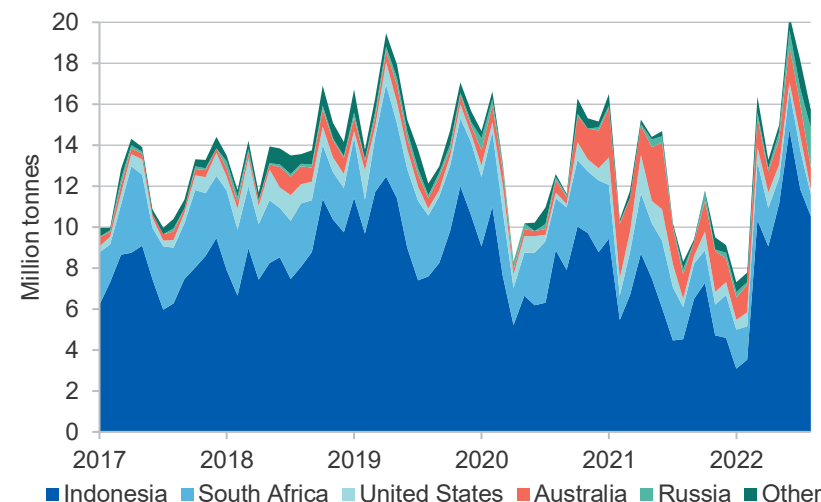
Figure 6.1: Thermal coal imports



Note: e Estimate f Forecast

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

Figure 6.2: India's thermal coal imports, monthly



Source: IHS (2022)

reliance has been exacerbated in recent years by higher gas prices (Figure 6.3). Thus far, only 10 reactors have been re-connected to the grid, and Japan consequently remains vulnerable to thermal coal price shocks. Japan's announced sanctions against Russia have obliged it to seek alternative sources of high quality thermal coal, including greater volumes from Australia. This has resulted in several very high contract price agreements between the two countries (see [Australia section](#)).

The pace of nuclear reactor connections to the power grid is accelerating, with the Japanese Government pushing for more rapid re-openings. The Japanese Government is prioritising a swift opening of 7 more reactors, and at least 12 are expected to be reconnected over the next five years. Ultimately, around half of the 54 closed generators are expected to come back online. Success on this front will see coal imports decline towards the end of the outlook period, with an accelerating pace of decline from 2024.

Taiwan's imports are passing their peak

Taiwan imported more than 7 million tonnes of thermal coal in August — the highest monthly import level since 2017. Taiwanese coal imports typically rise during the September quarter, but imports over the nine months to September were marginally below the level of a year ago. Imports appear to have edged back in the final months of 2022, with further small falls forecast through the outlook period. Taiwan has abandoned plans to upgrade its coal fleet, opting instead to convert existing coal plants to using gas.

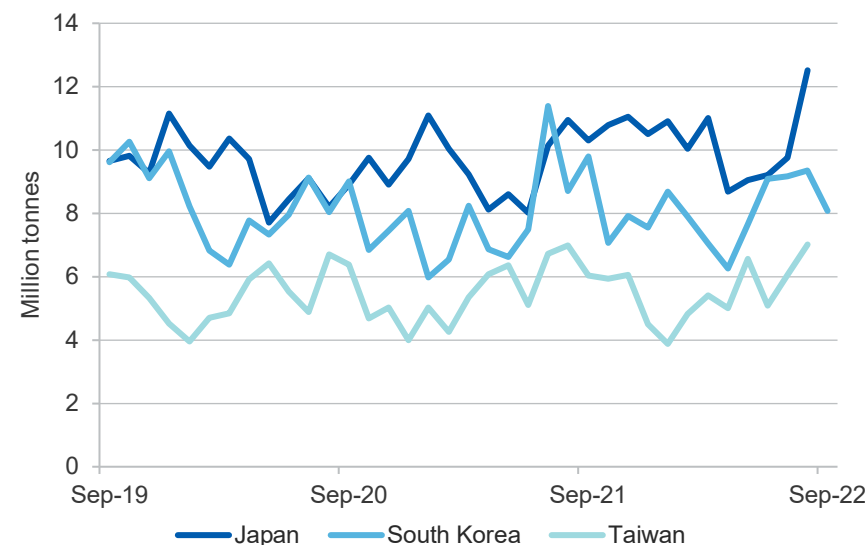
South Korean coal imports will face growing pressure

Imports to South Korea lifted from April (Figure 6.3), but have subsequently eased back in September. South Korea conducted routine maintenance on a number of nuclear plants in 2021 and 2022, but most of this maintenance has now concluded. This should result in reduced pressure on coal imports over 2023, with utilities likely to use the opportunity to cut back on any remaining imports from Russia.

Tight conditions in South Korean energy markets kept imports in the September quarter fairly close to those of the equivalent period in 2021,

but the trajectory is expected to tip down in the final months of 2022. The South Korean government has abandoned the previous government's nuclear phase-down policy, and will instead seek to build nuclear power up, placing coal imports on a downward trajectory over the longer term.

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



Source: IHS (2022)

South East and South Asia imports are set to grow

South Asia is now one of the primary growth markets for thermal coal. Despite the pipeline of proposed coal capacity across South Asian countries falling by 63% between 2015 and 2021, a sizeable number of plants remain under construction. Nations in the region (excluding India) are estimated to have collectively imported about 155 million tonnes of thermal coal in 2022, and this is expected to rise above 175 million tonnes by 2024 (Figure 6.4). South Asian governments are expected to continue prioritising security of supply as electricity generation capacity is rolled out across the region.

Filipino coal consumption is expected to double by the time of its peak, about 2030. Imports over the year to July were 4% higher than in the same period a year ago, and are expected to lift further in 2023 and 2024. The Philippines is expanding its coal output rapidly, with significant amounts of new coal capacity set to pass key construction milestones over the outlook period (though full grid connections will take slightly longer in most cases).

Thailand's coal imports will face some upward pressure over the next few years, as the country pursues long-held plans to increase its industrial output (notably cement production). However, imports lost ground over the eight months to August 2022, falling by 12% from the equivalent period in 2021. Coal plant construction has largely come to a halt in Thailand, with proposed plants cancelled in the Krabi and South Songkhla provinces. Official policy announcements support a reduction in coal use, though this will not have a noticeable impact on coal imports over the outlook period.

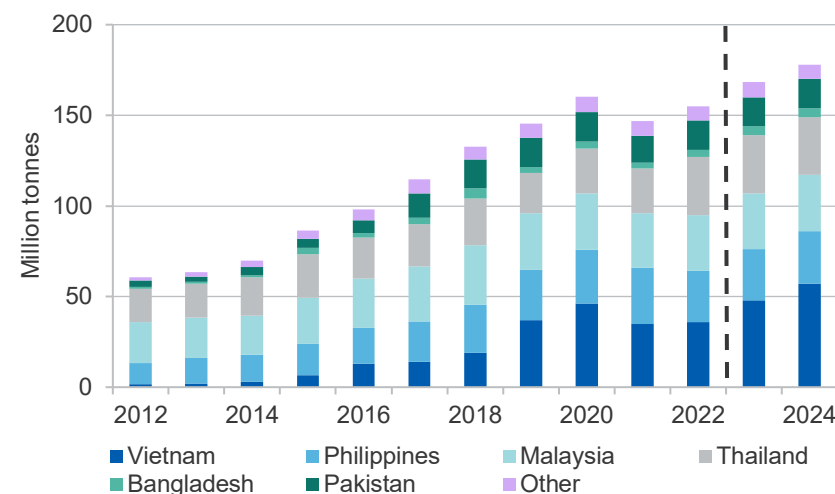
Coal reserves in Vietnam tend to be located in areas of high population density, rendering them largely inaccessible. Vietnam remains highly import dependent, with most imported thermal coal coming from Australia. Many recently built coal plants have been designed to use Indonesian coal, and it is expected that imports of Indonesian coal will rise as coal plants currently under construction are completed. However, plants at the pre-construction stage have largely been abandoned, meaning the peak in Vietnamese coal imports will be sooner and lower than previously thought.

6.4 World exports

Global thermal coal supply chains are now longer and less efficient than they were in 2019, having been disrupted firstly by Chinese informal import restrictions on Australia, and then by sanctions and import cuts from many OECD nations (including the EU, US, Japan and South Korea) against Russia. High grade thermal coal (mostly originating from Australia and Russia) has been particularly affected by longer freight distances, and the price premium for high grade coal grew notably larger in 2022.

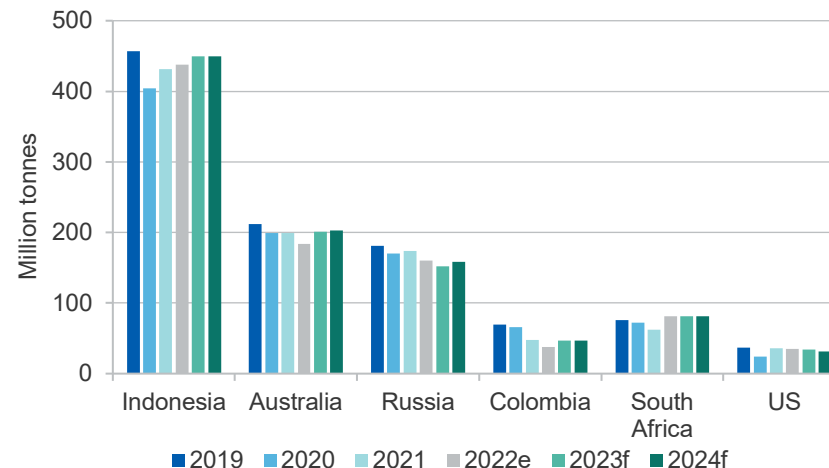
This premium has risen further still because of the needs of many power stations in Europe, which require high grade thermal coal to run properly.

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)

Figure 6.5: Thermal coal exports



Notes: Note: e Estimate f Forecast.

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

Lower grade coal poses performance risks to many of these stations, and substitutes such as metallurgical coal are not used in large amounts due to their lower ignition performance in coal-fired power plants.

A strong premium for high calorific coal has thus favoured Australian exporters in the wake of sanctions on Russia, though this has edged back slightly following the building of sizeable inventories across the EU (Figure 6.5).

Indonesia's exports remain solid despite temporary disruptions

Indonesian exports have been hampered by a series of disruptive weather conditions, which have persisted for almost as long as disruptive weather patterns in Australia. Rainfall has been unusually intense in Indonesia for several years, with repeated floods and infrastructure problems frustrating thermal coal exporters.

The likely end of the La Niña cycle (generally predicted for late in the March quarter 2023) may offset some of this, though much of the rainfall experienced in Indonesia pre-dates the emergence of the latest cycle. Indonesia is also entering a new seasonal rainfall period, with rain levels increasing in October. This is expected to unwind by the March quarter 2023, potentially setting up a rebound for Indonesian thermal coal exports in mid-2023.

Global demand for the lower grades of thermal coal typically exported by Indonesia has begun a long-term decline. However, efforts by Indian importers to make up lost Australian supply have provided a brief rally. Chinese imports of Indonesian coal have also grown, but have recently begun to show signs of peaking as domestic production in China picks up. Any rebound in Indonesian supply will thus come against a backdrop of falling long-term demand, and the two factors together could pull lower grade coal prices down significantly. This would likely occur from early- or mid-2023, though a repeat of poor weather conditions could mitigate some of the prospective price fall.

In volume terms, Indonesian exports are expected to edge up from a (weather disrupted) total of 438 million tonnes in 2022, to reach 450 million

tonnes in 2023 and 2024. Revenue is expected to decline, affected by falling prices in the short-term, and then by falling demand beyond the outlook period.

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

Russian thermal coal export volumes are estimated to have fallen by around one-fifth over the year to September as sanctions took their full effect. Increased shipments to parts of South and East Asia have not been able to make up the loss of markets in Europe, Japan and South Korea. Rail congestion and overuse led to bottlenecks in Taman (Russia's primary export hub to Asia), and this congestion is expected to persist for the full outlook period.

Russian exports thus face potential structural decline despite the high quality of their product. The duration of the war in Ukraine and subsequent sanction regimes remain uncertain.

Russia previously committed to a substantial upgrade of its eastern rail networks, but Western sanctions denying the Russian government access to essential equipment and parts could obstruct these plans. Russian rail capacity allocation to coal producers has been limited over the March quarter 2023, with a preference for higher value cargoes. However, seasonal declines in passenger trips over the winter season may free up some additional rail capacity for potential use by thermal coal exporters.

Emerging shortfalls of essential engineering and maintenance equipment will add to the risk premium for Russian coal, as will the likely curtailment of a range of previously announced investments in Russian mines and rail networks. Coal demand has come under particular pressure in Russia's traditional markets, as European countries seek both to meet climate targets and reduce their structural dependency on Russian energy sources.

Coal supply from Russia to Western Europe is unlikely to ever recover, and ongoing sanctions on equipment and parts will hamper efforts to direct Russian supply to alternative markets.

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

US thermal coal reserves are generally far inland, and rely on long supply chains (which encompass rail and barges), with west coast coal ultimately shipped from ports in California, British Columbia and Vancouver. The long distances and relatively low calorific quality make the US a marginal supplier to the offshore market, feeding export markets mostly when prices are strong.

The US has also been affected by infrastructure issues in recent years, though some of this has been resolved over the last few months. The Curtis Bay coal terminal, which supplies the Atlantic market, faced severe disruptions following an explosion in late 2021, but repairs have progressed, and output has now largely recovered. The restoration of normal function at Curtis Bay should result in stronger exports in the December quarter, though no structural growth in US exports over 2022 as a whole is expected.

Despite infrastructure challenges, the US is currently in the midst of an export earnings peak, supported by high prices and previous surges in European demand. However, net zero emission targets in key markets, high cost structures, and lack of investment in domestic capacity are all expected to bring exports down steadily during the outlook period, and more rapidly beyond it.

Colombian exports are not expected to recover fully

Colombian coal exports face challenging conditions. Mines have been affected by heavy rainfall over 2022, with the scale of the challenge increasing following the commencement of the latest La Niña cycle. Rain has blocked the largest rail lines (Cerrejon and Fenoco), and recent protests by traditional owners have led to further constraints. Mine output has increased in some areas, however, with production at Cerrejón almost tripling between January and September.

Supply chains connecting mines to export markets remain fraught, causing bottlenecks at rail and ports. Exports are expected to rebound in 2023 and 2024.

Long term prospects depend on the success of the Colombian Government in enabling expanded mine operations, and the success of Colombian exporters in finding alternatives to (falling) European demand. However, with some mines having been permanently closed in recent years, it is not expected that Colombia will reach its pre-COVID export levels.

South African exports are lifting

South African exports have grown in recent months, as suppliers ramp up output to meet European demand. Exports to India have also increased, as price-sensitive Indian buyers respond to the recent easing in seaborne prices. Maintenance at the Richards Bay Coal Terminal, which affected production in mid-2022, has now concluded, allowing recent output to expand in line with growing demand in South Africa's northern markets. Strike action affecting Transnet (South Africa's primary rail shipment network) largely ceased in September, adding further to the prospects of a significant rebound in South African coal exports in the December quarter 2022.

6.5 Prices

Prices are expected to decline but remain high compared to the past

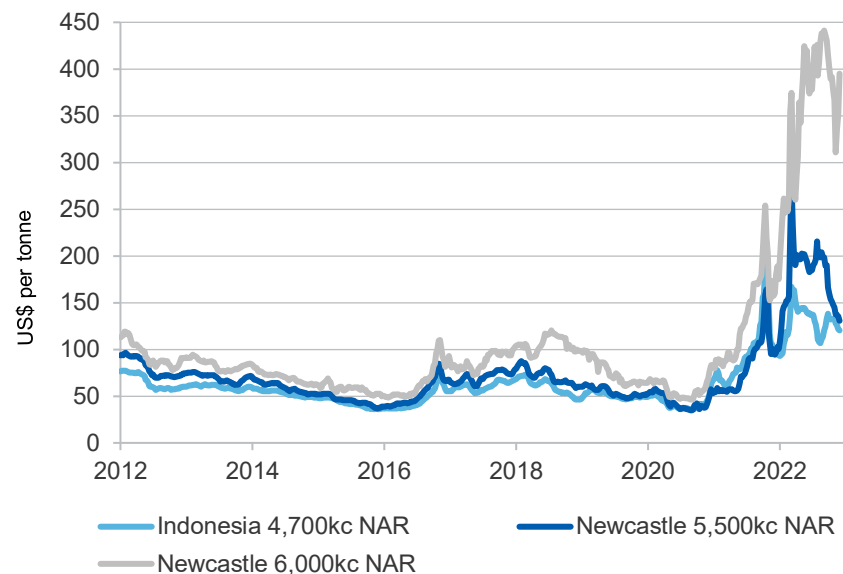
The recent decline in thermal coal prices is expected to continue, as factors behind the record price surge of mid-2022 continue to unwind.

Demand pressure is expected to ease from March with the passing of the Northern Hemisphere winter. Demand over winter itself is expected to be relatively well managed, especially with the rise in European inventories over recent months. The rise in inventories in Europe has seen some narrowing in the large price differential between higher-grade and mid-grade coal (Figure 6.6). European plants require high-grade thermal coal to operate efficiently, and were obliged to outbid other buyers for this coal after sanctions against Russian thermal coal exports took effect. However, this factor has become less pronounced as inventories have been built.

Weather disruptions in particular have a strong prospect of easing with the likely passing of the La Niña cycle.

Price pressures may briefly rebuild during the winter season if inventories decline more rapidly than expected. There is also a risk that prices could lift ahead of the winter period in 2023, when Europe potentially faces further energy shortages.

Figure 6.6: Thermal coal prices — Australian vs Indonesian



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

6,000 kcal Newcastle coal prices are expected to decline from US\$360 a tonne in 2022 to around \$US200 by 2024. However, prices are not expected to shift all the way back to pre-COVID levels in any foreseeable timeframe. Thermal coal remains subject to challenges with finance, insurance and long-term global demand, all of which have made supply side responses slow and difficult to manage. These factors will likely become more forceful over time, putting the sector into a permanent higher price phase. This is expected to reduce its competitiveness relative to other energy sources over the longer term.

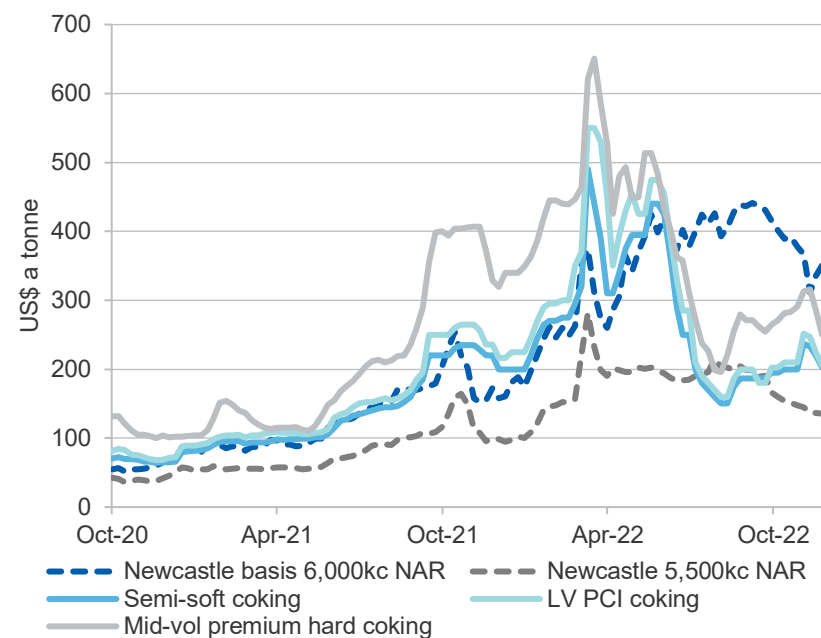
6.6 Australia

Australian thermal coal exporters continue to face disruptions

Australian coal producers continue to face strong price conditions, but this has been paired up with persistent difficulties in getting sufficient supply to market. These difficulties reflect ongoing weather issues: heavy rain and persistent flooding in NSW and Queensland have affected most of the coal supply chain, flooding mine pits and disrupting freight rail linkages. Monthly volume movements remain unusually volatile, as producers deal with the aftereffects of almost two years of disruptive weather conditions.

Reflecting the impact of these weather conditions, Glencore has lowered its 2022 coal production guidance by 9%, while Coronado Global Resources has cut its guidance by around 5%.

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



Source: IHS Markit (2022)

Despite high coal prices, many companies have been avoiding making significant investments. Glencore has been seeking to invest in new capacity, however its Glendell Continued Operations project was rejected by the NSW Independent Planning Commission. Other thermal coal investment prospects remain limited, with notable examples including Centennial Coal (in its Angus Place West mine), Delta Coal (in its Chain Valley Extension), and Mach Energy (in its Mount Pleasant Optimisation Project).

Spot prices have declined in recent weeks (Figures 6.6 and 6.7), but contract prices are likely to be supported by the recent announcement that Glencore and Tohoku have settled on a new supply agreement. Ordinarily, such contracts cover the Japanese fiscal year (commencing in April), but an unusually long period of negotiation between the parties means that the latest deal started six months late (from October 2022).

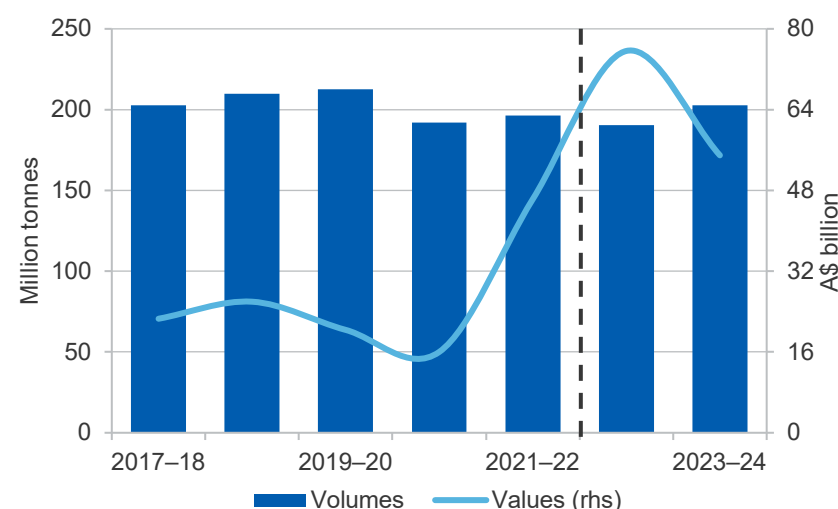
The announced price under the new contract is US\$395 a tonne for Glencore's premium GAR 6,322 kcal/kg coal. This is more than three times as high as the \$110 a tonne agreed between the parties in early 2021. This is also higher than the \$375 a tonne contract price agreed between Glencore and Nippon steel in mid-2022, which was itself a record.

Other prices in the Asian region are likely to be influenced by these results, as contract negotiators often use common benchmarks in pricing formulas. This is expected to underpin strong revenue on the contract side for Australian suppliers over the coming year. The surge in contract prices reflects higher competition between Japanese and European importers seeking Australia's high quality product, with the latest contract price outcome exceeding recent spot price results.

Prices are expected to decline but remain volatile and high compared to historical levels, with weather disruptions likely to persist through the remainder of the La Niña cycle (potentially to March 2023). Cyclones could pose a particular risk over the March quarter, but are expected to subside by mid-2023.

Export volumes are expected to increase marginally over the outlook period (Figure 6.8), with disruptions easing and output ramping up at the Carmichael mine in Queensland. Thermal coal exports are forecast to rise from 196 million tonnes in 2021–22 to 203 million tonnes by 2023–24. However, prices will likely remain subject to significant volatility, albeit with some overall ebbing over the next 12-24 months. Export values are forecast to rise from \$46 billion in 2021–22 to more than \$75 billion in 2022–23, before easing to around \$55 billion by 2023–24.

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 \$13 billion in 2022–23, and \$17 billion in 2023–24. Thermal coal export earnings are now expected to be around US\$130 billion over the full outlook period. Revisions reflect the extended La Niña cycle, which will likely add to prices over the next two years. The fallout from the Russian invasion of Ukraine has also 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	1,056	1,036	1,048	1,049	-1.8	1.2	0.1
Thermal coal imports								
Asia	Mt	835	862	890	898	3.2	3.3	0.9
China	Mt	284	246	226	222	-13.4	-8.2	-1.8
India	Mt	138	165	216	224	19.9	31.0	3.7
Japan	Mt	130	136	136	135	4.8	0.0	-0.7
South Korea	Mt	90	91	86	83	1.5	-5.5	-3.5
Taiwan	Mt	63	63	54	53	0.1	-14.3	-1.3
Thermal coal exports								
Indonesia	Mt	432	438	450	450	1.4	2.7	0.0
Australia	Mt	199	184	201	203	-7.4	9.1	1.0
Russia	Mt	174	160	152	158	-7.9	-5.0	3.9
Colombia	Mt	48	38	47	47	-20.2	23.7	0.0
South Africa	Mt	63	81	81	81	29.5	0.0	0.0
United States	Mt	36	35	34	31	-3.2	-2.9	-8.8

Notes: ^f Forecast ^s Estimate

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 ^f	2032 ^f	2024 ^f
Contract prices ^b								
– nominal	US\$/t	110	375	319	215	241.0	-14.9	-32.6
– real ^c	US\$/t	118	375	311	205	217.4	-17.1	-34.1
Spot prices ^d								
– nominal	US\$/t	135	360	292	197	167.2	-19.0	-32.5
– real ^e	US\$/t	145	360	282	186	147.3	-21.7	-34.0
Australia	Unit	2020–21	2021–22	2022–23 ^f	2023–24 ^f	2021–22 ^s	2022–23 ^f	2023–24 ^f
Production	Mt	228	246	257	253	8.0	4.4	-1.3
Export volume	Mt	192	196	190	203	2.2	-3.0	6.6
– nominal value	A\$m	16,009	46,274	75,622	54,951	189.1	63.4	-27.3
– real value ^h	A\$m	17,911	49,570	75,622	52,468	176.8	52.6	-30.6

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 2022–23 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 sector



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

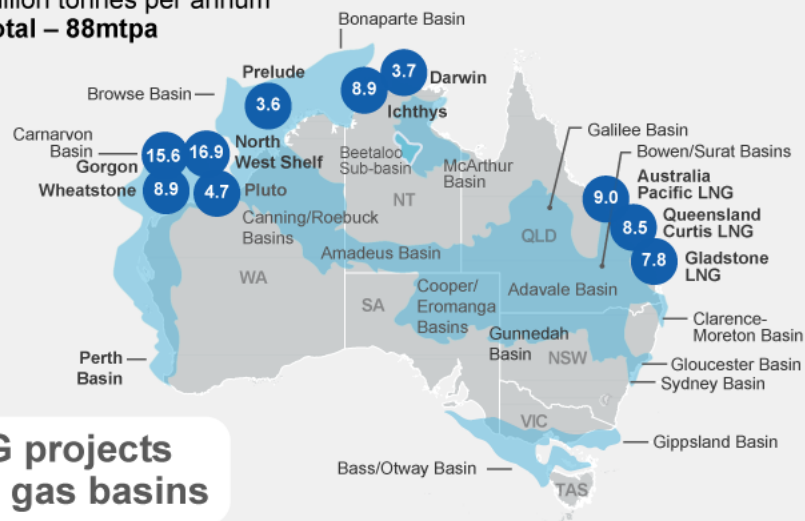


88m tonnes
per annum total
LNG nameplate
capacity



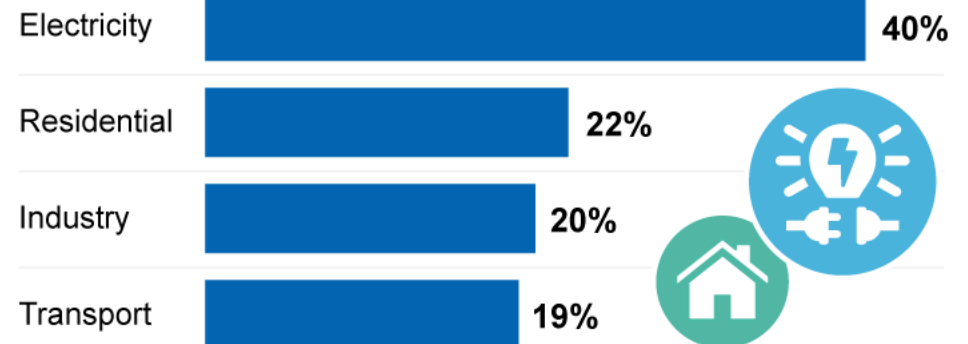
Around 3/4
sold on
long-term
contracts

- Gas basin
- Nameplate capacity,
million tonnes per annum
Total – 88mtpa



LNG projects and gas basins

Global gas use by sector



Steel facts



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



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

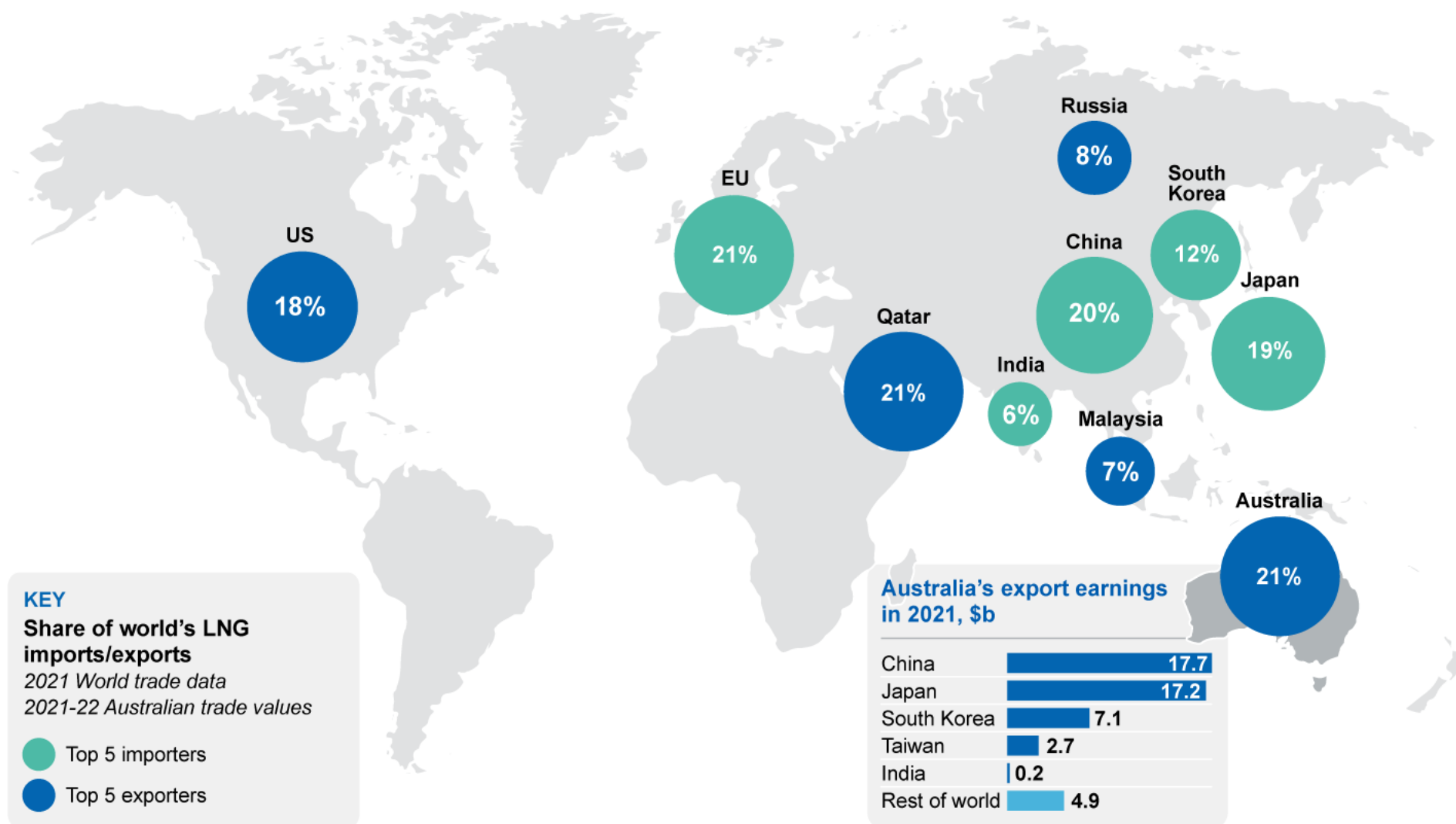


Natural gas made
up **23%** of the 2020
global electricity
generation mix



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

LNG TRADE MAP



7.1 Summary

- Australia's LNG export revenues are forecast to reach \$90 billion in 2022–23, on record high global energy prices and a lower Australian dollar. Earnings are forecast to fall to \$75 billion in 2023–24.
- After reaching 83 million tonnes (Mt) in 2021–22, Australia's LNG export volumes are forecast to decline then stabilise at around 81 Mt in 2024.
- Spot prices for Asian LNG are forecast to average US\$33/MMBtu and US\$27/MMBtu in 2023 and 2024 respectively, as global gas markets continue to reorganise following the curtailment of Russian pipeline gas supply to Europe.

7.2 World trade

Australian export earnings rise amidst global volatility

Global LNG markets are likely to remain highly volatile over the outlook period. The ongoing fallout from Russia's invasion of Ukraine has seen gas/LNG markets continue to reorganise.

Russian pipeline exports of natural gas to Europe have declined to 70 million cubic metres per day (mcm/d) as of 14 November, which is 79% below imports from the same time in 2021 and 84% below imports from the same period in 2020. On a cumulative basis, in 2022 Russian pipeline exports have fallen by 60 billion cubic metres, equivalent to 12% of the global LNG trade in 2021.

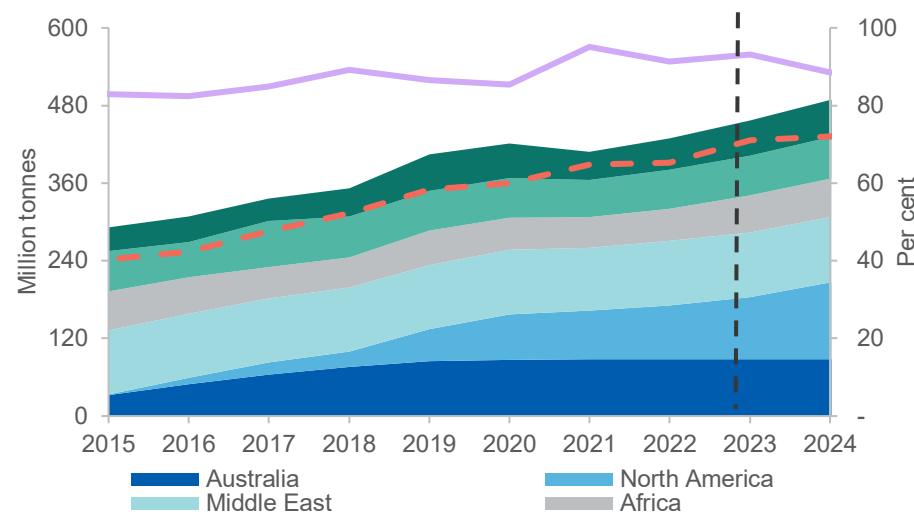
Europe has been able to offset lower pipeline gas from Russia with higher US LNG imports, as well as make gas-to-oil and other substitutions. Mild temperatures have also temporarily eased gas demand for space heating, and there has been significant demand destruction due to high prices. As a result, European storage inventories are entering winter at around 90% capacity, approximately 21% above 10-year averages. LNG prices remain at historically elevated levels, though have eased from recent highs as demand has moderated. The rate of decline of inventories of energy during the Northern Hemisphere winter remains a key consideration in the near term.

Looking ahead to the March quarter 2023, markets remain at risk of further tightening, particularly if strong Chinese LNG demand re-emerges. China could continue to relax restrictions associated with its dynamic zero-COVID policy in coming months, while plunging winter temperatures could lead to a spike in gas demand for space heating and power generation. Either occurrence could see a return to the levels of volatility witnessed earlier in 2022.

Australian LNG exports continue to play a crucial role in providing LNG supply to tight global markets. Australia earned \$25 billion from LNG exports in the September 2022 quarter alone: the highest quarterly earnings on record and only marginally below earnings for the full year 2020–21 (when earnings reached \$30 billion).

Earnings are estimated to reach \$23 billion in the December 2022 quarter, as rising export volumes partially offset the impact of falling spot prices. For 2022–23, exports are forecast to reach \$90 billion. However, earnings are forecast to ease to \$75 billion in 2023–24, as US supply rises and markets reorganise further.

Figure 7.1: Global LNG Demand and Capacity Utilisation



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

7.3 World imports

High prices and lockdowns weigh on China's LNG imports

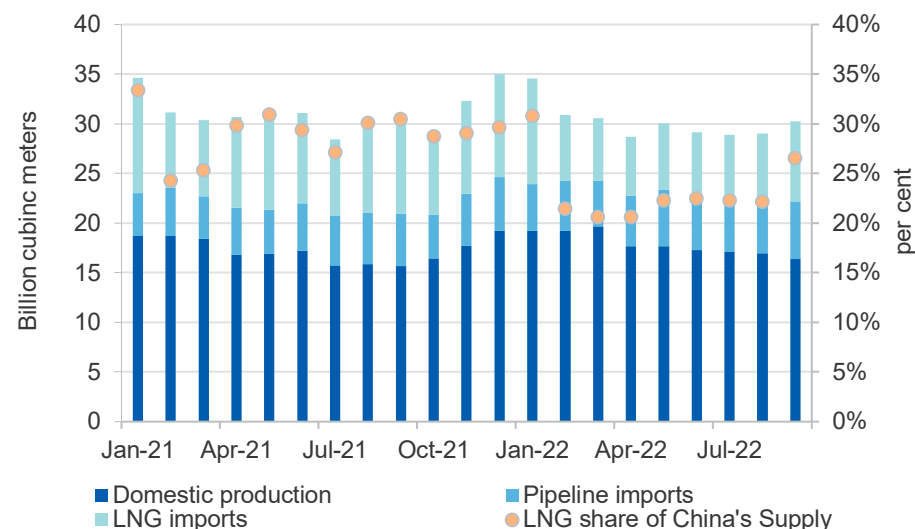
China's LNG imports fell to 15 Mt in the September quarter 2022, down by 22% from September quarter 2021. Australia's LNG exports to China have fallen from 7 Mt to 5 Mt over the same period, and now accounts for only 32% of China's total LNG imports. Meanwhile, China's LNG imports from Russia rose 33% year-on-year in the September quarter 2022 to 2 Mt. Russia now supplies 13% of China's LNG (Figure 7.3).

China's falling LNG demand in the September quarter 2022 follows subdued domestic gas demand and higher gas supply from pipeline imports and domestic production. China's LNG demand is highly seasonal, with imports typically peaking over December and January.

However, much will depend on the price sensitivity of China's LNG buyers and the need for gas-powered generation in the electricity sector (which typically acts as a form of peaking generation). China only obtains 25% of its gas from LNG imports. Most of China's gas supply is produced domestically (57%), and a sizable quantity is imported via pipelines from Russia and Central Asia (see Figure 7.2).

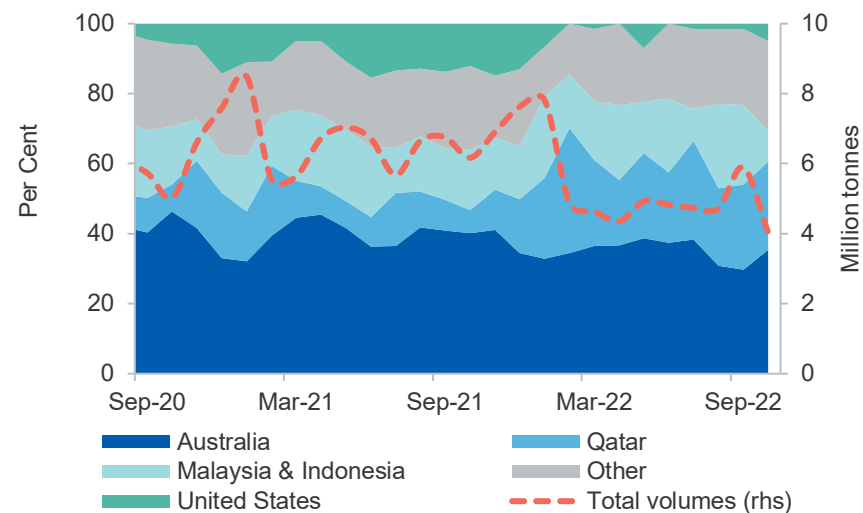
Gas consumption in China is similarly diversified, with the electricity and industrial sectors each accounting for roughly 24% of China's gas demand. The residential sector makes up roughly 20% of gas consumption, with the remaining consumption occurring in the transport and commercial sectors. The diversity of China's gas consumers and sources of gas supply could increase the price elasticity of China's LNG demand. For example, China's industrial users may become more price-sensitive, due to their exposure to international competition. At the same time, the availability of alternative gas supplies could make generators reluctant to purchase uncontracted LNG cargoes. As a result, there remains a possibility that China's demand for LNG could remain muted, even as the nation emerges from severe COVID restrictions.

Figure 7.2: Chinese Gas Supply by source



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

Figure 7.3: China's LNG imports by volume and source



Source: Kpler (2022)

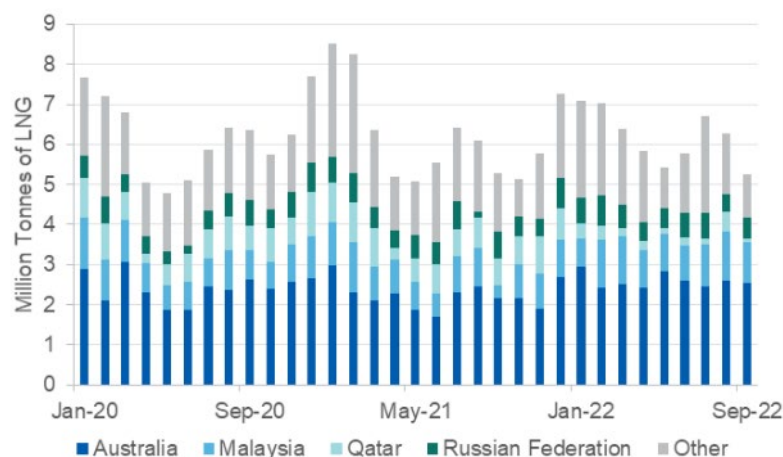
Persistently volatile LNG prices over the outlook period are expected to reduce the competitiveness of LNG relative to other natural gas sources — domestically produced or pipeline imports. As a result, China's LNG demand is forecast to fall by 19% to 67 Mt in 2022, with imports only modestly recovering to 79 Mt by 2024.

Japan's imports hold firm in September quarter

Japan's LNG imports were up by 2.3% year-on-year to reach 17 Mt in the September quarter 2022 (compared with 16 Mt in the September quarter 2021) (Figure 7.4).

Rising Australian exports helped offset falling LNG imports by Japan from the US and Qatar, which collectively fell by 64% year-on-year, from 3.7Mt to 1.3Mt in the September quarter 2022. Japan chose not to renew several long-term LNG contracts with Qatar at the beginning of 2022 and uncontracted US LNG cargoes have been redirected to higher priced European markets. Australian LNG exports to Japan rose 9.5% over the same period, reaching 7.6 Mt in the September quarter 2022 (compared with 7.0 Mt the year before).

Figure 7.4: Japan's LNG Imports



Source: Kpler (2022)

Unlike China, Japan obtains virtually all of its gas via LNG imports. Approximately 70% of Japan's gas consumption is concentrated in the power generation sector. As a result, Japan's LNG imports are much more sensitive to both weather-related changes in electricity demand and to the competitiveness of gas relative to other types of power generators (such as coal and nuclear).

Japan's LNG imports are expected to rise in the December and March quarters as cold temperatures increase domestic gas demand. To support near term purchases of LNG, Japan's largest LNG importer (JERA) has secured over US\$1 billion in credit from Japan's state-owned bank, the Japan Bank for International Co-operation.

Over the outlook period, Japanese LNG imports are expected to fall to about 70 Mt in 2024, as the electricity sector shifts away from gas (Figure 7.5). According to METI, Japan plans to reduce gas' share of total electricity generation from 38% in 2022 to 27% by 2030, while the share of nuclear power could go from 6% to 22% over the same period.

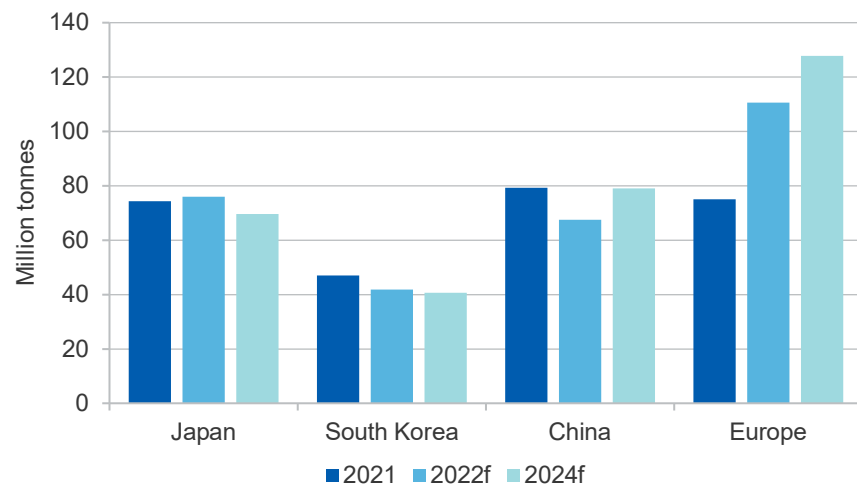
Korean imports remain steady amidst high prices

South Korea's LNG imports in the September quarter 2022 fell by 1.5% year-on-year to 11 Mt. Australian exports to South Korea remained stable at 2.7Mt (up 0.1 Mt since the September quarter 2021).

South Korea sources all of its gas from LNG imports, over half (55%) of which is consumed in the power sector to generate electricity. Of the remainder, 16% is used by the industrial sector (typically as a chemical feedstock or as a source of industrial heat), and 26% is used in the commercial and residential sectors.

To reduce the call on gas over winter, the South Korean government plans to increase available capacity from nuclear and coal-fired power. To support LNG purchases, the South Korean government has also agreed to extend its tariff exemption to LNG imports until the end of March 2023. High gas prices and the construction of new nuclear facilities will restrain growth in South Korean LNG imports. As a result, LNG imports are forecast to fall slightly to 41 Mt by 2024 (Figure 7.5).

Figure 7.5: World LNG demand forecasts



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

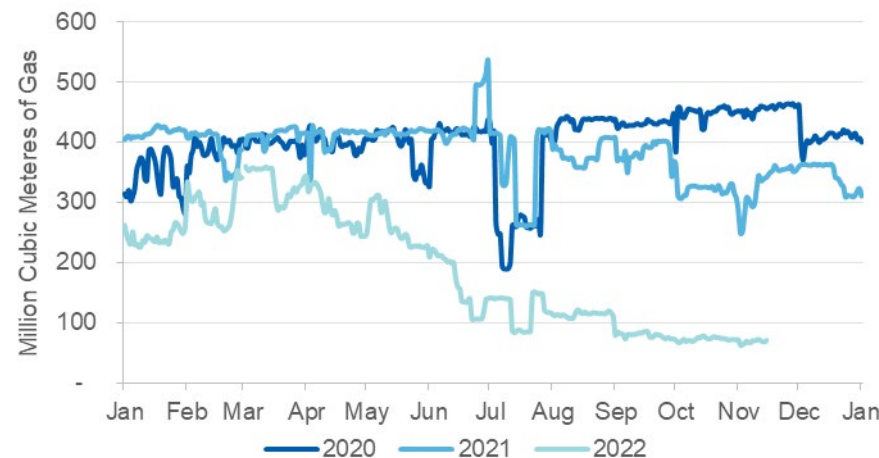
European inventories reach full capacity in preparation for winter

Total pipeline imports from Russia fell almost 72% year-on-year, dropping from 34 to 10 billion cubic meters between the September 2021 and 2022 quarters, respectively.

Russian pipeline flows to Europe were averaging 71 mcm/d as of 14 November, compared to 445 and 347 mcm/d for the same time in 2020 and 2021, respectively. The cumulative losses from Russian pipeline gas now amounts to roughly 60 bcm in 2022 (Figure 7.6).

European LNG imports rose 91% year-on-year in the September quarter 2022 to 37 billion cubic meters (bcm) compared to 19 bcm in September 2021 quarter. Higher European LNG imports — up by 44 bcm year-on-year in 2022 — have helped offset the impact of falling pipeline imports from Russia (Figure 7.7). Despite European efforts to replace Russian pipeline gas with LNG, Russia remained Europe's third largest LNG supplier in the September quarter 2022, accounting for 12% of Europe's LNG supply.

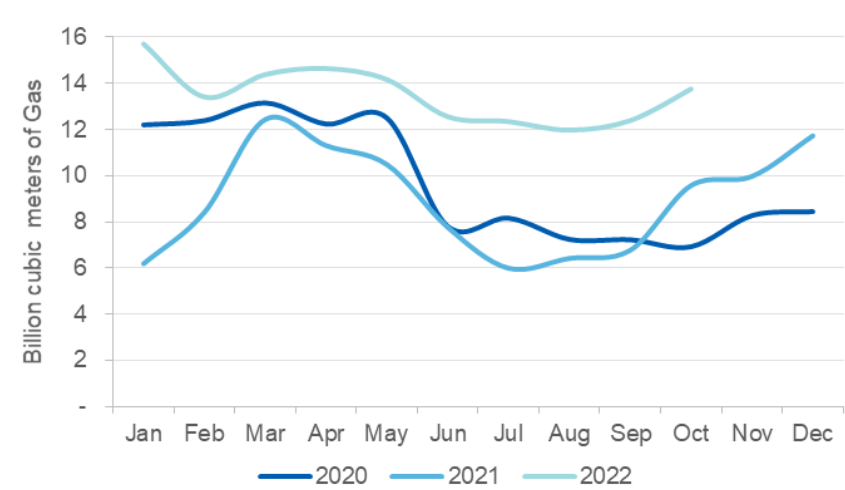
Figure 7.6: Russian Pipeline Exports to Europe, 2020-22



Notes: Includes all Russian pipeline exports to Europe that transit to Ukraine, Poland, Turkey and Germany.

Source: ENTSOG Transparency Platform (2022); Department of Industry, Science and Resources (2022)

Figure 7.7: European LNG imports, 2020-22



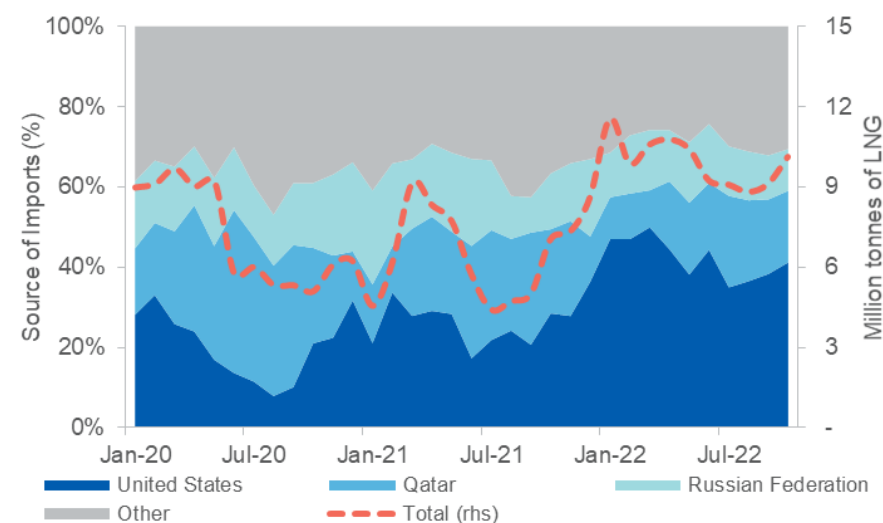
Source: Kpler (2022)

So far, LNG exports from Russia to Europe have risen 87% year-on-year, but the possibility of future Russian curtailments cannot be discounted (Figure 7.8).

The combination of higher LNG and pipeline imports from Norway and Algeria (supplemented by modest Russian pipeline imports in the first half of 2022) enabled the Europeans to bolster their gas storage inventories in the lead-up to the Northern Hemisphere winter. As a result, European storage inventories in November were around 95% full (Figure 7.9).

Additionally, favourable weather conditions in October and November have helped eased European gas demand for space heating, and weather forecasts suggest that winter temperatures in Europe could be warmer than average. The confluence of favourable events has placed Europe in the best position to deal with the coming winter. However, these circumstances are unlikely to repeat themselves in late 2023 as the cumulative losses from Russian pipeline imports begin to mount.

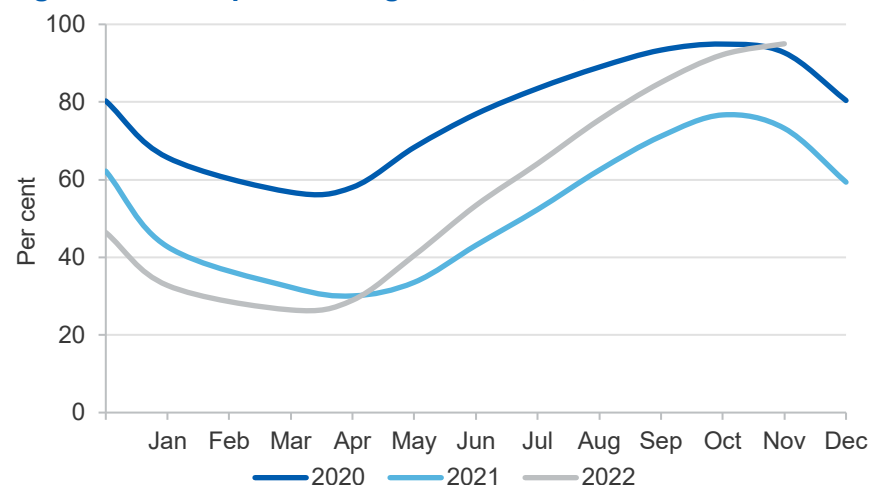
Figure 7.8: European LNG imports by source, 2020-22



Notes: Other producers include: Algeria, Nigeria and Trinidad and Tobago

Source: Kpler (2022)

Figure 7.9: European Storage Inventories, 2020-22



Source: Bloomberg (2022); Eurostat (2022)

The IEA has warned that Europe could face a 30-bcm shortfall next summer, a critical period for refilling European storage inventories. An assessment completed by the European Network of Transmission System Operators for Gas (ENTSO) warned that the security of Europe's gas system could deteriorate markedly over the next year if storage inventories deplete by April 2023. According to ENTSOG's modelling, if stocks are exhausted by the end of winter, some countries in Central and South-Eastern Europe could be struggling to reach 15% storage capacity by October 2023.

As such, the European market could become much tighter and more dependent on LNG in 2023 than in 2022. This higher dependency on LNG would necessitate the purchase of uncontracted cargoes through 2023, supporting spot LNG prices over the outlook period.

European LNG imports are expected to rise 43% year-on-year in 2022, reaching 111 Mt. Imports are expected to peak at 126 Mt and 128 Mt in 2023 and 2024, respectively, as infrastructure bottlenecks begin to limit the continent's ability to absorb additional LNG imports.

Taiwan's imports have been stable

Taiwan's gas is supplied exclusively via LNG facilities, and roughly 83% is consumed to generate electricity. After electricity, the next largest sector by gas consumption is industry (10%), with the commercial and residential sectors comprising the remainder. Taiwan's LNG imports in the September quarter 2022 rose 8% year-on-year to 5.6 Mt. Australian LNG exports to Taiwan rose 45% to 2.2 Mt over the same period. Taiwan's imports in the September quarter 2022 lifted as the nation attempted to rebuild storage inventories to prepare for peak winter heating demand. Taiwanese LNG imports are expected to stabilise at around 20 Mt per annum over the outlook period.

7.4 World exports

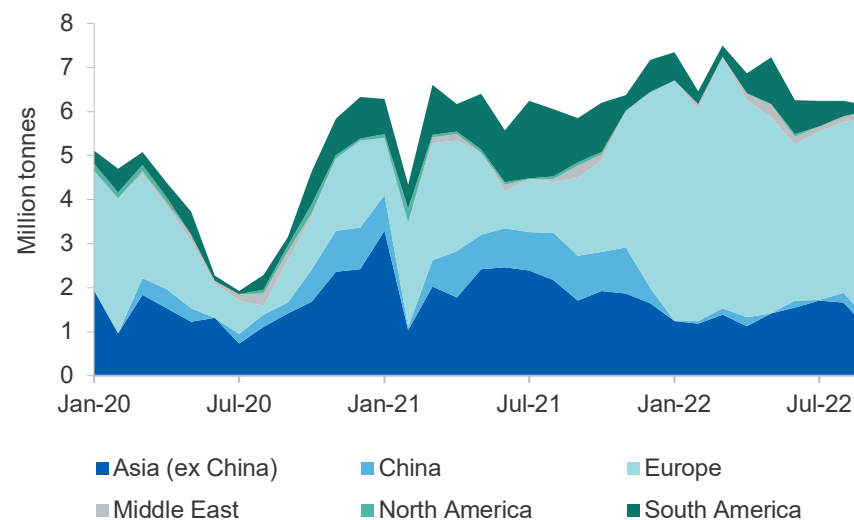
US LNG redirected to Europe amidst market reorganisation

US LNG exports fell 8% year-on-year in September quarter 2022 to 17.9 Mt, with exports weighed down by production disruptions at the Freeport LNG facility. This include a fall of 46% year-on-year (to 5 Mt) of US exports to Asia in the September quarter, as US suppliers continued to pivot towards Europe (Figure 7.10).

On 8 June, a pipeline connecting Freeport's LNG storage tanks to the LNG docking facilities caught fire, leading to the complete suspension of exports for the facility. Freeport LNG has a nameplate capacity of approximately 15 million tonnes of LNG per annum. In early December, Freeport LNG again delayed restart of its facility, and is now aiming to resume operations by year's end, pending regulatory approval.

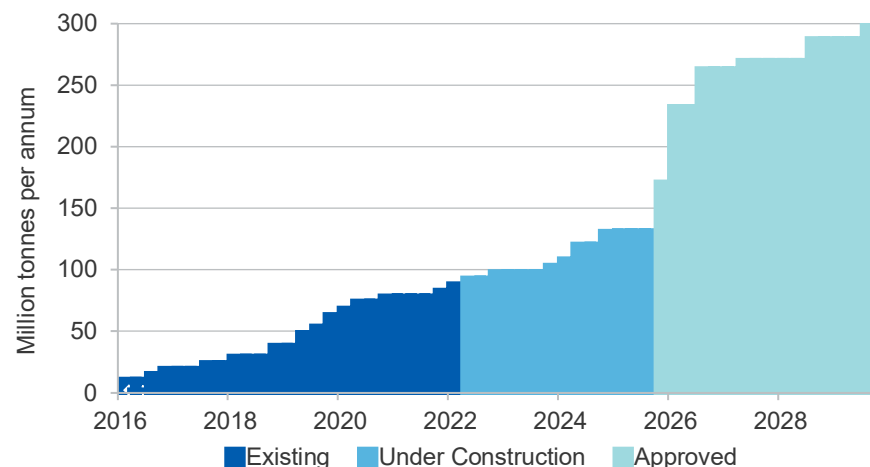
In the September quarter 2022, 63% of all US LNG exports (or around 15 Mt) were destined for Europe (Figure 7.10), with the remainder exported to Asia (25%) and South America (12%). The result contrasted heavily with the September quarter 2021, when half of all US LNG exports were exported to Asia. The reversal in flows matches changing pricing dynamics for global LNG, as Europe begins to outbid Asian buyers for US LNG supply in the wake of the fallout from Russia's invasion of Ukraine (see [Prices section](#)).

Figure 7.10: US LNG exports by destination, 2020-22



Source: US Energy Information Agency (2022)

Figure 7.11: US LNG capacity projections, 2016-24



Notes: Projects under construction include Golden Pass trains 1-3, Plaquemines LNG Phase 1, and Corpus Christi Liquefaction Stage 3

Source: US Energy Information Agency (2022)

The US is forecast to export 73 Mt of LNG in 2022, with the fall in LNG production from Freeport LNG partially offset by the impact of new facilities at Calcasieu and Sabine Pass. The two facilities are expected to lift US LNG nameplate capacity to 92 Mt in 2023 (Figure 7.11).

Four more LNG trains currently under construction (Golden Pass and Plaquemine's LNG phase one) are expected to boost US LNG capacity to 114 million tonnes per annum (Mtpa) by the end of 2024. However, it will likely take an additional year for the facilities to ramp up to full capacity. Another train, Corpus Christi Liquefaction Stage Three, is also under construction, but is not expected to ship its first cargo until March 2025. Corpus Christi stage three will boost the US's LNG capacity by an additional 10 Mt to 114 Mtpa.

Several proposed US LNG projects could fundamentally alter the global LNG market beyond the outlook period. There are currently 13 proposed LNG facilities (pre-FID) with a combined liquefaction capacity of over 180 Mtpa. If these facilities proceed to a final investment decision, they could triple the US's LNG export capacity to over 300 Mtpa.

Qatar exports stabilise, but larger volumes are on the horizon

The volume of Qatari exports was stable at 20 Mt in the September quarter 2022. Exports to Asia and Europe were largely unchanged from the September quarter 2021, with approximately 13.9 Mt exported to Asia and around 5.2 Mt to Europe. The Qatari Government has repeatedly stated that Qatar cannot materially boost its LNG supply in the short term, despite high prices and strong global demand for LNG.

Qatar is projected to expand its LNG export capacity in the coming years. However, export volumes are not expected to increase meaningfully during the outlook period. The expansion will be 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 export capacity is expected to rise to around 107 Mtpa by 2026.

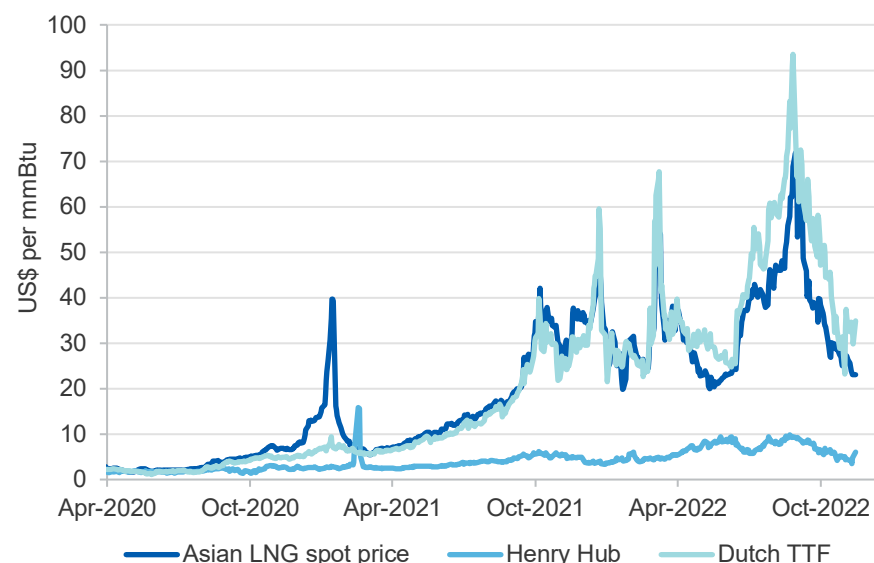
7.5 Prices

LNG prices experienced large volatility during September Quarter

Asian LNG spot prices were extremely volatile in the September 2022 quarter, due to shifting supply dynamics in European gas markets.

Prices rose from US\$23/MMBtu on 1 June to US\$72/MMBtu on 1 September, following Russia's suspension of gas flows along the Nord Stream pipeline. The outage at the Freeport LNG facility in June placed further upward pressure on gas prices. However, the combined impact of full European storage inventories, warm temperatures and sustained LNG imports has moderated LNG prices in recent months, easing to US\$23/MMBtu in November (Figure 7.12).

Figure 7.12: Global gas and LNG prices, 2020-22



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

Source: Argus (2022); Bloomberg (2022)

Volatile prices have spurred European policymakers to consider intervention in their domestic gas markets. The European Commission has proposed regulations for an intra-day volatility management mechanism to safeguard consumers against large price movements in spot markets, but only within daily trading intervals. The EU has also proposed a joint-purchasing tool for gas that would enable member states to aggregate their demand and coordinate the joint purchase of natural gas to exercise buying power and lower prices. While the tool may reduce intra-European competition for LNG cargoes, any pan-European buyers group would still need to compete with Asian buyers on global markets for LNG.

Prices remain high and volatile for the remainder of the outlook period

Prices are forecast to remain high and volatile over the outlook period, as global gas markets continue to reorganise following the curtailment of Russian pipeline gas supply to Europe. Prices are forecast to average US\$33/MMBtu and US\$27/MMBtu in 2023 and 2024, respectively.

Several factors are driving the outlook for prices in 2023 and 2024. Firstly, only a limited number of new LNG facilities will come online over the outlook period, and these facilities will not be able to offset lost Russian volumes. Secondly, assuming that Russian flows hold at their current rate next year, total European imports of Russian gas could amount to as little as 26 bcm over 2023 (compared to 140 bcm in 2021 and 146 bcm in 2020).

Because there are no alternative Russian pipelines or LNG facilities with the capacity to redirect these volumes to alternative buyers, the net effect of these reduced imports will be to tighten global LNG markets. There also remains a risk that easing COVID-19 restrictions in China could spur a surge in China's LNG demand.

Spiking oil prices in Q1 2022 flow through to LNG contracts

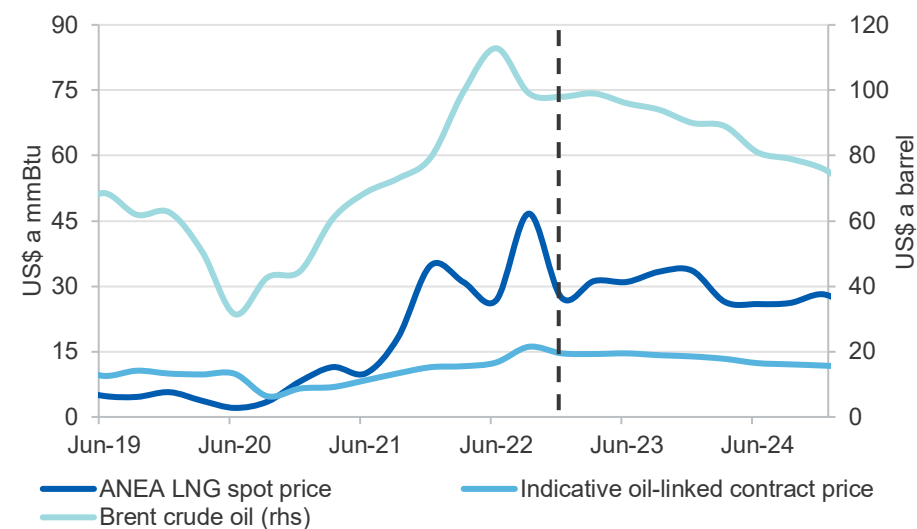
High oil prices in the June and September 2022 quarters have started to flow through to most of Australia's long-term LNG contracts. Around 80-90% of Australian LNG exports are sold under long-term contracts that link

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 remained elevated in the September quarter 2022, following the fallout of Russia's invasion of Ukraine. In the September quarter, prices averaged US\$109 a barrel in July, US\$98 a barrel in August and US\$91 a barrel in September (estimate) — with the quarter average up 34% year-on-year.

Oil-linked LNG contract prices are expected to average around US\$14/MMBtu and US\$12/MMBtu over 2023 and 2024, respectively. These levels are consistent with an oil price of US\$103 a barrel in 2022, US\$95 in 2023 and US\$80 a barrel in 2024 (Figure 7.13).

Figure 7.13: LNG spot and contract prices, 2019-24



Notes: ANEA is the Argus Northeast Asian 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 and Resources (2022)

7.6 Australia

Australia's LNG earnings rise amidst tight global energy markets

In the September quarter 2022, Australian LNG export earnings reached \$25 billion, up 79% compared to the September quarter 2021. This marks the highest quarterly earnings from Australia's LNG exports on record. Earnings in the December quarter 2022 are estimated to hold at \$22 billion, as higher export volumes partially offset the impact of lower LNG spot prices.

The value of Australia's LNG exports in 2022–23 is forecast to reach around \$90 billion, driven by high LNG spot prices and high oil prices (Figure 7.14). However, revenues are forecast to drop to \$75 billion in 2023–24, as global energy prices subside and export volumes ease.

Australia's export volumes set to ease

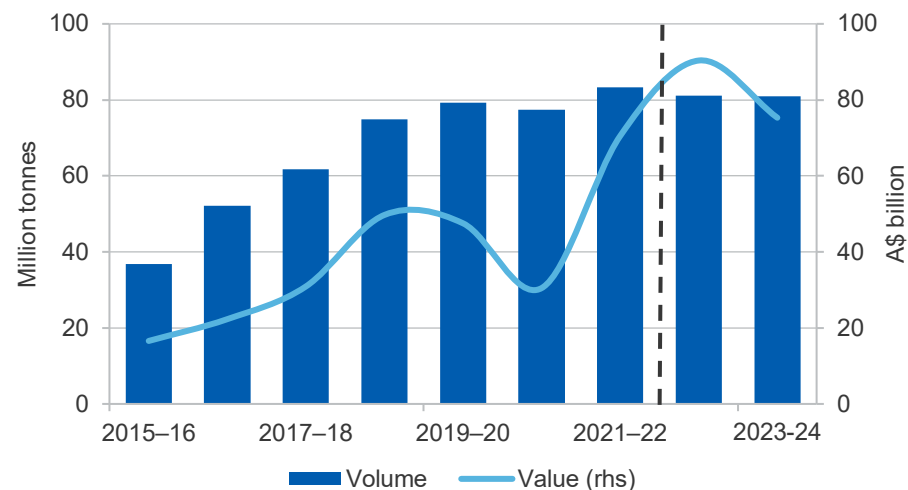
In the September quarter 2022, Australian LNG exports fell to 20 Mt, down 5% quarter-on-quarter, as several planned and unplanned outages affected export facilities. Output at Ichthys and APLNG were down quarter-on-quarter due to maintenance, while Prelude's output was curbed by industrial action in June/July. Volumes are estimated to rebound to 21 Mt in the December quarter 2022, as these facilities return to full production.

Australia's LNG exports are forecast to ease to 81.2 Mt in 2022–23 from 83.2 Mt in 2021–22, as field depletion issues at Darwin LNG offset higher utilisation rates at other Australian LNG facilities (Figure 7.14). Volumes are forecast to stabilise at 80.9 Mt in 2023–24, with no significant changes expected until the North West Shelf depletes (and a second train at Pluto LNG comes online) beyond the outlook period.

Revisions to the outlook

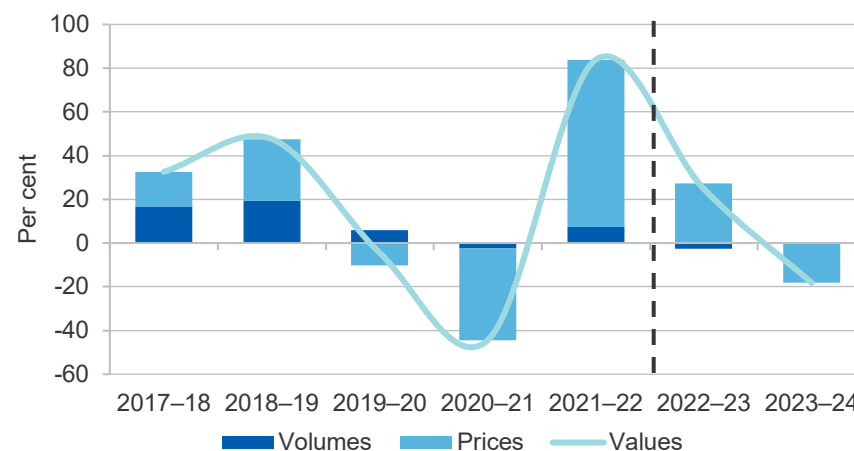
Forecast earnings for 2023–24 have been revised down by \$5 billion, due to lower assumed oil and spot LNG prices. Risks to the forecasts include the severity of the Northern Hemisphere winter, and a rebound in China's LNG demand as restrictions begin to ease.

Figure 7.14: 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)

Figure 7.15: Year-on-year price/volume contributions to LNG export values



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

Table 7.1: Gas outlook

World	Unit	2021	2022 ^s	2023 ^f	2024 ^f	Annual percentage change		
						2022 ^s	2023 ^f	2024 ^f
JCC oil price ^a								
– nominal	US\$/bbl	69.1	99.5	94.8	79.8	44	-4.8	-16
– real ^b	US\$/bbl	74.7	99.5	91.5	75.4	33	-8.0	-18
Asian LNG spot price								
– nominal	US\$/MMbtu ^c	18.6	26.4	32.3	26.7	42	22	-17
– real ^b	US\$/MMbtu	20.1	26.4	31.2	25.2	31	18	-19
LNG trade	Mt ^d	327.5	382.4	417.7	424.3	17	9.2	1.6
Gas production	bcm	4,091	4,118	4,170	4,244	0.7	1.3	1.8
Gas consumption	bcm	4,180	4,100	4,170	4,254	-1.9	1.7	2.0
Australia	Unit	2020–21	2021–22	2022–23 ^f	2023–24 ^f	2021–22	2022–23 ^f	2023–24 ^f
Production ^g	bcm	159.8	159.8	159.0	160.0	0.0	-0.5	0.6
– Eastern market	bcm	59.9	57.4	56.7	55.1	-4.1	-1.3	-2.8
– Western market	bcm	85.6	90.8	89.0	86.3	6.1	-2.0	-3.0
– Northern market	bcm	16.8	14.3	15.8	16.4	-15	11	4
LNG export volume	Mt ^c	77.4	83.2	81.2	80.9	7.5	-2.5	-0.3
– nominal value	A\$m	30,477	70,571	90,286	75,310	132	28	-17
– real value ^j	A\$m	34,099	75,598	90,286	71,908	122	-19	-20
LNG export unit value								
– nominal value	A\$/GJ	16.1	21.1	17.6	14.6	31	-16	-17
– real value ^j	A\$/GJ	17.2	21.1	16.8	13.5	22	-20	-20
– nominal value	US\$/MMBtu	12.3	14.9	13.5	11.5	22	-10	-14
– real value ^b	US\$/MMBtu	13.2	14.9	12.9	10.7	13	-14	-17

Notes: **a** JCC stands for Japan Customs-cleared Crude; **b** In 2022 US dollars; **c** 1 MMBtu is equivalent to 1.055 GJ; **d** 1 million tonnes of LNG is equivalent to approximately 1.36 billion cubic meters of gas; **e** Production includes both sales gas and gas used in the production process (i.e. plant use) and ethane. **f** forecast; **g** 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; **j** In 2021–22 Australian dollars; **s** estimate; 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 oil sector



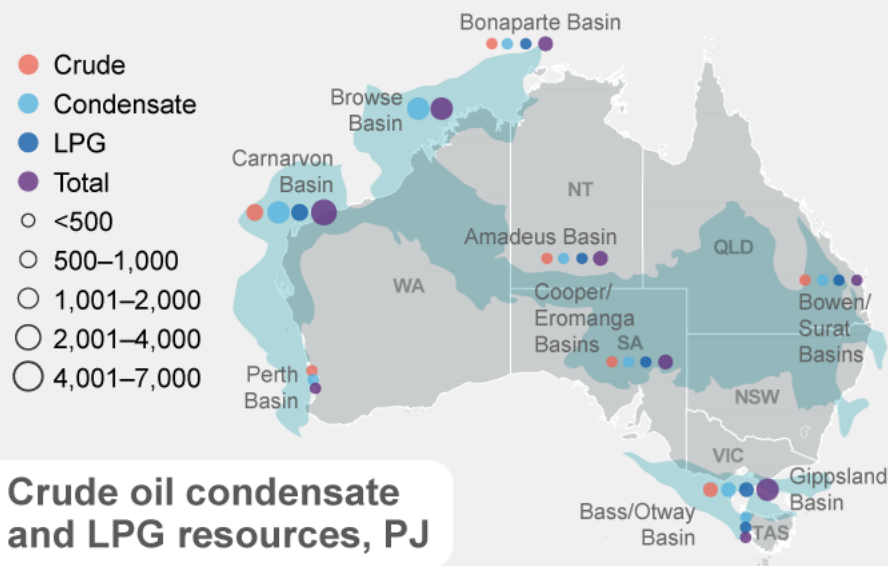
0.3%
of the world's
oil **reserves**



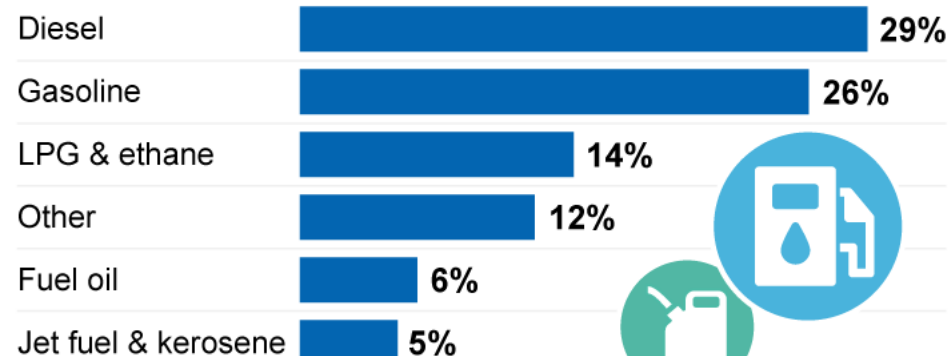
\$10.6 billion
worth of oil
exports in 2021



0.5%
of global
production



World consumption, 2021



Steel facts



Around **2/3** of Australia's **crude and condensate production** comes from the **Carnarvon basin**, offshore from WA

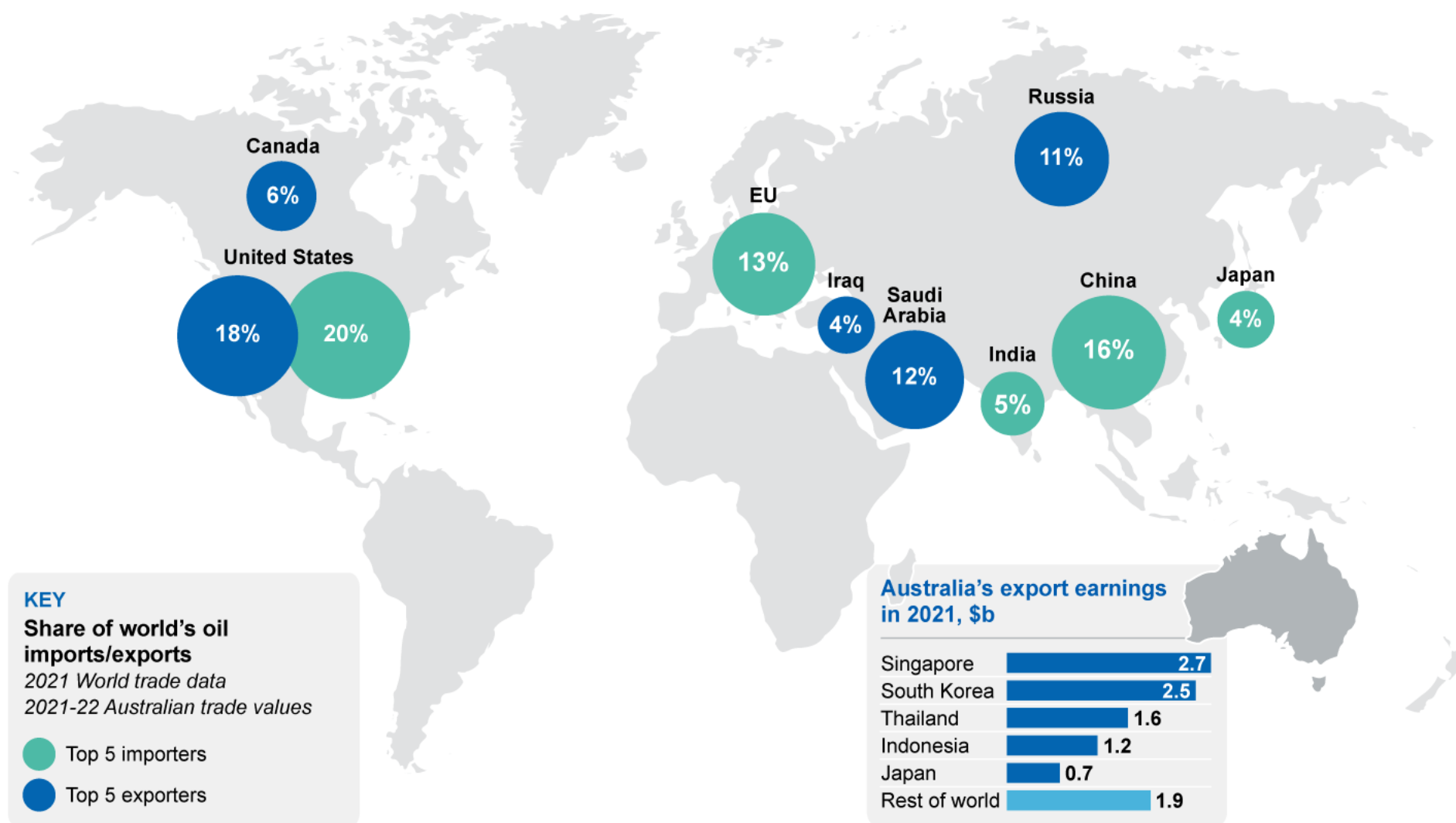


In 2021, around **28%** of refinery feedstock was domestically produced



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

Oil TRADE MAP



8.1 Summary

- Oil prices are expected to steady in early 2023, before coming down over the outlook period. High uncertainty persists in global oil markets, particularly around the level of demand from China and the impacts of sanctions on Russian crude and refined oil flows. Brent crude oil is forecast to average US\$90 a barrel in 2023 and US\$77 a barrel in 2024.
- Australian crude oil and feedstock exports eased to 254 thousand barrels a day (kb/d) in the September quarter, a 19% drop from the previous year. Export volumes are forecast to reach 268 kb/d in 2022–23, before reaching 287 kb/d in 2023–24.
- Australian oil export earnings remained high at \$3.8 billion in the September quarter. Elevated prices and a high US dollar should see earnings reach \$15.3 billion in 2022–23. Earnings for 2023–24 are forecast to ease to \$13.4 billion, as prices fall from 2022–23 levels.

8.2 World consumption

Consumption growth slower as economic woes compound other issues

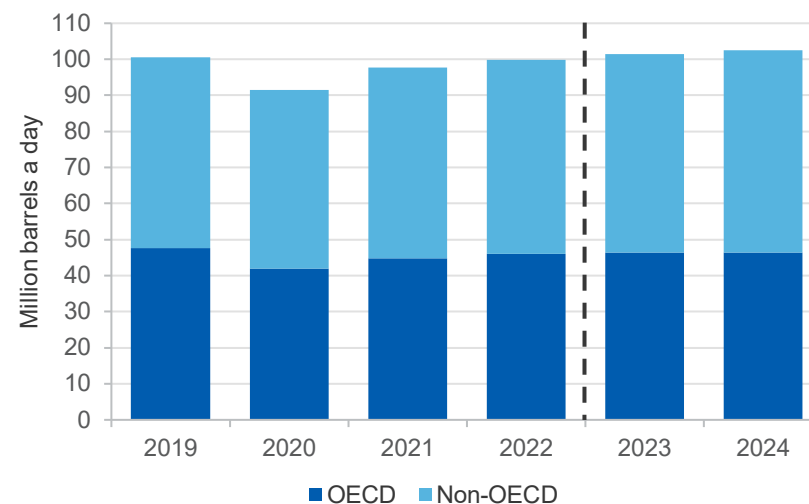
Global oil consumption in 2022 is estimated to be just under 100 million barrels per day (mb/d), an increase of 1.6% year-on-year — but still marginally below levels before the COVID-19 pandemic. It is estimated to decline by 0.3 mb/d year-on-year in the December quarter 2022 (Figure 8.1). Global consumption is forecast to be about 100.7 mb/d in 2023, barely exceeding 2019 levels. Consumption growth in 2023 will be hurt by three main elements: demand destruction as a result of high prices due to the Russian invasion of Ukraine, China's COVID-19 policy, and a general world economic slowdown. As these normalise, demand growth is expected to rise. For 2024, consumption is forecast to reach 102.5 mb/d.

As a result of the continuing war in Ukraine, demand for Russian crude oil is now close to its expected minimum in OECD countries, with most member countries completely switching away from Russian crude oil. Many are also implementing restrictions on Russian exports to third countries (see [Box 8.1 EU insurance ban and the oil price cap](#)). Flows of Russian crude oil were stopped by mid-year in a handful of OECD countries, most notably the USA and Germany. However, others including

Italy, Netherlands and South Korea have continued to import Russian products — albeit in a less regular fashion — with a noticeable rebound before the 5 December date for sanctions. Sanctions on exports of Russian oil products are also expected to take effect in February 2023.

Other countries have been purchasing unwanted Russian supply, most notably India and China, which together accounted for 40–55% of Russia's export volumes in the second half of 2022 — up from just over 20% in 2021. It is unclear whether these countries can continue to increase their share of Russian crude over the rest of the outlook period, but it is possible that some additional reorganisation will take place.

Figure 8.1: Global oil consumption, OECD and non-OECD



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

China increased its crude oil imports in September and October 2022. This followed a significant slowdown in its economy in the middle of the year due to continued COVID-19 outbreaks — and COVID-related restrictions — in a number of major cities. Oxford University's COVID Government Response Tracker indices for China fell through September and October

2022, despite lockdowns in Guangdong, Inner Mongolia and elsewhere, hinting at some relaxation overall. In November 2022, China officially eased some of its COVID-19 restrictions, notably shortening quarantine periods and giving up the tracing of second-degree contacts. However, fresh outbreaks in major cities continue to weigh on transport demand and industrial activity.

Ex-China demand has outstripped China's recovery in the last few quarters. However, the December quarter 2022 may see a reversal of this situation. A recovery in Chinese demand in 2023 is expected to at least partially offset growing economic headwinds in other world regions. Despite some price controls introduced during the dramatic early spikes at the beginning of Russia's invasion of Ukraine, OECD Europe has suffered from demand destruction due to persistent high energy prices. These high energy costs have also triggered a broader contraction of economic activity in the region.

Refined products are facing squeeze

Jet fuel demand remains the one exception to an otherwise gloomy outlook in oil markets, with global demand forecast to grow strongly in 2022 (18% year-on-year) and 2023 (13% year-on-year). This is largely on the back of a robust recovery in international passenger numbers, notably due to increased intra-European flights and less strict measures in China. The passenger flight recovery comes as the International Air Transport Association (IATA) reports a softening of cargo demand. The industry still expects air traffic to return to pre-pandemic levels in 2024, with the Americas reaching that level in 2023.

Gas-to-oil switching continued in the December quarter, despite a moderation in natural gas prices (see Gas chapter). This switching is expected to remain important in 2023, in both Europe and the Middle East. Road fuel usage has varied markedly, with falls in OECD Europe, the USA, and China, but increases elsewhere. A tight supply situation due to refinery strikes in France and the curbing of imports of Russian refined products has raised prices and caused demand destruction particularly for

diesel in Europe. USA diesel usage was also estimated to be down in the September and December quarters, despite overall growth in 2022.

Naphtha, normally used as an industrial solvent, is the only product estimated to fall year-on-year in 2022. The decline was driven by low demand in Europe during the second half of 2022, and by subdued (though recovering) demand from China. With diminished consumption, Europe has continued to largely rely on Russian naphtha despite looming bans on the product. For its part, China has been affected by refiners' limited activity, as well as lower demand caused by slowing industrial production and large negative differentials to crude at Singapore.

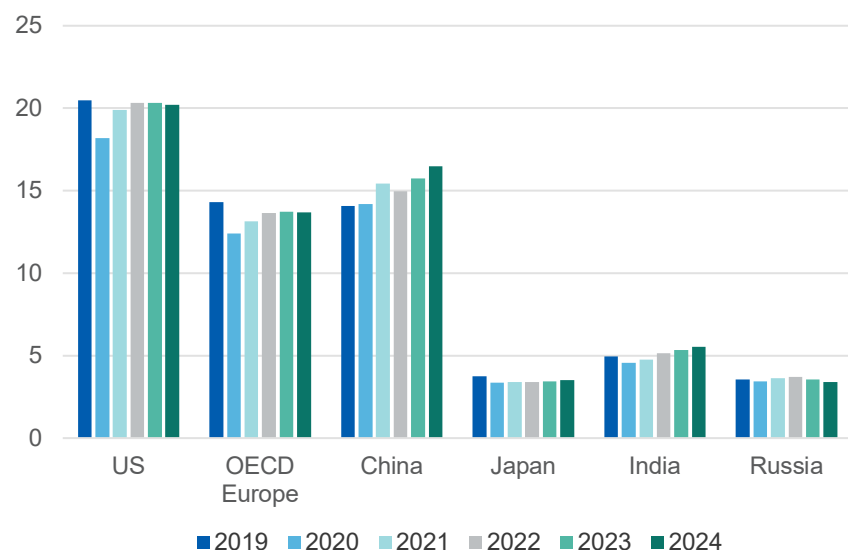
OECD road/industrial fuel declines now outweigh jet fuel/fuel oil growth

Overall, OECD demand is estimated to increase by 2.9% in 2022 year-on-year to 46.1 mb/d, and remain largely steady at 46.4 mb/d in 2023 and 2024. The decline in demand is estimated to extend further during the December quarter 2022, despite still increasing demand for jet fuels and some fuel oil for gas-to-oil substitution. The recovery should be slow in 2023 and 2024, and with the increased uptake of electric vehicles, demand may never reach again 2019 levels in the OECD region (see the *Lithium* chapter and Figure 8.1).

In Europe, warm weather during and beyond the summer months of 2022 has contributed to heightened demand for jet fuel and gasoline particularly, aided by comparatively lower prices. However, diesel — which still powers some 40% of the European passenger fleet — remained weak in OECD Europe. Diesel demand is estimated to fall a further 280 kb/d in the December quarter 2022, after a reduction of 240 kb/d in September 2022. The decline was driven by very large falls in Germany, UK and Spain due to high prices and weaker industrial demand.

In the US, gasoline and gasoil use growth slowed significantly in the September quarter 2022, due to weak economic sentiment and relatively high prices, which undermined the typical US 'driving season'. Gasoil is expected to increase only minimally during the heating season. Finally, in Korea and Japan, the main changes are a reduction in industrial fuel demand.

Figure 8.2: Major oil consumers



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

Non-OECD demand depends largely on China's COVID-19 measures

In the December quarter 2022, non-OECD oil demand is expected to fall by 100 kb/d year-on-year on the back of weaker economic activity in China. Non-OECD demand in 2022 is estimated to reach 53.7 mb/d an increase of 1.6% relative to 2021. Demand is forecast to pick up pace over the outlook period, reaching 55.0 mb/d in 2023 and 56.1 mb/d in 2024; non-OECD demand is thus increasingly outpacing OECD demand.

The situation in China remains volatile. The country's consumption increased in the September quarter 2022 (by 0.9%) — though from a low base — after various lockdowns brought down consumption in the June quarter. Strict COVID-19 containment measures (particularly regarding flights) have driven very weak demand for jet fuels, which are estimated to have dropped nearly by 30% year-on-year in 2022.

However, the situation may change with the recent relaxation of the country's 'dynamic zero-COVID' policy. The China's government is estimated to have allocated around RMB 5 trillion in fiscal stimulus (through local government special purpose bonds) during 2022 to spur economic activity, with 4 trillion already taken up by borrowers. On the back of this expenditure, and the strong baseline effect, China's oil demand overall is expected to grow 5.2% year-on-year in 2023.

India, by contrast, maintained very strong demand growth in 2022, including in recent months. Consumption is estimated to rise by 8.1% year to 5.2 mb/d, clearly exceeding pre-pandemic levels (Figure 8.2). Indian economic growth has been solid with both imports and exports approaching record levels.

Indian demand growth is expected to moderate in 2023 and 2024, reaching 5.4 and 5.5 mb/d respectively. Kpler data shows that India has maintained a high level of imports of Russian oil in recent months, occasionally overtaking China. In October and November, India imported around 25% of its oil from Russia, compared to less than 3% in 2021. This accounted for about 17% of Russia's oil exports in those months.

Oil consumption forecasts for Russia remain uncertain. September data showed an overall increase in demand buoyed by gasoil, which has various military uses. Jet fuel consumption dropped, likely as a result of a combination of sanctions affecting the sector and measures to stem the exodus of population liable to be mobilised. Growth in overall Russian oil consumption is estimated at 1.8% for 2022, but is forecast to be negative in 2023 (-4.0%) and 2024 (-4.5%), due to the flow-on effect of economic sanctions.

Box 8.1: EU insurance ban and the oil price cap

Sanctions by the EU, G7 and Australia on Russian crude oil started on 5 December. They include a ban on insuring Russian oil cargoes, agreed initially by EU countries in June. This insurance ban, if fully effective, would prevent Russian sales to non-EU countries. The G7 complemented this insurance ban in September with an oil price cap that allows insuring cargo if priced below a certain level. This price was set at US\$60 a barrel in early December. This is above the cost of production for the vast majority of Russian production (~US\$30) but below recent and forecast prices at the time of the ban.

The countries enforcing the bans are focused on securing implementation among private companies, rather than recruiting new enforcers among other countries. China's and India's oil importers are reportedly concerned about the measures, and are asking for government support to insure cargoes and remove some of the risk.

Direct impacts of these sanctions are likely to be delayed, due to a determination by the US Treasury to not consider cargoes loaded before 5 December and unloaded before 19 January as captured under the restrictions.

The primary aim of the measures is to maintain the flow of Russian oil to world markets, but reduce the revenue received by Russia. Lower revenues should reduce Russia's ability to finance its ongoing invasion of Ukraine.

Nonetheless, Russia has already rejected abiding by any such cap and has already acquired a number of vessels to transport its exports. It is uncertain whether this will be enough to offset lost cargo capacity. If not, the prospect would be for Russian oil exports to slow, putting upward pressure on global prices.

Source: Reuters (2022); US Treasury (2022) Department of Industry, Science and Resources (2022)

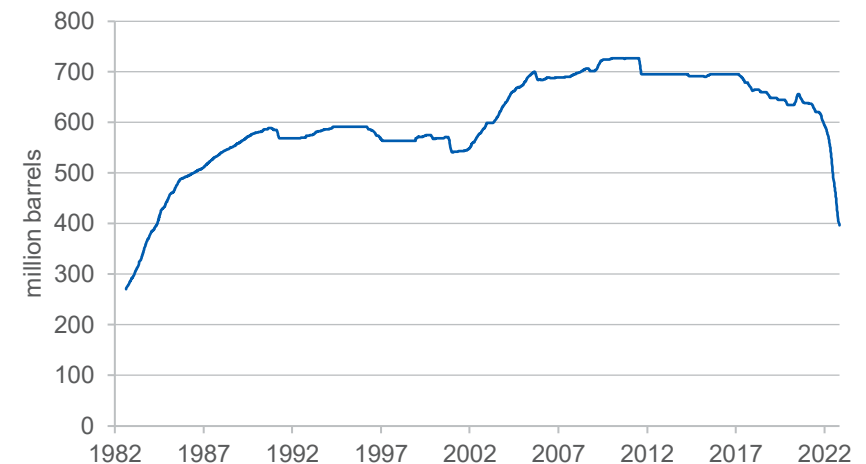
8.3 World production

Global output stabilises after US output growth partly offsets OPEC+ cuts

Global oil production is estimated to remain just under 100 mb/d in 2022. This still represents a significant year-on-year growth (4.8%), but is lower than previous forecasts. In 2023, output is forecast to rise to only 101.37 mb/d, whereas record figures had been expected. In 2024, production is forecast to lift to 103.22 mb/d.

A critical driver of higher supply in recent months has also been the releases from the US strategic petroleum reserve (SPR), totalling some 180 million barrels (see Figure 8.3). The US has flagged that these releases could continue over the Northern Hemisphere winter if Russian supply dwindles. The recent drawdown is the single largest in the history of the SPR, and has occurred over a particularly short period. Refilling the SPR will likely have implications for prices later in the outlook period (see [Prices section](#) below).

Figure 8.3: Stocks of crude oil in the US Strategic Petroleum Reserve



Source: U.S. Energy Information Administration (2022)

OPEC+ supply has stabilised after cuts to maintain high prices

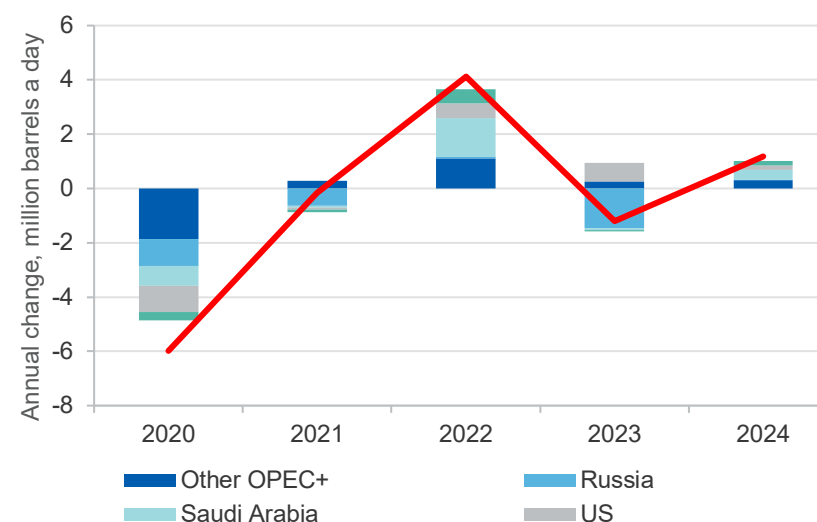
OPEC+ supply has declined after quota cuts in recent months that total 2.1 mb/d. While this is expected to further tighten the market, the actual size of the decline could be much lower, with many nations failing to reach higher output targets in preceding months. Overall, in 2022, OPEC+ output is estimated to rise to 52 mb/d, and come down to 50.9 mb/d in 2023. In 2024, output is forecast to reach 51.6 mb/d.

OPEC+ had agreed to lift output every month from August 2021 to unwind cutbacks measures made early in the pandemic. While some members are unable to produce at their quota levels, group output has risen. In September 2022, OPEC+ made a small quota cut of 0.1 mb/d, despite pleas from Western governments for more supply. This was followed by a larger cut of 2 mb/d in October 2022. The IEA expects the gap between the OPEC+ supply target and actual output (the 'quota gap') to shrink from 3.2 mb/d to 2 mb/d for the duration of its current targets.

Saudi Arabia and UAE have capacity to lift supply should demand recover in 2023. Iraq may also be expected to increase its supply, after a new government guaranteed political stability.

Russia is responsible for a third of the quota gap, as Western nations avoid Russian cargoes ahead of formal sanctions. Kpler data shows Urals oil, which is normally sent via pipeline to Europe, is now the dominant grade on water, saturating export capacity. Notably, CPC (Caspian Pipeline Consortium) oil, which is technically Kazakh oil that can only be shipped through Russia, has been curtailed. There seems to be a large incentive for Russia to prevent Kazakh exports from taking up valuable shipping facilities for its own oil, although Kazakh officials have blamed "inclement weather" and "regulatory spats". Regardless of the true cause, Kazakhstan is below its OPEC+ quota target, as are Nigeria, Angola and Malaysia. The IEA forecasts Russia's output to fall from 10.7 mb/d in the September quarter 2022 to about 9.5 mb/d in the March quarter 2023. Much will depend on the capacity of Russia to continue shifting its exports away from pipelines into Europe as well as European-insured vessels (see [Box 8.1](#)).

Figure 8.4: Change in oil production by major producers



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

Finally, hopes of a deal with Iran yielding additional global oil supply appear to be lost for now. Iran has been under sanctions, progressively curtailing its capacity for oil exports since 1987, with the last tightening taking place in 2006. In 2016, an agreement to lift some of the sanctions was reached with Iran by a group of countries including Russia, the EU and the USA. However, former US President Trump withdrew his country's crucial support for the deal shortly after and the sanctions on oil largely remained. The US Administration was recently open to a renewal of the deal. However, negotiations have recently broken down.

Non-OPEC+ production increases accelerate

Non-OPEC+ supply is estimated to increase by 1.6 mb/d in 2022 to reach 47.9 mb/d, primarily due to an increase in US production (1.1 mb/d). Brazil also recovered to pre-COVID levels of production in 2022. These countries, together with Norway and Canada, are expected to lift non-OPEC+ production a further 1.8 mb/d in 2023 to 49.7 mb/d. Production is forecast to reach 51.7 mb/d in 2024.

Despite caution among investors regarding investments in new oil capacity — notably shale oil in the USA — production across the OECD has been spurred by the incentive to replace Russian production, both from a geopolitical perspective and an economic one in response to high prices. The lower 48 states in the USA are responsible for most of the increase, particularly Texas. The North Sea field Sverdrup is set to commission its second phase, which comes at a particularly good time to replace Urals. Sverdrup is already the largest single field in the North Sea. Production should accelerate in 2023 and 2024, as several major projects in Brazil, Guayana, Norway and the US come online, totalling an additional 1.2 mb/d by the September quarter 2023.

8.4 Prices

Supply constraints have limited price falls due to economic slowdown

Oil prices have experienced significant fluctuations throughout 2022 (Figure 8.5). The slight upward trajectory early in the March quarter 2022 was boosted sharply by Russia's invasion of Ukraine, pushing the price of Brent crude to US\$134 a barrel on 8 March 2022 — the highest price since before the Global Financial Crisis. The June quarter 2022 saw prices oscillate between US\$100-110 a barrel, but the announcements of future bans on Russian oil exports pushed prices up to a peak of US\$127 a barrel.

The September quarter 2022 was largely characterised by a progressive drop in prices down to a bottom of US\$83 a barrel. The main drivers were a worsening economic outlook, recurring COVID-19 disruptions in China, and a stronger US dollar. Nonetheless, OPEC responded by a 2.0 mb/d cut in production on 5 October 2022. This move supported prices, with Brent averaging US\$93 that month. Nonetheless, November still trended lower, averaging US\$87 a barrel on concerns about subdued demand. At the time of compilation of this report, December prices were averaging around US\$80.

Figure 8.5: Brent oil price, daily – 2020 to 2022



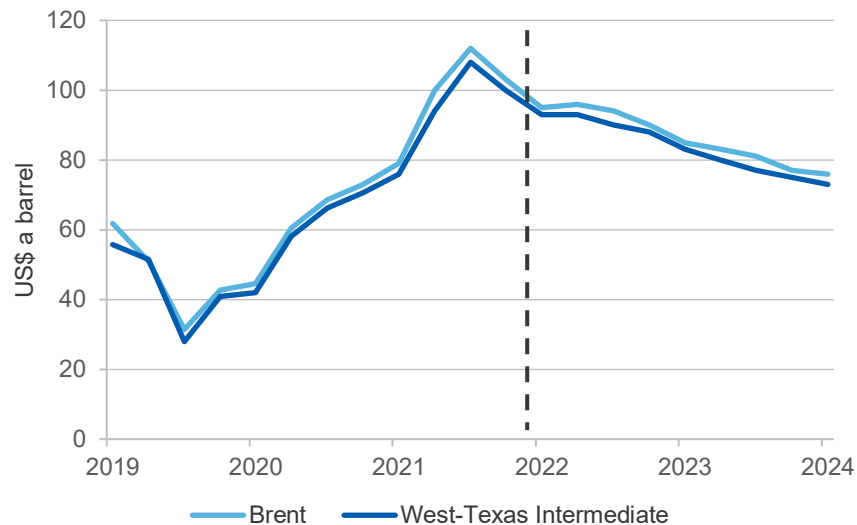
Source: Bloomberg (2022)

Prices to decline slowly, with shocks possible

Oil prices are estimated to average US\$93 a barrel in the December quarter 2022. Prices are likely to average about US\$93 a barrel in the March quarter 2023, before declining throughout the outlook period to a low of \$73 at the end of 2024 (Figure 8.6). The slow decline assumes that the gradual end of the COVID-19 pandemic in China only leads to modestly higher demand, and that Russian oil is directed away from Western nations at moderate but historically high prices.

The uncertain outlook for Russian oil exports has resulted in significant disagreement about the outlook among oil price forecasters. The range of estimates in the Energy & Metals Consensus Forecasts is particularly large for the September quarter 2023: there is a US\$60 a barrel difference between the lowest and highest forecast. This compares to US\$40 a barrel range soon after the start of the COVID-19 pandemic. The US\$60 range is similar to the range that prevailing at the start of the Russian invasion of Ukraine. By the September quarter 2023, the redirection of flows of Russian oil in response to sanctions is likely to have largely settled; there is likely to be limited impacts on overall supply, but uncertainties remain.

Figure 8.6: Price outlook



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

China's emergence from a state of continued lockdowns is expected to put significant upward pressure on prices. The effects of China's recent fiscal measures is expected to last until the second half of 2023. With inflation low, JPMorgan and Goldman Sachs among others expect additional stimulus measures to be announced, supporting China's oil demand over the outlook period.

US efforts to refill its SPR should lend support to oil prices over the outlook period. The USA has announced that it would replenish the SPR "likely" towards the end of 2023. However, the US administration may bring forward their purchases if the price weakens faster and further than expected. Total storage in the SPR has fallen significantly in recent months, dropping below 400 million barrels in November 2022 for the first time since 1984 (see Figure 8.3 in previous section).

8.5 Australia

Production steady as inflation postpones decision on major project

Australian crude oil and condensate production dropped to 284 kb/d in the September quarter 2022 on the back of some disruptions in Prelude (WA) and Ichthys (NT) projects. Production is estimated to reach 350 kb/d in the December quarter 2022, up 3.4% year-on-year.

Output is forecast to continue within its recent mid-300s range, reaching 327 kb/d in 2022–23 and 346 kb/d in 2023–24.

In terms of the production pipeline, the Dorado oil and gas field in offshore WA was expecting a final investment decision in the second half of 2022. However, this decision was delayed, due to cost increases and supply chain disruptions. The Dorado field is forecast to bring an additional 88 kb/d by 2026, from a total of 162 million barrels of contingent resources (2C). The proponents note that two additional fields could be tied into the Dorado floating platform: Pavo North and Pavo South, were this year assessed in 2022 to possess a combined contingent resource of 109 million barrels.

High prices and the strong US dollar keep Australian earnings high

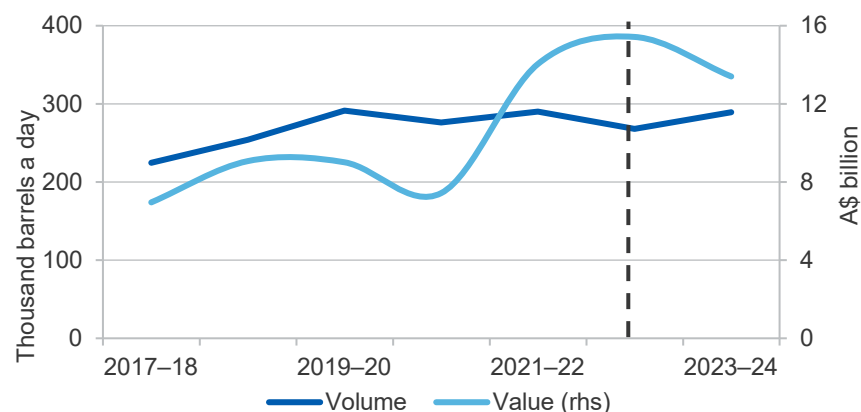
With export volumes expected to remain high on the back of continuing high prices, export earnings in 2022–23 are forecast to rise to \$15.3 billion. This is a 9.3% increase from the already high values last financial year, and in real terms represents a record since the beginning of major oil exports from Australia in the 1990s. Earnings are forecast to decline to \$13.4 billion in 2023–24, as oil prices fall and the Australian dollar recovers ground against the US dollar (Figure 8.7).

Domestic refinery production keeps falling despite consumption recovery

After an uptick during the June quarter 2022, the two remaining Australian refineries in Lytton (QLD) and Geelong (VIC) reduced production in the September quarter by 6.4% quarter-on-quarter (to be down 14% year-on-year). Aviation fuel production increased, while gasoline remained steady and diesel production reached a new low despite strong demand for the product.

The share of domestic input into refineries reached its lowest point since late 2018, with Australian refineries covering 25% of total usage, two percentage points lower than in the previous quarter. As a result, diesel represents a larger share of refined product imports over the past decade. It stood at 63% of total refined products in the September quarter, close to the all-time high of 69%. This reflects the shift of the remaining domestic refiners to higher value products for their limited domestic production.

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).

Australia's total oil consumption increased by 5.5% year-on-year to 0.97 mb/d in the 12 months to September 2022. It remains well below the all-time high of 1.1 mb/d in the calendar year 2018, and is still below pre-COVID-19 values. Demand is not forecast to reach pre-COVID levels during the outlook period. Despite a slower uptake of electric vehicles than the global average, the expectation is that it should follow the pattern of OECD consumption and will likely never again reach the 1 mb/d mark.

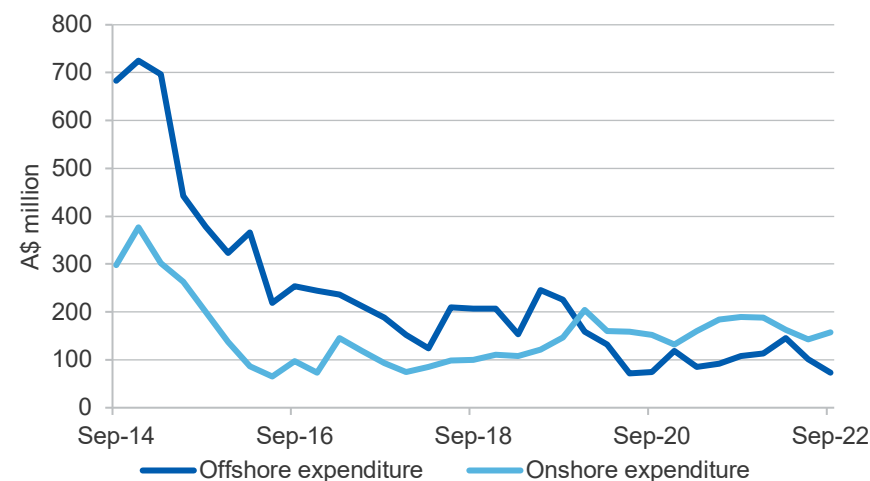
In terms of refined products consumption, aviation fuel continued to recover in the September quarter rising by 4.2% quarter-on-quarter. This was similar to increases in diesel and gasoline, but much slower than its

March and June quarter 2022 increases of 35%. Demand for air travel is likely to have softened as cost-of-living pressures induced consumers to forgo long-distance travel for holidays and other discretionary spending. As a result, aviation fuel consumption in Australia remains at 68% of its pre-COVID values, while gasoline has reached 99% and diesel consumption has surpassed those levels.

Exploration

Australia's petroleum exploration expenditure was \$230 million in the September quarter 2022 (seasonally adjusted basis), down 5.5% quarter-on-quarter and 23% year-on-year. Year-on-year, offshore exploration fell 32.6% to \$73 million, while onshore exploration spending decreased by 17.2% to \$157 million (Figure 8.8).

Figure 8.8: Petroleum exploration expenditure



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

Revisions to forecasts

Since the September 2022 *Resources and Energy Quarterly*, the forecast for Australia's crude and condensate export earnings has been revised up by around \$400 million in 2022-23, same as for 2023-24. Both are driven by high oil price forecasts.

Table 8.1: Oil Outlook

World	Unit	2021	2022 ^s	2023 ^f	2024 ^f	Percentage changes		
						2022 ^s	2023 ^f	2024 ^f
Production ^a	mb/d	95	100	101	103	4.9	0.8	2.5
Consumption ^a	mb/d	98	100	101	103	2.2	1.6	1.1
WTI crude oil price								
– nominal	US\$/bbl	68	97	90	76	42.8	-7.9	-14.8
– real ^b	US\$/	74	97	86	72	32.1	-11.0	-16.7
Brent crude oil price								
– nominal	US\$/bbl	70	102	95	80	45.3	-7.4	-15.8
– real ^b	US\$/bbl	76	102	92	75	34.5	-10.6	-17.7
Australia	Unit	2020–21	2021–22	2022–23 ^f	2023–24 ^f	2021–22	2022–23 ^f	2023–24 ^f
Crude and condensate								
Production ^{ac}	kb/d	335	336	327	346	0.5	-3.8	6.9
Export volume ^a	kb/d	276	290	268	287	5.0	-7.3	6.7
– Nominal value	A\$m	7,434	14,031	15,343	13,402	88.7	9.3	-12.6
– Real value ^h	A\$m	8,318	15,031	15,343	12,797	80.7	2.1	-16.6
Imports ^a	kb/d	247	180	168	158	-27.0	-6.8	-5.7
LPG production^{acd}	kb/d	94	107	97	112	14.9	-9.7	15.2
Refined products								
– Refinery production ^a	kb/d	375	248	246	243	-33.9	-0.5	-1.2
– Export volume ^{ae}	kb/d	13	8	6	6	-36.6	-29.0	2.5
– Import volume ^a	kb/d	647	743	816	821	14.8	9.8	0.6
– Consumption ^{ag}	kb/d	913	934	1,011	1,029	2.3	8.3	1.7

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 2022-23 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



Australia's uranium sector



Ranked 1st
for uranium
resources

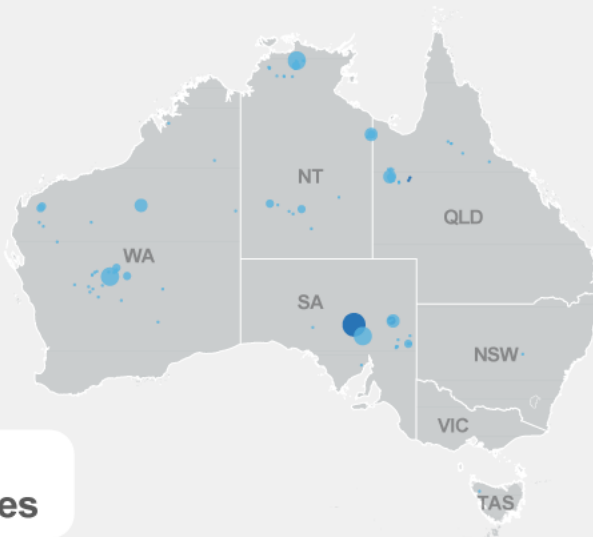


3rd largest
uranium **producer**
in the world



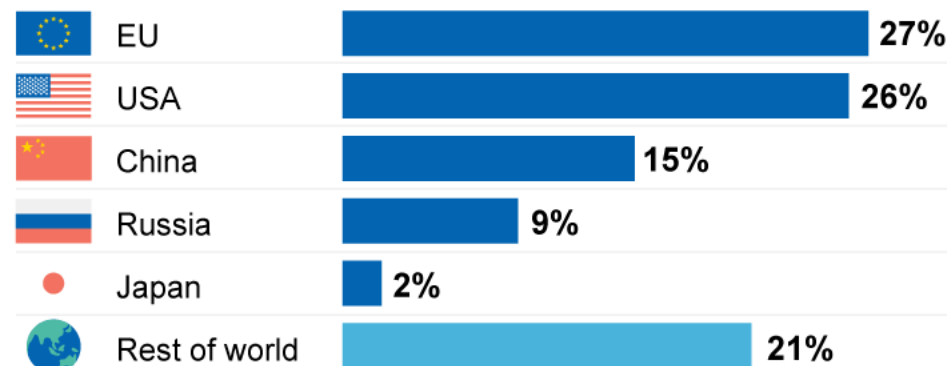
\$500m+
worth of
exports

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



**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

9.1 Summary

- Uranium prices are forecast to lift from US\$51 a pound in 2022 to almost US\$60 a pound by 2024. This is expected to lead to stronger production from Kazakhstan, Australia, Canada and Namibia.
- Australian exports are forecast to increase from 4,933 tonnes in 2021–22 to around 5,850 tonnes by 2023–24, as the Honeymoon mine reopens (see [Australia section](#)).
- Price and volume growth is expected to increase uranium export values from \$564 million in 2021–22 to around \$900 million by 2023–24.

9.2 World consumption

Market conditions have tightened up, pushing up prices

Uranium prices rose in 2021 and have held around US\$50 a pound for most of 2022. This higher price floor has encouraged additional uranium supply into markets, with production schedules moving forward and output increasing at a number of mines. These include the huge McArthur river mine in Canada, as well as mines in Africa, Australia and Kazakhstan.

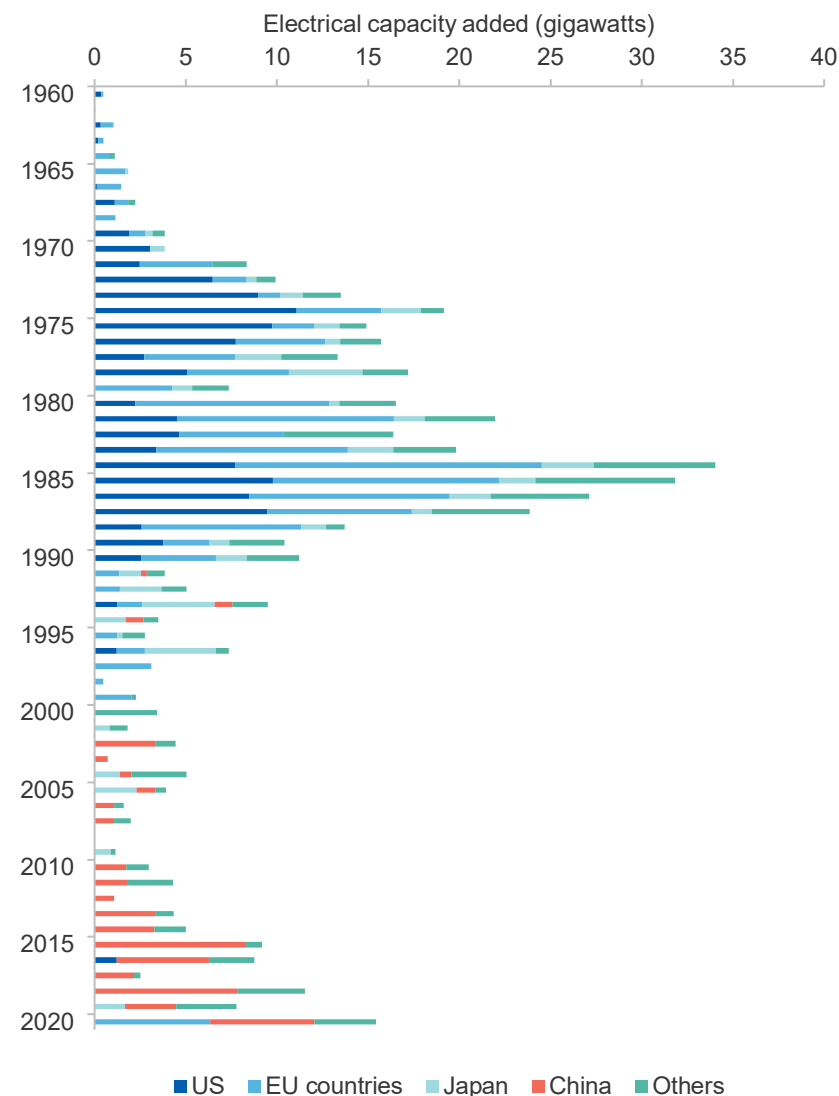
Nuclear deployments continue to broaden out to more countries (Figure 9.1). Supply chains have also shifted in recent quarters, as utilities seek to capitalise on new supply while reducing exposure to Russian sources.

In the US, the Vogtle plant has passed one of its final milestones, with fuel loading now underway. The reactor is expected to start up in 2023, making it the first new reactor to start in the US for thirty years.

Prospects remain mixed in Europe, with some countries phasing nuclear power down, while others expand their capacity. Belgium's Doel plant disconnected its third unit on 23 September, in line with the country's nuclear phase-out timetable. A further six reactors are expected to follow.

However, Sweden's newly elected government has announced it will seek to expand nuclear power, and has instructed Vattenfall (a state-owned energy company) to prepare for new reactor constructions. As an interim measure, the company has also been instructed to consider a restart of its recently-closed Ringhals plant.

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)

In Germany, the federal cabinet has approved an executive order to extend power generation at the country's three remaining nuclear plants, which had previously been scheduled to close at the end of 2022. The Emsland, Isar 2 and Neckarwestheim 2 plants will operate through the winter season, helping to offset the loss of access to Russian gas.

The Polish Government has announced it will expand its trade and technology ties with the US and South Korea, as it seeks to develop a domestic nuclear power industry. The Government has announced that three Westinghouse AP1000 reactors will be used for the country's first nuclear plant. An agreement has also been signed between Poland's Ministry of State Assets and South Korea's Ministry of Trade, Industry and Energy. The agreement also involves energy companies from both countries, who will develop the country's second nuclear plant.

In France, the Government remains committed to building up the nation's nuclear capacity. Draft legislation intended to streamline approval and administrative process around new reactors has passed the Council of Ministers. However, problems have emerged with some existing reactors, which have been taken offline temporarily for maintenance, corrosion issues with pipes, and due to industrial disputes.

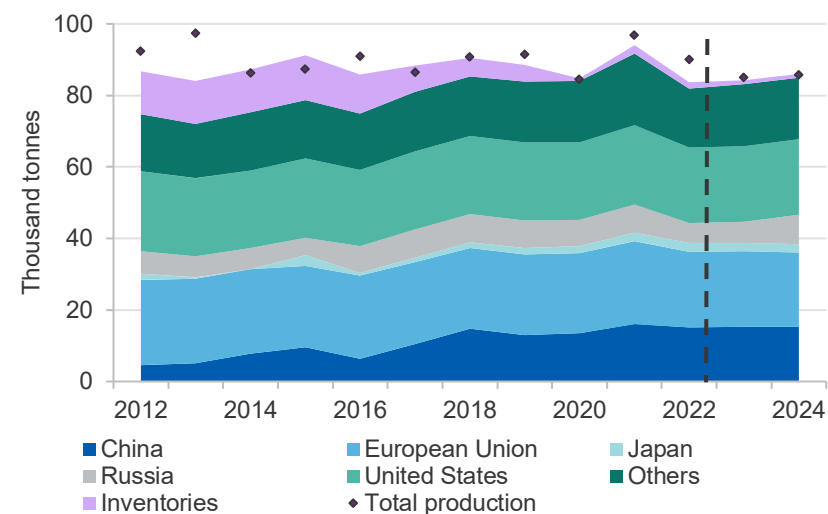
Other areas of the world are seeking to expand co-operation in nuclear development. Unit 3 of the UAE's Barakah plant (which was constructed in large part by the Korea Electric Power Company) has begun generating power. In Ghana, the Federal Government has announced a strategic collaboration with Japan and the USA to develop small modular reactors.

9.3 World production

Production is building, with short-term and long-term growth expected

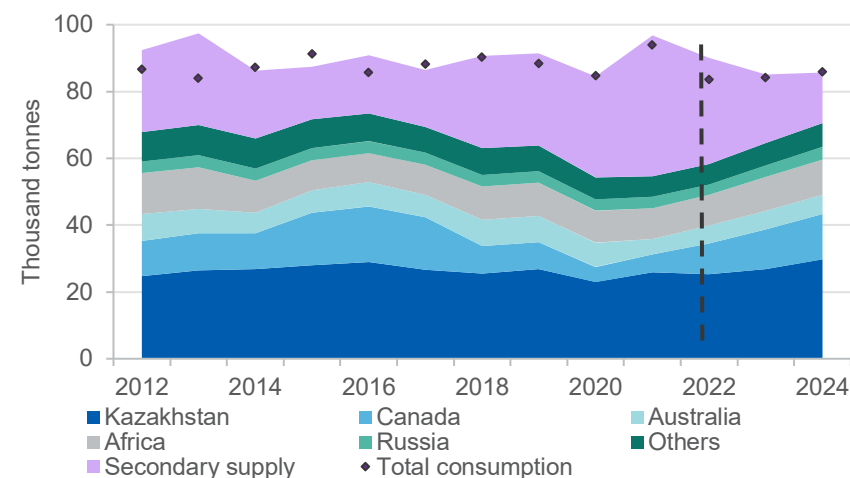
Production growth in Kazakhstan, Australia and Canada will support output over the next two years. The most notable addition will be from Canada's McArthur River mine — one of the world's largest uranium mines — which was temporarily closed in 2018 due to low prices. The first batch of ore from the newly reopened mine has now been milled as the mine shifts back towards normal production.

Figure 9.2: World uranium consumption and inventories (U3O8)



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

Figure 9.3: World uranium production (U3O8)



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

Longer-term growth in output is likely to be driven by nations in Africa. African energy ministers met at the 2022 International Atomic Energy Agency General Conference to discuss potential ways for Africa to expand its use of nuclear and its role as a global uranium supplier.

Africa has several promising untapped deposits, most of which are shallowly located. The shallowness of these deposits curbs much of the risk around mining and development, and African states generally have relatively permissive regulatory regimes which enable projects to reach production more quickly. Stronger uranium output from Africa could help to reduce the emerging supply shortfall otherwise expected in the late 2020s.

9.4 Prices

Prices are expected to rise steadily, and potentially rapidly

Uranium prices have increased following years of weakness, stabilising at around US\$50 a pound in mid- to late-2022. This growth reflects changing market fundamentals, with demand rising and supply constrained following years of underinvestment. Prices are expected to lift slowly over the outlook period, reaching near US\$60 a pound by the end of 2024.

However, increased investment in uranium supply will likely stave off some of the risk of supply shortfalls in the mid- to late-2020s, allowing prices to stay relatively contained in the longer term (Figure 9.4).

9.5 Australia

Higher prices and volumes will boost export earnings

Extra production and higher prices are expected to lift Australia's uranium export earnings from \$564 million in 2021–22 to around \$900 million by 2023–24 (Figure 9.5, Table 1). Growth will be driven by the start of output at Boss Energy's Honeymoon mine in South Australia, which is restarting from care and maintenance. The mine is set to produce around 1,100–1,200 tonnes of uranium per year for at least 10 years, and production is provisionally expected to commence in late 2023 or early 2024.

Revisions to the outlook

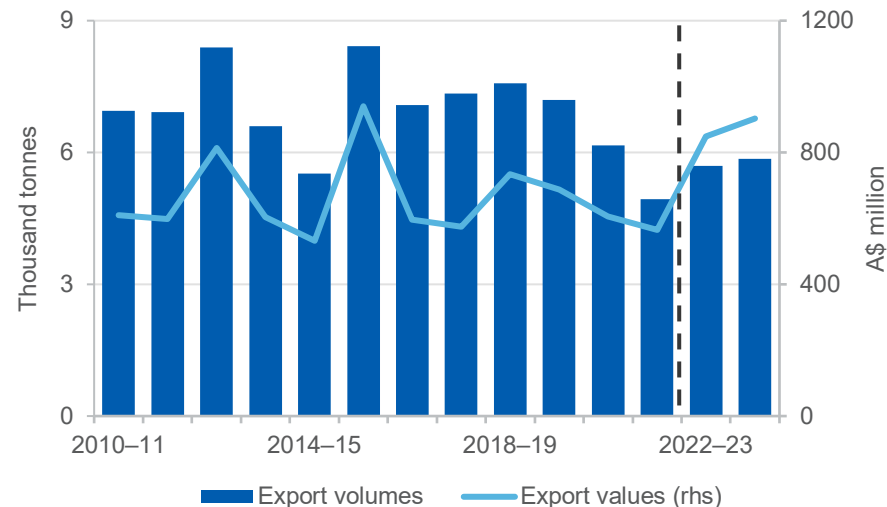
Export earnings forecasts have remained largely unchanged.

Figure 9.4: Uranium price outlook



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

Figure 9.5: 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 ^r	2023 ^r	2024 ^r
Production	kt	54.2	58.3	64.5	70.5	7.7	10.6	9.3
Africa ^b	kt	9.3	9.2	10.1	10.6	-0.5	9.6	4.7
Canada	kt	5.5	9.1	11.9	13.6	63.9	31.2	14.0
Kazakhstan	kt	25.8	25.4	26.9	29.8	-1.7	6.0	10.7
Russia	kt	3.3	3.1	3.5	3.7	-6.0	10.7	7.8
Consumption	kt	91.7	81.9	83.1	84.9	-10.7	1.5	2.2
China	kt	16.1	15.1	15.3	15.2	-6.3	1.8	-0.7
European Union 27	kt	23.1	21.3	21.1	20.8	-8.1	-0.9	-1.5
Japan	kt	2.4	2.4	2.4	2.4	0.0	0.0	0.0
Russia	kt	7.9	5.6	5.8	8.2	-29.5	3.4	42.1
United States	kt	22.2	21.0	21.2	21.2	-5.1	0.7	0.0
Spot price	US\$/lb	35.3	50.7	57.4	59.0	43.6	13.3	2.9
– real ^c	US\$/lb	38.1	50.7	55.4	55.8	32.9	9.4	0.6
Australia	Unit	2020–21	2021–22	2022–23^f	2023–24^f	2021–22^r	2022–23^r	2023–24^r
Mine production	t	6,213	4,485	5,697	5,855	-27.8	27.0	2.8
Export volume	t	6,166	4,933	5,697	5,855	-20.0	15.5	2.8
– nominal value	A\$m	606	564	848	902	-6.9	50.3	6.4
– real value ^d	A\$m	678	604	848	861	-10.9	40.3	1.6
Average price	A\$/kg	98.3	114.4	148.8	154.1	16.3	30.1	3.5
– real ^d	A\$/kg	110.0	122.5	148.8	147.1	11.4	21.5	-1.2

Notes: ^b Includes Niger, Namibia, South Africa, Malawi and Zambia; ^c In 2022 US dollars; ^d in 2022–23 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

Gold



Australia's gold sector



World's 2nd
largest **producer**
of gold, 2021

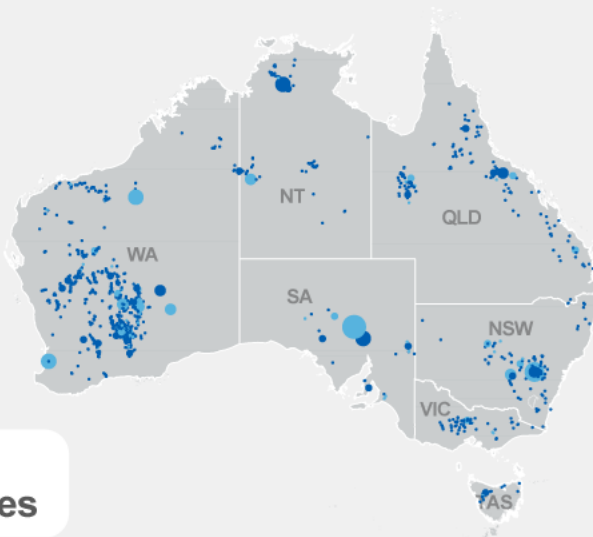


Largest
known share of
gold resources
at **21%**



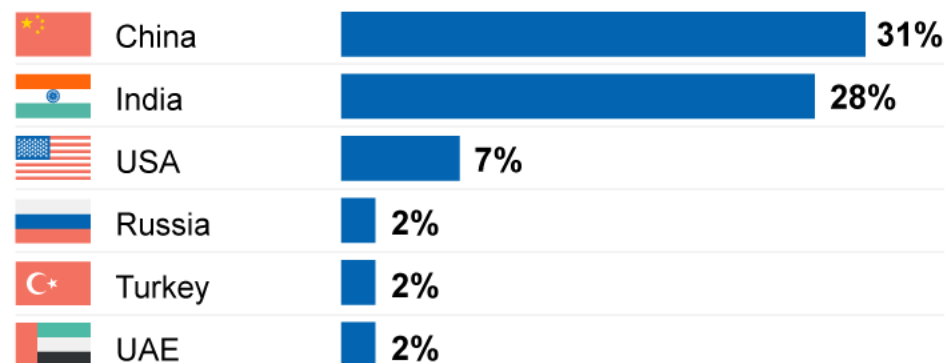
Largest
gold coin ever
created, cast
by Perth mint

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



**Major gold
deposits, tonnes**

Jewellery consumer markets, 2021



Gold facts



Gold is a critical
component in
COVID-19
diagnostic tests



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

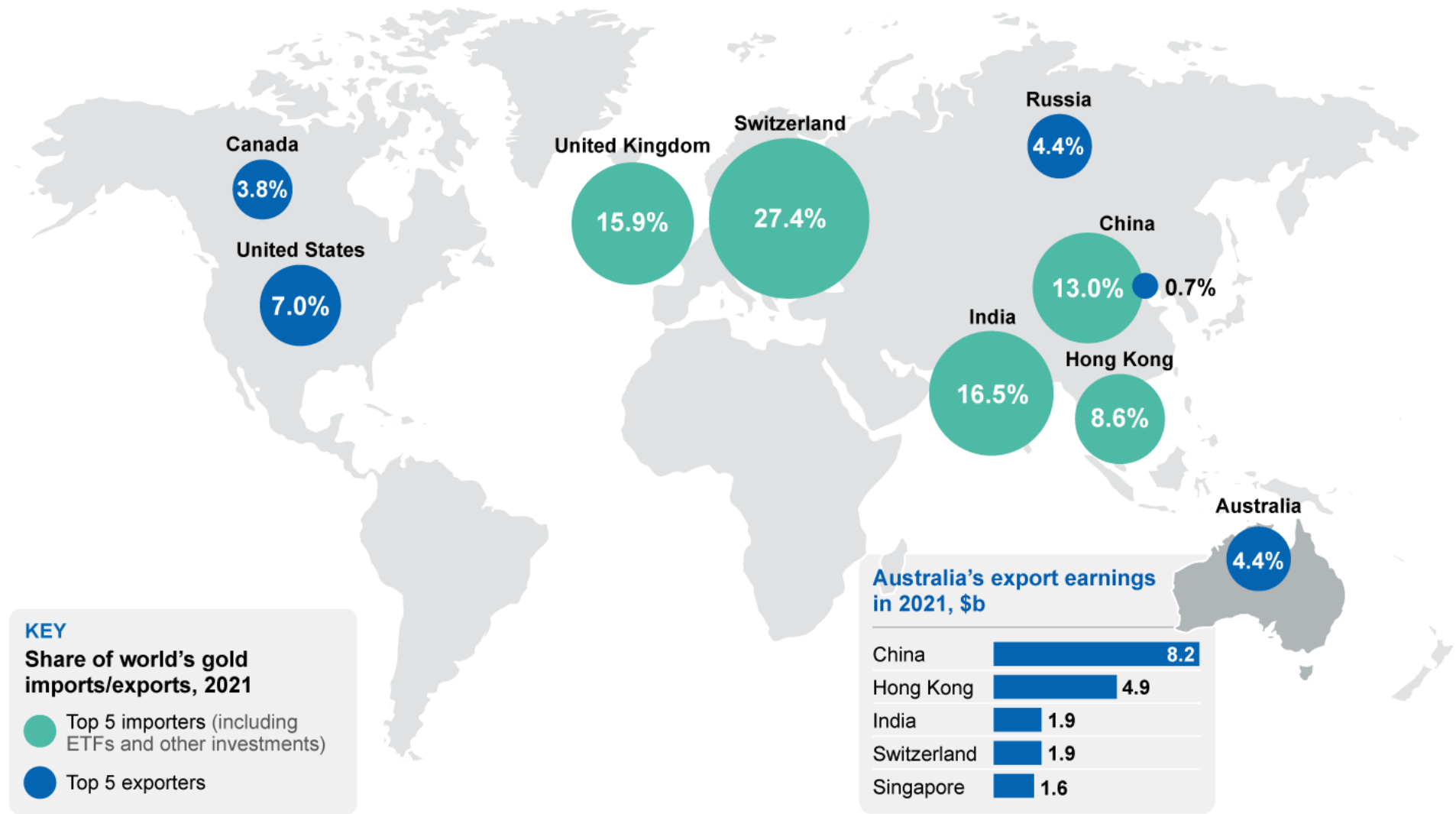


In 2021 jewellery
fabrication made
up **55%** of global
gold use



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

Gold TRADE MAP



10.1 Summary

- Gold prices averaged US\$1,728 an ounce in the September quarter 2022, coming under pressure from increasing bond yields and the strong US dollar. A rebound to above US\$1,750 an ounce in mid-November followed lower-than-expected US inflation data, which lowered market expectations for further interest rate increases.
- Australian gold mine production in the September quarter 2022 was 5.4% higher year-on-year at 78 tonnes. Production is forecast to increase to 329 tonnes in 2023–24, as new projects and expansions of existing projects come on line (see [Australia section](#)).
- Gold earnings are forecast to rise from \$23 billion in 2021–22 to around \$24 billion in 2023–24, as rising export volumes outweigh lower prices.

10.2 World consumption

World gold consumption increased in the September quarter 2022

World gold demand increased by 28% year-on-year to 1,181 tonnes in the September quarter 2022. This increase was driven by record central bank net purchases, which more than offset continued outflows from gold-backed exchange-traded funds (ETFs).

Official sector buying (central banks and other government financial institutions) increased by 341% year-on-year to a quarterly record of 399 tonnes in the September quarter 2022. This brought central bank purchases in 2022 so far to 673 tonnes, higher than any full year total in the World Gold Council's records which date back to 1967. According to the World Gold Council, Türkiye and Uzbekistan were the largest purchasers, collectively buying 57 tonnes of gold during the quarter.

ETF outflows reached 227 tonnes (US\$12 billion) in the September quarter 2022, the largest since June quarter 2013. Rising bond yields since May 2022 — following aggressive interest rate increases from most central banks, particularly the US Federal Reserve — have caused significant outflows from gold ETFs, and contributed to lower gold prices. Consecutive months of outflows from May–October 2022 have outweighed strong inflows from January–April 2022.

Consumer demand for gold (jewellery, gold coins and bars) strengthened during the September quarter 2022, also helping to partially offset the impact of strong ETF outflows. Gold jewellery consumption increased by 9.8% year-on-year to 523 tonnes in the September quarter 2022, driven by stronger demand from China and India.

Jewellery consumption in China was 163 tonnes in the September quarter 2022, up by 58% quarter-on-quarter and 4.7% year-on-year. The demand improvement came despite sporadic COVID-related mobility restrictions across the nation, and was driven largely by lower prices and pent up demand from the June quarter 2022.

Jewellery consumption in India rose by 17% year-on-year to 146 tonnes in the September quarter, with 2022-to-date demand almost returning to pre-COVID levels. Demand was strong among urban consumers, supported by recovering economic activity and credit expansion.

Retail investment in gold bars and coins increased by 36% year-on-year during the September quarter 2022, with investors purchasing 351 tonnes. Demand was supported by gold price falls during the quarter, surging global inflation, and declines in the equity markets of major consuming nations such as China and India.

Official sector demand to push gold consumption higher in 2022

World gold consumption is estimated to increase by 11.6% to 4,486 tonnes in 2022, driven largely by stronger official sector buying (which rose by 76% year-on-year) (Figure 10.1).

Official sector buying in 2022 is now estimated at 798 tonnes; this is 68% higher than forecast in the September 2022 *Resources and Energy Quarterly*, largely a result of record buying during the September quarter 2022. Investment demand (gold-backed ETFs or bar and coin holdings) is expected to increase by 8.5% in 2022. This is a downward revision compared to the September 2022 *Resources and Energy Quarterly*, due to significant outflows in gold-backed ETFs. Investment demand is expected to remain supported by ongoing geopolitical and economic uncertainty through to the end of the year.

Figure 10.1: World gold demand by sector



Notes: 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)

Jewellery consumption in 2022 is estimated to be marginally lower year-on-year, with weaker demand in China and India during the first half of 2022 being offset by strong consumption over the second half. Chinese consumption is expected to be lower than in 2021, due to the weak first half of the year. Chinese consumer sentiment has been hindered by the country's 'zero-COVID' policy measures.

Gold consumption is expected to fall in 2023 but recover in 2024

World gold consumption is forecast to decrease by 10% to 4,032 tonnes in 2023, as official sector buying and investment demand ease from relatively strong levels in 2022. While safe-haven demand will tend to support gold investment — so long as geopolitical and economic uncertainty persists — real bond yields are unlikely to decline to the negative levels seen throughout 2021 and 2022. This will make investors more likely to seek alternative safe-haven assets, such as interest-bearing bonds.

World gold consumption is forecast to increase by 8.1% in 2024 to 4,357 tonnes, driven largely by continued growth in global jewellery consumption. Jewellery consumption is expected to grow by 12% year-on-year in 2024, as economic recovery and a forecast decline in gold prices support purchases in key consuming nations such as China and India.

10.3 World production

World supply increased in the September quarter 2022

World gold supply increased by 0.6% year-on-year to 1,215 tonnes in the September quarter 2022, driven by a 2.3% rise in global mine production.

Global mine production rose to a near-record third quarter total of 949 tonnes during the September quarter 2022, driven largely by increased production in China, and Central/South America.

Chinese production — the world's largest gold producing nation — rose by 14% year-on-year to around 95 tonnes in the September quarter 2022, as mining operations in Shandong province returned to normal. Shandong's provincial government halted operations in 2021, in order to enable safety inspections to take place.

Australian production — the world's second-largest gold producing country — increased by 5.4% year-on-year in the September quarter 2022, to 78 tonnes (see [Australia section](#)).

Russian production — the world's third-largest gold producing country — declined by 11% year-on-year. This was due to a combination of lower grades at several major mines and lower production — due to rising costs, shortages of equipment and reduced financing due to sanctions.

Central and South American production was 10 tonnes higher year-on-year in the September quarter 2022.

Gold recycling declined by 5.8% year-on-year, largely reflecting the impact of disruptions in China related to the government's zero-COVID policy. Partially offsetting declines in China, recycling flows were higher in several markets (such as Japan, the EU and the UK), supported by local currency depreciation against the US dollar.

World supply expected to fall after 2022 as recycling activity eases

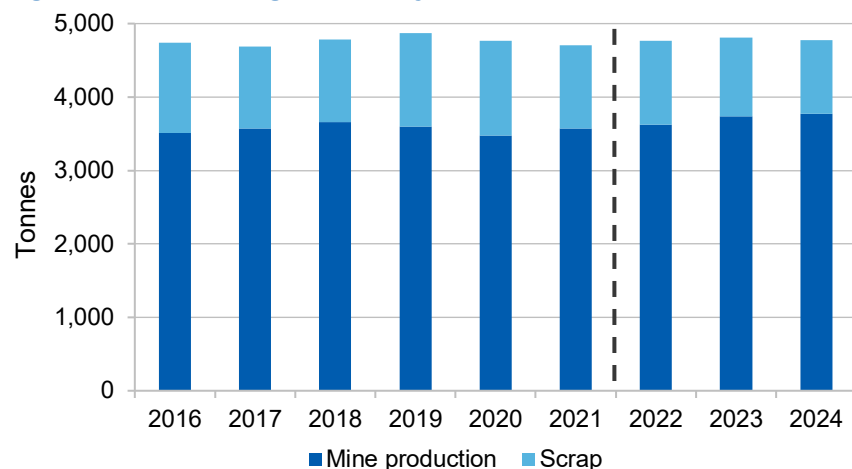
In 2022, global gold supply is estimated to rise by 1.6% to 4,758 tonnes, driven mainly by higher gold mine production. World gold mine production is estimated to rise by 1.4% in 2022 to 3,620 tonnes, led by increases in China, Australia, Canada and West Africa.

High gold prices in the first half of the year supported greater recycling activity, with recycling volumes forecast to rise as a result by 0.5% to 1,142 tonnes in 2022.

World gold supply is forecast to be relatively steady at about 4,800 tonnes in 2023 and 2024, as lower recycling activity offsets increases in mine production (Figure 10.2).

Lower forecast gold prices are expected to discourage recycling activity, with global scrap supply declining at an average rate of 6.5% a year over the outlook period.

Figure 10.2: World gold supply



Note: Net producer hedging is not included.

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

Gold mine production is expected to increase at an average rate of 2.1% over the outlook period to about 3,800 tonnes as new projects come online in Canada, Chile, Brazil and Australia. Gold production increases will be particularly large in Canada, with the 11 tonnes per year Côté project and the 10 tonnes per year Blackwater project commencing production in the next two years. Continued environmental regulations and industry consolidation in China will see production fall over the medium-term.

10.4 Prices

Gold prices rebounded following lower interest rate expectations

The London Bullion Market Association (LBMA) gold price returned to above the US\$1,750 an ounce mark in mid-November 2022, driven by a lower-than-expected US inflation result of 7.7% in October 2022. This decline in inflation prompted markets to revise down expectations for US interest rate increases, resulting in declines in both bond yields and the US dollar.

Prior to the US October inflation release, gains in real bond yields and the US dollar had been placing significant downward pressure on gold prices. Gold prices averaged US\$1,728 an ounce over the September quarter 2022 and briefly touched below US\$1,650 an ounce in late September as real bond yields rose beyond 1.5% (Figure 10.3).

Higher-than-expected inflation in advanced economies continued to drive central banks to lift interest rates aggressively through the second half of 2022. The US Federal Reserve continued its aggressive tightening against persistently high domestic inflation. US interest rate increases have continued to outpace those of other major currency hubs such as the European Union and the United Kingdom — as well as Japan and China, who have not yet raised interest rates. This resulted in strong demand for the US dollar, which pressured US dollar gold prices during the quarter.

Rising bond yields tend to undermine gold's appeal to institutional and retail investors as a secure asset to hedge against inflation or other risks.

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



Source: Bloomberg (2022)

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

On 2 November 2022, the US Federal Reserve lifted the target for the Fed funds rate by 75 basis points to 3.75%-4.00%. Markets are now pricing in a peak in the Fed Funds rate of about 5.0% by the middle of 2023 — 50 basis points higher than expected at the time of the release of the September 2022 *Resources and Energy Quarterly*.

Gold prices to fall over the short and medium term

Gold prices are forecast to fall at an average annual rate of 4.9% over the outlook period, from about US\$1,800 an ounce in 2022 to US\$1,625 an ounce in 2024 (Figure 10.4). Gold prices have mostly resisted sharp increases in real bond yields so far this year, however this resistance is

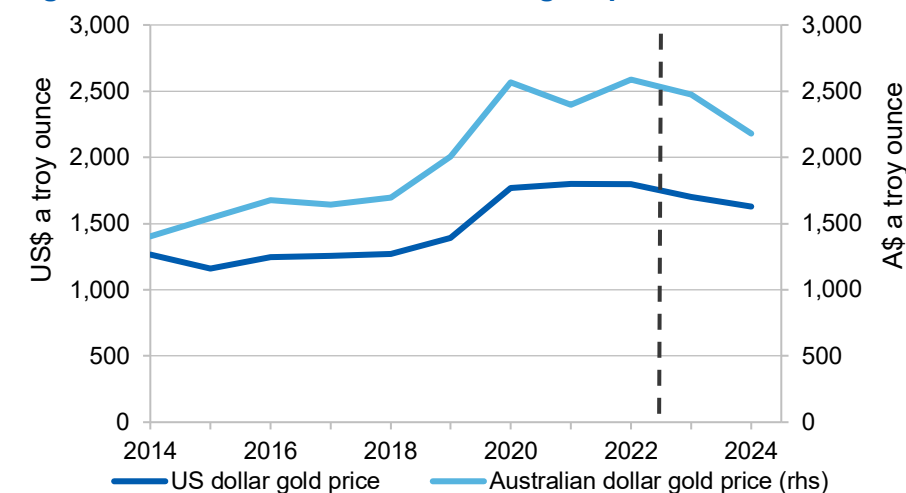
expected to unwind over time as interest rates continue to rise and as global inflation cools (see *Macroeconomic Outlook*). Lower safe haven demand will do less to ameliorate the impact of higher interest rates on gold demand.

The lower US dollar gold price is expected to drive the Australian dollar gold price lower from around A\$2,600 an ounce in 2022 to A\$2,200 an ounce in 2024.

There are several risks to the gold price assessment over the outlook period. These include the arrival of any new COVID variants and the disruption associated with China’s COVID containment toolkit. Persistent outbreaks could dampen future gold demand from one of the world’s largest importers and consumers of gold.

A further risk to the price assessment is the continued fallout from Russia’s invasion of Ukraine. An escalation in the conflict is likely to have a pronounced impact on the safe-haven demand for gold. Finally, the path of official interest rates — and by extension inflation — over the forecast period is uncertain.

Figure 10.4: US and Australian dollar gold prices



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

Persistent global inflation could result in a higher-than-expected rise in official interest rates, leading to a steeper than forecast decline in gold prices — as the opportunity cost of holding gold increases. Should global inflation decline more quickly than expected, a less aggressive tightening of monetary policy would likely occur, leading to a slower than forecast decline in gold prices.

10.5 Australia's trade, production and exploration

Australian gold exports increased in the September quarter 2022

Australia's gold exports increased by 23% year-on-year to \$6.7 billion in the September quarter 2022. The increase was driven by a 12% increase in export volumes, also supported by higher Australian dollar gold prices.

Australia exported \$2.2 billion of gold to China in the September quarter 2022, which was flat year-on-year. Gold exports to India were 22% lower at \$404 million.

Australian exports to the financial hubs (United States, United Kingdom, Switzerland, Hong Kong and Singapore) were collectively worth \$3.1 billion in the September quarter 2022 – a 61% increase year-on-year.

Australian gold exports to increase with higher production

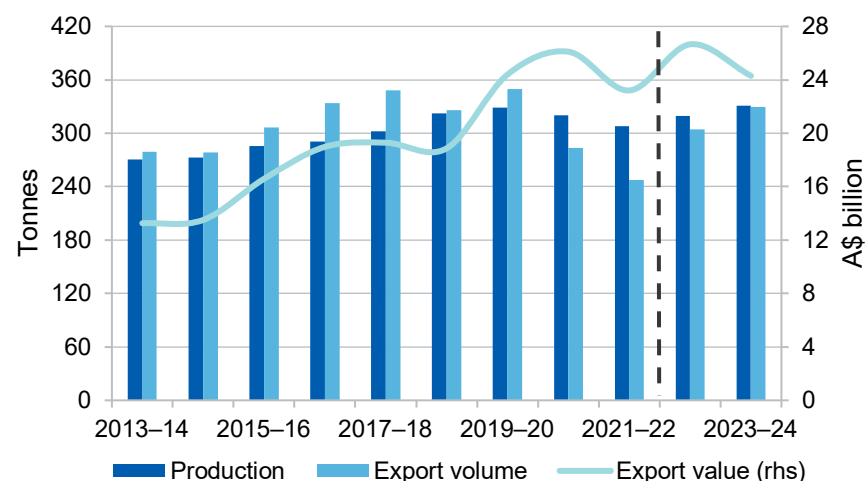
Australian gold export earnings are forecast to rise by 15% to almost \$27 billion in 2022–23, before falling back to \$24 billion in 2023–24 (Figure 10.5). Increased gold production is expected over the next two years, however, lower US and Australian dollar gold prices will drive the forecast fall in export values in 2023–24 (see [Prices section](#)).

Australian gold mine production increased in the September quarter 2022

Australia's gold production was 79 tonnes in the September quarter 2022, up by 5.4% year-on-year. Fewer gold miners reported production impacts from labour shortages and logistical issues (such as delays to road haulage) related to COVID-19 outbreaks over the quarter.

Red 5's 5.5 tonnes per year King of the Hills gold project in WA achieved first gold in June 2022 and began ramping up production over the quarter.

Figure 10.5: Australian gold exports



Notes: Export volume contains ash, waste and scrap gold, with gold content unknown.

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

King of the Hills will become the company's main processing hub, taking in ore from its Darlot project.

Production at Newcrest's Cadia mine in NSW increased to about 4.4 tonnes in the September quarter 2022, up 30% year-on-year. This year-on-year increase was largely a result of planned maintenance to replace the plant's SAG mill motor from July-November 2021.

Production at Agnico Eagle's Fosterville gold operation in Victoria was about 2.5 tonnes in the September quarter 2022, down 39% year-on-year. Mine production at Fosterville continues to be affected by primary ventilation operating restrictions related to low frequency noise constraints.

AngloGold Ashanti produced 1.8 tonnes of gold from their Sunrise Dam operation in WA, steady year-on-year. Meanwhile, production from their Tropicana Joint Venture with Regis Resources was 27% higher year-on-year at 3.8 tonnes in the September quarter 2022. AngloGold Ashanti attributed the increases at Tropicana to improvements in both processing tonnage and grade.

BHP's Olympic Dam reported an 80% increase year-on-year for a record 1.5 tonnes of gold produced in the quarter. BHP attributed the improvement to debottlenecking initiatives implemented over the year.

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 3.7% during 2022–23 and 2023–24. Production is forecast to reach 320 tonnes in 2022–23, propelled by production from new mines and existing mine expansions. Production will continue to ramp up for Calidus Resources' 4.3 tonnes per year Warrawoona gold project in WA and Red 5's 5.5 tonnes per year King of the Hills gold project, with both achieving first production in mid-2022.

Australian output is forecast to reach 331 tonnes in 2023–24: Bellevue Gold's 5.7 tonnes per year Bellevue gold mine in WA is expected to come online in the second half of 2023, while Northern Star Resources' Super Pit gold operation will begin long-term expansion from 2024.

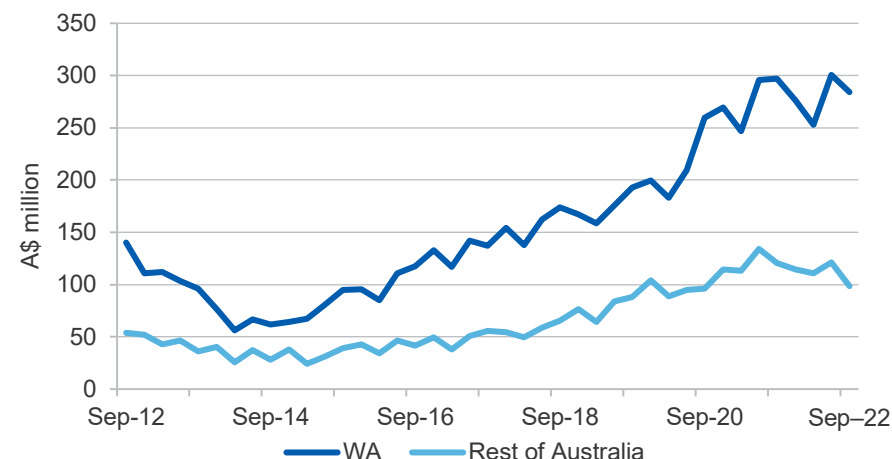
The primary risk to the Australian gold production forecast is the extent to which supply chain issues and labour or skill shortages persist in the short term. Weaker than expected gold prices present a further downside risk to the forecasts of Australian gold production (see [Prices section](#)). Much weaker prices would see high-cost Australian producers cease or cut back their operations.

Gold exploration expenditure decreased in September quarter 2022

Australia's gold exploration expenditure decreased by 8.5% year-on-year to \$382 million in the September quarter 2022 (Figure 10.6). As a result, gold's share of Australian mineral exploration expenditure declined to 35.2% in the September quarter 2022, down from 41.9% a year earlier. Western Australia remained the centre of gold exploration activity in Australia, accounting for 74% of total gold exploration expenditure. A 4.4%

decline year-on-year in Western Australian gold exploration expenditure accounted for much of the decline in overall gold exploration expenditure, while expenditure was also down year-on-year in Victoria (by 24%) and New South Wales (21%).

Figure 10.6: Australian gold exploration expenditure



Source: ABS (2022)

Revisions to the outlook

Australia's forecast gold export earnings have been revised up by 4.3% for 2022–23 compared with the September 2022 *Resources and Energy Quarterly*. This mostly reflects an upgrade to forecast US dollar gold prices over the forecast period, with Australian dollar gold prices receiving additional support from the lower exchange rate assumption over 2022–23. Higher prices more than offset a downgrade in forecast export volumes, resulting from lower forecast mine production. Australian gold export earnings have been revised down by 2.0% in 2023–24, due to a downgrade in forecast export volumes.

Table 10.1: Gold outlook

World	Unit	2021	2022 ^s	2023 ^f	2024 ^f	Annual percentage change		
						2022 ^s	2023 ^f	2024 ^f
Total demand	tonnes	4,020	4,486	4,032	4,357	11.6	-10.1	8.1
Fabrication consumption ^b	tonnes	2,560	2,596	2,529	2,811	1.4	-2.6	11.2
Mine production	tonnes	3,570	3,620	3,737	3,774	1.4	3.2	1.0
Price ^c								
– nominal	US\$/oz	1,800	1,798	1,703	1,626	-0.1	-5.3	-4.5
– real ^d	US\$/oz	1,938	1,798	1,645	1,537	-7.2	-8.5	-6.6
Australia	Unit	2020–21	2021–22	2022–23 ^f	2023–24 ^f	2021–22	2022–23 ^f	2023–24 ^f
Mine production	tonnes	318	308	320	331	-3.2	3.8	3.5
Exports								
– volume	tonnes	283	248	304	329	-12.6	23.0	8.1
– nominal value	A\$m	26,105	23,200	26,657	24,296	-11.1	14.9	-8.9
– real value ^e	A\$m	29,207	24,853	26,657	23,199	-14.9	7.3	-13.0
Price								
– nominal	A\$/oz	2,481	2,529	2,569	2,298	1.9	1.6	-10.5
– real ^e	A\$/oz	2,776	2,709	2,569	2,194	-2.4	-5.2	-14.6

Notes: **b** includes jewellery consumption and industrial applications; **c** London Bullion Market Association PM price; **d** In 2022 US dollars; **e** In 2022–23 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



Australia's aluminium sector



Largest
bauxite
producing nation
– **103 million**
tonnes in 2021

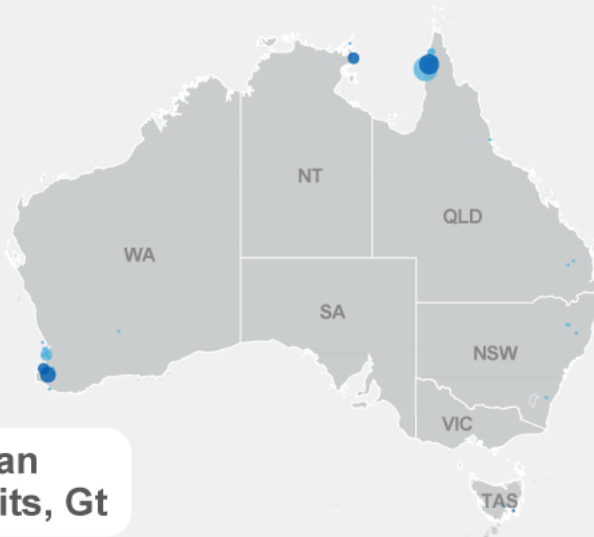


Largest
alumina exporter
– **18 million**
tonnes in 2021



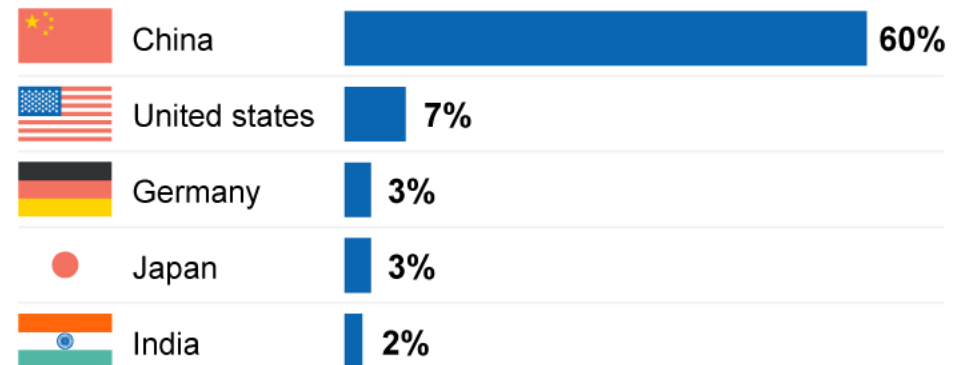
2nd largest
alumina producer
– **21 million**
tonnes in 2021

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



**Major Australian
bauxite deposits, Gt**

Primary aluminium top consumer markets, 2021



Aluminium facts



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



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

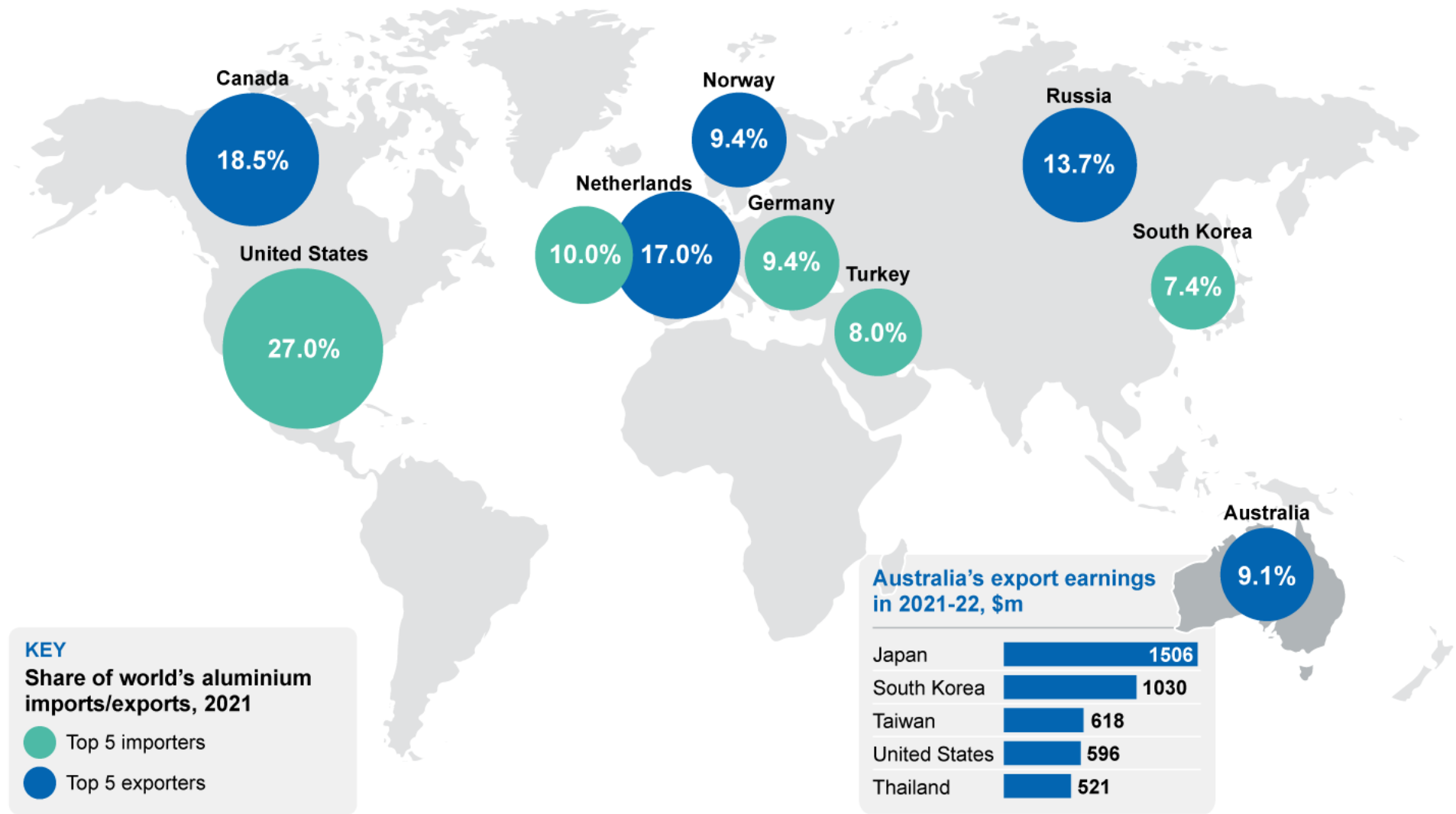


China is the **largest producer and consumer** of primary aluminium



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

Aluminium **TRADE MAP**



11.1 Summary

- Higher primary aluminium supply from China is expected to place downward pressure on aluminium prices over the outlook period, trending lower from an average of US\$2,710 a tonne in 2022 to US\$2,400 a tonne in 2024. Growing demand for new energy-efficient cars and technologies will provide some support for aluminium prices.
- Australia's annual primary aluminium and alumina output is expected to be broadly steady over the outlook period at around 1.6 million tonnes of primary aluminium and 21 million tonnes of alumina. Australia's annual bauxite output is expected to increase from 105 million tonnes in 2022–23 to nearly 108 million tonnes in 2023–24 (see [Australia section](#)).
- The total value of Australia's aluminium, alumina and bauxite exports is forecast to fall by 4.3% in 2022–23 and by 4.9% in 2023–24 to \$14 billion.

11.2 World consumption

China led higher primary aluminium consumption in Q3 2022

Global primary aluminium consumption rose by 1.5% year-on-year to 17 million tonnes in the September quarter 2022, driven by higher demand from China.

In China, primary aluminium consumption rose by 4.4% year-on-year in the September quarter 2022 to nearly 11 million tonnes. The improvement in the automotive sector offset the continued weakness in the property sector. Since the June 2022 *Resources and Energy Quarterly (REQ)*, the Chinese Government has rolled out a further series of measures to stabilise the economy. These measures have supported the recovery of China's automotive market, with total automotive production rising by 8.1% year-on-year in the first-ten months of 2022 to 22 million units. Over this period, China's automotive sales also rose by 4.9% year-on-year to nearly 22 million units.

The weakness in the Chinese property sector (previously discussed at the September 2022 *REQ*) shows no signs of abating, despite policy

loosening from local authorities. Supportive measures include lifting of home purchase restrictions, loosening of mortgage terms, lowering of borrowing rates, and the provision of subsidies for homebuyers.

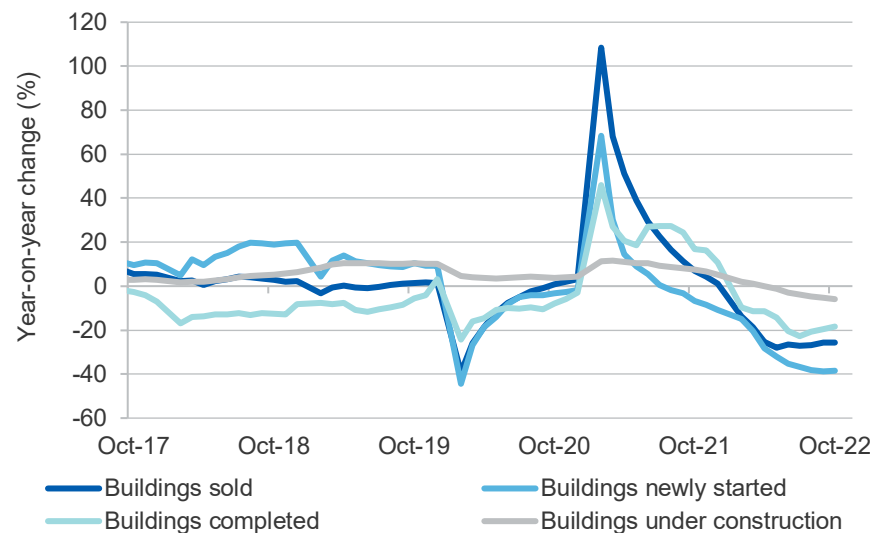
Chinese residential building activity indicators showed continued weakness in October 2022. This includes residential sales falling by 26% year-on-year to 941 million square meters, new residential building starts falling by 39% year-on-year to 759 million square meters, residential buildings under construction falling by 5.9% year-on-year to 6,283 million square meters, and residential buildings completed falling by 18% year-on-year to 338 million square meters (Figure 11.1).

The European automotive sector has continued to be affected by rising energy costs. Vehicle car sales decreased by 14% year-on-year in the first-ten months of 2022 to 10 million units. According to the German Association of the Automotive Industry September 2022 survey, around 10% of firms in the sector have already cut output, with another 30% planning production cuts. In term of investment, 53% of automotive producers in Europe are likely to defer or cancel their planned investments.

World alumina usage increased by 4.1% year-on-year in the September quarter 2022 to 34 million tonnes, due to higher global aluminium production (up by 1.2% year-on-year over the same period). China remains the world's largest alumina consuming country, accounting for 59% of global alumina consumption. In the September quarter 2022, China consumed nearly 20 million tonnes of alumina, an increase of 7.1% year-on-year. Outside of China, alumina consumption in India and the UAE rose by 7.2% and 14%, to reach 2.1 and 1.3 million tonnes in the September quarter 2022, respectively.

World bauxite usage increased by 3.5% year-on-year in the September quarter 2022 to nearly 92 million tonnes, due to a rise in global alumina production (up 2.2% in the September quarter 2022). China remained the world's largest bauxite consuming country, accounting for 55% of global bauxite consumption.

Figure 11.1: China's residential buildings activity



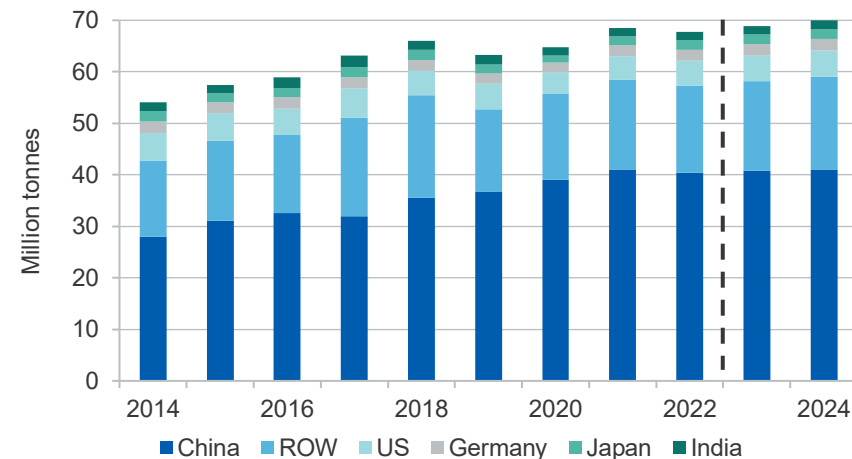
Source: Bloomberg (2022)

Slowing global economy reduces primary aluminium usage in 2022

Global primary aluminium consumption is estimated to decrease by 1.1% in 2022, to 68 million tonnes (Figure 11.2). Slowing global economic growth and rising inflation and interest rates in many parts of the world are expected to affect primary aluminium consumption over the rest of 2022 and the first-half of 2023.

In early November, the Chinese government announced 20 measures guiding a partial relaxation of COVID controls, as well as 16 measures to revive its sluggish property sector. Support for the sector included measures such as extending existing developer loans, supporting property sales through lower down-payments and mortgage rates, boosting other funding channels to the developers, and ensuring the delivery of pre-sold property. Despite the recent government support, a stabilisation of China's property sector has yet to materialise. As a result, primary aluminium demand from China is estimated to fall by 1.4% in 2022.

Figure 11.2: World primary aluminium consumption



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

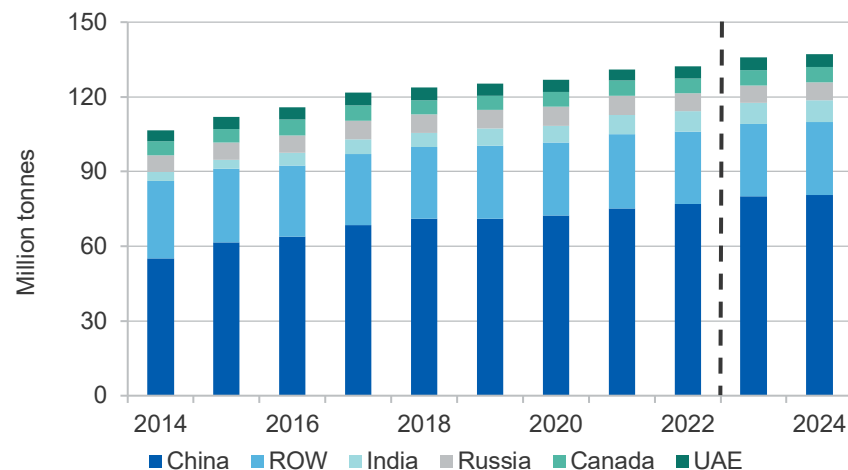
Amongst other major consumers, European economic woes, likely to lead to a recession in coming months, are expected to lead to a further fall in primary aluminium consumption across the region.

In the US, strong demand in the first-half of 2022 is likely to offset soft demand in the second-half of 2022. The housing sector remained under pressure, with new privately owned housing units started (by structure) fell by 6.9% year-on-year in the September quarter 2022 to nearly 4.4 million units. The slowdown indicates that the successive interest rate hikes by the US Federal Reserve have hit the US housing market. As a result, primary aluminium demand from the US is estimated to increase by 4.7% in 2022.

World alumina usage is estimated to rise by 1.1% in 2022 to 132 million tonnes (Figure 11.3). This follows an expected 0.6% rise in global primary aluminium output in 2022.

World bauxite usage is estimated to increase by 1.3% in 2022 to 363 million tonnes (Figure 11.4). The rise is expected to be driven by higher Chinese alumina output.

Figure 11.3: World alumina consumption



Notes: ROW: Rest of the world

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

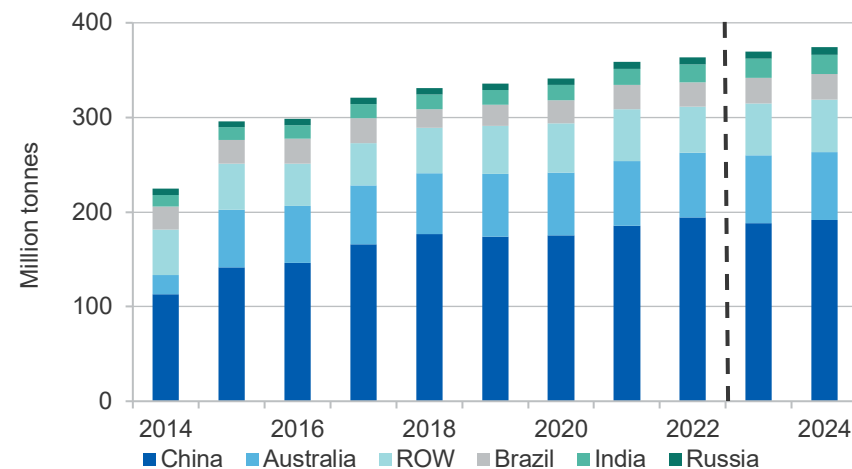
New energy-efficient cars and technologies boost aluminium consumption

Beyond 2022, world primary aluminium consumption is forecast to grow at an annual average rate of 1.6%, to reach 70 million tonnes by 2024 (Figure 11.2). A significant driver of aluminium demand is expected to come from new energy-efficient cars and technologies.

EV passenger car sales are forecast to rise from 6.8 million units in 2021 to 17.6 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 2.8 million tonnes in 2022 to about 4.4 million tonnes in 2024 (Figure 11.5).

In China, larger investments in the electric grid and renewable power are expected to support aluminium demand. According to China's National Energy Administration, newly installed solar power rose by 110% year-on-year in the first-seven months of 2022. Newly installed wind power was up by 19% year-on-year over the same period. China's grid investment in the current five-year plan (2021-2025) is expected to reach RMB3.1 trillion,

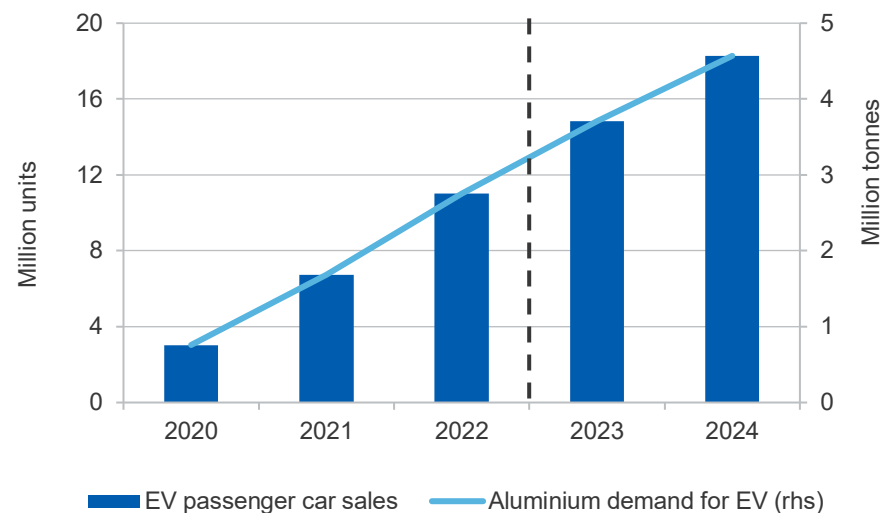
Figure 11.4: World bauxite consumption



Notes: ROW: Rest of the world

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

Figure 11.5: Global EV car sales vs aluminium demand



Notes: Figures do not include hybrid car sales.

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

a rise of 18% on the previous five-year plan. The demand for wire and cable in China is expected to grow at an average annual rate of 4.5% between 2022 and 2024.

World alumina usage is forecast to rise at an average annual rate of 1.8% over the outlook period, reaching 137 million tonnes by 2024 (Figure 11.3). Alumina demand is driven by primary aluminium production, which is forecast to lift by an average of 2.1% a year during 2023 and 2024.

World bauxite usage is forecast to grow at an average annual rate of 1.1% over the outlook period to 371 million tonnes in 2024 (Figure 11.4). The gains are expected to be largely driven by higher alumina output from existing refineries in China and India.

11.3 World production

Aluminium, alumina and bauxite output grew in Q3 2022

Global primary aluminium production increased by 3.2% year-on-year in the September quarter 2022 to 17 million tonnes, propelled by higher output in China — the world's largest aluminium producer. China produced 10 million tonnes of primary aluminium in the September quarter 2022, up 7.1% year-on-year, with Chinese smelters responding to the removal of power restrictions and higher power supply.

Primary aluminium production in the UAE increased by 8.6% year-on-year in the September quarter 2022 to 618,000 tonnes, driven by the commission of 92 new reduction cells at Emirates Global Aluminium' Al-Taweelah aluminium smelter.

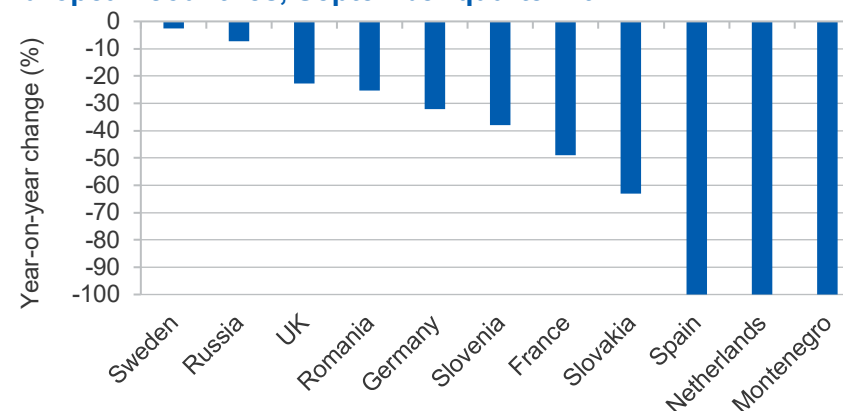
In Europe, primary aluminium output in the September quarter 2022 was severely affected by the region's energy crisis. A number of countries, including Spain, the Netherlands and Montenegro had paused production of primary aluminium, and France and Germany reduced their output by 50% and 32% year-on-year, respectively (Figure 11.6).

In the September quarter 2022, Russian primary aluminium output fell by 7.2% year-on-year to 915,000 tonnes (Figure 11.6). In comparison with the June quarter 2022, Russian primary aluminium output was stable. Stable

aluminium production reflects the gradual commissioning of Rusal's 429,000 tonnes a year Taishet aluminium smelter.

World alumina supply increased by 2.0% year-on-year in the September quarter 2022 to nearly 36 million tonnes, driven by higher alumina output from China — the world's largest alumina producer. Over this period, China produced 21 million tonnes of alumina, up 8.9% year-on-year.

Figure 11.6: Primary aluminium production of selected European countries, September quarter 2022



Source: World Bureau of Metal Statistics (2022)

Outside of China, Indonesia's alumina output rose by 10% year-on-year in the September quarter 2022 to 375,000 tonnes, propelled by continued production ramp-up at the 300,000 tonnes a year Tayan alumina refinery.

High energy prices have hit the European alumina sector severely, with production curtailments occurring across the region. In Romania, Alro Slatina's 600,000 tonnes a year Alum Tulcea alumina refinery — Romania's sole alumina producer — temporarily suspended production from August 2022, due to high energy prices.

And in Spain, in early July 2022 Alcoa announced a 15% production cut to its 1.6 million tonnes a year San Ciprian alumina refinery, due to high energy prices. Another 45% of production capacity was cut in August/September 2022.

Alumina production in Australia — the world's second largest alumina producer — fell by 7.8% year-on-year in the September quarter (see *Australia's exports and production* section).

World bauxite supply increased by 6.1% year-on-year in the September quarter 2022, to 94 million tonnes, driven by higher output in Guinea — the world's second largest bauxite producing country. Over this period, bauxite production in Guinea increased by 34% year-on-year to 25 million tonnes, as the ramp up of production continued. In the September quarter 2022, Australian production fell by 1.7% year-on-year to 26 million tonnes (see *Australia's exports and production* section).

World aluminium, alumina and bauxite output estimated to rise in 2022

World primary aluminium output in 2022 is estimated to increase by 0.6% year-on-year to nearly 68 million tonnes, driven by increased production from China, India and Australia (Figure 11.7).

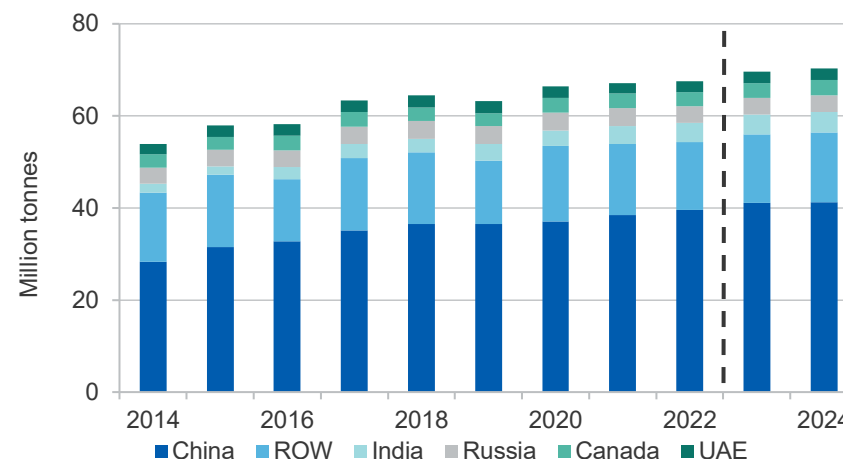
In China, aluminium smelters in the Sichuan province have resumed operations as power supply has been restored. The 400,000 tonnes a year Baiyinhua aluminium smelter in Inner Mongolia area was commissioned in October 2022, after a one year delay due to strict environmental and energy control policy. As a result, Chinese primary aluminium output is estimated to increase by 2.6% in 2022 to nearly 40 million tonnes.

Downside risks to Chinese production include impending 2022–23 winter production cuts, with some aluminium smelters in Henan province already instructed to curtail their production. It is estimated around 110,000 tonnes a year of capacity is to be cut in Henan province during this winter period. Implementation of winter production curtailments for aluminium smelters in other regions remains unclear at this stage.

Primary aluminium production in India is estimated to increase by 3.2% year-on-year to reach nearly 4.1 million tonnes in 2022.

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

Figure 11.7: World primary aluminium production



Notes: ROW: Rest of the world

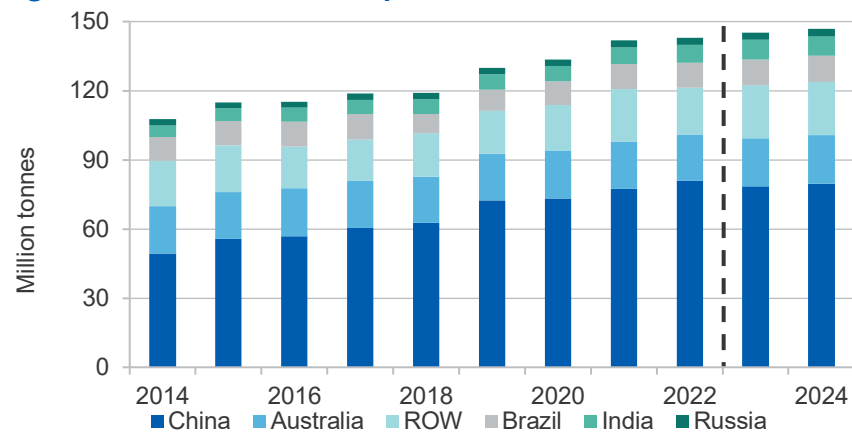
Source: World Bureau of Metal Statistics (2022); Macquarie (2022); Department of Industry, Science and Resources (2022)

In Europe, primary aluminium output is expected to continue declining in the December quarter 2022, due to lower power availability this winter. As a result, European (ex-Russian) primary aluminium output is estimated to fall by 18% in 2022 to 3.4 million tonnes.

World alumina output is estimated to increase by 0.8% year-on-year to 143 million tonnes in 2022, driven by increased alumina production from China (Figure 11.8). Like its aluminium smelters, Chinese alumina refineries have resumed operations after power rationing in July and August of this year.

Bosai Minerals' 800,000 tonnes a year Nanchuan Shuijiang alumina refinery partially resumed operations in mid-September 2022. Bosai Group's 3.6 million tonnes a year Wanbo New Materials alumina refinery in Wanzhou province cut its capacity by 20% in August 2022, but has gradually resumed its production since early September 2022.

Figure 11.8: World alumina production



Notes: ROW: Rest of the world

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

World bauxite supply is estimated to rise by 4.1% to 383 million tonnes in 2022, driven by higher production in Guinea (up 10% year-on-year to 96 million tonnes) (Figure 11.9).

Guinea is expected to join Australia as the only two nations to produce over 100 million tonnes of bauxite in a year (Figure 11.10). Over the last decade, Guinea's bauxite production has grown an average of 18% a year (Figure 11.10). Guinea is expected to overtake Australia as the world's largest bauxite producer before the end of 2024.

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

World primary aluminium output is forecast to rise at an average annual rate of 2.1% in 2023 and 2024, reaching 70 million tonnes by 2024 (Figure 11.7). The gains are expected to be driven by increased aluminium output from China and Bahrain. After a 2.6% rise in 2022, China's primary aluminium output is forecast to continue growing: by 4.0% in 2023, followed by a further 0.5% growth in 2024 to over 41 million tonnes.

The risk to the Chinese production forecast remains the timing of restarts in the Yunnan province. Due to power restrictions in July/August 2022,

most aluminium smelters in the province were asked to curtail or stop production. With the power restrictions now removed, smelters in the region are expected to restart either before the end of this year or in the first-half of 2023. However, the restarts will not be implemented if there remains uncertainty about the power supply. The Chinese Government's zero-COVID policy is a further risk to the restarts.

Outside of China, the Alba Aluminium smelter in Bahrain completed a pre-feasibility study for its Line 7 expansion project in the September quarter 2022. It is highly likely that the proposed Line 7 project will commence in 2023. Once completed, it will increase the smelter's output from 1.56 million tonnes in 2021 to 1.68 million tonnes in 2024.

World alumina output is forecast to increase by 1.4% a year over the outlook period, reaching 147 million tonnes by 2024 (Figure 11.8). The gains are forecast to be driven by China and Indonesia.

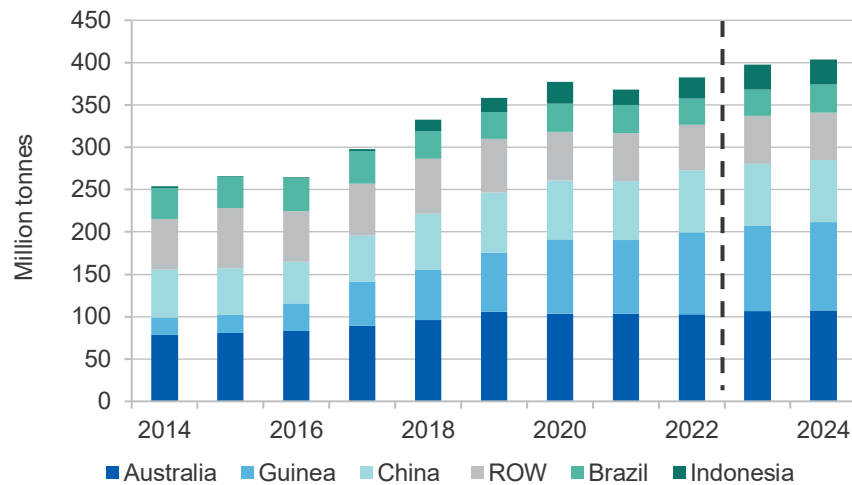
China Aluminium Company and the Indonesian joint-venture partners' 2 million tonnes a year Mempawah alumina refinery in Indonesia is expected to come online in 2024. The operators and contractors reached an agreement in October 2022 to continue the work after several contract adjustments were made.

In August 2022, the eastern Indian state of Odisha approved Adani's 4 million tonnes a year alumina refinery project. The cost of the project is estimated to be US\$5.2 billion. Start and completion dates for the project are still unknown.

After 2022, world bauxite production is forecast to increase by 2.7% a year over the outlook period, reaching 403 million tonnes by 2024 (Figure 11.9). Australia, Guinea and Brazil are expected to contribute most to this rise.

In October 2022, Norwegian aluminium producer Norsk Hydro announced a US\$110 million investment to expand its 11 million tonnes a year Paragominas bauxite mine in Brazil. The expansion is expected to come online in mid-2023.

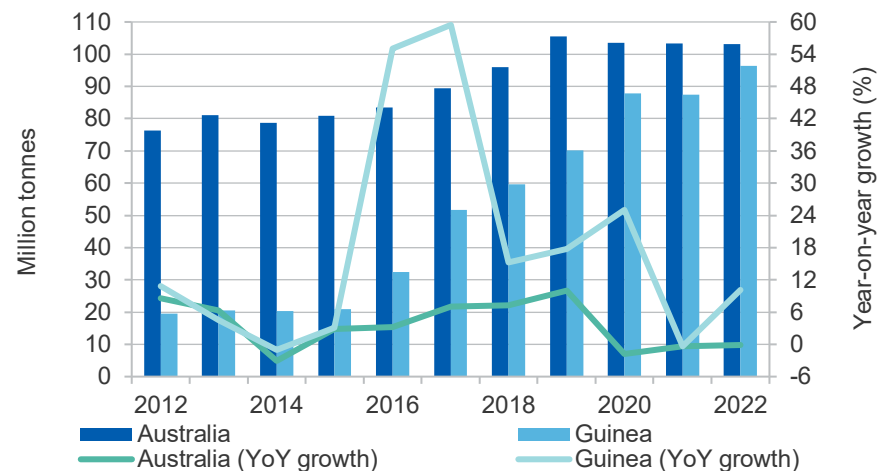
Figure 11.9: World bauxite production



Notes: ROW: Rest of the world

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

Figure 11.10: Australian and Guinean bauxite production



Notes: Production figures for December quarter 2022 are estimated.

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

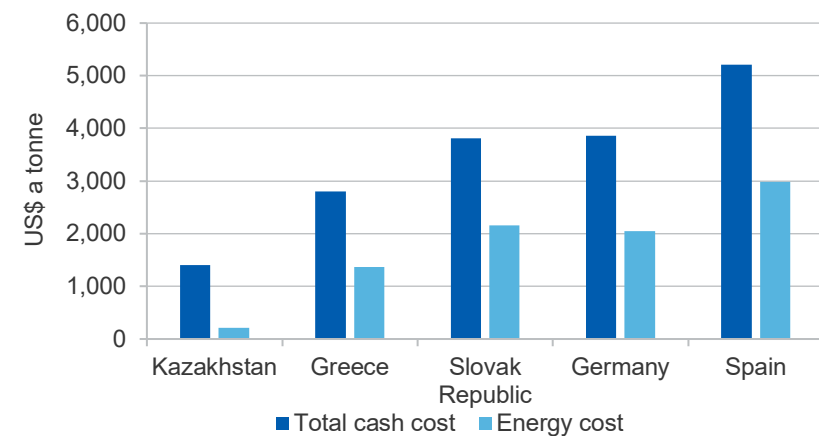
Cost of production

Figure 11.11 shows the aluminium smelters' total cash and energy costs by primary aluminium producing nations in 2022. Out of 35 producing nations, 25 have an average total cash costs above the US\$2,000 a tonne profitability boundary. In Europe, the cost of producing a tonne of primary aluminium has skyrocketed due to higher energy costs. The total cost has averaged US\$5,205 a tonne in Spain, US\$3,856 a tonne in Germany, US\$3,813 a tonne in Slovak Republic and US\$2,798 a tonne in Greece.

Energy is the main contributor to rising primary aluminium production costs in Europe. It accounts for about 49-57% of costs of major producers such as Spain, Germany, Slovak Republic and Greece. In comparison with Kazakhstan (the lowest cost producer), the cost of energy is 13 times higher in Spain, 9 times higher in Germany, 9 times higher in Slovak Republic and 5 times higher in Greece.

Vedanta — India's largest aluminium producer — sees lower costs of production in the second-half of 2023 financial year. With lower alumina prices, lower power cost and better coal linkages, the company expects its aluminium production cost will be reduced by around US\$341 a tonne.

Figure 11.11: Aluminium smelter cash and energy costs, 2022



Source: Wood Mackenzie (2022)

11.4 World trade

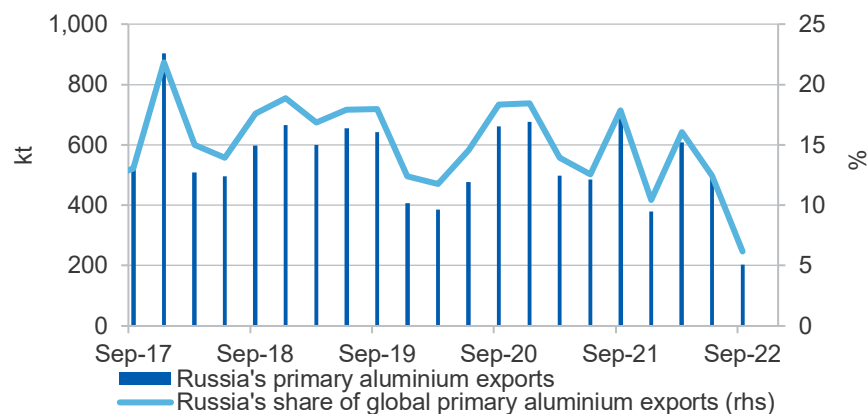
Weak aluminium exports from Russia in the September quarter 2022

World primary aluminium exports decreased by 15% year-on-year in the September quarter 2022 to 3.3 million tonnes, due to lower exports from Russia and Norway.

The fallout from the Russian invasion of Ukraine has reduced Russian primary aluminium exports by 71% year-on-year in the September quarter 2022 to 204,000 tonnes. Despite Russian aluminium not being sanctioned in the US and other western nations, Russian aluminium exports have fallen, with the country's share of world primary aluminium exports falling from 16% in the March quarter 2022 to 6.2% in the September quarter 2022 (Figure 11.12).

Offsetting the fall in aluminium exports from Russia were higher primary aluminium exports from China. China's primary aluminium exports accelerated in the first-ten months of 2022. Over this period, China exported 202,738 tonnes of primary aluminium, 24 times higher year-on-year (Figure 11.13). Of this, 31% was exported to the Netherlands, 17% to Türkiye and 15% to South Korea.

Figure 11.12: Russia's primary aluminium exports and share of global primary aluminium exports, quarterly



Source: UN Comtrade (2022); World Bureau of Metal Statistics (2022)

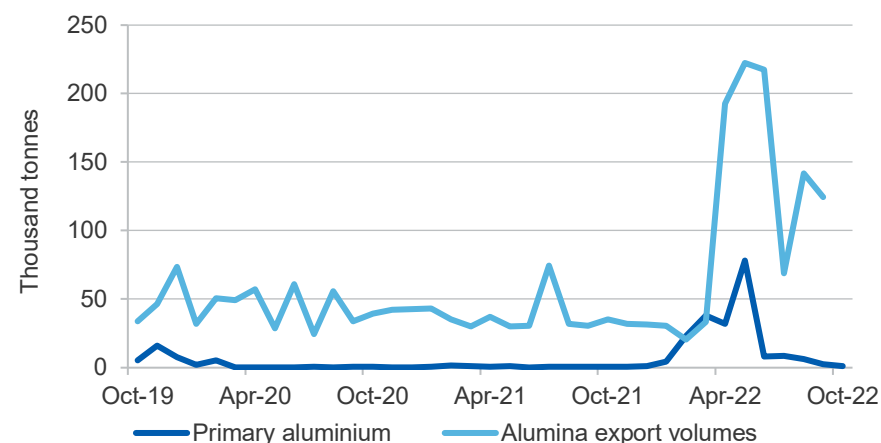
World alumina exports declined by 4.0% year-on-year in the September quarter 2022 to over 10 million tonnes, due to lower alumina exports from Australia. Over this period, exports from Australia — the world's largest alumina exporter — declined by 8.4% year-on-year. A 7.8% year-on-year fall in Australian alumina output in the September quarter 2022 was the driver of lower alumina exports (see *Australia's exports and production*).

Offsetting the decline in alumina exports from Australia was an increase in alumina exports from Brazil and China. In the September quarter 2022,

Brazil exported 2.5 million tonnes of alumina, a rise of 26% year-on-year. Over this period, China exported 335,000 tonnes of alumina, an increase of 145% year-on-year (Figure 11.13).

World bauxite exports increased by 10% year-on-year in the September quarter 2022 to nearly 38 million tonnes, propelled by a 30% year-on-year rise in Guinea — the world's largest bauxite exporter. Over this period, bauxite exports from Australia — the world's second largest bauxite exporter — fell by 8.6% year-on-year to 8.8 million tonnes. Bauxite exports from Indonesia decreased by 19% year-on-year in the September quarter 2022 to 3.3 million tonnes.

Figure 11.13: China's primary aluminium and alumina exports



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

Some Indonesian mines have obtained export quotas to China from the Indonesian government in the second-half of 2022. It is expected that about 3 million tonnes of bauxite will be delivered to China in the December quarter 2022. At the time of writing, the Indonesian Government had not indicated whether a bauxite export ban will be imposed before the end of the year.

Higher aluminium and bauxite imports, but lower alumina imports

World primary aluminium imports rose by 5.3% year-on-year in the September quarter 2022 to 5.2 million tonnes, driven by increased imports from the US and some European countries.

In Europe, primary aluminium output has been declining since mid-2021, due to energy shortages and higher power costs, with many nations turning to imports to meet primary aluminium demand. In the September quarter 2022, Germany imported 532,000 tonnes of primary aluminium, up 7.9% year-on-year. Over the same period, Italy imported 335,000 tonnes of primary aluminium, up 28% year-on-year.

In the US, primary aluminium imports rose by 27% year-on-year in the September quarter 2022 to 1.6 million tonnes, due to lower primary aluminium production. Over this period, the US produced 189,000 tonnes, down by 16% year-on-year.

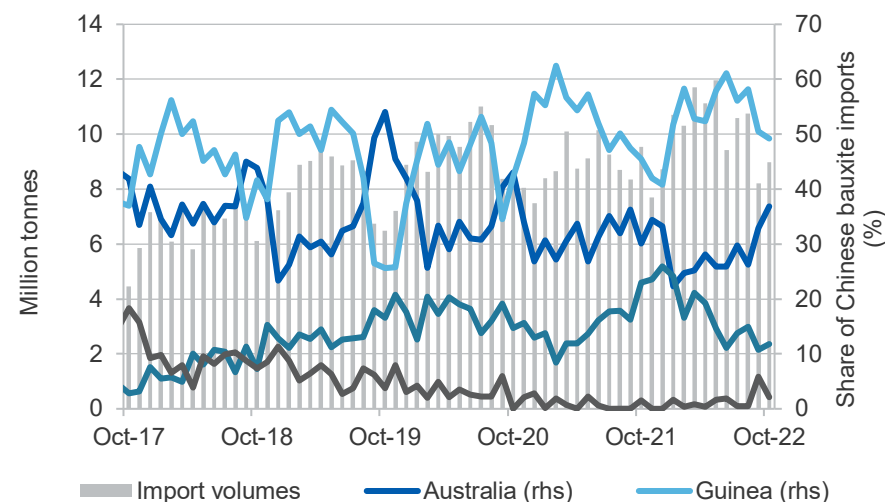
On 10 November 2022, the US Government revoked Russia's 'market economy' status. This decision is likely to lead to higher imported duties on Russian aluminium. However, the US is less dependent on Russian primary aluminium than in the past, and reduction in Russian exports as a result of higher duties is expected to have a limited impact on US primary aluminium supply.

China's primary aluminium imports fell by 55% year-on-year to 176,000 tonnes in the September quarter 2022, due to lower domestic demand.

World alumina imports fell by 3.2% year-on-year in the September quarter 2022 to 9.6 million tonnes, due to a 56% year-on-year fall in alumina imports from China. Imports fell due to higher Chinese alumina production.

World bauxite imports rose by 5.6% year-on-year in the September quarter 2022 to nearly 36 million tonnes, driven by higher imports from China — the world's largest bauxite importer. China imported nearly 30 million tonnes of bauxite in the September quarter 2022, a 12% year-on-year rise from the September quarter 2021. Over this period, Guinea was the largest supplier of bauxite to China accounting for 55% of China's total bauxite imports, followed by Australia (accounting for 30%), and Indonesia (accounting for 13%) (Figure 11.14).

Figure 11.14: China's bauxite import volumes and sources



Notes: ROW: Rest of the world

Source: Bloomberg (2022)

11.5 Prices

LME aluminium price under pressure

The London Metal Exchange (LME) spot price for aluminium is expected to come under pressure during 2023: higher interest rates and weakening global economic growth remain risks to aluminium prices. Rising inflation has forced central banks around the world to increase interest rates, which is dampening economic activity. The strong US dollar is also likely to be a continued headwind for the primary aluminium price (Figure 11.15).

The rise of aluminium inventories in Malaysian, Singaporean and South Korean LME warehouses has led to a rise in the global LME inventories.

After reaching a 39-year low of 277,050 tonnes in August 2022, LME stocks rose to 497,925 tonnes in December 2022. Shanghai Futures Exchange stocks fell to a 2.5-year low in July 2022, at 185,358 tonnes, and remained low at 95,477 tonnes in December 2022. LME off-warrant stocks have risen from their lowest level in March 2022, at 361,864 tonnes

Figure 11.15: LME primary aluminium price and the US dollar



Notes: The US dollar trade weighted index is a measure of the value of US dollar relative to currencies that are most widely used in international trade.

Source: Bloomberg (2022); Investopedia (2022)

in September 2022 (Figure 11.16).

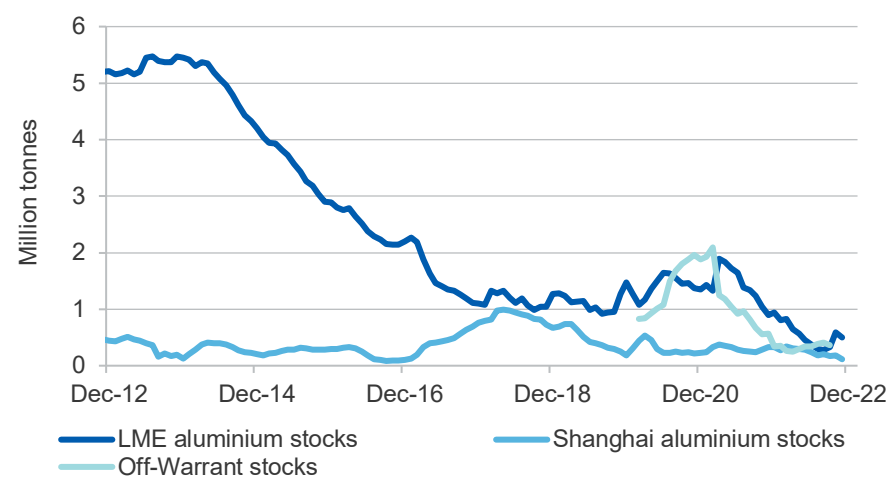
The LME primary aluminium spot price is likely to average around US\$2,710 a tonne in 2022, up 9.4% from 2021 (Figure 11.18). This is 32% below a 34-year high of US\$3,985 a tonne on 7 March 2022 — when the market reaction to the Russian invasion of Ukraine was at its peak.

The September 2022 REQ forecast a world aluminium deficit in 2022. However, a surge in Chinese production in the second half of 2022 now appears to have created a market surplus for the year. This surplus has pushed the LME price lower. In line with the rise in primary aluminium price, the free on board (FOB) Australian alumina price is estimated to increase by 11% in 2022 to average US\$365 a tonne (Figure 11.17).

Primary aluminium and alumina prices to fall in 2023 and 2024

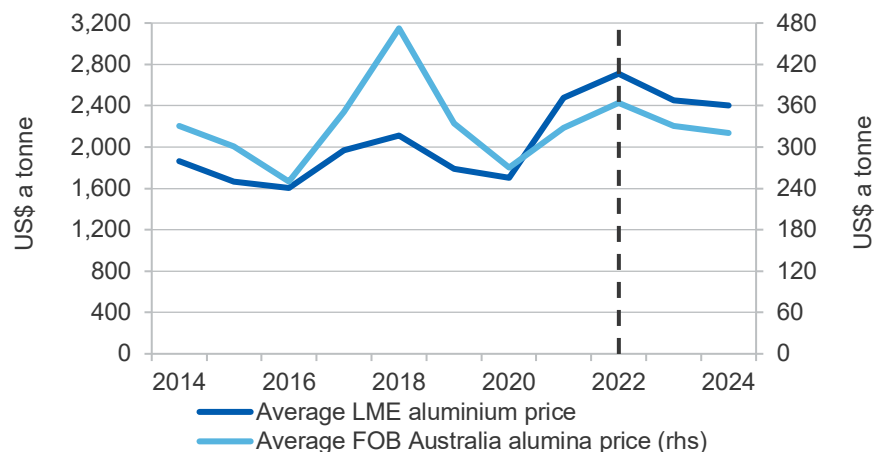
The LME aluminium price is forecast to drift down to an average of US\$2,450 and US\$2,400 a tonne in 2023 and 2024, respectively (Figure 11.17). Slowing global economic growth and rising global primary aluminium production are expected to be significant factors of decreased

Figure 11.16: Exchange aluminium stocks



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

Figure 11.17: World primary aluminium and alumina prices



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

aluminium prices. The outlook for 2023 and 2024 is also dependent on the strength of Chinese aluminium demand and Russian aluminium exports.

Like aluminium, the FOB Australian alumina price is forecast to fall in 2023 and 2024, averaging US\$320 a tonne in 2024 (Figure 11.17).

11.6 Australia's exports and production

Higher alumina prices drove exports in the September quarter 2022

Australia's aluminium, alumina and bauxite (AAB) exports increased by 3.4% year-on-year in the September quarter 2022 to \$3.7 billion, propelled by higher alumina prices. A 6.9% year-on-year rise in the FOB Australian alumina price in the September quarter 2022 helped boost Australian alumina export values by 14% year-on-year to \$2.1 billion in the September quarter 2022.

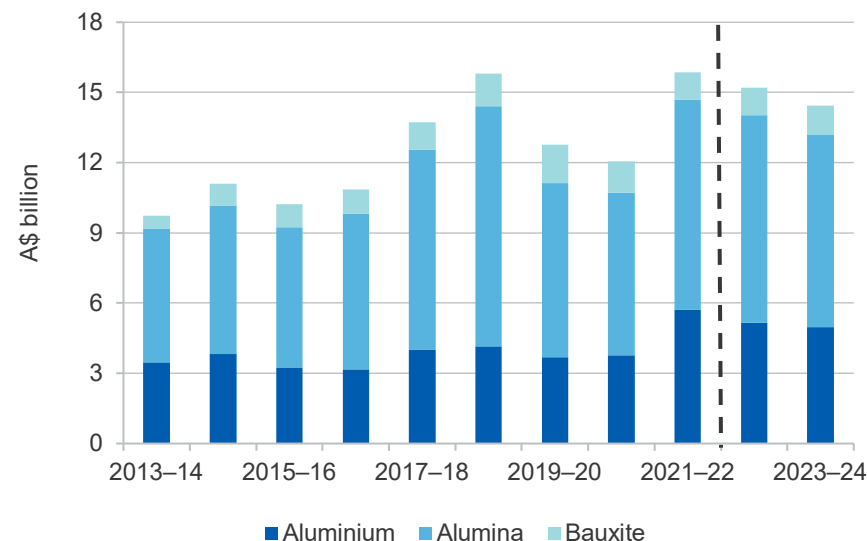
Australian primary aluminium export values decreased by 5.5% year-on-year in the September quarter 2022 to \$1.3 billion, due to an 11% year-on-year fall in the LME aluminium prices in the September quarter. At 345,000 tonnes, Australia's primary aluminium export volumes were down by 9.1% year-on-year in the September quarter 2022.

Australian bauxite export values decreased by 19% year-on-year in the September quarter 2022 to \$279 million. Australia's bauxite export volumes decreased by 7.3% year-on-year in the September quarter 2022. China remained virtually the whole market for Australian bauxite, accounting for 99% of Australian exports in the September quarter 2022.

Lower aluminium, alumina and bauxite exports over the outlook period

An expected fall in aluminium and alumina prices over the outlook period is likely to reduce Australia's AAB export earnings by 4.3% in 2022–23, and by 4.9% in 2023–24 to \$14 billion (Figure 11.18).

Figure 11.18: Australian aluminium/alumina/bauxite exports



Note: April to September 2022 export figures are provisional.

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

Australia's alumina/aluminium/bauxite production fell in Q3 2022

Australia's primary aluminium output fell by 4.7% year-on-year in the September quarter 2022 to 371,000 tonnes, due to lower output at Boyne Island, Tomago and Bell Bay aluminium smelters.

Production at Rio Tinto's Boyne Island aluminium smelter in Queensland decreased by 12% year-on-year in the September quarter 2022 to 110,000 tonnes. Rising thermal coal prices in Queensland in the September quarter 2022 affected the output at Boyne Island smelter. Production at Tomago aluminium smelter in NSW and Bell Bay aluminium smelter in Tasmania also fell by 2.7% and 4.2% year-on-year to 146,000 and 46,000 tonnes, respectively.

Australia's alumina output fell by 7.8% year-on-year in the September quarter 2022 to 4.8 million tonnes. Alumina output at South 32, Japan Alumina and Sojitz Alumina joint-venture Worsley Alumina refinery in Western Australia fell by 8.6% year-on-year in the September quarter 2022 to 1.1 million tonnes, due to planned calciner maintenance.

Production at Rio Tinto's Yarwun alumina refinery in Queensland decreased by 7.1% year-on-year in the September quarter 2022 to 715,000 tonnes, due to planned maintenance. Over this period, production at Rio Tinto's Queensland Alumina Limited (QAL) refinery fell by 10% year-on-year to 827,000 tonnes, due to equipment stability issues.

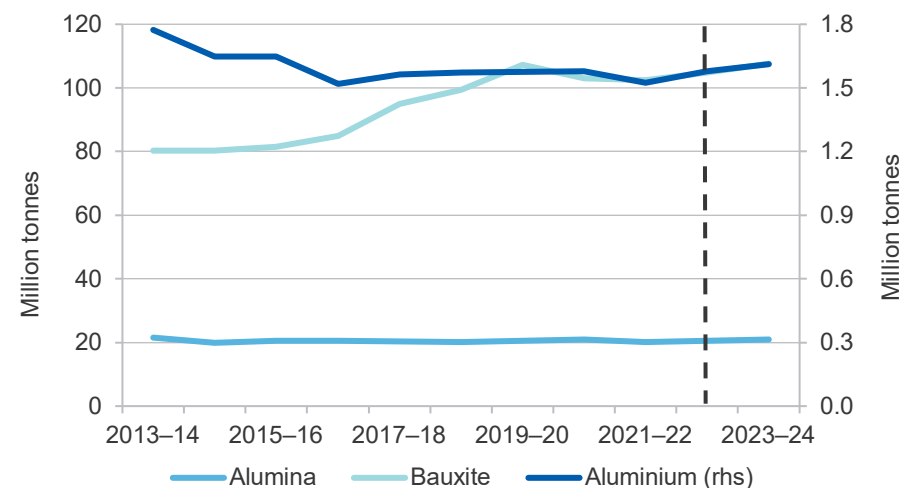
Australia's bauxite output fell by 1.7% year-on-year in the September quarter 2022 to nearly 26 million tonnes. This was due to lower output at the Gove bauxite mine in the Northern Territory (down by 5.3% year-on-year to 2.9 million tonnes), largely due to equipment issues.

Higher bauxite output expected over the outlook period

The restart of 35,000 tonnes a year idled capacity at Portland Aluminium smelter in Victoria in September 2022 is expected to boost Australian primary aluminium output to above 1.6 million tonnes a year from 2022–23 and beyond (Figure 11.19).

Alumina production at Worsley Alumina refinery in WA is expected to be above its nameplate capacity of 4.6 million tonnes a year, driven by improved production initiatives. Absent major disruptions, with no planned expansions at existing alumina operations over the outlook period, Australia's alumina output is forecast to remain at about 21 million tonnes a year (Figure 11.19).

Figure 11.19: Australian aluminium/alumina/bauxite output



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

Australia's bauxite output is forecast to increase at 2.5% a year between 2022–23 and 2023–24, reaching 108 million tonnes in 2023–24 (Figure 11.19). The expansion of Metro Mining's Bauxite Hills mine in Queensland (subject to financing) from 3.5 million tonnes a year to 6 million tonnes a year is the main driver of this increased output.

Revisions to the outlook

The forecast for the LME aluminium (spot) price has been revised down from the September *REQ*: by US\$110 a tonne in 2023 and by US\$90 a tonne in 2024. The revision reflects higher than expected primary aluminium output from China.

The forecast for Australia's aluminium, alumina and bauxite export earnings has been revised down from the September 2022 *Resources and Energy Quarterly*: by \$309 million in 2022–23 and by \$885 million in 2023–24. The revision reflects lower forecast prices for primary aluminium over the outlook period.

Table 11.1: Aluminium, alumina and bauxite outlook

						Annual percentage change		
World	Unit	2021	2022 ^s	2023 ^f	2024 ^f	2022 ^s	2023 ^f	2024 ^f
Primary aluminium								
Production	kt	67,119	67,425	69,520	70,248	0.5	3.1	1.0
Consumption	kt	68,467	67,358	68,459	69,585	-1.6	1.6	1.6
Prices aluminium ^c								
- nominal	US\$/t	2,477	2,710	2,450	2,400	9.4	-9.6	-2.1
- real ^d	US\$/t	2,676	2,710	2,367	2,268	1.3	-12.6	-4.2
Prices alumina spot								
- nominal	US\$/t	328	365	330	320	11.1	-9.4	-3.0
- real ^d	US\$/t	354	365	319	303	2.8	-12.5	-5.1
Australia	Unit	2020–21	2021–22	2022–23 ^f	2023–24 ^f	2021–22	2022–23 ^f	2023–24 ^f
Production								
Primary aluminium	kt	1,579	1,525	1,578	1,612	-3.4	3.5	2.1
Alumina	kt	20,949	20,138	20,463	20,972	-3.9	1.6	2.5
Bauxite	Mt	103.0	102.4	104.8	107.6	-0.5	2.3	2.7
Consumption								
Primary aluminium	kt	284	240	197	209	-15.3	-18.1	6.2
Exports								
Primary aluminium	kt	1,357	1,368	1,431	1,451	0.8	4.6	1.4
- nominal value	A\$m	3,763	5,712	5,171	4,963	51.8	-9.5	-4.0
- real value ^e	A\$m	4,210	6,118	5,171	4,739	45.3	-15.5	-8.4
Alumina	kt	18,600	17,739	17,889	18,246	-4.6	0.8	2.0
- nominal value	A\$m	6,948	8,977	8,846	8,232	29.2	-1.5	-6.9
- real value ^e	A\$m	7,774	9,616	8,846	7,860	23.7	-8.0	-11.1
Bauxite	kt	35,782	35,957	35,088	35,598	0.5	-2.4	1.5
- nominal value	A\$m	1,339	1,177	1,174	1,251	-12.1	-0.2	6.5
- real value ^e	A\$m	1,498	1,260	1,174	1,194	-15.9	-6.9	1.7
Total value								
- nominal value	A\$m	12,050	15,865	15,191	14,446	31.7	-4.2	-4.9
- real value ^e	A\$m	13,483	16,995	15,191	13,793	26.1	-10.6	-9.2

Notes: **c** LME cash prices for primary aluminium; **d** In 2022 calendar year US dollars; **e** In 2022–23 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



Australia's copper sector



Ranked 2nd
for copper
resources

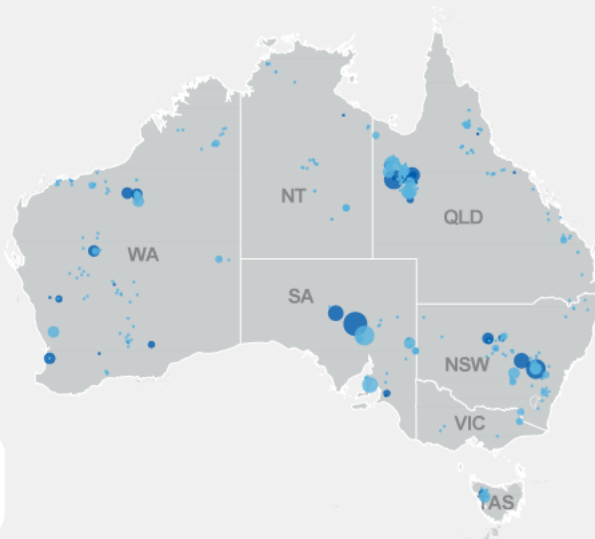


6th largest
mined copper
producer in the
world



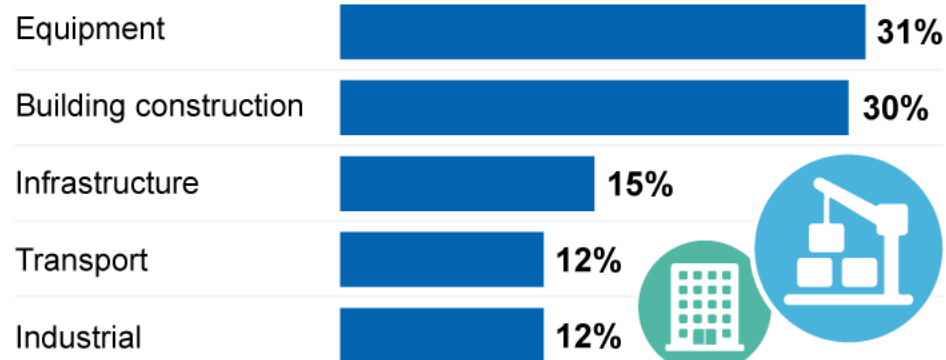
\$12 billion
of copper
exports in
2021-22

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



**Major copper
deposits, Mt**

World consumption



Copper facts



The average
home contains
180kg of copper



Being 100%
recyclable, **nearly
80%** of copper
produced is still in use

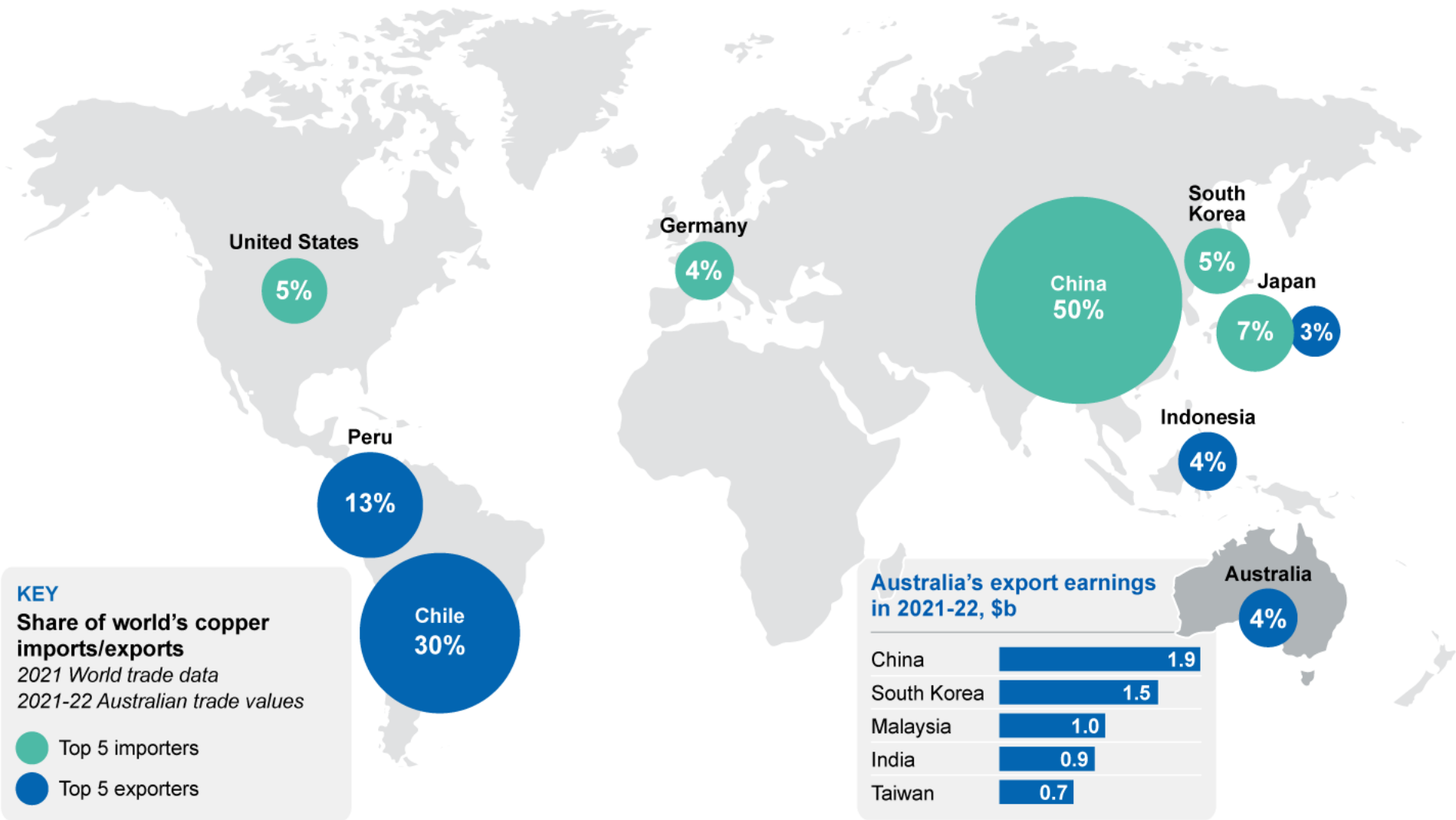


An electric car
contains **about 5x**
more copper than
equivalent ICE cars



China consumes
half of the world's
copper

Copper TRADE MAP



12.1 Summary

- Copper prices are estimated to fall by 5.7% to below US\$8,800 a tonne in 2022, as weak growth and high energy prices weigh on demand. Prices are forecast to fall to US\$7,900 a tonne in 2024 as mine production grows.
- Australia's copper exports fell to 813,000 tonnes in 2021–22 as scheduled maintenance reduced production. Copper exports are expected to grow to 895,000 tonnes by 2023–24 as production from new mines and mine expansions comes online (see [Australia section](#)).
- Weaker prices are forecast to see Australia's copper export earnings fall to \$12 billion in 2022–23, but increased production and export volumes are likely to increase export earnings to nearly \$13 billion in 2023–24.

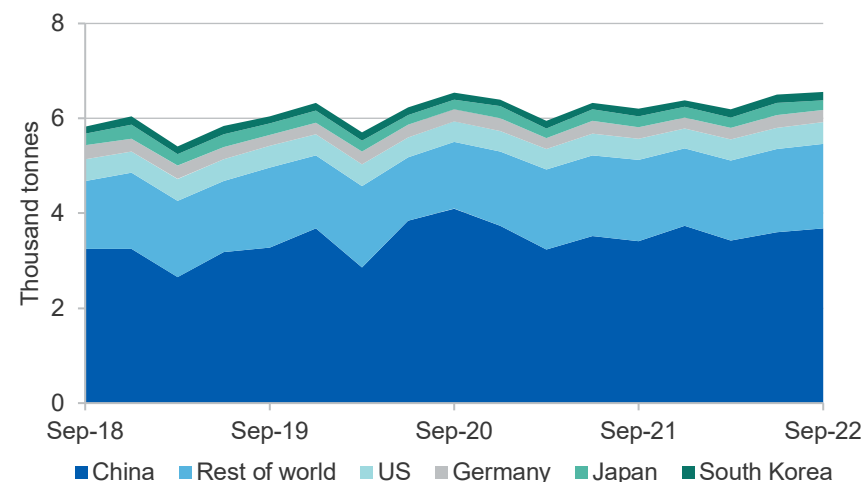
12.2 World consumption

Copper demand grows despite economic challenges

In the September quarter 2022, refined copper consumption increased by 0.9%, to be 5.7% stronger than in the September quarter 2021 (Figure 12.1). Copper consumption grew by 2.4% in Europe, despite Germany (its largest economy) experiencing a fall in consumption. Consumption in Asia grew modestly, at 0.4% quarter-on-quarter, with a 2.3% growth in China outweighing falls in Japan (-19%) and Taiwan (-30%). Consumption in the US grew 1.6% in the September quarter 2022.

Copper consumption in 2022 is estimated to reach 26 million tonnes, an increase of 2.1% from 2021. However, weak manufacturing PMI results point to a potential slowing in copper consumption in the near term. The manufacturing PMI for the EU has been in contractionary territory for five consecutive months, and stands at 47.1 for November 2022. Both PMIs in China — the National Bureau of Statistics measure (skewed towards state-owned businesses) and the Caixin measure (skewed towards smaller, export-oriented companies) — are both in contractionary territory. While the US manufacturing PMI remained above 50 (indicating growth) for October, it fell sharply to 47.7 in November (indicating contraction).

Figure 12.1: Refined copper consumption



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

But weak economic outlook threatens to affect copper growth

Global inflation continues to plague major economies. Central banks in most developed nations continue to tighten monetary policy, which is likely to affect economic growth — and copper demand — over the outlook period. While many US macroeconomic indicators remain strong, signs of weak demand are beginning to show. Weak growth is more apparent in Europe, given its exposure to impacts of the Russian invasion of Ukraine.

China is an outlier, however, with low inflation allowing greater flexibility for economic stimulus. In November 2022, 16 new measures were announced to support its property sector, including extending developer loans and lowering deposit requirements and mortgage rates. New construction starts continue to increase (though remain half of December 2021 levels), which will eventually flow through to construction completions (where copper is used in higher intensity) over the outlook period.

Copper consumption is expected to increase by 2.9% in 2023 and by 3.0% in 2024, when it is expected to reach over 27 million tonnes.

Electrification surge to provide welcome support

Globally, EV sales are expected to reach 11 million units this year (up 64% on 2021) before increasing further to 18 million units in 2024. Copper is used in EV motors and batteries, and a typical EV contains five times as much copper than a comparable internal combustion vehicle.

Electric vehicle (EV) sales in China have increased by 120% year-on-year in 2022, benefitting from national EV purchase tax exemptions and select local government subsidy programs. It is estimated that 1 in 5 new cars sold in China in 2022 was an EV.

The proliferation of EVs in China is contributing to its growing energy needs. Investment in the energy grid increased by 9.1% in the year to September, underpinning the demand for copper. Further supporting copper demand, 53 gigawatts of solar and 19 gigawatts of wind capacity have also been installed since the start of the year.

12.3 World production

Mined copper production grows despite disruptions

In the September quarter, global mined copper production grew by 0.5%, and was 1.5% higher compared to the September quarter 2021.

Production in Chile fell by 6.1% quarter-on-quarter in the September quarter 2022. The drop affected most of the major producers, and was attributed to lower-grade ore and lower processing during the period. Operational problems and lack of water availability have also impacted select operations.

Production in Peru rose by 17% quarter-on-quarter in the September quarter 2022, recording its strongest output since the December quarter 2020. Protest activities at Las Bambas (MMG) were reduced in the September quarter, with quarterly production rising to 81,000 tonnes (up from only 32,000 tonnes in the June quarter). However, recent reports suggest that protests have recommenced and are likely to reduce production at Las Bambas to 30% of its nameplate capacity for the December quarter 2022.

Production in the Democratic Republic of Congo continues to ramp up. While growth was a 'modest' 1.8% quarter-on-quarter, it represents a growth of 18% year-on-year, and is its highest level of output on record. This increase in production is mostly attributable to the ramp up at the Phase 2 concentrator at Kamoakakula (Ivanhoe Mines), with 2022 production at the mine expected to triple 2021 results.

Mined copper production is estimated to grow by 2.4% in 2022 to reach 22 million tonnes.

Additional growth in mined production expected over the outlook period

Over the outlook period, production from new projects and expansions at existing projects are expected to add significantly to global copper output. Quellaveco (Anglo American, Peru) — which produced first concentrate in the September quarter 2022 — is expected to produce over 300,000 tonnes annually. BHP has announced mine guidance of 1.2 million tonnes a year from its Escondida operations over the next 5 years, an uplift of around 300,000 tonnes annually.

Global mined output is expected to grow by 7.5% in 2023, before moderating to 3.7% in 2024, when output is expected to surpass 24 million tonnes. Most of the growth is expected from Chile and Peru, who are forecast to add a combined 1.3 million tonnes of annual mined copper capacity between now and 2024.

While Chile has softened its stance on tax and royalty increases on mining companies, the deteriorating global economic outlook and continued cost inflation pose clear downside risks.

Refinery output growth slowing

After a strong 2021, global refined copper production growth slowed in 2022. In the September quarter 2022, refined output increased by 0.3% quarter-on-quarter, to be 0.9% higher than the same quarter in 2021.

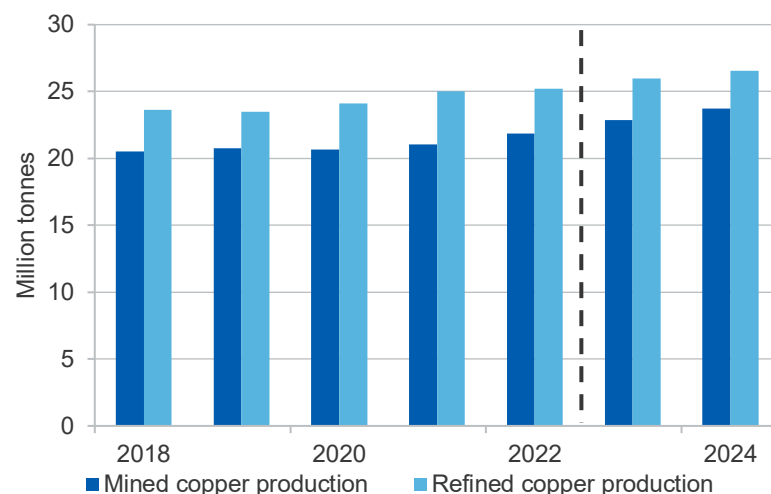
Refined output rebounded in Spain after a severe downturn in the June quarter, leading to a 6.7% increase in European refined production (though it remains 2.7% lower than the September quarter 2021).

In Asia, refined copper production in India rose by 14% quarter-on-quarter, in the September quarter 2022 and is catching up to South Korean production (which fell by 1.2% quarter-on-quarter). Refined copper production in China benefitted from fewer COVID-19 containment measures, with output increasing 1.5% quarter-on-quarter and surpassing the record set in the December quarter 2021.

Refined copper production is estimated to grow by 2.1% in 2022 to above 25 million tonnes. Refined production is forecast to reach almost 27 million tonnes in 2024 (Figure 12.2).

Risks to refined copper production are skewed to the downside, with high energy prices and other costs of production squeezing smelter profit margins; production cutbacks are thus possible. While energy prices have come down more than anticipated, they still remain at historically high levels.

Figure 12.2: Annual production of mined and refined copper



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

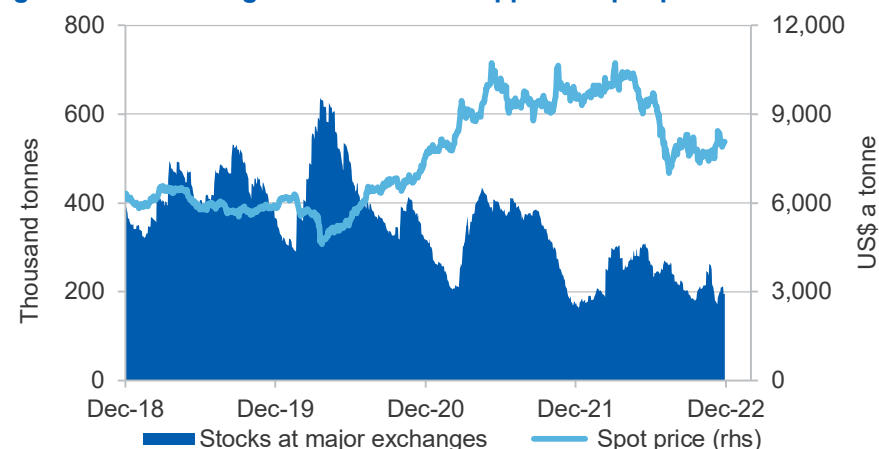
12.4 Prices

Prices decline from record levels in first half of 2022

Copper prices were at record highs at the beginning of 2022, peaking at US\$10,730 a tonne in March, and averaged almost US\$10,000 a tonne in the March quarter 2022 (Figure 12.3). Since then, demand weakness and soft property markets in China, a strengthening US dollar, and high energy prices in Europe have all weighed on copper prices. Prices fell 19% to average around US\$7,700 a tonne in the September quarter 2022, with the December quarter average estimated at US\$7,900 a tonne.

Copper is expected to average US\$8,800 a tonne in 2022 — down 5.7% from 2021. Little recovery in prices is forecast over the outlook period, averaging US\$8,100 a tonne in 2023 and US\$7,900 a tonne in 2024.

Figure 12.3: Exchange inventories of copper vs spot price



Source: LME (2022) official cash price; Bloomberg (2022)

Stockpiles hold steady but at historically low levels

In late 2021, warehouse inventories were drawn down to their lowest levels since 2014. Warehouse inventories recovered in early 2022, but the build-up in inventories has since stalled. As at 2 December 2022, stocks at major exchanges stood at 186,000 tonnes — 37% down from the 296,000 tonnes of stock as at the end of February.

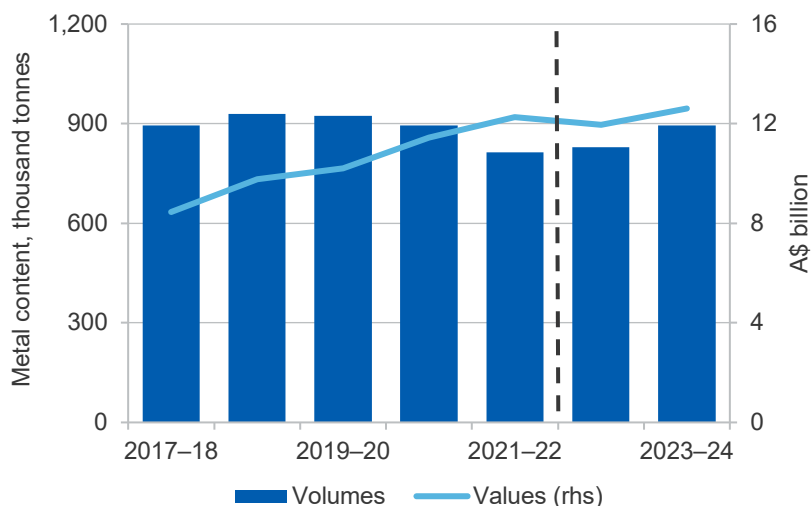
12.5 Australia

Higher volumes offsets price falls

Export volumes are forecast to increase by 2.0% in 2022–23, reaching 829,000 tonnes. Increases in mine output in 2023–24 are expected to lift export volumes, which are forecast to rise to 895,000 tonnes.

Exports rose to \$13 billion in 2021–22, as a result of record copper prices. As prices come off these record highs, export earnings are forecast to fall to \$12 billion in 2022–23, despite higher export volumes. (Figure 12.4). Further increases in production, combined with a relatively stable price outlook, should see export values to rise to \$13 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)

Mine production to grow over the outlook period

Australian copper mine production is expected to grow by 6.0% in 2022–23 to reach 829,000 tonnes, after COVID-19 disruptions, extreme weather events and maintenance affected 2021–22 production levels.

Mine output was effectively unchanged quarter-on-quarter in the September quarter 2022. Copper production at Cadia (Newcrest mining) fell 18% quarter-on-quarter, as mill throughput declined due to planned maintenance). However, the expansion project completed in the September quarter will see mill throughput increase to 35 million tonnes per annum from the December quarter 2022.

Further output gains are expected in 2023–24, when mined output is forecast to reach 892,000 tonnes. However, this is dependent on some new mines coming online. Downside risks include delays to project starts, soft copper prices or increasing costs affecting mine profitability.

Copper exploration falls, but still historically high

Copper exploration expenditure grew by 17% quarter-on-quarter to \$158 million in the September quarter 2022 (Figure 12.5).

Figure 12.5: Australian copper exploration expenditure



Source: ABS (2022)

Revisions to the outlook

Since the September 2022 *Resources and Energy Quarterly*, the forecast for Australia's copper export earnings in 2022–23 and 2023–24 have been revised down by \$1.6 billion and \$0.3 billion respectively, as a result of downward revisions to mine output and export volumes.

Table 12.1: Copper outlook

						Annual percentage change					
World	Unit	2021	2022 ^s	2023 ^f	2024 ^f	2022 ^s	2023 ^f	2024 ^f			
Production											
– mine	kt	21,025	21,880	22,886	23,710				4.1	4.6	3.6
– refined	kt	25,015	25,200	25,981	26,527				0.7	3.1	2.1
Consumption	kt	25,251	25,775	26,511	27,297				2.1	2.9	3.0
Closing stocks	kt	1 148	942	1 348	1 595				-18	43	18
– weeks of consumption		2.4	1.9	2.6	3.0				-20	39	15
Prices LME											
– nominal	US\$/t	9,315	8,783	8,100	7,870				-5.7	-7.8	-2.8
	USc/lb	423	398	367	357				-5.7	-7.8	-2.8
– real ^b	US\$/t	10,065	8,783	7,826	7,438				-13	-11	-5.0
	USc/lb	457	398	355	337	-13	-11	-5.0			
Australia	Unit	2020–21	2021–22	2022–23 ^f	2023–24 ^f	2021–22	2022–23 ^f	2023–24 ^f			
Mine output	kt	878	782	821	892	-11	4.9	8.6			
Refined output	kt	452	349	427	435	-23	22	1.8			
Exports											
– ores and concs ^c	kt	1,672	1,660	1,566	1,790				-0.7	-5.7	14
– refined	kt	420	330	384	392				-21	16	2.1
– total metallic content	kt	894	813	829	895				-9.0	2.0	7.9
Export value											
– nominal	A\$m	11,440	12,257	11,944	12,608				7.1	-2.6	5.6
– real ^d	A\$m	12,800	13,130	11,944	12,038				2.6	-9.0	0.8

Notes: ^b In 2022 calendar year US dollars; ^c Quantities refer to gross weight of all ores and concentrates; ^d In 2022–23 financial year Australian dollars; ^f Forecast; ^s Estimated.

Source: ABS (2022) International Trade, 5465.0; LME (2022) spot price; World Bureau of Metal Statistics (2022); Department of Industry, Science and Resources (2022).

Nickel



Australia's nickel sector



22%
of the world's
nickel **resources**

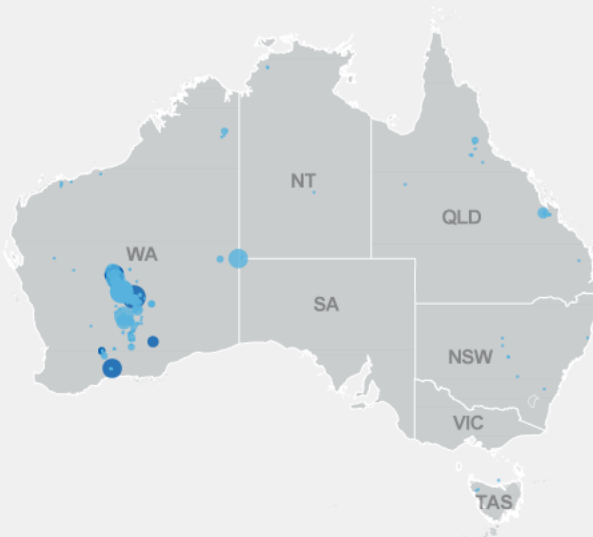


200,000+
tonnes typically
produced each year



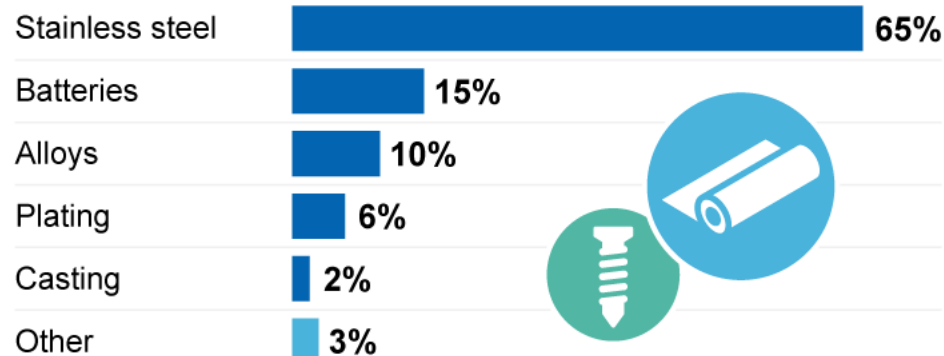
\$4.4 billion
contributed to the
economy last
year

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



**Major nickel
deposits, Mt**

World consumption



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

13.1 Summary

- Nickel prices are expected to average US\$25,300 a tonne in 2022, boosted by the fallout from the Russian invasion of Ukraine. Prices are expected to ease over the outlook period, as increased (Indonesian) production outweighs rising consumption, particularly in electric vehicle (EV) battery usage.
- Recent high prices have boosted Australia's nickel export earnings, which reached \$4.4 billion in 2021–22. Export earnings are forecast to rise by 17% to \$5.1 billion in 2022–23, before easing by 11% to \$4.5 billion in 2023–24.
- Australia's export volumes are estimated to rise from 157,000 tonnes in 2021–22 to 188,000 tonnes in 2023–24, supported by the need for Australian nickel for the transition to low-emissions technologies.

13.2 World consumption

Soft economic conditions create mixed results for nickel demand

Global economic headwinds and a price spike have seen nickel consumption weaken over the past year. In the September quarter 2022, global nickel consumption fell by 0.2% quarter-on-quarter, but a rebound in consumption in the month of September 2022 saw consumption 2.5% higher than the September quarter of 2021.

Consumption in Asia grew by 2.4% compared to June quarter 2022. Gains in Chinese consumption (up 6.5% since last quarter) offset falling demand in Japan (down 12%) and South Korea (down 6.0%). European consumption fell 26% quarter-on-quarter as the economy slowed, with falls in consumption recorded across most of the major nickel consuming nations.

As a result of recent weakness, estimated global nickel consumption has been downgraded slightly from previous forecasts. Consumption is estimated to be 2.8% higher in 2022, at slightly more than 2.8 million tonnes in 2022.

Battery demand on the charge

Sales of EVs are estimated to hit 11 million units in 2022 — an increase of 64% on the 6.7 million EVs sold last year. As a result, nickel use in batteries is expected to grow by 42% in 2022.

Much of this demand is driven by China. Spurred on by purchase tax exemptions and select local government subsidy programs, EV sales have risen by 120% in nine months to September 2022 compared to the equivalent period in 2021. On average, the price of an EV in China is only 10% greater than that of traditional cars, and EVs are set to exceed 20% of Chinese new car sales in 2022 (meeting the Government's 2025 target three years early).

EV sales in Europe appear to be less rosy, with EV penetration stalling in 2022. This has been attributed to long wait times due to supply chain issues, a reduction in tax incentives for some jurisdictions, and price spikes for some battery metals. Further, the fleet-wide target of <95g CO₂/km is not set to be tightened until 2025, providing little incentive for automakers to increase EV production.

In October 2022, the US government announced almost \$3 billion in grants as part of its \$7 billion package to support the domestic battery supply chain. The projects selected under the funding will produce enough battery-grade nickel to supply approximately 400,000 EVs annually. The package targets projects at all stages of the life-cycle (including raw materials extraction, battery cell and pack manufacturing, and recycling), so it will have both direct and indirect impacts.

Over the outlook period, global EV sales are set to reach 15 million in 2023 and 18 million in 2024. By 2024, 18% of global nickel demand is forecast to be for battery material (compared to just 5% in 2018).

Lower scrap ratios offset fall in Chinese stainless steel production

After a rebound in production over September and October 2022, Chinese stainless steel production is estimated to fall by 3.6% in 2022. Cheap and readily available Indonesian nickel pig iron (NPI) is incentivising Chinese

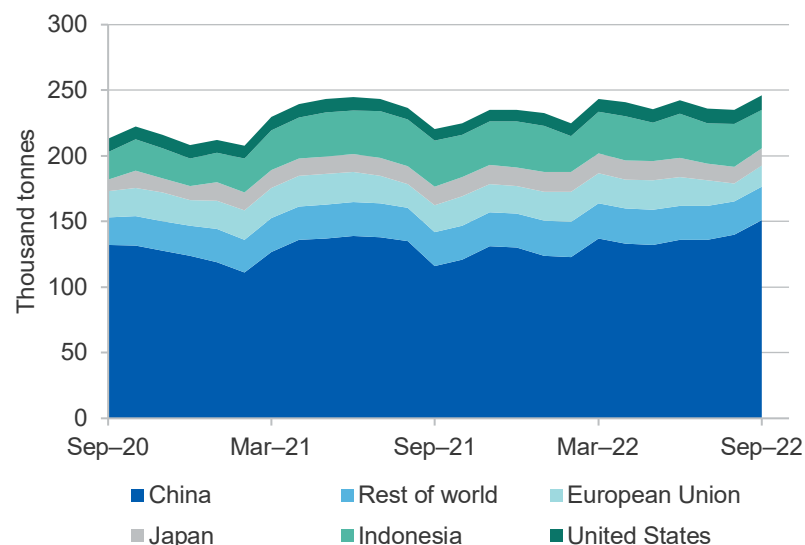
producers to use virgin material over scrap. A 5 percentage point decrease in the scrap ratio (to 21% in the September quarter 2022) means that while global stainless steel production is expected to fall, primary nickel demand in stainless applications is expected to remain flat.

In Europe, weak end-user demand, high inventories and high energy prices are combining to squeeze margins, with output forecast to drop 10% this year. Further declines are forecast for the US (-12%), Taiwan (-19%) and South Korea (-25%) in 2022.

Stainless steel production is expected to rebound over the outlook period, growing 7.1% in 2023 and 10% in 2024, as demand for stainless applications (consumer goods, dwellings and infrastructure) improves.

Global nickel usage is expected to grow strongly over the next two years, increasing by 5.1% in 2023 and by 4.2% in 2024, when consumption will be approximately 3.0 million tonnes and 3.1 million tonnes, respectively.

Figure 13.1: Composition of world nickel consumption, monthly



Source: International Nickel Study Group (INSG); Wood Mackenzie; Department of Industry, Science and Resources (2022)

13.3 World production

Global nickel production to increase in 2022

Global mined nickel production is estimated to rise by 13% year-on-year to 3.1 million tonnes in 2022, as production ramps up in Indonesia and returns to pre-COVID-19 levels in other regions.

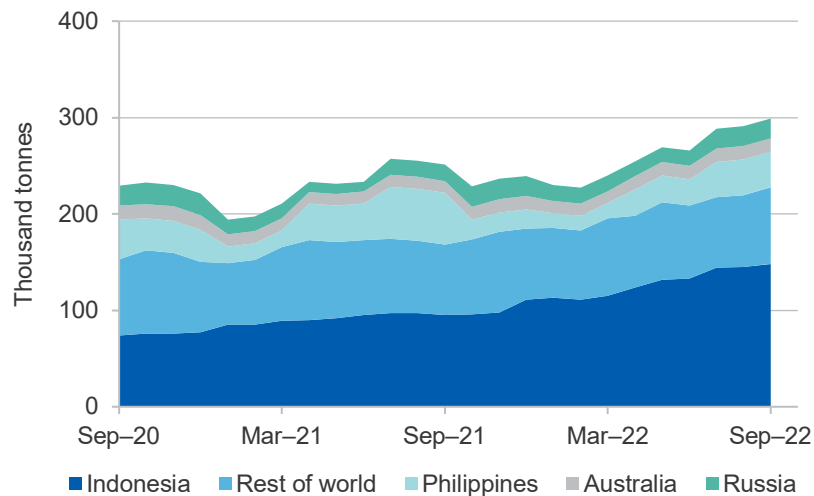
Mine production in the September quarter 2022 increased by 11% quarter-on-quarter (+15% year-on-year). Gains in mined production were led by Indonesia, with production increasing by 12% quarter-on-quarter (+51% year-on-year). For the year to September, Indonesia accounts for almost half (49%) of world mined nickel production — up from 40% for the same period in 2021.

In the refined nickel sector, production is estimated to rise by 11% year-on-year and reach almost 2.9 million tonnes in 2022. Refined production grew by 5.1% quarter-on quarter in the September quarter 2022 (+17% year-on-year). The increased mined nickel production in Indonesia has flowed through to refined production — aided by the government's export bans — which has seen production grow 6.0% compared to the June quarter 2022, and a substantial 36% compared to the September quarter 2021. China also saw strong gains in the September quarter 2022, with output increasing 8.2% quarter-on-quarter (16% year-on-year).

Over the outlook period, Indonesia is expected to lead gains in both the mined and refined nickel sectors. Mined nickel production is forecast to average 5.6% growth over the next two years, reaching approximately 3.5 million tonnes in 2024. Refined nickel production is forecast to average 8.3% growth over the next two years, reaching approximately 3.4 million tonnes in 2024.

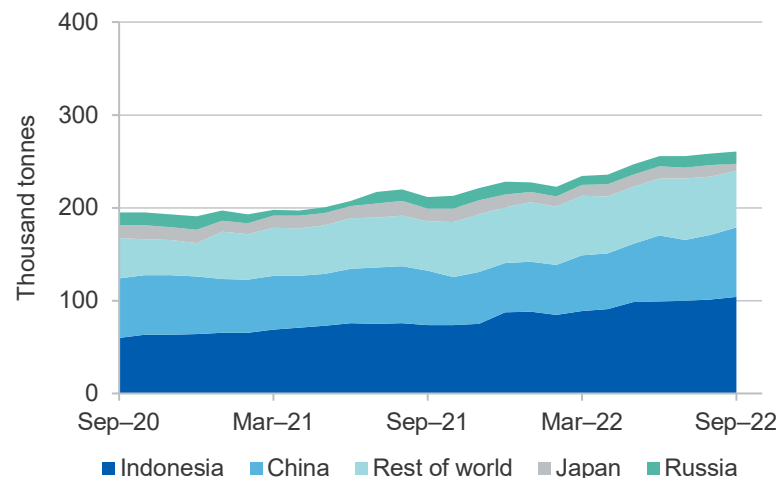
With global production heavily dependent on Indonesian supply, downside risks are heavily concentrated. For example, there are some concerns that supply infrastructure bottlenecks could emerge at the mine level. Further, since Indonesian nickel output largely serves the Chinese market, any disruption to Chinese demand (such as new COVID-19 outbreaks) could induce producers to ease back on planned supply growth.

Figure 13.2: Composition of world mined nickel production, monthly



Source: International Nickel Study Group; Department of Industry, Science and Resources (2022)

Figure 13.3: Composition of world refined nickel production



Source: International Nickel Study Group; Department of Industry, Science and Resources (2022)

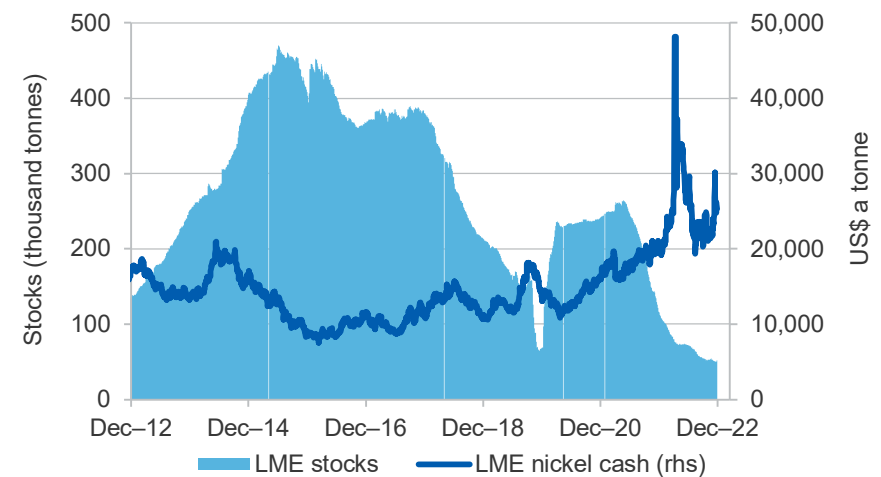
13.4 Prices

Prices stabilise initially

After averaging US\$22,000 a tonne in the September quarter 2022, nickel prices seemed to stabilise in the early part of the December quarter 2022. Prices in October averaged US\$22,000 a tonne, and stayed in a narrow band between US\$21,000-23,000 a tonne.

One upside risk noted in the September REQ — ruminations surrounding LME sanctions on Russian metals — has not eventuated. There were concerns that significant inflows of Russian metals (including nickel) to LME warehouses would be subject to self-sanctioning by consumers, leading to a disorderly market. However, the LME pointed to “a material portion” of the market which was still accepting Russian base metals and decided not to ban Russian inflows.

Figure 13.4 Nickel spot price and stock at exchanges



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

Liquidity in the market remains poor, as traders are yet to fully regain confidence in the LME nickel market following the cancellation of some trades and the suspension of trading in March 2022. Trading volumes remain low, at just 30% of their pre-suspension levels.

But volatility soon returns

Another upside risk noted last quarter persists. Warehouse inventories have continued to fall, reaching 49,000 tonnes in November 2022. While visible inventories subsequently recovered to 53,000 tonnes early in December 2022, it remains less than half that during the same period last year. Low stocks raise the likelihood of price spikes when a significant threat to supply arises.

The December quarter 2022 average for nickel is estimated at US\$23,800 a tonne, equating to an average price of US\$25,300 a tonne in 2022 (+37% year-on-year) (Figure 13.4).

Class 1 premiums rise to record levels

The large increase in Indonesian nickel production has been a recurring theme over past editions of the REQ. Despite this sizeable increase, there has been little impact on class 1 nickel prices at the major exchanges.

One reason is that Indonesian production consists of class 2 products (nickel pig iron and ferronickel) and intermediates (nickel matte). The capacity to convert these units into class 1 units is limited; class 2 producers thus have little ability to alleviate tightness in the class 1 market.

Market tightness is further compounded by concerns over Russia — a major supplier of class 1 nickel — and the growing need for high quality nickel in EV batteries. As a result, large premiums for class 1 nickel (over class 2/intermediates) have increased. That said, with additional mixed hydroxide precipitate (MHP) coming from China over the outlook period (see World Production section), class 1 prices should come down over time.

The nickel price is forecast to ease gradually over the outlook period — to US\$19,900 in 2024 — as the surge in world supply due to the ramp up in Indonesian production outpaces demand. That said, significant upside risks exist, as LME inventories remain at historically low levels (despite this increase in production) and if the Russian invasion of Ukraine deteriorates further.

13.5 Australia

Higher volumes to support export earnings growth

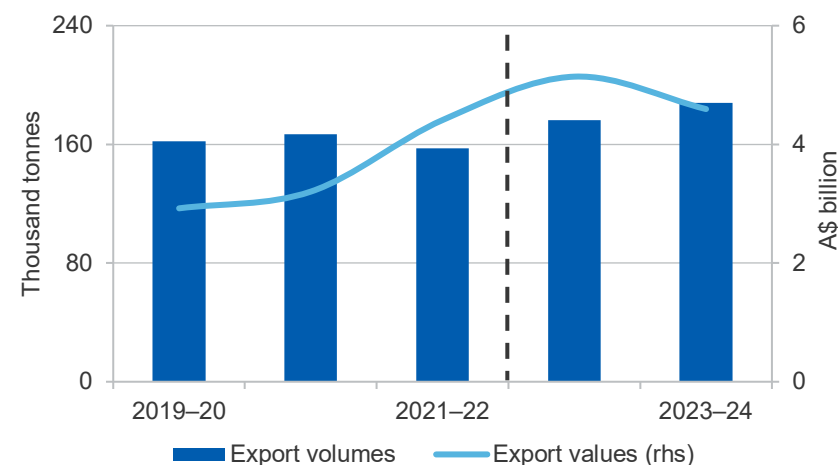
After falling 6.0% in 2021–22, export volumes are set to increase by 12% to reach 176,000 tonnes in 2022–23. Mined production is supporting this increase, with higher volumes to come from Mincor's Kambalda restart and Mallee Resources' Avebury restart, adding 12,600 tonnes and 8,100 tonnes of nickel production, respectively.

Stable nickel prices and growing volumes should support solid earnings early in the outlook period. Export values are forecast to rise by 17% to around \$5.1 billion in 2022–23.

Before prices drag earnings lower

With lower prices expected towards the end of the outlook period, export earnings are expected to ease slightly. Export earnings are forecast at \$4.5 billion in 2023–24, a drop of 11% year-on-year. Export volumes for 2023–24 are forecast at 188,000 tonnes, up 6.6% year-on-year.

Figure 13.5: Australia's exports to grow over the outlook period



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

Australia's production set to expand as new production comes online

IGO Limited's Cosmos project is expected to commence in early 2023–24, adding 13,000 tonnes of nickel capacity. Australian Mines Limited is also progressing with its Sconi project, with a final investment decision expected in the near term. The project — which will produce battery grade nickel sulphate, cobalt sulphate and scandium oxide — is slated to start production in the 2024 calendar year.

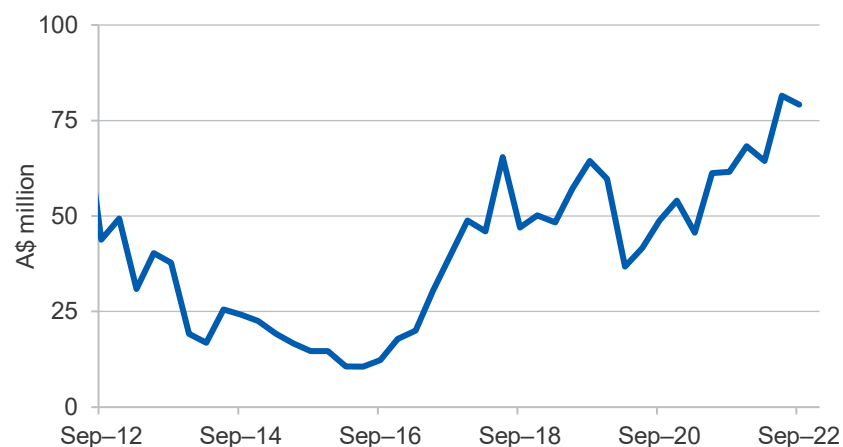
Mined nickel output is forecast to grow 19% to 183,000 tonnes in 2022–23, and by a further 10% to 202,000 tonnes in 2023–24.

Refined nickel output is forecast to grow 9.7% to 108,000 tonnes in 2022–23, and remain relatively flat in 2023–24.

Exploration expenditure hits 14 year high

Nickel and cobalt exploration expenditure fell by 2.8% from the June quarter 2022, at \$79 million in the September quarter 2022. Despite this, it remains at historically high levels, and was 29% higher than in the September quarter 2021 (Figure 13.6).

Figure 13.6: Nickel and cobalt exploration still strong



Source: ABS (2022) *International Trade in Goods and Services*, 5368.0

Revisions to the outlook

Compared to the September 2022 *Resources and Energy Quarterly*, nickel export volumes have been revised down to reflect a slower ramp up in Australian mined production.

Export earnings have been revised down by \$0.1 billion in 2023–24 as a result, with a weaker exchange rate offsetting some of the decrease in export volumes.

Table 13.1: Nickel outlook

						Annual percentage change			
World	Unit	2021	2022 ^s	2023 ^f	2024 ^f	2022 ^s	2023 ^f	2024 ^f	
Production									
– mine	kt	2,769	3,116	3,334	3,475		13	7.0	4.2
– refined	kt	2,606	2,901	3,157	3,401		11	8.8	7.7
Consumption	kt	2,772	2,849	2,994	3,120		2.8	5.1	4.2
Closing stocks	kt	591	443	606	888		-25	37	46
– weeks of consumption		11.1	8.3	14.0	18.1		-25	69	29
Prices LME									
– nominal	US\$/t	18,468	25,335	21,563	19,938		37	-15	-7.5
	USc/lb	838	1 149	978	904		37	-15	-7.5
– real ^b	US\$/t	19,956	25,335	20,832	18,842		27	-18	-9.6
	USc/lb	905	1 149	945	855	27	-18	-9.6	
Australia	Unit	2020–21	2021–22	2022–23 ^f	2023–24 ^f	2021–22	2022–23 ^f	2023–24 ^f	
Production									
– mine ^c	kt	162	154	183	202		-4.8	19	10
– refined	kt	105	98	108	105		-6.5	9.7	-2.8
– intermediate		29	31	27	29		7.5	-15	8.4
Export volume ^{dg}	kt	167	157	176	188		-6	12	6.6
Export value ^g									
– nominal value	A\$m	3,204	4,410	5,141	4,595		38	17	-11
– real value ^e	A\$m	3,585	4,724	5,141	4,387		32	8.8	-15

Notes: **b** In 2022 calendar year US dollars; **c** Nickel content of domestic mine production; **d** Includes metal content of ores and concentrates, intermediate products and nickel metal; **e** In 2022–23 financial year Australian dollars; **f** Forecast; **g** OCE estimates based on publicly available data; **s** Estimated.

Source: ABS (2022) International Trade, 5465.0; LME (2022) spot price; World Bureau of Metal Statistics (2022); Company reports; Department of Industry, Science and Resources (2022).

Zinc



Australia's Zinc sector



3rd largest producer in the world, 2021

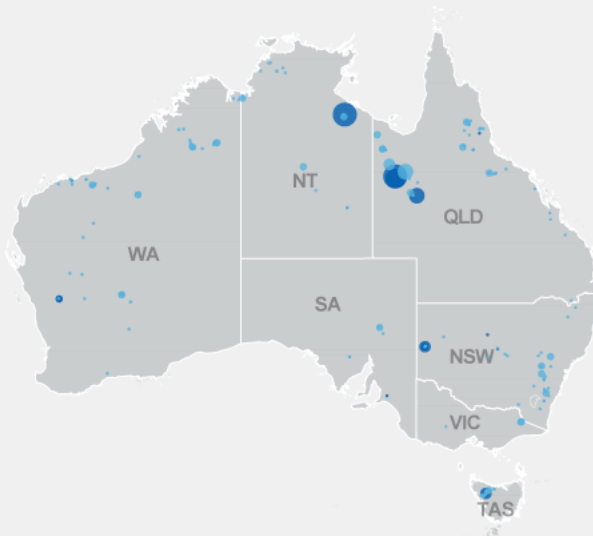


29% of the world's known **zinc resources** held



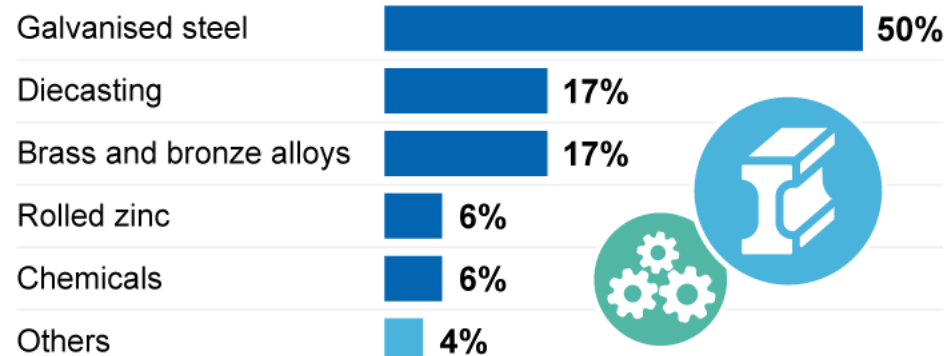
2nd largest exporter in the world, 2021

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



Major zinc deposits, Mt

World consumption



Zinc facts



Zinc ore was used in **ancient Greece** to produce brass



Zinc is used by the human body to **fight infection**

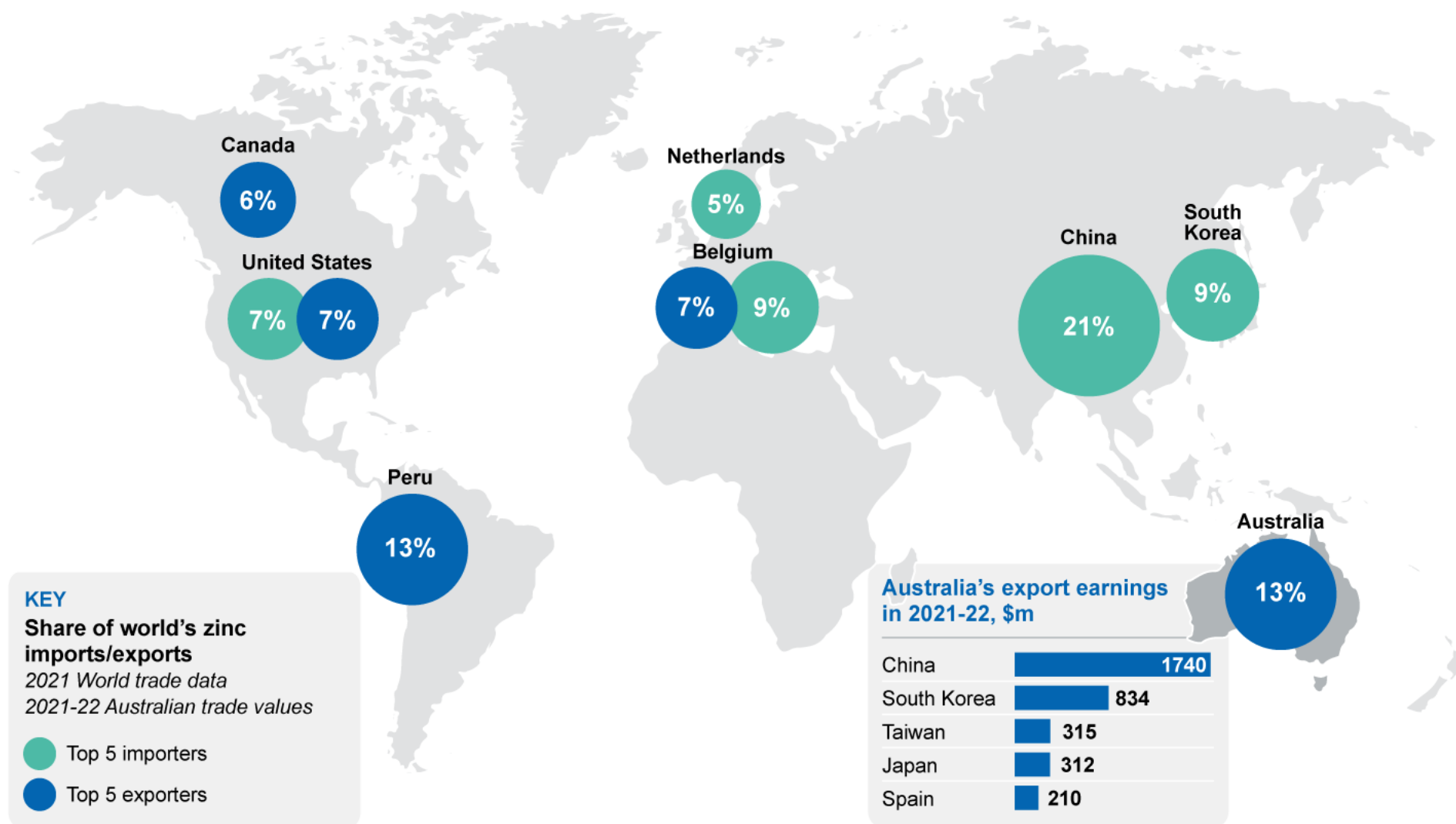


Zinc is used in **wound-care and sunscreen**



Zinc is an **emerging battery mineral**

Zinc TRADE MAP



14.1 Summary

- The LME zinc spot price is estimated to average around US\$3,500 a tonne in 2022, with tight supply keeping prices high over the majority of the year. With the macroeconomic environment weakening, prices are forecast to ease, particularly in the first half of the outlook period. Zinc should average about US\$3,000 a tonne in 2024.
- Australia's zinc production is forecast to rise by 5.2% per year to around 1.4 million tonnes by 2023–24, as output recovers from COVID disruptions, supported by historically high prices (see [Australia section](#)).
- Australia's zinc export earnings are forecast to peak at \$4.7 billion in 2022–23, before easing to \$4.6 billion in 2023–24.

14.2 World consumption

Sharp rebound in world zinc demand in September quarter

Zinc consumption tends to follow the world industrial production cycle, given its primary role in galvanising steel (Figures 14.1 and 14.2), and its heavy use in the construction sector and vehicle production. World refined zinc consumption rose by 1.9% year-on-year in the September quarter 2022, a sharp rebound compared to the fall of 8.7% year-on-year in the June quarter 2022. This increase was supported by recovering vehicle production and infrastructure spending in China. Consumption rose year-on-year in China (5.6%) and ex-China Asia (7.0%). This was partially offset by falls in the European Union (-5.9%) and the US (-3.8%).

A strong rise in global vehicle production drove zinc demand in the September quarter 2022, with global vehicle sales rising 9.6% year-on-year, compared to a fall of 16% year-on-year in the June quarter 2022. The vehicle industry saw an easing in supply bottlenecks, and sharp falls in semiconductor prices. Through the early stages of the COVID-19 pandemic, households increasingly shifted spending towards products (rather than services). Amidst shutdown-related production disruptions, this resulted in a shortage of semiconductors and long order backlogs for vehicle manufacturers. The surge in vehicle sales in the September quarter 2022 accompanied a recovery in production, with manufacturers

catching up on order backlogs, despite increasingly soft consumer sentiment in key markets. Over the longer term, the adoption of electric vehicles is expected to support sales.

Near term zinc demand is also being supported by China committing additional infrastructure spending to stimulate its slowing economy. The spending has been funded largely through increasing the annual issuance quota of local government special purpose bonds, totalling 5.15 trillion renminbi this year. More than 90 percent of the quota has already been issued.

Elevated inflation weakens outlook for zinc demand

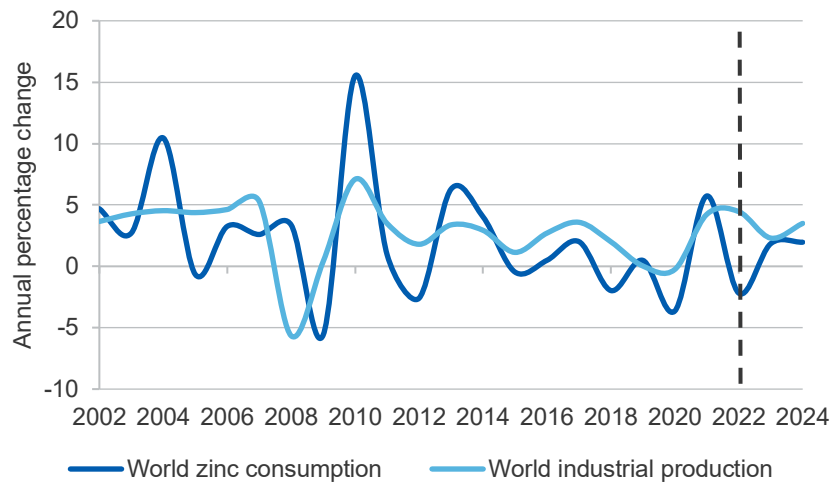
The outlook for growth in world industrial production – particularly in 2023 — remains highly uncertain (see *Macroeconomic Outlook* chapter), and this will weigh on zinc demand during the first half of the outlook period.

Expectations for consumer zinc demand have been weakened by softening demand in Europe and the US, where inflation remains elevated. If inflation persists, additional central bank rates hikes will follow and create greater risks that these economies will face a hard landing.

Expectations for consumer demand (including residential construction) from China have improved since the September 2022 *Resources and Energy Quarterly*. Since the conclusion of the National Congress of the Chinese Communist Party in November, the Chinese government has tried to boost growth. Central to this has been some relaxation of COVID restrictions and an easing of restrictions on property developers. This could support the weak residential property construction sector, where developers have struggled with falling sales and a lack of credit.

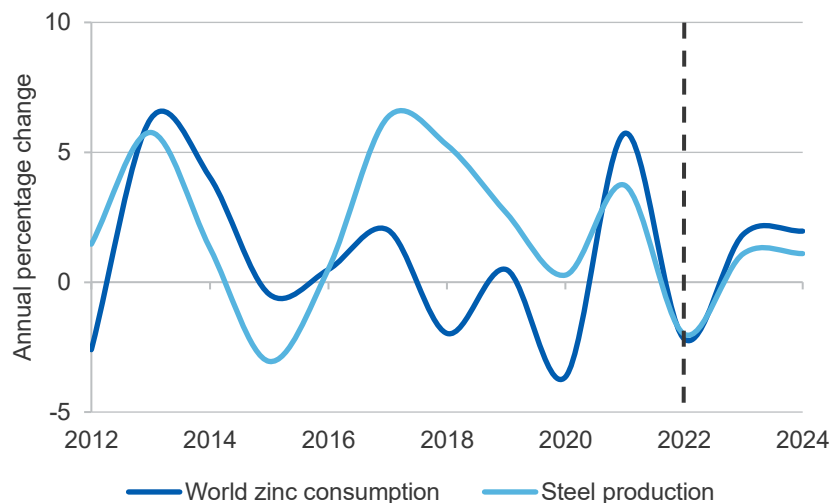
Over the longer term, the global energy transition is expected to support demand for zinc, due to its role as a key input to wind turbines and solar panels. Spending on the deployment of these technologies is supported by policies such as the US Inflation Reduction Act and the EU Next Generation package. Developments in zinc battery technology also have the potential to drive additional demand.

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).

Over the outlook period, world zinc usage is forecast to grow on average 1.9% per year, from 13.7 million tonnes in 2022 to 14.3 million tonnes in 2024 (Table 14.1), recovering from the drop in consumption over 2022. Long term demand growth will be driven by infrastructure and vehicle production as part of the global transition to low emissions technologies.

14.3 World production

Global mine production falls from COVID related disruptions

World mined zinc production fell by 2.9% year-on-year in the September quarter 2022, due to lower production in China, Peru and Australia. Chinese mine production in the quarter was 5.8% lower year-on-year, affected by containment measures associated with the country's zero COVID policy. Peruvian mine production in the quarter fell by 2.9% year-on-year, due the end-of-life closure of the Iscaycruz mine last year. Zinc output from Australian mines in the quarter was 6.3% lower year-on-year. Output has been affected by COVID-related absenteeism since the Omicron outbreak in the March quarter 2022. Production is expected to begin normalising as mandatory isolation requirements end in October.

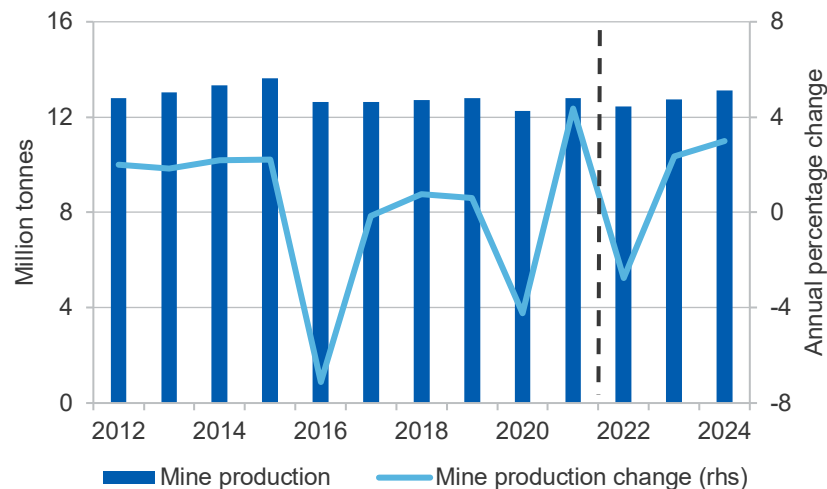
Changes in mine output from smaller producers in North America also affected the market shares of Canada and the US. Canadian output halved in the year to September quarter 2022. Its largest zinc mine, the 777 mine, closed as reserves ran out. This decline was offset by a 24% year-on-year rise in the US, with higher production at the Red Dog mine.

Mine production to recover over the outlook period

World mine output is estimated to fall by 2.7% to 12.4 million tonnes in 2022. Among the world's three largest zinc producers, operations in China and Australia were disrupted by COVID restrictions, while production in Peru fell due to mine closures and lower ore grades.

Global mine production capacity is expected to increase over the outlook period, as new mines and mine expansions come online. Over the outlook period, mine output is forecast to rise by an average of 2.7% per year to 13.1 million tonnes by 2024, as miners respond to elevated zinc prices and COVID-related operational disruptions subside (Figure 14.3).

Figure 14.3: World zinc mine production, metallic content



Source: International Lead Zinc Study Group (2022); Department of Industry, Science and Resources (2022).

The largest new projects expected to add to mining production capacity over the outlook period are located in Russia, Kazakhstan, Mexico and Australia. The fallout from the Russian invasion of Ukraine has led to difficulty in sourcing equipment in Russia and Kazakhstan, as imports have been disrupted by sanctions, and some business have withdrawn operations in the region. China, the world's largest producer of zinc ore, is expected to expand production across smaller mines.

The Ozeroye mine in Russia has been delayed and is now expected to begin operating in 2024. The mine has a capacity of up to 360,000 tonnes of zinc per year, but will likely to take several years to ramp up to that level. Some markets are closing to Russian ore exports, but there is potential for part of the excess Russian supply to be redirected to Chinese and Indian refiners.

Kazzinc's Zhairam mine in Kazakhstan has not been able to ramp up as quickly as expected. The mine is expected to reach its nameplate capacity

of 160,000 tonnes of zinc per year in 2023, while year-to-date production in 2022 remains similar to 2021.

Grupo Mexico's Buenavista mine in Mexico is expected to begin operating in 2023, ramping up to nameplate capacity of 120,000 tonnes of zinc per year by 2025.

New Century Resources' Century mine in Australia restarted in 2018, and has since produced around 120,000 tonnes of zinc per year. The mine is expected to expand output to 230,000 tonnes of zinc per year by 2024.

World refinery production falls in September quarter as energy price rises

World refined zinc production fell by 2.8% year-on-year in the September quarter 2022. The fallout from the Russian invasion of Ukraine has pushed up global energy prices, particularly in Europe, where gas previously supplied by Russian pipelines had to be replaced with alternative sources. With the northern winter expected to be mild, the prospects of a widespread energy shortage in Europe in the near-term have now diminished. However, the loss of overall supply to the market will likely keep prices above their pre-war levels.

Refined zinc production in the European Union (EU) fell by 12% year-on-year in the September quarter 2022. Zinc refining capacity in EU member states has gradually been taken offline over the past year due to high energy prices. However, with energy prices easing since August, cuts to European zinc refining capacity have slowed. The Budel smelter in the Netherlands partially restarted production in November 2022, having closed in September 2022. The Portovesme smelter in Italy remains closed, while the Nordenham smelter in Germany closed in November 2022.

Production in China — the largest zinc refiner globally — fell by 2.1% year-on-year in the September quarter 2022, with output affected by ongoing localised COVID lockdowns. Additionally, the drought and heatwave in south-western China led to power rationing and affected zinc smelters in the Sichuan province in August.

However, output in China could rebound in the December quarter 2022, as the Chinese government relaxes COVID restrictions. The fall in production capacity in Europe will also see some excess concentrates flowing towards China. Treatment prices of imported concentrates in China have risen substantially in the second half of 2022, and Chinese smelters could increase production if operational disruptions can be resolved.

Among the smaller producers, refined metal production in Canada fell by 23% year-on-year in the September 2022 quarter. Deterioration in the condition of key equipment led to declining production at the Valleyfield smelter, and the smelter was closed at the end of October for repairs.

Over the outlook period, refined production from primary and secondary sources is expected to rise by 2.5% a year, reaching 14.3 million tonnes in 2024. The majority of new capacity is expected to be in China. European smelters are likely to reopen gradually, with the pace of the reopening depending on energy market conditions.

14.4 Prices

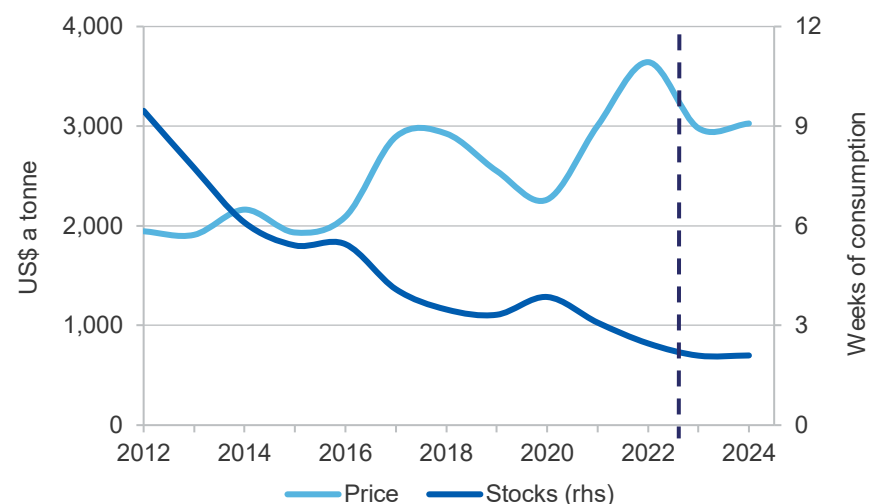
Spot price falls despite tight supply, as concerns over global growth looms

The London Metal Exchange (LME) spot zinc price rallied to US\$3,600 a tonne in early August, as high energy prices threatened further zinc refining closures and cutbacks in Europe. However, the price fell to \$2,700 by the end of October with the market discouraged by entrenched inflation in many major economies. The market recovered to about \$3,000 in November, on the prospect of COVID restrictions easing in China.

The benchmark treatment price remains unchanged at US\$230 a tonne. However, the refining closures and cutbacks in Europe have resulted in surplus concentrates which are flowing into China, where the treatment price for imported concentrates rose from US\$189 a tonne in July to US\$270 a tonne in October.

LME stocks declined to 50,000 tonnes at the end of October, down from 81,000 tonnes at the end of the June quarter 2022 and 200,000 tonnes at the start of 2022 (Figure 14.4). Stocks are low in the US and Europe, with the vast majority of the remaining inventory in Asian warehouses.

Figure 14.4: Zinc prices and stocks



Source: LME (2022); International Lead Zinc Study Group (2022); Department of Industry, Science and Resources (2022).

The LME zinc spot price is estimated to average around US\$3,500 a tonne in 2022 (up by 16% from 2021), as prices have stayed high for the majority of the year despite recent declines. The price is forecast to fall by 15% to around \$3,000 a tonne by 2024 as improving global zinc supply and uncertainty over macroeconomic conditions sees market tightness ease. This forecast is sensitive to the substantial uncertainty in the current global macroeconomic environment.

14.5 Australia's exports and production

Export earnings to remain steady as output growth offsets price declines

Australia's combined export earnings for both concentrates and refined zinc are estimated to reach \$4.7 billion in 2022–23 as mine output recovers from COVID disruptions.

Australian export earnings are then forecast to decline to around \$4.6 billion in 2023–24 due to lower forecast prices.

Australia's mine output fell in September quarter on COVID disruptions

COVID cases continued to create workforce disruptions in Australian mines over the September quarter 2022. As a result, Australia's mined zinc output fell by 6.9% year-on-year in the quarter.

Production at Glencore's Australian operations, including Mt Isa in Queensland and McArthur River in the Northern Territory, fell 15% year-on-year to 130 kilotonnes in the September quarter 2022. This fall was mainly due to COVID-related workforce disruptions.

Production at MMG's Australian operations, including Dugald River in Queensland and Rosebery in Tasmania, fell by 1.5% year-on-year to 61 kilotonnes in the September quarter 2022. Output fell at the Rosebery mine on COVID-related workforce problems and lower ore grades.

Production at New Century's Century mine rose 22% year-on-year to 35 kilotonnes in the quarter, with the deployment of the next generation hydraulic mining cannon. A planned shutdown to mitigate wet weather is expected to affect production over the December 2022 quarter.

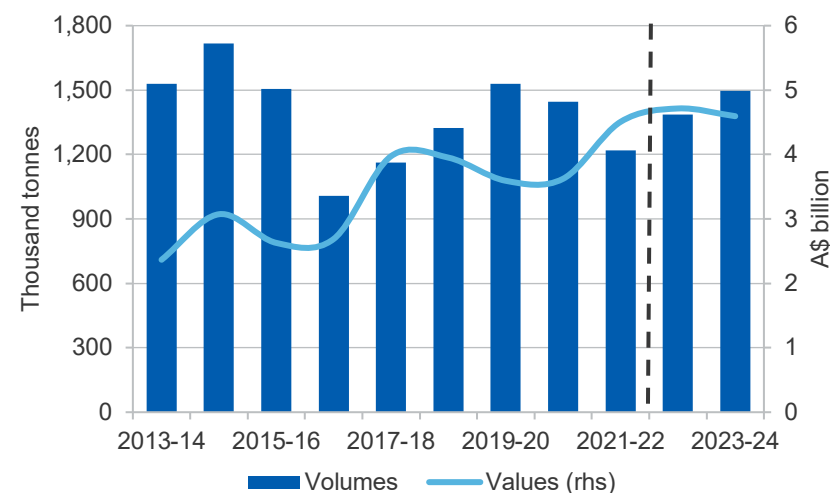
Export earnings grew on elevated prices and a weaker exchange rate

In the September quarter 2022, Australian zinc concentrate exports rose by 10% year-on-year to \$682 million, and refined zinc exports rose 3.8% year-on-year to \$364 million. Export volumes rose by 4.4% year-on-year to 497 kilotonnes, and refined zinc export volumes fell 23% year-on-year to 66 kilotonnes (Figure 14.5).

China is the largest market for Australian zinc concentrate exports. In the September quarter 2022, the value of Australia's concentrate exports to China rose by 36% year-on-year to \$443 million driven by higher volumes. As high power prices cause smelter closures or cutbacks in Europe, concentrate trade is shifting towards China.

The value of refined zinc exports to China fell 77% year-on-year in the September quarter 2022 to \$24 million. Given the majority of refined zinc stocks are located in Asia and many zinc refineries have closed in Europe, Australian refined zinc is flowing towards European and US markets.

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).

The value of refined zinc exports to the US rose to \$134 million in the September quarter 2022, increasing 81% quarter-on-quarter and compares with an average of \$3 million a quarter in 2021.

Australian mine production is expected to increase over the outlook period

Australian output is expected to grow over the outlook period, with mine output forecast to lift from 1.3 million tonnes in 2022–23 to 1.4 million tonnes in 2023–24. Increases will be driven by expansion of the Century mine, and recovery in production from COVID disruptions at the Mt Isa and McArthur River mines.

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 these hard rock resources have the potential to extend 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 possible first production in the second half of 2023, and estimates the project will generate additional zinc production of 30,000 tonnes a year.

Exploration expenditure increased significantly in 2021–22

Exploration expenditure for silver, lead and zinc rose 50% year-on-year in the September 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 moderate with zinc prices returning to a lower level.

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 September 2022 *Resources and Energy Quarterly*, forecasts for zinc export revenue are down 11.0% to \$4.7 billion in 2023–24. The difference is due to the downwards revision to forecast zinc prices over the outlook period.

Table 14.1: Zinc outlook

						Annual percentage change			
World	Unit	2021	2022 ^{fs}	2023 ^f	2024 ^f	2022 ^s	2023 ^f	2024 ^f	
Production									
– mine	kt	12,778	12,438	12,729	13,109		-2.7	2.3	3.0
– refined ^a	kt	13,841	13,608	13,907	14,291		-1.7	2.2	2.8
Consumption	kt	14,033	13,741	13,995	14,270		-2.1	1.8	2.0
Closing stocks	kt	809	676	588	608		-16.4	-13.0	3.5
– weeks of consumption		3.0	2.6	2.2	2.2		-14.7	-14.6	1.5
Price									
– nominal	US\$/t	3,005	3,501	2,979	3,027		16.5	-14.9	1.6
	USc/lb	136	159	135	137		16.5	-14.9	1.6
– real ^b	US\$/t	3,247	3,501	2,878	2,861		7.8	-17.8	-0.6
	USc/lb	147	159	131	130	7.8	-17.8	-0.6	
Australia	Unit	2020–21	2021–22	2022–23 ^f	2023–24 ^f	2021–22	2022–23 ^f	2023–24 ^f	
Mine output	kt	1,327	1,257	1,323	1,393	-5.3	5.2	5.3	
Refined output	kt	458	406	397	443	-5.0	-8.8	11.7	
Export volume									
– ore and concentrate ^c	kt	2,118	2,033	2,290	2,385	-4.0	12.7	4.1	
– refined	kt	496	313	334	398	-36.8	6.6	19.3	
– total metallic content	kt	1,480	1,220	1,386	1,497	-17.6	13.6	8.1	
Export value									
– nominal	A\$m	3,623	4,506	4,716	4,595	24.4	4.7	-2.6	
– real ^d	A\$m	4,054	4,827	4,716	4,387	19.1	-2.3	-7.0	

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** Estimated.

Source: ABS (2022) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Science and Resources (2022); International Lead Zinc Study Group (2022); Wood Mackenzie (2022); LME (2022).

Lithium



Australia's lithium sector



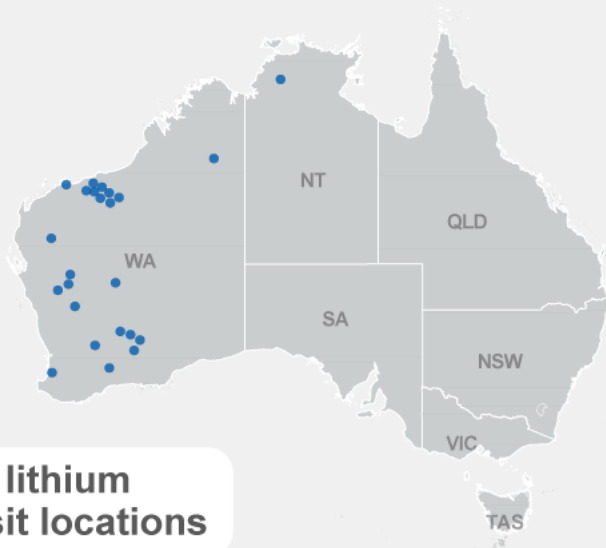
Largest exporter in the world



46% of the world's lithium **production** in 2021

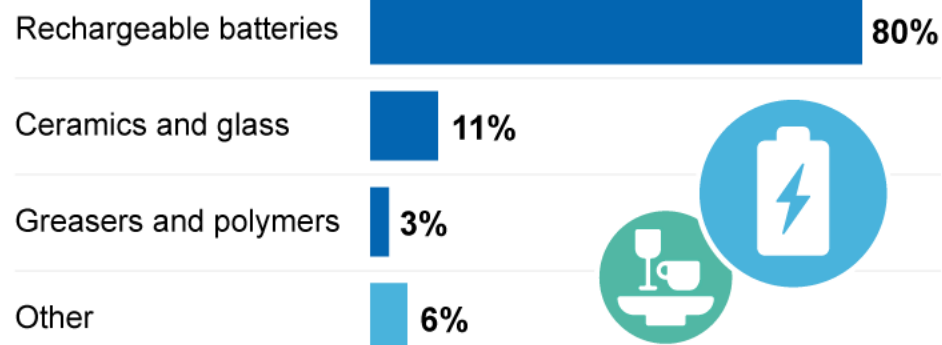


in 2022-23 production ramp up planned for **2 refineries**



Major lithium deposit locations

World consumption



Lithium facts



Lithium metal is so light it **floats on water**



Electric vehicle sales are expected to grow tenfold over 10 years to 2030



Australian lithium exports revenue **expected to triple** in 2022/23



In Kwinana, Nov 2022, **commercial production** of lithium hydroxide began

15.1 Summary

- Spodumene prices are estimated to rise from an average of US\$598 a tonne in 2021 to US\$2,700 a tonne in 2022, and US\$4,010 a tonne in 2023 before moderating to US\$3,130 in 2024. Lithium hydroxide prices are expected to lift from US\$17,370 a tonne in 2021 to US\$39,900 in 2022 and US\$61,200 in 2023, moderating to US\$48,500 by 2024.
- Australia's lithium production is forecast to grow from 335,000 tonnes of lithium carbonate equivalent (LCE) in 2021–22 to 399,000 tonnes in 2022–23 and 470,000 tonnes of LCE in 2023–24.
- In 2022–23 Australia's export earnings are forecast to more than triple — from \$4.9 billion in 2021–22 to \$16.1 billion, and \$17.0 billion in 2023–24.

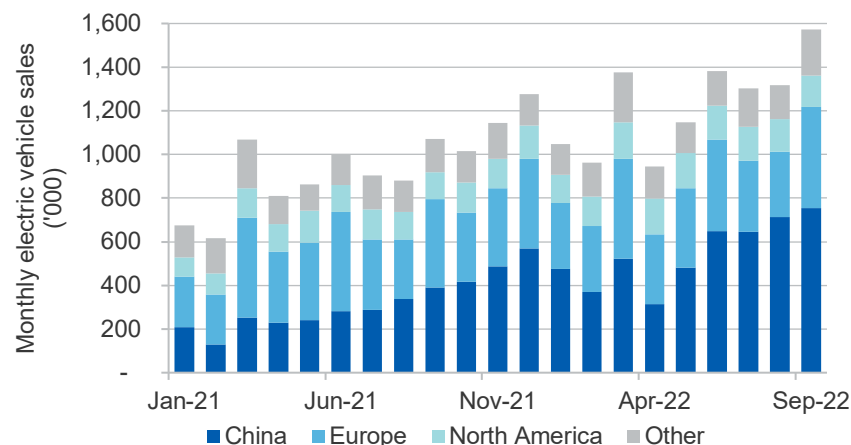
15.2 World demand

Chinese electric vehicle sales remain strong

Rising demand for electric vehicle batteries saw global lithium demand continue to grow strongly in the September quarter 2022. Despite a weakening in global economic conditions, sales and production of electric vehicles (EVs) continued their rapid growth trend. Global sales of all types of EVs increased 40% in the nine months to September 2022 compared with the same period in 2021 — with Chinese sales up 110%, European sales up 6%, and North American sales up 27% (Figure 15.1).

Fallout from the Russian invasion of Ukraine and the resulting higher power prices and factory shutdowns saw European sales slow in July and August, before picking up in September. While US EV sales have continued to grow, the North American market remains relatively small. In China, total monthly EV sales reached over three-quarters of a million for the first time in September. Auto production and supply chains in China have recovered from the COVID-19s lockdowns that disrupted industrial output in the June quarter 2022. Tax incentives and government subsidies continue to support purchases of new energy vehicles, and a number of local governments — such as Shenzhen, Shandong, and Hubei — have also provided subsidies and incentives to encourage EV purchases.

Figure 15.1: Electric vehicle sales (all types) by country



Source: IEA (2022).

Policies to promote EV uptake have also been implemented in many countries. In the United States, the Inflation Reduction Act of 2022 (with funding of US\$391 billion) contains provisions to promote the clean energy transition including significant incentives to purchase EVs.

Global passenger EV sales are expected to continue to grow strongly, albeit at a slower rate than in 2021 — when passenger EV sales more than doubled to an estimated 6.8 million vehicles. Passenger EV sales are expected to reach over 14 million in 2023.

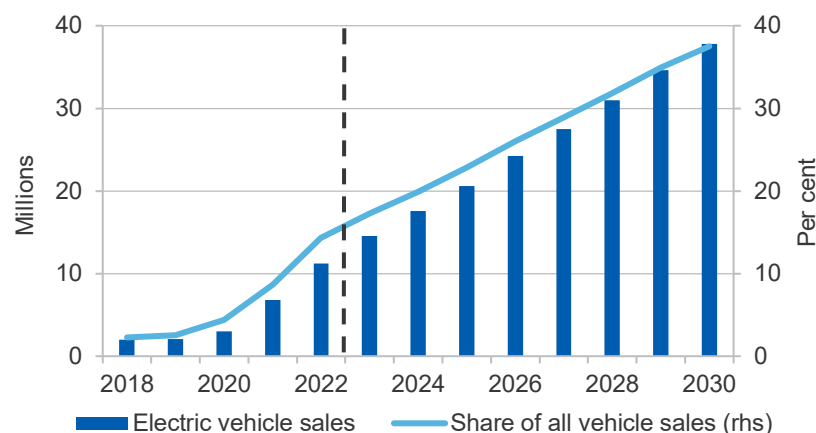
Major global automakers continue to accelerate plans to transition to EVs by developing new product lines and converting existing manufacturing capacity. The global market share for passenger EVs has quadrupled since 2019, with EV sales representing about 9% of the car market in 2021 (Figure 15.2). Strong underlying demand and EV manufacturers' declarations of further increases in production, imply that EV sales could reach almost 40% of annual vehicle sales by 2030.

World demand for lithium is estimated to increase from 592,000 tonnes of lithium carbonate equivalent (LCE) in 2021 to 745,000 tonnes in 2022 (Table 15.1). Over the following two years, demand is forecast to rise by

over 40%, reaching 1,091,000 tonnes by 2024. Despite the spread of new battery manufacturing capacity into Europe and the US, Asia remains the major source of demand for lithium.

In September, the Chinese government announced a continuation of vehicle purchase tax exemptions for new energy vehicles through to the end of 2023. The 12 month extension is expected to cost around 100 billion yuan. Compared to a similarly priced internal combustion engine (ICE) passenger car model, Chinese government subsidies provide a saving to customers of about 10,000 yuan.

Figure 15.2: Long term passenger EV sales projections



Source: Wood Mackenzie (2022), Department of Industry, Science and Resources (2022); IEA (2022).

The supply chain issues that plagued EV manufacturers and battery makers between late 2021 and early 2022 have eased somewhat. But supply of key inputs including batteries (see next section) and microchips remains tight, with reports of delivery timeframes for a number of EV models being pushed into 2024.

Higher prices for lithium and other key battery materials (such as nickel, graphite and cobalt) continue to put upward pressure on the cost of batteries which in turn is putting upward pressure on EV prices.

15.3 World production

Global lithium production to grow, but supply gap will take time to close

World output was 551,000 tonnes LCE in 2021, and is estimated to reach 691,000 tonnes in 2022 and 1,087,000 tonnes in 2024 (Figure 15.3). This rapid growth is forecast to be met by gains in output by Australia (see section below), Chile (via expansions to SQM and Albemarle brine operations) and Argentina (via new and expanded brine operations by Allkem, Livent and Minera Exar).

A supply gap is forecast to persist over the outlook period, with total supply from both mine and brine operations currently insufficient to meet demand. With new lithium projects being developed rapidly, the supply gap is expected to reduce over the outlook, but will take time to close. Lithium stockpiles remain hard to ascertain, with some estimates of 4-8 weeks for spodumene.

Global lithium project pipeline continues to grow

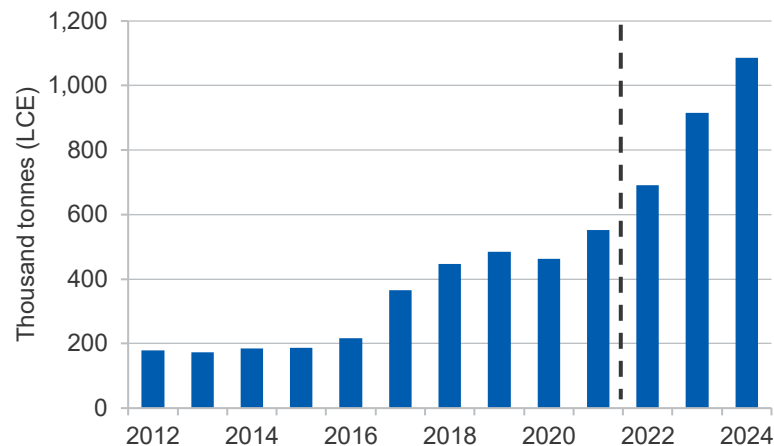
The strong demand outlook for lithium chemicals is attracting capital to build global supply. A number of expansions and new projects have been announced during 2022, with exploration and drilling activities picking up in many countries over recent months.

A pre-feasibility study for the Ewoyaa lithium project in Ghana has been completed by ASX-listed Piedmont Lithium. The project aims to produce 255,000 tonnes a year of 6% spodumene concentrates over a 12.5-year mine life, with capex of US\$125 million. The project is targeting first production of spodumene concentrate in late-2024, subject to receipt of a mining licence in late-2023 and the project meeting all other statutory requirements.

The Naraha Lithium Hydroxide plant in Japan produced its first lithium hydroxide in November 2022.

In addition to ongoing expansions to brine operations in Chile, state-owned mining firm Codelco is undertaking exploration in the Salar de Maricunga, with drilling due for completion early next year.

Figure 15.3: Global lithium production



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

Pilbara Minerals' joint venture with POSCO has seen contracts awarded and preliminary site activities are underway for the 43,000 tonnes a year primary lithium hydroxide chemical processing facility in South Korea. The joint venture plans to source over 300,000 tonnes a year of spodumene concentrate from the Pilgangoora operations.

European Lithium is progressing arrangements to secure additional capital to progress the Wolfsberg Lithium Project, a hard rock lithium project, located 270km south-west of Vienna, Austria. The project comprises 54 exploration licences and 11 mining licences covering a total area of 11.33 square kilometres and is located close to several planned battery gigafactories.

The UK's first large-scale lithium refinery has been announced for Teesside, Middlesbrough, with the region also chosen as the location for the nation's largest planned recycling facility for EV batteries. The proposed facility is planned to produce 50,000 tonnes of battery-grade lithium each year once it enters full operations, scheduled for 2025.

¹ The SC6% CIF China price is an industry accepted reference price. The actual spodumene concentrate grade produced and shipped by Australia's lithium producers varies, and is

Britishvolt secured £1.7bn of additional funding for construction of a gigafactory near Blyth, which is scheduled for completion in late 2025.

Interest in battery recycling continues to rise around the globe. However, large scale operations will take time to get established. Rising volumes of used EV batteries, combined with higher lithium prices, should strengthen the economics of recycling projects over time.

15.4 Prices

Record spot prices see contract prices reset in September quarter

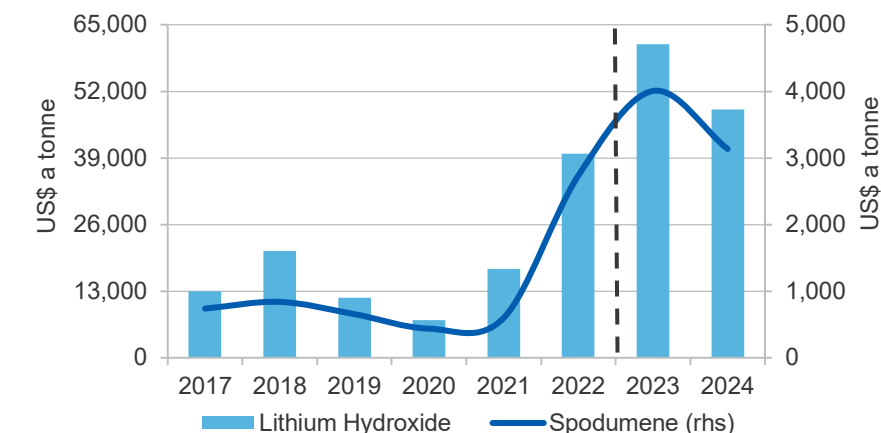
Spot prices continue to set record highs, driven by shortages of spodumene, lithium hydroxide and lithium carbonate. Spot spodumene concentrate averaged about US\$6,100 per tonne in November 2022 (SC6.0, CIF China).¹ This was up 6.4% from October, representing a more than three-fold gain from the US\$1,900 a tonne average spot price for November 2021. In November 2022, spot lithium hydroxide price (delivered to China) averaged around US\$78,950 a tonne, up from US\$28,560 in November 2021.

As most Australian producers have historically utilised long term contracts, prices received take time to adjust to shifts in spot prices. High prices reported by Australian producers confirm spot prices are now flowing more rapidly into contract prices. Spodumene contract prices appear to be increasingly linked to battery-grade lithium chemicals, particularly lithium hydroxide. ABS trade data indicate that average realised prices (which reflect a mix of contract and spot priced exports) rose strongly in 2022, as processors sought to ensure supply was sufficient to meet likely demand.

Spodumene prices are forecast to rise from an average of US\$598 a tonne in 2021 to US\$2,730 a tonne in 2022, as record spot prices feed through into contract prices (Figure 15.4). Prices are expected to grow further next year as contract prices reset in the September quarter 2022, averaging US\$4,010 a tonne in 2023 before moderating to US\$3,130 in 2024.

often lower than the 6% lithium content. Hence, when companies report prices received they adjust the actual price received to generate a 6% 'reference' price.

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).

The lithium hydroxide price is estimated to rise to US\$39,850 a tonne in 2022, up from US\$17,370 a tonne in 2021. Prices are expected to peak at over US\$60,000 a tonne in 2023 before moderating to average about US\$48,000 in 2024.

Rapid price movements and the relative immaturity of the market will likely lead to ongoing uncertainty. Risks to the lithium price forecasts are balanced over the outlook period. While expansions to production are already underway in Australia and overseas, there are long lead times for lithium mine and brine operations. Moreover, the potential for delays in bringing such large volumes of lithium into production, mean risks remain of persistent supply shortages over the next few years.

However, one of the drivers of recent high spot prices appears to be a push by refiners and battery makers to build up inventories, due to concerns about global supply chains. The lack of data on global lithium stocks makes it difficult to judge how well battery producers have built up stockpiles. If these concerns ease, prices could moderate more rapidly over the outlook period. Prices may also ease if global economic growth slows more sharply than the IMF has forecast.

15.5 Australia

Lithium exports set to triple

The strong growth in spodumene prices that saw Australia's export revenue reach a record \$4.9 billion in 2021–22 — up from \$1.1 billion in 2020–21 — is expected to drive a further tripling in annual export earnings over the outlook period. Production from lithium hydroxide refineries is forecast to steadily build, lifting total annual lithium export revenue to an estimated \$16 billion in 2022–23 and \$17 billion in 2023–24.

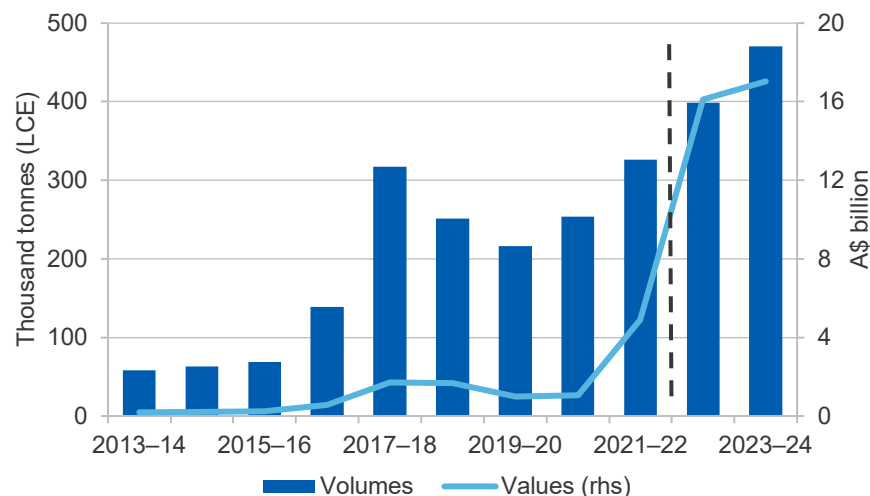
While much of the forecast export growth is price driven, Australia's production capacity is also forecast to grow strongly over the outlook. Expected annual average growth of over 18% a year will see production rise from 335,000 tonnes of LCE in 2021–22 to 399,000 tonnes in 2022–23, and 470,000 tonnes in 2023–24 (Figure 15.5).

Export volumes of spodumene concentrate are forecast to grow by more than one-third from 2021–22 levels over the forecast period: spodumene concentrate exports are forecast to rise to 3.2 million tonnes in 2023–24 from 2.3 million tonnes in 2021–22.

China accounts for the overwhelming majority of Australia's lithium exports. In 2021–22, China imported 96% of Australia's lithium exports — predominantly spodumene concentrate — in both value and volume terms. The next largest export destination was Belgium, accounting for only 2.3% of Australia's lithium export volumes, followed by South Korea (0.9%) and the United States (0.7%). Monthly trade data confirm these export shares have continued largely unchanged into 2022–23 (Figure 15.6).

The EV battery supply chain is heavily reliant on China, which makes 75% of all lithium-ion batteries, and holds about 70% of cathode production capacity and 85% of anode output. Further, over half of lithium, cobalt and graphite processing and refining capacity is located in China. The IEA estimates that the majority of the supply chain is likely to remain in China through to 2030. For example, around 70% of new global battery production capacity announced for the period to 2030 is in China (IEA 2022).

Figure 15.5: Australia's exports of lithium



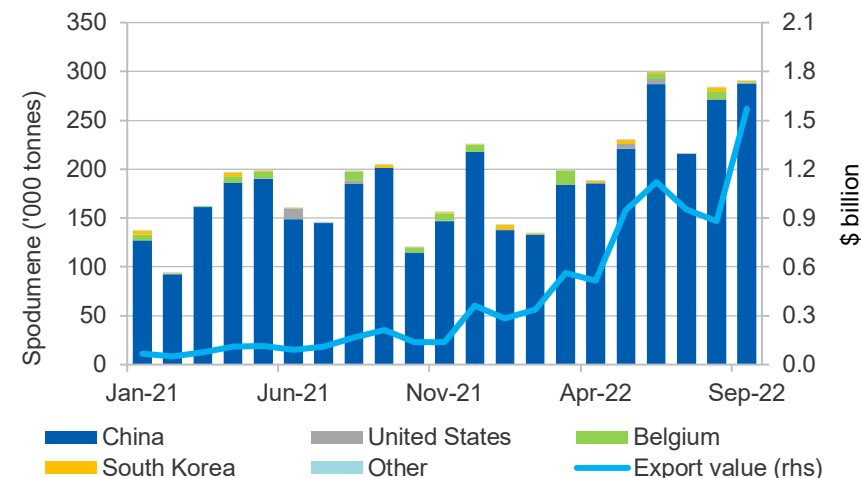
Notes: Export values include revenue from spodumene concentrate and lithium hydroxide. Lithium volumes include total exports of spodumene concentrate and lithium hydroxide converted to LCE.

Source: Company reports; WA Department of Mines, Industry Regulation and Safety (2022), Wood Mackenzie (2022); Department of Industry, Science and Resources (2022).

As economies around the world look to reduce their dependency on Chinese imports and develop their own lithium and battery production, increased export opportunities will arise for Australian producers. For example, under US Government's Inflation Reduction Act a new EV will only be eligible for tax credits when at least 40% of the battery's critical minerals are extracted or processed from: the US, a free trade agreement partner such as Australia, or North American recycling operations.

The US content requirement includes minerals such as lithium, nickel, cobalt and graphite. Policies such as these — as well as broader trends in global battery and EV production — can be expected to affect trade patterns for Australia's resource exports (including lithium) over the coming decade. However, the likely rate and magnitude of any resulting changes to Australia's export markets remains subject to considerable uncertainty.

Figure 15.6: Australia's spodumene exports by country



Source: ABS (2022).

Production and exports continued to expand in September quarter

Talison Lithium's three operational plants at Greenbushes produced a combined record total of 361,227 tonnes of spodumene concentrate in the September quarter 2022. This was up by 7% from the June quarter. Spodumene sales revenues were also boosted due to a reset in contract pricing for chemical grade spodumene from US\$1,770 a tonne (FOB) for the second half of FY22 to US\$4,187 a tonne FOB for the September 2022 quarter. For the September quarter, the company reported a slightly lower average realised price of US\$3,729 a tonne, due to a delayed shipment at the previous lower benchmark price.

Talison's Tailings Retreatment Plant continued to ramp up, with an increase in throughput in the September quarter following completion of construction earlier this year. The company has announced that its chemical grade plant 2 has also continued to ramp up.

Pilbara Minerals produced 147,236 dry metric tonnes (dmt) of spodumene concentrate output in the September quarter 2022. This was an increase of 16% from the June quarter. The company has announced that the next

stage of the plant expansion, the 'P680' Project, has commenced. This follows a final investment decision (FID) in the June quarter, with bulk earthworks underway and long-lead item contracts awarded. Commissioning for the new crushing plant and ore sorting facility is expected to begin in the December quarter 2023. This project includes \$50 million of pre-investment capital to assist with the proposed next phased expansion — with a targeted production capacity of up to 1 Mtpa. FID for the 'P1000' Project is targeted for late December 2022.

In November, Pilbara Minerals announced that it had secured a 10-year debt facility of up to \$250 million from the Australian Government (through the Export Finance Australia and Northern Australia Infrastructure Facility agencies) to support the expansion of its Pilgangoora operation. In addition, a significant highlight of the September quarter was the Ngungaju Plant achieving nameplate capacity of 180–200,000 dmt per year.

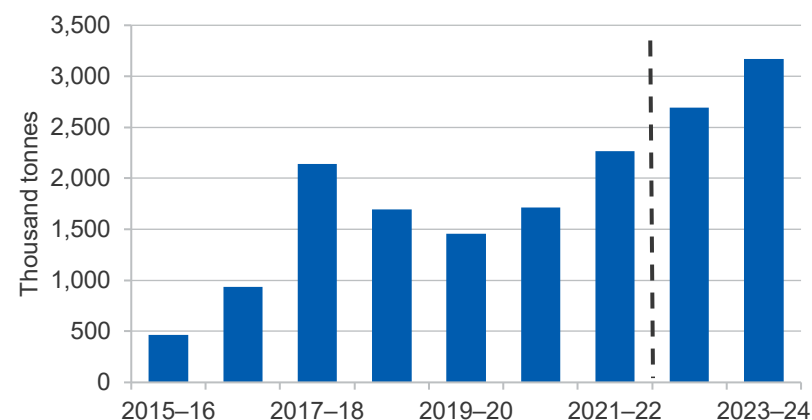
Pilbara Minerals stated that the average realised spodumene sales price achieved in the September quarter 2022 was US\$4,813 per dmt (SC6% CIF China basis). This was a 13% gain on the June quarter 2022 price of around US\$4,267/dmt. Pilbara Minerals sold several cargos at auction for US\$7–8,000 a tonne (SC6%, CIF China basis) in the September quarter 2022, and in November achieved a sale of US\$8,575 a tonne (SC6%, CIF China basis) for a cargo of 5,000 dmt.

Output from Mt Marion (50% Mineral Resources and 50% Jiangxi Ganfeng Lithium) totalled 108,000 dmt of spodumene concentrate in the September quarter 2022, with an average realised price of US\$2,364 a tonne for Mineral Resources' offtake share. The company reported that output was lower in the quarter, due to the mining of lower-grade transitional ore and plant shutdowns associated with the expansion of production capacity. The joint venture has announced it will lift spodumene output at Mt Marion, targeting an annual plant capacity of 900,000 tonnes (equal to 600,000 tonnes of 6% spodumene concentrate) by end 2022. The company's average spodumene concentrate (SC6%) equivalent FOB reference price for the September and December quarters is estimated at US\$4,187 per dmt.

Mineral Resources and Albemarle stated that the restart of Wodgina continued to ramp up during the September quarter, with first spodumene concentrate from Train 2 produced in July.

Allkem's Mt Cattlin mine produced 17,606 dmt of spodumene concentrate in the September quarter 2022. The average spodumene realised price received in the September quarter was US\$5,028 per dmt (SC5.4% CIF).

Figure 15.7: Australian spodumene exports



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

Following FID in the June quarter, Liontown's Kathleen Valley project has continued, with receipt of all major approvals achieved in the September quarter, and most key mechanical and electrical equipment supply contracts awarded. The project is expected to deliver about 500,000 tonnes of spodumene concentrate in the first year, rising to about 700,000 tonnes a year by year 6. Construction of accommodation at the site continued, with around 70% of in-ground services complete.

Site construction continues at Core Lithium's Finnis Project near Darwin. Mining of spodumene ore commenced in early October, and the company sold ore at a price of US\$951 a tonne. The company reports that development is on schedule for first spodumene concentrate production in the first half of 2023.

Kwinana refinery commences commercial production

During the September quarter the Kwinana lithium hydroxide refinery (51% Tianqi and 49% IGO) completed gradual close-out of commissioning activities. Commercial production of Train 1 was declared on 30 November, with ramp-up to nameplate capacity expected over 2023. IGO announced in December that Train 1 was able to operate continuously to produce battery-grade lithium hydroxide, and that independent testing had confirmed the product meets the required standards for the lithium-ion battery industry. Product qualification with offtake partners continues.

In late November, IGO noted that significant sunk capital and progress has already been made on Train 2, with the FID imminent. Train 2 is expected to commission in 2024. Each train has a capacity of 24,000 tonnes a year.

Kemerton Train 1 lithium hydroxide plant (Albemarle 60%, Mineral Resources 40%) is commissioning, and is expected to produce qualification samples by year end. Kemerton's Stage 2 — which will produce an additional 25,000 tonnes a year — has achieved mechanical completion and is transitioning to commissioning.

Construction of Covalent Lithium's (Wesfarmers 50%, SQM 50%) Kwinana lithium hydroxide refinery progressed in the June quarter 2022. The refinery is forecast to start in 2024 — making 50,000 tonnes of lithium hydroxide a year. The refinery will source spodumene from Mt Holland, where construction of the village and aerodrome has been completed, and pre-strip mining and construction of the concentrator is underway.

By 2024, Australia could have up to 10% of global lithium hydroxide refining capacity, rising to about 20% of global lithium refining by 2027. However, there are a number of risks over the outlook. Approval and construction delays for new mines and processing plants, as well as difficulties achieving ramp up to full output, would see slower growth in spodumene output volumes and export values. There are also technical challenges associated with achieving required product grade, purity and consistency, which could delay output and exports.

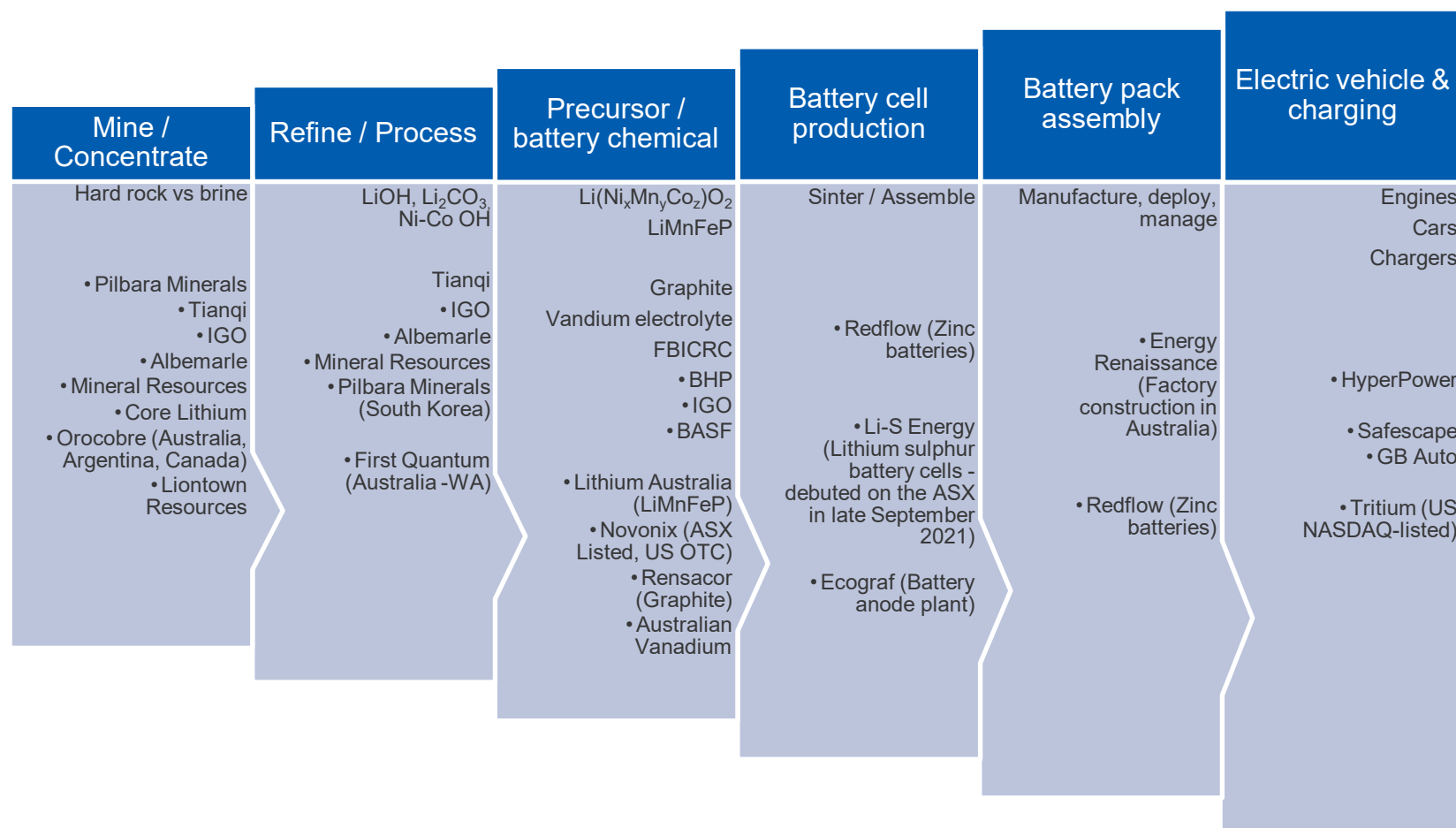
Australian businesses are expected to continue their expansion into higher value-added activities over the outlook period. Potential avenues include growth up the battery value chain, from mining and refining into precursor chemicals for cathodes, electrolyte production, battery anode plants, battery cell research/production, and battery manufacturing (Figure 15.8).

Revisions to the outlook

Forecast export revenue over the outlook period has been revised up substantially. This reflects rapid price rises, faster than expected pass-through of spot prices to contract prices and exchange rate effects.

Since the September 2022 *Resources and Energy Quarterly*, revenue from lithium exports in 2022–23 has been revised up by \$2.3 billion (to \$16 billion), and 2023–24 has been revised up by \$4.2 billion (to \$17 billion).

Figure 15.8: Global 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.

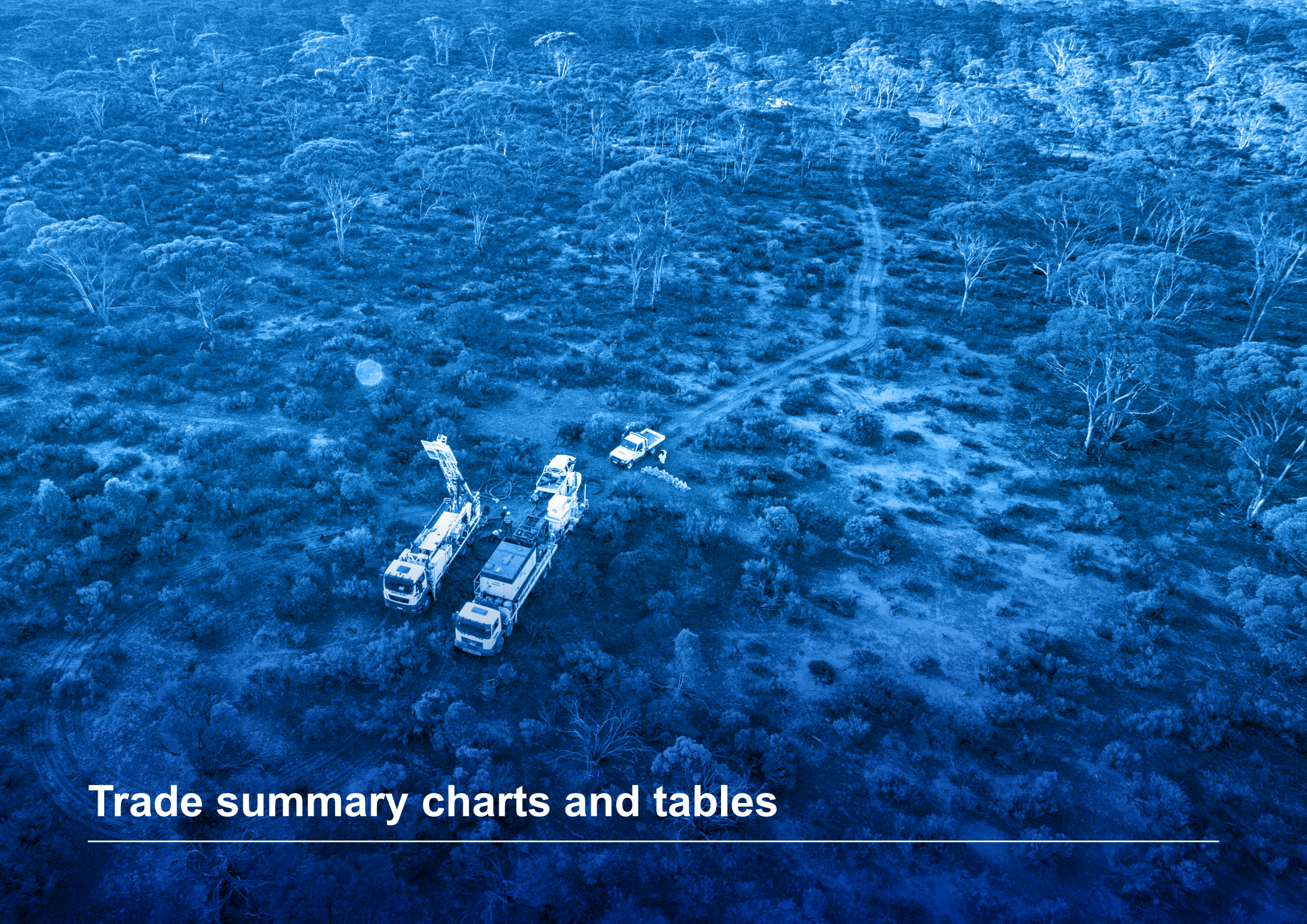
Source: BloombergNEF (2021), *Australasian Institute of Mining and Metallurgy: Thought leadership conference*, September 2021; Future Battery Industry Co-operative Research Centre (2021).

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	551	691	915	1,087	25.4	32.5	18.7
Lithium demand	kt	592	745	924	1,091	25.7	24.1	18.0
Spodumene price								
– nominal	US\$/t	598	2,730	4,010	3,130	356.3	46.9	-21.9
– real ^b	US\$/t	647	2,730	3,870	2,960	322.3	41.7	-23.5
Lithium hydroxide price								
– nominal	US\$/t	17,370	39,850	61,220	48,450	129.4	53.6	-20.9
– real ^b	US\$/t	18,770	39,850	59,150	45,790	112.3	48.4	-22.6
Australia	Unit	2020–21	2021–22	2022–23 ^f	2023–24 ^f	2021–22	2022–23 ^f	2023–24 ^f
Mine production ^a	kt	247	335	399	470	35.9	19.0	17.8
Spodumene export volume ^c	kt	1,711	2,264	2,693	3,173	32.3	19.0	17.8
Export value								
– nominal value ^d	A\$m	1,055	4,907	16,104	17,034	365.2	228.2	5.8
– real value ^e	A\$m	1,180	5,256	16,104	16,265			

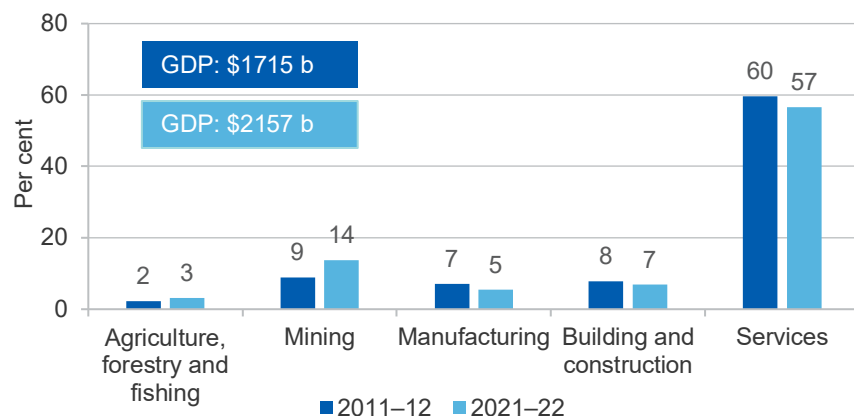
Notes: **a** Lithium Carbonate Equivalent (LCE) — a measure of the quantity of refined product; **b** In 2022 US dollars; **c** Includes spodumene concentrates exported — mostly 6 per cent Li₂O concentrate — plus spodumene concentrate used to produce lithium hydroxide for export; **d** Revenue from spodumene concentrate as well as lithium hydroxide; **e** In 2022–23 Australian dollars; **s** Estimate; **f** Forecast.

Source: Company reports; Department of Industry, Science and Resources (2022); Wood Mackenzie (2022); Government of Western Australia Department of Mines, Industry Regulation and Safety (2022).



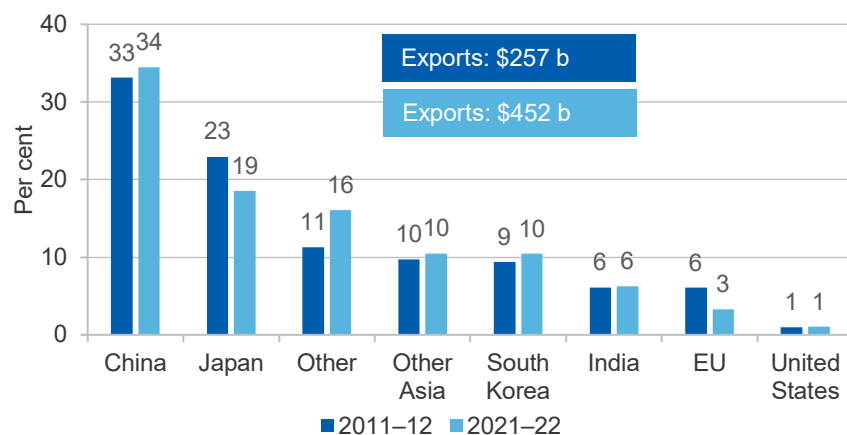
Trade summary charts and tables

Figure 16.1: Industry shares of GDP



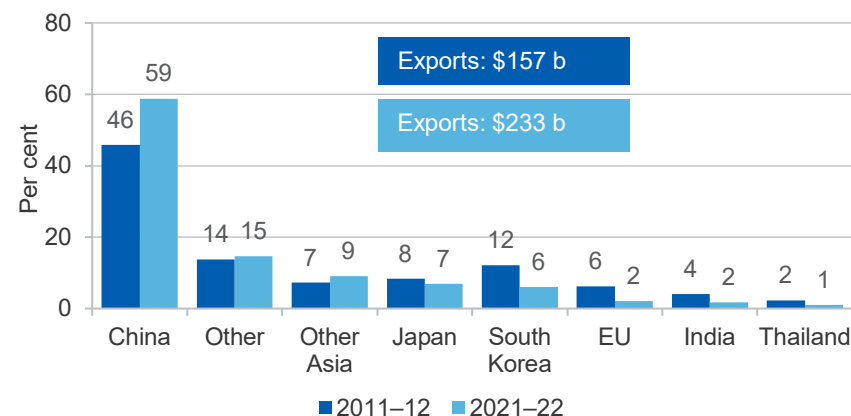
Source: ABS (2021) Australian National Accounts, National Income, Expenditure & Production, 5204.0

Figure 16.2: Principal markets for Australia's resources and energy exports, 2022-23 dollars



Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.3: Principal markets for Australia's resources exports, 2022-23 dollars



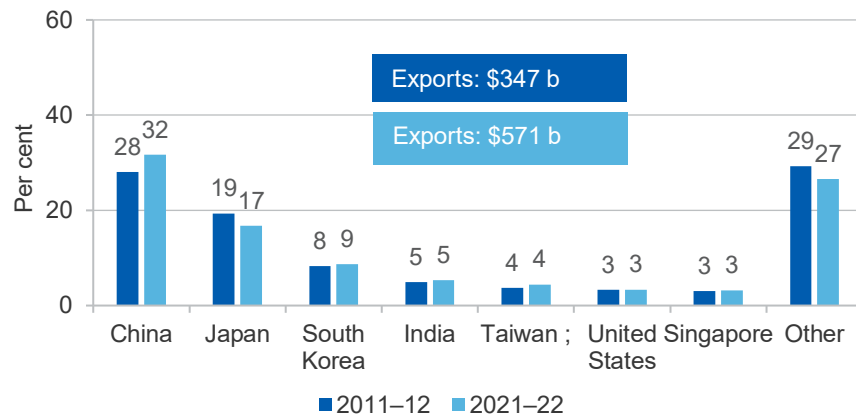
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.4: Principal markets for Australia's energy exports, 2022-23 dollars



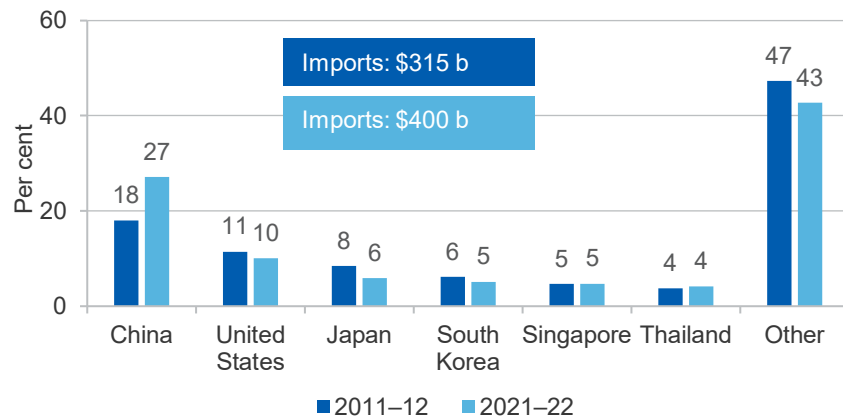
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.5: Principal markets for Australia's total exports, 2022–23 dollars



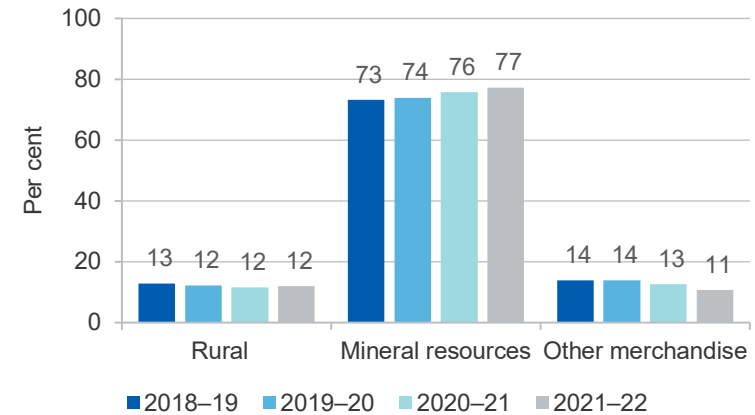
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.6: Australia's total imports by country of origin, 2022–23 dollars



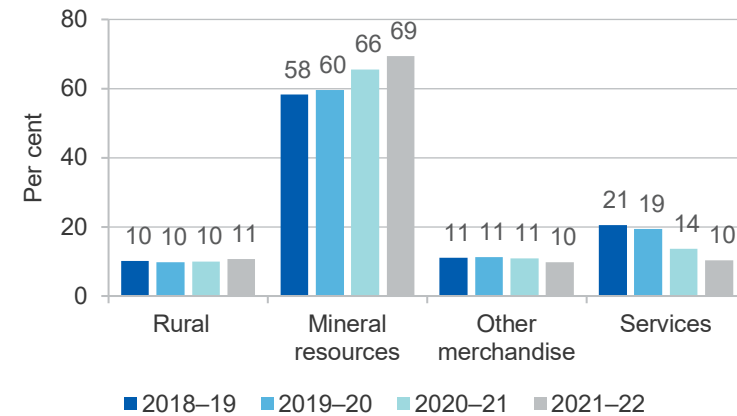
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2022) International Trade in Goods and Services, 5368.0

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, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
Japan	\$m	11,521	13,400	9,491	7,842	25,529
South Korea	\$m	3,480	4,392	3,232	2,873	7,305
Taiwan	\$m	3,011	3,643	2,713	2,305	7,109
Vietnam	\$m	150	765	1,183	796	1,809
Malaysia	\$m	875	1,042	608	626	1,534
Thailand	\$m	434	461	491	580	866
Total	\$m	26,452	29,909	23,167	17,911	49,570

Source: ABS (2022) International Trade in Goods and Services, 5368.0

Table 16.2: Principal markets for Australia's metallurgical coal exports, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
India	\$m	11,106	12,953	8,515	8,481	22,377
Japan	\$m	8,507	8,823	6,918	5,307	15,138
South Korea	\$m	4,295	4,636	3,449	3,057	10,101
Netherlands	\$m	2,098	2,064	1,412	991	4,394
Taiwan	\$m	2,264	2,992	2,266	1,490	4,249
China	\$m	9,811	11,395	11,116	1,867	0
Total	\$m	44,262	50,278	38,936	25,943	72,402

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, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
Singapore	\$m	1,375	2,242	1,546	1,858	1,620
Thailand	\$m	810	800	384	100	695
South Korea	\$m	421	346	156	102	234
China	\$m	1,532	747	865	689	197
Indonesia	\$m	738	1,161	1,174	181	169
Malaysia	\$m	686	1,890	1,152	736	50
Total	\$m	8,149	10,452	10,243	8,318	15,031

Note: Department of Industry, Science and Resources estimates based on International Trade Centre data.

Source: ABS (2022) International Trade in Goods and Services, 5368.0; International Trade Centre (2022) International Trade Statistics

Table 16.4: Principal markets for Australia's LNG exports, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
Japan	\$m	16,996	24,438	22,658	13,033	28,886
China	\$m	11,197	20,142	18,506	12,729	18,269
South Korea	\$m	4,319	6,115	5,868	3,740	13,014
Taiwan	\$m	875	2,700	2,948	2,503	8,587
Singapore	\$m	1,330	1,425	1,182	971	2,603
Malaysia	\$m	426	1,005	1,655	558	720
Total	\$m	36,197	57,295	54,035	34,099	75,598

Note: Department of Industry, Science and Resources estimates based on International Trade Centre data.

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, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
China	\$m	58,697	73,126	96,402	139,655	116,118
Japan	\$m	6,244	6,633	8,002	10,160	10,992
South Korea	\$m	4,224	5,377	7,074	10,107	8,884
Taiwan	\$m	1,446	2,037	2,133	3,435	2,992
Indonesia	\$m	52	50	31	45	41
India	\$m	351	273	23	11	37
Total	\$m	71,900	89,356	116,952	171,156	142,028

Source: ABS (2022) International Trade in Goods and Services, 5368.0

Table 16.6: Principal markets for Australia's aluminium exports, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
Japan	\$m	1,609	1,520	1,155	1,070	1,613
South Korea	\$m	988	884	1,294	1,013	1,103
Taiwan	\$m	383	338	409	466	662
United States	\$m	217	969	280	287	638
Thailand	\$m	438	452	329	390	558
Indonesia	\$m	214	138	109	124	175
Total	\$m	4,700	4,800	4,198	4,210	6,118

Source: ABS (2022) International Trade in Goods and Services, 5368.0

Table 16.7: Principal markets for Australia's copper exports, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
China	\$m	4,412	4,155	4,306	3,074	2,106
South Korea	\$m	340	787	740	1,471	1,547
Malaysia	\$m	1,019	1,430	937	951	1,030
India	\$m	981	512	526	701	1,008
Japan	\$m	1,786	2,112	2,417	19	19
Philippines	\$m	196	705	410	0	0
Total	\$m	9,897	11,257	11,607	12,800	13,032

Source: ABS (2022) International Trade in Goods and Services, 5368.0

Table 16.8: Principal markets for Australia's gold exports, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
China	\$m	3,441	5,844	936	2,269	8,762
Hong Kong	\$m	9,421	5,036	3,798	1,578	5,241
India	\$m	857	666	75	1,649	2,065
Switzerland	\$m	1,282	1,338	2,159	2,113	2,012
Singapore	\$m	1,355	1,831	1,618	3,282	1,721
United States	\$m	86	147	3,501	4,405	1,480
Total	\$m	22,595	21,738	27,736	29,207	24,853

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