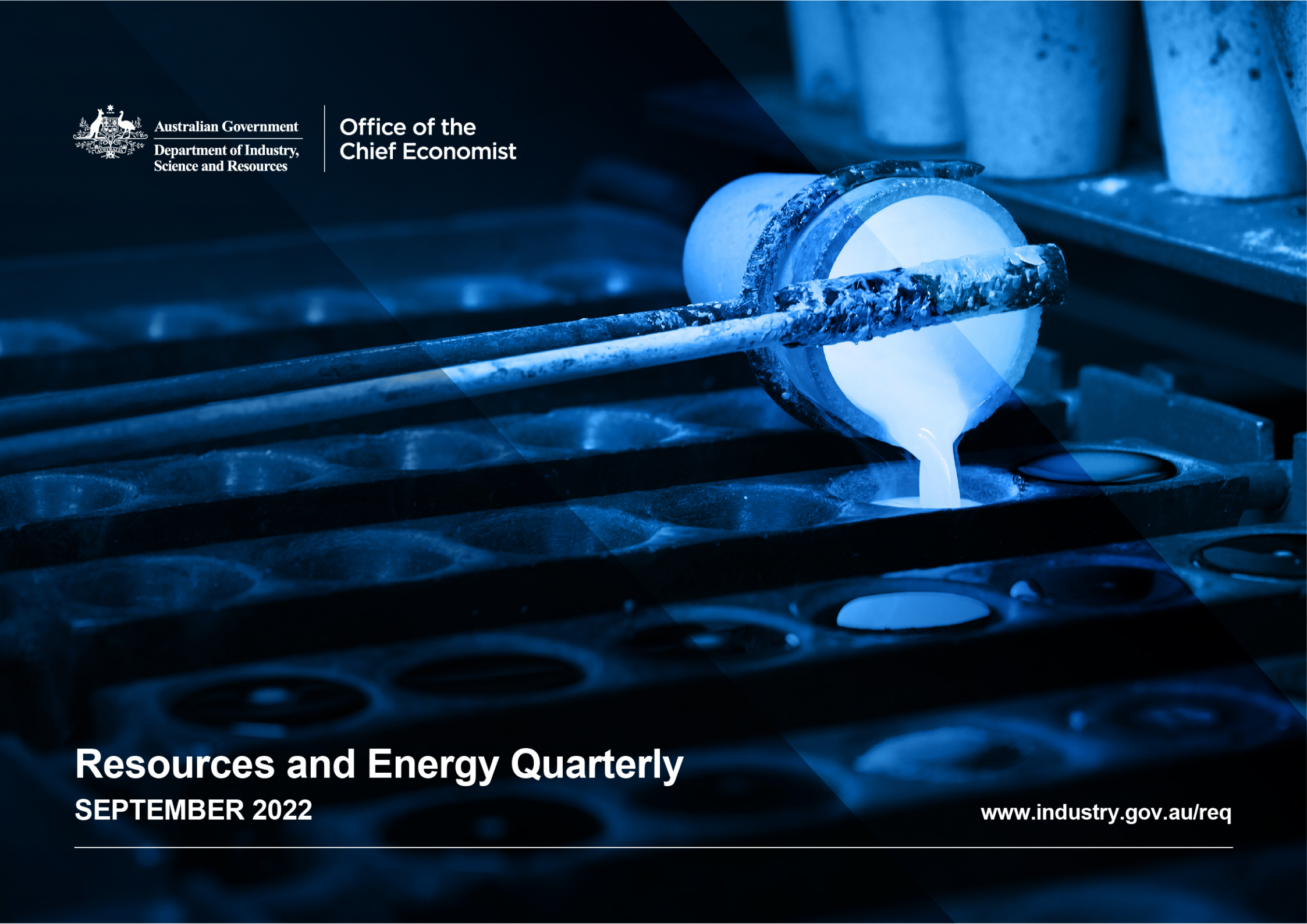

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Department of Industry, Science and Resources

Office of the Chief Economist

Resources and Energy Quarterly

SEPTEMBER 2022

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Further information

For more information on data or government initiatives please access the report from the Department's website at: www.industry.gov.au/oce

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Contents

Resources insights

Foreword

Australia's resource and energy export earnings are forecast to reach $450 billion in 2022–23, surpassing last year's record of $422 billion. Earnings are then forecast to fall to $375 billion in 2023–24 (still the third highest ever), as world supply responds to high prices amidst a soft demand backdrop.

Driving the current surge in resource and energy export earnings is a spike in energy prices and Australian dollar weakness against the US dollar. Energy prices are elevated largely because of a looming drop in exports of gas, coal and oil by Russia, one of the world's largest energy exporters. Gas, LNG and thermal coal prices are at record levels, as Northern Hemisphere nations try to build stockpiles ahead of winter. Drought in large parts of Western Europe, the United States and southern China has exacerbated energy shortages. High energy prices have caused the curtailment of energy-intensive metal smelting/refining, 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).

Since the June 2022 *Resources and Energy Quarterly*, metallurgical coal prices have declined sharply, but the price of thermal coal and other energy commodities prices have remained extremely high. 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 have shrunk noticeably: transport and infrastructure constraints will likely prevent a full diversion of some of these energy commodities from the West to nations such as China and India. 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. High prices are likely to accelerate the push towards the adoption of low emission technologies.

Despite easing LNG export volumes, earnings from LNG are forecast to be $90 billion in 2022–23. Meanwhile, thermal and metallurgical coal should both earn over $57 billion. LNG and coal earnings are forecast to be two to three times higher than in 2020–21, when the COVID-19 pandemic saw energy prices dip sharply. Earnings from these commodities are likely to fall back towards pre-COVID-19 levels after 2023–24, as supply improves.

Australia is well placed in the global push towards low emission technologies: exports of metals used intensively in low emission technologies (namely copper, nickel and lithium) are expected to generate $33 billion in export earnings in 2022–23, over double what they earned in 2020–21.

Since our last report, the Chinese Government has taken further action to support China's economic growth. The economy has been impacted by COVID-19 lockdowns in some major cities, stresses in the property market and drought. The consensus amongst analysts is that China will not reach the Government's 2022 growth target of 5.5%. Further measures to boost growth may occur ahead of the Chinese Communist Party's 20th National Congress in mid-October.

The IMF forecasts world GDP growth of 3.2% in 2022 and 2.9% in 2023, with China forecast to grow by 3.3% in 2022, rising to 4.6% in 2023. It is possible that inflation is peaking in most major economies; if inflation rates fall back towards target levels, monetary action may taper over 2023.

The La Niña weather pattern has returned, and this is likely to combine with a strongly negative Indian Ocean Dipole to result in wetter-than-normal conditions in eastern Australia over spring/summer. With Northern Hemisphere nations trying to build energy inventories, disruptions to Australian coal supply (due to possible flooding) will boost prices.

The risks to the forecast for Australia's export earnings in 2022–23 and 2023–24 are skewed modestly to the downside. Markets appear to have priced in the loss of some Russian resource and energy commodity output from world supply. Should world supply hold up better than expected and/or demand prove weaker than expected, our exports could suffer. New outbreaks of vaccine-resistant COVID-19 strains also pose risks to the outlook. Especially so if they occur in China, where small outbreaks are currently being met with aggressive suppression measures.

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 23 September 2022.

Resources and Energy Quarterly publication schedule

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

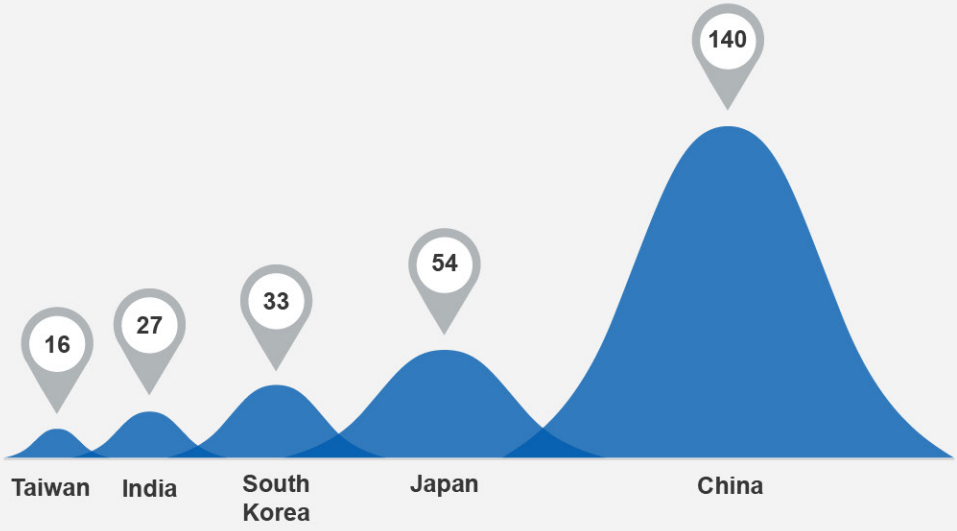
Source: Department of Industry, Science and Resources (2022)

Overview

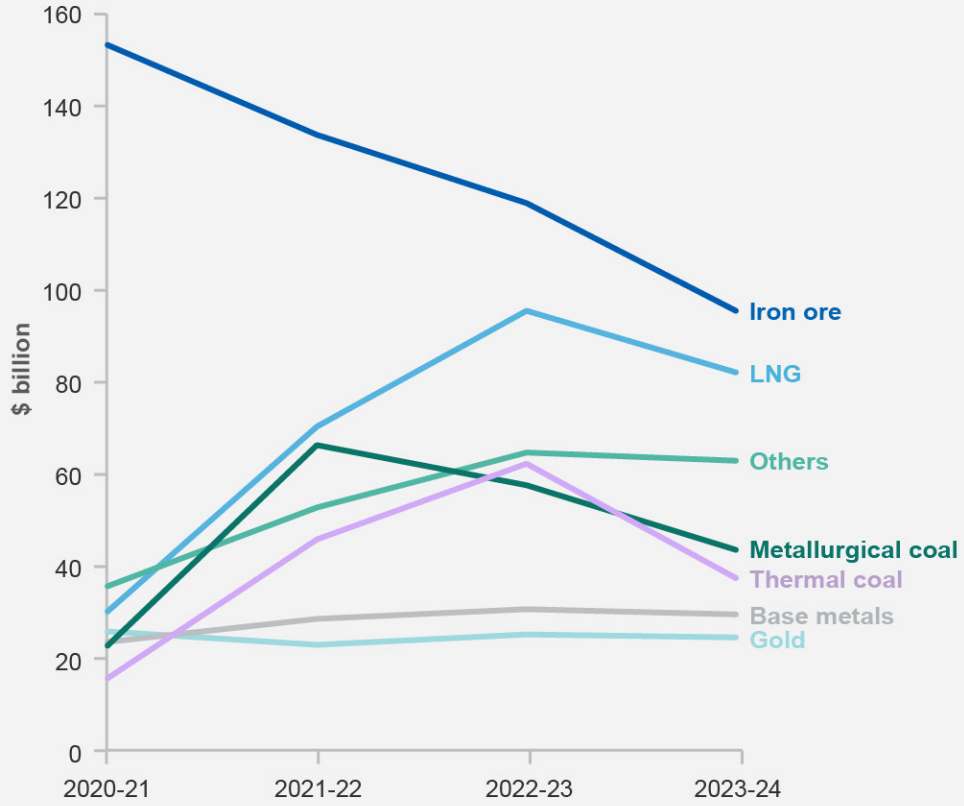
Australia's mining sector

- Contributes to around **10% of GDP**
- Over **two-thirds** of Australia's total goods and services exports
- Directly employs **more than a quarter of a million** people

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



Australia's resources and energy exports



1.1 Summary

- Energy prices remain elevated, as the fallout from the Russian invasion of Ukraine exacerbates existing energy shortages. Energy prices (other than gas) will likely fall back in 2023 and 2024, as gains in world supply combine with soft demand.
- High energy prices and a weak Australian dollar against the US dollar are driving a surge in export earnings. After a record $422 billion in 2021–22, resource and energy export earnings are expected to increase to $450 billion in 2022–23, before falling back to $375 billion in 2023–24.
- Metals central to the global energy transition (copper, nickel, lithium) are set to earn $33 billion in 2022–23, double what they earned in 2020–21.

1.2 Export values

Australia's export values are forecast at $450 billion in 2022–23

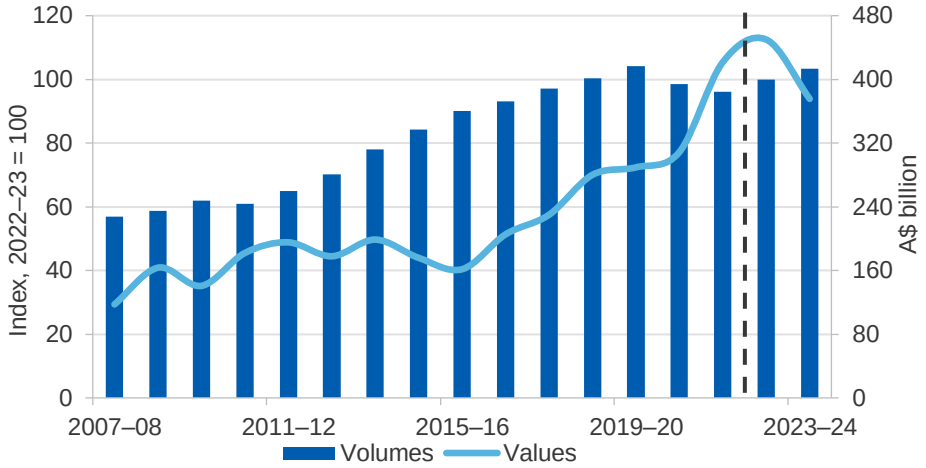
In the September quarter 2022, the Office of the Chief Economist's (OCE) Resources and Energy Export Values Index rose 25% from the September quarter 2021; a tiny rise in volumes added to a 24% gain in prices.

After a record $422 billion in resource and energy exports in 2021–22, this financial year is likely to be even stronger, at $450 billion (Figure 1.1). Exports are forecast to fall to $375 billion in 2023–24, as the loss of some Russian fossil fuels and base metals from world markets is filled by other suppliers, cutting prices. Price, rather than volume-changes are forecast to (continue to) drive most of the move in future earnings (Figure 1.2).

Energy shortages and the lower exchange rate are boosting earnings

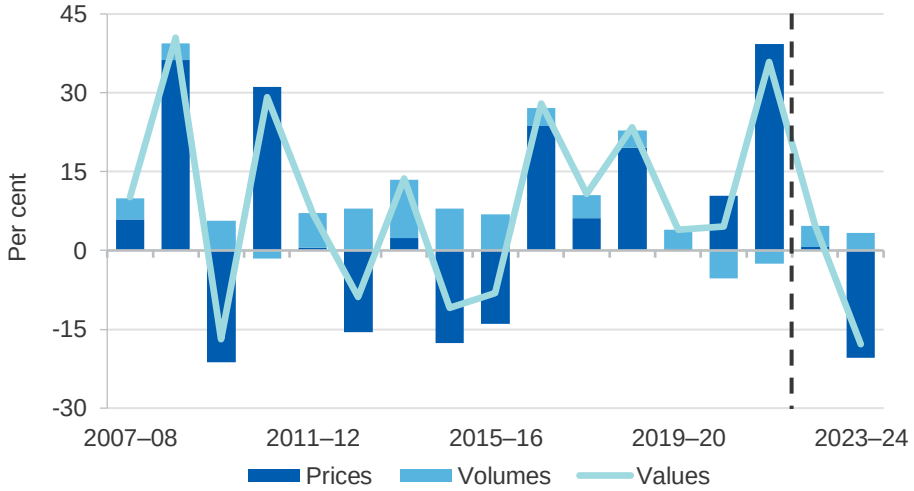
In Australian dollar terms, the OCE's Resources and Energy Commodity Price Index fell by 9% (preliminary estimate) in the September quarter 2022, but was up 19% on a year ago. In US dollar terms, the index fell by 12% in the quarter, but was 12% higher than a year ago. The index of prices for resource commodity exports (Australian dollar terms) fell by 24% in the year to the September quarter 2022. Energy commodity prices rose by 91% (Figure 1.3) from the September quarter 2021, as the looming loss of some Russian supply intensified existing market shortages.

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



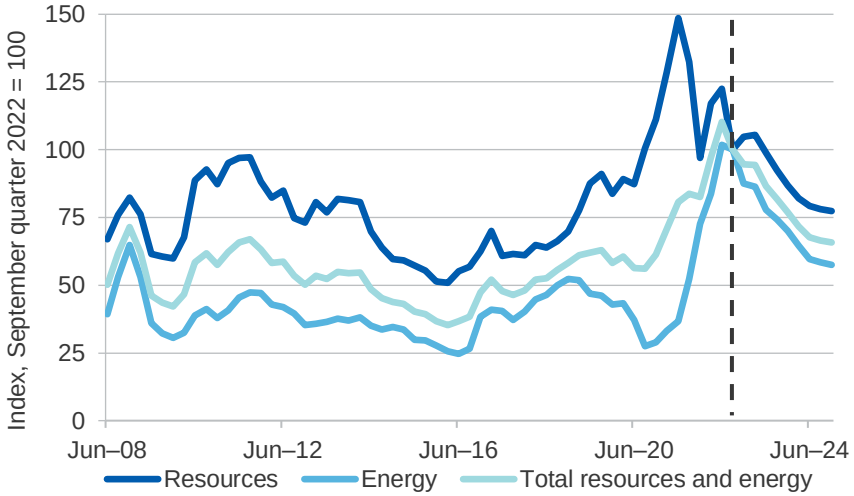
Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022)

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



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

Figure 1.3: Resource and energy export prices, AUD terms



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

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

1.3 Macroeconomic, policy, trade and other factors

Growth in world economic activity has slowed considerably in recent months. A multitude of factors have hurt growth: the ongoing fallout from Russia's invasion of Ukraine and new COVID outbreaks have damaged confidence and pushed food/energy prices higher, and macroeconomic policy has become much less stimulatory in the major economies.

China's economy is being badly affected by COVID-19 lockdowns, a weakening property market, and drought conditions in southern China. As a result, officials have increased policy support, resulting in an easing of financial conditions — in contrast to most of the rest of the world. In mid-August, China's central bank cut the policy rate by 10 basis points to try to support economic activity. Further measures to support growth are likely ahead of the Chinese Communist Party's 20th National Congress in mid October. These would help support resource/energy commodity prices.

A severe drought in Europe has exacerbated the adverse impact of high energy prices on European economic growth. Numerous metal refineries and smelters have ceased operating because of high power prices, adding to market shortages. Very low water levels on key European rivers have inhibited hydro and French nuclear power generation, and made it difficult to transport diesel, coal and other commodities about the continent.

Since the June 2022 REQ, the US Federal Reserve has continued to raise official interest rates, in an effort to contain US inflation. With US growth slowing, and inflation likely peaking in H2 2022, bond markets now suggest the bulk of the US Federal Reserve's tightening is likely done.

In July, the IMF (further) lowered its forecast of world economic growth in 2022 and 2023. The IMF forecasts world GDP growth of 3.2% in 2022 and 2.9% in 2023, with Chinese growth of 3.3% in 2022 and 4.6% in 2023.

As the Northern Hemisphere winter looms, some nations are scrambling to fill the supply gap for energy (for heating) left by bans on Russian energy exports. Thermal coal usage is likely to lift in Western nations unable to procure the necessary LNG/gas. Producers of metallurgical coal are likely to continue to divert some supply to thermal coal users if the current price spread persists. Global resource and energy commodity trade is re-organising, as Western sanctions imposed on Russia ramp up further. China and India are taking heavily discounted cargoes shunned by the West. As a result, China and India are now buying fewer cargoes of non-Russian energy commodities. If adopted, a plan to cap the price of Russian oil exports should lower world oil prices: an effective cap would diminish the likelihood of some Russian oil production being stranded. Russian coal exports will likely fall, keeping coal prices higher than they would otherwise have been. Stronger US LNG exports over the next few years will only partly compensate for lost Russian gas/LNG exports.

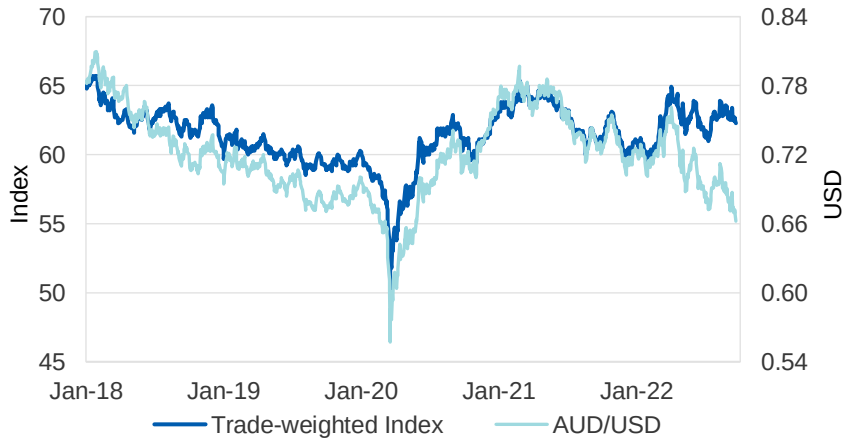
Over the forecast period, Australian coal and LNG exports should achieve relatively high prices, as the stranding of some Russian coal and gas production sees global energy shortages persist. Against a tepid demand backdrop, as global coal and gas/LNG supply lifts, price falls are forecast.

The transition to low emission technologies will add significantly to the demand for non-ferrous exports over the outlook period. Notably, lithium exports are now forecast to rise by over 180% to $13.8 billion in 2022–23 but then drop to $12.9 billion in 2023–24, as prices ease. Lithium exports in 2021–22 were almost $5 billion, up from $1.1 billion in 2020–21.

EV and EV battery manufacturing is currently dominated by China (see Figure 15.8 Lithium chapter). With many nations looking to reduce their reliance on Chinese (and Russian) supply chains, Australia's resource exports are likely to become more diversified over the long term.

Resource and energy export earnings are forecast to reach $450 billion in 2022–23. The weak AUD/USD (actual and forecast) will play a significant part in this surge. With commodity prices set in US dollars, Australia is set to benefit noticeably from the surge in the US dollar since March (Figure 1.4). Earnings are forecast to fall back to $375 billion in 2023–24 — still the 3rd highest ever. Higher global interest rates — in response to high inflation — pose a downside risk to global economic activity and hence to mineral exports. Heightened geopolitical tensions also pose a threat to growth. US mid-term elections in November will add to uncertainty in financial markets.

Figure 1.4: Australian dollar, TWI vs AUD/USD



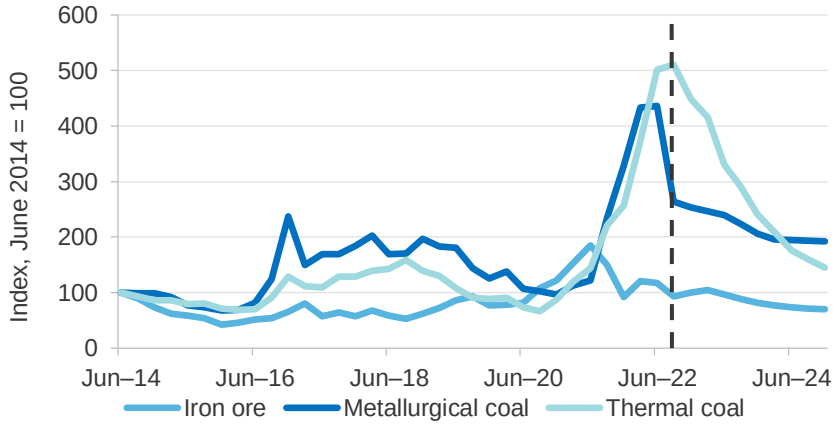
Source: Reserve Bank of Australia (2022)

1.4 Prices

Since the June 2022 *Resources and Energy Quarterly*, the iron ore price has edged lower, but remains well above the November 2021 cycle low. Weak Chinese demand has added to the impact of improved supply in major exporting nations (Figure 1.5). Prices are likely to ease further over the outlook period, as world supply gains faster than demand.

Australian thermal coal prices remain extremely high. European nations are scrambling to build stockpiles ahead of the Northern Hemisphere winter, as sanctions on Russian exports take effect. Some Russian coal production will likely be stranded from export markets. Bad weather in Australia and COVID-19 workforce impacts threaten global supply (Figure 1.5). Prices are expected to ease over the outlook period, as trade flows re-organise and export supply lifts. Metallurgical coal prices have declined as steel markets weaken; some producers are diverting some of their production to thermal coal markets, which should keep metallurgical coal prices higher than they might otherwise have been. Prices are likely to drift down but average relatively high levels over the next year, as more Russian supply becomes stranded.

Figure 1.5: Bulk commodity prices



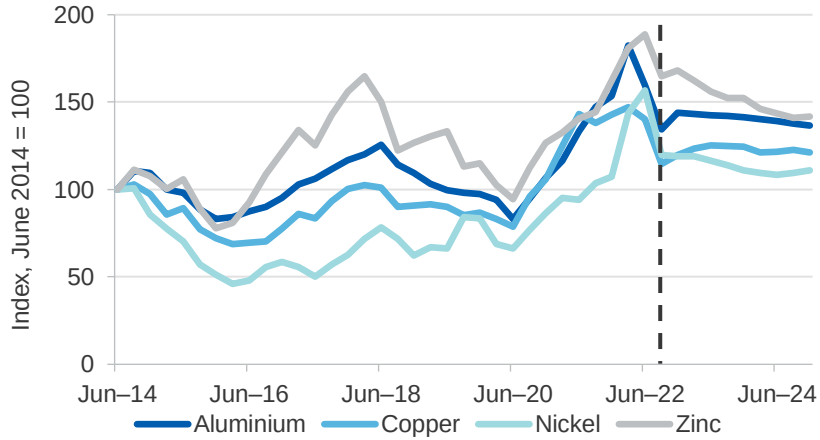
Notes: Prices are in US dollars, and are the international benchmark prices

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

Oil prices recently surged to their highest level in a decade, as the market reacts to looming sanctions on exports of Russian oil/oil products by the EU. OPEC+ has lifted supply modestly, but most of the group's members have limited scope to raise supply noticeably. The oil price is likely to weaken, as a reorganisation of global supply combines with a slowing global demand. Contract LNG prices are forecast to ease from high levels, as oil prices drift down. Spot LNG is likely to be very high for some time, as the world struggles to replace reduced Russian gas/LNG exports.

The price of gold has fallen to under US$1,700 an ounce, hurt by US dollar strength and rising bond yields. As geopolitical tensions flare, safe haven demand appears to have prevented sharper falls. The price is likely to fall modestly in the next two years, as the withdrawal of widespread central bank stimulus supports real bond yields. Base metal prices have stopped falling, helped by the prospect of stronger demand from China and the likely loss of some Russian supply (especially nickel and aluminium) from world markets (Figure 1.6). Inventories generally remain low. Prices should be flat to modestly weaker over the outlook period, as supply slowly catches up with demand and stockpiles stop falling.

Figure 1.6: Base metal prices



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

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

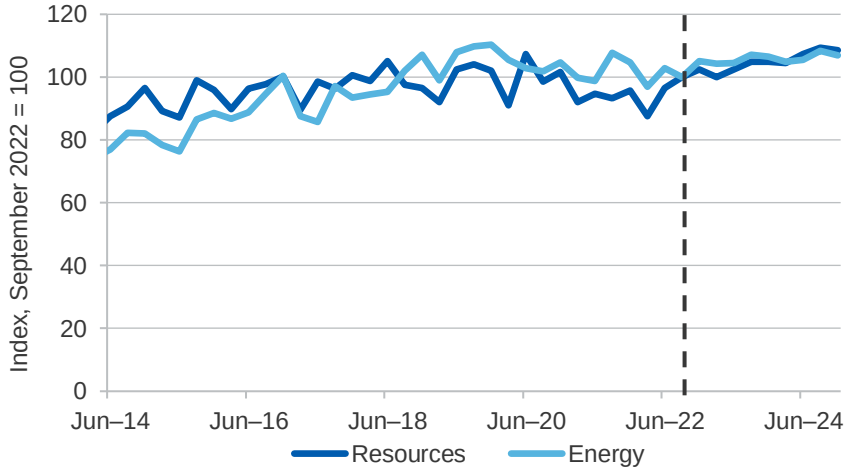
1.5 Export volumes

September quarter export volumes rose, driven by resource exports

The OCE's Resources and Energy Export Volumes Index (preliminary estimate) was unchanged in the September quarter 2022 from the June quarter, and was 1% lower than a year before. Within this total, resource commodity volumes rose by 7% in the year to the September quarter 2022, while energy commodity volumes fell 7% (Figure 1.7). Energy exports were impacted by production problems: operational, weather and COVID-19 related workforce issues were central to these problems.

In volume terms, resource exports are likely to show further significant growth over the outlook period. GDP and industrial production will grow modestly, increasing the demand for Australia's ferrous and non-ferrous metals. The increased production of EVs and low emission technologies will see growing demand for metals such as copper, aluminium, lithium and nickel. The volume of energy exports is forecast to show similar growth, but surging prices will cause some demand destruction.

Figure 1.7: Resource and energy export volumes



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

1.6 Contribution to growth and investment

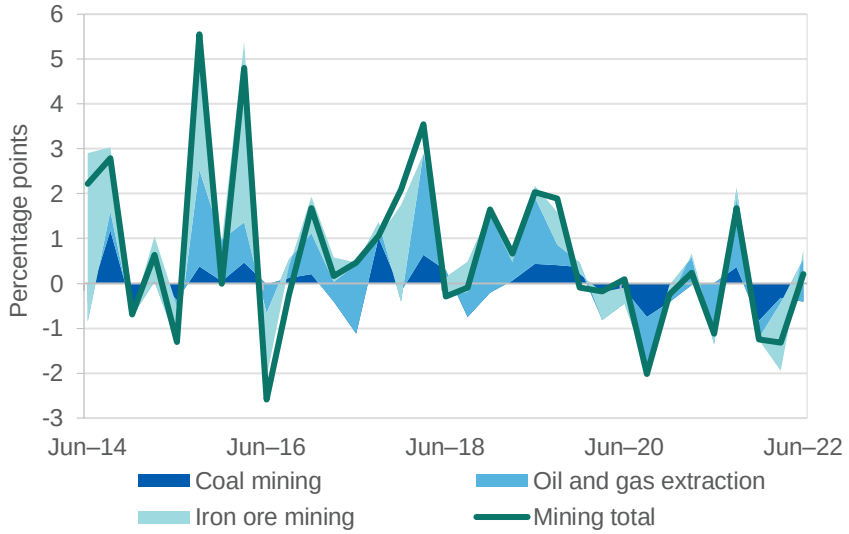
Mining industry contracted while the overall economy expanded

Australia's real Gross Domestic Product rose by 0.9% in the June quarter 2022, and was up 3.6% over the year since the June quarter 2021.

Mining value-added fell by 0.2% in the June quarter, and was down 0.7% over the previous twelve months (Figure 1.8). COVID-19-related labour shortages impacted most sectors to some extent, and coal mining was also impacted by flooding.

In the coming two years, it is likely that the resource and energy sectors will make a significant contribution to real GDP growth. 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 because of high energy prices, allowing Australian producers to pick up market share.

Figure 1.8: Contribution to quarterly growth, by sector

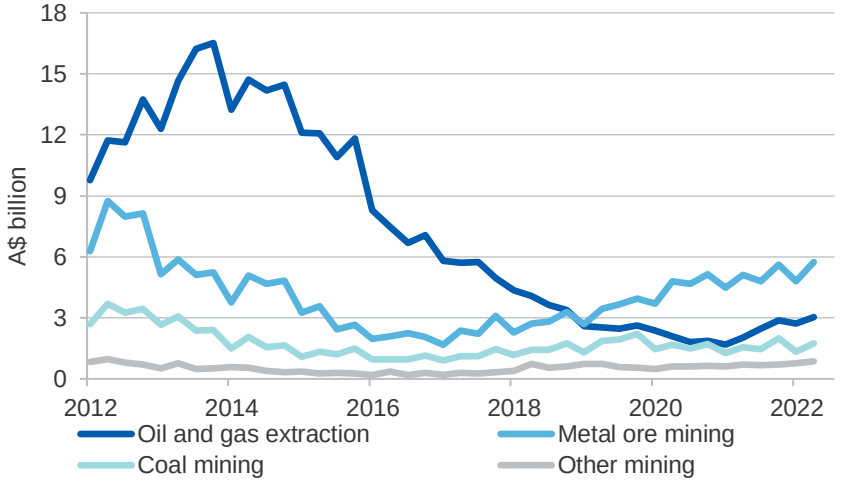


Source: ABS (2022) Australian National Accounts, 5206.0

Mining investment is picking up

The ABS Private New Capital Expenditure and Expected Expenditure survey for the June quarter 2022 shows that Australia's mining industry invested $11.4 billion in the quarter. This was up 21% from the June quarter 2021. In quarterly terms, investment by the metal ore sector increased despite a slight softening in iron ore prices. Investment among energy commodity sectors also increased (Figure 1.9).

Figure 1.9: Mining capex by commodity, not seasonally adjusted

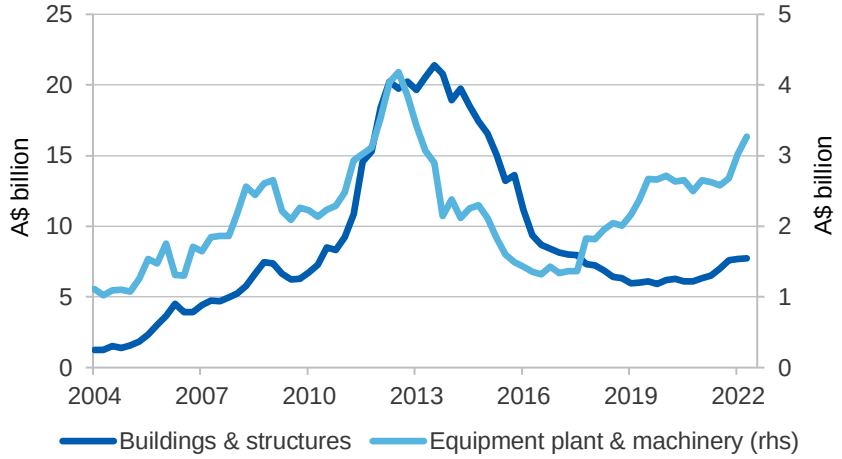


Notes: Other mining includes non-metallic mineral mining and quarrying and exploration and other mining support services; chart data is in nominal, original terms

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

In the June quarter 2022, expenditure on equipment plant and machinery lifted strongly, while expenditure on buildings and structures levelled out (Figure 1.10). Spending in both categories has risen in recent quarters, and forward expectations suggest that investment in 2021–22 and 2022–23 will be slightly higher than in 2020–21 (Figure 1.11). 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.

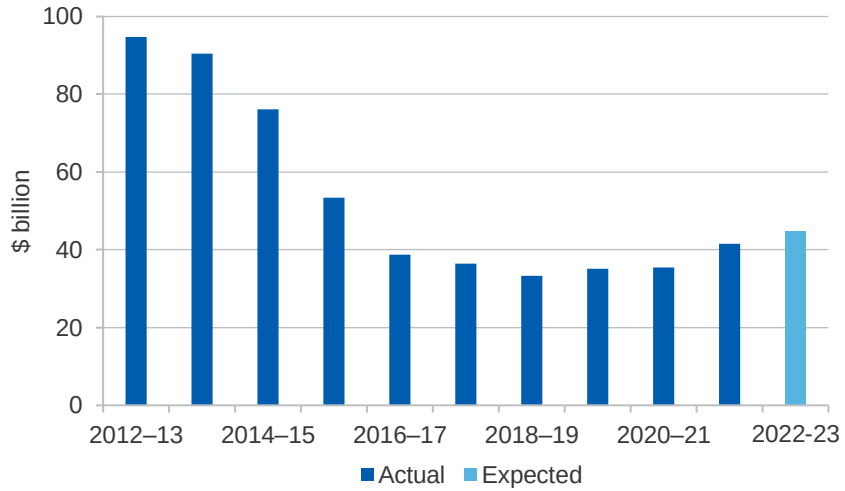
Figure 1.10: Mining industry capital expenditure by type, quarterly



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

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

Figure 1.11: Mining industry capital expenditure, fiscal year

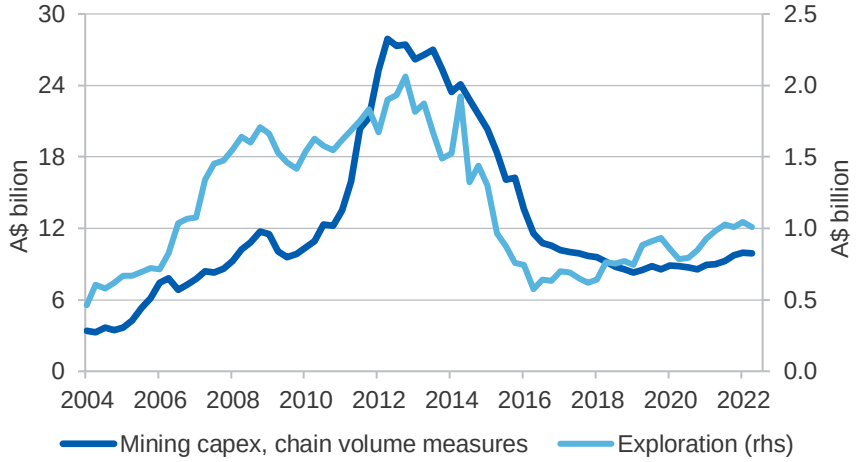


Notes: Chart data is in nominal terms

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

Exploration expenditure (adjusted for inflation) edged down to $1.0 billion in the June quarter. However, this is still significantly higher than the recent low of $783 million in the June quarter 2020. The positive trend is consistent with growth in capital expenditure since 2018–19 (Figure 1.12). The strength appears to reflect a strong long term outlook for minerals, especially for those used in low emission technologies.

Figure 1.12: 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

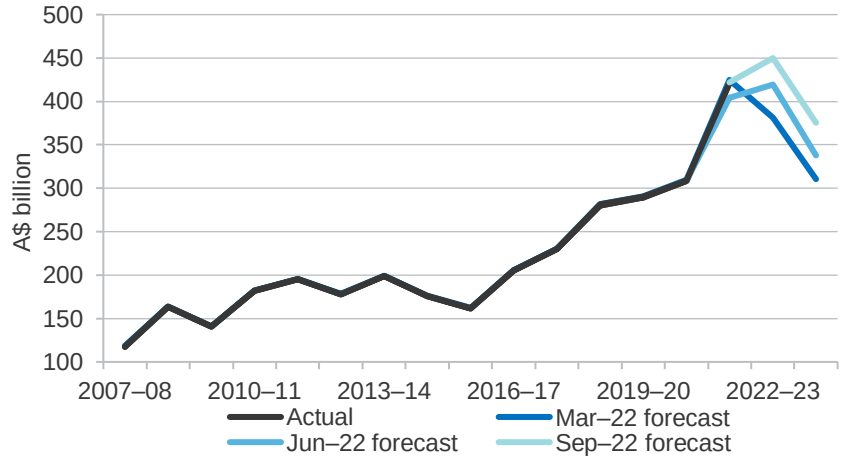
At $450 billion, the estimate for Australia's resources and energy exports in 2022–23 is $31 billion higher than the forecast contained in the June quarter 2022 *Resources and Energy Quarterly*. The forecast for 2023–24 is up by $38 billion from the June 2022 REQ (Figure 1.13).

The surge in energy 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 become stranded from world markets.

LNG earnings in 2022–23 and 2023–24 have been revised up by $6 billion and $13 billion, respectively. The revisions reflect the impact of forecast higher LNG prices. Gas/LNG shortages are causing some nations to seek thermal coal to generate power for heating for the forthcoming winter. Thermal coal earnings in 2022–23 and 2023–24 have been revised up by $18 and $7 billion, respectively.

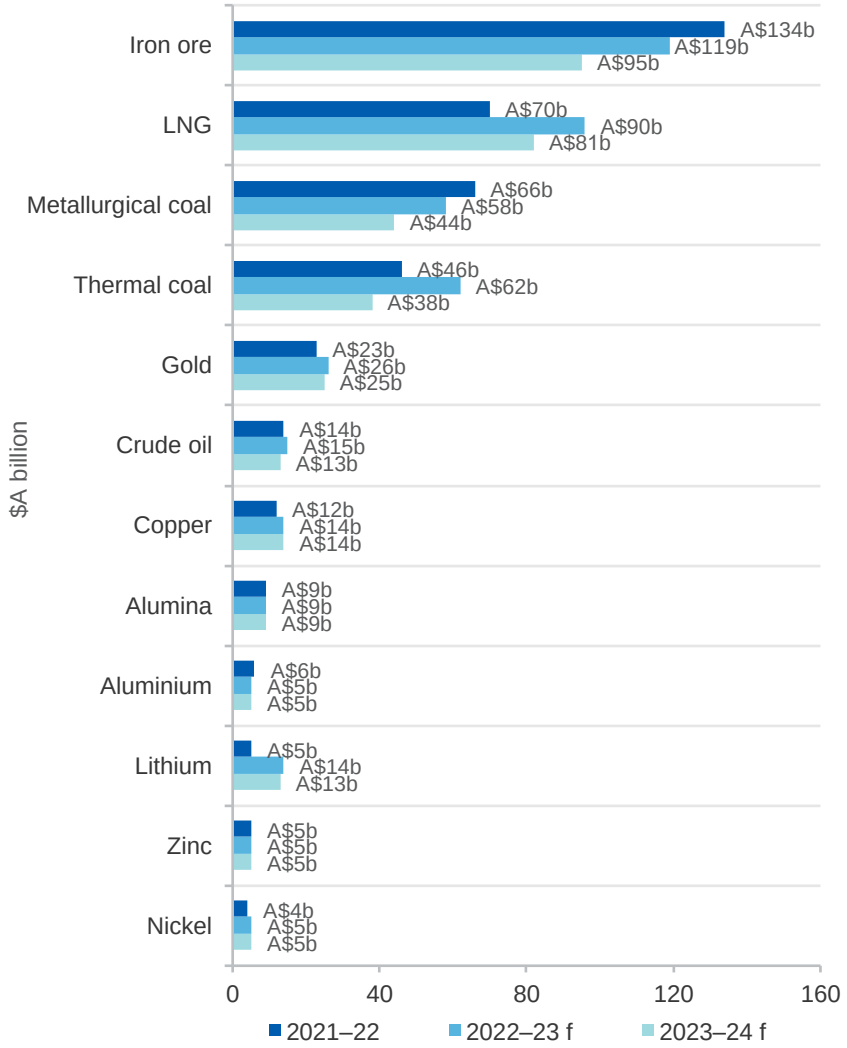
Iron ore earnings in 2023–24 have been revised up by $10 billion. The revisions reflect the weaker AUD/USD and higher costs in iron ore mining. Chinese iron ore demand is likely to strengthen as Beijing looks to support the weak residential property sector.

Figure 1.13: 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
Iron ore	3	-14	-11	4	-23	-20
LNG	-4	41	27	1	-15	-10
Metallurgical coal	7	-19	-13	3	-27	-24
Thermal coal	0	36	36	3	-41	-39
Gold	36	-19	10	5	-8	-3
Crude oil	-8	16	7	6	-15	-11
Copper	14	-3	10	7	-4	2
Alumina	3	-2	0	1	0	1
Aluminium	6	-13	-8	0	-5	-6
Lithium	15	145	182	21	-23	-7
Zinc	15	1	17	4	-14	-10
Nickel	24	-8	15	4	-12	-9

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

					Percentage change			
Exports (A$m)	**2020–21**	**2021–22**	**2022–23[f]**	**2023–24[f]**	**2020–21**	**2021–22**	**2022–23[f]**	**2023–24[f]**
Resources and energy	308,589	421,563	449,963	375,486	6.6	36.6	6.7	–16.6
– real[b]	344,850	451,046	449,963	360,274	4.9	30.8	–0.2	–19.9
Energy	81,229	202,527	231,078	181,150	–29.7	149.3	14.1	–21.6
– real[b]	90,774	216,691	231,078	173,811	–30.8	138.7	6.6	–24.8
Resources	227,360	219,037	218,885	194,336	30.7	–3.7	–0.1	–11.2
– real[b]	254,076	234,355	218,885	186,463	28.6	–7.8	–6.6	–14.8

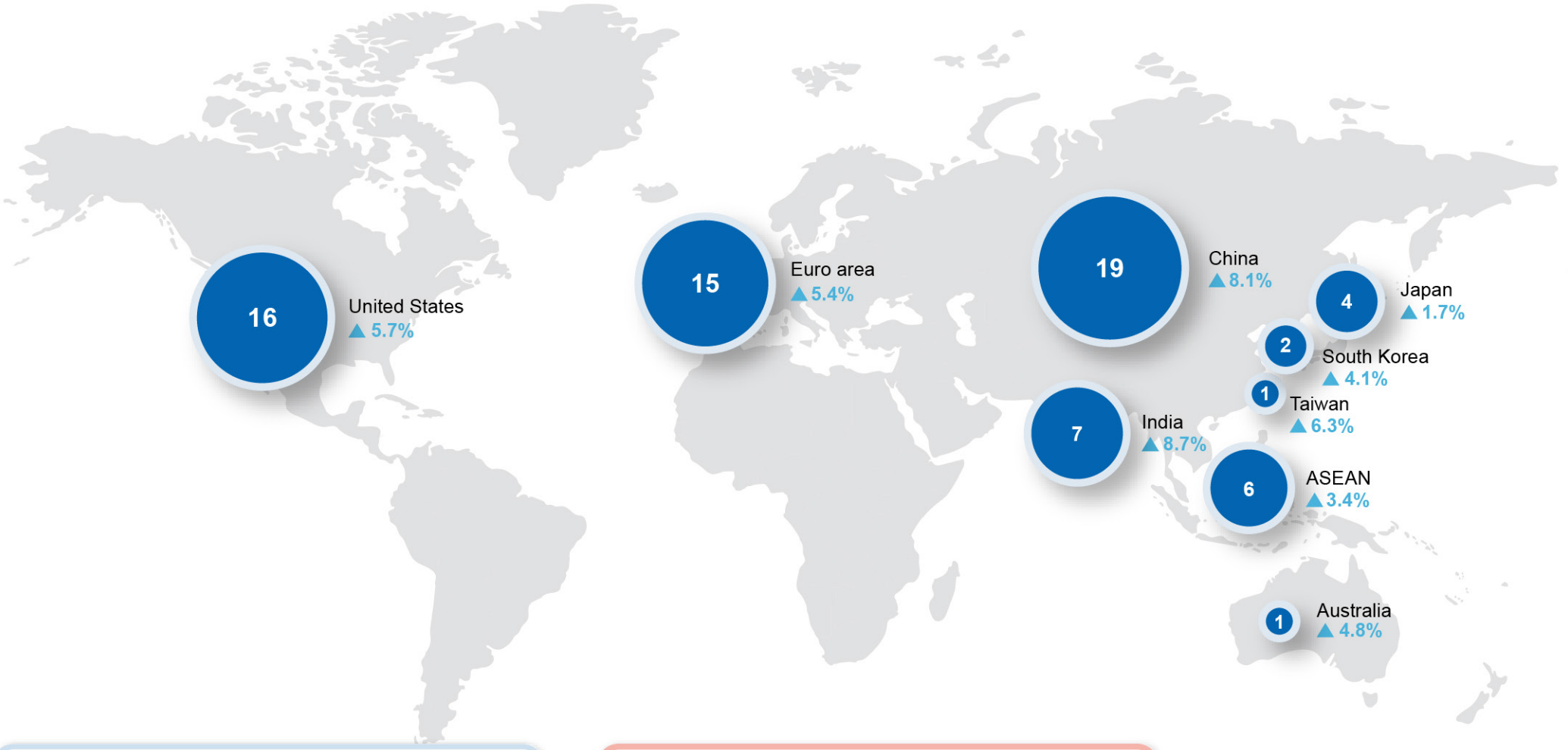
Notes: **b** In 2022–23 Australian dollars; **f** forecast.
Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022)

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

		Prices				Export volumes			Export values, A$b		
	Unit	**2021–22**	**2022–23[f]**	**2023–24[f]**	**Unit**	**2021–22**	**2022–23[f]**	**2023–24[f]**	**2021–22**	**2022–23[f]**	**2023–24[f]**
Iron ore	US$/t	119	97	79	Mt	875	903	937	134	119	95
LNG	A$/GJ	16.0	22.6	19.2	Mt	83	80	81	70	90	81
Metallurgical coal	US$/t	404	283	231	Mt	162	174	180	66	58	44
Thermal Coal	US$/t	245	309	167	Mt	197	197	203	46	62	38
Gold	US$/oz	1,832	1,682	1,633	t	242	330	347	23	26	25
Crude oil	US$/bbl	91	99	87	kb/d	292	267	286	14	15	13
Copper	US$/t	9,645	8,199	8,352	kt	802	916	977	12	14	14
Alumina	US$/t	381	345	339	kt	17,736	18,188	18,280	9.0	9.0	9.1
Aluminium	US$/t	2,891	2,536	2,531	kt	1,369	1,449	1,443	5.7	5.3	5.0
Lithium	US$/t	1,470	3,528	2,745	kt	2,264	2,609	3,166	4.9	13.8	12.9
Zinc	US$/t	3,506	3,376	3,082	kt	1,249	1,442	1,500	4.5	5.3	4.7
Nickel	US$/t	23,594	21,900	20,438	kt	157	195	202	4.4	5.1	4.6
Uranium	US$/lb	45	54	59	t	4,933	5,840	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



In 2021, global economic activity increased by 5.8%. Growth is expected to slow to 3.2% in 2022. Spiralling energy costs and problems with COVID-19 outbreaks (particularly in China) are weighing heavily on global growth.

Risks include flow-on impacts of Russian invasion of Ukraine on energy prices and growth, the potential for new variants of the pandemic, as well as the persistence of supply chain disruptions. Tighter financial conditions in many countries, triggered by elevated inflation, also weighing heavily on markets.

● = Per cent share of global GDP

▲ = Economic growth in 2021

▼ = Economic contraction in 2021

2.1 Summary

- The global macroeconomic environment continues to weaken. Spiralling energy costs and problems with COVID-19 outbreaks (particularly in China) are weighing heavily on global growth.
- Tighter financial conditions in most major economies — triggered by elevated inflation — are heightening concerns about the global outlook.
- In July, the IMF forecast the world economy to grow by 3.2% in 2022 and 2.9% in 2023, around half the rate achieved in 2021 and a downward revision of 0.4 and 0.7 percentage points, respectively, since the previous forecast in April 2022.

2.2 World economic outlook

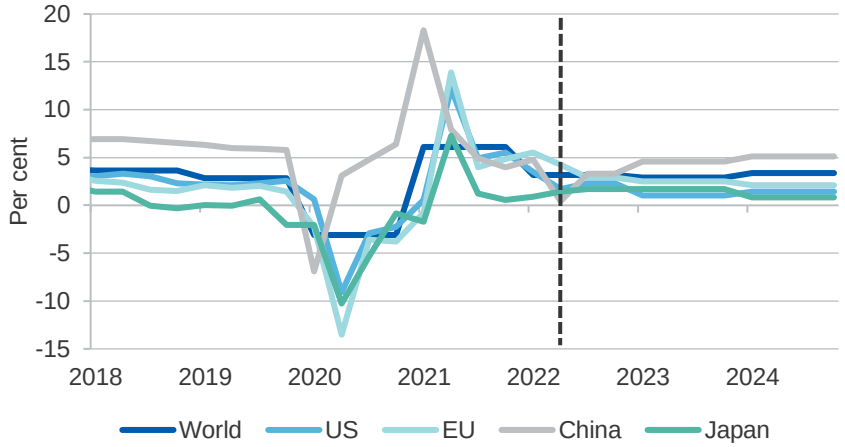
Global growth stalls in the June quarter as the outlook darkens

The International Monetary Fund (IMF) projects the world economy to grow by 3.2% in real terms in 2022 and 2.9% in 2023 (Figure 2.1). This is around half the rate of growth achieved last year and represents a downward revision of 0.4 percentage points in 2022 and 0.7 percentage points for 2023 from the April 2022 World Economic Outlook.

Global output stalled in the second quarter of this year, with GDP falling quarter-on-quarter (q/q) in China, the US and the UK, while Germany had zero growth. Downward revisions to forecast growth occurred across most economies, including substantially lower IMF growth forecasts for the US, China, the Euro Area, Japan and India (discussed below). The RBA expects growth in Australia's major trading partners to be well below its pre-pandemic average in the next two years.[1]

Policymakers in most economies currently face major challenges: they are having to manage high levels of inflation in an environment of sharply slowing (and even negative) growth. Inflation has surged, as supply problems add to a surge in energy prices due the fallout from the Russian invasion of Ukraine. The supply problems are both a remnant of the COVID-19 pandemic and a result of severe drought in Western Europe, southern China and the US.

Figure 2.1: GDP growth forecasts



Source: IMF (2022)

Downside risks are substantial. These include: Russia cutting off gas exports to Europe; inflation proving harder to reduce than expected; tighter global financial conditions inducing debt distress in emerging market and developing economies; renewed COVID-19 outbreaks and lingering problems in the Chinese property sector.

Whether the global economy experiences a hard or soft landing remains in the balance. Labour markets are extremely tight in some advanced economies, especially the US and the UK, raising nominal wage growth. But real wages have mostly fallen, eroding household purchasing power and consumer sentiment. Households in advanced economies are servicing historically high debt levels, in part by drawing down savings built up during the pandemic. How labour markets perform will be critical as business investment and household spending respond to tighter financial conditions over the coming quarters.

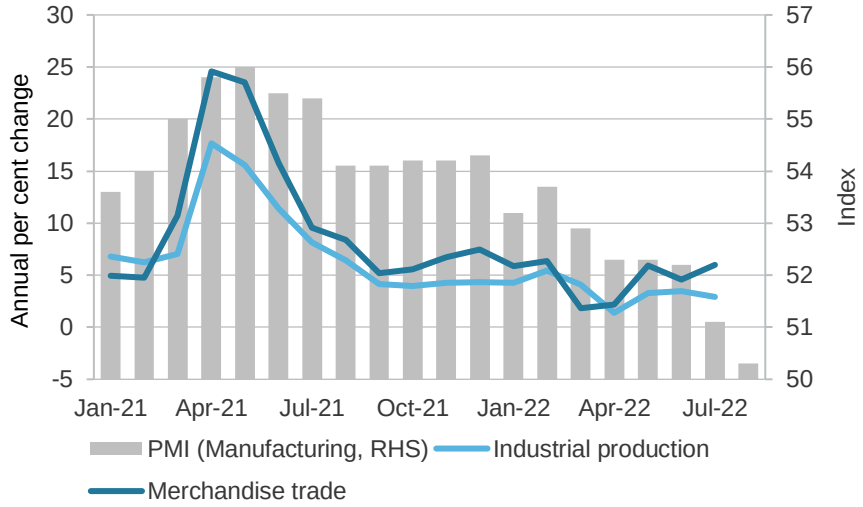
[1] *RBA Statement on Monetary Policy* – August 2022.

The IMF believes a worse scenario is plausible. In this scenario, inflation rises further, and global growth declines to about 2.6 percent and 2.0 percent in 2022 and 2023, respectively, putting growth in the bottom 10 percent of outcomes since 1970.[2]

Global industrial production and orders continue to fall

Global industrial production and trade recovered in recent months following sharp falls in March and April. Global industrial output grew by 2.9% year-on-year in July (Figure 2.2), up from 1.4% in April 2022.

Figure 2.2: World industrial production, trade and PMI



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

Global merchandise trade recovered to be up 6.0% year on year in July, up from 2.2% in April, and is forecast to grow by around 4.0% in 2022. However, the immediate trade outlook for Australia's major trading partners has weakened, with GDP growth over the 12 months to December 2022 forecast by the RBA to reach 3.3%, down from its forecast of 4.0% in May.[3]

Manufacturing orders continue to weaken. The Global Manufacturing Purchasing Managers Index (PMI) has been declining steadily since the start of the year, driven by falls in the US, Eurozone and China. The Global PMI fell from 51.1 in July 2022 to 50.3 in August 2022, the weakest since June 2020. Results for individual countries are discussed below.

Supply chain pressures ease as global demand softens

Global supply chain pressures have eased substantially over 2022. After reaching its highest levels on record in December 2021, the Global Supply Chain Pressure Index — a composite measure of cross-border transportation costs, delivery times, and order backlogs — has fallen sharply to be down over 60% in August from its end 2021 peak (Figure 2.3). The fall reflects declines in most subcomponents of the index, including reduced transit times and port delays as well as falling costs.

Easing supply chain pressures are reflected across a range of indicators. The Baltic Dry Index — a measure of the average prices paid for transporting dry bulk materials — has reached its lowest level since January 2021. US port congestion has also eased in recent months. For example, counts of vessels queuing outside the port of Los Angeles have fallen by around 75% since the start of the year, despite a pickup of traffic in recent months. However, with the commencement of peak shipping season in August, any new disruptions to key global ports, particularly in China (for example, in response to new COVID-19 outbreaks), would see a reversal of the recent improvement in delay times.

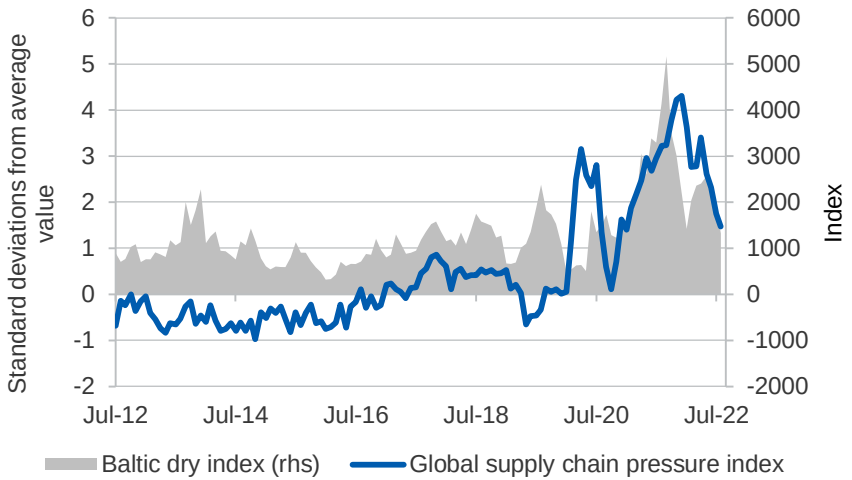
Falls in global freight rates have gathered momentum in recent months, with the average price for a 40-foot shipping container (Drewry's composite World Container Index) falling to around US$4,500 in

[2] *IMF WEO Update* – July 2022.

[3] *RBA Statement on Monetary Policy* – August 2022.

September, down more than 50% from a peak of around US$10,400 in late 2021. However, container rates remain well above historical averages, with these higher costs continuing to support elevated global goods prices.

Figure 2.3: Global supply chain pressures



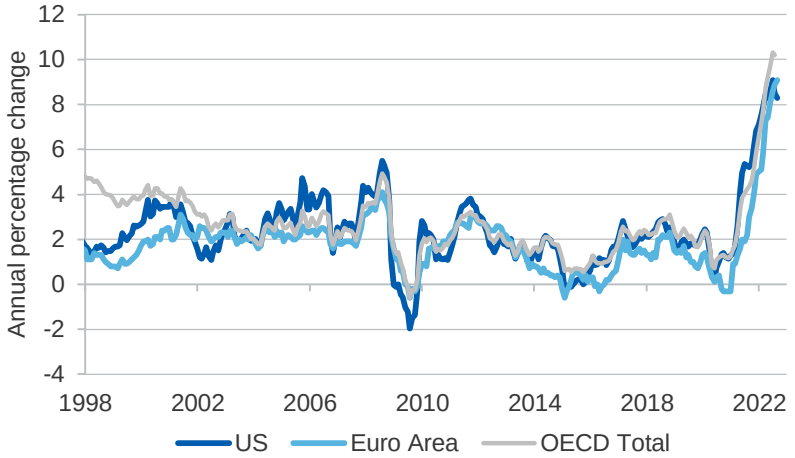
Source: Bloomberg (2022); New York Federal Reserve (2022)

Inflation persists at multi-decade highs in many economies

Elevated inflation rates remain the central concern for policy makers across most major economies. While goods inflation has begun to moderate in some economies, price growth remains high. In August, the US CPI was 8.3%, down slightly from 8.5% in July. US core inflation — which excludes food and energy — increased to 6.3%, which was above market expectations. In August, Euro area inflation reached 9.1% — the highest since the commencement of the monetary union — and the UK reached 9.9%. For the OECD as a whole, inflation was 10.2% in July (Figure 2.4).

These increases have been larger and more broadly based than expected, and have been underpinned by rising food and energy prices as well as lingering supply-demand imbalances. The IMF has revised its forecast of global inflation for 2022 to 6.6% in advanced economies and 9.5% in emerging market and developing economies — upward revisions of 0.9 and 0.8 of a percentage point, respectively.

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)

Producer Price Indices (PPIs) — which measure changes in prices received by producers — have eased in recent months, but remain at historically high levels. Driven by spiralling energy prices, Eurozone industrial producer prices increased by a record 37.9% year-on-year in July 2022, up from 36% in June. US manufacturing producer prices declined from a peak of 20.4% growth in the year to June 2022, to 14.2% in August. Chinese manufacturing producer price growth — which has been well above CPI growth over the past year — has continued its steady decline to record an 18-month low of 2.3% in the year to August, a fall of over 11 percentage points from the peak of 13.5% in October last year.

In contrast to easing goods inflation, services inflation (particularly recreational services and rents) has increased in most economies, driven

by a recovery in demand for services, faster wages growth and high costs for key inputs (food and fuel).[4]

In response, central banks in most economies have lifted policy rates and begun to reduce holdings of assets purchased under quantitative easing programs. Global financial conditions have generally tightened — due to expectations of further tightening of monetary policy — and, along with the Russia/Ukraine conflict and related sanctions, lowered investors' appetite for risk. The US Fed lifted rates at its September meeting, the fifth time this year, for a cumulative increase in its benchmark overnight interest rate of 300 points. The European Central Bank raised its deposit facility rate by 75 basis points in September following a 50 basis points increase in July, the first increase in over a decade. Most central banks have signalled further increases in policy rates, and market expectations are that rates will peak around mid-2023.

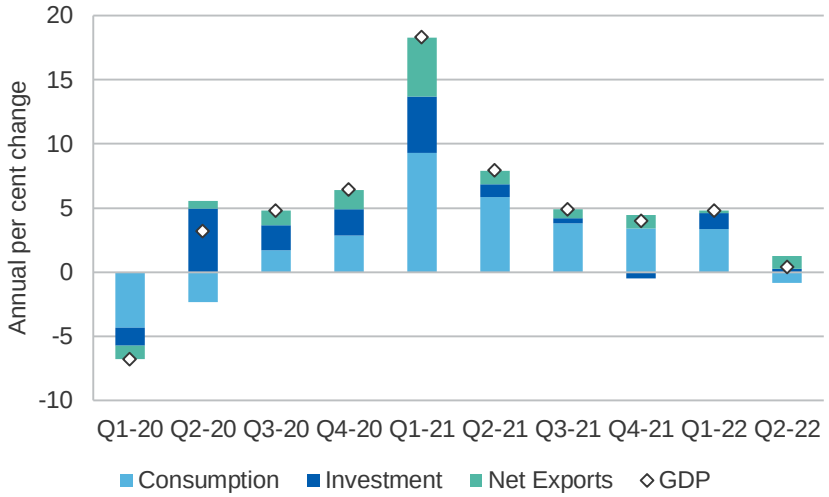
2.3 Major trading partners' economic outlook

Chinese growth falters amid COVID-19 outbreaks and property sector weakness

China's economy grew by 0.4% year-on-year in the June quarter 2022 (Figure 2.5). The weak result was driven by a fall in domestic consumption, its first negative contribution since the June quarter 2020. Investment was down sharply from its healthy contribution to growth in the March quarter. A positive contribution from net exports, driven by strong export growth, ensured year-on-year growth remained in positive territory.

The June quarter weakness was expected, due to the impact of COVID-19 suppression measures on manufacturing production and exports, as well as consumption. Economic activity in regions that were locked down or faced significant restrictions — including Jilin, Shanghai and Beijing — contracted in the June quarter. However, the easing of severe restrictions imposed in April and May has not seen the anticipated rebound in activity. Early indicators for the September quarter have been below market expectations, with retail sales increasing by only 2.7% in July year-on-year, down from 3.1% in June — around half market expectations. The extended drought and heatwaves in China's south-west regions will likely have an adverse impact on September quarter growth. The extreme conditions have led to restrictions on power usage, which has reduced industrial production in some industries.

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 woes continue to drag on growth, driving weak consumption and investment in real estate. Sentiment among households and business remains subdued, and demand for property remains weak amid concerns pre-sold apartments may not be completed, leading to mortgage boycotts. This is further straining debt-laden developers by weighing on their ability to raise funds by pre-selling yet-to-be-built apartments. Anaemic demand for credit saw new bank loans fall 37% year-on-year in July, while new household and corporate lending were down 70% and 34%, respectively. As a result, property investment was

[4] RBA *Statement on Monetary Policy August 2022*.

down 6.4% in July, following a 5.4% fall in June. In the year to July, the value of property sales was down 29%, with the new house prices falling for the 11th consecutive month in July. In volume terms (measured in square metres of floor space) newly-started residential property was down 38% in the year to August, and residential building sales were down 27%.

In August the People's Bank of China (PBoC) cut the Medium-Term Lending Facility, a key policy rate. In response, the 1-year and 5-year Loan Prime Rates fell. The 5-year Loan Prime Rate, which fell the most, is the benchmark lending rate for most mortgages. It remains to be seen how effective the strategy of increased liquidity will prove to be in spurring consumption and investment in light of the underlying structural problems faced by China's property sector. Rebuilding household and business confidence will be critical. The Chinese Government announced in August that it will also offer special loans to ensure property projects facing difficulties are delivered to buyers.

Following the lockdown-induced plunge in China's PMI in May, and subsequent recovery in June, the index again turned negative, dropping from 50.4 in July to 49.5 in August. China's industrial output increased by 3.8% year-on-year in July, below market consensus, following growth of 3.9% in June. Manufacturer survey responses suggest the slowdown was linked to muted customer demand, lingering COVID-19 impacts and power supply disruption at some firms.

However, passenger vehicle production and sales recovered strongly from the lockdowns, averaging over 2 million sales a month in June, July and August compared with fewer than a million vehicles produced (and sold) in April —at the height of the lockdowns. This pick up in vehicle production and sales is being supported by policy measures, including subsidies for the purchase of conventional and electric vehicles.

Following the stimulus measures announced in late May to support growth and put downward pressure on unemployment (discussed in the June 2022 edition of the *Resources and Energy Quarterly*), in August China's state media flagged additional fiscal stimulus. The China Securities Journal reported that local governments could utilise some of the US$229 billion of unused bond quota from previous years, to fund infrastructure investment.

China's weakening economic outlook has seen downward revisions to forecast growth, with most economists now expecting growth in 2022 well below the Government's 5.5% growth target (Bloomberg 2022). In August, the RBA Board stated it expected China's growth to be around 3.25% for 2022. In July, the IMF forecast Chinese growth of 3.3% in 2022, a hefty 1.1 percentage point downgrade — the lowest growth in more than four decades, excluding the COVID-19 crisis. As disruptions ease, the IMF forecasts China's growth will rise to 4.6% in 2023.

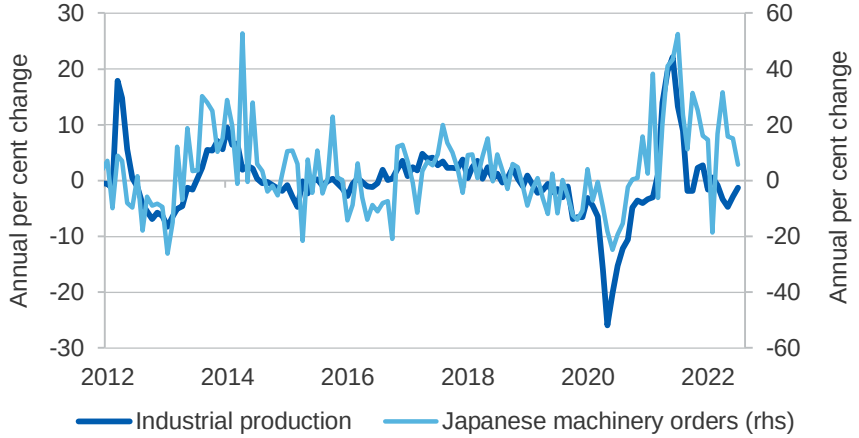
Japan's GDP back to pre-pandemic levels

Japan's slow recovery from the pandemic has continued: GDP growth was 1.6% year-on-year in the June quarter 2022, driven by private consumption — up 3.0% year-on-year. This growth, as well as a positive revision to the March quarter (from a fall to an increase in GDP), lifted the level of Japan's GDP to above its pre-pandemic level (in late 2019).

Despite these positive results, downside risks for the Japanese economy remain, due to slowing growth in Japan's major trading partners and surging numbers of COVID-19 cases in August. Japan's core inflation was 2.8% in August 2022, exceeding the inflation target of the Bank of Japan (BoJ) of 2.0% for the fifth month in a row. Ongoing 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 approximately one fifth of its value over the last year, driven by the growing interest rate differential between Japan and its trading partners.

Japan's industrial output fell by 1.2% year-on-year in July 2022, continuing the pattern of weak industrial growth over the past 12 months. Machinery orders have also weakened, with orders up 5.8% year-on-year in July 2022, down from 32% growth in April (Figure 2.6). The Jibun Bank Japanese Manufacturing PMI fell from 52.1 in July 2022 to 51.5 in August 2022. While this represented the 19th consecutive month of positive (above 50) readings, new orders fell at the sharpest rate in nearly two years, contributing to the fall in industrial output.

Figure 2.6: Japan industrial production and machinery orders



Notes: IP and machinery orders data are to July 2022.

Source: Bloomberg (2022)

In contrast to the Fed and other central banks (which are withdrawing stimulus), relatively muted inflation has allowed the BoJ to maintain its accommodative monetary policy — and the BoJ is now the only major central bank adding to its bond holdings.

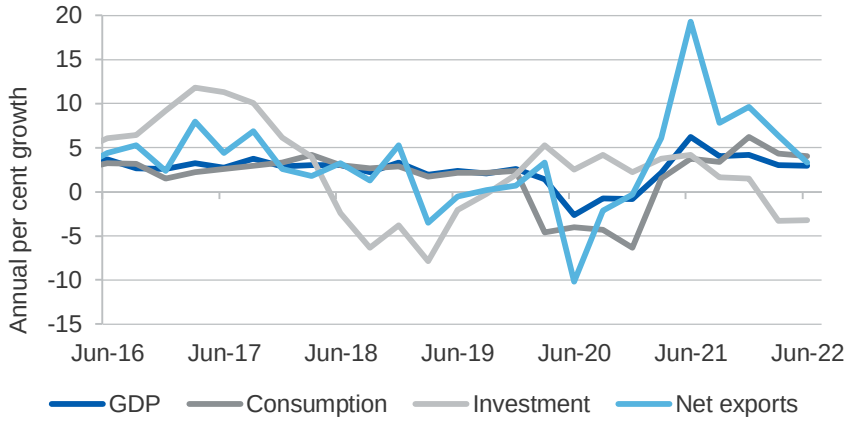
Looking ahead, the IMF July forecasts were for Japanese economic growth of 1.7% in 2022 and 2023, a downward revision of 0.7 and 0.6 percentage points, respectively, since April.

South Korea's economy steady in June quarter

South Korea's economic growth of 2.9% year-on-year in the June quarter was slightly slower than the 3% increase in the March quarter. Over this period, private and government spending contributed to growth, while private investment continued to drag on economic growth (Figure 2.7).

South Korea's industrial production slowed sharply in June, to 1.4% year-on-year down from 7.4% in May.

Figure 2.7: South Korea contributions to quarterly real GDP



Source: Bloomberg (2022)

South Korea's manufacturing PMI shifted into negative territory in July — the first negative result since September 2020 — with a reading of 49.8, down from 51.3 in June. The index fell further in August, down to 47.6 driven by sharp falls in both output and new orders. Price and supply pressures eased in August due to the weaker demand conditions.

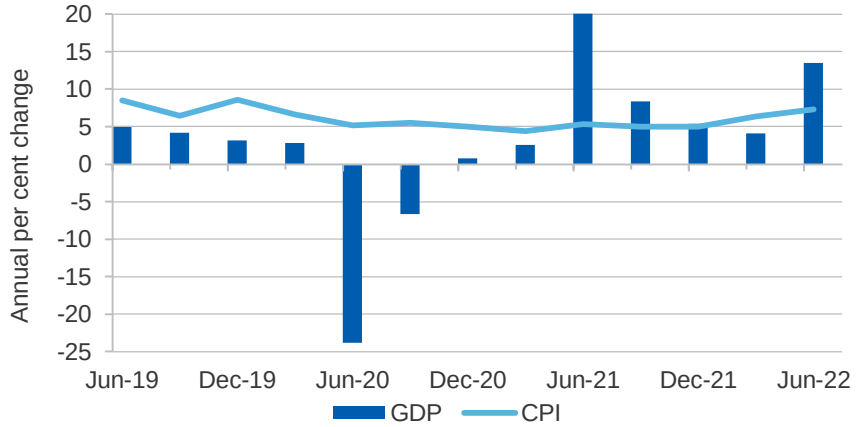
Led by a surge in energy prices, South Korean inflation increased to 6.3% year-on-year in July 2022, accelerating from a 6.0% increase in June and the highest level in over two decades. Rising inflation prompted the Bank of Korea to raise its benchmark interest rate by 25 basis points in August to 2.5% an increase of two percentage points since August 2021. Given current debt levels, managing tighter monetary conditions while keeping robust economic growth presents a key challenge to South Korea over the outlook period.

In July 2022, the IMF lowered South Korea's forecast economic growth to 2.3% in 2022 and 2.1% in 2023, downward revisions of 0.2 and 0.8 percentage points respectively.

India's GDP surges in June quarter driven by private consumption

India's GDP growth increased to 13.5% year-on-year in the June quarter 2022, up from 4.1% in the March quarter. The strong result was due in part to lingering base effects as well as pent-up demand following reopening after the Omicron wave which slowed growth in the March quarter (Figure 2.8). Output growth was recorded in all key sectors, but was strongest in services industries, with trade, hotels and transport up 26% and construction output up 17%. Steady output growth was also recorded in the goods sector, with manufacturing up 4.8%, agriculture up 4.5% and mining up 6.5%.

Figure 2.8: India quarterly GDP and CPI



Source: Bloomberg (2022)

India's manufacturing PMI eased slightly in August, down to 56.2, from 56.4 in July, the second strongest result since November 2021. The strong result was underpinned by expansions in output and new orders, in particular new export orders. Accompanying this positive result was a marked softening in price pressures. After rising rapidly in June, input costs and output charge inflation — the prices manufacturers receive for their outputs — softened to a 12-month low in August.

The IMF forecasts India's economic growth to slow to 7.4% in 2022 and 6.1% in 2023, down from 8.7% in 2021 and a downward revision of 0.8 percentage points in each year from the April estimate. The downward revisions largely reflect less favourable external conditions and more rapid policy tightening to address inflationary pressures.

US economy shrinks in the first half of 2022

In year-on-year terms, the US economy grew by 1.7% in the June quarter 2022 (Figure 2.9). However, the US economy fell by 0.1% quarter-on-quarter (q/q) in the June quarter, following a 0.4% q/q fall in the March quarter. While the fall in the March quarter was driven primarily by a fall in net exports, it also reflected a sharp fall in business investment.

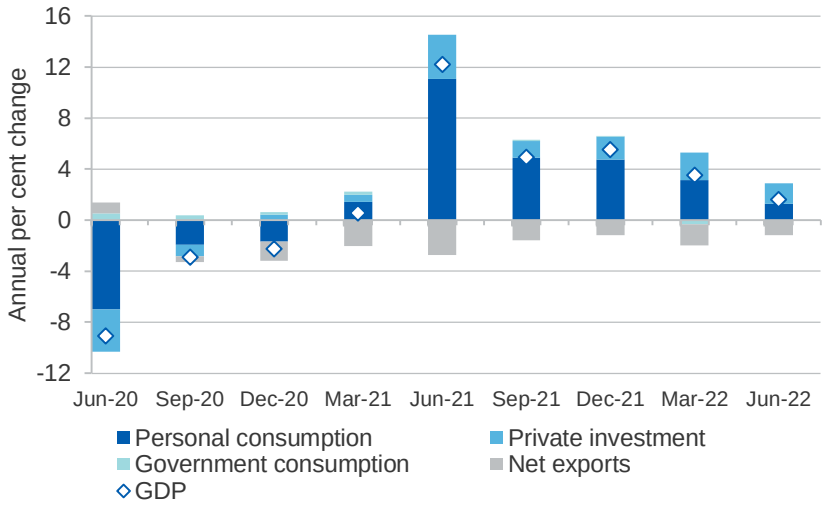
Despite the weak GDP results, the US economy continues to show resilience. The labour market remains tight, with nonfarm payroll employment rising by 315,000 in August following an increase of more than half a million in July. While rising workforce participation saw unemployment increase to 3.7% in August, up from 3.5% in July, it remains at close to 50-year lows. Corporate profits are also at record highs, with after-tax profits as a share of gross value added for non-financial corporations reaching the highest level in over 70 years in the June quarter.

Growth in personal consumption spending, which has driven GDP growth over the past year, also slowed to 1.8% year-on-year in the June quarter, down from 4.5% in the March quarter, and well below the high growth rates achieved in 2021. The slowdown in personal consumption spending was evident across both goods and services. However, the slowing in goods purchases has been the most marked, down to 6.3% year-on-year in the June quarter, from 11% in the March quarter 2022 and 16% in the December quarter 2021 (Figure 2.10). Housing demand has also weakened, with home sales around 20–30 per cent lower than at the start of the year.

The US net private saving rate continued to fall from the record rates achieved during the pandemic, dropping below US$1 trillion per year in the June quarter for the first time since 2016 (Figure 2.10). However, while the

saving rate has fallen, the stock of accumulated excess savings remains substantial. Even accounting for drawdowns in recent months the stock of savings built up since the onset of the pandemic is estimated to be in excess of US$2 trillion as at June 2022.[5] For those households with accumulated savings, this should continue to provide some buffer to US consumption as interest rates and payments continue to rise.

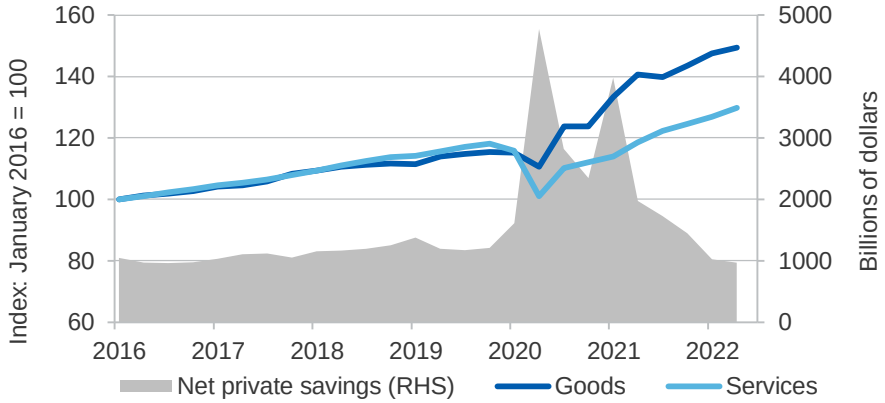
Figure 2.9: US contributions to quarterly real GDP



Source: Bloomberg (2022)

US industrial production grew by 3.3% in August year-on-year, up from 2.9% in July. The US Manufacturing PMI index remained weakly positive in August (51.5), but was well down from the levels achieved earlier in 2022 and is at its lowest level in 2 years. Manufacturing output fell for the second consecutive month, contributing to the subdued conditions, which reflected weaker demand, as new orders fell for the third month in a row. The rising cost of living was the most commonly cited cause of lower sales, as well as the worsening economic outlook. The survey found prices paid by manufacturers remained elevated in August due to higher transportation, fuel and raw material prices.

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)

The US Fed lifted rates in its September meeting, the fifth time this year, taking the cumulative rise in its benchmark overnight interest rate to 300 basis points. With US inflation still near 40-year highs, curbing price pressures remains a critical priority for the Federal Reserve, with Fed members' expectations pointing to further rate hikes this year. In August, the US 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 (Box 2.1 next page).

In July, the IMF downgraded its forecast for US economic growth substantially, by 1.4 and 1.3 percentage points for 2022 and 2023 respectively. This reflects the negative March and June quarter GDP results, and the weakening momentum in private consumption, as household purchasing power is eroded and monetary tightening continues.

[5] CaixaBank Research *2022: US: how can the accumulated savings support the economy?*

Box 2.1: US Inflation Reduction Act 2022

The US *Inflation Reduction Act* (the Act) was signed into law in August 2022. The 750-plus page legislation covers a wide range of issues, including provisions designed to relieve US households from rising prices and promote the transition to low emission technologies.

Key provisions of the Act include changes to: corporate taxes; prescription drug prices; IRS tax enforcement; and health care subsidies. The Act also earmarks over $350 billion for **clean energy** and climate change mitigation initiatives, including tax credits for households to offset energy costs, investments in clean energy, and tax credits aimed at reducing emissions.

The Act makes a number of significant investments to boost **electric vehicle** production. It provides US$10 billion to extend the Advanced Energy Project Credit, which includes 'clean' vehicle manufacturing projects, and US$3 billion for Advanced Technology Vehicles Manufacturing.

Under the 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 or a free trade agreement partner (such as **Australia)**, or from recycling in North America.

This content requirement applies only to the minerals in the batteries, rather than the entire EV, and includes minerals such as lithium, nickel, cobalt and graphite. The minimum share will rise to 80% by 2027.

As a major producer of critical minerals, Australia is well placed to supply US EV producers with key inputs. Australian lithium and nickel producers have existing links with US automakers including Tesla, General Motors and Ford. Australia produces almost half of the world's lithium, and is fast developing major downstream processing capacity.

Over the next 5 years Australia is forecast to produce around one-fifth of the world's battery grade lithium hydroxide (see **Lithium chapter**). Australia is also a major producer of nickel (used heavily in batteries), with more than a fifth of the world's nickel resources and producing around 200,000 tonnes a year (see **Nickel chapter**). Australia is the third largest producer of raw cobalt (second largest in global reserves) and the eighth largest graphite reserves holder. Cobalt and graphite are used heavily in many types of batteries.

The *Inflation Reduction Act* extends eligibility for **carbon capture** tax credits to apply to a broad array of carbon capture, direct air capture, and carbon utilisation projects.

The Act also provides a **clean hydrogen** production tax credit of up to US$3 a kilogram or a 30% investment tax credit, based on the life cycle greenhouse gas emissions rate of carbon dioxide for the first 10 years of operation. The Act also offers grant and funding opportunities for advanced manufacturing and deployment of hydrogen and fuel cell technologies.

Other clean energy initiatives included in the Act include:

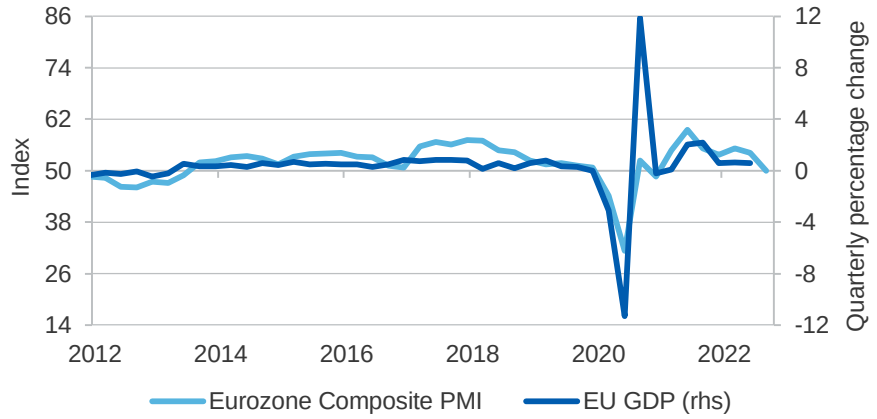
- Extending the production tax credit for electricity from renewable resources to include solar and geothermal production.
- Extending the energy investment tax credit to include energy storage, qualified biogas, microgrid controllers and linear generators.
- Extending tax credits for individuals investing in residential clean energy (including solar, wind and battery storage).
- Establishing a new tax credit for existing **nuclear** power owner/operators.
- Extending advanced energy project credits, with at least US$4 billion earmarked for projects where **coal** mines and coal power plants have closed.

Source: *Inflation Reduction Act of 2022* (US Congress 2022).

Europe growing, but war, soaring energy costs and drought are weighing

Despite the many headwinds it faces, the Eurozone economy continues to grow, with GDP in June quarter 2022 up 0.7% from the March quarter 2022, and by 3.9% from the June quarter 2021. While annual growth was down from the 5.4% growth in the March quarter 2022, it was still reasonably strong (Figure 2.11). Growth in the quarter was supported by France, Italy and Spain — all significant tourist destinations benefiting from the gradual recovery in the sector following the easing of pandemic restrictions.

Figure 2.11: Eurozone GDP and Composite PMI (quarterly)



Notes: September quarter 2022 Eurozone Composite PMI is an estimate based on July and August 2022 results.

Source: Bloomberg (2022)

However, German GDP was flat in June, and up only 1.5% year-on-year, as manufacturers struggled with soaring energy prices. Record energy prices have resulted in industrial closures in Germany, prompting the Economy Minister to warn that German manufacturing faces a 'structural rupture' due to the loss in competitiveness. These fears have been compounded by transport and power disruptions stemming from record low water levels in the Rhine (due to drought).

In the June quarter, industrial production in the Eurozone increased by 2.4% year-on-year, following 1.6% growth in March. This was three times higher than expected and was due largely to strong growth in the output of capital goods which rose 2.6% month-on-month and 7.6% year-on-year.

Leading indicators point to a weaker H2 2022. The Eurozone Composite Output Index saw its second monthly fall in August, to 49.2 down from 49.9 in July, following a 16-month period of above 50 readings (growth). The drop in output was driven by the manufacturing sector, where production fell appreciably. The Eurozone manufacturing PMI has fallen each month since the Russian invasion of Ukraine, moving into negative territory in July and edging down further in August. Manufacturing output has fallen sharply in recent months, with large drops in the basic materials/metals and automotive sectors. The service sector registered only weak growth in activity during August, with the rate of expansion slowing to the softest since the sector returned to growth in April 2021.

As noted earlier, headline inflation in the Eurozone reached 9.1% (year-on-year) in August 2022 — up from 8.9% in July and the highest on record. Since July the European Central Bank has raised its deposit facility rate by 125 basis points, the first increases in over a decade, and ended net asset purchases.

Flow-on impacts from the Russian invasion of Ukraine present the largest risk to Europe's outlook over the rest of 2022. Higher energy prices, weaker consumer confidence and slower momentum in manufacturing — due to persistent supply chain disruptions and rising input costs — continue to drag on Europe's growth.

In July, the IMF downgraded its forecast for European growth, reflecting spill overs from the Russian invasion of Ukraine and the assumption of tighter financial conditions (due to monetary tightening). Growth in the Euro area was revised down by 0.2 percentage points in 2022 and by 1.1 percentage points in 2023. A key contributor to the downgrade was Germany, with the IMF projecting it would have the lowest growth of G7 nations in 2022, due to its reliance on Russian gas (see chapter 7.3).

Table 2.1: Key IMF GDP assumptions

	2021	2022[a]	2023[a]
Economic growth[b]			
Advanced economies	**5.2**	**2.5**	**1.4**
Australia	4.8	3.8	2.2
Euro Area	5.4	2.6	1.2
France	6.8	2.3	1.0
Germany	2.9	1.2	0.8
Japan	1.7	1.7	1.7
New Zealand	5.6	2.7	2.6
South Korea	4.1	2.3	2.1
United Kingdom	7.4	3.2	0.5
United States	5.7	2.3	1.0
Emerging economies	**6.8**	**3.6**	**3.9**
ASEAN-5[d]	3.4	5.3	5.1
China [e]	8.1	3.3	4.6
India	8.7	7.4	6.1
Latin America	6.9	3.0	2.0
Middle East	5.8	4.8	3.5
World [c]	**6.1**	**3.2**	**2.9**

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	0.72
Inflation rate[b]			
United States	4.7	7.7	2.9
	2020–21	**2021–22[a]**	**2022–23[a]**
Australia	1.6	4.3	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

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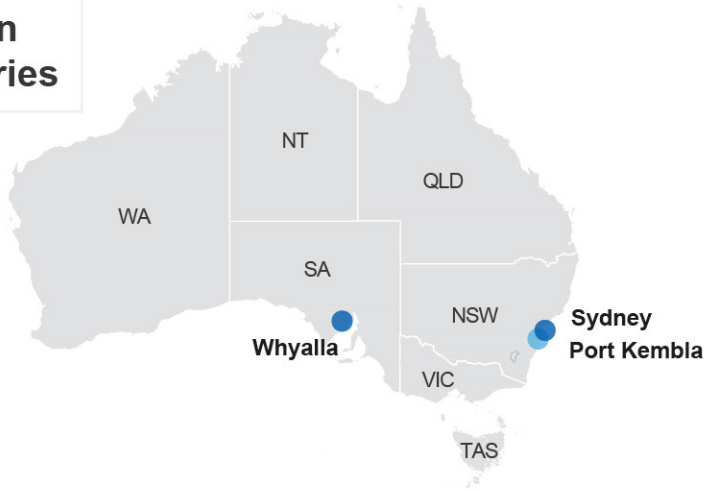
Australian steel refineries



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**

World consumption

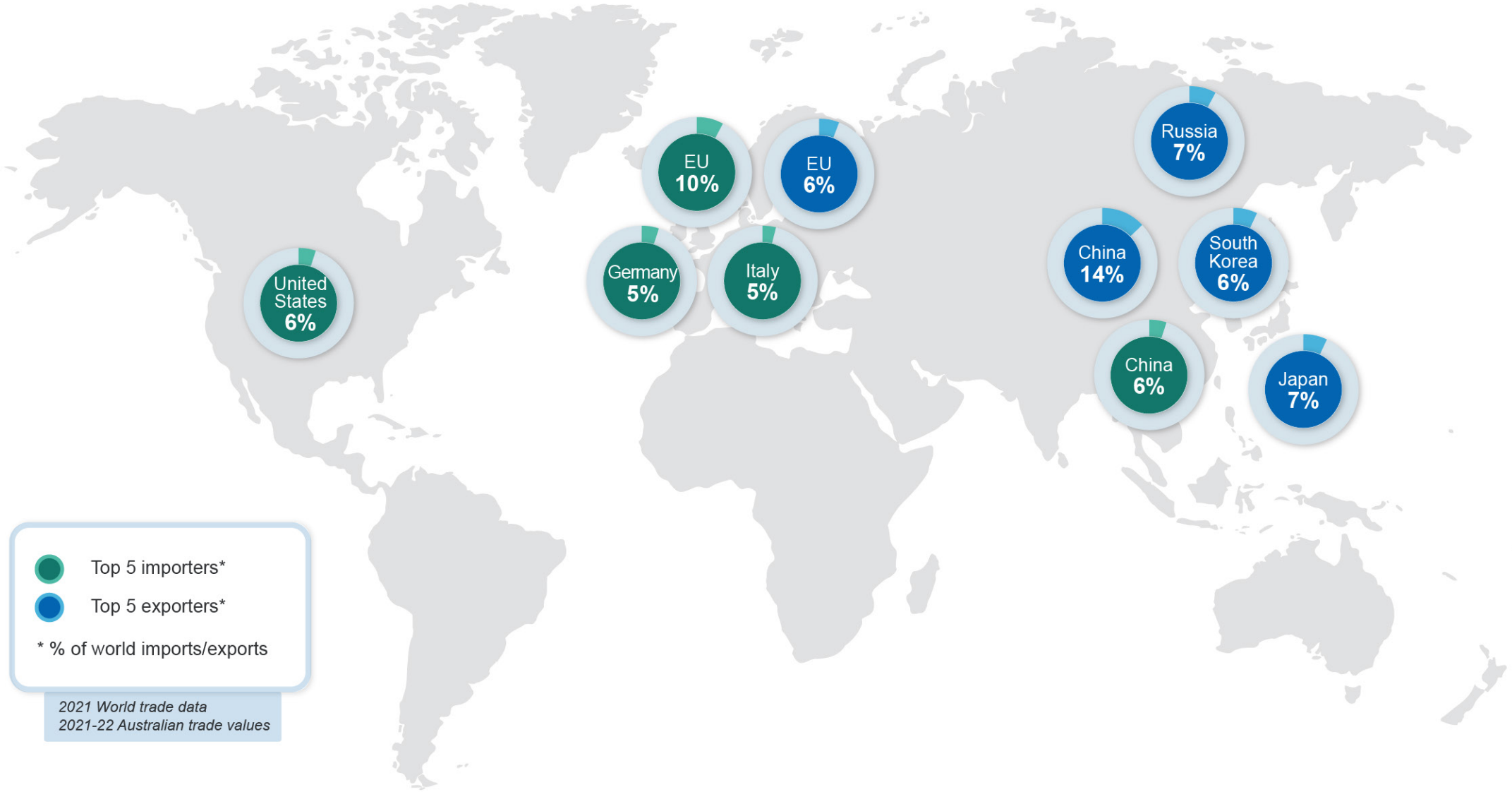
- **52%** Construction
- **16%** Mechanical machinery
- **12%** Other applications
- **12%** Automotive
- **5%** Other Transport
- **3%** Electrical Equipment

Australia's steel

- **5m+ tonnes produced** each year
- **100,000+ employed** in steelmaking
- **Significant export markets**
  - China
  - Japan
  - South Korea
  - Taiwan
  - India

Steel

Trade map | September 2022



3.1 Summary

- World steel production fell 5.1% (year-on-year) in the first half of 2022. This followed new outbreaks of the COVID-19 pandemic in China, as well as ongoing weakness in its residential property sector. Energy shortages — intensified by the fallout from Russia's invasion of Ukraine — are also weighing on activity in other major steel making nations.
- With growing signs of weak global economic growth, world steel production is forecast to fall 0.7% in 2022. This will be driven by current fragility in China's residential construction sector, and global industrial production more broadly.
- Global steel output is expected to rebound to growth of 1.3% in 2023 and 1.1% in 2024, with large infrastructure rollouts planned or underway in a number of major economies. However risks remained skewed to the downside, with a more pronounced global slowdown or persistent energy shortages further threatening industrial production over the outlook.

3.2 World consumption and production

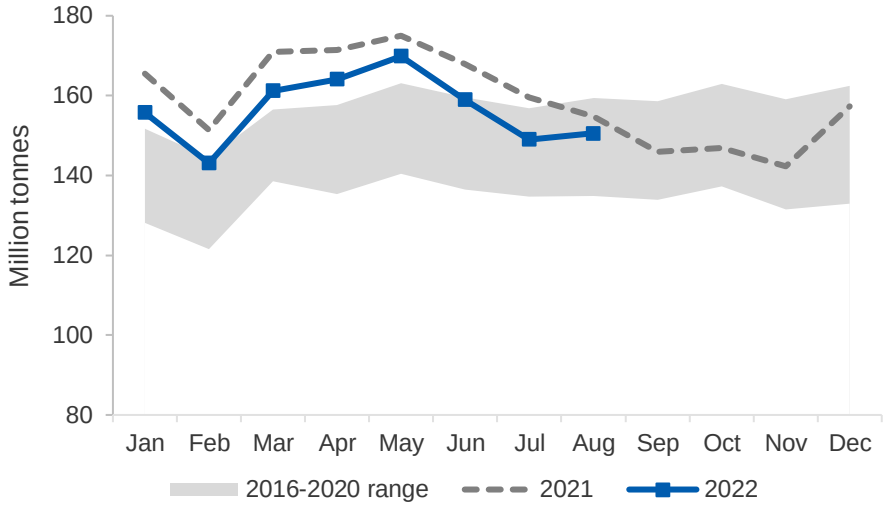
Global steel production to fall in 2022 on faltering demand

World steel production in the first half of 2022 was around 952 million tonnes. This was 5.1% lower year-on-year (Figure 3.1), though remained close to 10% higher than the average for the period 2016 to 2020.

The slowing global recovery anticipated for 2022 has been further burdened in recent months by a number of critical shocks. Persistent inflationary pressures have seen financial conditions tighten across a number of major economies, with rising implications for global growth prospects. This has been further compounded by new outbreaks of the COVID-19 pandemic — particularly in China — and ongoing energy shortages (see *Macroeconomic Outlook chapter*).

In August, the JPMorgan Global Manufacturing PMI — a broad measure of current conditions in the global manufacturing sector — reached its lowest level (50.3) in over two years. This included a further weakening in new orders, and signals a likely contraction of industrial activity and steel output in the near term (Figure 3.2).

Figure 3.1: Global monthly steel production



Source: World Steel Association (2022)

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)

Further outbreaks of the pandemic in China from March — combined with the nation's 'dynamic zero' COVID policy — saw economic growth slow to 0.4% year-on-year in the June quarter 2022. This was China's weakest growth in 2 years, and led to a substantial downgrade to the IMF's forecast of 2022 Chinese GDP growth. The slowdown has been exacerbated by China's deteriorating property sector, with construction starts and new home sales continuing to show double-digit annual falls in August.

The fallout from the Russian invasion of Ukraine continues to impact steel production amongst other major producers, particularly Europe. This is due to the region's heavy reliance on Russian energy. Further mandated cuts to gas consumption, or an extended northern hemisphere winter, raises the risks of additional cuts to EU industrial production over the rest of 2022 (see *Gas chapter*). Ukraine is also expected to produce less than half of its 2021 steel output this year due to lost capacity from the invasion.

With the world economy now forecast to slow to growth of 3.2% this year, global industrial production and steel output are expected to see a comparable slowdown for the rest of this year. Global steel production is expected to fall by 0.7% for the full year 2022.

Among the major producers, China is expected to see a fall in steel output this year, consistent with weaker domestic demand and the central government's crude steel production curbs. Other producers such as the EU, Japan and South Korea, are all also expected to register falls in steel output in 2022, owing to critical energy shortages and slowing demand. Conversely, India is expected to produce about 7 million tonnes more than in 2021, with healthy growth in its construction sector expected for 2022.

Over the outlook period (to the end of 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 1.3% in 2023 and by 1.1% in 2024 to reach 1.98 billion tonnes.

Construction resilient despite weaker aggregate demand for steel

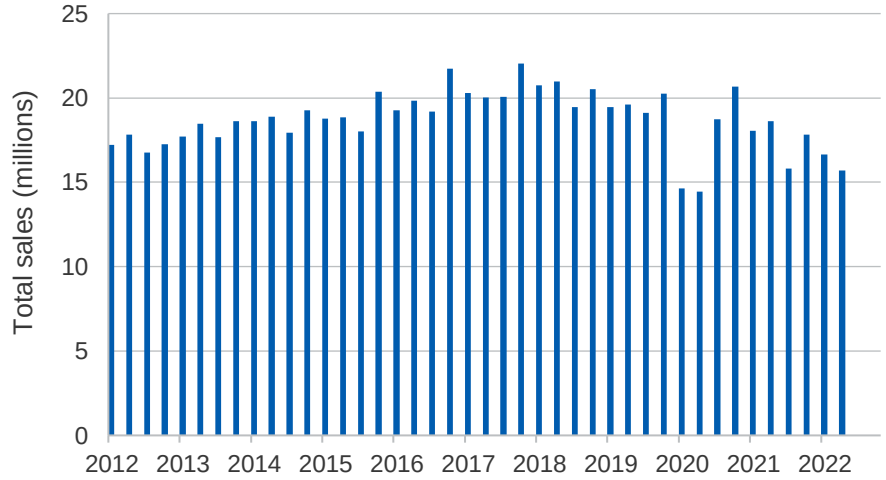
Global steel consumption is forecast to fall by 0.6% in 2022 — a 1.1 percentage point reduction from the June 2022 REQ forecast.

In July, the IMF downgraded its forecast for global growth in 2022 from 3.6% to 3.2%. This reduction was based on continued fallout from the Russian invasion of Ukraine, a worse-than-anticipated slowdown in China, and continued price pressures across major economies including the US and China (see *Macroeconomic Outlook chapter*).

Global construction activity slowed in the June quarter, particularly in Europe, and parts of the Asia Pacific. This followed mounting macroeconomic headwinds, as well as the persistence of rising input costs and critical raw material shortages. Despite the challenges, the outlook for the next 12 months remains upbeat, especially for infrastructure spending, particularly in regions such as the Americas, Middle East and Africa.

Following a challenging 2021, the automotive sector has continued to face disruptions, with COVID-related supply chain shortages further aggravated by fallout from the Russian invasion of Ukraine, and recent outbreaks of the pandemic in China. This led to global auto sales in the June quarter reaching their lowest levels in over two years (Figure 3.3).

Figure 3.3: Global auto sales, quarterly



Source: Bloomberg (2022)

Revised 2022 forecasts from S&P Global in July show some optimism for light vehicle sales in China (revised up 1.7%, 407,000 units) and South Asia (up 2.7%, 225,000 units), but weaker output is now expected for both Europe and South America. The sector also faces further near-term risks to demand destruction from growing global economic headwinds.

Over the outlook period, global steel consumption is expected to grow by 1.2% in 2023 and 1.1% in 2024, as COVID-related containment measures are removed, and global supply chains improve.

Chinese steel demand still facing weak property sector in H2 2022

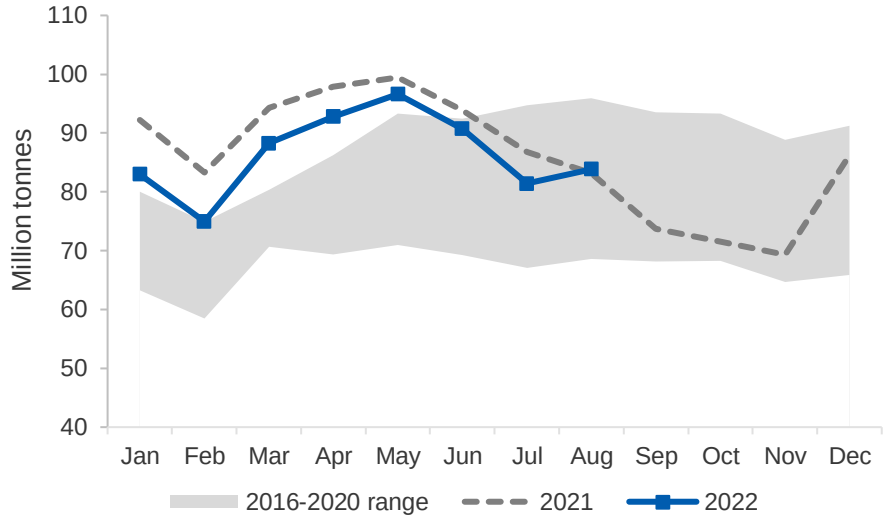
China's total steel output in the first half of 2022 was around 526 million tonnes. This was 6.2% lower year-on-year, but 16% higher than the comparable average for the period 2016 to 2020 (Figure 3.4).

The fall in output so far in 2022 reflects winter production curbs in place in northern provinces (to mitigate pollution) during the March quarter; renewed COVID-19 lockdowns across many cities from the June quarter; and significant weakness in China's residential property sector.

China's real estate sector — which typically accounts for around 35-40% of the country's total steel consumption — has continued to weaken throughout 2022. Housing starts in the year-to-August were down 37% year-on-year, while new home sales over the same period were down 21% year-on-year (Figure 3.5). In August, home prices (China's 70 large and medium-sized cities index) also fell for a 12th straight month.

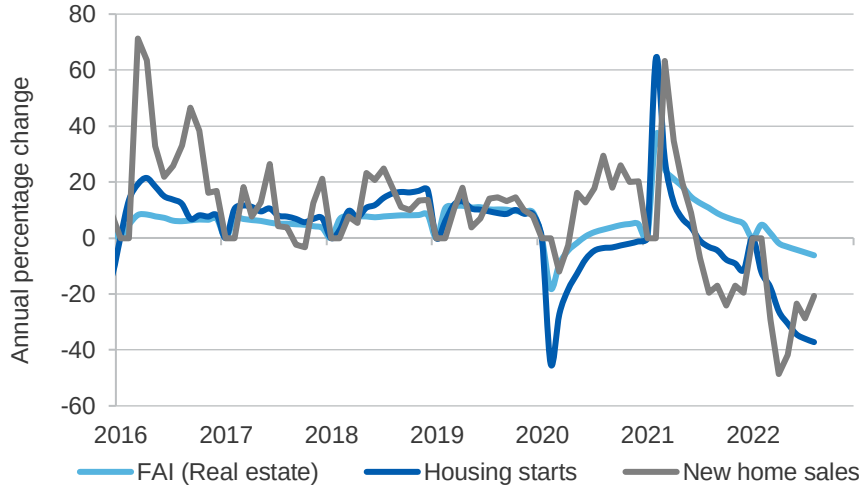
Pessimism surrounding China's residential property market has seen fixed asset investment (FAI) in real estate fall 6.2% year-on-year in the year-to-August, intensifying financing pressures on many of the country's property developers. Frailty in the sector has spread to Chinese households, with the emergence in recent months of a mortgage boycott movement for a number of stalled projects in China. In August, as many as 320 projects in 100 cities were reported to have seen homeowners threatening to withhold mortgage payments from banks, with growing concerns about the completion of these projects. These fears could translate into further weakness in housing pre-sales in coming months, adding to liquidity pressures of Chinese property developers.

Figure 3.4: Chinese steel production, monthly



Source: World Steel Association (2022)

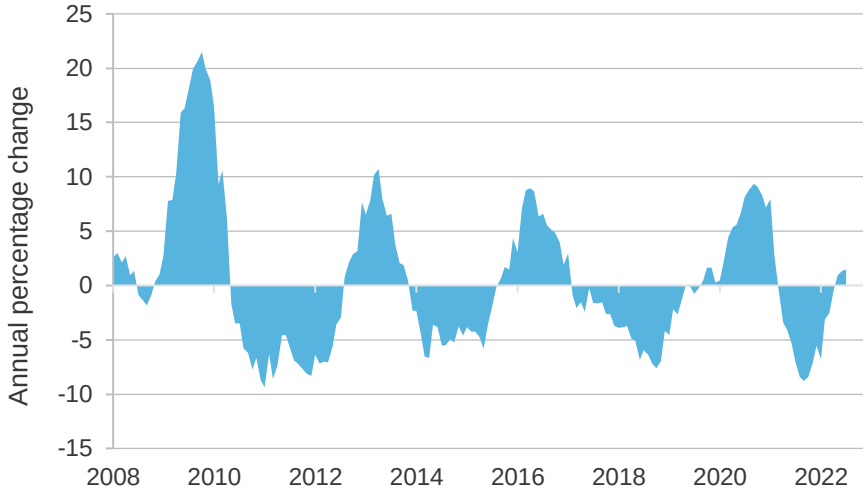
Figure 3.5: China's residential property sector



Notes: Housing starts measured by cumulative million square metres in each calendar year; New home sales measured as sales of residential buildings in CNY trillions each month

Source: NBS (2022); Bloomberg (2022)

Figure 3.6: China credit impulse



Notes: China credit impulse measures new loans as a percentage of GDP
Source: NBS (2022); Bloomberg (2022)

Figure 3.7: China's infrastructure investment

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

Chinese policymakers are continuing to try and stabilise the sector and ensure the completion of existing projects. In July, China's Politburo announced guidance for local governments to ensure the completion of unfinished homes, and more than 30 cities have introduced policies aimed at relaxing purchasing restrictions for multi-child homes. And in late August, China's State Council announced a new 19-point policy package (in addition to a 33 point policy package announced in May) aiming to respond to the country's current economic challenges.

The People's Bank of China (PBoC) has also announced plans to establish a real estate fund to provide as much as RMB 200 billion (US$45 billion) in low interest loans to complete stalled developments. These funds would be issued to commercial banks with the option to leverage as much as RMB 1 trillion (US$150 billion) in lending to embattled developers for completion of existing projects.

China banking on easier credit conditions and new infrastructure

In response to the housing downturn, and with the country experiencing new COVID-19 outbreaks and weakening domestic activity, Chinese policymakers have sought to ease 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. This is the third reduction in the 5-year Loan Prime Rate (the benchmark rate for most mortgages) this year.

There are some signs of a new credit upcycle, with China's credit impulse — a measure of new loans as a percentage of GDP — turning positive in June (Figure 3.6). However, lending data for July shows much of this was from local government borrowing (rather than households). This suggests government efforts to stabilise the property sector and stimulate household spending will remain an ongoing challenge moving into the second half of 2022.

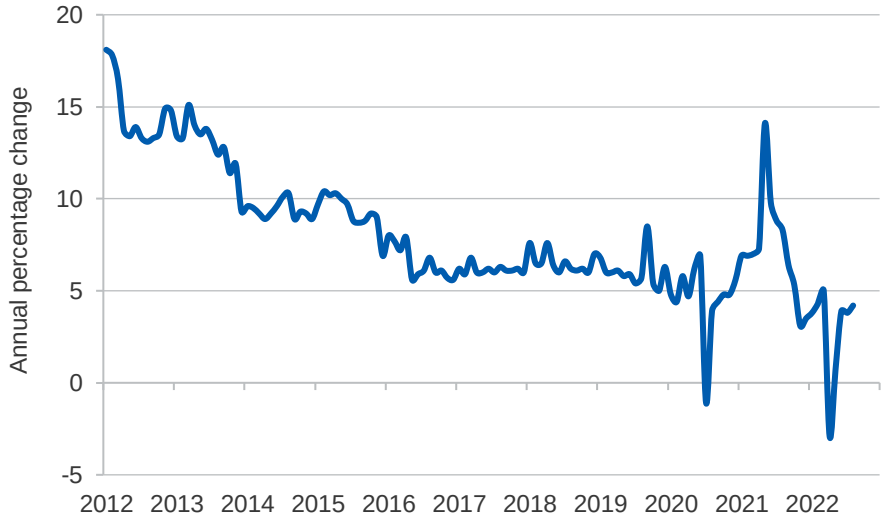
Infrastructure investment — representing 20-25% of the country's total consumption of steel — has seen a significant ramp up so far in 2022, with more than 90% of this year's quota of local government special purpose bonds (RMB 3.4 trillion or US$500 billion) already allocated in the first half

of the year. In August, China's infrastructure investment (3 month average) was around 13% higher year-on-year (Figure 3.7).

With China's economy growing just 0.4% in the June quarter, the central government has announced a number of new policies that could see total infrastructure spending rise to more than RMB 7 trillion (US$1 trillion) in 2022. This spending is expected to boost construction activity in the December quarter 2022 and into 2023. However, it is unclear if the stimulus will fully offset continued weakness in China's property sector.

China's manufacturing sector is also a major steel user, and also faces a challenging finish to 2022. Continued outbreaks of the pandemic and subsequent lockdowns have stifled domestic consumption in recent months (with retail sales growing just 2.7% year-on-year in July), as well as industrial production (growth of just 3.8% year-on-year in July). In August, the country was also facing its worst heat wave in six decades, forcing power rationing in a number of southern provinces. This drought threatens to place further pressure on industrial output in coming months.

Figure 3.8: China's industrial production growth



Source: NBS (2022); Bloomberg (2022)

Russian invasion of Ukraine leads to large steel supply cuts

In the first half of 2022, Ukraine's steel production was 4.5 million tonnes. This represents a fall of around 58% (6 million tonnes) from the comparable period in 2021.

The capture of parts of Ukraine's eastern provinces by Russian forces has meant a loss of around 40% of the country's steelmaking capacity. Russia's control of the Black Sea has also restricted the export capability of major Ukrainian steel producers. While Ukraine's Ministry of Infrastructure has announced plans to increase throughput capacity of ports on the Danube, exports are expected to remain constrained in the near-term. As a consequence, Ukraine steel production is forecast to fall by more than 50% (12 million tonnes) in 2022, to reach 9 million tonnes.

Russian total steel production in the first six months of 2022 was 36 million tonnes, down 2.3 million tonnes (5.9%) year-on-year.

In early March, the EU agreed a fourth package of punitive measures against Russia, including an import ban on Russian exports of steel (which totalled around 3.2 million tonnes in 2020). Russian producers have continued to find alternative markets for these products, with heavy discounts attracting higher purchases in Turkey and Asia. However, the rising impact of sanctions on Russia appears to be driving weaker domestic economic activity in more recent months. Russia's industrial activity fell by 0.5% year-on-year in July, and new auto sales — a major end user of steel — fell by more than 60% year-on-year in the month of August.

Ukraine briefly became the largest supplier of iron ore to the EU in the June quarter. This followed Ukraine exporting excess domestic supply — due to steel capacity cuts — and Europe trying to replace lost Russian supply of pellets (around 8 million tonnes in 2021). However, ongoing logistical constraints around rail and barge capacity mean this jump in Ukraine-EU iron ore trade is likely to have been temporary. This has implications for EU-based steelmaking in H2 2022 (the destination for the majority of Ukraine's high-grade, 65% Fe pellets).

Ex-China steelmaking curbed by energy and materials shortages

In the first half of 2022, world steel output (exc. China) was 425 million tonnes. This was 2.4% lower than the same period in 2021, but 3.2% above the average for the period 2016 to 2019 (Figure 3.9).

Energy and raw material shortages have continued to impact manufacturing activity across many major economies so far in 2022. This has seen industrial production, particularly in the EU and Japan continue to trend lower over the year (Figure 3.10). The weakening global outlook in recent months has also seen a marked drop in steel prices across major markets, particularly flat products such as HRC (Figures 3.11 and 3.12).

European production facing critical energy shortages in coming months

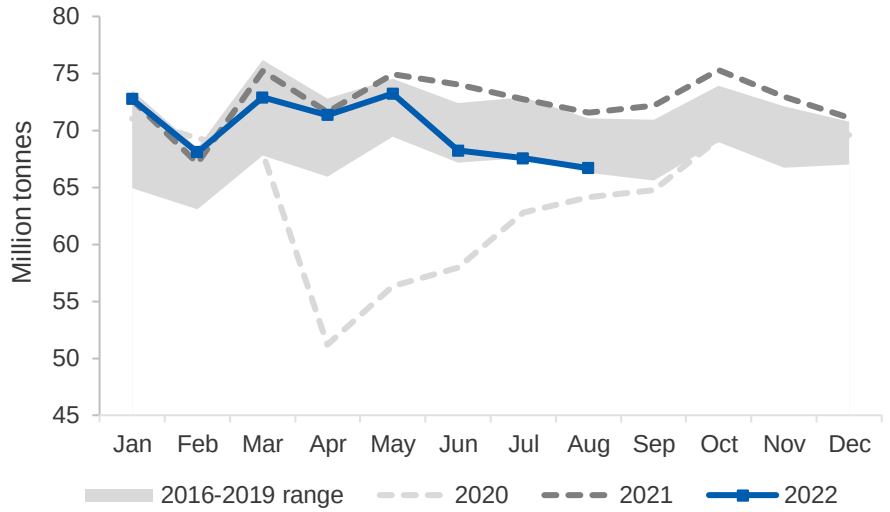
Steel production in the EU — the world's second largest steel-producing jurisdiction — fell 5.3% year-on-year in the first half of 2022 (and was also 4.6% below 2019 levels) to reach around 69 million tonnes.

Europe has continued to experience supply chain challenges and high energy prices throughout 2022, contributing to rising price pressures in the region. In July, the Eurozone Producer Price Index (PPI) was around 38% higher year-on-year.

These pressures have had deleterious impacts on steel-intensive industries in Europe, including its construction and automotive sectors. The S&P Global Eurozone Construction Total Activity Index registered a fourth straight month of contraction in August, with a reading of 44.2. This included significant falls in commercial and residential construction. Firms identified rising cost pressures and tighter financial conditions, as well as a markedly more downbeat outlook for the next 12 months.

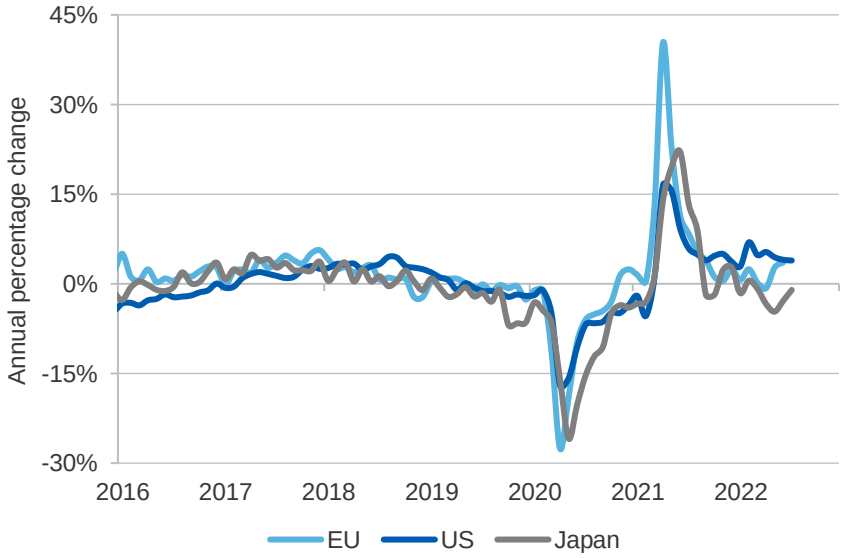
While the semiconductor shortage that heavily impacted producers in 2021 has shown some signs of easing, weaker demand and squeezed margins continue to limit any upside potential for European automakers in the short term. In July, S&P Global made further downward revisions (of around 200,000 units) to estimated light vehicle production for Europe in 2022.

Figure 3.9: Monthly steel production – Global (exc. China)



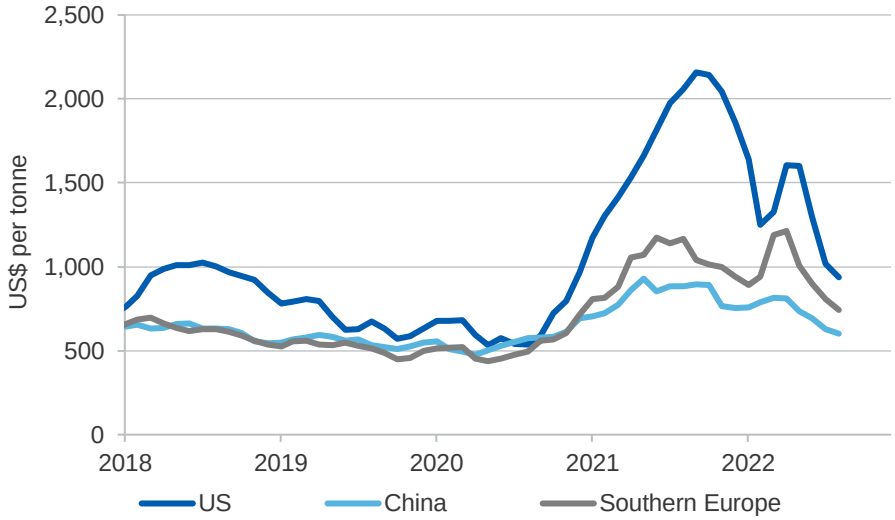
Source: World Steel Association (2022)

Figure 3.10: Industrial production — EU, US and Japan



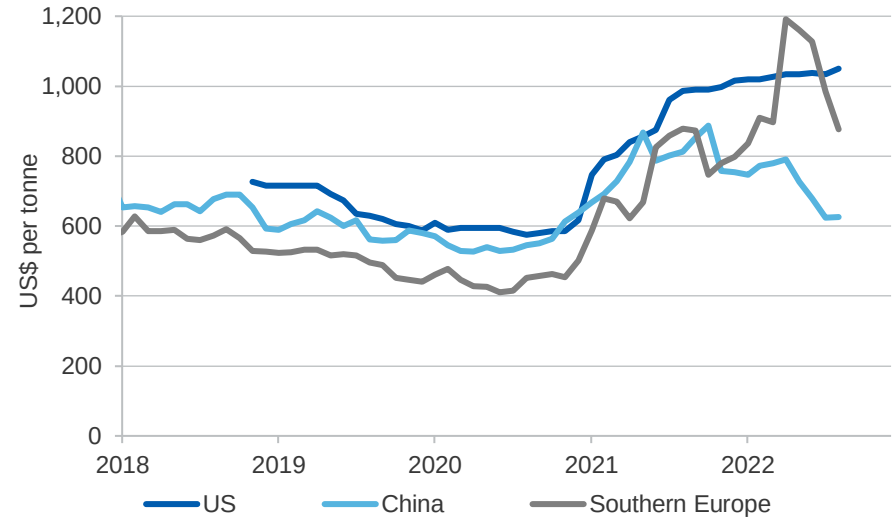
Source: Bloomberg (2022)

Figure 3.11: HRC steel prices



Source: Bloomberg (2022)

Figure 3.12: Rebar steel prices



Source: Bloomberg (2022)

Europe remains extremely vulnerable to energy shortages and rising electricity prices, with natural gas supplies from Russia now drastically reduced as the northern hemisphere winter approaches (see *Gas chapter*). This has seen EU energy ministers reach an agreement in late July for member countries to cut gas consumption by 15% from August 2022 to March 2023, and gas price caps now also being considered. The cutbacks are likely to see a material reduction in steel production in the region through to early 2023, where more than 40% of production is through an EAF process.

EU steel production is forecast to fall 9.9% in 2022 to total 137 million tonnes. Over the outlook period, steel output is forecast to see a rebound in 2023 to reach 144 million tonnes in 2023, and 147 million tonnes in 2024 (Figure 3.13).

Indian steel output growing in 2022 on strong construction activity

Indian steel output reached 63 million tonnes in the first half of 2022, a rise of 8.8% year-on-year. Total production is forecast to grow 6.1% in 2022 (to 125 million tonnes), in line with the Indian Government's target to double national production capacity to 300 million tonnes by 2030–31.

India's construction activity accelerated in the June quarter, particularly in its residential and commercial sectors. While the September quarter typically tends to see weaker activity (and steel demand) due to monsoonal rains, healthy growth is forecast for the full year 2022. Coal shortages remain a risk in the near term. Thermal coal accounts for around 70-75% of India's total power demands, and manufacturing firms have already experienced power cuts throughout 2022 to date. India has announced plans to import significant quantities of thermal coal in its 2022–23 financial year (April to March), in order to safeguard power sources this year. However, current high prices for thermal coal may hamper these efforts (see *Thermal coal chapter*).

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.

Japanese manufacturing facing acute inflationary pressures

Japanese steel production in the first half of 2022 fell by 4.3% year-on-year and was 10% below the comparable period in 2019. This follows weaker demand from Japan's construction sector over the period, with total steel consumption in the June quarter down around 6.7%. Japan has also seen a weakening of its manufacturing sector in recent months, with industrial production down 1.2% year-on-year in July. The sector has been impacted by raw material shortages, and a weakening Yen which has seen growing cost pressures.

Japanese steel production is forecast to fall by 4.8% in 2022 to 92 million tonnes. Over the outlook, Japan's steel output is projected to remain relatively flat through to 2024.

US construction robust, while auto production shows first signs of rebound

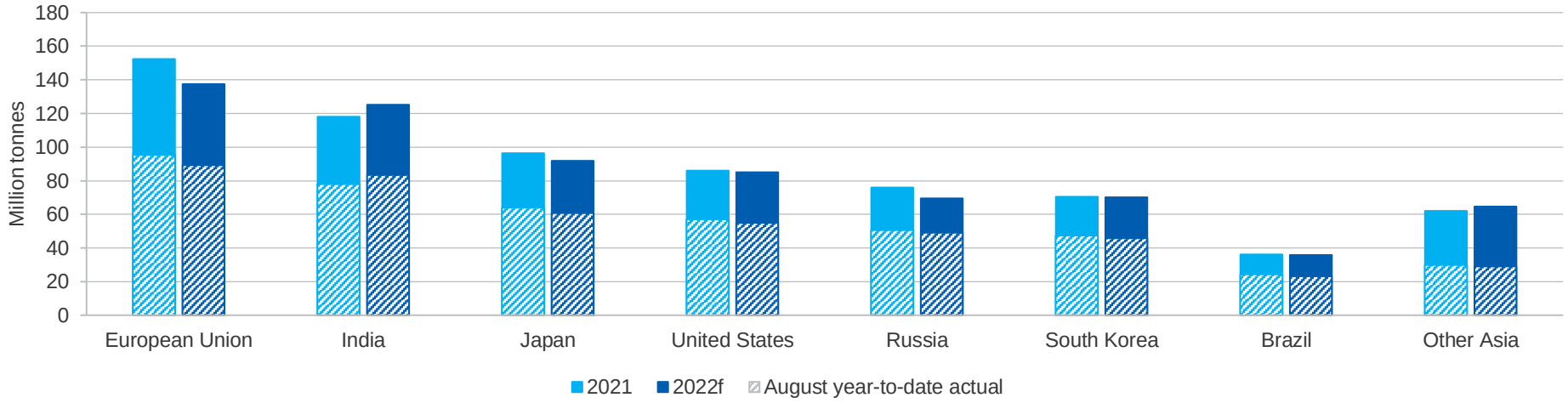
US steel production fell by 2.4% year-on-year in the first half of 2022, and remained around 7.4% lower than the same period in 2019.

Rebar prices in the US continue to hold at multi-year highs, reflecting strong activity in its construction sector. This includes robust growth across infrastructure, residential and non-residential construction. However, rising labour and materials costs, and higher interest rates remain a key risk for the rest of 2022 and over the outlook period.

The US auto industry has shown initial signs of recovery in July, with industrial production for the motor vehicles and parts growing by 6.6% month-on-month and 13.3% year-on-year. However, parts shortages remain expected to result in around 1 million less cars produced in the US in 2022, equivalent to 1 to 1.4 million tonnes less end demand for steel.

US steel production is now forecast to fall by 1.3% in 2022. Despite the short-term challenges, the US is expected to rebound in 2023, with average annual growth of around 2.9% to 2024 to reach 90 million tonnes. This is expected to support implementation of the US$1.2 trillion Infrastructure and Jobs Act, which includes US$550 billion in new federal government investment in roads and bridges, rail, water and electrical infrastructure.

Figure 3.13: Steel production – other major producers



Notes: 2021 actual; f forecast

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

Table 3.1: World steel consumption and production

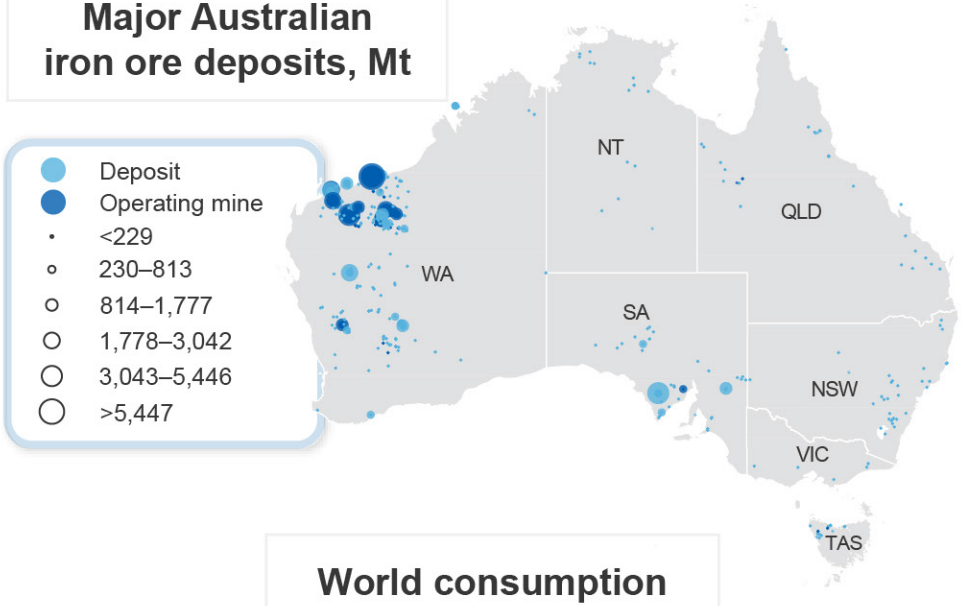
	Million tonnes				Annual percentage change		
Crude steel consumption	**2021**	**2022[f]**	**2023[f]**	**2024[f]**	**2022[r]**	**2023[r]**	**2024[r]**
China	1,046	1,025	1,022	1,017	-2.0	-0.3	-0.5
European Union	155	144	148	152	-7.1	2.6	3.1
United States	94	101	108	112	6.8	7.2	3.9
India	104	111	116	121	7.1	4.8	4.5
Japan	56	56	57	59	-0.6	3.0	2.8
South Korea	51	51	53	53	0.4	3.2	1.1
Russia	49	47	45	44	-4.7	-3.1	-3.3
Brazil	25	27	29	31	7.5	8.7	8.0
World steel consumption	1,959	1,947	1,970	1,992	-0.6	1.2	1.1
Crude steel production	**2021**	**2022[f]**	**2023[f]**	**2024[f]**	**2022[r]**	**2023[r]**	**2024[r]**
China	1,033	1,020	1,017	1,009	-1.3	-0.3	-0.8
European Union	153	137	144	147	-9.9	4.9	1.8
India	118	125	133	139	6.1	6.1	4.9
Japan	96	92	93	94	-4.8	1.8	0.6
United States	86	85	88	90	-1.3	3.7	2.2
Russia	76	69	68	68	-8.6	-1.6	-0.4
South Korea	71	70	72	74	-0.7	2.7	2.5
Brazil	36	36	37	39	-0.7	4.1	3.8
World steel production	1,951	1,937	1,962	1,984	-0.7	1.3	1.1

Notes: **f** Forecast; **r** Compound annual growth rate

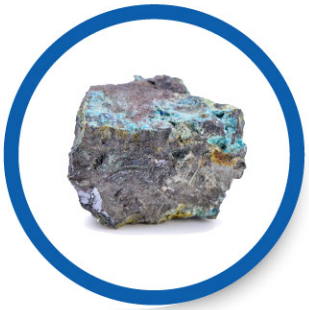
Source: World Steel Association (2022); Department of Industry, Science and Resources (2022)

26 Fe 55.845 Iron Ore

Major Australian iron ore deposits, Mt



Iron ore



- Iron is the most abundant element on earth, forming much of the **planet's core**
- Iron ore deposits were originally **formed by algae**
- Humans have been working with iron for at least **5,000 years**
- Iron was central to the **industrial revolution**

World consumption

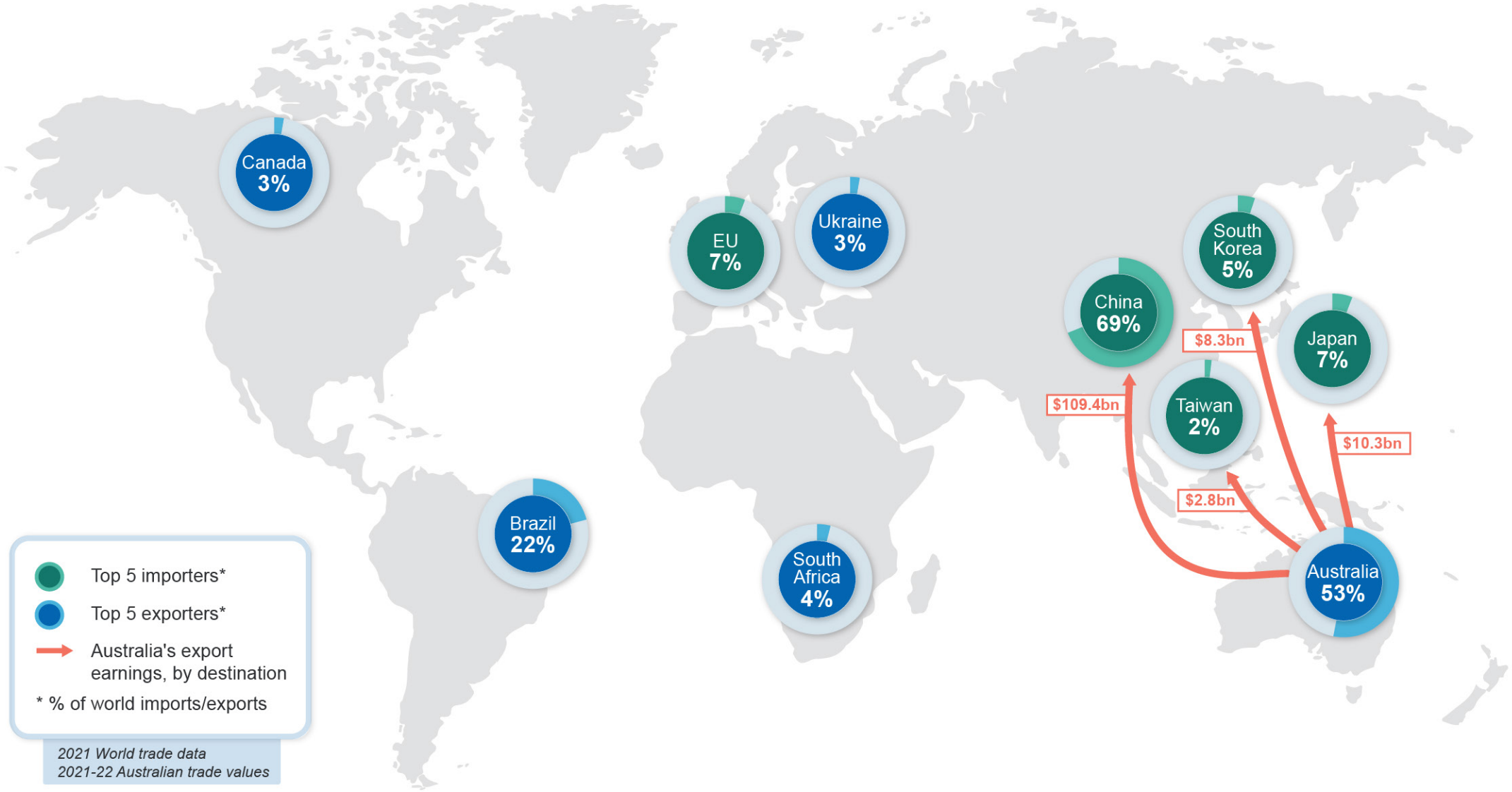
- **62%** China
- **7%** India
- **4%** EU
- **4%** Japan
- **3%** South Korea
- **20%** Rest of the world

Australia's iron ore

- **World's no.1** for iron ore **resources**
- **Largest iron ore producer** in the world
- **Exports** earned **$134 billion** in 2021-22

26 Fe Iron Ore

Trade map | September 2022



4.1 Summary

- Iron ore prices have fallen by around 20% in the September quarter 2022. Combined with growing global recessionary fears, new COVID-19 outbreaks and weakness in China's housing sector, have dampened world steel and iron ore demand in recent months.
- Australian export volumes were 0.9% higher year-on-year in the first half of 2022, with new greenfield supply starting to come online from major producers. Exports are forecast to increase by 3.1% in 2022–23 to reach 903 million tonnes, and rise by 3.8% to 937 million tonnes in 2023–24.
- Lower prices over the outlook are expected to see Australia's iron ore export earnings ease from $134 billion in 2021–22 to $119 billion in 2022–23, and then to $95 billion in 2023–24.

4.2 Prices

Iron ore prices dip in September quarter on weaker global steel demand

Following 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 again dipped in the September quarter, averaging around US$100 a tonne (Figure 4.1). The rebound in prices in the first half of 2022 followed an improvement in monthly steel output in China over much of the period, as well as the expectation of a substantial boost in the country's infrastructure-related construction activity from the June quarter.

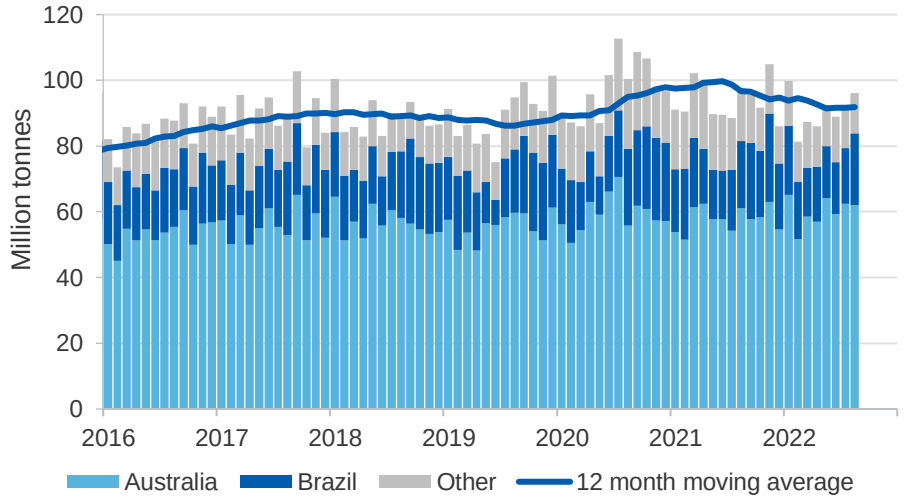
However, renewed outbreaks of COVID-19 infections — in combination with China's 'dynamic zero' COVID policy — and ongoing weakness China's residential property market, have stalled the recovery in steel and iron ore demand in recent months. Chinese manufacturing activity — another major end-user of steel — has also slowed, with industrial production in China's manufacturing sector growing just 3.8% year-on-year in July.

China's total imports of iron ore slackened considerably in H1 2022, with volumes (536 million tonnes) around 4.5% lower than the corresponding period in 2021. This included falls from major importing nations such as Brazil (–6.1%), South Africa (–3.5%) and India (–65%) (Figure 4.2).

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

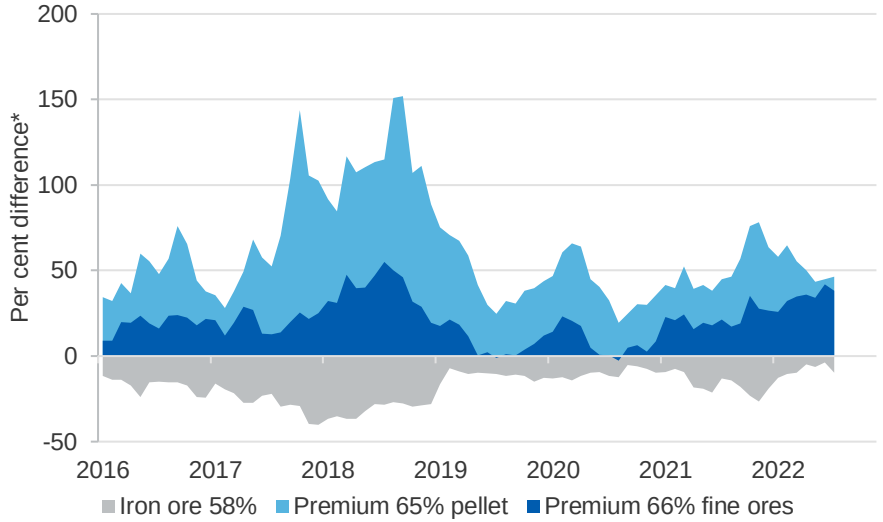
Notes: China import Iron ore fines 62% Fe spot (CFR Tianjin port)
Source: Bloomberg (2022) China import prices; World Steel Association (2022)

Figure 4.2: China's monthly iron ore imports



Source: Bloomberg (2022)

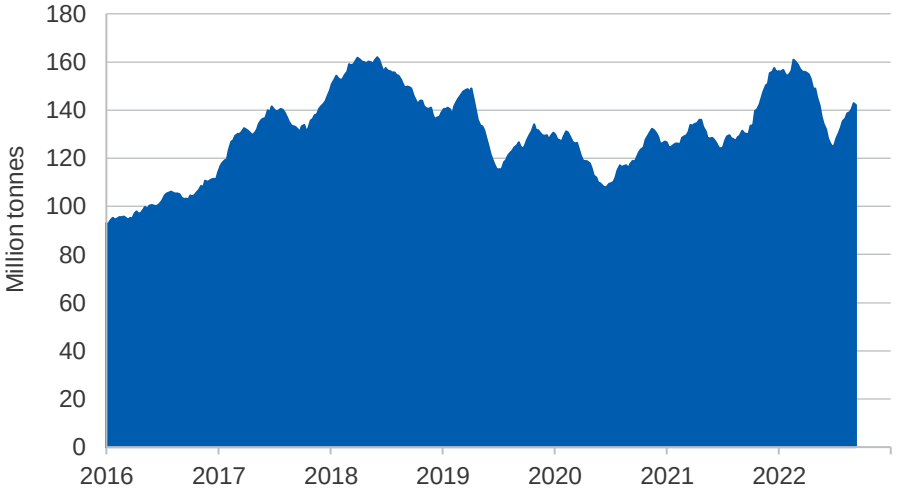
Figure 4.3: Iron ore price spread between grades



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

Source: Bloomberg (2022); China import prices

Figure 4.4: China's weekly iron ore port stocks



Source: Bloomberg (2022)

Weakening demand in China, combined with a cost increase in many raw materials inputs has also driven steel mill margins down so far in 2022, with reports of as many as half of all mills operating at a loss in July (particularly EAF-based steelmaking). This contributed to a falling premium for 65% Fe grade pellets and a narrowing in the discount for 58% Fe fines (to just US$4 a tonne in July), as mills sought to reduce operating costs (Figure 4.3).

On the supply side, weaker export volumes from Brazil in H1 2022 (down 7.5% year-on-year) have more than offset a modest increase from Australia (up 0.9%) over the period, contributing to slightly tighter global seaborne supply. This was due to heavy rains in Vale's Southern and South-Eastern systems in the March quarter, as well as permitting delays in its Northern operations. These are expected to ease as H2 matures.

Global iron ore markets also continue to experience fallout from the Russian invasion of Ukraine. With Ukraine's typical supply chains either blockaded or disrupted by Russian forces, iron ore exports in recent months have plummeted, particularly for pellets. This is having an outsized impact on European steel producers in 2022 (see *World Trade section)*.

Following a multi-month decline in China's portside stocks, iron ore inventories rebounded from July, reaching around 140 million tonnes by mid-September (Figure 4.4). Despite the increase in portside stocks, inventories at steel mills remain low in year-on-year terms, which may provide some tailwind to iron ore demand over the rest of 2022.

Infrastructure aiming to offset frailty in China's property sector in H2 2022

The boost in new infrastructure investment and looser credit conditions in China in recent months are expected to provide some support to iron ore demand (and prices) over the outlook period. China is now expected to spend more than RMB 7 trillion (US$1 trillion) in the 2022 calendar year. In recent months, the one-year and five-year Loan Prime Rates have fallen, easing monetary conditions. This is expected provide a boost to construction activity and steel demand late in 2022 and in 2023.

However, until now these policies have been unable to fully counteract the ongoing weakness seen in China's residential property sector. New residential housing starts and new home sales continued to fall at a double digit rate year-on-year in the year-to-August. This has intensified liquidity concerns amongst Chinese developers, and led to stalled projects and generally weaker sentiment throughout China.

Property construction is China's biggest consumer of steel, and real estate more generally accounts (directly and indirectly) for as much as 30% of the country's GDP. Without stabilisation and recovery of this sector in coming months, the rebound in China's demand for steel is likely to be muted.

On the supply side, volumes from the world's two largest producers — Australia and Brazil — are expected to continue to grow throughout the second half of the year, as weather conditions improve and new supply comes online. This will likely outweigh reduced volumes now projected from India (due to new export duties imposed on concentrate and pellet exports from May), as well as Russia and Ukraine (due to the ongoing conflict). Overall, the coming months are expected to see less tightness in the global seaborne market.

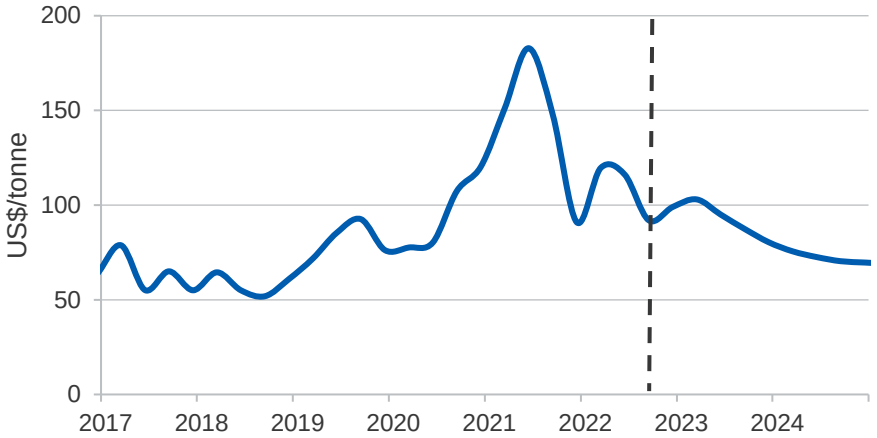
The spot price for 62% Fe iron ore fines (FOB) for calendar 2022 is now forecast to average around US$110 per tonne in 2022 (Figure 4.5).

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

Over the rest of the outlook period, 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 environment. Slower growth in blast furnace steelmaking capacity will also take place alongside growing supply from Australia and Brazil. Growing global recessionary fears present further downside risks to iron ore prices over this period.

From a forecast average price of around US$110 per tonne (FOB) in 2022, the benchmark iron ore price is projected to average US$90 per tonne in 2023 and around US$70 per tonne in 2024 (Figure 4.5).

Figure 4.5: Iron ore price outlook, quarterly



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

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

4.3 World trade

Global iron ore supply improved in June quarter, but remains tight in 2022

Combined shipments for Australia, Brazil, South Africa and Canada — representing more than 80% of global seaborne supply — were estimated to be around 334 million tonnes in the June quarter 2022. This was 9.0% higher quarter-on-quarter, reflecting an improvement in weather conditions in Australia and Brazil (following a typically wet March quarter).

However for the first half of 2022, total shipments for the four major exporting-countries were around 640 million tonnes, a fall of 1.3% compared with the same period in 2021. This was due to weaker export volumes for Brazil (down 7.5% year-on-year) and South Africa (down 4.6%) over the period.

Total iron ore exports from Australia in the first half of 2022 were around 430 million tonnes. This was 0.9% higher year-on-year, and was on account of a comparatively dry March quarter this year, as well as the ramp up of major brownfield and greenfield projects for Rio Tinto, BHP and Fortescue this year (see Australia section).

Total Australian exports are forecast to reach 882 million tonnes in 2022, an increase of 1.3% 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 add 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 3.2%, to reach around 959 million tonnes by 2024 (Figure 4.7).

Total shipments of iron ore from Brazil — the world's second largest exporter behind Australia — were around 154 million tonnes in the first half of 2022.

Brazil's largest producer, Vale, had total production of around 137 million tonnes in the first half of 2022, a fall of 3.7% year-on-year. This followed heavy rains in its Southern and South-eastern Systems operations in the March quarter, continued tie-in effects at its S11D mine, and licensing issues in its Northern System operations.

For 2022, Vale has revised its guidance down (from 320-335 million tonnes) to 310-320 million tonnes. The company has continued to emphasise a 'value over volume' strategy in recent quarters, with an aim to produce higher-grade, lower-impurity ore at the expense of maximising production volumes. This includes construction of a US$345 million 'green' pig iron plant in its Northern System, with initial annual production capacity of 250,000 tonnes and a planned start-up of 2025.

Total Brazilian exports are forecast to reach 347 million tonnes in 2022, a fall of around 2.8% compared with 2021. Over the outlook period, Brazil's total iron ore export volumes are projected to grow by around 2.7% annually, to reach around 390 million tonnes by 2024 (Figure 4.7).

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. While India's iron ore exports rose in 2021 — in response to strong Chinese demand — India is expected to continue raising its domestic steelmaking capacity. This drive is expected to include securing increased domestic supply of raw materials such as iron ore, with the government raising the export duty on iron ore concentrates (to 50%) and pellets (to 45%) in May.

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

Russia/Ukraine prompting both a market restructure and regional shortfall

The Russian invasion of Ukraine has continued to see a reorganisation of iron ore and steel exports in recent months. Supply chain constraints are likely to lead to some shortfalls in regional supply of iron ore in 2022.

With most of Ukraine's iron ore mines located in areas outside major conflict zones, Ukrainian producers had been able to maintain a reasonably high level of exports through the early months of the invasion. This was despite Russia's blockade of the country's primary export hub at the port of Pivdennyi, with Ukrainian producers redirecting cargos by rail and barge to ports in Poland and Romania for export.

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 for the rest of 2022. This has led to major iron ore producers such as Metinvest and ArcelorMittal suspending a number of operations from July.

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 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 and steel import bans (see *Steel chapter*), a number of major European steelmakers have announced the removal of Russian materials (such as iron ore) from their steel supply chains. While Russia temporarily suspended publication of trade data in

late April, reports suggest a fall of as much as 30% month-on-month in March for iron ore exports (and a similar fall for ferrous products).

Russia is expected to seek new markets for displaced export volumes previously sent to Europe, including markets such as Asia, Africa 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 announces a significant new state-owned iron ore enterprise

In July, China established a new state-backed entity, China Mineral Resources Group, 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 new company has registered capital of RMB 20 billion (around US$3bn). The move is seen as an effort by the Chinese government to guarantee the supply of important minerals resources and increase the negotiating power of China's steel industry. This could include establishing a single, central purchasing platform for iron ore, though how this would function across China's vast steel industry remains unclear. Further detail on the company is expected in Q4 2022.

Development of Guinea's Simandou project back on track

Following another halt to the project in June, the establishment of a new company — *La Compagnie du TransGuinéen (CTG)* — in July has seen renewed progress on the prospective Simandou iron ore mine. CTG will oversee the delivery of a new port and transport infrastructure required to bring the mine to production and export.

The Simandou iron ore mine, located in Guinea, has a potential production capacity of 200 million tonnes per year (around 15-20% of output currently produced in the Pilbara region of Western Australia). However, the project requires significant investment in mining-related and transport infrastructure to get minerals to market. This includes development of a new port and 650 kilometres of railway, which got underway in 2021.

The new company — a joint venture between Winning Consortium (WCS), Rio Tinto and the Guinean Government — will now oversee the project construction. Delivery is expected to be bound to the requirements set by the Guinean Government in March, with all port and rail infrastructure to be finished by 2024, and commercial production to begin by Q2 2025.

In August, a new agreement was signed by the Fortescue-backed joint venture, Ivindo Iron SA, to explore the Belinga iron ore project in Gabon. Belinga is seen as one of the largest untapped reserves of high-grade iron ore in the world, with prior estimates suggesting an annual production capacity of 30 million tonnes per annum. Located around 500km east of Gabon's coastal capital Libreville, the project would require extensive port and rail infrastructure to bring product to the market. Fortescue is expecting an exploration program of around US$90 million over 3 years.

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. However, growing macroeconomic headwinds — such as weakening global growth, energy shortages and further COVID-19 outbreaks — present a mounting risk to steel demand growth over the outlook, which would have repercussions for iron ore demand.

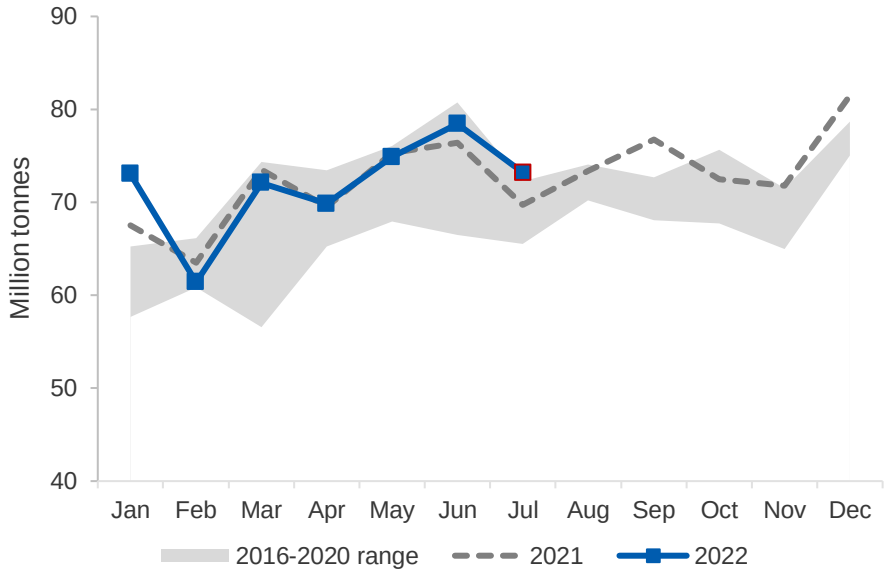
4.4 Australia

Rising export volumes in first half of 2022 (partially) offset fall in prices

Australia's total iron ore export earnings in the June quarter 2022 were $36 billion, a 28% (or $14 billion) fall year-on-year. The decrease primarily reflects the lower price for iron ore in 2022, with the unit export price for June quarter averaging around US$116 per tonne, 37% lower compared with the same period in 2021.

Australia exported 223 million tonnes of iron ore in the June quarter 2022. This was 8.1% (or 17 million tonnes) higher quarter-on-quarter, reflecting the recovery from seasonal wet weather typical in the March quarter. Compared with the same period last year, export volumes for the June

Figure 4.6: Australian monthly iron ore export volumes



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

quarter 2022 were 0.9% higher (Figure 4.6). This follows the ongoing ramp up of projects for Rio Tinto, BHP and Fortescue (Gudai Darri, South Flank and Eliwana respectively) so far in 2022, with further production gains expected over the rest of 2022.

The growth in volumes came despite supply and labour shortages experienced by many producers, due to COVID-19 border restrictions in place until March this year. Record rainfall in the Pilbara in May also caused further disruptions to production and exports in the June quarter.

Iron ore exports to China reached around $30 billion in the June quarter 2022, around 84% of Australia's total iron ore export earnings. By value, Australia's exports to China in the June quarter 2022 were 26% lower year-on-year, while volumes (171 million tonnes) were 3.3% higher.

Rio Tinto shipped almost 80 million tonnes of iron ore in the June quarter 2022. This was a rise of 12% quarter-on-quarter, and 5% from the same period in 2021. The company has cited continued impacts from skilled labour constraints, COVID-19 disruptions and wet weather impacts in 2022, contributing to H1 shipments being around 2% lower year-on-year.

The company has left their full year (2022) guidance steady at 320-335 million tonnes. This includes ramp up of its new 43 million tonne per annum Gudai Darri — the company's first greenfield iron ore project in over a decade — which delivered its first ore in June 2022.

In September, Rio Tinto also announced it will be developing its new Western Range project in partnership with China Baowu Group. The new project is intended to sustain production from its existing Paraburdoo hub, and is expected to produce 25 million tonnes per annum. Construction is forecast to begin in early 2023, with first production by 2025.

BHP's iron ore output was around 64 million tonnes in the June quarter 2022. This was 8% higher quarter-on-quarter, but remained flat compared with the same period in 2021. Despite temporary labour constraints (related to COVID-19), and rail and port maintenance through 2022, the company was able to meet its 2021–22 financial year guidance, reaching production of 253 million tonnes. This includes a ramp up of its South Flank project, which managed an average production rate of 67 million tonnes per annum in the June quarter 2022 (up from 58 million tonnes per annum in March). BHP has set 2022–23 guidance of 246–256 million tonnes, reflecting port debottlenecking work it has underway, as well as a continued ramp up of its South Flank mine.

Fortescue's total iron ore exports were 49.5 million tonnes in the June quarter 2022. This was a 6% higher quarter-on-quarter, but flat compared with the same period in 2021. Total shipments of 189 million tonnes for the 2021–22 financial year represented a 4% increase year-on-year, and exceeded the company's guidance of 180-185 million tonnes. The strong result was underpinned by continued ramp up of its Eliwana project, which ran at its nameplate production capacity of 30 million tonnes per annum in April. Fortescue has set its 2022–23 fiscal year production guidance at 187–192 million tonnes. This will likely 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.

In February this year, the Western Australian Government approved a development plan to increase Port Hedland's export capacity to 660 million tonnes of iron ore per year (the port achieved throughput of 523 million tonnes of iron ore in 2020–21). This plan includes a substantial increase in allocation for BHP, Fortescue and Roy Hill. As part of its 2022–23 Budget, the WA Government has provided funding for road infrastructure to the port, as well as dredging of the port. The WA Government expects to finalise capacity allocations and development approvals in 2022.

Export values to ease over outlook on moderating prices

Higher production volumes and stable prices are estimated to have led to Australia's iron ore export earnings reaching around $134 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 $119 billion in 2022–23, falling to $95 billion by 2023–24 (Figure 4.7).

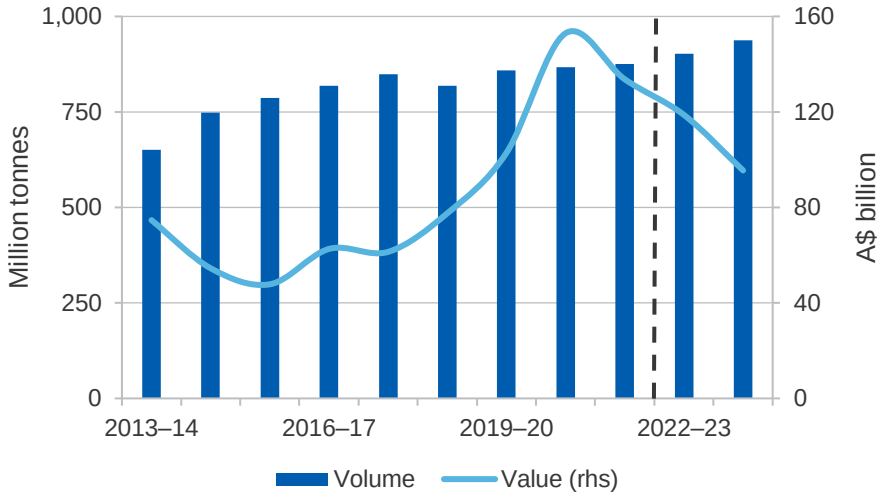
Iron ore exploration expenditure highest in 9 years in June quarter

A total of $201 million was spent on iron ore exploration in the June quarter 2022 (Figure 4.8). This was an increase of 44% compared with the previous quarter, and 33% higher than the same quarter in 2021. Exploration has remained elevated in recent quarters following iron ore prices reaching historical highs in the first half of 2021.

Revisions

Forecast export earnings for 2022–23 (in nominal terms) have been revised up from $116 billion in the June 2022 *Resources and Energy Quarterly* to $119 billion in this edition, due to changes in price expectations. Export earnings have been revised up (by around $9 billion) to $95 billion for 2023–24. This reflects an expectation of a slower fall in iron ore prices and weakening AUD through 2023 and 2024.

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



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

Figure 4.8: Australian iron ore exploration expenditure

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

Table 4.1: World trade in iron ore

	Million tonnes				Annual percentage change		
	2021	2022[f]	2023[f]	2024[f]	2022[r]	2023[r]	2024[r]
World trade	1,626	1,588	1,634	1,703	-2.3	2.9	4.2
Iron ore imports							
China	1,126	1,112	1,106	1,095	-1.2	-0.6	-1.0
Japan	113	110	112	112	-3.0	1.8	0.6
European Union	94	78	83	86	-17	6.5	3.5
South Korea	74	76	78	80	2.0	2.6	2.4
Rest of Asia[a]	57	74	77	86	29	5.1	11
Iron ore exports							
Australia	871	882	920	959	1.3	4.2	4.3
Brazil	357	347	362	387	-2.8	4.3	6.9
South Africa	68	66	67	68	-2.9	1.5	1.5
Canada	54	57	58	58	5.6	1.8	0.0
Ukraine	44	28	29	30	-36	3.5	3.4

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

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

Table 4.2: Iron ore outlook

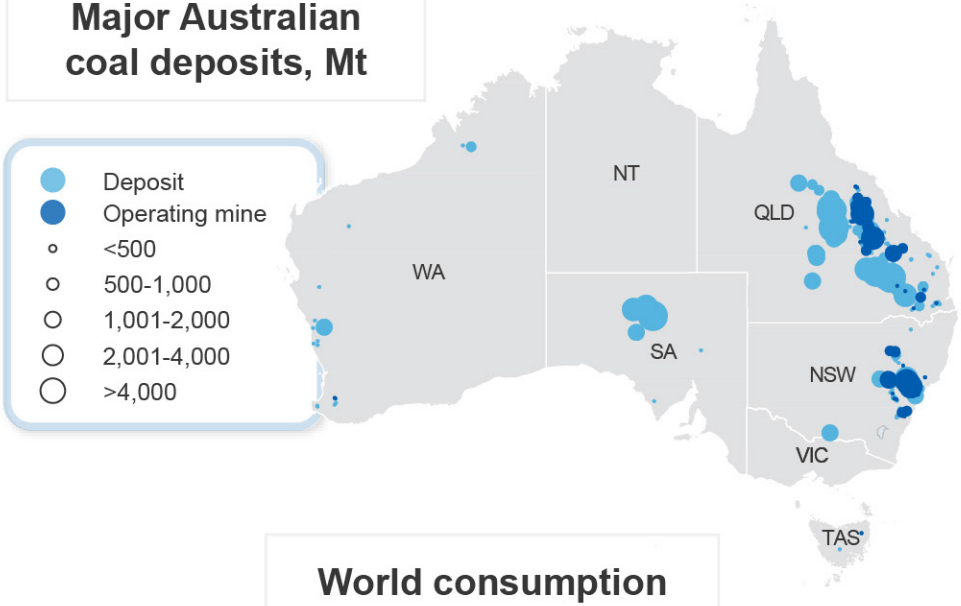
World	Unit	Million tonnes 2021	2022[f]	2023[f]	2024[f]	Annual percentage change 2022[r]	2023[r]	2024[r]
Prices [a]								
– nominal	US$/t	143	107	91	72	-25	-14	-21
– real [b]	US$/t	155	107	89	68	-31	-17	-23
Australia	**Unit**	**2020–21**	**2021–22**	**2022–23[f]**	**2023–24[f]**	**2021–22[r]**	**2022–23[r]**	**2023–24[r]**
Production								
– Steel [e]	Mt	5.7	5.8	5.8	5.8	2.0	0.0	0.0
– Iron ore	Mt	912	928	958	979	1.7	3.2	2.3
Exports								
Steel [e]	Mt	0.78	0.81	0.81	0.81	4.5	0.5	0.2
– nominal value	A$m	773	992	925	967	28	-6.8	4.6
– real value [g]	A$m	864	1,061	925	928	23	-13	0.3
Iron ore	Mt	867	875	903	937	1.0	3.1	3.8
– nominal value	A$m	152,975	133,649	118,754	95,477	-13	-11	-20
– real value [g]	A$m	170,950	142,996	118,754	91,609	-16	-17	-23

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 2022–23 Australian dollars; **r** Compound annual growth rate
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)

6 C Carbon 12.011

Metallurgical coal

Major Australian coal deposits, Mt



Metallurgical coal

- Metallurgical coal is primarily used **to make steel**
- Contains **more carbon and less ash & moisture** than thermal coal
- 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**

World consumption

59% China

10% India

7% Russia

5% EU28

5% Japan

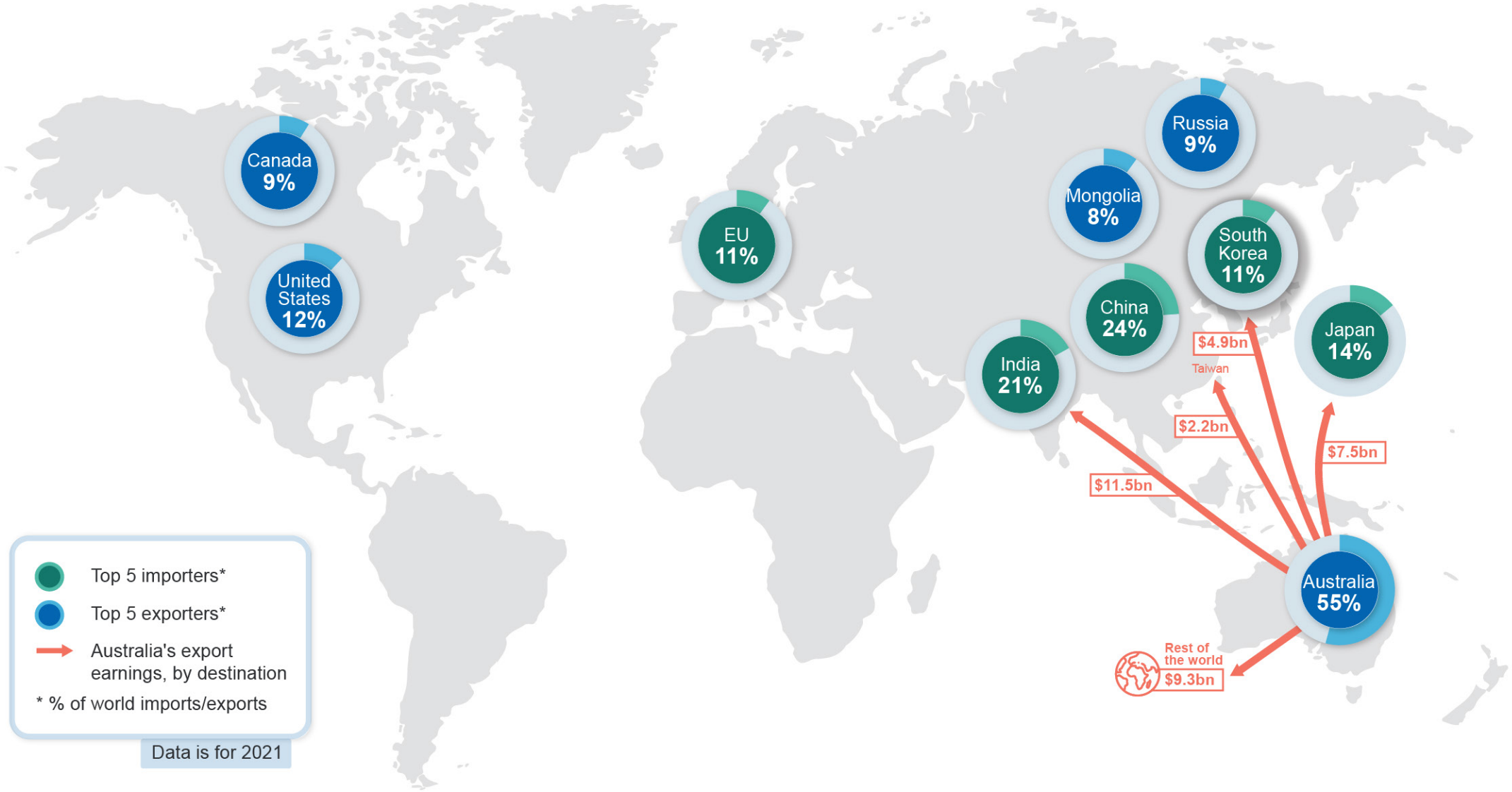
4% South Korea

Australia's metallurgical coal

- **World's no.1** **metallurgical coal** exporter
- **170m tonnes** of **metallurgical coal** exported each year
- **Almost all** of Australia's production is **exported**

Metallurgical coal

Trade map | September 2022



5.1 Summary

- Metallurgical coal prices have eased back from historic highs in the September quarter. The Australian premium hard coking coal price is forecast to average almost US$400 a tonne in 2022, but is expected to fall by almost half as supply conditions normalise, ultimately reaching around US$220 a tonne by 2024.
- Higher production in NSW and Queensland is expected to push up Australia's exports, from 171 million tonnes in 2020–21 to 180 million tonnes by 2023–24 (see Australia section).
- Australia's metallurgical coal export values are forecast to track with price movements, rebounding from $23 billion in 2020–21 to peak above $66 billion in 2021–22, before falling back to $44 billion in 2023–24.

5.2 World trade

Metallurgical coal prices have fallen significantly from the record levels of early 2022. The fall initially appeared to be a correction following the surge in prices in response to the Ukraine war. However, prices have continued to fall amidst softening demand from steelmakers, with a downturn in global steel production now expected in 2022 (see *steel chapter*). This downturn reflects a broader weakening in global economic conditions.

Steelmaking has been affected by high energy prices and a general downturn in the global economic outlook. The IMF has cut its global GDP growth forecast further — to 3.2% for 2022, having originally forecast growth of 4.9% for the year. This has flowed through to metallurgical coal markets, where supply is now exceeding demand. Inventories have begun to rebuild, and price volatility is declining.

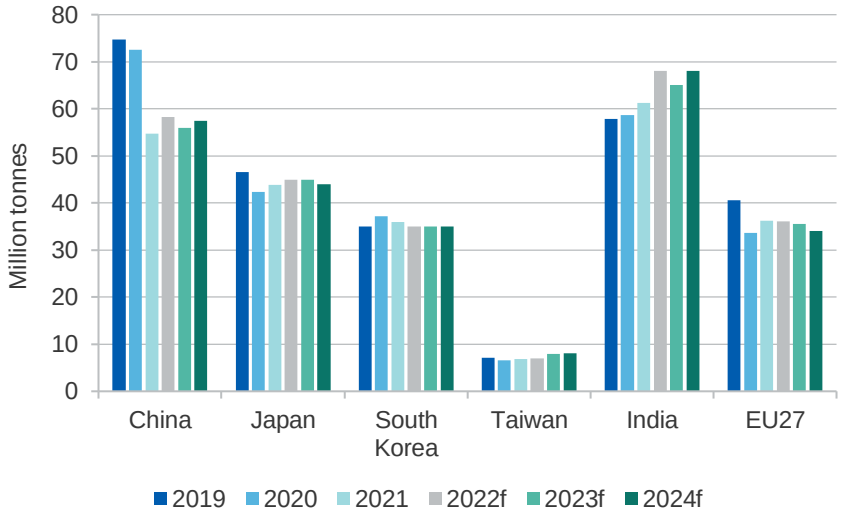
Further weather events pose an ongoing risk to supply, but lower demand and higher inventories should prevent any significant new price shocks in the changed global environment.

In 2020–21, metallurgical coal markets were previously forced to adjust to accommodate the Chinese import restrictions targeting Australia, and are now reordering again to accommodate EU sanctions on Russia. The adjustments have lengthened shipping distances and pushed up freight costs, and there is potential for further disruptions when EU sanctions take full effect. However, prices may not push up substantially, as much of the impact has already been factored in by markets, and European inventories have been rebuilt in preparation.

Metallurgical coal supply is expected to exceed demand over the outlook period as steelmaking flattens and some supply disruptions ease. Global automotive manufacturing, construction and other steel-using industries have all faced downward revisions in their requirements. This will allow additional metallurgical coal to enter thermal coal markets, which remain in critical shortfall.

On balance, world metallurgical coal trade is forecast to increase from 296 million tonnes in 2021 to 323 million tonnes by 2024 (Figure 5.1). The bulk of the growth in trade is expected in 2023, as global steelmaking and industrial activity regain some momentum.

Figure 5.1: Metallurgical coal imports



Notes: **f** forecast

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

5.3 World imports

Chinese metallurgical coal imports have picked up

Chinese steel production fell by 3.0% in 2021. Output was curbed by policy interventions intended to meet environment/emissions controls, but also amidst record iron ore and metallurgical coal prices. Chinese production of metallurgical coal remains strong, but imports lifted in July nonetheless — perhaps reflecting efforts to raise inventories.

Steelmaking in China has faced months of cost pressure, as energy and metallurgical coal prices rendered much of it unprofitable, and as demand eased amidst a softening global economic outlook. Industrial production growth fell to 3.8% in July (below market expectation of 4.6%), while youth unemployment in China — an important leading indicator of economic health — rose sharply to almost 20%. Dwelling construction has turned down, reducing domestic steel requirements over the near term, and disruptions linked to COVID-19 outbreaks have led some industries to curb activity. Previously, supply shortages pushed domestic metallurgical coal prices above US$600 a tonne, but this has eased substantially now.

Responding to a deterioration in the growth outlook, the Chinese Government has announced further plans to invest in infrastructure as a stimulus measure. Previous infrastructure packages have involved a high use of steel, but further stimulus faces risks in the form of COVID-19 lockdowns, which could disrupt infrastructure rollouts by shutting down construction zones or by paralysing the supply chains involved.

China's informal import restrictions on Australian metallurgical coal are expected to remain in place over the outlook period. While speculation of a policy change has affected some markets, there is no firm indication of any revision.

US exports to China increased rapidly in 2021, from under 2 million tonnes in 2020 to more than 10 million tonnes. However, in 2022, exports from the US appear to be declining again, due to a number of factors: China has increased its domestic output, and imports from Mongolia have lifted — as COVID-19 related border restrictions eased and the freight rail connection between the two nations was improved.

China is also set to increase its total coal imports from Russia in 2022, potentially by up to one-third, to around 70 million tonnes. Growth will be somewhat constrained by infrastructure limitations, but the completion (and potential expansion) of a new railway bridge could provide additional capacity. The facility is not exclusive to coal; it will also be used to move iron ore as well as other commodities and manufactured goods.

The increasing trade links with Russia and Mongolia — in conjunction with greater efforts to source metallurgical coal domestically — are expected to fill much of the gap left by the loss of Australian metallurgical coal.

India's metallurgical coal imports are recovering

The Indian government continues to place a high priority on developing its domestic steel industry. 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 imports of metallurgical coal largely holding steady over the first half of 2022.

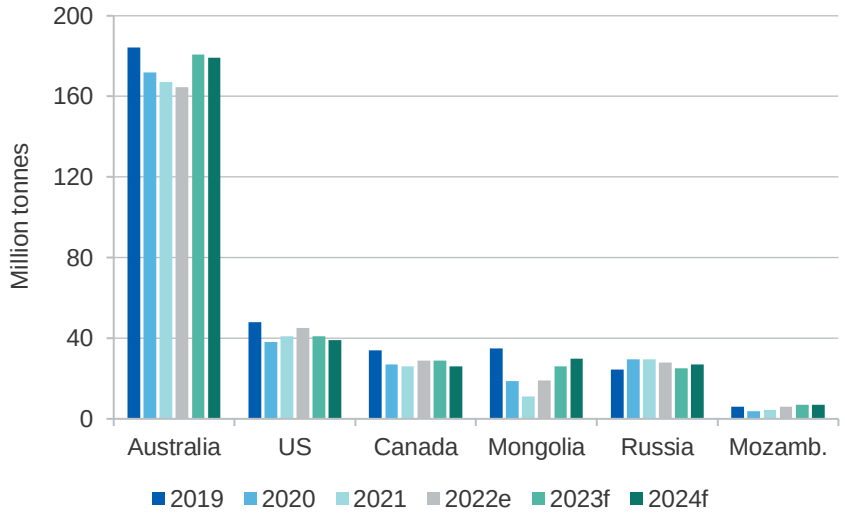
Australia accounted for almost three-quarters of Indian metallurgical coal imports in 2021, while import shares from Canada and the US slumped to 3% and 5%, respectively. However, heavy rainfall and COVID-19 issues caused some disruption to Australian supply to India in the first half of 2022. Efforts are underway in India to source more metallurgical coal from Russia, and expansions in rail capacity continue to progress. Imports of Russian coking coal have increased by around 20% over the year to June, with Russia becoming India's third largest coal supplier.

India's metallurgical coal needs are likely to grow over the next two years. Indian steelmakers have US$11 billion worth of projects announced, some of which are 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).

5.4 World exports

Global metallurgical coal supply is recovering from disruptions related to weather events and COVID-19. But the full effects of EU sanctions against Russia are yet to be felt, and may disrupt markets further from September.

Figure 5.2: Metallurgical coal exports



Notes: **f** forecast **e** estimate
Source: IHS (2022); Department of Industry, Science and Resources (2022)

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

US metallurgical coal exports remain subject to infrastructure constraints, and were not able to scale up significantly during the boom prices of early 2022 (Figure 5.2). With prices receding once more, the brief surge of revenue is now passing, potentially reducing funding for mine expansions and extensions in US capacity — which is traditionally high-cost.

US freight rail networks have partially recovered following a series of maintenance problems and parts shortages. Several barges have also faced mechanical problems, further constraining inland coal transit. An explosion due to accumulated coal dust severely affected CSX's Curtis Bay Piers in December 2021, with repairs ongoing. US metallurgical coal exports have increased moderately (but not as much as originally expected) since the price boom began. Over the outlook period, US exports are expected to edge back, as prices fall and cost-sensitive exporters withdraw from the 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), it is expected to be attained in early 2023.

Strong conditions for Canadian exporters are expected to see exports remain solid through to the end of the outlook period (Figure 5.2).

Exports from Africa are recovering

Mozambique's exports fell 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 exports face a difficult outlook

Russian exports face uncertain prospects, with the EU sanctions set to take full effect in September 2022. Russia previously exported about 10 million tonnes of metallurgical coal to Ukraine annually, another 7 million tonnes to the EU, and 5 million tonnes to Japan. China, India and various South Asian nations are raising their imports of Russian coal, but are not expected to absorb the full amount (see World imports section).

The amount of displaced Russian coal will become apparent in September and October, but there was little sign of successful redirection to Asian markets in August. Russian coal exports to China fell in August, as did exports to Asia as a whole. Capacity shortages in the rail system (and difficulties accessing additional shipping) appear to be acting as a constraint. On balance, it is expected that around a third to a half of Russian exports will be stranded in the immediate future. Ultimately, around 5 million tonnes annually is expected to be stranded from global markets.

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

Mongolian coal exports are expected to rise over time (Figure 5.2), with Chinese investment helping to develop the previously minimal freight rail links between the two nations. Mongolian coal exports have typically been dominated by truck shipments, but the launch of 3 railway lines in 2022 should underpin a more efficient and stable transport system. Mongolian exports are forecast to rise by over 30% between 2021 and 2024.

5.5 Prices

Metallurgical coal prices are expected to ease gradually

Metallurgical coal prices fell sharply between late May and early July, before recovering slightly. Supply continues to face disruptions from floods in Australia and other weather events, but the fall in demand has allowed market tightness to ease nonetheless. High global energy prices are likely to act as an ongoing curb on steelmaking, especially in China and Europe — where gas shortages are likely to force some moderation in overall energy use over the winter.

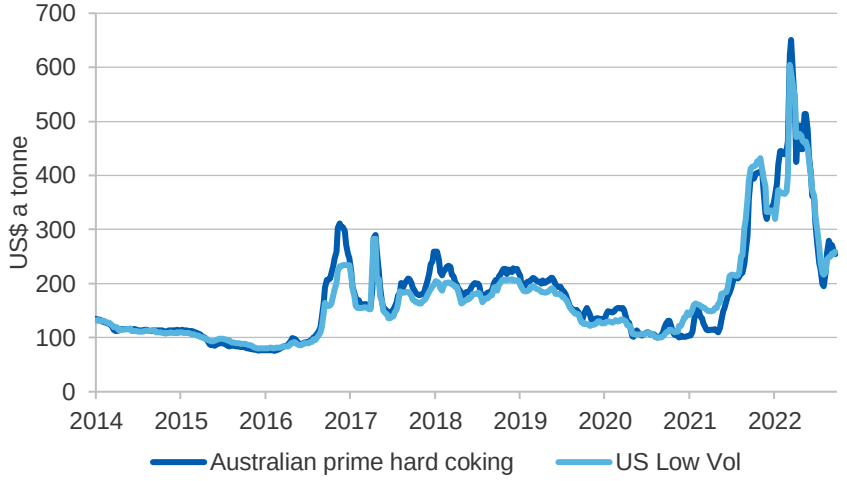
Inventories in Europe, which previously faced shortfalls, have recently been rebuilt. With metallurgical coal inventories now at comfortable levels and prices surging for thermal coal, metallurgical coal has begun to enter thermal coal markets in larger quantities. This trend is likely to support metallurgical coal prices somewhat by removing excess supply from the market. However, prices remain weighted down by widespread softening in global demand, most notably from China, with greater buyer discretion acting as a curb on further outbreaks of volatility.

It is expected that thermal coal prices will remain above metallurgical coal prices for some time — an unprecedented situation — and likely enduring while steel demand remains low and energy shortages persist. Around 5-10% of European steelmaking capacity is idled at present, due to high gas prices and the softening in global economic growth, which has led to demand concerns.

Price risks have shifted to the downside in recent months. Falling global demand and rising interest rates have added to the risk of a global recession. However, there are significant risks to supply too, largely from weather events in Australia, the world's dominant supplier.

Prices for Australian hard coking coal are expected to decrease from US$420 a tonne in 2022 to US$220 a tonne in 2024 (Figure 5.3).

Figure 5.3: Metallurgical coal prices – Australian Prime Hard vs US Low Vol, 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 exports and prices have lifted in 2022 (Figures 5.4 and 5.5), supported by rising demand in several major markets, including Japan, Taiwan, and South Korea. Exports to Europe are also increasing, and should lift further as the second half of 2022 progresses.

However, recent falls in global steelmaking have softened the demand for metallurgical coal, reducing the record revenues of metallurgical coal producers.

Producers have increasingly directed metallurgical coal into thermal coal markets in recent months, capitalising on favourable thermal coal prices. The shift reduces the need to wash the coal and allows producers to capitalise on record thermal coal prices. Producers of higher-grade and harder metallurgical coal (most of which are based in Queensland) typically do not include by-pass capacity in their wash plants, and have less incentive and capacity to redirect to thermal markets.

Ongoing weather issues represent the primary risk to Australian production at present. The chances of a La Niña weather pattern are high, and the Indian Ocean Dipole is strongly negative, raising the likelihood of wetter than normal conditions in the eastern half of Australia during the spring/summer period. Flooding and weather disruptions are already having an impact on exports early in 2022–23, with significant impacts on mines and transport in July.

South32 has abandoned its attempt to secure NSW Government approval for a US$700 million life extension to its Dendrobium coking coal mine. The extension was intended to allow production to last until 2048, but the company has pulled out on the grounds that extending operation of the mine no longer represents the best use of capital. The mine, which currently supplies Port Kembla steelworks, is now expected to close in the early 2030s.

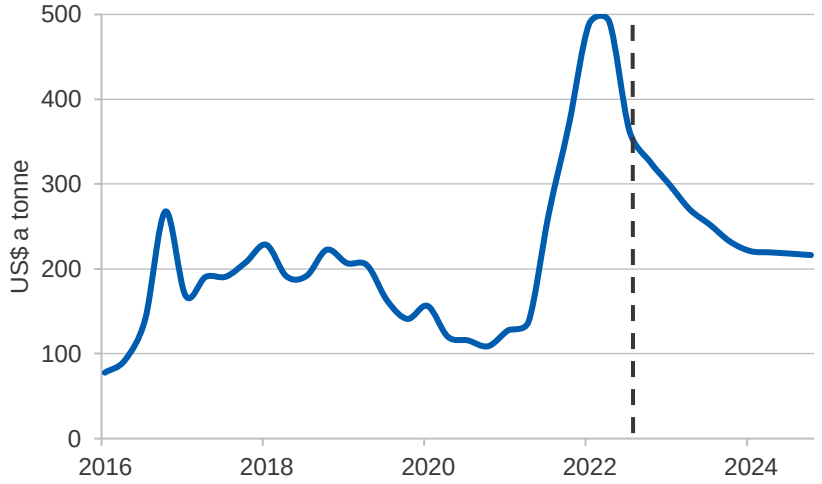
On balance, long term factors for metallurgical coal remain largely positive. Higher production in NSW and (especially) Queensland is expected to push up Australia's exports, from 171 million tonnes in 2020–21 to 180 million tonnes by 2023–24.

Metallurgical coal export earnings were $23 billion in 2020–21 (Figure 5.6), but surged to $66 billion in 2021–22. Prices are easing as seasonal and short-term supply issues pass and demand edges back. This should see earnings fall moderately over the outlook, with export values eventually easing to a (still-high) $44 billion by 2023–24.

Coal exploration expenditure has increased

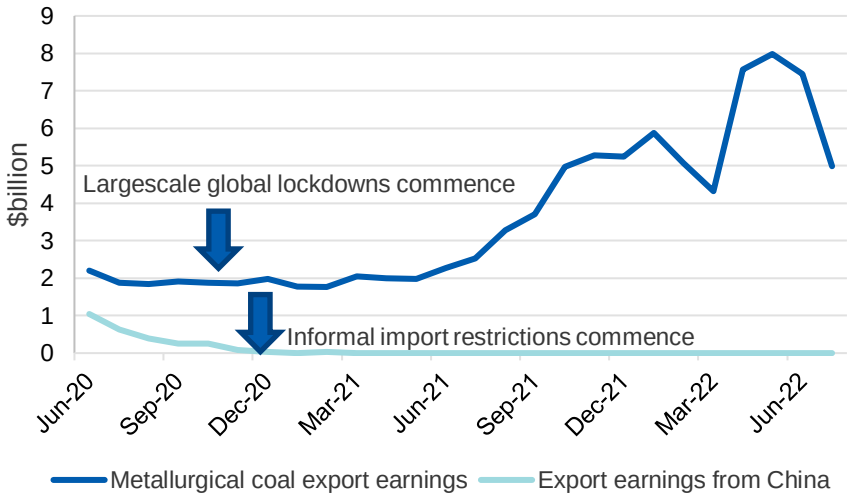
Australia's coal exploration expenditure increased to $61 million in the June quarter, to be 12% higher through the year. Prices have risen markedly for Australian coal, but thermal producers face issues with finance, insurance and social licence. Recent growth in exploration is thus likely to have been dominated by metallurgical coal (Figure 5.7).

Figure 5.4: Australian metallurgical coal spot price, quarterly



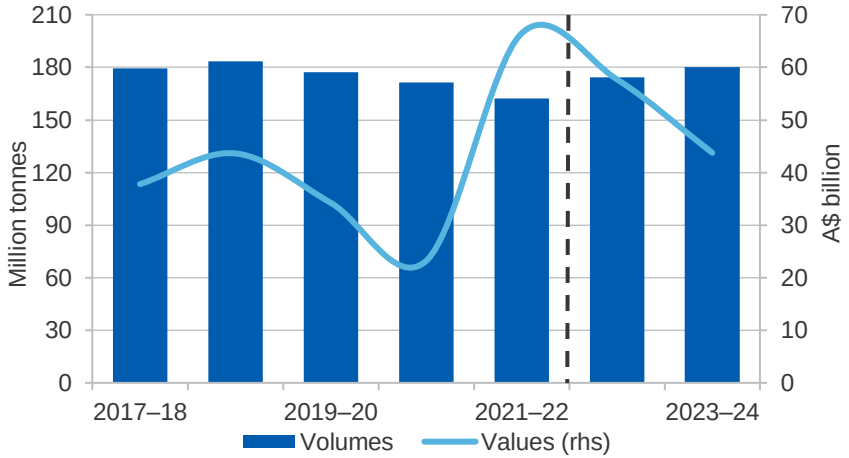
Source: Platts (2022); Department of Industry, Science and Resources (2022)

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



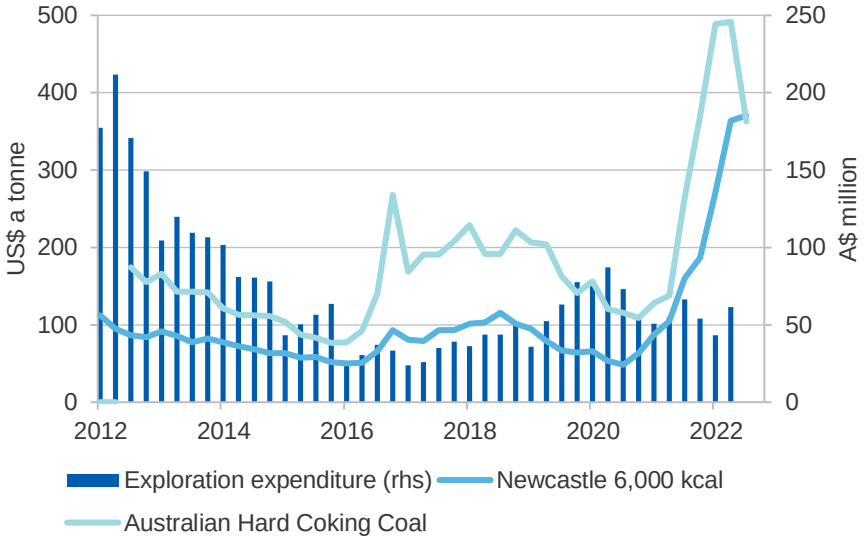
Source: ABS (2022) International Trade, Australia 5454.0

Figure 5.6: Australia's metallurgical coal exports



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

Figure 5.7: Australian coal exploration expenditure and prices



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

Revisions to the outlook for Australian metallurgical coal exports

The forecast for export earnings has been revised up by around $6 billion (nominal terms) in aggregate over the forecast period. Revisions reflect wetter than normal conditions in Australia (including the emergence of a new La Niña weather pattern), which are expected to add to supply pressures and place upward pressure on prices.

Table 5.1: World trade in metallurgical coal

	Unit	2021	2022	2023[f]	2024[f]	Annual percentage change 2022	2023[f]	2024[f]
World trade	Mt	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	165	181	179	-1.4	9.8	-0.9
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

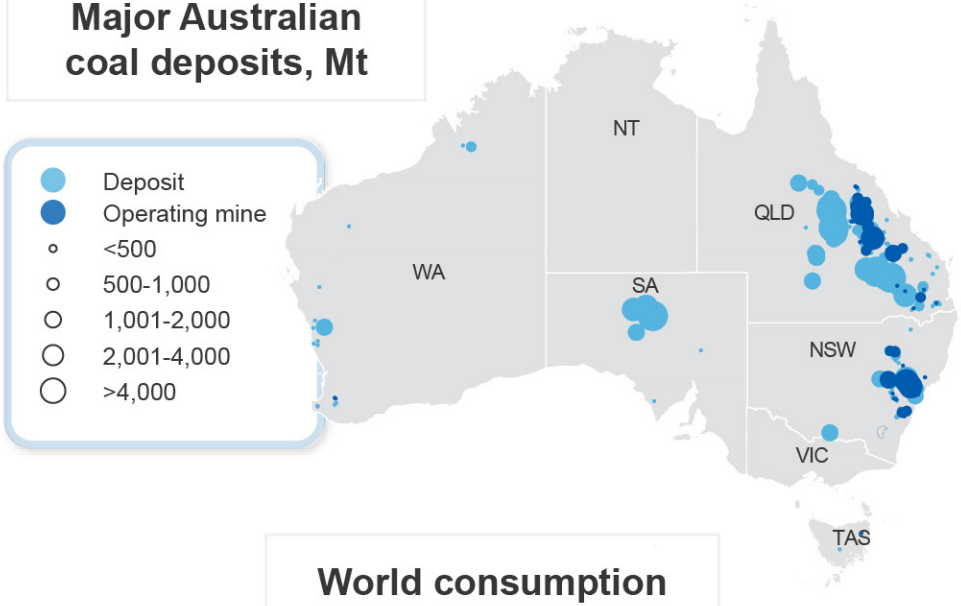
						Annual percentage change		
World	**Unit**	**2021**	**2022**	**2023[f]**	**2024[f]**	**2022[f]**	**2023[f]**	**2024[f]**
Contract prices[e]								
– nominal	US$/t	205	383	263	220	86.7	-31.4	-16.2
– real[d]	US$/t	221	383	255	209	73.4	-33.5	-18.0
Spot prices[g]								
– nominal	US$/t	225	391	258	219	73.7	-34.0	-15.2
– real[d]	US$/t	242	391	250	208	61.3	-35.9	-17.1
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	10.1	-1.7	2.3
Export volume	Mt	171	162	174	180	-5.1	8.4	2.3
– nominal value	A$m	23,187	66,437	57,714	43,748	186.5	-13.1	-24.2
– real value[i]	A$m	25,911	71,084	57,714	41,976	174.3	-18.8	-27.3

Notes: **d** In 2022 US dollars. **e** Contract price assessment for high-quality hard coking coal. **i** In 2022–23 Australian dollars. **f** Forecast. **g** Hard coking coal fob Australia east coast ports. **s** Estimate.
Source: ABS (2022) International Trade in Goods and Services, Australia, 5368.0; Department of Industry, Science and Resources (2022); Platts (2022)

Thermal coal

6 C Carbon 12.011

Major Australian coal deposits, Mt



Thermal coal

- Thermal coal is primarily used in **electricity generation**
- Coal supplies **over one-third** of global electricity generation
- Mines are underground or open cut depending on the **deposit's geology**
- **Coal formation** began 290-360 million years ago

World consumption

55% China

14% India

8% United States

3% South Africa

3% Indonesia

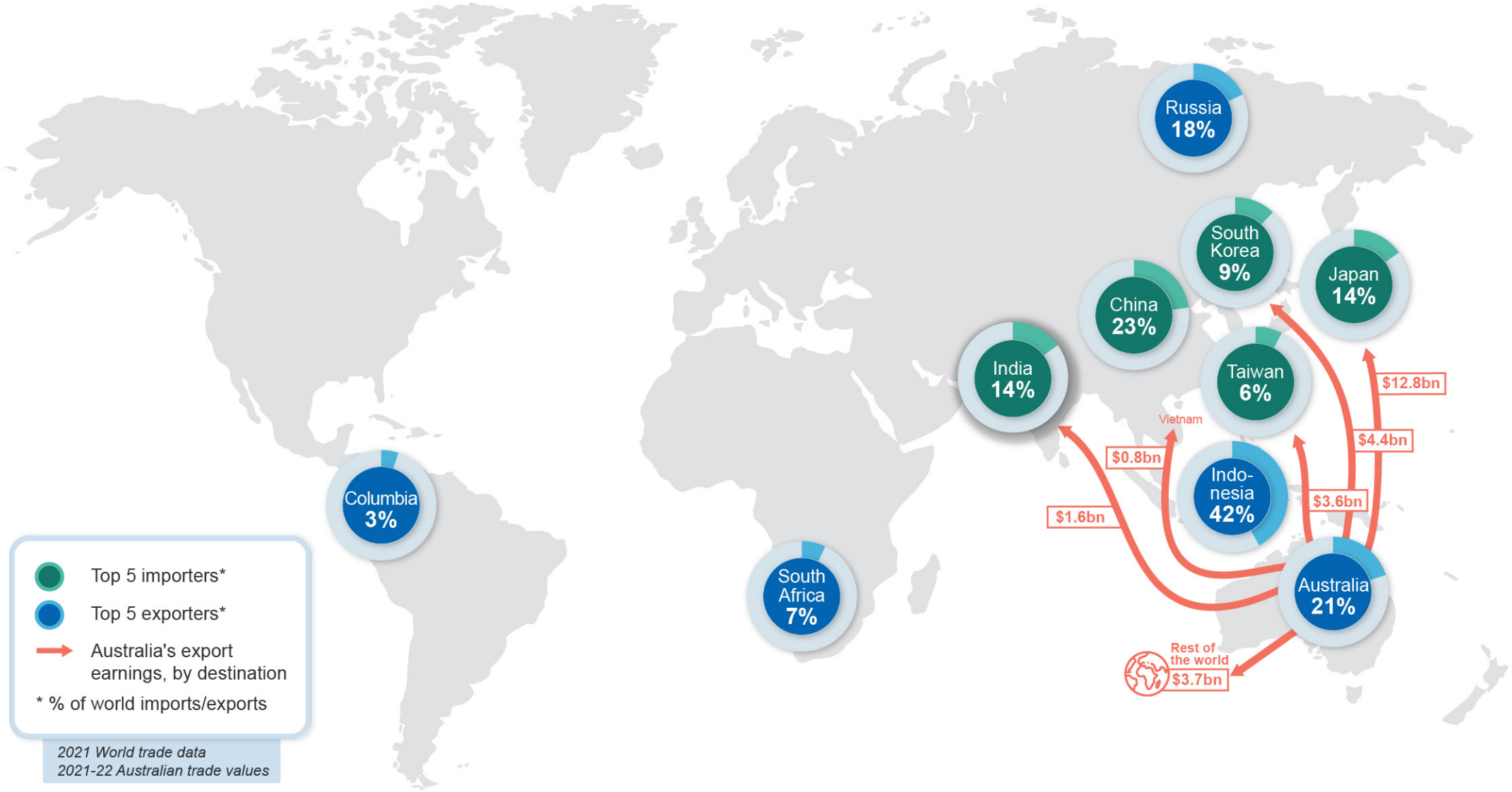
2% Japan

Australia's thermal coal

- **World's 2nd** largest **thermal coal** exporter
- **World's 4th** largest **black coal** resources
- **75-80%** of thermal coal **is exported**

Thermal coal

Trade map | September 2022



6.1 Summary

- Thermal coal prices remain extremely high, driven by weather and COVID-19 disruptions, as well as market uncertainties linked to the Russian invasion of Ukraine. As more normal conditions return, the Newcastle benchmark price is forecast to ease from an average of US$333 a tonne in 2022, to around US$125 in 2024 (still well above historical averages).
- A resolution of recent supply disruptions is expected to see Australian thermal coal exports increase from 192 million tonnes in 2020–21 to 203 million tonnes by the end of the forecast period (see Australia section).
- Record prices are expected to see export values reach $62 billion in 2022–23 before a (price-driven) easing to about $38 billion in 2023–24.

6.2 World trade

A return to 'normal' conditions in the coal market is not expected over the outlook period. A range of unusual factors remain in play, with most expected to persist for the foreseeable future.

Among these factors is the COVID-19 pandemic. Many of the impacts of the pandemic have eased (outside of China), but there is potential for renewed impacts if new and more dangerous variants of the virus emerge. China's ongoing zero-COVID policy could also lead to further economic and industrial shocks, with flow-through effects on commodity markets.

It is not clear how long the Russian invasion of Ukraine and subsequent sanctions against Russia will affect coal markets. The exclusion of large quantities of Russian coal from markets in the Northern Hemisphere could inflate coal prices for years to come. Several European Union member states and the UK have made preparations to increase coal-fired power generation in response to the reduced supply of natural gas from Russia. Announcements from Germany, Austria, France and the Netherlands suggest that over 10 GW of coal-fired power generation capacity has been placed on standby in Europe for the 2022-23 European winter.

Germany's Substitute Power Plant Maintenance Act (passed in July) imposes new limits on natural gas use and locks in existing coal capacity until the end of March 2024. The Netherlands has announced that 4.5 GW of coal-fired power plants will be permitted to operate at full capacity until the end of 2023 (previously, capacity utilisation at the plants had been limited to 35%). The UK Government has asked Uniper (which owns a coal plant at Ratcliffe-on-Soar) and EDF (which owns the two West Burton A units) to extend their plants beyond their previously planned closure in September 2022. However, the UK Government has not changed its overarching net zero timetable, which schedules complete closure of the nation's remaining coal generation by 2024. Broader European net zero target also remain unaltered.

Coal is being increasingly affected by global energy transition, with investment in new coal capacity continuing to decline. This lack of investment hampers the ability of coal producers to respond to high prices with additional supply. In the short term, these shortfalls may be exacerbated by shortages of skilled labour in some areas. In the longer term, it is likely to be exacerbated by the increasing average depth of deposits and falling coal quality, leading to a further, gradual tightening in affordable supply.

Weather disruptions, which have persistently affected coal supply over the past year, are expected to ease. However, risks remain in the form of the Indian Ocean Dipole and La Niña in the final months of 2022. The emergence of these weather patterns adds to the risk of supply disruptions, notably through the higher flood risk across eastern Australia.

Some less recent disruptions continue to affect markets. The primary impacts of Chinese informal import restrictions on Australia have passed, but the reworking of global trade routes continues to add to freight costs and distances in the seaborne coal market. Rumours of a Chinese policy change have circulated in recent weeks, but have not been supported by any official announcements at the time of writing.

Given the scale of these variables and the lack of clarity around their likely duration, a 'base case' for coal has become difficult to define. However, it

is expected that thermal coal prices will remain elevated and volatile through the outlook. Prices should ease to some extent as markets adjust (partially) to sanctions on Russia, and as weather conditions improve in the most affected parts of the world.

Trade volumes are expected to largely hold steady just below their pre-COVID level, with investment shortfalls and peaking demand continuing to constrain 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

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

Chinese thermal coal imports continue to trend down, partly as a result of rising domestic production in early 2022 (some of which has been maintained through to mid-year); and partly due to lower industrial activity as a result of COVID-19 containment measures.

Imports have also come under pressure, as the Government further prioritises reducing import dependency. Policies to this end include strict sale price controls on domestic production, acceleration of approvals for new or expanded domestic coal mines, investment in domestic coal transport, and expansion of coal-by-wire energy transfer. Investments in nuclear power, renewables and gas plants have also risen in recent years, as Beijing and provincial governments in China seek to reduce pollution and diversify their power grids.

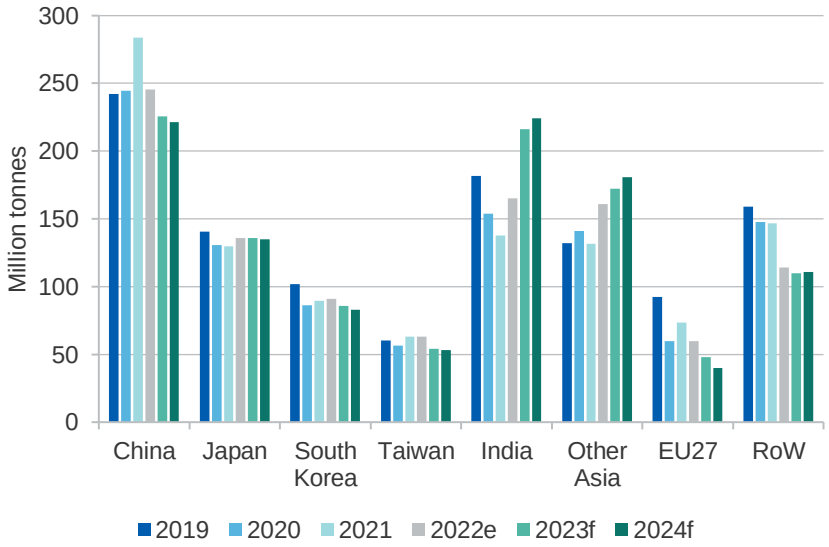
Imported thermal coal volumes are expected to keep falling. Imports are also expected to become more volatile as China's coal import share shrinks relative to domestic production. The Chinese Government has previously announced a target of an additional 300 million tonnes of coal from domestic assets in 2022. This would build on around 200 million tonnes of capacity added in 2021 (about three-quarters of which is thermal coal). This target is close to being reached, with domestic coal output up by 260 million tonnes over the first seven months of 2022 compared to the same period in 2021. The government continues to pressure domestic coal mines to speed up output, in order to deal with an unusually hot/dry Northern Hemisphere summer.

Some parts of China are also seeking to reduce coal consumption, potentially pushing a broader energy transition in China via policy and technology transfer. Notable cases include Hong Kong, where thermal coal imports fell by half in 2020 (partly in the wake of COVID-19, but also as a result of longer-running efforts to reduce carbon intensity).

In contrast however, Sichuan province recently hit a 2 year high in coal consumption as summer heatwaves combined with a drought pushed up energy demand while restricting hydro-electric output.

With strong pressure now being applied to increase domestic coal output, Chinese imports are expected to decline from 284 million tonnes in 2021 to 222 million tonnes by 2024 (Figure 6.1).

Figure 6.1: Thermal coal imports



Note: **f** Forecast

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

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

India is expected to continue growing in importance as a global thermal coal importer, progressively displacing China as Chinese imports recede (Table 6.1). India expanded its imports of Russian and Indonesian coal in mid-2022 to replace Australian coal, which has been increasingly directed to Europe at the expense of more price-sensitive Indian buyers. Indian imports are expected to come under some pressure in 2022 and 2023, as a result of high coal prices around the world. This may soften import growth, but it is not expected to lead to a fall in imports given the failure of Indian domestic coal output to grow in line with domestic electricity needs.

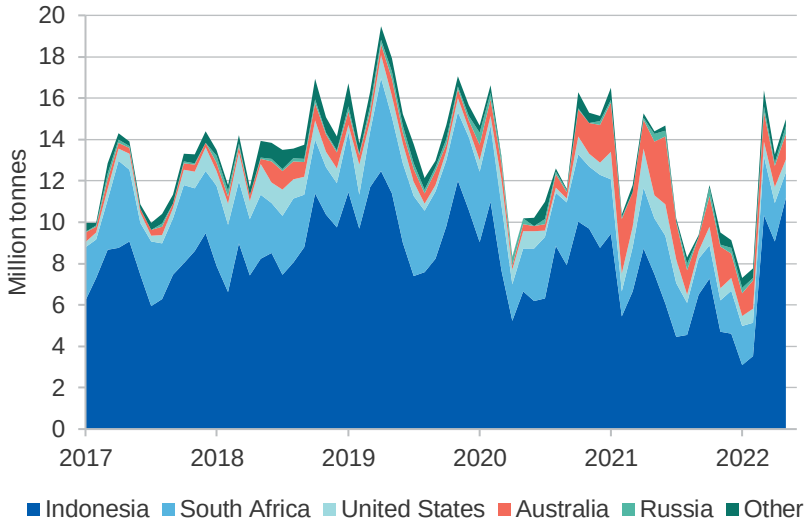
Demand and price pressures are likely to grow further as the Northern Hemisphere winter peaks. However, high prices and potential power curbs will likely constrain demand somewhat over the outlook period. Indian thermal coal importers are typically highly price sensitive, and are not expected to lift imports from the current high levels (Figure 6.2) during the final stages of 2022. Imports are expected to increase in subsequent years.

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

Coal remains important to Japan following the closure of most of its nuclear fleet. Of the 54 reactors taken offline after the Fukushima accident in 2011, only 10 have been re-connected to date. The closure of nuclear plants has increased Japan's reliance on coal, making it more vulnerable to coal price impacts which followed the Russian invasion of Ukraine. Japan's announced sanctions against Russia would obligate it to seek alternative sources of high quality thermal coal supply.

The pace of nuclear reactor connections is accelerating, with the Japanese Government increasing its push for re-openings. Recent opinion polls suggest more than half of respondents now favour use of nuclear power (the first such result for more than 10 years). The Japanese Government is prioritising a rapid 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.

Figure 6.2: India's thermal coal imports, monthly



Source: IHS (2022)

In the short-term, however, Japan remains coal-dependent, with thermal coal imports growing above expectations in recent months as extreme weather and tight inventories affect energy markets (Figure 6.3). Coal imports are expected to ease slightly during the outlook period, with scheduled coal plant closures and the completion of the country's final coal-fired power plant constructions offsetting each other.

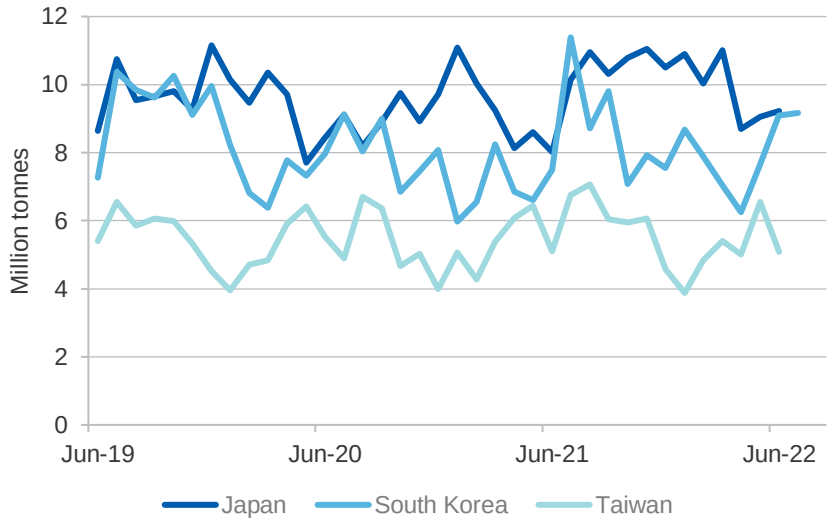
South Korean coal imports will face growing pressure

The conclusion of scheduled maintenance at several nuclear plants in South Korea during 2022 is expected to reduce pressure on coal plants. However, efforts to diversify away from Russian coal would increase demand for imports from other sources. South Korea's state utility (Korea Electric Power Corporation) has announced that orders for Russian coal have now halted. Previously, the company sourced about 10% of its imports from Russia. Other South Korean power generators are similarly seeking alternative suppliers, including from Australia. Despite this, South Korean coal imports from Russia increased in July, though the bulk of this

appears to have occurred under long-term contracts, with purchases from spot markets falling sharply.

Tight conditions in South Korean energy markets have pushed imports up in mid-2022 relative to the same period in 2021. On balance, it is expected that coal imports are peaking and will ease back slowly over the outlook period. The completion of maintenance at the remaining nuclear plants (alongside new nuclear plants coming online) should reduce pressure on South Korean coal imports from late 2022.

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



Source: IHS (2022)

Taiwan's imports are expected to start declining slowly

Taiwanese coal imports have risen in recent months, with the country importing 6.5 million tonnes of thermal coal in May — its highest monthly total to date in 2022. This is largely seasonal, reflecting the impact of the northern hemisphere summer just passed, and is around the same level as in May 2021. Coal demand likely peaked in June or July.

In the coming years, coal imports are likely to be somewhat constrained. Taiwan has abandoned plans to upgrade its coal fleet, opting instead to convert existing coal plants to using gas. Given the age of Taiwan's coal fleet, it is expected that coal imports will begin a long-term decline over the next few years.

South East and South Asia imports are set to grow

Markets in South and South-East Asia remain the key growth centre for thermal coal (Figure 6.4). The pipeline of proposed coal capacity across South Asian countries fell by 63% between 2015 and 2021, but a sizeable number of plants remain under construction. South Asian countries have not shown significant interest in targeting Russia with sanctions. Nations in the region (excluding India) collectively import about 150 million tonnes of thermal coal each year, and this is expected to rise over the outlook period (Figure 6.4).

With significant coal-fired capacity under construction, the Philippines is expected to require more coal over the next three years. Imports in April and May were above the level of a year ago: this increase is partly structural, reflecting higher quantities of coal burning capacity. Imports are expected to grow each year of the outlook period, with coal consumption expected to double by the time of its peak, around 2030.

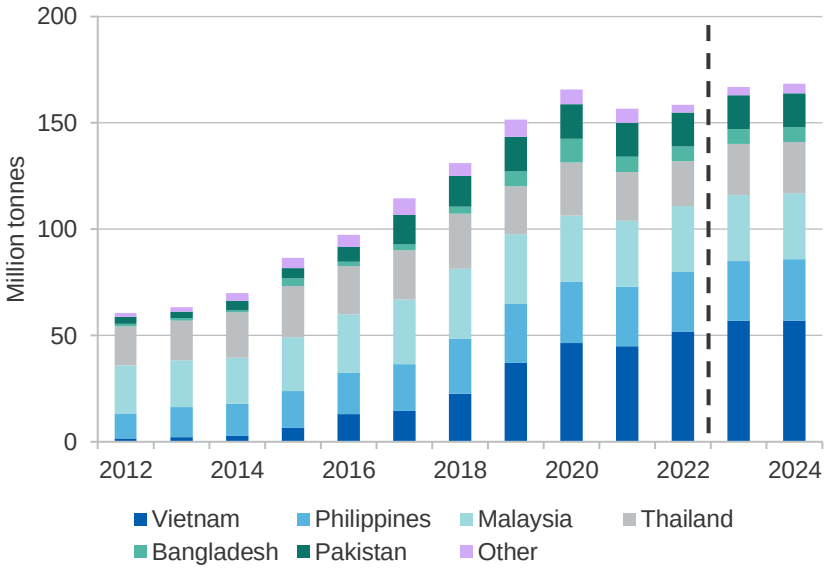
Thailand's coal imports are rising in line with growing demand from the country's industrial sector, which has been led by a rapid expansion in cement production. Imports rose sharply in February, but subsequently eased back slightly, remaining relatively high in April and May. However, coal plant construction has largely come to a halt, with proposed plants cancelled in the Krabi and South Songkhla provinces. Official policy announcements support a reduction in coal use, but mostly beyond the outlook period.

Coal reserves in Vietnam tend to be located in areas of substantial population density, rendering them 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 increase as

coal plants currently under construction are completed. However, plants at the pre-construction stage have largely been abandoned, meaning that the peak in Vietnamese coal imports will be sooner and lower than previously thought.

Most East Asian governments have expressed intentions to move away from coal imports, but the process is likely to be complex in practice. Security of supply remains a key requirement for countries in the area, and coal is likely to remain important given the surge in gas/LNG prices and reduction in global gas supply following the invasion of Ukraine. Coal imports are expected to rise in key countries over the outlook period, and no fall is expected across the South Asian region in the near term.

Figure 6.4: South and South East Asia thermal coal imports

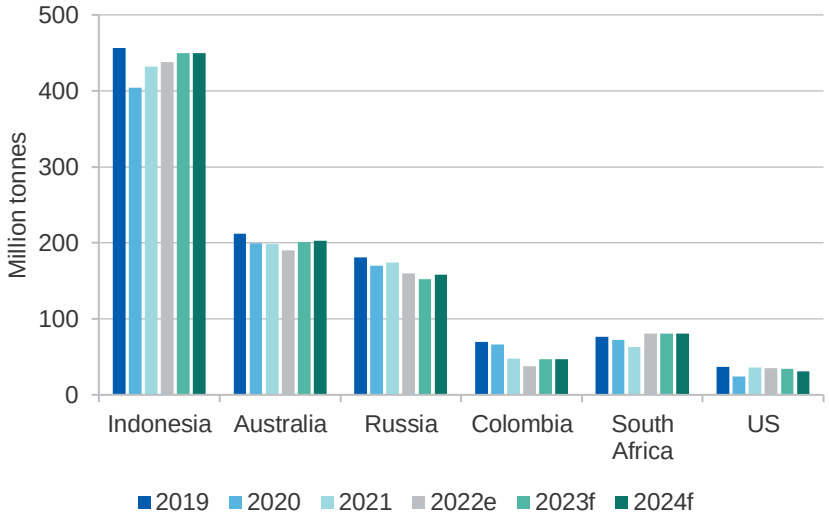


Source: IEA (2022) Coal Information; Department of Industry, Science and Resources (2022); IHS (2022)

6.4 World exports

Global supply chains have reorganised twice in recent months: once following the imposition of Chinese informal import restrictions on Australia, and again following the imposition of sanctions on Russia. Coal supply chains have lost a degree of efficiency as a result, with the higher costs and distance exacerbating the impact of other disruptions to global seaborne trade. Australia and Indonesia are expected to maintain a dominant position in global coal markets through the outlook period, with Russia losing some market shares (Figure 6.5).

Figure 6.5: Thermal coal exports



Notes: **f** Forecast.

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

Over time, extended high coal prices will likely see coal losing competitiveness relative to other energy sources, with implications for its long-term viability. However, Australian coal, which is high quality and low-cost, retains a strong competitive advantage. And high prices are producing a bonanza for many existing coal mines around the world.

Indonesia's exports remain solid despite temporary disruptions

Indonesian exports rose in April and May following a policy-driven plunge in January, and are now above the level of a year ago. Exports over 2022 YTD are around the same level as in 2021, but higher prices have more than doubled coal export revenue to Indonesia. These high prices are expected to mostly hold up over the coming months, though the discount between the Indonesian benchmark and the Newcastle benchmark has widened recently. This widening reflects the importance of Australian coal to European plants, which would potentially suffer from degraded performance if lower calorific coals were used.

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

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

Russian exports have likely passed their peak, with European importers having stocked up ahead of the commencement of EU sanctions. The imposition of these sanctions (in August) is expected to see Russian coal exports to most of Europe drop to virtually nil. This freeze could potentially last for years, and could be magnified by similar announcements from Japan and the US. Informal sanctions from companies in other parts of the world will further lift the quantity of Russian coal pushed out of global markets.

Partially offsetting this, Russian exports to India, China and South Asia are expected to rise, but limits on infrastructure will likely prevent anything close to a full substitution. This will result in a long-term fall in volumes available to the global coal market, and a lift in the long-run floor price for thermal coal, especially at the higher grades where most Russian output sits.

Russia has significant coal reserves, but extraction is largely concentrated in the Kuznetsk Basin, which has infrastructure connections to ports in the Black Sea and the Pacific. Infrastructure constraints continue to affect coal in other regions, and sanctions on equipment supplies to Russia will likely magnify this impact.

The duration of the war and the sanctions remain unclear, and it remains possible that sanctions could persist even in the absence of active war. The resulting lack of essential engineering and maintenance equipment will add to the risk premium for Russian coal, as will the likely curtailment of a range of possible investments in Russian mines.

Russian exports are not expected to recover over the outlook period, and trade flows are not expected to return to their pre-war patterns. EU governments are seeking (through numerous means) to permanently offset their dependency on Russian energy exports, and these efforts are likely to curb trade flows between Russia and Europe substantially.

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, feeding markets mostly when prices are strong. US output fell sharply in 2020, but has recovered in the wake of surging prices in 2021 and 2022. Sales to Europe in the first half of 2022 were particularly strong, as European countries attempted to substitute for Russian coal and gas.

It is likely that some of the factors driving high prices will ease over the outlook period, reducing the incentive for marginal US suppliers. With investment now heavily constrained, it is likely that mine closures will result in permanent reductions in coal extraction in the US. However, recent rapid closures of domestic coal plants will indirectly support export markets for a time, with most of the initial fall in coal output being offset by lower

domestic demand. Mines that remain open will become more export oriented, potentially increasing their vulnerability to long-running issues around the cost and quality of US coal. These issues remain masked by high coal prices for the time being.

Shipments from California are expected to end within four years, following an announcement that the Levin-Richmond terminal will halt coal exports from its facilities by 2026. Coal exports from the eastern states (which typically support the Atlantic market) are high-cost even by US standards. The push by EU countries for alternatives to Russian coal will assist Atlantic exporters temporarily, but closer integration to the European market brings risks given the EU commitment to net zero targets and the long-term phase out of thermal coal.

On balance, the US appears now to be in the midst of an export peak, supported by high prices and surging 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

Like the US, Colombia is a relatively high cost exporter, which has similarly benefited from the recent surge in prices and the imminent exclusion of some Russian coal from the market. Colombian exports are being sought to meet European demand, and this should underpin solid volumes over the outlook period.

Some mines, such as the Prodeco and CNR projects, continue to ramp up output. Other mines, including La Jagua and Calenturitas, remain out of operation, but could return to active use — with the country's National Mining Agency attempting to seek potential buyers and investors. 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 European demand. However, with some mines having been permanently closed in recent years, it is not expected that pre-COVID export levels will be reached.

Exports from other countries face mixed prospects

South African exports remained steady in 2022 despite infrastructure constraints. Thermal coal shipments to the Richards Bay Coal Terminal (which exports the majority of coal from South Africa) have been hampered by rail issues and other disruptions. Export volumes from the port fell to a 25-year low in 2021. As yet, Transet, (which owns and operates the associated rail network), has not managed to restore full capacity. However, the decline at Richards Bay has been partly offset by very strong export results at South Africa's other ports.

South African export markets have shifted over time. During the 10 years to 2020, South African exports withdrew from the declining European market, finding new markets in South Asia. This was partially reversed in the wake of the EU sanctions against Russia, with Richards Bay coal pricing becoming increasingly important in the Atlantic market, despite persistent technical issues at the port.

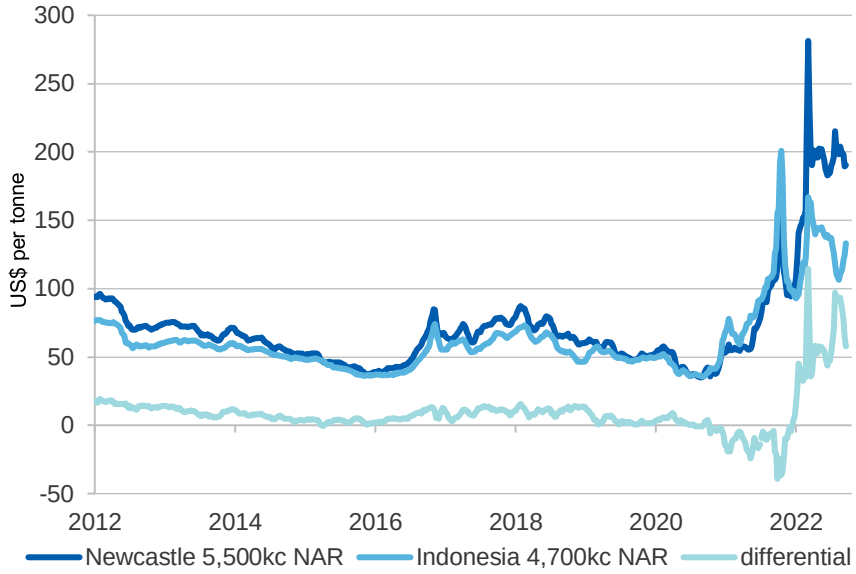
In Canada, both major export mines (Bighorn's Vista and Westmoreland's Coal Valley) continue to perform solidly. Both are relatively new mines, with production at Coal Valley having restarted only at the end of 2021. Canada's coal exports may be constrained by policy commitments, including a proposal to cancel all new thermal coal mines, and a commitment to cutting thermal coal exports to zero by 2030. Over the outlook period, however, export prospects look relatively solid, supported by a ramp-up at Coal Valley.

6.5 Prices

Prices are expected to continue to be relatively high and volatile

Supply shortages continue to send thermal coal prices to record levels in 2022. As previously noted, shortages are the product of a string of disruptions from COVID-19, weather events, the fallout from the Russian invasion of Ukraine, and a shortage of new investment. The price impact on higher grade coals has been greater, increasing their price differential relative to lower grades. This reflects the requirement for many European plants for access to high-calorific grades.

Figure 6.6: Thermal coal prices — Australian vs Indonesian



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

Many of these factors are likely to be long-term and structural, resulting in high and volatile prices for thermal coal over the foreseeable future. However, issues with social licence, insurance, finance and government policy are expected to persist, preventing a major supply increase despite the high prices on offer.

In quarterly terms, prices are expected to peak at US$385 a tonne in the September quarter, declining to $US325 a tonne in the December quarter. Prices are expected to continue easing slowly, finally falling below US$200 a tonne by the end of 2023. Prices are expected to remain above their long-term average out to 2024 and beyond.

6.6 Australia

Australian thermal coal exporters face volatile conditions in Q4 2022

Coal shipments from Australia have not picked up significantly in the first half of 2022, despite some easing in disruptive weather events, which included severe flooding in NSW and Queensland. There is a risk that output will be constrained further over the rest the year and into 2023, as a result of two further ongoing weather events: the Indian Ocean Dipole and the emerging La Niña. Both of these are typically correlated with high rainfall across eastern Australia, where coal operations have already faced months of flooding and lengthy mine de-watering.

Flood issues are still ongoing in some areas, including Maitland and the Hunter, where transport continues to face impacts from repeated cycles of heavy rain. Transportation services in the Hunter now appear to be resuming, but fresh flooding is creating new issues for thermal coal exports in nearby areas early in 2022–23, with significant impacts on mines and transport in July.

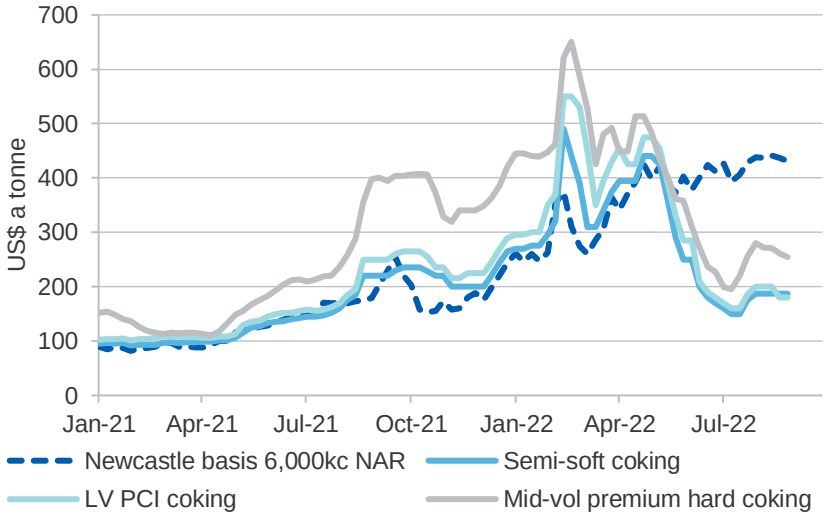
Australian coal remains highly profitable, with high prices (Figure 6.6) and reasonable volumes persisting despite weather disruptions. Volumes are expected to sustain through the outlook period, with a drawn-out peak over the next few years. Output is expected to be constrained in the longer term by a lack of progress in bringing new mines online. However, high prices will support maximum production at existing mines through the outlook period. Some volume growth is also expected in the early part of the outlook, as output ramps up at the Carmichael mine in Queensland.

Contract price negotiations between Glencore and Nippon Steel in Japan have concluded, with the agreed contract price for the year to March 2023 increasing from around US$120 a tonne to US$375 a tonne. This is the highest contract price ever agreed between the two parties, and reflects the impact of the Russian invasion of Ukraine and its spill over to gas and coal markets. The agreement may also affect negotiations between Glencore and Tohoku Electric, whose contracts are often seen as a benchmark price for the wider Asian region.

China's informal import restrictions on Australian coal are assumed to remain in effect through the outlook period. Although rumours have emerged that changes to the current policy are under consideration, at the time of writing there has been no formal announcement suggesting any change.

Australian coal remains in high demand in the wake of the Russian invasion of Ukraine, with Australia being the primary alternative supplier for higher coal grades. This has led to additional price pressure among higher grade products (Figure 6.7) and is likely to see a larger share of Australian coal directed to Europe over time. Japan and South Korea have also expressed interest in more imports of Australian coal, and may draw on contractual rights that would provide them with access ahead of European importers.

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



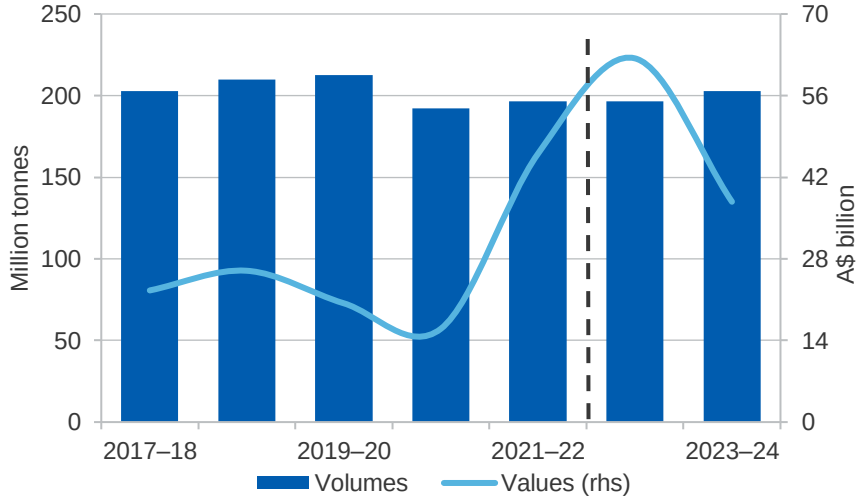
Source: IHS Markit (2022)

Export volumes are expected to increase marginally over the outlook period (Figure 6.8). However, prices will likely remain subject to significant volatility, with a gradual ebbing in the huge growth that followed the Russian invasion of Ukraine. Export values are forecast to rise from $46 billion in 2021–22 to more than $62 billion in 2022–23, before easing to $38 billion by 2023–24.

Revisions to the outlook for Australian thermal coal exports

The forecast for export earnings has been revised up by around $22 billion (nominal terms) in aggregate over the forecast period. Thermal coal export earnings are now expected to be around US$100 billion over the full outlook period. Revisions reflect the confirmation of a new 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.

Figure 6.8: Australia's thermal coal exports



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

Table 6.1: World trade in thermal coal

	Unit	2021	2022[f]	2023[f]	2024[f]	Annual percentage change 2022[f]	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	190	201	203	-3.2	4.4	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

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

Table 6.2: Thermal coal outlook

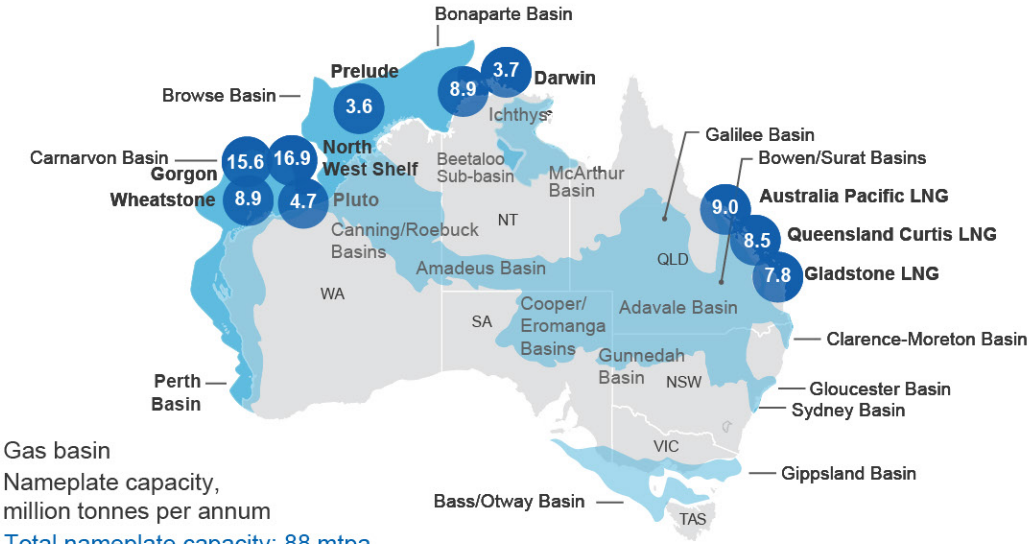
						Annual percentage change		
World	**Unit**	**2021**	**2022[f]**	**2023[f]**	**2024[f]**	**2022[f]**	**2032[f]**	**2024[f]**
Contract prices[b]								
– nominal	US$/t	110	203	150	129	84.7	-26.3	-14.0
– real[c]	US$/t	118	203	146	123	72.8	-28.0	-15.8
Spot prices[d]								
– nominal	US$/t	135	333	232	125	147.0	-30.2	-46.0
– real[e]	US$/t	145	333	225	119	129.4	-32.3	-47.2
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	197	197	203	2.4	0.9	2.1
– nominal value	A$m	16,009	46,006	62,391	37,798	187.4	35.6	-39.4
– real value[h]	A$m	17,890	49,223	62,391	36,267	175.1	26.8	-41.9

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

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

Gas

Australia's LNG projects and gas basins



Gas basin
Nameplate capacity, million tonnes per annum
Total nameplate capacity: 88 mtpa

Gas facts

- LNG is produced by **cooling natural gas to -161°C**
- **LNG shrinks** to 1/600th the volume of natural gas
- Natural gas accounted for **23%** of the 2020 global electricity generation mix
- **Over 73%** of global LNG demand came from Asia in 2021

Global gas use by sector

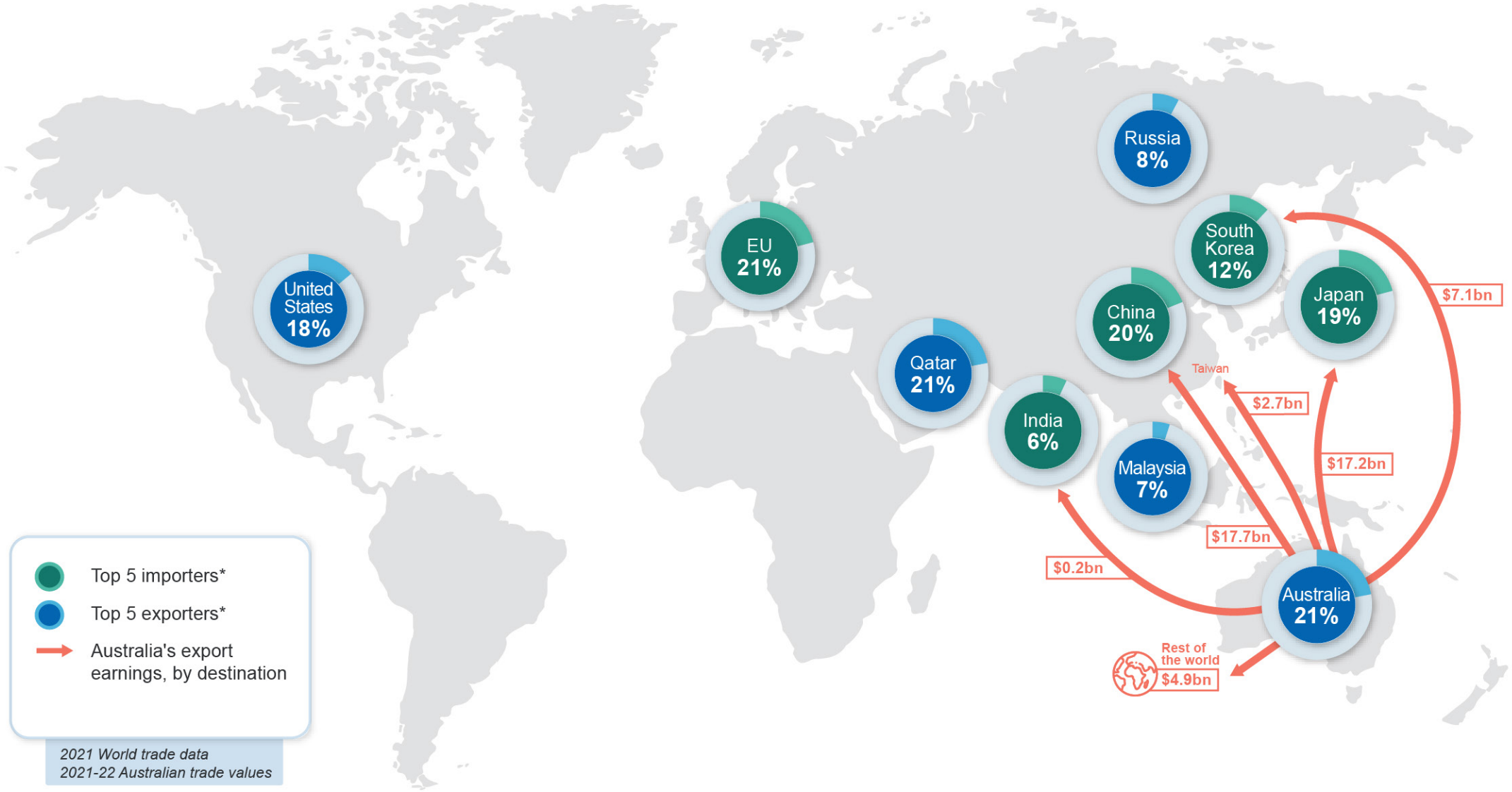
- **40%** Electricity
- **22%** Residential
- **20%** Industry
- **19%** Transport

Australia's LNG

- **81m tonnes** exported in 2021,valued at **$50bn**
- **88m tonnes** per annum **total LNG nameplate capacity**
- **Around 3/4** sold on **long-term contracts**

LNG

Trade map | September 2022



7.1 Summary

- Australia's LNG export earnings are forecast to rise from $70 billion in 2021–22 to $90 billion in 2022–23, as the fallout from Russia's invasion of Ukraine continues to place upward pressure on LNG spot prices.
- Australia's LNG export volumes are forecast to ease and stabilise at around 81 million tonnes (Mt) through to 2024, after reaching 83 Mt in 2021–22.
- Spot prices for Asian LNG are expected to reach over US$ 49 per million British thermal units (MMBtu) in the December 2022 quarter as Europe attempts to replace pipeline gas curtailed by Russia. Prices are forecast to average US$ 45/MMBtu and US$ 44/MMBtu in 2023 and 2024.

7.2 World trade

LNG earnings rise as European gas crisis reverberates to Asia

Global LNG prices remain elevated (and highly volatile) as the fallout from Russia's invasion of Ukraine continues. The outlook for LNG markets remains highly uncertain, as geopolitical events have become the key driver behind global price formation.

Declining Russian pipeline gas exports to Europe, which have fallen dramatically since mid-June, are behind the worsening global outlook. Russian gas flows to Europe have fallen 78% year-on-year from 373 million cubic meters per day (mcm/d) in September 2021 to 81 mcm/d in September 2022. If the current flows are sustained for a year, Europe could lose roughly 78 Mt of LNG-equivalent gas. This figure is roughly equivalent to 21% of the global LNG trade in 2021 or 92% of Australia's total LNG exports in FY21 –22 (see section 7.3 – World imports).

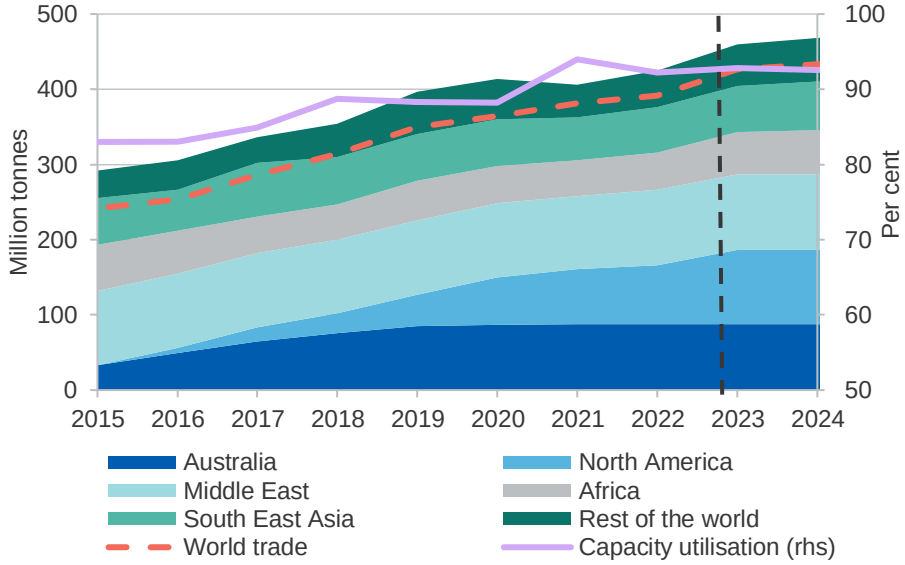
Crucially, Russia lacks the infrastructure needed to re-divert this gas to countries outside of Europe, and the global LNG trade is only expected to grow by 41 Mt between 2022 and 2024 (Figure 7.1). As a result, global gas markets are expected to be tight for the duration of the outlook period, with large-scale demand destruction inevitable if current conditions endure.

Fears of a gas shortage in Europe have sent buyers scrambling for the world's remaining uncontracted LNG cargoes. Amidst the rush, Asian customers now face the grim prospect of competing with desperate European importers (see section 7.4 – World exports).

Our forecast earnings remain heavily contingent on political developments in Europe. Australia's higher forecast earnings will be transient if Russia restores European gas flows. But should the flows continue to fall, earnings could rise higher.

There appear to be signs of a surge in US LNG investment beyond the outlook period. There are now enough proposed US LNG facilities to effectively triple the US's installed capacity to 240 Mt by the end of the decade (See section 7.4 – World exports). If viable, the proposed facilities could bring much-needed respite to global gas markets over the long-term.

Figure 7.1: Global LNG capacity and world trade, 2015-2024



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

7.3 World imports

High prices and lockdowns weigh on Chinese LNG imports

Chinese LNG imports fell 14.5 Mt in the June quarter 2022, down by 28% from June quarter 2021. While total Australian imports are down 3.1 Mt year-on-year, Australia's share of total Chinese LNG imports has remained steady at 38% (Figure 7.2).

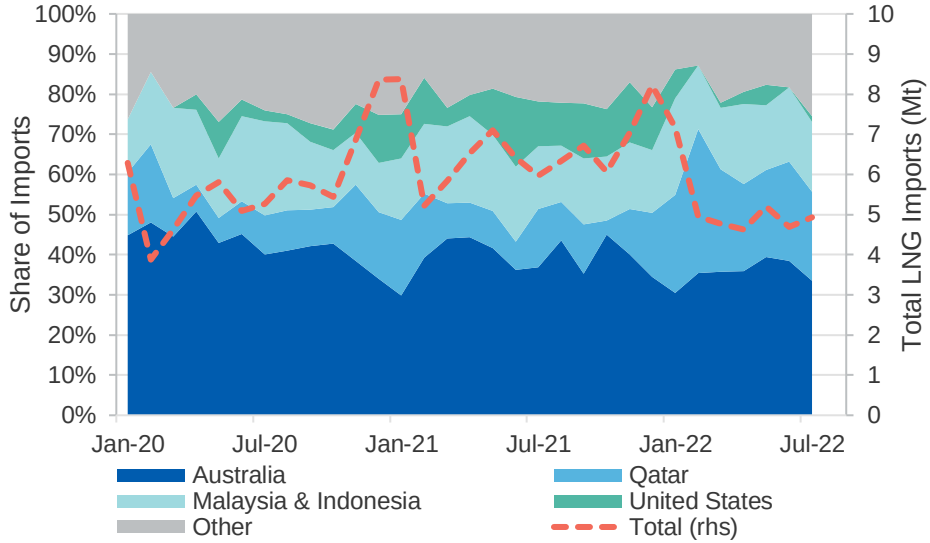
Falling Chinese LNG demand in the June quarter 2022 can be attributed to the combined impact of high LNG spot prices and COVID-19 lockdowns on industrial gas demand. But the re-emergence of Chinese LNG buying in the closing stages of 2022 could place global markets under further strain. Much depends on whether Chinese LNG buyers become more price sensitive than buyers from other parts of Asia.

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 (15%). 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.[1]

The diversity of China's gas consumers and gas supply sources could increase the price elasticity of Chinese LNG demand at such extreme prices. For example, China's industrial users may become more price sensitive due to their exposure to international competition, while the availability of alternative gas supply could also make industrial users reluctant to purchase uncontracted LNG cargoes. As a result, there is a possibility that Chinese demand for LNG will remain muted even as the nation emerges from lockdowns.

Over the long-term, persistently high LNG prices will erode the competitiveness of LNG relative to other natural gas sources — be it domestically produced or pipeline imports. As a result, Chinese LNG demand is forecast to fall by 19% to 67 Mt in 2022, with imports only modestly recovering to 79 Mt by 2024.

Figure 7.2: Chinese LNG imports by volume and source



Notes: July 2022 data as of the 8 August
Source: Kpler (2022)

Japanese imports rally amidst record temperatures

Japanese LNG imports in the June quarter 2022 were up by 8.5% year-on-year to reach 17.6 Mt (and compared with 15.8 Mt in the March quarter 2021). Australian LNG exports to Japan rose 32% over the same period, reaching 7.8 Mt in the June quarter 2022 (compared with 5.9 Mt the year before). Rising Australian exports helped offset falling LNG imports from the US and Qatar, which collectively fell by 54% year-on-year, from 3.1Mt to 1.4Mt in the June quarter 2022.

[1]Nexant WGM

Increased Japanese LNG imports can be attributed to a severe heatwave, which kept daytime temperatures well above the seasonal averages in June.[2] Higher temperatures increased the reliance on gas-powered generators to provide electricity for cooling demand and even prompted Japan's Ministry of Economy, Trade and Industry (METI) to urge 37 million citizens to switch off unnecessary lighting.[3]

Unlike China, Japan obtains virtually all of its gas via LNG imports, and its gas consumption is heavily concentrated in the power generation sector, which accounts for roughly 70% of Japanese gas demand.[4] As a result, Japanese LNG imports are much more sensitive to weather-related changes in electricity demand and the competitiveness of gas relative to other types of power generators.

LNG imports are expected to fall to about 70 Mt in 2024 as the electricity sector shifts away from gas (Figure 7.3). According to METI, Japan plans to reduce gas' share of electricity generation from 38% in 2022 to 27% by 2030, while nuclear's share rises from 6% to 22% over the same period.

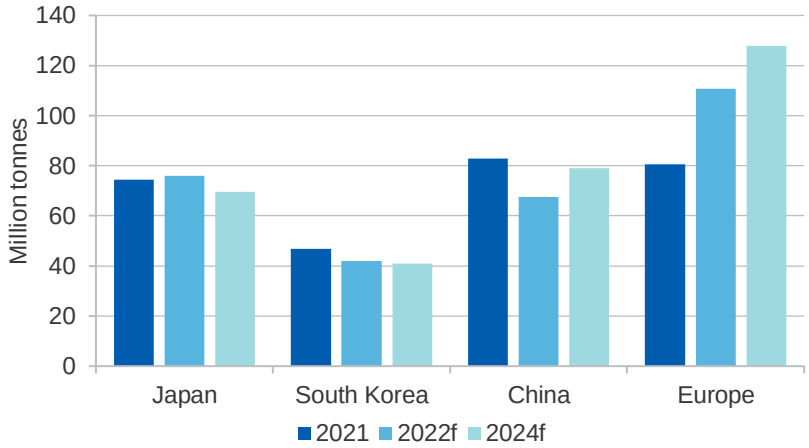
South Korean imports remain steady amidst high prices

At 9.5 Mt, South Korea's LNG imports in the June quarter 2022 were unchanged from the March quarter 2022, rising only 1.4% year-on-year. However, Australian exports to South Korea have risen 48% over the same period, reaching 2.3 Mt (up 0.7 Mt since the June quarter 2021). As with Japan, Australian LNG appears to be filling the gap left by lower US imports, which dropped by 0.7 Mt year-on-year in the June 2022 quarter.

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, the South Korean government suspended voluntary emission restrictions on coal-fired power generators. However, LNG demand has remained in line with seasonal trends, due to persistently higher demand for electricity during the summer season. High gas prices and the construction of new nuclear facilities will restrain growth in South Korean LNG imports. As a result, LNG imports are estimated to fall slightly to 41 Mt by 2024 (Figure 7.3).

Figure 7.3: World LNG demand forecasts



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

Europe on the brink of crisis as Russia cuts gas supply

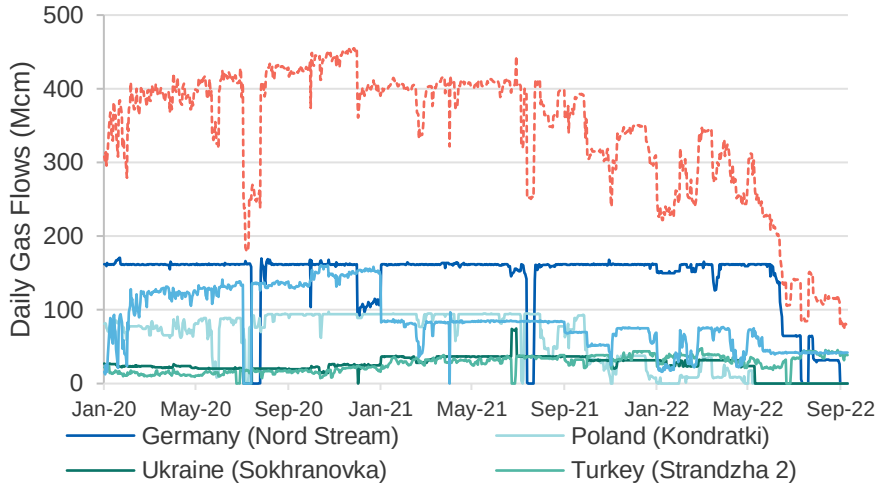
Europe's energy security has deteriorated significantly since the June *Resources and Energy Quarterly* report. In recent months, Europe has experienced a dramatic reduction in its pipeline imports from Russia (Figure 7.4) and a temporary disruption in LNG imports from the United States. The latter is due to issues encountered at the US Freeport LNG facility (see section 7.4 – World exports), and the former is due to deliberate disruptions of Russian gas exports via the Nord Stream and Yamal-Europe pipeline.

[2] Argus, Argus Global LNG- July 2022, pg. 8

[3] BBC, *Japan urges 37 million people to switch off lights,* 27 June 2022

[4] Nexant WGM

Figure 7.4: European pipeline imports from Russia, 2022

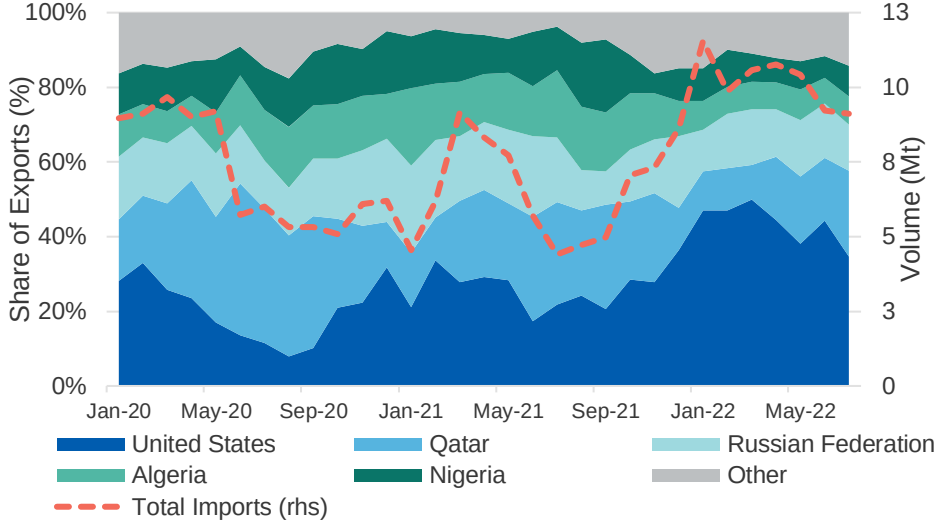


Note: Figure only includes major transmission pipelines for Russian gas exports to Europe. Flows from Strandzha 2 will include some non-Russian volumes.
Source: ENTSOG Transparency Platform

European pipeline imports from Russia declined considerably during the June quarter 2022. Total imports fell by almost 78% in September 2022 year-on-year, dropping from 373 to 81 million cubic meters per day (mcm/d). However, the recent reduction in German pipeline imports has been the most dramatic, with flows falling from 162 mcm/d on 1 June to zero by 1 September (Figure 7.4).

The rapid decline in pipeline imports can be attributed to several decisions made by either the Russian government or its state-owned company, Gazprom. First, in May, Russian authorities prohibited gas deliveries to Poland via the Yamal-Europe pipeline, to sanction Poland's pipeline operator, EuRoPol Gaz. Then, in early June, Gazprom claimed that "safety issues" at the compressor station powering Nord Stream 1 pipeline necessitated a reduction in gas flows to Germany. Gazprom had initially claimed that European sanctions had prevented the company from re-importing the gas turbine from Canada to power the compressor station.

Figure 7.5: European LNG imports by volume and source, 2020-22



Source: Kpler (2022)

However, after securing an exemption to the sanctions in July, Gazprom refused to re-import the turbine and halved the remaining flows along the pipeline citing additional "safety issues" with a second turbine. In late August, Gazprom shut down the last remaining turbine after uncovering an oil leak. However, spare capacity on other pipelines, such as the Sudzha and Sokhranovka pipeline in Ukraine is not being utilised to make up for the shortfall. The motivation for cuts is clearly political and thus makes these crucial exports totally dependent on the mood in the Kremlin.

While Europe has become increasingly dependent on US LNG in 2022 to replace Russian pipeline gas imports, production issues at the Freeport LNG facility have weighed on US exports in recent months (see section 7.4 – World exports). This saw European LNG imports in the June quarter fall 4.9% quarter-on-quarter to 30 Mt.

Despite European efforts to replace Russian pipeline gas with LNG, Russia remained Europe's third-largest LNG supplier in the June quarter 2022, accounting for 14% of Europe's total LNG supply. So far, Russian

LNG imports have remained consistent year-on-year, but the possibility of future Russian curtailments cannot be discounted (Figure 7.5).

This has all occurred amidst urgent efforts by Europe to fill its gas storage before the coming 2022–23 winter. As of 23 September, European storage inventories were approximately 87% full and had already exceeded the legislated target of 80% by November (Figure 7.6).

But given the huge disruptions to Germany's pipeline supply and infrastructure bottlenecks constraining the flow of gas from Western Europe to Central Europe, there is a possibility that full storage inventories will not guarantee Europe's energy security come winter.

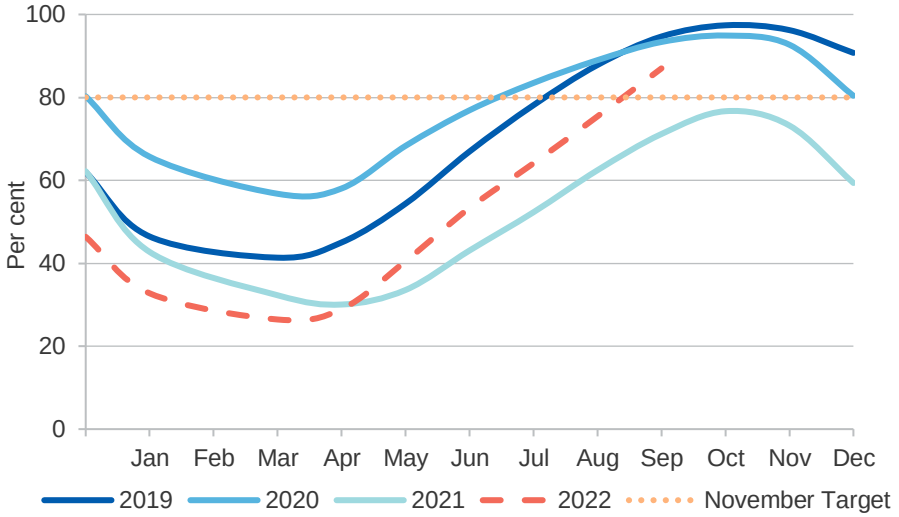
During a typical European winter, Russia supplies around 6,000 gigawatt hours of gas per day to Europe (GwH/d). Gas from underground storage provides about 4,000 GWh/d on average, which can be ramped up to 10,000 GWh/d to meet peak day demand.[5] So while storage inventories may be able to offset Russian imports initially, there may not be enough total storage capacity to sustain these offsetting flows for the entire winter.

The European Commission has outlined a proposal to reduce gas usage by 15-20% by next spring to help alleviate the coming shortage.[6] Meanwhile, Klaus Muller, head of Germany's Federal Network Agency, has explicitly stated, "If [Germany] fails to reach our [15%] target, then there is a serious risk that we will not have enough gas".[7]

However, the composition of European gas users will make it difficult for the EU to curtail its ex-industrial gas demand because half of Europe's gas is consumed in sectors where demand is highly price inelastic. Roughly 32% (188 bcm) of Europe's gas is consumed to generate electricity, and 26% (151 bcm) is consumed by the residential sector for space heating.

After the power and residential sectors, the third largest consumer is the Industrial sector, with roughly a 20% (118 bcm) share of consumption.[8]

Figure 7.6: European Storage Inventories, 2019-22



Source: Eurostat (2022)

Drought conditions in Europe have also significantly depleted reservoirs needed to power hydroelectric dams and have compromised coal transport along the upper section of the Rhine. It is conceivable that these two factors, if combined with an unusually cold winter, could increase the call on gas for space heating and power generation rather than reduce it.

In the event of a shortfall, EU regulations clearly state that households and gas-powered generators are to be given priority over other gas

[5] ENTSOG, *Winter Supply Review* 2020/2021, 8 October 2021, pg.23,32

[6] European Commission, Save gas for a Safe Winter, 20 July 2022, https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4608

[7] Financial Times, *Germany must cut gas use by 20% to avoid winter rationing*, 14 August 2022,

[8] Nexant WGM: Note aggregate figures include Turkey

consumers. Industrial users are encouraged to reduce their consumption by taking demand-side measures to restore market balance.[9]

The combination of adverse shocks paints an increasingly bleak picture of the outlook for European gas security, particularly for industrial gas users in Central Europe who were heavily dependent on Russian volumes. As a result, European LNG imports are forecast to rise 43% year-on-year, reaching 111 Mt in 2022. Imports are expected to peak at 126 and 128 Mt in 2023 and 2024, respectively, as infrastructure bottlenecks begin to limit the continent's ability to absorb additional LNG imports.[10]

Taiwanese imports remain stable

Taiwanese LNG imports were stable at 4.9 Mt in the June quarter 2022, rising only 1% year-on-year. Australian LNG exports to Taiwan rose 25% (0.35 Mt) to 1.76 Mt over the same period. Unlike Korea and Japan, Australian LNG exports mainly displaced Russian and Malaysian LNG, as US exports to Taiwan held steady at 0.7Mt.[11]

All of Taiwan's gas is supplied 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.[12]

Taiwanese imports in the June quarter 2022 were supported by the need to rebuild storage inventories to prepare for peak summer cooling demand. Taiwanese LNG imports are expected to stabilise at around 20 Mt per annum over the outlook period.

India remains price sensitive

Hot weather and a scarcity of coal appear to have boosted recent Indian LNG demand. Indian LNG imports rose by an unseasonal 14% in the June quarter 2022, reaching 5.7 Mt despite record high LNG prices. Indian LNG imports are forecast to fall from 24 Mt in 2021 to 22 Mt by 2024, as high prices weigh on demand.

7.4 World exports

US LNG redirected to Europe amidst market reorganisation

US LNG exports reached 19.5 Mt in June quarter 2022. While this was 11% higher than the June quarter 2021, volumes were 4.4% lower than the March quarter 2022, due to issues at the Freeport LNG facility.[13]

In April 2022, Freeport LNG underwent planned maintenance that took out approximately 0.5 Mt of LNG capacity. Then 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. The facility is only expected to resume normal operations in mid-November, which will significantly weigh on US exports in H2 2022.[14]

In the June quarter 2022, 63% of all US LNG exports (or around 15 Mt) were destined for Europe (Figure 7.7), with the remainder exported to Asia (25%) and South America (12%). The result contrasted heavily with the June 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 Russia's invasion of Ukraine. (see section 7.5 – Prices)

[9] European Parliament, *Regulation 2017/1938 concerning measures to safeguard the security of gas supply*, Articles 23-25, http://data.europa.eu/eli/reg/2017/1938/oj

[10] Europe's total LNG import capacity is 184 Mtpa, but approximately 55 Mpta is located in the Iberian Peninsula where there are few interconnecting pipelines to continental Europe. An additional 35 Mpta is located in the UK, which must transit through heavily contracted pipelines in Belgium and the Netherlands to reach Central Europe.

[11] Kpler

[12] Nexant WGM

[13] Kpler

[14] gCaptin, Freeport LNG set to resort Production at Key LNG export Facility, 5/8/2022

The US is forecast to export 75 Mt of LNG in 2022,[15] with the fall in LNG production from Freeport LNG partially offset by new facilities at Calcasieu and Sabine Pass. The two facilities are expected to add 12 Mt to the United States' nominal liquefaction capacity over the outlook period. This will help lift US LNG production to 92 Mt in 2023 (Figure 7.8).

Meanwhile, two more facilities under construction (Golden Pass and Plaquemine's LNG phase one) are expected to boost US LNG capacity to 114 Mt 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.[16]

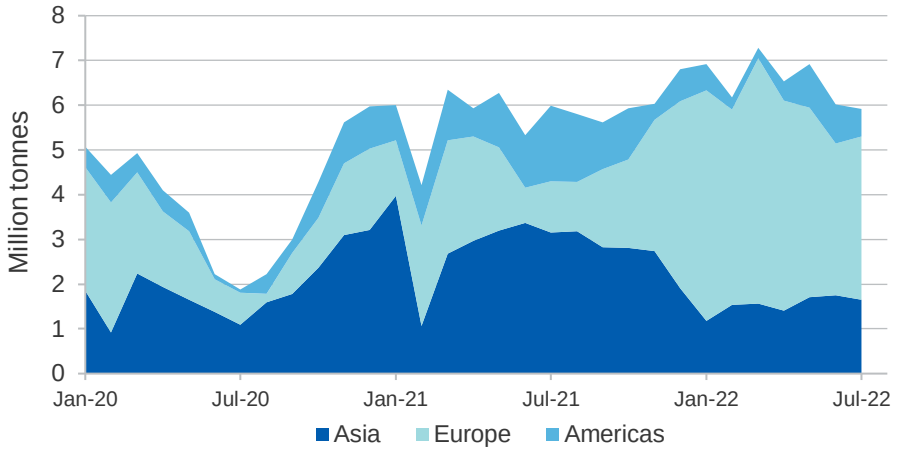
Several proposed US LNG projects could fundamentally alter the global LNG market beyond the outlook period. According to the US Energy Information Agency (EIA), there are now 14 proposed LNG facilities (pre-FID) that have a combined liquefaction capacity of over 172 Mtpa[17]. If successful, these facilities could almost triple the US's current LNG export capacity of 82 Mtpa.[18]

Qatar exports stabilise, but larger volumes are on the horizon

The volume of Qatari exports was stable at 20 Mt in the June quarter 2022. Exports to Asia and Europe remained 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.

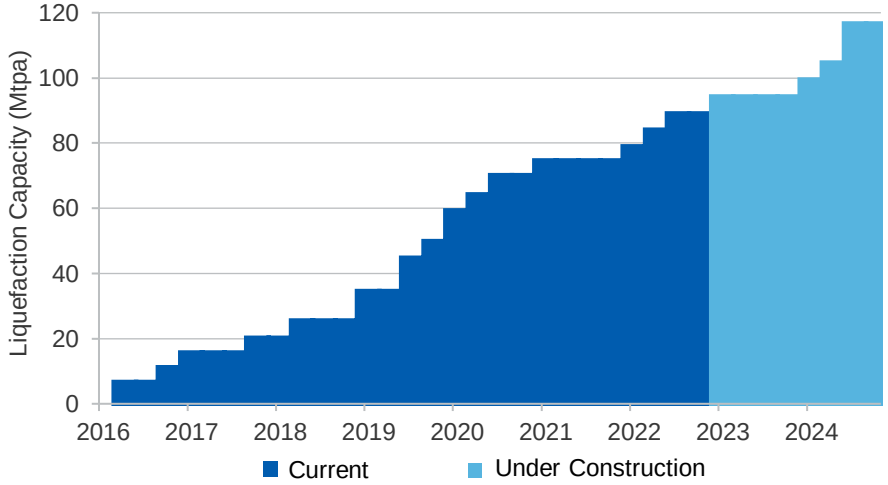
Qatar is projected to expand its LNG export capacity in the coming years. However, this is not expected to meaningfully increase export volumes in the outlook period. The expansion will be facilitated by its North Field South project — which reached FID in late 2021. The LNG project will be the second 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.

Figure 7.7: US LNG exports by destination, 2020



Source: Kpler (2022)

Figure 7.8: US LNG capacity projections, 2016-24



Source: US Energy Information Agency (2022)

[15] NexantWGM

[16] EIA, Database of US LNG export facilities, 8 June 2022

[17] EIA, Database of US LNG export facilities, 8 June 2022

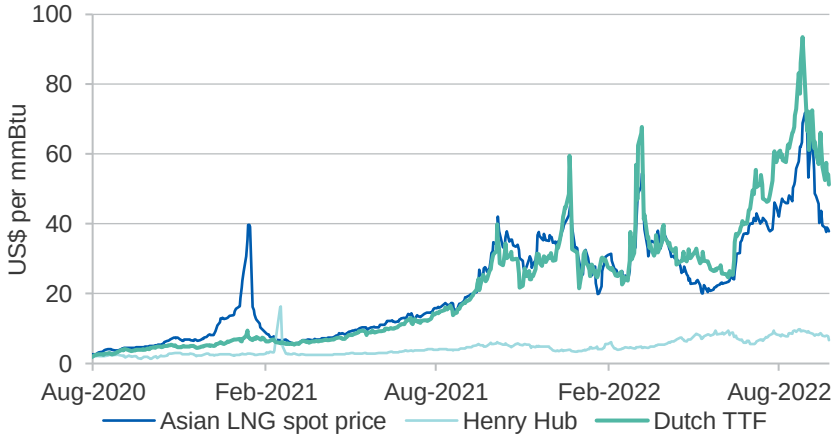
[18] IGU, 2022 world LNG Report, Pg.44

7.5 Prices

High prices spread across an interconnected global market

After reaching over US$ 50/MMBtu in March 2022, Asian LNG prices fell sharply at the start of April, hitting US$ 20/MMBtu in early May. However, prices began to rise dramatically from mid-June after the gradual suspension of gas flows along the Nord Stream pipeline (see section 7.3 – World imports) and the fire at the Freeport LNG facility. Both events had the effect of sharply constraining Europe's gas supply. Moreover, with Europe and Asia competing for the same supply of uncontracted LNG, prices in both markets have tended to track each other (Figure 7.9).

Figure 7.9: 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)

The status of gas flows along the Nord Stream pipeline will be the key factor shaping the outlook for global gas prices. The significance of Nord Stream to European — and thus global energy — security cannot be understated. One of the largest pipelines in Europe, Nord Stream can carry approximately 55 billion cubic meters (bcm) of gas per year or 150 million cubic meters (mcm) per day. But, as of September, daily flows along the pipeline have been completely suspended.

If Russia maintains its current level of gas exports to Europe indefinitely, the cumulative losses from the curtailed gas flows could reach 106 bcm by September 2023.[19] To put this figure into perspective, the total LNG trade in 2021 was estimated at 517 bcm, while total Australian gas production in 2021 was estimated at 160 bcm. In other words, given enough time, the gas curtailed by Russia could amount to 21% of the annual LNG trade — or 66% of Australia's annual gas production. The unambiguous effect of such a disruption will be to raise the value of uncontracted LNG until new US and Qatari supply comes online beyond the outlook period (Figure 7.10).

Prices to remain high for the remainder of the outlook period

Prices are forecast to remain well above long-run averages for the rest of the outlook period — assuming Russian flows are held constant — as LNG supply struggles to meet gas demand. Prices are expected to average US$ 47MMBtu and US$ 46/MMBtu in 2023 and 2024, respectively.

Several factors are driving the bullish outlook for prices in 2023 and 2024. Firstly, given that LNG facilities typically take three to four years to construct, any new facilities coming online from 2023 to 2024 will need to have reached FID during or just before the COVID-19 pandemic. As a result, only a modest amount of additional LNG production (around 41 Mt) is forecast to come online between 2023 and 2024.

Secondly, European supply conditions are likely to deteriorate further in 2023 if the current level of Russian pipeline imports is maintained. Relatively modest Russian flows in the first half of 2022 have supported healthy injections into Europe's storage inventories in preparation for winter (Figure 7.6). However, the current level of Russian flows will make it much more difficult for the Europeans to re-fill their storage inventories in preparation for the 2023–24 winter season.

[19] When compared with annualized daily flows from September 2021.

An assessment completed by the European Network of Transmission System Operators for Gas (ENTSOG) in July 2022 indicated that a complete disruption to Russian gas supplies would prevent most European countries from reaching their winter storage targets in 2023. According to ENTSOG's assessment, even if Europe has a mild 2022-23 winter, sources additional LNG imports, and successfully reduces gas demand by 15% with full cooperation amongst all members states, storage inventories may only reach 70% on average by 1 October 2023 (with inventories in Central and Southern Europe struggling to reach even 40% capacity).[20]

The threat of sustained prices has triggered calls for regulatory intervention in the European gas markets. On 9 September, EU officials met in Brussels to discuss several proposals to cap the price of natural gas. The proposed measures included an administered price cap in specific European markets, a price cap on Russian imports only and a price peg to Asian LNG markets.

EU policymakers face a delicate balancing act between lowering gas prices and incentivising LNG sales. If the price caps work and European hub prices fall, the lower prices could disincentivise LNG imports and exacerbate Europe's gas shortage. However, if Russia cuts its remaining gas exports in retaliation to a price cap, hub prices may need to rise even higher to incentivise further offsetting LNG imports. Meanwhile, a price-peg to Asian LNG markets could theoretically work, but European Hub prices are already de-facto pegged to Asian LNG prices (see Figure 7.9).

The outcome of the proposals is highly uncertain, and discussions are still in their preliminary stage at the time of writing. Moreover, each proposal carries both upside and downside risks to LNG prices, but none address the fundamental supply imbalance in European gas markets.

Soberingly, the European market could become much tighter and more dependent on LNG in 2023. This reinforced dependency on LNG will necessitate the purchase of uncontracted cargoes in 2023, supporting spot LNG prices over the outlook period.

[20]ENTSOG, *Yearly Supply Outlook 2022/2023,* July 2022, pg.18-20

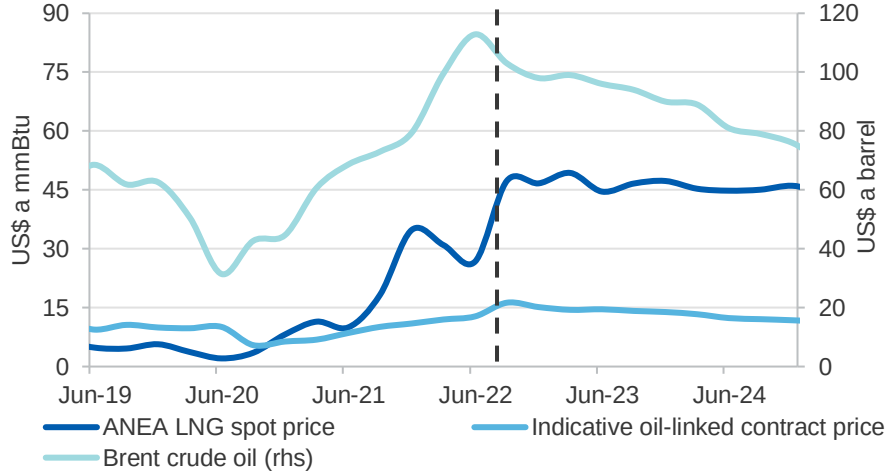
Spiking oil prices in Q1 2022 flow through to LNG contracts

High oil prices in the first half of 2022 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 June quarter 2022, following the fallout of Russia's invasion of Ukraine, peaking at US$ 134 a barrel on 8 March (see *Oil chapter*). 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% y-o-y.

Over the outlook period, oil-linked LNG contract prices are expected to peak at levels consistent with oil at US$ 103 a barrel in 2022 before falling to US$ 95 in 2023 and US$ 80 a barrel in 2024 (Figure 7.10).

Figure 7.10: LNG spot and contract prices, 2019-24



Notes: ANEA is the Argus Northeast Asia spot price. LNG prices are DES (Delivered Ex Ship. The long-term oil-linked contract price is indicative only.
Source: Argus (2022); Bloomberg (2022); Department of Industry, Science and Resources (2022)

7.6 Australia

Australia's LNG earnings rise amidst deteriorating global outlook

The value of Australia's LNG exports in 2022–23 is now expected to reach around $90 billion, as global LNG spot prices rise and as high oil prices in the March and June quarters flow through to oil-price linked LNG contracts (Figure 7.11). Revenues are expected to drop to $81 billion in 2023–24 as oil prices ease and export volumes decline modestly.

Australia exported a record $70 billion of LNG in 2021–22, up from $30 billion in 2020–21 (and still high compared to $50 billion in 2018-19 and $48 billion in 2019-20). In the June quarter 2022 alone, Australian LNG export earnings reached $19.5 billion, up 123% compared to the June quarter 2021.

Given the significant deterioration in Europe's energy security outlook, forecasts for Australia's LNG revenues now bear close resemblance to the 'worst-case' global impact scenario modelled in the March 2022 *Resources and Energy Quarterly* report (see March 2022 REQ, pages 100-102).

Risks to the forecast for Australia's LNG export earnings include additional actions by Gazprom to alter Europe's gas supply, the severity and scope of the upcoming Northern hemisphere winter season and the price elasticity of Chinese LNG demand.

Australia's export volumes set to decline

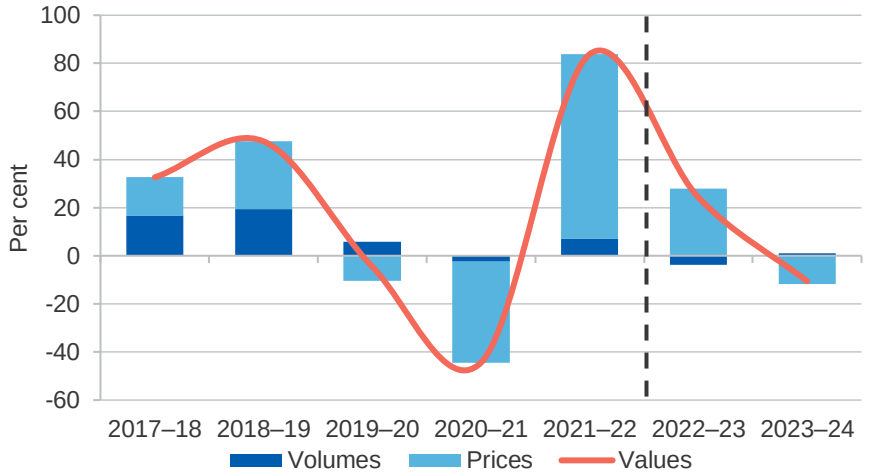
In the June quarter 2022, Australian LNG exports reached 21 Mt, up 4% quarter-on-quarter. This is the highest volume of LNG exports recorded for any June quarter and it marks the third-highest quarterly result on record. However, volumes are expected to cool off to 18.8 Mt in Q3 as several facilities experience planned and unplanned disruptions to production.

Australia exported 83 Mt of LNG in 2021–22, up by 4.7 Mt on 2020–21. Exports were largely driven by high LNG prices, which have incentivised many LNG facilities to operate at or above capacity for the last 12 months.

Higher production from the Gorgon LNG facility appears to have driven the result. The facility boosted LNG production from an estimated 11.3 Mt in 2020–21 to an estimated 16.6 Mt in 2021–22 (a 47% increase). Moreover, Gorgon's production in the June quarter 2022 was estimated at over 110% of the facility's nominal nameplate capacity. Similarly, Ichthys' LNG output reached an estimated 9.4 Mt in 2021–22, up 18% from 2020–21.

In 2022–23, Australia's LNG exports are forecast to ease to 80 Mt as several facilities undertake maintenance activity and as the depletion of gas basins reduces supply to other facilities, particularly Darwin LNG (Figure 7.12).

Figure 7.11: Price/volume contributions to LNG earnings, 2014-24



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

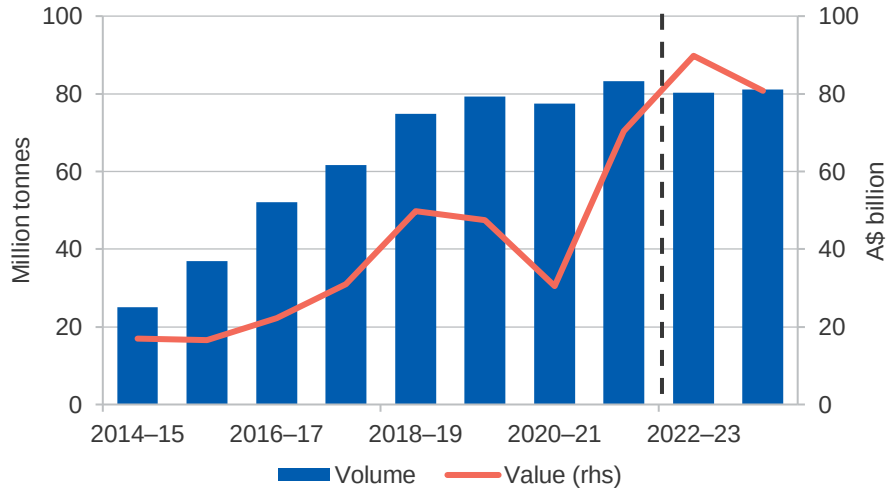
Ongoing industrial action on the Prelude Floating LNG facility will similarly constrain export volumes in the September quarter. In May 2022, union members working on the Prelude FLNG facility voted to strike after parties failed to resolve their disagreements during wage negotiations. Strike actions on Prelude commenced in July and are set to continue until 1 September. As a result, Shell has had to delay planned maintenance until at least 2023, which is expected to further weigh on the facility's output.

Prelude is now forecast to export less than 0.2 Mt in the September quarter.

The Queensland Curtis LNG Project (QCLNG) also underwent maintenance on half a train between 16 June and 18 July. The maintenance is likely to have reduced QCLNG's output by either 0.2 or 0.4 Mt. In addition, APLNG conducted maintenance on an entire train between 28 July and 26 August 2022, which will similarly drag production down by an estimated 0.3 Mt over the September quarter 2022. Due to ongoing field depletion issues, output from the Darwin LNG facility is expected to fall from 0.8 Mt in 2022–23 to zero in 2023-24.

After 2023–24, Australian LNG volumes are estimated to settle around 80 Mtpa. Volumes are not expected to rise meaningfully until 2026, when Woodside's Scarborough field and Pluto Train 2 projects come online. On 25 August, Bechtel commenced site preparation works on the new Pluto train.

Figure 7.12: Australia's LNG exports by value and volume, 2014-24



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

Revisions to the outlook

Australia's nominal export volumes for the June quarter 2022 were revised up by 1.4 Mt due to higher than expected production from the Gorgon, APLNG and Prelude FLNG facilities. Forecasts for 2022–23 have similarly been revised up by 0.4 Mt to account for the higher anticipated capacity utilisation in the aforementioned facilities.

Australia's nominal LNG export earnings for 2022–23 and 2023–24 have been revised up by $6 and $12 billion respectively, due to higher forecast Asian LNG spot prices.

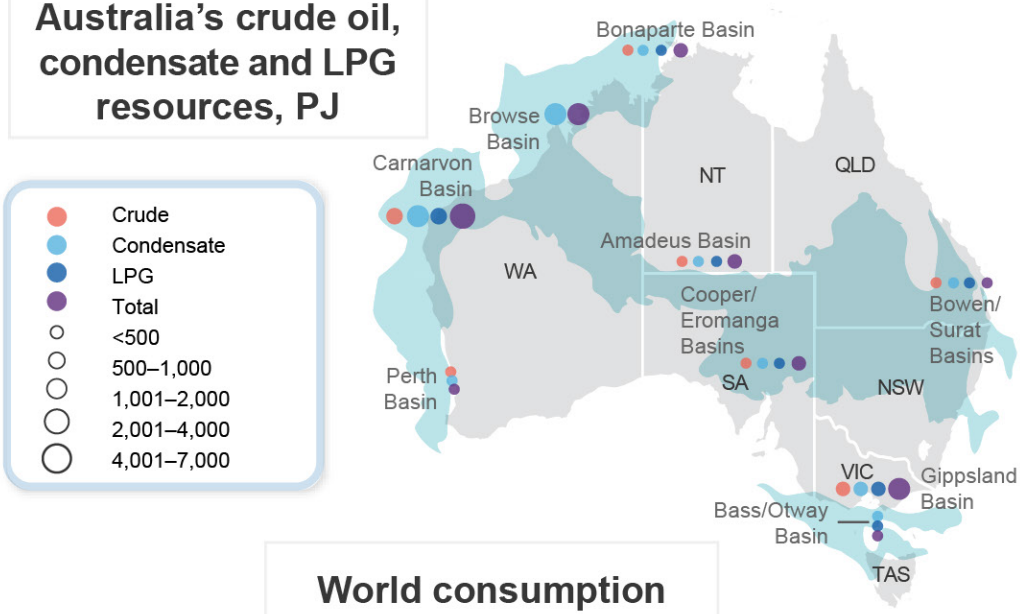
Table 7.1: Gas outlook

						Annual Percentage Change		
World	**Unit**	**2021**	**2022 f**	**2023 f**	**2024 f**	**2022 f**	**2023 f**	**2024 f**
JCC oil price[a]								
– nominal	US$/bbl	69.1	99.8	94.8	79.8	99.8	94.8	79.8
– real[h]	US$/bbl	74.4	99.8	91.9	75.7	33.7	-7.6	-17.7
Asian LNG spot price								
– nominal	US$/MMbtu	18.6	38.6	48.5	46.8	107.4	25.6	– 3.7
– real[h]	US$/MMbtu	20.1	38.6	47.1	44.4	92.5	21.9	– 5.8
LNG trade	Mt c	371.9	380.5	403.5	421.5	2.3	6.1	4.4
Gas production	Bcm	4,159	4,208	4,265	4,353	1	1	2
Gas consumption	Bcm	4,211	4,205	4,243	4,351	0	1	3
Australia	**Unit**	**2020–21**	**2021–22**	**2022–23 f**	**2023–24 f**	**2021–22**	**2022–23 f**	**2023–24 f**
Production[d]	Bcm	151.1	159.8	159.8	159.0	5.8	– 0.0	– 0.5
– Eastern market	Bcm	57.6	57.7	56.0	54.9	0.1	– 2.9	– 1.9
– Western market	Bcm	79.6	85.6	92.8	92.8	7.6	8.4	– 0.0
– Northern market [k]	Bcm	13.9	16.3	14.1	15.2	17.6	– 13.7	8.1
LNG export volume	Mt c	77.4	83.3	80.4	80.5	7.5	– 3.5	0.1
– nominal value	A$m	30,477	70,451	89,779	80,763	131.2	27.4	– 10.0
– real value[e]	A$m	34,058	75,378	89,779	77,491	121.3	19.1	– 13.7
LNG export unit value[g]								
– nominal value	A$/GJ	7.5	16.0	22.9	19.6	114.9	43.1	– 14.6
– real value[e]	A$/GJ	8.3	17.1	22.9	18.8	105.8	33.7	– 18.1
– nominal value	US$/MMBtu	5.9	12.3	16.9	15.2	108.7	37.5	– 10.0
– real value[h]	US$/MMBtu	6.6	13.1	16.9	14.6	99.8	28.5	– 13.7

Notes: **a** JCC stands for Japan Customs-cleared Crude; **b** Production includes both sales gas and gas used in the production process (i.e. plant use) and ethane. Historical gas production data was revised in the June quarter 2017 to align with Australian Petroleum Statistics; **c** Gas production from Bayu-Undan Joint Production Development Area is not included in Australian production. Browse basin production associated with the Ichthys project is classified as Northern market; **d** 1 million tonnes of LNG is equivalent to approximately 1.36 billion cubic meters of gas; **e** In 2021–22 Australian dollars; **f** Forecast; **g** 1 MMBtu is equivalent to 1.055 GJ; **h** In 2022 US dollars**; r** Average annual growth between 2022 and 2024 or 2021–22 and 2023–24; **z** Projection.
Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022); Company reports; Nexant (2022) World Gas Model.

Oil

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



Oil facts

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

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

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

World consumption

29% Diesel

26% Gasoline

14% LPG and Ethane

12% Other

6% Fuel oil

5% Jet fuel and Kerosene

Australia's oil

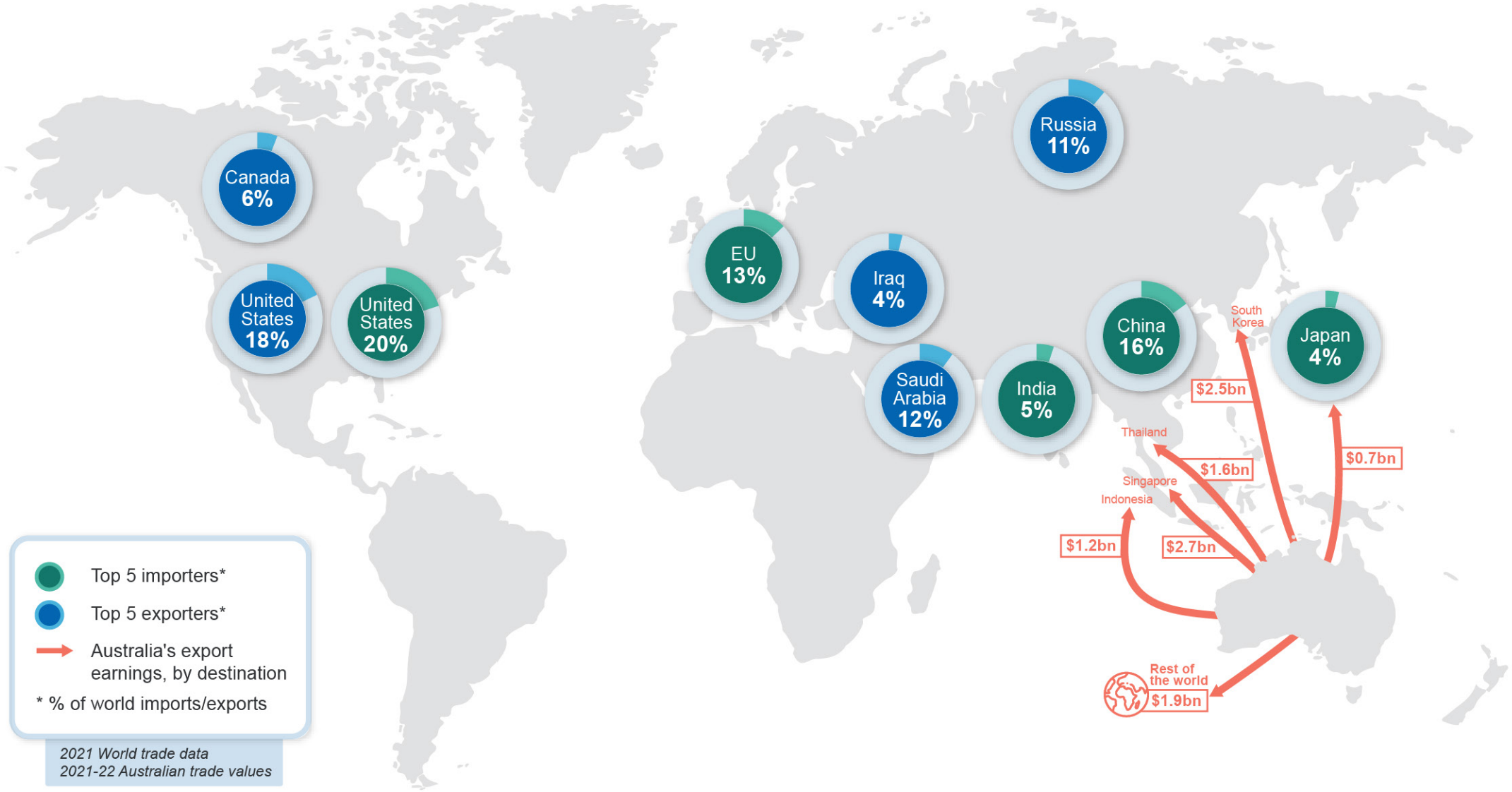
0.3% of the world's oil reserves held

$14 billion worth of oil exports in 2021-22

0.5% of global production

Oil

Trade map | September 2022



8.1 Summary

- Oil prices are forecast to trend downward over the outlook period, following multi-year highs in the first half of the year. However, there is a higher than normal level of uncertainty around the forecasts. Brent crude oil is forecast to average US$103 a barrel in 2022, before declining over the rest of the forecast period.
- Australian crude oil and feedstock exports rose to 292 thousand barrels a day (kb/d) in 2021–22. Export volumes are forecast to decrease to 267 kb/d in 2022–23, before returning to 286 kb/d in 2023–24.
- Australian oil export earnings rose by 88% to $14.0 billion in 2021–22, due to the surge in oil prices. Elevated prices and a weak AUD/USD should see earnings reach $15.0 billion in 2022–23. Earnings for 2023–24 are forecast at $13.4 billion, as prices fall from 2022–23 levels.

8.2 World consumption

Consumption forecast to lift, but geopolitics adding to high uncertainty

Global oil consumption is predicted to rise by 2.2% in 2022 to 100 million barrels per day (mb/d), still lagging behind pre-COVID levels of 2019. However, final usage for 2022 is subject to heightened uncertainty, with a number of global developments capable of drastically impacting demand.

China's dynamic zero-COVID policy led to the introduction of severe lockdown restrictions in major consuming regions/cities (including Shanghai) in H1 2022. A resurgence of outbreaks in second-tier cities, like Wuhan, saw lockdowns renewed in early July. Restrictions were subsequently eased but new outbreaks can be expected to hamper any recovery in consumption in the September and December quarters. COVID outbreaks in the world's second largest oil consuming nation will thus continue to be a major risk to global oil consumption in the near term.

Economic activity in major OECD nations has shown early signs of deterioration, with surging fuel costs and high inflation weighing on growth. Reduced exports of refined petroleum products from Russia — due to official sanctions and independent corporate actions — have boosted retail prices for gasoline and diesel fuel. The high prices for road fuels are afflicting demand, with both OECD gasoline and diesel consumption declines posted in June, according to preliminary data. It was previously expected that the Northern hemisphere summer driving season would help boost gasoline demand this year. However, the soaring pump prices are expected to weigh on this growth.

At the same time, jet fuel demand in the OECD has continued to recover due to the ongoing rebound in air traffic. For the June quarter, jet fuel posted the largest annual growth rate among all OECD refined fuel products demand (up 38%). According to International Air Transport Association data, global air traffic in July increased 59% compared to July 2021, and is now measuring 75% of pre-COVID levels. The International Air Transport Association expects global traveller numbers to exceed pre-COVID-19 levels by 2024.

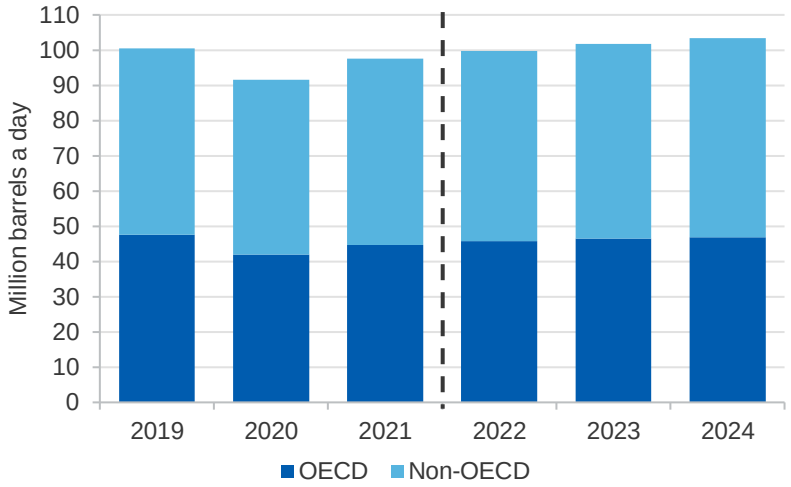
Soaring natural gas prices (see *Gas chapter*), which remain well above oil price rises over the same period, have triggered a significant interest in fuel switching for industrial activities and power generation in Europe and the Middle East. Gas-to-oil switching, mostly in industry, is expected to result in a boost in demand for the remainder of this year and into 2023. Heat waves early in the Northern Hemisphere summer have already resulted in an increase of fuel oil and direct crude use for power generation in various Middle Eastern and European nations.

Consumption of naphtha is forecast to fall in 2022 — the only major oil product forecast to decline overall. This comes after continual annual growth due to thriving petrochemical demand. Naphtha demand fell by 1.1 mb/d (more than double the typical seasonal fall) between January and May 2022. The decline primarily reflects the fallout from the Russian invasion of Ukraine — Russia is the world's largest naphtha exporter.

Rising crude oil prices have affected margins in the US petrochemical industry. Asia typically accounts for about 70% of global naphtha usage, but this year's severe lockdowns in China have impacted domestic producers and have prevented China's neighbours from importing the product. However, some recovery in naphtha consumption is expected in the second half of the year, due to the easing situation in China.

Global oil consumption is forecast to increase by 2.1% to 102 mb/d in 2023, rising above pre-pandemic levels. Consumption is forecast to reach 103 mb/d in 2024 (Figure 8.1). Growth is expected to be driven by the gradual rebound in air traffic — and subsequent jet fuel demand — and gas-to-oil switching. However, outbreaks of new COVID-19 variants in China, and a weakening global economic outlook, may weigh on oil demand. Sanctions on imports of Russian oil will result in a rearrangement of global trade, and could shift global demand patterns in the near term.

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



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

Recovery in OECD aviation demand exceeds declines elsewhere

The weakening economic climate (see *Macroeconomic overview*) has become a major risk to overall oil consumption in major OECD nations for the remainder of this year, and over the forecast period. In 2022, demand is expected to rise 2.4% from 2021. OECD growth is forecast to be restricted to 1.4% in 2023, and hold steady in 2024. Consumption may not return to 2019 levels, due to the uptake of electric vehicles (see the *Lithium chapter* and Figure 8.1).

Soaring transport fuel prices, high inflation and weakening consumer confidence may result in a decline in OECD gasoline and diesel consumption growth for the remainder of 2022 and into 2023. Preliminary June consumption data shows a fall for both products, with the US registering some of the lowest seasonal levels for gasoline consumption in decades.

Nonetheless, the recovery in jet fuel demand has made impressive gains, as borders have reopened and consumers look to holiday internationally. The recovery is set to continue, providing a strong boost to overall consumption figures.

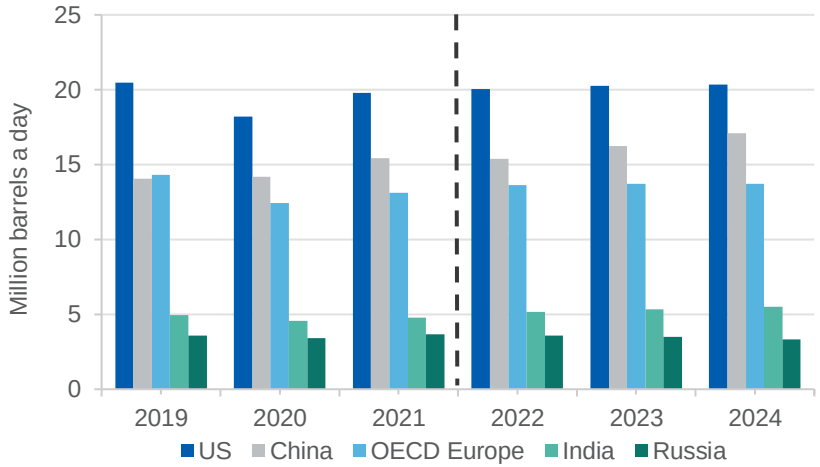
The fallout from the Russian invasion of Ukraine will influence the course of oil trade, and potentially consumption, in the major OECD nations. The US announced a ban on Russian oil, gas and other energy imports on 8 March 2022. In 2021, around 8% of US oil imports came from Russia. At the beginning of June 2022, the EU adopted the sixth package of sanctions on Russia, including an almost total embargo on Russian oil. A price cap is now being proposed (see Box 8.1 below).

The EU sanctions will ban seaborne imports of Russian crude oil from 5 December 2022, and ban petroleum product imports from 5 February 2023. The sanctions will cover around 90% of oil imports from Russia. Imports via pipeline will be exempt from the sanctions, due to member states like Hungary, Slovakia and the Czech Republic depending very heavily on imports via the Druzhba pipeline. However, Germany and Poland, who consumed 500 kb/d of the 750 kb/d carried in the pipeline, will voluntarily give up those imports. In 2021, 25-30% of Europe's oil imports were supplied by Russia, so these measures will require the EU to secure a substantial oil supply from outside of Russia.

With natural gas prices soaring, and EU members committing to reducing their demand for gas by 15% from August 2022 to March 2023 (see *Gas chapter*), gas-to-oil substitution is forecast to rise significantly in OECD Europe. Increased demand for crude, non-transport gasoil and fuel oil could add up to 300 kb/d to oil product deliveries until the end of 2023.

In 2022, US oil demand growth is forecast to slow down to 1.3%, reflecting the deteriorating macroeconomic climate. In 2023, consumption is expected to grow a further 1.0%. OECD Europe demand is forecast to rise 3.9% in 2022 and by less than 1% in 2023.

Figure 8.2: Major oil consumers



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

China's zero-COVID strategy to slow non-OECD consumption growth

Total consumption growth for the non-OECD region is forecast to be comparatively moderate, at 1.9% (compared to the 6.8% in 2021). This is largely due to the strict COVID lockdown measures in place in major regions of China throughout the majority of the June quarter. With Chinese demand set to grow solidly in 2023, non-OECD consumption is expected to lift by a further 2.8% to 55 mb/d in 2023, and to continue rising to 57 mb/d by 2024. Non-OECD demand is expected strongly exceed OCED demand over the outlook — including by a forecast 20% in 2023.

Chinese consumption for the June quarter 2022 fell 6.4% compared to the same period last year. This reflected the impact of the implementation of the Chinese government's zero-COVID policy, which saw hundreds of millions of people subject to strict containment measures. Chinese demand in 2022 is forecast to remain at 2021 levels, at just over 15 million barrels a day (Figure 8.2). However, demand largely depends on the unpredictable path of the virus and the Chinese government's response, which may change.

Strong economic growth, continuing demand by the manufacturing sector, and effective COVID-19 management, have all supported Indian oil consumption growth so far in 2022. Gasoline and diesel usage are expected to see major gains this year, due to increased mobility and strong industrial activity. After China, India is the second largest net oil importer, and typically imports around 85% of its oil.

In 2021, less than 3% of India's crude imports came from Russia. However, in 2022, sanctions from advanced Western nations, emerging market gaps, and reports of significant discounts, have led to a massive and rapid increase in Indian imports of Russian oil. This trend is set to continue over the outlook period. In 2022, Indian oil consumption is expected to grow a solid 8.0% year-on-year to 5.1 mb/d, reaching pre-pandemic levels (Figure 8.2).

Oil consumption forecasts for Russia remain uncertain. June data shows a rebound in aviation consumption, after registering declines since March. However, growth in overall oil consumption is expected to slow in the second half of this year, leading to overall falls in 2022 (1.4%) and 2023 (3.3%), due to rising sanctions.

Box 8.1: EU insurance ban and the oil price cap

Since June, Western countries have discussed introducing a price cap for Russian oil imports, to limit financing for Russia's invasion of Ukraine and reduce energy prices. In 2021, 45% of the Russian federal budget came from oil and gas revenues, and Russia was the largest oil exporting country in the world (13% of total exports).

The price cap is a proposal aimed at minimising the adverse impact of EU sanctions on oil consumers. These sanctions were agreed upon by the EU in June, and are set to come into effect in December 2022. In particular, the EU has banned European companies (incl. British and Norwegian) from providing

insurance for Russian cargoes. These companies currently cover some 97% of oil tankers worldwide. Uninsured tankers would be unacceptable for many ports and canals (notably Suez), thus theoretically stranding much Russian oil from the world market. With this prospect, oil prices have already surged, and could go higher.

On 2 September, the G7 announced support for the price cap. This arrangement would allow cargoes to be insured only if they are sold at or below a certain price — to be set at a level just above Russia's cost of production and below the pre-invasion price for the Ural benchmark: $40-60/barrel.

8.3 World production

Global production set to rise with increased OPEC+ quotas and US output

Developments surrounding Russia's invasion of Ukraine will likely continue to create uncertainty around global oil production for at least the rest of this year. The trajectory of production in Russia — the world's third largest oil producer and largest exporter of oil to global markets — remains unknown amidst changing trade flows. OPEC+ supply remains similarly uncertain, not least due to ongoing talks for a return to the Iran nuclear deal (see further below). Despite this, global production is expected to lift this year, reflecting increased OPEC+ production volumes and a boost from other non-OPEC+ producers — including the US, Canada and Brazil.

Global output is expected to rise by 5.0% to 100 mb/d in 2022. In 2023, output is expected to rise to 102 mb/d; a potential annual output record (Figure 8.3). In 2024, production should grow by 1.4% to 103.1 mb/d.

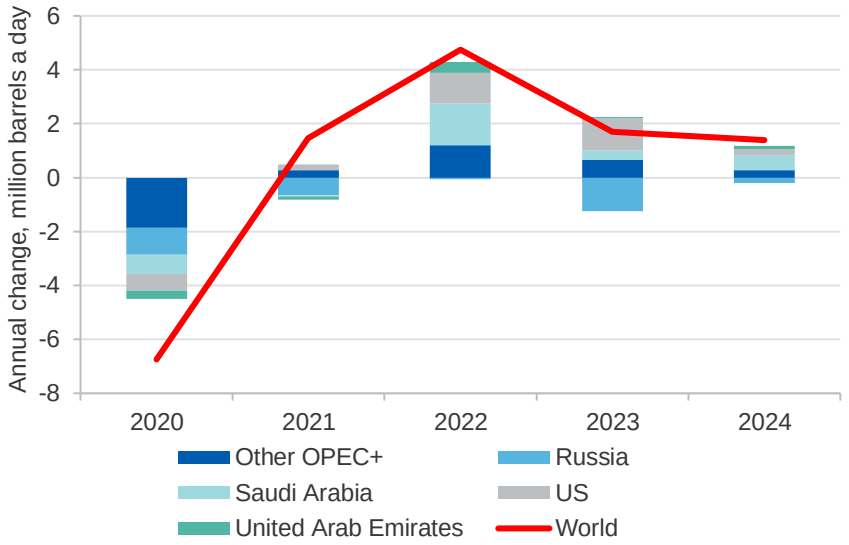
OPEC+ supply progressively rising, but underperforming stated targets

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

At their June meeting, the alliance agreed to accelerate its production hikes through the Northern Hemisphere summer, lifting its output target by 648 kb/d in July and August, up from the 432 kb/d rise in June, and 400 kb/d increase in the preceding months. However, in their meeting on 3 August, the group agreed to increase its production target by a modest 100 kb/d, which was nonetheless removed in their 5 September meeting.

The group has struggled to hit production targets; in July 2022, output rose by 570 kb/d among the 19 members involved in the supply deal, compared to a planned 648 kb/d increase. Some member countries, including Nigeria, Malaysia and Angola, are struggling to meet quotas, due to a lack of spare capacity and chronic operational issues.

Figure 8.3: Change in oil production by major producers



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

At their August meeting, the group noted a "severely limited availability of excess capacity" and that there was insufficient investment in the upstream sector. Then, in September, OPEC countries emphasised the adverse effects on the oil market of volatility and a decline in liquidity, emphasising its commitment to intervene if it disagrees with these conditions.

Russian production is expected to decline as sanctions from the EU are implemented. However, the extent to which this happens is still mired in high levels of uncertainty. In July figures showed that Russian production lifted by 25 kb/d to reach 11,090 kb/d, down just 310 kb/d from pre-invasion levels, following previous months of decline. Crude exports have remained above pre-war levels, albeit with changing destinations. Russian oil products have recovered somewhat but remain below the 3.13 mb/d peak just before the invasion. The rise helped to offset maintenance-related outages in Kazakhstan and further losses in Libya for the OPEC+ group. Production in Libya, which is currently exempt from a quota under the OPEC+ supply deal, has been impacted by shut-ins at several fields due to the ongoing political crisis in that nation.

Meanwhile, talks for a return to the Iran nuclear deal (officially called the Joint Comprehensive Agreement Plan of Action) are ongoing. The EU submitted a "final draft agreement" to both USA and Iran, which would enable a major expansion of Iranian oil exports to global markets. An easing of sanctions on Iran could eventually add 1.3 mb/d to global supply. However, the latest Iranian response was deemed inadequate by the USA and no changes are expected for the remainder of 2022.

In 2022, OPEC+ output is expected to rise 6.3% to 52 mb/d and hold at similar levels in 2023 and 2024.

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

After a slow start to 2022 — which included freezing temperatures in major producing regions — US production is expected to rise steadily for the rest of 2022, and contribute nearly half of the supply growth of non-OPEC+ growth in 2022. Production growth is forecast to moderate in 2023 and 2024.

Various sanctions on Russian crude, and elevated prices, have provided an opportunity for US producers to bring further supply online. Since the invasion, monthly exports of US crude and products to Europe have soared to some of their highest levels since 2016, according to Kpler shipping data. The trend is set to continue as the EU partial ban on Russian oil imports takes effect. US production is expected to rise 6.9% to 18 mb/d in 2022 — a potential annual average record. However, investor support, amid weakening economic conditions, remains a key risk to US production and rate of ramp up.

Brazil, Canada and Norway are also expected to drive higher non-OPEC + supply in 2022. In 2022, non-OPEC+ production is expected to surpass pre-COVID-19 levels, averaging 48 mb/d. In 2023, production is forecast to average 50 mb/d.

8.4 Prices

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

Oil prices have travelled a turbulent path so far in 2022 (Figure 8.4). Following Russia's invasion of Ukraine, prices broke the US$100 a barrel mark in the first days of March and continued to soar. Brent prices peaked at US$134 a barrel on 8 March 2022 — the highest levels since July 2008 — with the risk of sustained energy supply shocks, and sanctions on Russian oil, creating significant market uncertainties. Volatility continued into the June quarter. In early June, prices returned to early March levels, as the market reacted to the EU's partial ban on Russian oil imports, and the supply decisions of OPEC+.

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

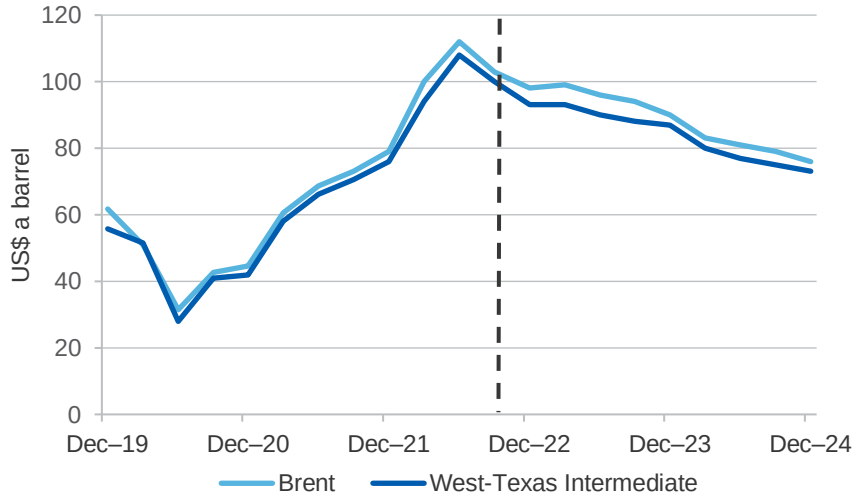
Source: Bloomberg (2022); Department of Industry, Science and Resources (2022).

Prices gradually declined from these highs, with Brent averaging 109 a barrel in July. In early August, prices once again dipped below US$100 a barrel, weighed down by a darkening global economic outlook. In September, prices continued to drop, averaging an estimated $90 a barrel with the September quarter average still up some 20% year-on-year.

Prices forecast to decline, but high market uncertainty to persist

On a quarterly average basis, oil prices are forecast to continue on a downward trend from the highs reached earlier in the year, averaging US $98 a barrel in the December quarter 2022 before steadying in the March quarter 2023. Increased supply from the US is expected to help offset Russian production losses. With sluggish demand, prices are forecast to soften over the forecast period, averaging US$95 a barrel in 2023, and US $80 a barrel in 2024 (Figure 8.5).

Figure 8.5: Price outlook



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

As with recent *Resource and Energy Quarterly* reports, forecasts of prices come with elevated levels of uncertainty and high potential for some volatile moves. The ongoing fallout from the Russian invasion of Ukraine, weaker growth and high inflation will create risks for oil supply and demand — especially in major markets in Europe and US.

There is high market uncertainty surrounding the implementation of EU sanctions on Russian oil imports late in the year — particularly the influence of the re-orientation of global trade, production in Russia and intertwined demand effects with declining natural gas use. In addition, the extent and longevity of future COVID-19 restrictions in China — or other global responses to future virus strains — have a strong potential to impact global demand growth and, subsequently, prices.

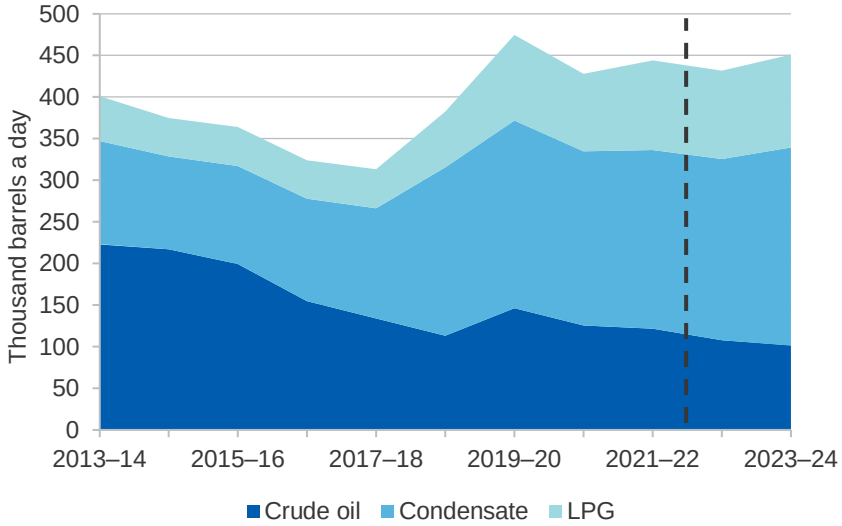
8.5 Australia

Anticipated final investment decisions to influence future oil production

Australian crude and condensate production held steady at 330 kb/d in 2021–22. National condensate production recorded an overall rise 2021–22. However, after production reached record levels in the second half of 2021, in tandem with the record LNG production (see *Gas chapter*), national condensate output rates declined considerably in the March quarter. This was largely attributed to Prelude remaining shut for Q1 2021, due to critical safety issues. Overall crude and condensate production is forecast to hold steady over the outlook — falling to 325 kb/d in 2022–23, before returning to 339 kb/d in 2023–24. In 2021–22, condensate accounted for 48% of Australian crude, condensate and LPG output. Crude oil accounted for 27% (Figure 8.6).

Beyond the forecast period, there are several potential and progressing projects. These will act to offset the impact on crude and condensate production of natural decline in existing fields. Santos and Carnarvon Energy are targeting their Dorado project to be FID ready in the second half of 2022, with the Front-End Engineering and Design stage nearing completion.

Figure 8.6: Composition of Australian oil production



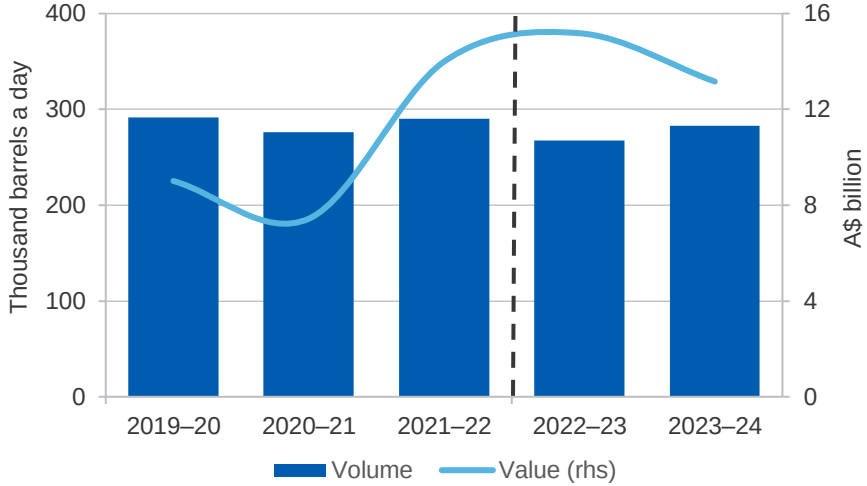
Source: Bloomberg (2022); Department of Industry, Science and Resources (2022)

In late March, Santos announced the Pavo-1 exploration well confirmed a significant oil discovery in the Bedout sub Basin, less than 50 km east of the Dorado field. The 2C continent resource at the Pavo site, assessed at 43 million barrels of oil, could add significant value to the Dorado project. Dorado has an estimated initial capacity of 75-100 kb/d — nearly 25% of 2021–22 Australian crude oil and condensate output.

Australian export earnings lifting with high oil prices

A rise in export volumes and the jump in oil prices, coupled with a strong US dollar, provided a strong boost to Australian crude and condensate export revenue in 2021–22. Export earnings soared to $15.0 billion — up 88% year-on-year. With prices forecast to remain elevated overall, export earnings will rise further in 2022–23, to $14.9 billion. Earnings are forecast to return to $13.4 billion in 2023–24, as prices decline (Figure 8.7).

Figure 8.7: Australian oil and feedstock exports



Notes: Includes crude oil and condensate, but excludes LPG.
Source: Australian Bureau of Statistics (2022); Department of Industry, Science and Resources (2022).

Domestic refinery production falling, but refined fuel consumption lifting

Australian refinery output of petrol, diesel and jet fuel has continued to fall, following the closure of the Kwinana and Altona refineries in 2021. Refinery output in 2021–22 was 29% lower than 2020–21, reflecting Altona's closure in August 2021. There are now two remaining Australian refineries — Ampol's refinery in Lytton (Queensland) and Viva Energy's refinery in Geelong (Victoria). In 2021–22, domestic refinery output represented around 29% of Australia's total fuel consumption, down from 41% in 2020–21. Refined product imports increased by 15% in 2021–22, due to the reduced refining capacity.

Australia's total oil consumption lifted slightly (by 2.3%) in 2021–22, but with COVID recovery in transport fuel demand now tracking very strongly, overall consumption is expected to continue to lift in 2022–23 and 2023–24. COVID-19 lockdowns and disruptions weighed heavily on petrol demand in 2021–22, with demand falling 5%. However, demand for diesel and jet fuel saw significant lifts, of 3% and 33% (respectively) from

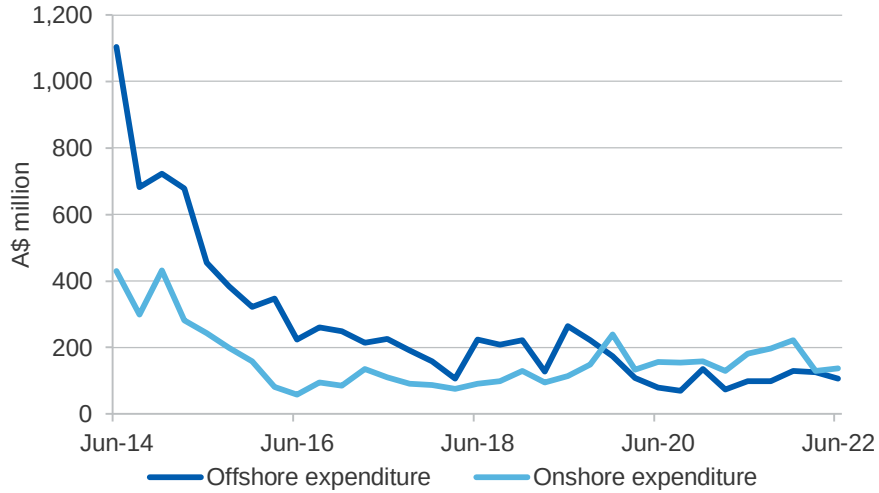
2020–21 levels. The increase in jet fuel demand saw a sharp increase when Australia's borders re-opened earlier this year, and has continued to build month on month, as both business and leisure air travel return. An increase in diesel demand reflects its broad consumer base across road transport, mining and agriculture. In 2021–22, diesel accounted for 61% of refined product imports, and aviation fuels accounted for 29%.

With reduced national refining capacity, and demand for aviation, road fuels and diesel set to strengthen, Australian refined product imports are forecast to continue to lift by a further 3.3% in 2022–23.

Exploration

Australia's petroleum exploration expenditure was $245.1 million in the June quarter 2022 (seasonally adjusted basis), a quarterly decrease of $96.9 million or 27.9%. This is 3.2% lower year-on-year. Offshore exploration fell 34.6% to $107 million, while onshore exploration spending decreased by 21.7% to $138.1 million (Figure 8.8).

Figure 8.8: Australian petroleum exploration (quarterly)



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

Revisions to forecasts

Since the June 2022 *Resources and Energy Quarterly*, the forecast for Australia's crude and condensate export earnings has been revised up by around $700 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 [f]	2023[f]	2024[f]	Annual percentage change 2022[f]	2023[f]	2024[f]
Production[a]	mb/d	95	100	102	103	5.0	1.7	1.4
Consumption[a]	mb/d	98	100	102	103	2.2	2.1	1.6
WTI crude oil price								
– nominal	US$/bbl	68	100	90	76	48.1	-10.2	-15.3
– real[b]	US$/bbl	73	100	87	72	37.5	-12.9	-17.1
Brent crude oil price								
– nominal	US$/bbl	70	103	95	80	47.0	-8.3	-15.8
– real[b]	US$/bbl	76	103	92	76	36.5	-11.0	-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	325	339	0.5	-3.2	4.3
Export volume[a]	kb/d	276	292	267	286	6	-8	7
– Nominal value	A$m	7,434	14,022	14,953	13,377	88.6	6.6	-10.5
– Real value[h]	A$m	8,308	15,003	14,953	12,835	80.6	-0.3	-14.2
Imports[a]	kb/d	247	180	210	209	-27.0	16.9	-0.8
LPG production[acd]	kb/d	94	107	106	112	14.9	-1.0	5.2
Refined products								
– Refinery production[a]	kb/d	375	266	263	259	-28.9	-1.5	-1.2
– Export volume[ae]	kb/d	13	8	5	5	-36.6	-40.1	0.2
– Import volume[a]	kb/d	647	745	770	795	15.1	3.3	3.3
– Consumption[ag]	kb/d	913	934	996	1,016	2.3	6.6	2.0

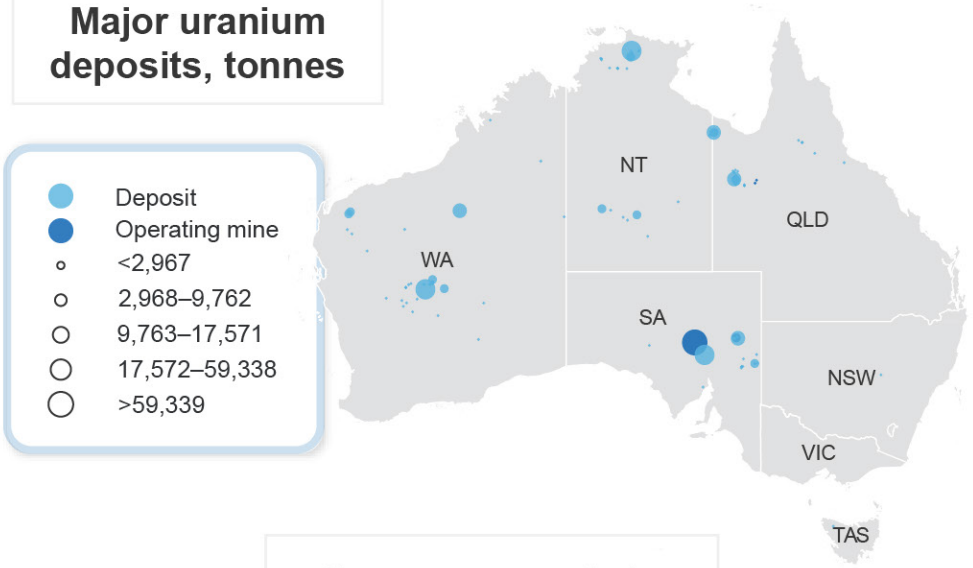
Notes: **a** The number of days in a year is assumed to be 365, and a barrel of oil equals 158.987 litres; **b** In 2022 calendar year US dollars; **c** Historical production data was revised in the June quarter 2022 to align with the Australian Petroleum Statistics **d** Primary products sold as LPG; **e** Excludes LPG; **f** Forecast; **g** Domestic sales of marketable products, including imports; **h** In 2022-23 financial year Australian dollars.

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

92 U 238.029

Major uranium deposits, tonnes



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

Consumer markets

- **27%** EU
- **26%** USA
- **21%** Others
- **15%** China
- **9%** Russia
- **2%** Japan

Australia's Uranium

- **Ranked 1st** for **uranium resources**
- **3rd largest uranium producer** in the world
- **$500m+** worth of **exports**

9.1 Summary

- Uranium prices are forecast to lift from US$51 a pound in 2022 to US$60 a pound by 2024. Uranium shortfalls have become a prospect in the wake of years of low prices and underinvestment.
- Australian exports are forecast to decline to 4,500 tonnes in 2021–22. This is expected to rise to around 5,500 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 $880 million by 2023–24.

9.2 World consumption

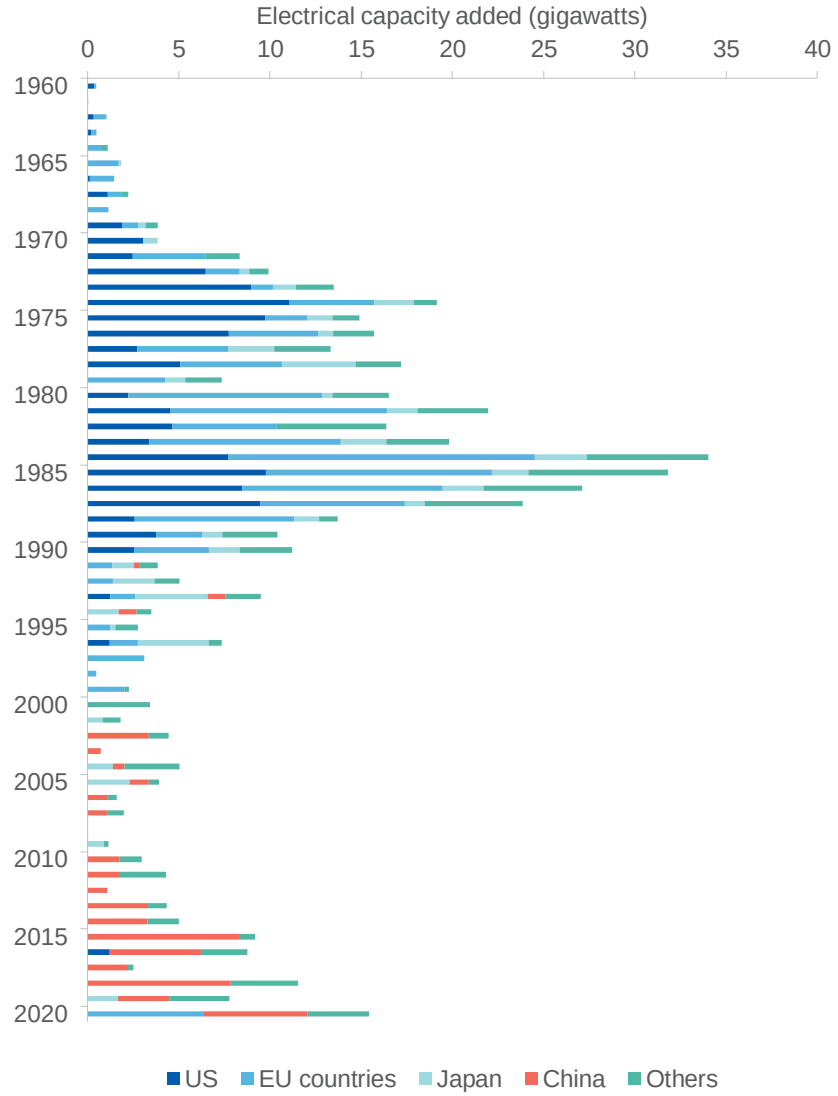
Market conditions have shifted as supply becomes tighter

Uranium prices have stabilised at just under US$50 a tonne in recent months, following lifts in the September quarter 2021 and March quarter 2022. Prices have long been low, but appear now to be turning due to potential shortfalls in global supply.

With coal and gas prices currently extremely high, the prospects for nuclear deployment have improved: notably in Asia, but also in Africa, Eastern Europe and the Middle East (Figure 9.1). Policies aiming to phase out nuclear power in in Japan and South Korea have recently been reversed. In its latest *Nuclear power and secure energy transitions* report, the IEA offers a relatively optimistic appraisal of the future of nuclear energy, noting that 19 countries now have nuclear reactors under construction. The report notes that the case for nuclear deployment has strengthened in light of increased focus on energy independence, reliability, and low-carbon energy.

South Korea's new government has extended its efforts to revitalise the country's nuclear industry, signing a Memorandum of Understanding with various significant stakeholders and manufacturers of nuclear energy equipment. The MoU aims to develop business support measures and underpin cooperation to improve the competitiveness of South Korea's large nuclear industry. The government has also announced that Shin Hanul Unit 1 has entered final testing and is expected to commence

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)

commercial operation in September. Three further APR-1400 reactors are also under construction at the site.

In China, unit 2 of the Zhangzhou nuclear power plant has moved closer to completion following the placement of three new steam generators. Engineers managed to hoist and place the second steam generator in less than three hours, with China's National Nuclear Corporation subsequently announcing that this was the fastest hoist 'in the history of nuclear power'. Several more reactors are also moving close to completion.

In the UAE, the newly built Barakah nuclear power plant, which comprises four large Korean APR-1400 reactors, is close to commencing full operation. Three of the four units are already operating, with the fourth recently concluding its hot functional testing. The final unit is scheduled to start operating in early 2023.

In India, Unit 3 of the Kakrapar nuclear power plant has been completed, and is set to start operating in late 2022. The reactor is the first of a planned batch of domestically designed 700 MWe heavy water reactors.

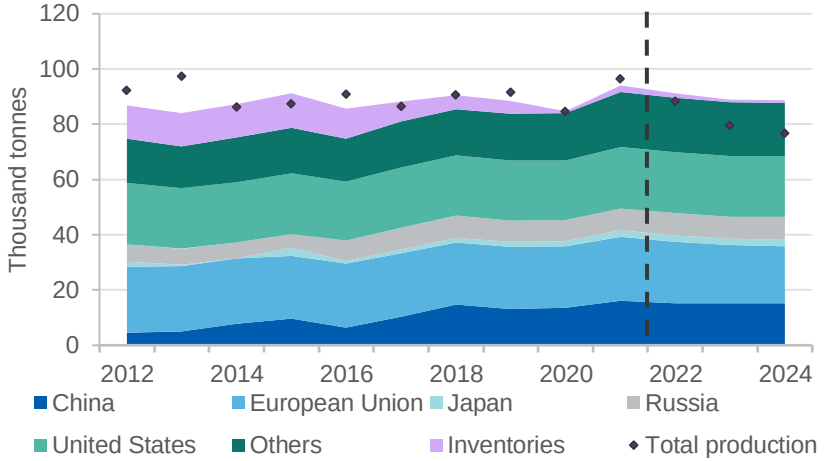
In the US, the newly passed *Inflation Reduction Act of 2022* includes significant measures to support nuclear power, including tax credits to support low or zero-carbon energy production, and funding to develop a domestic supply of High-Assay Low-Enriched Uranium fuel, which many Generation IV reactors are expected to need.

Reactor development has faced mixed conditions in Finland: test production at the new Olkiluoto 3 reactor has resumed, with the reactor on track to provide full power from September 2022. However, the proposed Hanhikivi power project has been cancelled, with the owners citing geopolitical uncertainties and issues with its Russian supplier.

In the UK, the Hinkley Point B1 and B2 reactors have completed their scheduled shut downs after 46 years of operation.

Uranium consumption is expected to hold largely steady in global terms during 2023 and 2024, with reactor closures and openings approximately balanced. Uranium requirements are expected to build from 2025.

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



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

9.3 World production

Large suppliers are restoring production, but slowly

Years of low investment could make it challenging to scale production with demand over the medium-term. Many projects were placed in hiatus or paused during the long run of low prices after 2011, and will require significant time to reopen or finalise. However, progress is picking up.

In Niger, Global Atomic has reached a deal with the government to develop the Dasa project, which is a high-grade deposit located near existing facilities in Arlit. The project is expected to start producing in 2025. Also set to restart is Paladin's Langer Heinrich mine in Namibia, which is expected to become a major supplier by 2026.

Canada's large McArthur River mine, which has been in care and maintenance for several years, is expected to start producing again by the December quarter.

Despite this, most mine openings around the world remain years off, with overall supply expected to remain little changed over the outlook period.

9.4 Prices

Prices are expected to rise steadily, and potentially rapidly

Emerging supply pressures in the uranium market have reversed the price conditions of the last 11 years, with prices increasing in recent quarters and recently stabilising close to US$50 a pound. Prices are expected to increase further over time, though ample inventories should curb any rapid spikes. Uranium mines typically take a long time to obtain approvals, potentially drawing out any supply shortages over the longer term, and creating a baseline for structurally higher prices over the rest of the 2020s (Figure 9.3).

9.5 Australia

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

Extra production and higher prices are expected to lift Australia's uranium export earnings from $564 million in 2021–22 to around $880 million by 2023–24 (Figure 9.4, Table 1).

On June 1, Boss Energy announced its final investment decision, and will restart its Honeymoon mine in South Australia. The mine is set to produce around 1100-1200 tonnes of uranium per year for at least 10 years, and production is provisionally expected to commence in late 2023 or early 2024.

A new mine is also in prospect, with Vimy Resources moving towards development of its Mulga Rock deposit. The deposit is substantial and could produce at least 1600 tonnes a year for at least 15 years. Output at the site could commence from 2025 or 2026.

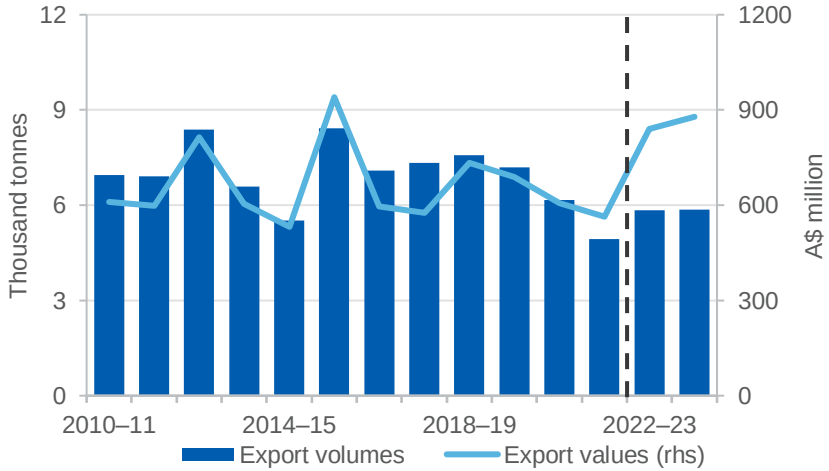
Revisions to the outlook

Export earnings forecasts for 2021–22 and 2022–23 have remained largely unchanged, with a small upward revision in 2022–23 offsetting a small downward revision in 2023–24. This reflects a slight frontloading in the timing of expected price movements.

Figure 9.3: Uranium price outlook

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

Figure 9.4: Australia's uranium exports



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

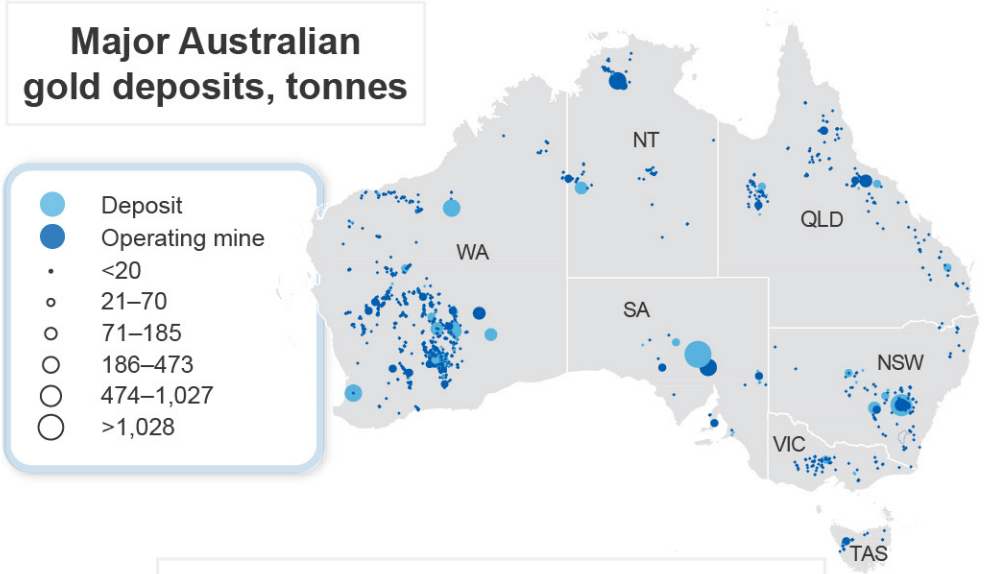
Table 9.1: Uranium outlook

						Annual percentage change		
World	**Unit**	**2021**	**2022[s]**	**2023[f]**	**2024[f]**	**2022[s]**	**2023[f]**	**2024[f]**
Production	kt	54.2	56.7	59.0	61.6	4.6	4.2	4.4
Africa[b]	kt	9.3	9.2	10.1	10.5	-0.5	9.6	3.8
Canada	kt	5.5	6.8	7.1	6.4	23.0	5.0	-10.0
Kazakhstan	kt	25.8	25.9	26.1	28.3	0.6	0.5	8.6
Russia	kt	3.3	3.3	3.7	3.9	0.0	12.2	3.6
Consumption	kt	91.7	89.5	87.9	87.7	-2.4	-1.8	-0.2
China	kt	16.1	15.1	15.1	15.2	-6.3	0.4	0.6
European Union 27	kt	23.1	22.3	21.1	20.6	-3.8	-5.3	-2.4
Japan	kt	2.4	2.4	2.4	2.4	0.0	0.0	0.0
Russia	kt	7.9	8.2	7.8	8.2	3.2	-5.0	5.7
United States	kt	22.2	22.0	22.2	22.2	-0.6	0.7	0.0
Spot price	US$/lb	35.3	51.0	57.9	59.6	44.6	13.5	2.9
real[c]	US$/lb	38.0	51.0	56.2	56.5	34.3	10.2	0.6
Australia	**Unit**	**2020–21**	**2021–22**	**2022–23[f]**	**2023–24[f]**	**2021–22[s]**	**2022–23[f]**	**2023–24[f]**
Mine production	t	6,213	4,486	5,840	5,855	-27.8	30.2	0.3
Export volume	t	6,166	4,933	5,840	5,855	-20.0	18.4	0.3
– nominal value	A$m	606	564	841	879	-6.9	49.1	4.5
– real value[d]	A$m	678	604	841	843	-10.9	39.3	0.3
Average price	A$/kg	98.3	114.4	144.0	150.1	16.3	25.9	4.2
– real[d]	A$/kg	109.9	122.4	144.0	144.0	11.4	17.7	0.0

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

79 Au 196.967 Gold

Major Australian gold deposits, tonnes



Gold

- Gold is a critical component in **COVID-19 diagnostic tests**
- The US holds the largest stockpile of gold reserves, at **8,133 tonnes**
- In 2021 jewellery fabrication made up **55% of global gold use**
- Gold only makes up **3 parts per billion** of the Earth's outer layer

World jewellery consumer markets

31% China

28% India

7% United States

2% Russia

2% Turkey

2% UAE

Australia's gold

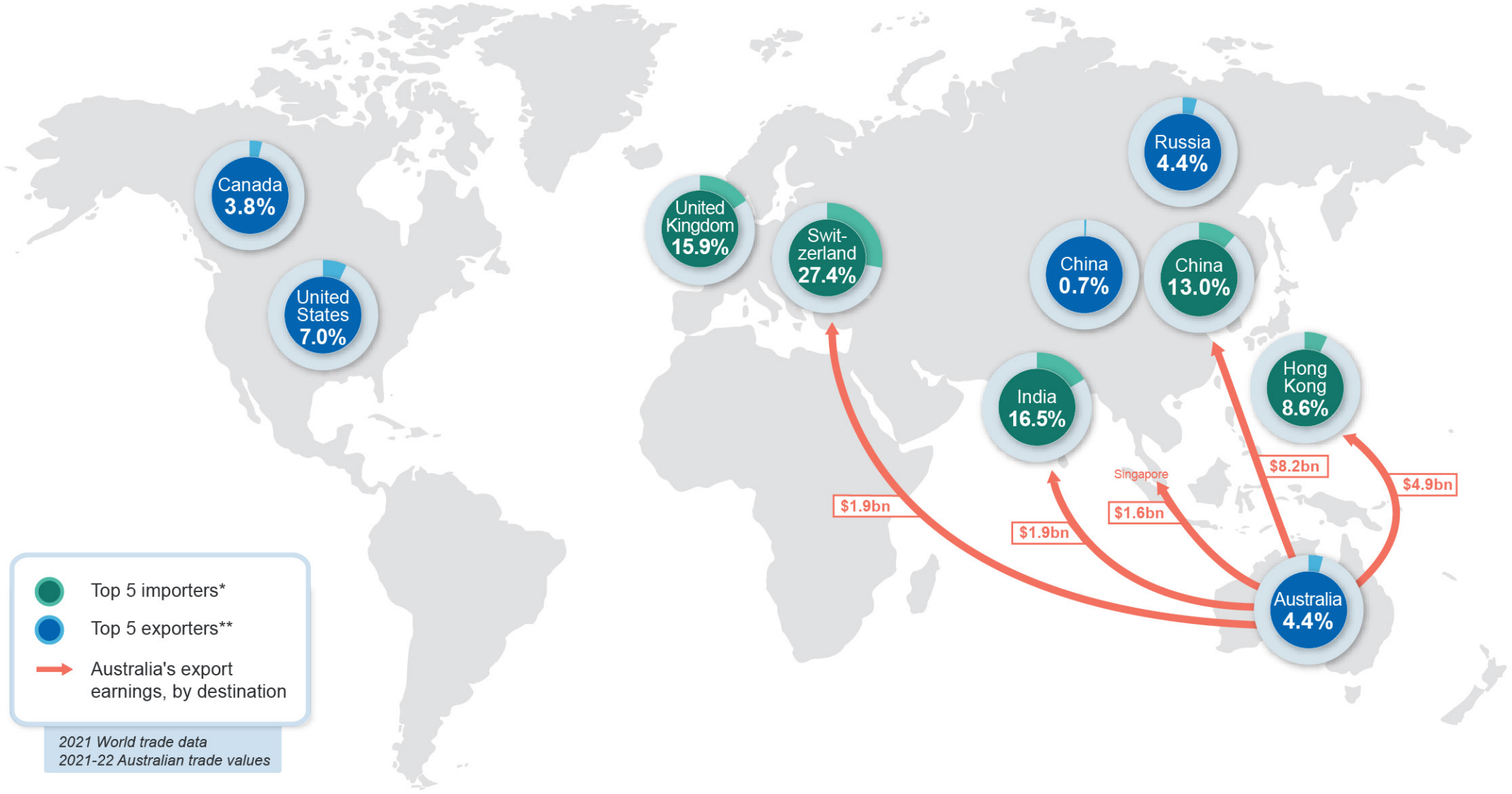
World's 2nd largest producer of gold in **2021**

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

Largest gold coin ever created, cast by Perth mint

79 Au 196.967 Gold

Trade map | September 2022



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

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

10.1 Summary

- Gold prices averaged US$1,872 an ounce in the June quarter 2022, before falling to an average of about US$1,730 an ounce in the September quarter 2022. Prices came under pressure from the strong US dollar and rising bond yields, following aggressive US monetary tightening and heightnened uncertainty over global economic growth.
- Australian gold mine production in the June quarter 2022 was 0.9% higher year-on-year at 81 tonnes. Labour and skill shortages were still affecting mining operations, however production was 10% higher than the disrupted March quarter 2022 (see Australia section).
- Gold earnings are forecast to rise from $23 billion in 2021–22 to about $25 billion in 2023–24, as rising export volumes outweigh lower prices.

10.2 World consumption

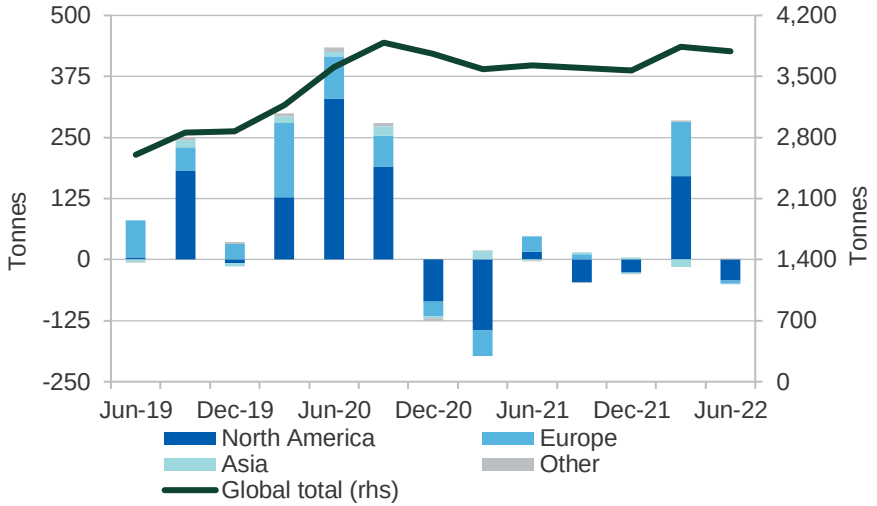
World gold consumption increased in the first half of 2022

World gold demand increased by 12% year-on-year to 2,189 tonnes in the first half of 2022. This increase was driven by strong flows into US and European gold-backed exchange-traded funds (ETFs), which gained 234 tonnes, compared to an outflow of 127 tonnes in 2021 (Figure 10.1).

Heightened geopolitical risk following Russia's invasion of Ukraine, weaker equity markets and mounting inflation concerns, drove significant investment flows into safe-haven assets (such as gold ETFs) from January-April 2022. From May 2022, rising real bond yields and a strong US dollar eroded gold's appeal to investors, leading to ETF outflows and lower gold prices over the remainder of the June quarter 2022.

Official sector buying (central banks and other government financial institutions) fell by 17% year-on-year to 270 tonnes in the first half of 2022. According to the World Gold Council, Turkey and Egypt were the largest purchasers, collectively buying 107 tonnes of gold during the quarter. Kazakhstan was the largest seller, with net sales of 18 tonnes of gold from their reserves in the first half of the year, followed by the Philippines with 6 tonnes and Germany with 4 tonnes.

Figure 10.1: Changes to gold held in global ETFs



Source: World Gold Council (2022)

Consumer demand for gold (jewellery, gold coins and bars) was weaker during the first half of 2022, partially offsetting the strong ETF inflows. As a result, gold jewellery consumption declined by 2.2% year-on-year to 928 tonnes in the first half of 2022, driven by weaker demand from China.

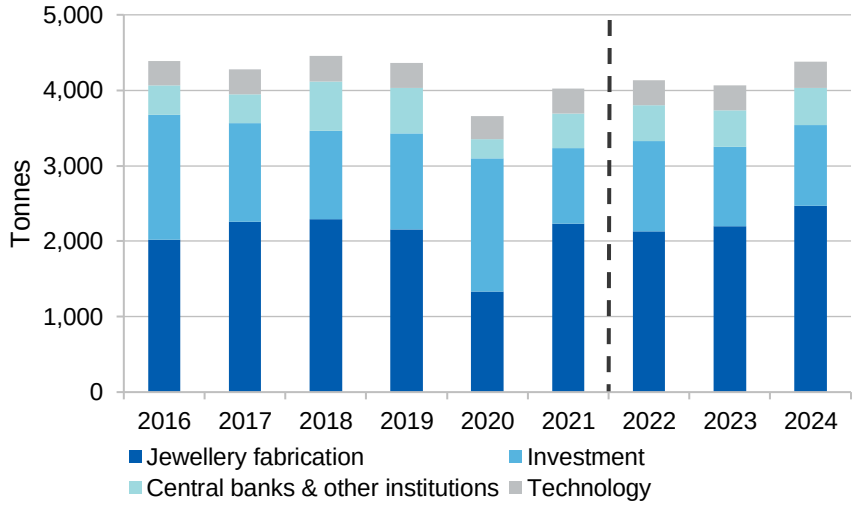
Jewellery consumption in China fell by 23% year-on-year to 384 tonnes. Demand was weakened by lockdowns in major cities throughout April and May, while COVID-related mobility restrictions across the country affected millions of consumers. Local currency depreciation and increased precautionary saving by Chinese households also contributed to weak jewellery demand amidst the ongoing economic uncertainty.

Retail investment in gold bars and coins was 12% weaker year-on-year during the first half of 2022, with investors purchasing 526 tonnes of gold. Lockdowns in major Chinese cities resulted in bar and coin investment falling by 40% year-on-year to 87 tonnes. Festival-related purchases in India lifted bar and coin investment 11% higher to 72 tonnes in the first half of 2022, partially offsetting weaker demand in China.

Investment demand to push gold consumption higher in 2022

World gold consumption is forecast to increase by 2.7% to 4,129 tonnes in 2022, driven largely by stronger investment demand — rising by 18% year-on-year (Figure 10.2). Investment demand (gold-backed ETFs or bar and coin holdings) has been revised down to 1,193 tonnes in 2022; this is 7.1% lower than forecast in the June 2022 *Resources and Energy Quarterly*. While investment in gold-backed ETFs was strong in the first half of 2022, ongoing strength in the US dollar and the potential for inflation to be lessened (mainly by tighter monetary policy in the US), have created headwinds for investment. This change in investor sentiment emerged in July 2022, with 81 tonnes of outflows from global gold ETFs, according to the World Gold Council. Investment demand is expected to remain supported by ongoing geopolitical and economic uncertainty through to the end of the year.

Figure 10.2: World gold demand by sector



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

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

Jewellery consumption is now expected to decrease by 3.9% year-on-year in 2022, due to weaker than expected demand in China and India during the first half of the year. Chinese consumption is expected to be lower than in 2021, mostly due to the weak first half of the year. The potential for Chinese consumer sentiment to be further hindered by the country's 'zero COVID' policy measures poses a downside risk to this forecast.

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

World gold consumption is forecast to decrease by 1.6% to 4,065 tonnes in 2023, as investment demand eases 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 7.7% in 2024 to 4,376 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 countries such as China and India.

10.3 World production

World supply increased in the first half of 2022

World gold supply increased by 4.9% year-on-year to 2,357 tonnes in the first half of 2022. The increased supply was driven by a 3.1% rise in global mine production and an 8.0% increase in gold recycling. Stronger gold recycling activity in the quarter largely reflected the impact of higher US dollar gold prices, with increases achieved despite disruptions in China related to the country's zero COVID policy.

Global mine production rose to a record high 1,764 tonnes during the first half of 2022, driven largely by increased production in China and Australia.

Production in China — the world's largest gold producing nation — rose by 14% year-on-year to around 175 tonnes in the first half of 2022, as most mines in Shandong province resumed production. Shandong's provincial government halted operations in 2021 for safety inspections to take place.

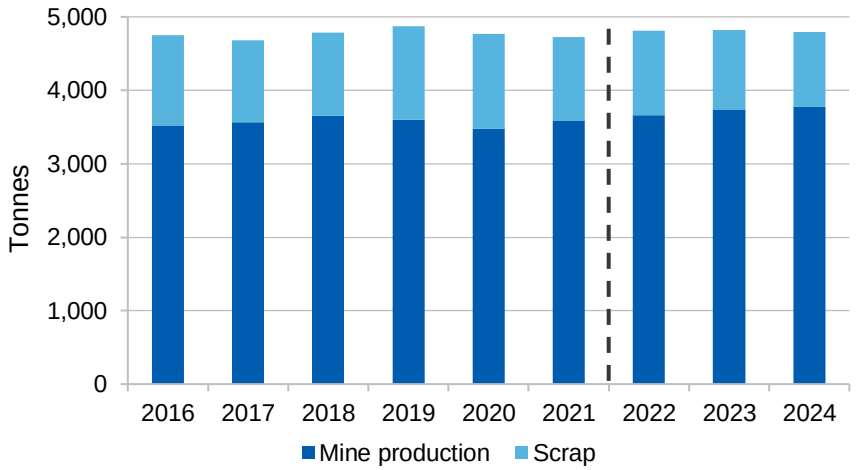
Production in Australia — the world's second-largest gold producing country — increased by 0.8% year-on-year in the first half of 2022, to 155 tonnes (see Australia section).

Production in the United States was 10% lower year-on-year in the first half of 2022, primarily due to lower ore grades and reduced output from the Carlin mines of Nevada.

World supply expected to fall after 2022 as recycling activity eases

In 2022, global gold supply is forecast to rise by 2.2% to 4,807 tonnes, driven mainly by higher gold mine production. World gold mine production is forecast to rise by 2.3% in 2022 to 3,663 tonnes, led by increases in China, Australia, North America and West Africa.

Figure 10.3: 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).

High gold prices are also expected to support greater recycling activity, with recycling volumes forecast to rise by 0.6% to 1,196 tonnes in 2022.

World gold supply is forecast to be relatively steady in 2023 and 2024, as lower recycling activity offsets increases in mine production (Figure 10.3).

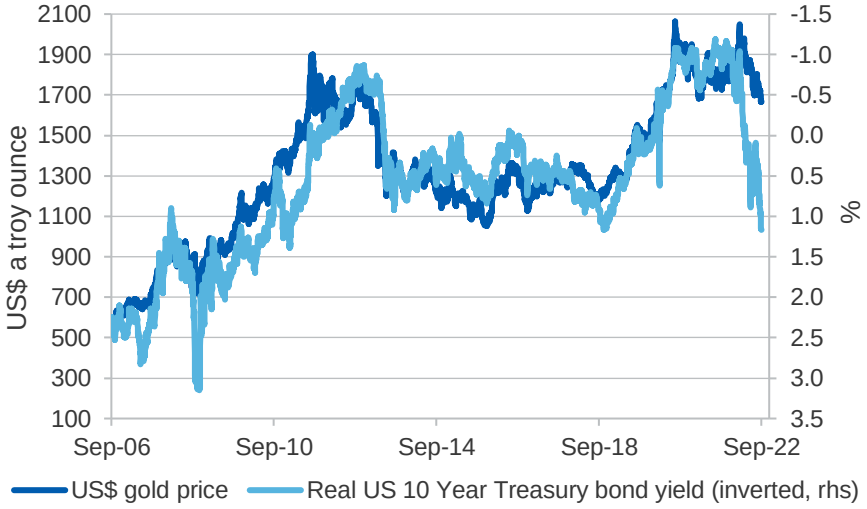
Gold mine production is expected to increase as new projects come online in Canada, Chile, Brazil and Argentina. Production in Australia is forecast to rise during 2023 and 2024, driven by new projects and expansions of existing projects. Continued environmental regulations and industry consolidation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

10.4 Prices

Gold prices under pressure from rising bond yields

The London Bullion Market Association (LBMA) gold price retreated below US$1,700 an ounce in mid-September, driven by sharp increases in real bond yields and a strengthening US dollar (Figure 10.4).

Figure 10.4: Gold price and real US 10-Year Treasury yield



Source: Bloomberg (2022)

The price fall came after gold prices averaged US$1,875 an ounce over the first half of 2022, with prices supported earlier in the year by safe-haven demand — amid the Russian invasion of Ukraine and increasing inflation in advanced economies.

Higher than expected inflation in advanced economies resulted in most central banks ceasing bond-buying programs and lifting interest rates, with further hikes expected over the remainder of the year. Aggressive tightening of US monetary policy compared to other advanced nations also resulted in strong demand for the US dollar, pressuring USD gold prices.

As a result of the central bank action, real bond yields lifted sharply in the June quarter 2022, and have remained above zero for the first time since the beginning of the pandemic in 2020. Rising bond yields tend to undermine gold's appeal to institutional and retail investors, as a secure asset to hedge against inflation or other risks. 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.

Market expectations for US interest rates increased after hawkish messaging from Federal Reserve Chair Jerome Powell at the Jackson Hole Economic Symposium in late August. These "higher for longer" expectations were reinforced by higher than expected US inflation in August – particularly for the core inflation measure. This change in expectations was reflected in real bond yields rising from about 0.1% at the beginning of August to a recent peak of 0.98% in mid-September.

On 21 September 2022, the US Federal Reserve lifted the target for the Fed funds rate by 75 basis points to 3.00%-3.25%. Markets are pricing in a Fed Funds rate of about 4.2% by the end of the year — 100 basis points higher than expected at the time of the release of the June 2022 *Resources and Energy Quarterly*.

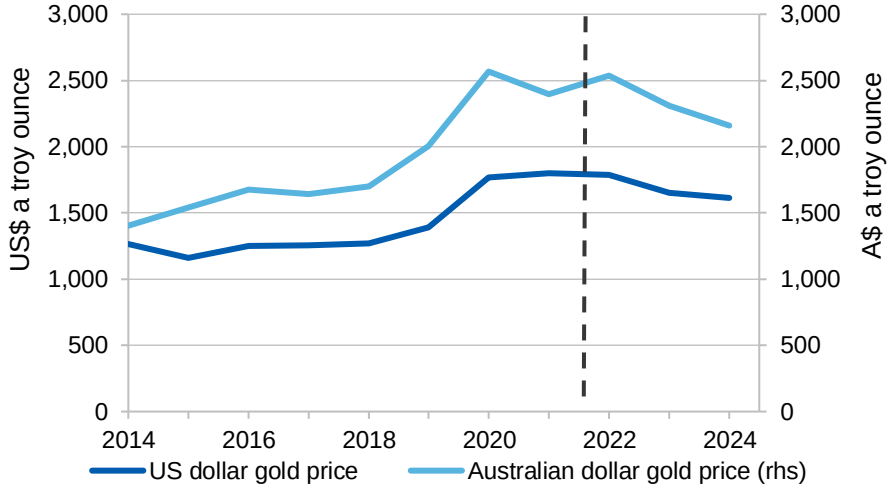
Gold prices to fall over the short and medium term

Gold prices are projected to fall at an average annual rate of 4.9% over the outlook period, from about US$1,788 an ounce in 2022 to US$1,614 an ounce in 2024 (Figure 10.5). 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 economic uncertainty continues to support the US dollar. Lower safe haven demand will do less to ameliorate the impact of higher interest rates on gold demand.

In combination with forecast appreciation in the Australian dollar, the lower US dollar gold price is expected to lower the Australian dollar gold price from around A$2,540 an ounce in 2022 to A$2,160 an ounce in 2024.

There are several risks to the gold price assessment in the remainder of of 2022. These include the arrival of any new COVID-19 variants and the extent to which COVID-19 lockdowns and control measures persist in China. Persistent outbreaks could dampen future gold demand from one of the world's largest importers and consumers of gold.

Figure 10.5: US and Australian dollar gold prices



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

A further risk to the price assessment is the continued fallout from Russia's invasion of Ukraine. An escalation or de-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 partly by extension, real bond yields — over the forecast period, is highly uncertain. A faster than expected rise in official interest rates could lift or maintain high real bond yields, leading to a steeper than forecast fall in gold prices — as the opportunity cost of holding gold increases. On the other hand, a slower tightening of monetary policy would likely result in a slower than forecast decline in gold prices, as real bond yields return below current levels.

10.5 Australia's trade, production and exploration

Australian gold exports declined in 2021–22

Australia's gold exports fell by 11% to $23 billion in 2021–22. The fall was driven by lower export volumes, the impact of which was only partially offset by higher Australian dollar gold prices.

Australia exported $8.2 billion in gold to China (excluding Hong Kong) in 2021–22. This was sharply higher (303%) than the $2.0 billion in gold exports during 2020–21 — which was impacted by bans imposed by Beijing when COVID-19 hit. Gold exports to India were worth $1.9 billion in 2021–22, 31% higher than in 2020–21.

Australian exports to the financial hubs (United States, United Kingdom, Switzerland, Hong Kong and Singapore) were collectively worth $10 billion in 2021–22, 48% lower year-on-year, due to base effects after strong inflows into global gold-backed ETFs during 2020–21.

Australian gold exports to increase with higher production

Australian gold export earnings are forecast to rise by 10% to almost $26 billion in 2022–23, before falling back to $25 billion in 2023–24 (Figure 10.6). Increased gold production is expected over the next two years, however, the forecast fall in export values in 2023–24 is expected to be driven by lower US and Australian dollar gold prices (see Prices section).

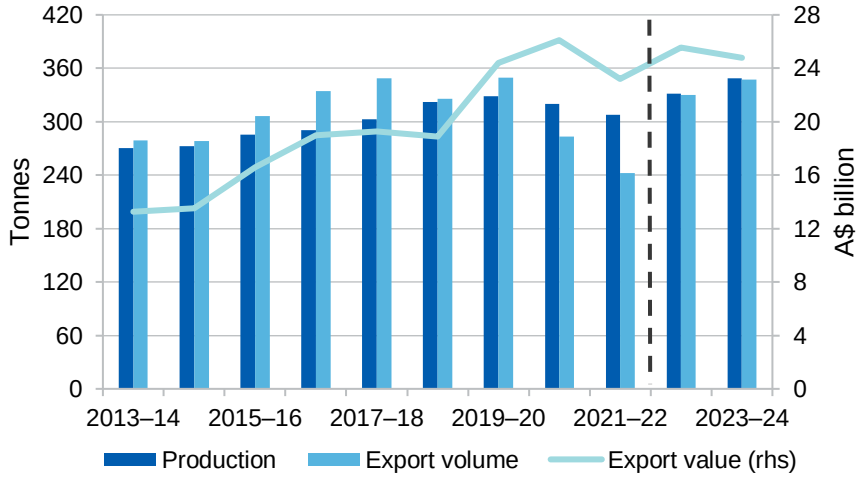
Australian gold mine production declined in 2021–22

Australia's gold production declined by 3.0% year-on-year in 2021–22 to 308 tonnes. Lower ore grades affected several of the larger operations early in the financial year, while wet weather in Western Australia (WA) and New South Wales (NSW) affected production over the second half of the year.

Many gold miners reported production impacts from labour shortages and logistical issues (such as delays to road haulage) related to COVID-19 outbreaks and border closures through much of 2021–22.

Production at Newcrest's Cadia mine in NSW decreased by 27% year-on-year to about 14 tonnes in 2021–22. This decline was largely a result of planned maintenance to replace the plant's SAG mill motor from July-November 2021. A scheduled underground shutdown in the March quarter also temporarily reduced mining rates.

Figure 10.6: 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).

Production at Agnico Eagle's Fosterville gold operation in Victoria was 23% lower in 2021–22, with output additionally impacted by lower workforce availability and primary ventilation operation restrictions in the June quarter 2022.

AngloGold Ashanti produced 7.6 tonnes of gold in 2021–22 from their Sunrise Dam operation in WA, equal to production in 2020–21. The company attributed a production loss of 0.3 tonnes in the first half of 2022 to COVID-related absenteeism of critical underground operators.

Production at Northern Star's Super Pit gold operation in WA in 2021–22 was 1.6% higher year-on-year at 15 tonnes, while Newmont's Boddington mine finished the financial year up 14% at 25 tonnes.

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 6.5% during 2022–23 and 2023–24. Production is forecast to reach 331 tonnes in 2022–23, propelled by production from new mines and existing mine expansions. Red 5's 6.2 tonnes per year King of the Hills gold project in WA achieved first gold in June 2022, with production expected to ramp up through 2022–23. First gold was poured from Calidus Resources' 4.3 tonnes per year Warrawoona gold project in WA in May 2022, with production expected to ramp up through 2022–23.

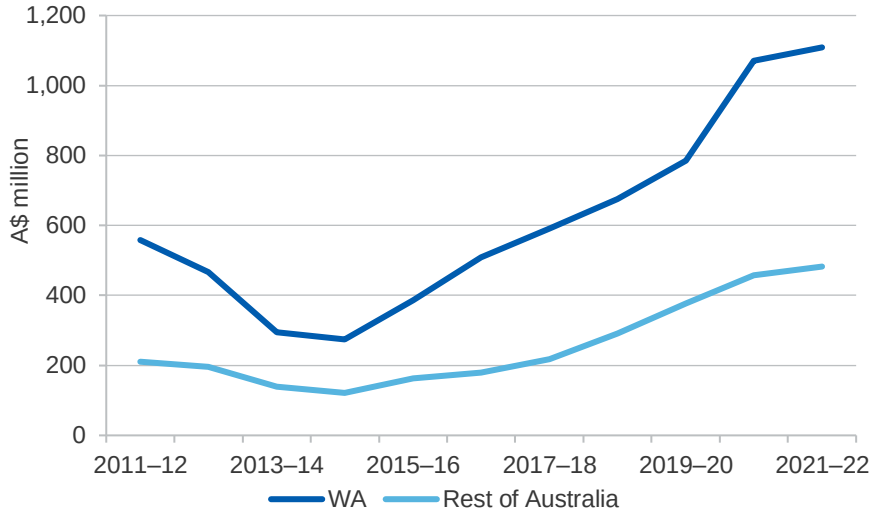
Australian output is forecast to reach 349 tonnes in 2023–24: Bellevue Gold's 5.7 tonnes per year Bellevue gold mine in WA is expected to come online in the second half of 2023, while Northern Star Resources' Super Pit gold operation will begin long-term expansion from 2024.

The primary risk to the Australian gold production forecast is the extent to which supply chain issues and labour or skill shortages continue in the short term. A further downside risk to the forecasts of Australian gold production is weaker than expected gold prices (see Prices section). In this scenario, high-cost Australian producers would be expected to cease or cut back their operations.

Record Australian gold exploration expenditure in 2021–22

Australia's gold exploration expenditure reached a record high of $1.6 billion in 2021–22, up 4.0% from the previous record in 2020–21. Gold accounted for 41% of Australia's total mineral exploration expenditure (at $3.9 billion) in 2021–22. Western Australia remained the centre of gold exploration activity in Australia in 2021–22, accounting for 71% (or $1.1 billion) of total gold exploration expenditure, followed by Victoria (10% or $166 million) and NSW (7.2% or $114 million).

Figure 10.7: Australian gold exploration expenditure



Source: ABS (2022)

Revisions to the outlook

Australia's forecast gold export earnings have been revised down for 2022–23 and 2023–24 compared with the June 2022 *Resources and Energy Quarterly*. This most reflects a downgrade to forecast export volumes, coinciding with a downgrade to forecast Australian gold production. Lower forecast US dollar gold prices also contributed to the downgrade, however the lower exchange rate assumption over 2022–23 has partially offset the fall in Australian dollar gold prices.

Table 10.1: Gold outlook

						Annual percentage change		
World	**Unit**	**2021**	**2022[f]**	**2023[f]**	**2024[f]**	**2022[f]**	**2023[f]**	**2024[f]**
Total demand	tonnes	4,021	4,129	4,065	4,376	2.7	-1.6	7.7
Fabrication consumption [b]	tonnes	2,560	2,462	2,534	2,812	-3.8	3.0	10.9
Mine production	tonnes	3,581	3,663	3,737	3,774	2.3	2.0	1.0
Price [c]								
– nominal	US$/oz	1,800	1,788	1,652	1,614	-0.6	-7.6	-2.3
– real [d]	US$/oz	1,938	1,788	1,603	1,532	-7.8	-10.4	-4.4
Australia	**Unit**	**2020–21**	**2021–22**	**2022–23[f]**	**2023–24[f]**	**2021–22**	**2022–23[f]**	**2023–24[f]**
Mine production	tonnes	320	308	331	349	-3.7	7.6	5.3
Exports								
– volume	tonnes	283	242	330	347	-14.5	36.3	5.3
– nominal value	A$m	26,105	23,205	25,567	24,798	-11.1	10.2	-3.0
– real value [e]	A$m	29,172	24,828	25,567	23,794	-14.9	3.0	-6.9
Price								
– nominal	A$/oz	2,481	2,529	2,412	2,222	1.9	-4.6	-7.9
– real[e]	A$/oz	2,589	2,706	2,412	2,132	4.5	-10.9	-11.6

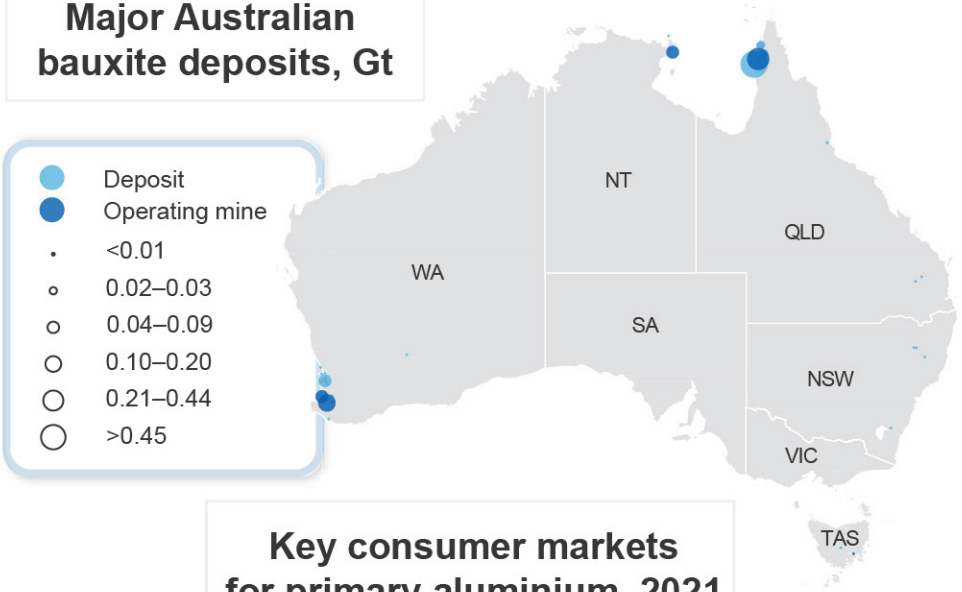
Notes: **b** includes jewellery consumption and industrial applications; **c** London Bullion Market Association PM price; **d** In 2022 US dollars; **e** In 2022–23 Australian dollars; **s** Estimate; **f** Forecast. Gold export volume contains ash, waste and scrap gold, of which the metal content is 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

13 Al 26.982

Major Australian bauxite deposits, Gt



Aluminium

- **Bauxite ore** is refined to recover alumina, smelted to make aluminium
- **2-3 tonnes of bauxite** is required to produce one tonne of alumina
- China is the **largest producer and consumer** of primary aluminium
- Each electric vehicle **contains 0.25 tonne** of aluminium

Key consumer markets for primary aluminium, 2021

60% China

7% United States

3% Germany

3% Japan

2% Turkey

Australia's aluminium

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

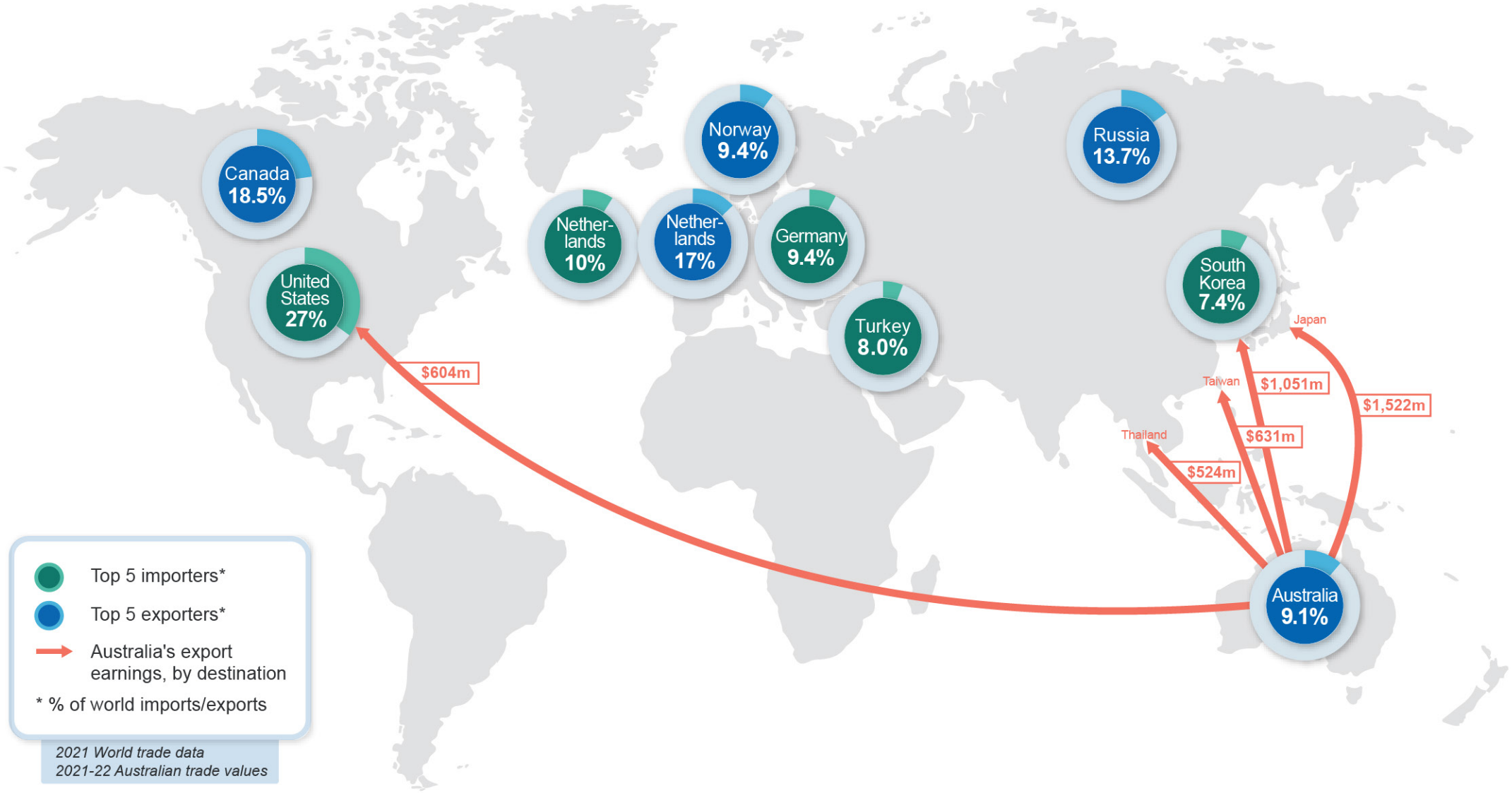
Largest alumina exporter, **18m tonnes** in 2021

2nd largest alumina producer, **21m tonnes** in 2021

13 Al 26.982

Aluminium

Trade map | September 2022



11.1 Summary

- Lower primary aluminium supply from China and Europe is expected to keep aluminium prices at high levels in 2022, averaging US$2,790 a tonne. Prices are forecast to drift down through the rest of the forecast period, averaging US$2,490 a tonne in 2024, getting some support from growing demand for new, energy-efficient cars and technologies.
- 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 106 million tonnes in 2022–23 to nearly 109 million tonnes in 2023–24 (see Australia section).
- Australia's aluminium, alumina and bauxite export earnings are forecast to be steady at $15 billion a year in 2022–23 and 2023–24.

11.2 World consumption

China and the EU led lower primary aluminium consumption in H1 2022

Global primary aluminium consumption fell by 1.1% year-on-year to 34 million tonnes in the first half of 2022, largely due to a 2.0% year-on-year fall in demand in China — the world's largest aluminium consumer.

Weaker Chinese demand was due to a softening in GDP. In quarter-on-quarter terms, Chinese GDP contracted by 2.6% in the June quarter 2022 — the lowest quarterly result in more than two years. Over the year to the June quarter 2022, Chinese GDP grew by just 0.4%.

On top of the impacts of COVID-19 lockdowns, the Chinese property sector has continued to struggle. Financial stress has forced Chinese property developers to suspend work on projects for households who have purchased off-plan homes. As property developers delay projects, home buyers have also suspended their mortgage repayments. Property construction accounts for around 30% of China's aluminium consumption.

Outside of China, aluminium usage dropped in Spain (by 18% year-on-year to 244,000 tonnes), Sweden (down by 16% year-on-year to 52,000 tonnes), and the Netherlands (down by 46% year-on-year to 30,000 tonnes).

The European automotive sector has continued to be impacted by global supply chain issues. According to Auto Forecast Solutions (AFS), the semiconductor shortage has reduced European car output by over 1.0 million units in the year to 24 July 2022. This represents a loss of around 207,000 tonnes of aluminium consumption. Based on the data from the European Automobile Manufacturers' Association, passenger car registrations in Europe fell by 14% year-on-year in the first-half of 2022.

World alumina usage decreased by 0.5% year-on-year to 65 million tonnes in the first-half of 2022, due to lower global aluminium production, which was down by 0.5% year-on-year in the same period. China remains the world's largest alumina consuming country, accounting for 57% of global alumina consumption. Outside of China, alumina consumption in India and the UAE rose by 4.5% and 12%, to reach 4.0 and 2.4 million tonnes in the first-half of 2022, respectively.

World bauxite usage fell by 1.1% year-on-year in the first-half of 2022 to 179 million tonnes due to a fall in global alumina production (down 1.1% in the first-half of 2022). China remained the world's largest bauxite consuming country, accounting for 51% of global bauxite consumption.

Lower global primary aluminium, alumina and bauxite usage in 2022

Slowing global economic growth and rising inflation and interest rates in many parts of the world are expected to impact primary aluminium consumption over the rest of 2022.

A European Union agreement on 26 July 2022 to reduce the demand for natural gas by 15% in the 2022–23 winter season will dampen the Eurozone's industrial activity in the second-half of 2022. The result could be a further fall in primary aluminium consumption across the region.

In the US, there are signs of slowing construction activity: a 2.0% month-on-month drop in housing starts in the month of June 2022 followed a 12% month-on-month decline in May 2022. Housing permits also dropped to the lowest level since September 2021. The slowdown in construction activity indicates that the successive interest rate hikes by the US Federal

Reserve have begun to hit the US housing market. This is likely to reduce aluminium demand in the construction sector.

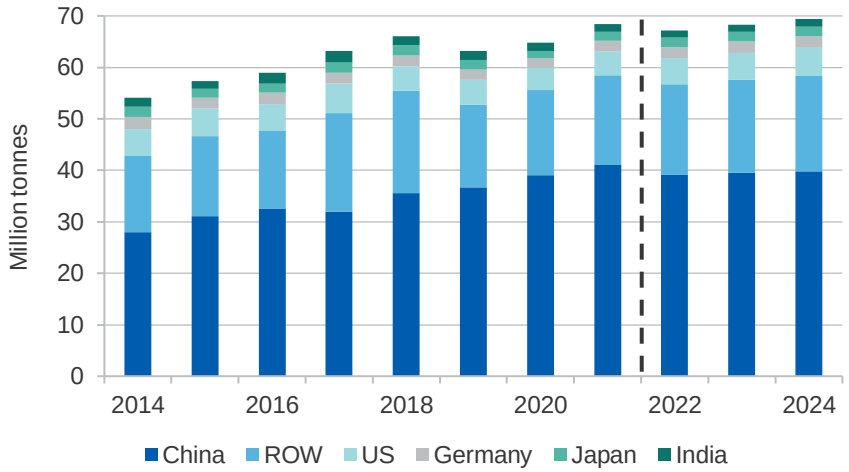
Since the June 2022 *Resources and Energy Quarterly* (REQ), the Chinese Government has rolled out a further series of measures to stabilise the economy. These measures should see sentiment/activity improve in 2023.

Global primary aluminium consumption is estimated to decrease by 1.9% in 2022, to 67 million tonnes (Figure 11.1).

World alumina usage is estimated to decrease by 0.5% in 2022 to 130 million tonnes (Figure 11.2). An expected 1.0% fall in global primary aluminium production in 2022 is likely to reduce global alumina demand. China is expected to attribute mainly to the fall in global alumina demand, with an estimated 0.9% decline in primary aluminium production in 2022.

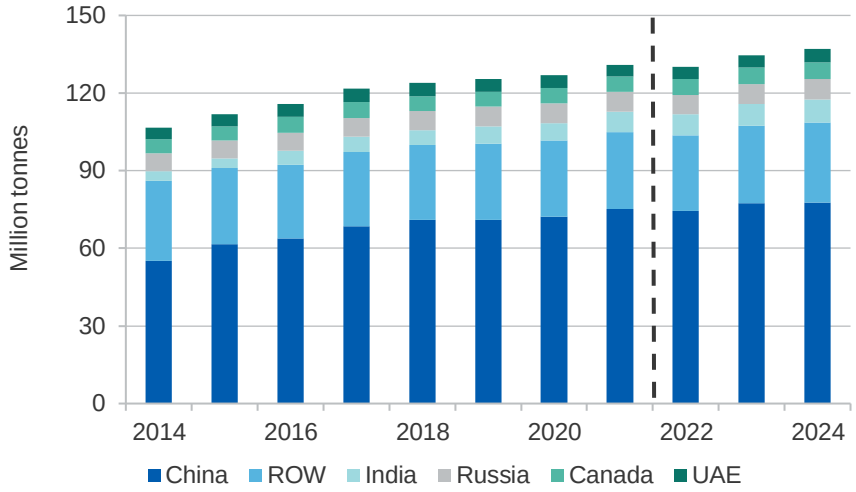
World bauxite usage is estimated to fall by 0.3% in 2022 to 357 million tonnes (Figure 11.3). The falls are expected to be due to lower alumina output from China.

Figure 11.1: World primary aluminium consumption



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

Figure 11.2: World alumina consumption



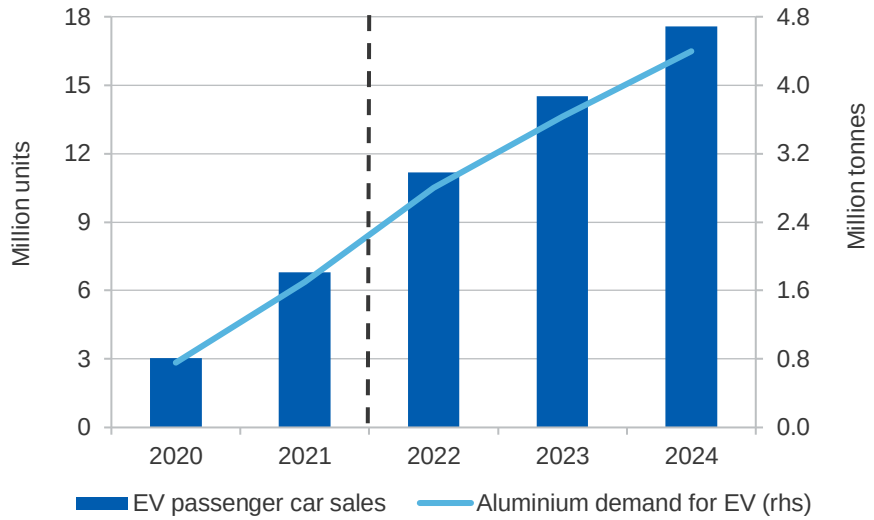
Notes: ROW: Rest of the world

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

Beyond 2022, world primary aluminium consumption is forecast to grow at an annual average rate of 1.7%, to reach 69 million tonnes by 2024 (Figure 11.1). A significant driver of aluminium demand is expected to come from cars, particularly energy-efficient vehicles and electric vehicles (EVs) — which contain a higher proportion of aluminium. It is estimated that EV passenger car sales will 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 11.3).

World alumina usage is forecast to rise at an average annual rate of 2.6% over the outlook period, reaching 137 million tonnes by 2024 (Figure 11.2). Alumina demand is driven by primary aluminium production, which is forecast to lift by an average of 2.8% a year between 2023 and 2024.

Figure 11.3: Global EV car sales vs aluminium demand



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

World bauxite usage is forecast to grow at an average annual rate of 2.0% over the outlook period to 372 million tonnes in 2024 (Figure 11.4). The gains are expected to be largely driven by higher alumina output from existing refinery capacities in China and India.

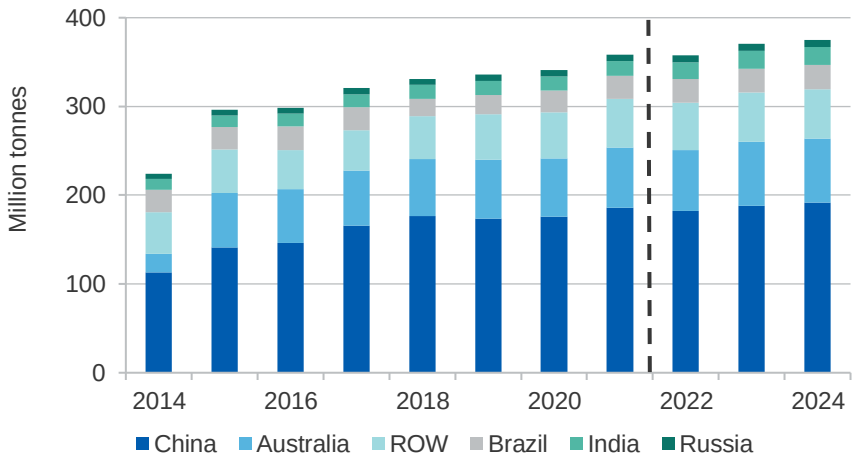
11.3 World production

Aluminium and bauxite output grew, but alumina output fell in H1 2022

World primary aluminium production fell by 0.5% year-on-year to nearly 34 million tonnes in the first-half of 2022, due to lower output in China and Brazil.

China produced over 19 million tonnes of primary aluminium in the first half of 2022, down by 0.8% year-on-year, as the COVID-19 containment measures and power restrictions in the March quarter 2022 affected smelting operations. Production recovered slightly in the June quarter 2022, driven by the removal of power restrictions and higher power supply.

Figure 11.4: World bauxite consumption



Notes: ROW: Rest of the world

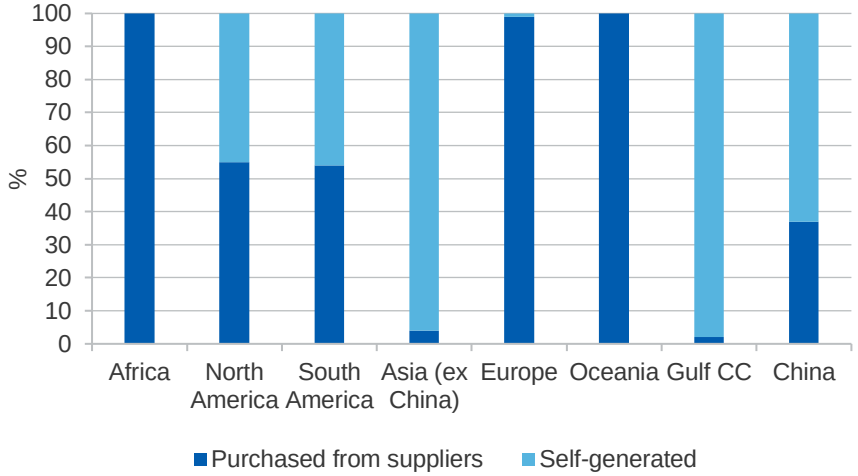
Source: Department of Industry, Science and Resources (2022)

Primary aluminium production in Brazil decreased by 8.9% year-on-year in the first-half of 2022 to 347,000 tonnes. The restart of Alcoa/South 32 447,000 tonnes a year Alumar aluminium smelter in Brazil was slower than expected, due to the need to stabilise the electrolytic bath. The smelter only produced 1,000 tonnes of primary aluminium in the June quarter 2022.

Primary aluminium production in the UAE increased by 12% year-on-year in the first-half of 2022 to 1.2 million tonnes, driven by the commission of 92 new reduction cells at Emirates Global Aluminium' Al-Taweelah aluminium smelter.

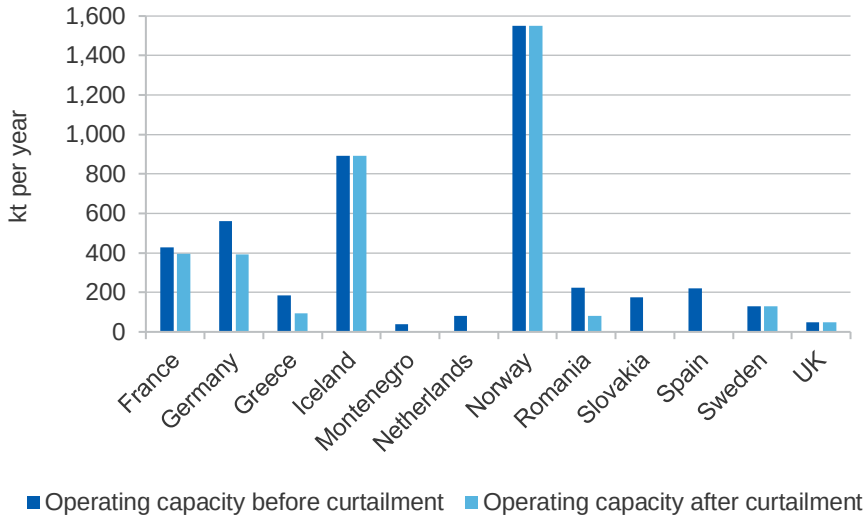
The spike in energy prices is a concern for aluminium smelting operations in Europe. The need to secure a competitive power price has become more difficult for European aluminium smelters, where they rely on third party power supply. Figure 11.5 shows the global aluminium smelting by power source. In Europe, nearly 100% of power is purchased from a third

Figure 11.5: Global aluminium smelting by power source



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

Figure 11.6: Ex-Russia European aluminium smelting capacity



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

party supplier. As a result, those aluminium smelters exposed to floating power prices are vulnerable to increased energy costs.

The big rise in power costs since the December quarter 2021 has resulted in around 755,000 tonnes a year of smelting capacity curtailments in ex-Russia Europe (Figure 11.6).

The curtailments account for over 17% of Europe's total operating capacity. An additional 201,000 tonnes a year of aluminium smelting capacity is expected to be curtailed in Europe before the end of 2022. Norsk Hydro has curtailed 40% capacity at its 174,000 tonnes a year Ziar nad Hro aluminium smelter in Slovakia since late 2021. On 17 August 2022, the company announced it would close the operation from the end of September 2022, due to high electricity prices.

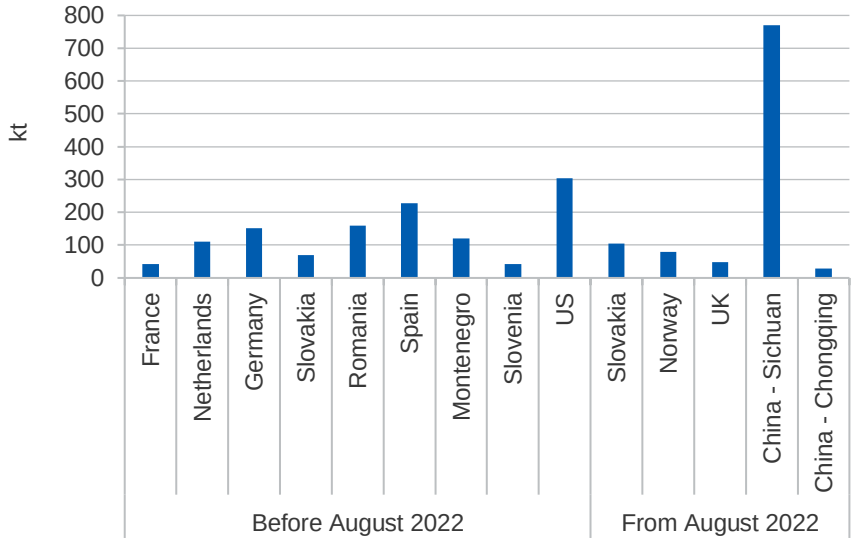
In Greece, the operation at Mytilineos Holdings' 186,000 tonnes a year Distomon aluminium smelter is likely to be impacted by the gas shortage in Europe.

In the US, the rise in energy costs has also affected the country's aluminium smelting capacity. Century Aluminium's 190,000 tonnes a year Hawesville aluminium smelter in Kentucky has been idled since 27 June 2022. The closure is expected to last for about a year until energy prices return to more normal levels.

On 1 July 2022, Alcoa announced a partial curtailment of 54,000 tonnes a year at its Warrick aluminium smelter in Indiana, citing labour shortages, higher energy and labour costs.

Figure 11.7 shows primary aluminium production curtailment in China, Europe and the US in 2022. Over 1.2 million tonnes of primary aluminium capacity were curtailed before August 2022. The US has the largest production curtailment (304,000 tonnes), followed by Spain (228,000 tonnes), Romania (159,000 tonnes), Germany (151,000 tonnes), Montenegro (120,000 tonnes), Slovakia (70,000 tonnes), France (43,000 tonnes) and Slovenia (43,000 tonnes).

Figure 11.7: Primary aluminium production curtailment in 2022



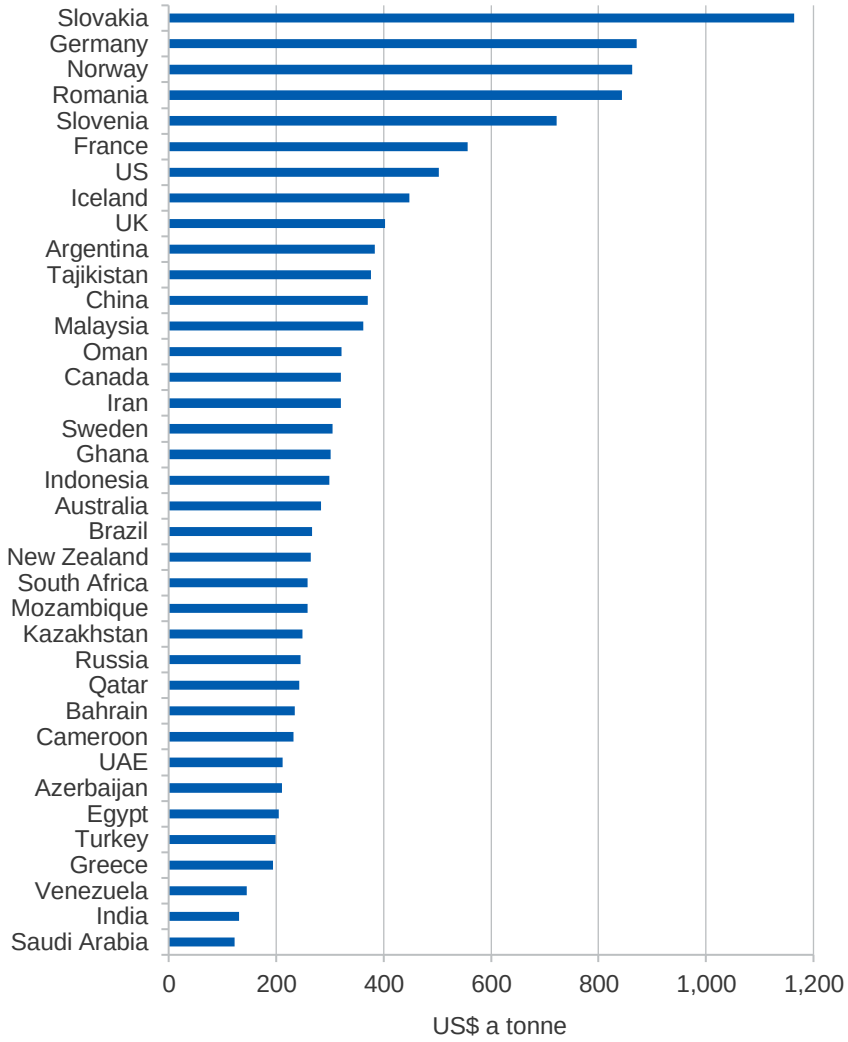
Source: SMM (2022)

Another 1.0 million tonnes of primary aluminium capacity have been curtailed from August 2022. China had the largest production curtailment (799,000 tonnes), followed by Slovakia (105,000 tonnes), Norway (80,000 tonnes) and the UK (48,000 tonnes).

The cost of producing a tonne of primary aluminium is estimated to go up in 2022 in all aluminium producing countries. In China — the world's largest aluminium producer — the cost of production is expected to increase by US$371 a tonne in 2022. Outside of China, the cost is expected to rise by US$284 a tonne in 2022.

Figure 11.8 shows the aluminium smelters' cash costs difference between 2021 and 2022. In Saudi Arabia, the cost of producing a tonne of primary aluminium is expected to increase by US$123 in 2022. In Europe, the cost of producing a tonne of primary aluminium is expected to rise by US$1,164 in Slovakia, US$871 in Germany, US$863 in Norway, US$844 in Romania

Figure 11.8: Aluminium smelters' cash costs difference between 2021 and 2022



Notes: Cash costs difference is the difference in the costs of producing a tonne of primary aluminium in 2021 and 2022. 2022 figures are estimated.

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

and US$556 in France in 2022. Energy now accounts for around 80% of the cost of producing aluminium in Europe.

Rusal — the world's largest aluminium producer outside China — reported a 33% (to US$2,028 a tonne) jump in production costs in the first-half of 2022. The ban on alumina exports to Russia imposed by the Australian Government and the suspension of production at its Nikolaiev alumina refinery in Ukraine, have been the main contributors to increased production costs.

According to Wood Mackenzie, at a price of US$2,450 a tonne, around 16% of ex-China primary aluminium smelters are losing money on a commercial cash cost basis. If the LME spot price for primary aluminium falls to US$2,000 a tonne, it is estimated that 37% of ex-China primary aluminium smelters will make losses.

World alumina supply fell by 1.1% year-on-year in the first half of 2022 to nearly 71 million tonnes, due to lower output in Europe and China — the world's largest alumina producer. Over this period, production in China fell by 1.0% year-on-year to 39 million tonnes. Alumina refinery output declined in northern China, but rose in southern China. In the northern China region, the 1.2 million tonnes a year Liulin Senze alumina refinery cut 400,000 tonnes of alumina capacity in June and July 2022 for environmental upgrades.

The 2.1 million tonnes a year Kaiman alumina refinery in Henan province lost nearly 20,000 tonnes of alumina output in June 2022, due to maintenance activity. In the southern China region, the 2.8 million tonnes a year Jiaokou alumina refinery restarted a 700,000 tonnes a year production line in June 2022 that was curtailed in 2021, due to a bauxite shortage.

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. According to the company, the cost of producing a tonne of alumina has reached US$900, whereas the spot alumina is trading at around US$330 a tonne.

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. The cost of natural gas at the refinery has increased from US$45 a tonne in early 2021 to US$245 a tonne in the June quarter 2022.

World bauxite supply increased by 3.0% year-on-year in the first half of 2022, to nearly 189 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 2.1% year-on-year to nearly 47 million tonnes, as the ramp up of production continued.

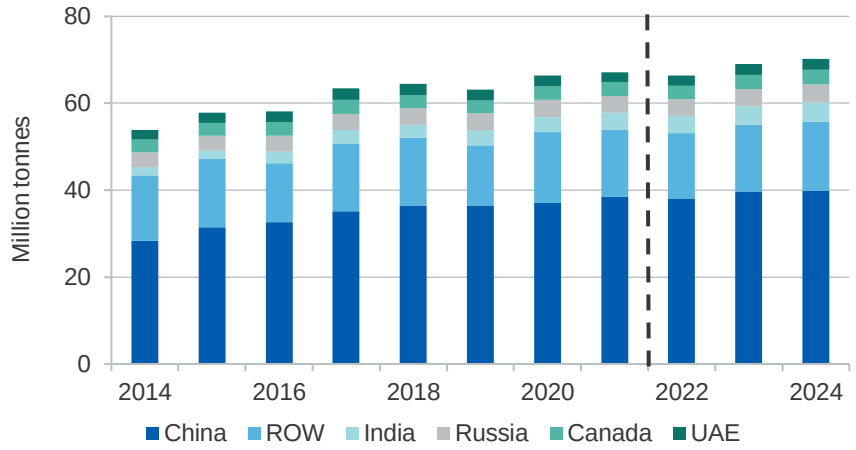
Over the first-half of 2022, production in Australia fell by 1.3% year-on-year to 51 million tonnes, due to lower bauxite mine output in the Northern Territory and Western Australia.

World primary aluminium output is estimated to fall by 1.0% year-on-year to 66 million tonnes in 2022, due to lower primary aluminium output from China and Europe (Figure 11.9).

China's primary aluminium production is forecast to fall by 0.9% year-on-year in 2022 to 38 million tonnes. A tighter power market in the second half of 2022 (amid soaring temperatures during summer) is the main factor in the decline of primary aluminium output. A number of hydropower stations have been impacted. This has led the aluminium hubs of Sichuan and Chongqing to announce that they will prioritise electricity for residential users.

Facing a huge electricity shortage, the provincial government of Sichuan ordered local industrial companies to suspend production from 15 to 20 August 2022. In a similar move, the local administrator of Chongqing city decided to suspend all production at some industrial enterprises for one week, from 17 to 24 August 2022.

Figure 11.9: 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)

The power shortage issue is likely to spread through other areas of China. Zhejiang, Anhui, Hubei and Jiangsu provinces have also issued alerts about potential shortages, with some industrial enterprises being asked to use electricity judiciously.

In Europe, over half of European (ex-Russia) aluminium smelting capacity has been curtailed so far in 2022. More capacity is expected to go offline by the end of 2022, due to power supply crisis in winter (as discussed above).

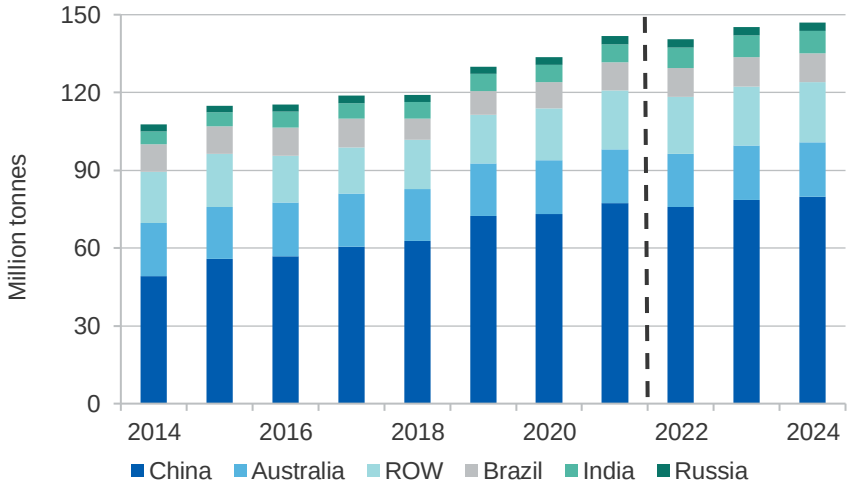
Primary aluminium production in India is forecast to increase by 3.2% year-on-year to reach nearly 4.1 million tonnes in 2022.

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.

World alumina output is estimated to decrease by 0.9% year-on-year to 140 million tonnes in 2022, due to lower alumina output in China (Figure 11.10). Like aluminium smelters, Chinese alumina refineries face energy shortages that lead to production suspension or cuts. The 800,000 tonnes a year Chongqing alumina refinery shut down production completely in August 2022.

The rise in production costs is another concern for alumina refineries in China. Bauxite and caustic soda are the key ingredients in the refining of alumina. In China, the prices for both commodities have increased since April 2022, particularly in Shanxi and Henan provinces, where bauxite is scarce. The 3.2 million tonnes a year Lingshi alumina refinery cut 1.0 million tonnes of alumina capacity in July 2022, due to bauxite shortages. The 1.5 million tonnes a year Huaqing alumina refinery cut 200,000 tonnes of alumina capacity in July 2022, due to a shortage of caustic soda supply.

Figure 11.10: 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 3.0% to 379 million tonnes in 2022, driven by higher production in Guinea (up 5.5% year-on-year to 92 million tonnes) (Figure 11.11).

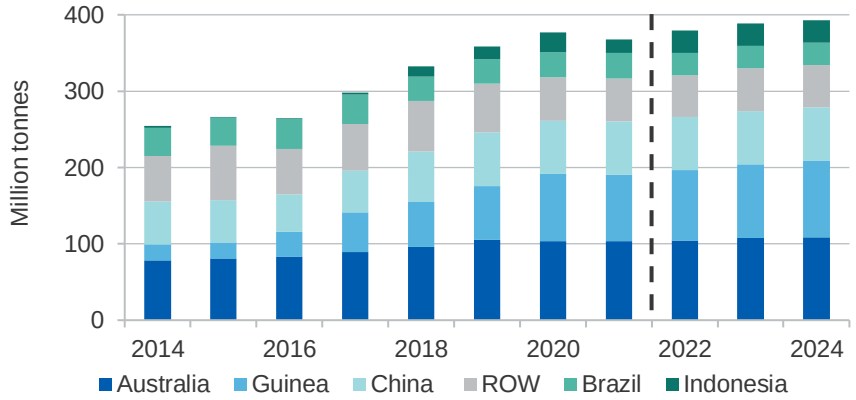
In Guinea, the Compagnie des Bauxites de Guinée mine is due to expand further to 28 million tonnes by the end of 2022, after expanding from 13 to 18 million tonnes a year in 2019. Emirates Global Aluminium is also ramping up output at its 12 million tonnes a year bauxite mine in Guinea.

The Indonesian Government has revoked 2,065 mining permits for various minerals, including bauxite, due to non-compliance or because they have not been used. This revocation is likely to reduce Indonesian bauxite production capacity from 2022 and beyond. In 2021, Indonesia produced 18 million tonnes of bauxite, accounting for 4.9% of total global bauxite output.

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

World primary aluminium production is forecast to increase at an average annual rate of 2.8% in 2023 and 2024, to reach 70 million tonnes by 2024 (Figure 11.9).

Figure 11.11: World bauxite production



Notes: ROW: Rest of the world

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

The gains are expected to be driven by increased aluminium output from China and Indonesia. After a 0.9% fall in 2022, China's primary aluminium output is forecast to resume growing by 4.0% in 2023 to nearly 40 million tonnes, followed by a further 0.5% growth in 2024.

Zhongrui Aluminium is expected to commence the construction of stage 2 of its Gansu aluminium smelter in Baiyin City, Guangdong province before the end of 2022. The expansion is expected to lift the smelter's output from 100,000 tonnes a year in 2022 to 292,000 tonnes a year in 2024.

New Zealand Aluminium Smelter is exploring potential pathways with electricity suppliers that would see its 350,000 tonnes a year Tiwai Point aluminium smelter stay open beyond the end of 2024.

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

World alumina output is forecast to increase by 2.3% a year over the outlook period, reaching 147 million tonnes by 2024 (Figure 11.10). The gains are forecast to be driven by China, Australia, India, Indonesia, and other small alumina refining nations.

China Aluminium Company and the Indonesian joint-venture partners' 2 million tonnes a year Mempawah alumina refinery in Indonesia is expected to come online in 2024. The project could be delayed or terminated if there is no agreement between the operators and contractors by October 2022.

In August 2022, the eastern Indian state of Odisha approved Adani's 4.0 million tonnes a year alumina refinery project. The cost of the project is estimated to be US$5.2 billion. The start and completion dates of the project are still unknown at the time of writing.

After 2022, world bauxite production is forecast to increase by 1.8% a year over the outlook period, reaching 393 million tonnes by 2024 (Figure 11.11). Australia and Guinea are expected to contribute most to this rise.

Low carbon aluminium, alumina and bauxite

At the end of June 2022, Rio Tinto and Corona Canada launched Canada's first low carbon beverage can pilot program. This pilot is a step towards a fully traceable beverage can that will allow consumers to use the QR codes to see how their products were made from mine to the market.

On 14 July 2022, Rio Tinto unveiled a plan to spend US$188 million to boost the production of low carbon aluminium billets (to 202,000 tonnes a year) at its Alma smelter in Lac-Saint-Jean in Quebec, Canada. The expansion will allow the company to meet the surging demand for high quality aluminium alloys and value-added products made with renewable hydroelectricity.

On 21 July 2022, Rio Tinto signed a non-binding memorandum of understanding with Ford Motor Company to supply low carbon materials — such as aluminium, lithium and copper — to be used in Ford lightweight and electric trucks. Rio aims to produce the first commercial batches of near zero aluminium from its ELYSIS joint-venture with Apple in Canada in 2024. The near carbon-free aluminium is made by using Canada's abundant hydroelectricity and the ELYSIS smelting process which employs non-carbon anodes to electrolyse raw alumina.

In Australia, Rio Tinto has contracted EDL (a global producer of sustainable distributed energy) to build a 4.0 megawatt solar farm and a 4.0 megawatt battery to complement its existing 1.6 megawatt farm at its Weipa bauxite mines in Queensland.

Following its call for proposals to develop large scale wind and solar power in central and southern Queensland to power its Boyne aluminium smelter, Yarwun alumina refinery and Queensland alumina refinery in June 2022, Rio Tinto said in August 2022 that it had received several offers. Despite it being early in the process, the initiative is likely to help Rio Tinto to meet its climate change commitments.

Brisbane based Graphene Manufacturing Group (GMG) has recently signed an informal partnership with Rio Tinto to develop a graphene aluminium-ion battery. GMG claims the battery can charge up to 70 times faster, with three times more battery life than lithium-ion batteries. GMG is working on a pilot plan to start producing graphene aluminium-ion batteries by 2024. Rio Tinto will supply aluminium from its alumina refinery in Gladstone.

11.4 World trade

Strong aluminium and alumina exports from China in the first half of 2022

World primary aluminium exports decreased by 13% year-on-year in the first half of 2022 to 6.5 million tonnes, due to lower exports from Russia, Canada and the Netherlands.

The fallout from the Russian invasion of Ukraine has reduced Russian primary aluminium exports by 88% (or 439,000 tonnes) year-on-year in the March quarter 2022. Export data for the June quarter 2022 is not publicly available.

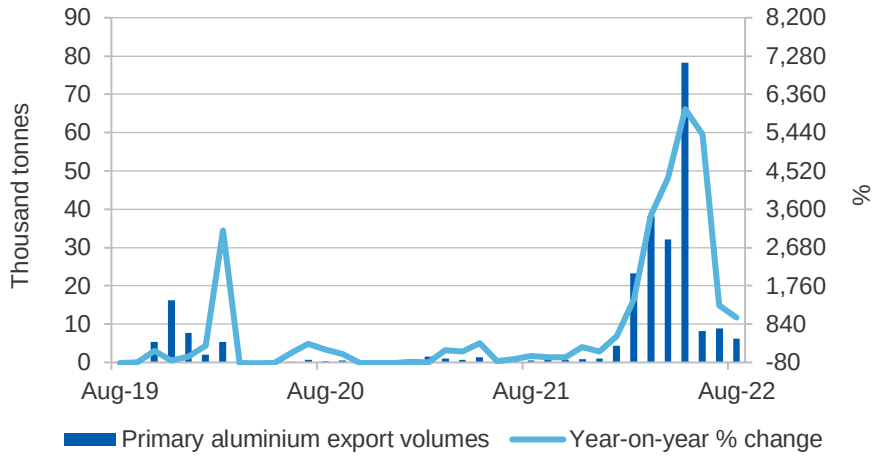
In Canada, primary aluminium exports fell by 6.2% year-on-year in the first-half of 2022 to nearly 1.4 million tonnes, as the slowdown in the US construction activity affected primary aluminium demand from Canada.

In the Netherlands, primary aluminium exports fell by 0.5% year-on-year in the first half of 2022 to 1.2 million tonnes. Over this period, the Netherlands imported 58,658 tonnes of primary aluminium from China, and re-exported it to other European countries.

Offsetting the fall in aluminium exports from Russia, Canada and the Netherlands was higher primary aluminium exports from China.

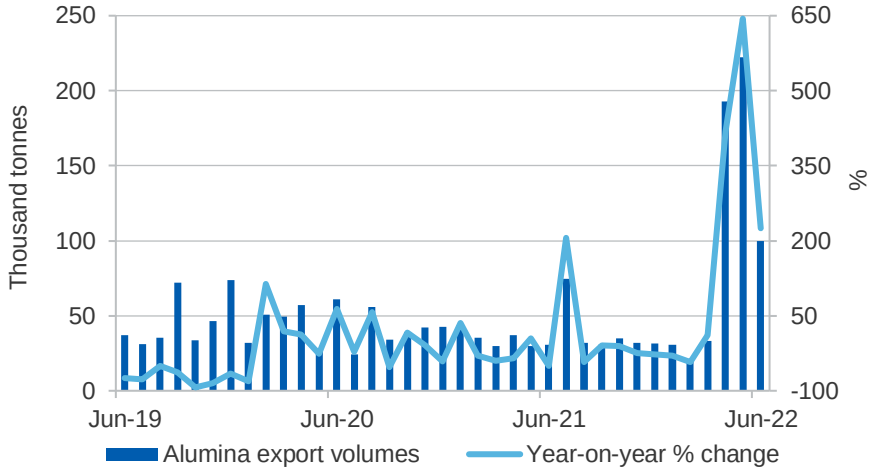
China's primary aluminium exports accelerated in the first eight months of 2022. Over this period, China exported 199,386 tonnes of primary aluminium, up 2,912% year-on-year (Figure 11.12), of which 31% were exported to the Netherlands, 17% to Turkey and 15% to South Korea. In particular, exports in May 2022 jumped by 6,004% year-on-year to over 78,000 tonnes. Most of the metal was exported from bonded warehouses, and was not subject to the 15% export tax.

Figure 11.12: China's primary aluminium exports (monthly)



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

Figure 11.13: China's alumina exports (monthly)



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

World alumina exports decreased by 8.4% year-on-year in the first half of 2022 to 20 million tonnes due to lower alumina exports from Australia and Ukraine. Over this period, Australia — the world's largest alumina exporter — recorded a 6.8% year-on-year fall in alumina exports. The Australian Government's decision to ban alumina exports to Russia in March 2022 impacted Australian alumina export earnings in the June quarter 2022.

The conflict with Russia has hit Ukraine's alumina exports. The country used to export 1.8 million tonnes of alumina a year before the war. In the first half of 2022, Ukraine's alumina exports fell by 71% year-on-year to 255,000 tonnes, with no exports at all in the June quarter 2022.

Offsetting the decline in alumina exports from Australia and Ukraine was an increase in alumina exports from China. In the first half of 2022, China exported 716,782 tonnes of alumina, a rise of 247% year-on-year (Figure 11.13).

World bauxite exports increased by 5.1% year-on-year in the first half of 2022 to 79 million tonnes, propelled by a 3.7 year-on-year rise in Australia — the world's second largest bauxite exporter — and a 56% rise in Indonesia — the world's third largest bauxite exporter. Indonesian bauxite exporters ramped up their exports ahead of an export ban likely to be imposed by the Indonesian Government before the end of 2022. Over this period, bauxite exports from Guinea — the world's largest bauxite exporter — rose by 0.5% year-on-year.

Higher aluminium and bauxite imports, but lower alumina imports

World primary aluminium imports rose by 3.0% year-on-year in the first-half of 2022 to over 10 million tonnes, driven by increased imports from the US, European countries and China.

In the US, primary aluminium imports increased by 25% year-on-year in the first half of 2022 to over 3.2 million tonnes. Strong economic activity in the March quarter 2022 — prior to the US Federal Reserve's first rate hike in 2022 — and increased aluminium use in new energy efficient cars and technologies were contributing factors to higher aluminium imports.

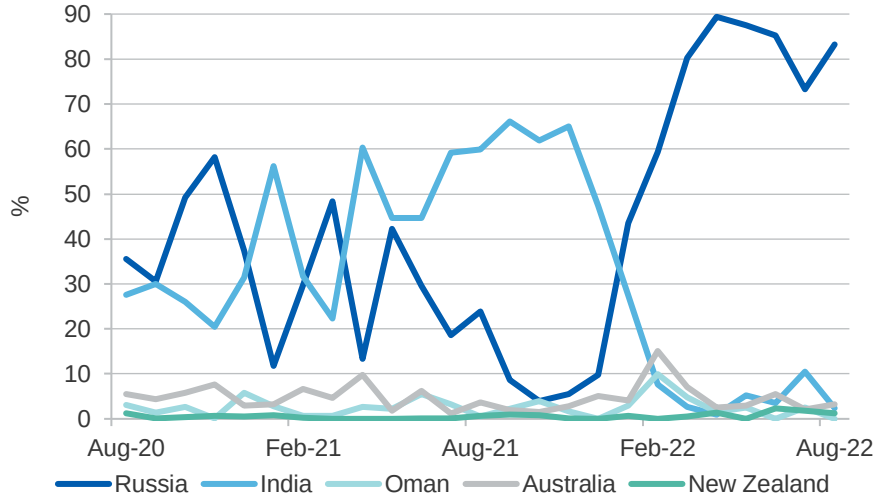
In Europe, primary aluminium output has been declining since mid-2021, due to energy shortages and higher power costs, with many countries turning to imports to meet primary aluminium demand. In the first half of 2022, primary aluminium imports by Germany rose by 7.2% year-on-year to 1.0 million tonnes, Italy (up 11% year-on-year to 594,000 tonnes), France (up 9.4% year-on-year to 245,000 tonnes), and Greece (6.5% year-on-year to 213,000 tonnes).

China's imports of primary aluminium decreased by 73% year-on-year in the first half of 2022 to 200,000 tonnes, due to lower domestic primary aluminium consumption.

Russia's share of China's primary aluminium imports accelerates in 2022

Russia's share of China's primary aluminium imports has accelerated since the start of 2022. As at August 2022, Russia accounted for 83% of China's total primary aluminium imports. It reached a peak of nearly 90% in April 2022 (Figure 11.14).

Figure 11.14: Shares of China's primary aluminium imports



Source: China Customs (2022)

After reaching a peak of 15% in February 2022, Australia's share of China's primary aluminium imports fluctuated between 2.2% and 7.0% (Figure 11.14).

India was China's largest primary aluminium supplier in 2021, reaching a peak share of 66% in September 2021. However, its share of China's primary aluminium imports has tumbled to less than 10% in 2022 (Figure 11.14).

World alumina imports fell by 22% year-on-year in the first half of 2022 to nearly 15 million tonnes, due to a 37% and 6.7% year-on-year fall in alumina imports from China and Norway, to 912,000 and 1.3 million tonnes, respectively. Lower primary aluminium production in China (down by 0.8% year-on-year) and Norway (down by 6.7% year-on-year) was the main reason for lower alumina imports.

World bauxite imports increased by 10% year-on-year in the first-half of 2022 to nearly 78 million tonnes, driven by higher imports from China — the world's largest bauxite importer.

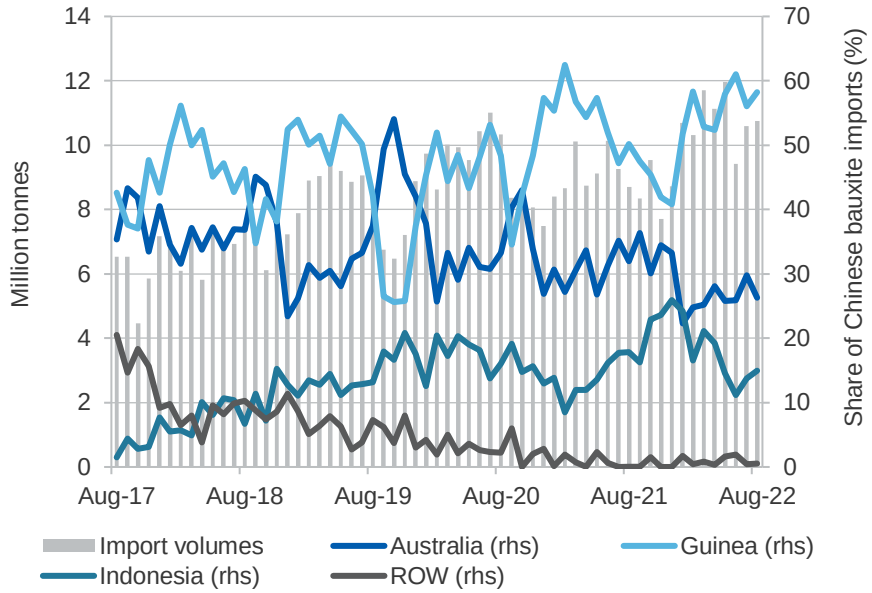
China imported 87 million tonnes of bauxite in the first eight months of 2022, an 18% year-on-year rise from 2021. The largest ever monthly import volume was in May 2022 at 12 million tonnes (Figure 11.15).

Guinea is China's largest bauxite import source, accounting for 56% of China's total bauxite imports.

Australia is China's second largest bauxite import source, accounting for 26% of China's total bauxite imports. Australia's share of China's bauxite imports has fallen to less than 30% since the start of 2022.

Indonesia is China's third largest bauxite import source, accounting for 17% of China's total bauxite imports. Indonesia's share of China's bauxite import is likely to fall further over the coming months: the Indonesian Government is expected to implement a bauxite export ban before the end of 2022. This is part of the Indonesian Government's push to refine more of its mine production domestically, in order to create more employment in Indonesia.

Figure 11.15: China's bauxite import volumes and sources



Notes: ROW: Rest of the world

Source: Bloomberg (2022)

11.5 Prices

Falling demand pushed aluminium prices lower

The London Metal Exchange (LME) spot price for primary aluminium has decreased 25% so far in 2022, sitting at US$2,106 a tonne on 27 September 2022 — compared to an average of US$2,384 a tonne in the first nine months of 2021. Falling demand from key primary aluminium consuming countries or regions — Europe and China — was the main driver of the weakening in the primary aluminium price in the June quarter 2022 (see *World Consumption* section).

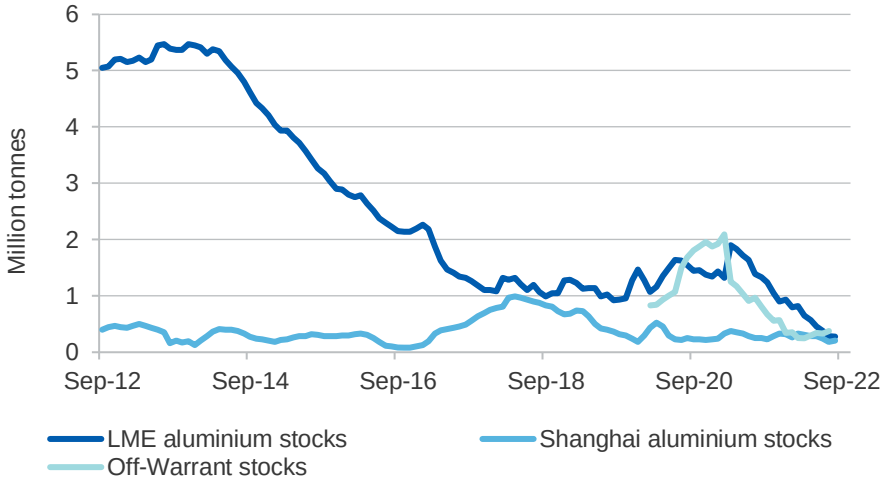
LME stocks reached a 39-year low in July 2022, at 277,050 tonnes, and remained low at 335,625 tonnes in late September 2022. A high proportion of cancelled warrants further reduced availability, with 51% of stocks booked for removal. Shanghai Futures Exchange stocks fell to a 2.5-year low in July 2022, at 185,358 tonnes, and remained low at 209,998 tonnes in late September 2022. LME off-warrant stocks have risen from their lowest level in March 2022, at 381,394 tonnes in July 2022 (Figure 11.16).

Despite a gloomy outlook for the global economy, the LME spot price for primary aluminium has remained stable since August 2022 amid lower supply from China and Europe. In China, primary aluminium producers have been asked to suspend or cut their production in responding to power shortages. In Europe, about half of aluminium smelting capacity has been curtailed, and more is set to go offline before the end of 2022 amid power supply issues (see *World Production* section).

As a result of lower supply, the LME primary aluminium spot price is estimated to average US$2,790 a tonne in 2022, a rise of 13% year-on-year (Figure 11.17).

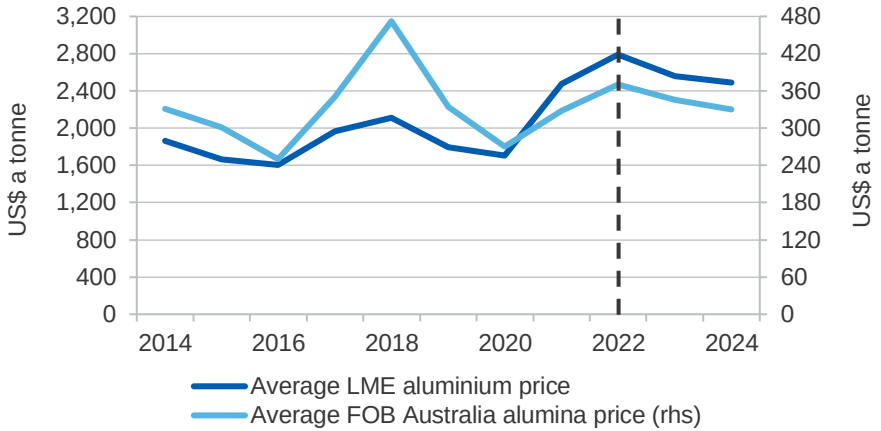
Inflation, rising interest rates and weakening global economic growth remain risks to aluminium prices over the outlook period. Higher inflation rates have forced central banks around the world to increase interest rates, which are likely to have dampening effects on economic activity.

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)

The strong US dollar — which reached parity against the Euro in July 2022 — is also likely to be a headwind for all commodity prices. The LME spot price for primary aluminium is no exception.

The free on board (FOB) Australian alumina price has increased 0.3% so far in 2022, at US$346 a tonne on 28 September 2022 — compared to an average of US$367 a tonne in the second half of 2021. Alumina supply from ex-Russia markets, including Australia, is in abundant and putting downward pressure on alumina prices.

The FOB Australian alumina price is forecast to US$370 a tonne in 2022 (up 13%), driven by higher aluminium production in China (Figure 11.17).

Primary aluminium and alumina prices to fall in 2023 and 2024

After 2022, the LME aluminium price is forecast to drift down to an average of US$2,560 and US$2,490 a tonne in 2023 and 2024, respectively (Figure 11.17). Despite this fall, primary aluminium prices are expected to remain at relatively high levels, as growing demand for new, energy-efficient cars and technologies supports aluminium usage. As a result, the FOB Australian alumina price is forecast to fall to US$330 a tonne in 2024 (Figure 11.17).

11.6 Australia's exports and production

Higher aluminium and alumina prices drove exports in 2021–22

Australia's aluminium, alumina and bauxite exported increased by 32% year-on-year in 2021–22 to nearly $16 billion, propelled by higher primary aluminium prices. A 42% year-on-year rise in the LME aluminium price in 2021–22 helped boost Australian primary aluminium export values by 54% year-on-year to nearly $5.8 billion in 2021–22.

Over this period, primary aluminium exports to Japan and Taiwan rose by 57% and 48% year-on-year to $1,505 million and $618 million, respectively, as manufacturing of energy efficient technologies (requiring higher aluminium content) picked up.

Australian alumina export values rose by 29% year-on-year in 2021–22 to nearly $9.0 billion, driven by a 35% year-on-year rise in alumina prices in 2021–22. Alumina export volumes were down by 4.6% year-on-year in 2021–22 to nearly 18 million tonnes.

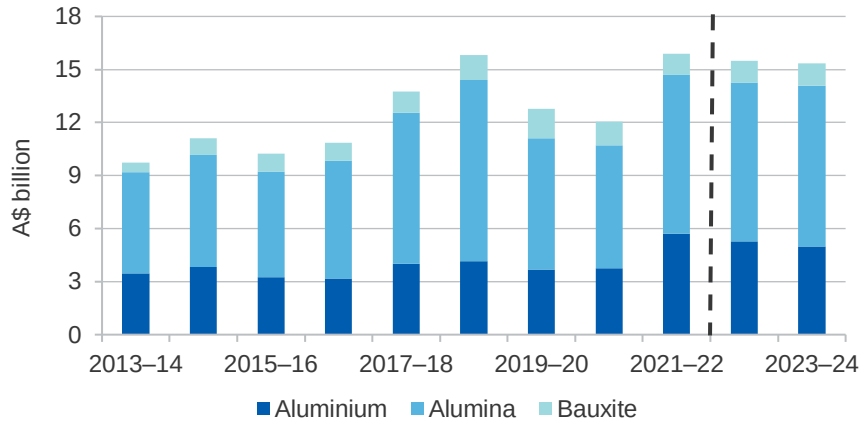
Australian bauxite export values decreased by 12% year-on-year in 2021–22 to nearly $1.2 billion, despite a 0.5% year-on-year rise in bauxite export volumes. China remained the main market for Australian bauxite, accounting for 98% of total Australian bauxite exports in 2021–22.

Steady alumina, aluminium and bauxite exports over the outlook period

Over the outlook period, Australia's aluminium, alumina and bauxite exports are forecast to be steady, at $15 billion a year, with the prices of primary aluminium forecast to remain relatively high over the outlook period (Figure 11.18).

On 12 August 2022, South 32 reached a 10-year alumina supply agreement with Aluminium Bahrain BSC. Under the agreement, South 32's Worsley alumina refinery in WA will supply up to 1.25 million tonnes a year of alumina.

Figure 11.18: Australian aluminium/alumina/bauxite exports



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 2021–22

Australia's primary aluminium output fell by 3.1% in 2021–22, to 1.53 million tonnes, due to lower production at Rio Tinto's Boyne Island aluminium smelter operations in Queensland. The COVID-19 related unplanned absences have taken a hit to the smelter's production (down by 6.3% year-on-year in 2021–22).

Australia's alumina output fell by 3.9% to 20.1 million tonnes in 2021–22. The fall is attributed to lower alumina production (down by 5.6% year-on-year in 2021–22) at Rio Tinto's Queensland Alumina Limited (QAL) refinery in Queensland. The refinery operations were badly affected by COVID-19 related absences, bad weather and unplanned outages in the June quarter 2022. Offsetting the production decline at the QAL was improved output from South 32, Japan Alumina and Sojitz Alumina joint-venture Worsley Alumina refinery in Western Australia. In 2021–22, production at Worsley rose by 1.3% year-on-year to 4.6 million tonnes.

Australia's bauxite production fell by 0.4% year-on-year to 103 million tonnes in 2021–22, due to lower production at the Boddington bauxite mine in WA (down by 2.0% year-on-year to 18.8 million tonnes) and Gove bauxite mine in the Northern Territory (down by 4.6% year-on-year to 11.6 million tonnes).

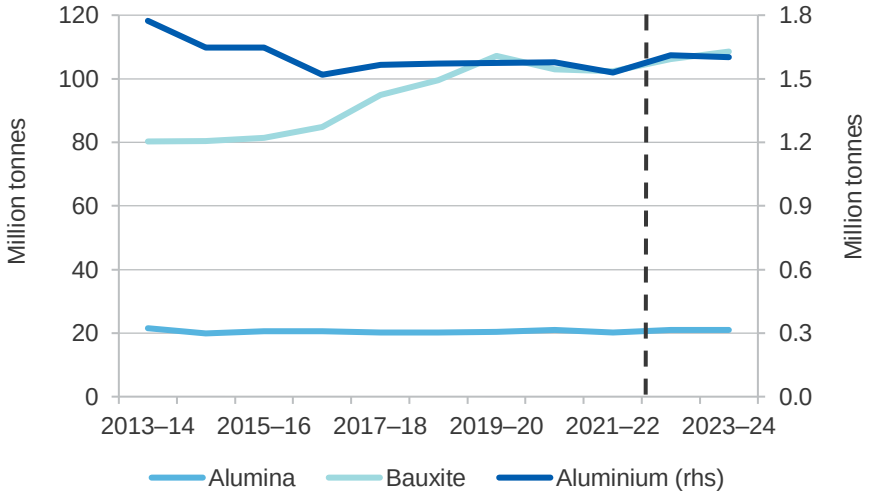
Higher bauxite output over the outlook period

On 7 November 2021, Alcoa announced a restart of 35,000 tonnes a year idled capacity at its Portland Aluminium smelter in Victoria. The reactivated capacity came online in September 2022, and will bring Australia's primary aluminium output to 1.6 million tonnes a year from 2022–23 and beyond (Figure 11.19).

No expansions or major disruptions are expected at existing alumina operations in Australia over the outlook period. Australia's alumina output is forecast to remain at about 21 million tonnes a year over this time (Figure 11.19).

Australia's bauxite output is forecast to increase at 2.9% a year between 2022–23 and 2023–24, reaching 109 million tonnes in 2023–24 (Figure 11.19). On 29 June 2022, Metro Mining's board approved a final

Figure 11.19: Australian aluminium/alumina/bauxite output



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

investment decision (subject to financing) to expand the capacity of its Bauxite Hills mine in Queensland from 4 million tonnes a year to 7 million tonnes a year. The expansion is expected to be completed in the September quarter 2023.

In August 2022, the Western Australian Environmental Protection Authority gave stakeholders and community groups an additional two weeks (from 16 to 29 August 2022) to comment on South 32's proposed expansion at its Worsley alumina operations in WA. This proposal will allow for the expansion of existing activities at the refinery, which has production capacity of 4.7 million tonnes a year, while allowing the impacts to be assessed and increasing the effectiveness and efficiency of environmental management.

Revisions to the outlook

The forecast for Australia's aluminium, alumina and bauxite export earnings has been revised down from the June 2022 *Resources and Energy Quarterly*: by $942 million in 2022–23 and by $808 million in 2023–24. The revision reflects lower forecast prices for primary aluminium over the outlook period.

The forecast for world primary aluminium production has been revised down from the June 2022 *Resources and Energy Quarterly* — by 1.9 million tonnes in 2022, 2.1 million tonnes in 2023 and 2.2 million tonnes in 2024. The revision reflects larger than expected primary aluminium production curtailments in China and Europe in 2022.

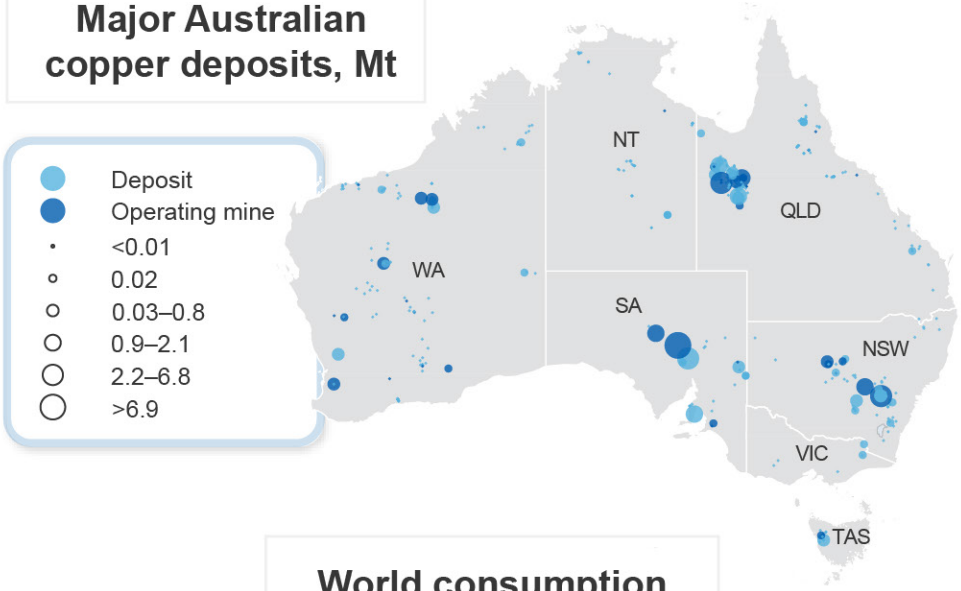
Table 11.1: Aluminium, alumina and bauxite outlook

						Annual percentage change		
World	**Unit**	**2021**	**2022 [s]**	**2023[f]**	**2024[f]**	**2022 [s]**	**2023[f]**	**2024[f]**
Primary aluminium								
Production	kt	67,119	66,447	69,063	70,244	-1.0	3.9	1.7
Consumption	kt	68,467	67,185	68,302	69,453	-1.9	1.7	1.7
Prices aluminium[c]								
- nominal	US$/t	2,477	2,790	2,560	2,490	12.6	-8.2	-2.7
- real[d]	US$/t	2,667	2,790	2,484	2,363	4.6	-11.0	-4.9
Prices alumina spot								
- nominal	US$/t	328	370	345	330	12.7	-6.7	-4.3
- real[d]	US$/t	353	370	335	313	4.7	-9.4	-6.4
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	1,610	1,603	-3.5	5.6	-0.4
Alumina	kt	20,949	20,113	20,906	21,011	-4.0	3.9	0.5
Bauxite	Mt	103.0	102.5	106.2	108.6	-0.4	3.6	2.2
Consumption								
Primary aluminium	kt	284	245	209	208	-13.7	-14.6	-0.3
Exports								
Primary aluminium	kt	1,357	1,369	1,449	1,443	0.9	5.9	-0.4
- nominal value	A$m	3,763	5,721	5,269	4,971	52.0	-7.9	-5.6
- real value[e]	A$m	4,205	6,122	5,269	4,770	45.6	-13.9	-9.5
Alumina	kt	18,600	17,736	18,188	18,280	-4.6	2.5	0.5
- nominal value	A$m	6,948	8,977	9,008	9,098	29.2	0.3	1.0
- real value[e]	A$m	7,765	9,605	9,008	8,730	23.7	-6.2	-3.1
Bauxite	kt	35,782	35,957	35,128	35,902	0.5	-2.3	2.2
- nominal value	A$m	1,339	1,177	1,222	1,261	-12.1	3.8	3.2
- real value[e]	A$m	1,496	1,259	1,222	1,210	-15.9	-3.0	-0.9
Total value								
- nominal value	A$m	12,050	15,875	15,498	15,331	31.7	-2.4	-1.1
- real value[e]	A$m	13,466	16,985	15,498	14,710	26.1	-8.8	-5.1

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).

29 Cu 63.546 Copper

Major Australian copper deposits, Mt



Copper facts

- The average home contains **180 kg of copper**
- Being 100% recyclable, nearly 80% of copper produced is **still in use**
- An electric car contains about **5x more** copper than equivalent ICE cars
- China consumes half of the **world's copper**

World consumption

- **31%** Equipment
- **30%** Building Construction
- **15%** Infrastructure
- **12%** Transport
- **12%** Industrial

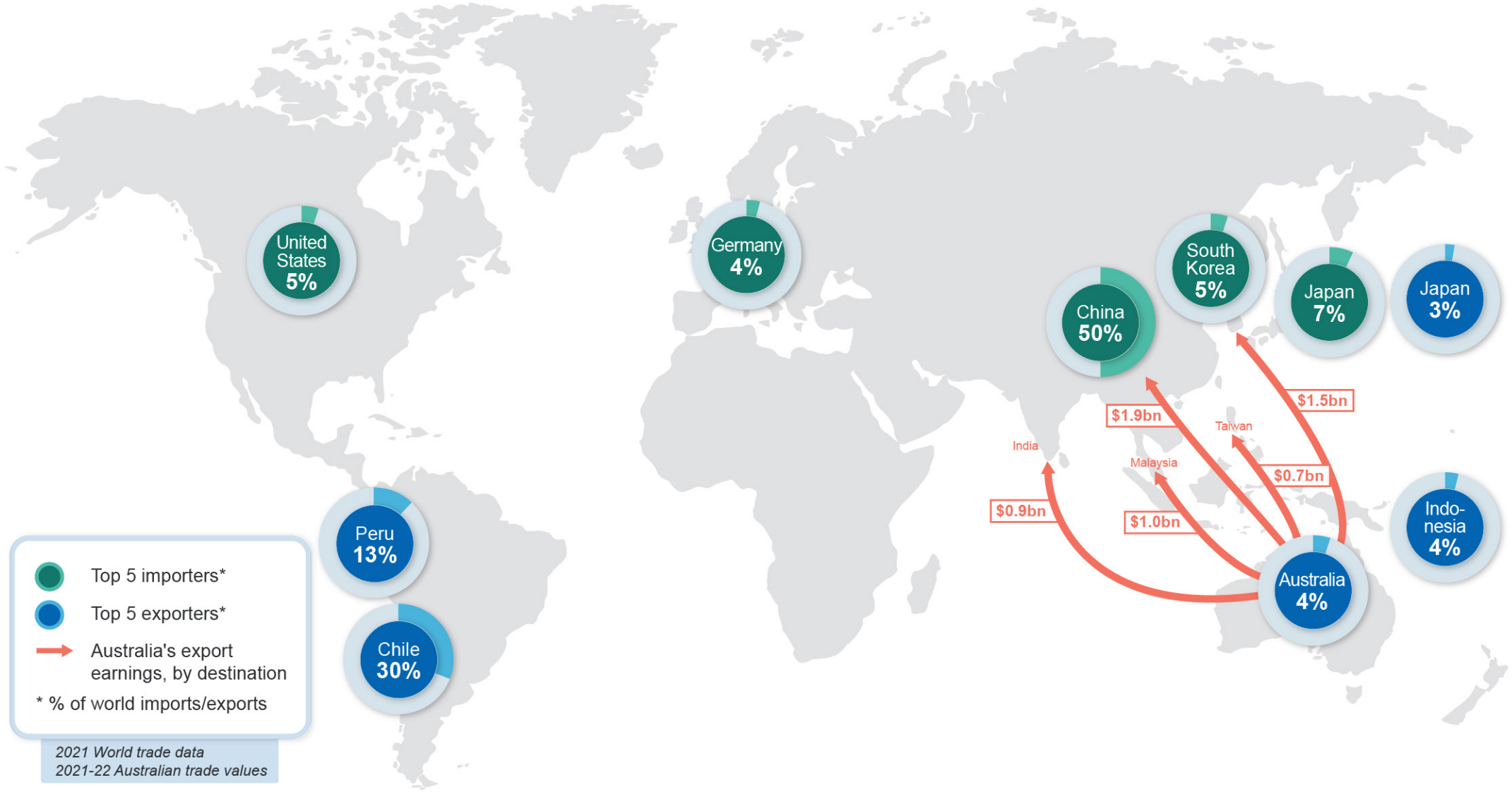
Australia's copper

- **Ranked 2nd** for **copper resources**
- **6th largest mined copper producer** in the world
- **$12 billion** of **copper exports** in 2021-22

Copper

29 Cu 63.546

Trade map | September 2022



12.1 Summary

- Copper prices are forecast to fall by 4.9% to below US$8,900 a tonne in 2022, as COVID-19 containment measures and high energy prices weigh on demand. Prices are forecast to fall to US$8,300 a tonne in 2024 as mine production grows.
- Australia's copper exports fell to 802,000 tonnes in 2021–22 as scheduled maintenance reduced production. Copper exports are expected to grow to 977,000 tonnes by 2023–24 as production from new mines and mine expansions come online (see *Australia section*).
- As output and export volumes grow, Australia's copper export earnings are projected to lift from $12.3 billion in 2021–22 to $13.9 billion in 2023–24.

12.2 World consumption

Global macroeconomic headwinds weigh on copper demand

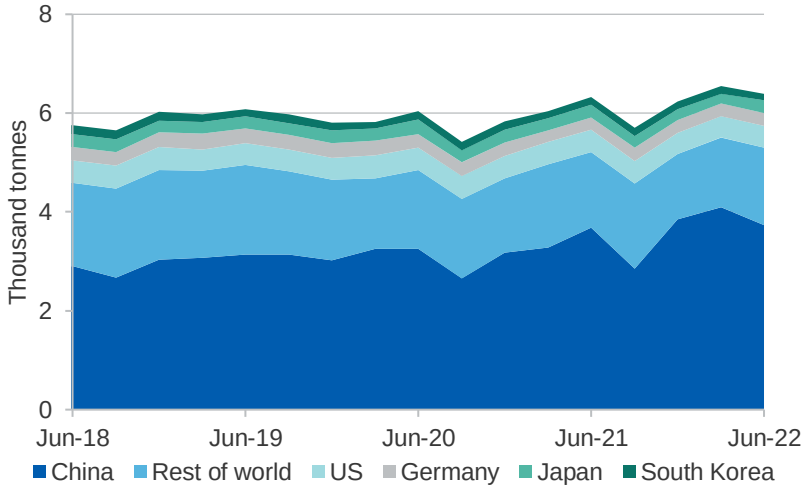
In the June quarter 2022, global copper consumption rose by 4.0% quarter-on-quarter, but was only 1.7% higher than the same period last year. Global consumption is seasonally strong each June quarter: in China, refinery shutdowns occur during the Chinese Lunar New Year celebrations in the March quarter, and then activity is strong before the Northern Hemisphere summer. The stunted year-on-year growth may largely reflect the severe lockdown restrictions in place in major Chinese cities (including Shanghai) between March and May this year.

While the COVID-19 situation in China is likely to remain uncertain, fewer lockdowns are likely to see rising Chinese usage over the remainder of the year. The weaker economic outlook in other major refined copper consuming nations (the US and Europe) has the potential to weigh on copper demand over the remainder of 2022 and in 2023 (Figure 12.1). In 2022, global refined copper consumption is expected to increase by 1.2% to more than 25 million tonnes.

In 2023, refined copper consumption is expected to increase by 3.7% to 26 million tonnes, and by a further 3.1% — to 27 million tonnes — in 2024, in line with growth trends in industrial production.

Over the longer term, the global energy transition is set to bolster the demand for copper, due to its relatively heavy use in renewable energy technologies, battery storage and electric vehicles. Uncertainty in traditional energy markets resulting from Russia's invasion of Ukraine is providing incentive for countries to accelerate this energy transition. This could see the increase in copper demand brought forward.

Figure 12.1: Refined copper consumption



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

Chinese growth, property sector key risks

Developments in China — the world's top consumer for refined copper — are contributing heavily to the risk landscape for global copper consumption forecasts. This includes COVID-19 outbreaks and ongoing issues in the Chinese property sector, where reports are that local buyers are refusing to make mortgage payments on unfinished properties by developers facing financial distress. Building activity (measured by floor area of new construction starts) fell by 37% year-on-year in July 2022, and a further downturn in construction activity would significantly affect copper demand (given the property sector accounts for 20% of Chinese demand). The Government took measures in August to support the property sector.

Industrial production also faces heightened uncertainty as a result of China's 'dynamic zero COVID' policy, and how the Chinese Government responds to future virus variants. It is likely that China will not reach its goal of 5.5% GDP growth for 2022, and further undershooting of growth will drag on copper consumption.

On the upside, following the easing of containment restrictions in major Chinese manufacturing hubs, passenger vehicle production rebounded in June, and recorded overall growth of 6% for the first half of 2022. Chinese production of electric vehicles (EVs) — which require five times as much copper as conventional vehicles — has also seen major gains this year, with volumes reaching a monthly record of 590,000 units in June.

Government investment in telecommunication technologies and to support a growing network of EVs, will also help to support copper consumption in the longer term. More than 150 billion yuan will be spent on upgrading the power transmission network, expanding the 5G network, and rolling out more EV charging facilities.

Industrial production growth softens in the US

Targeting 40-year high inflation, the US Federal Reserve has rapidly tightened official interest rates, raising its benchmark rate to 3-3.25% to tame consumer spending. With August's CPI results showing core inflation proving to be 'sticky', further tightening is anticipated by the Federal Reserve board to ensure inflation trends back towards its target.

There are signs that industrial production is losing momentum. In June 2022, manufacturing output fell by 0.5% month-on-month. While still being up 3.6% year-on-year, it was its second consecutive month-on-month fall. Unlike in China, automotive production in the US fell year-on-year in the first half of 2022. While vehicle demand is strong, the microchip shortage and general supply chain issues have seen production levels cut. At the current rate of production, half a million fewer vehicles will be produced in the US in 2022 compared to 2021. However, the recently signed Inflation Reduction Act has potential to increase future US copper demand through tax credits for solar panels and EVs.

12.3 World production

Chile and Peru disappoint on mine production

Chile and Peru are set to account for the majority of growth in mined copper production over the outlook period. However, both face significant production disruptions in the immediate term.

While mine production increased by 5.5% quarter-on-quarter in Chile, June quarter 2022 production was 5.4% lower compared to the same quarter in 2021. Antofagasta announced that its Los Pelambre operation suffered a leak in the concentrate pipeline. Production at BHP's Escondida increased quarter-on-quarter, and production is expected to increase in future years.

In Peru, MMG temporarily withdrew its production guidance for Las Bambas after on-and-off protest activity. It has subsequently reinstated its guidance for Las Bambas to 240,000 tonnes — down from previous guidance of 300,000-320,000 tonnes. Peruvian mine output fell 2.0% quarter-on-quarter, marking its second consecutive quarterly decline in mine production. However, the ramp up at Mina Justa and first concentrate production at Quellaveco are likely to see increased mine production for the second half of the year. Quellaveco's total capacity of 300,000 tonnes a year will boost Peruvian production by 10% once ramp up is complete.

Global mine production is expected to reach 22 million tonnes in 2022 (up 5.4% year-on-year). Mine production is expected to increase to 23 million tonnes in 2023, and to 24 million tonnes in 2024 (Figure 12.2). The gains will be largely driven by increased production in Chile, Peru and the Democratic Republic of Congo.

Refinery output growth slowing

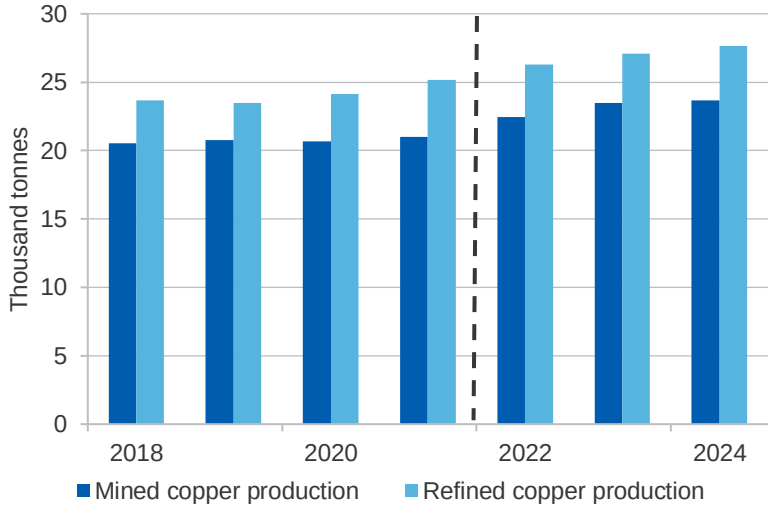
After a strong 2021, global refined copper production growth has slowed this year. In the June quarter 2022, refined output increased by 1.3% quarter-on-quarter, and was only 0.4% up on the same quarter in 2021.

In Europe, refined output was down 9.6% quarter-on-quarter, with half of the decline accounted for by a drop in Spanish production. In Asia,

quarter-on-quarter growth in refined output was 3.6%, with growth coming across the major refiners in China, Japan and South Korea.

Refined copper production is expected to grow by 2.1% to above 25 million tonnes in 2022. Refined production is forecast to reach almost 27 million tonnes in 2024 (Figure 12.2). However, the risks for refined copper production are skewed to the downside. A hot, dry summer in China — affecting hydro power generation — has led to power rationing, adversely affecting smelter output. In Europe, surging power prices are squeezing smelter profit margins, and they may look to cut output to manage costs.

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

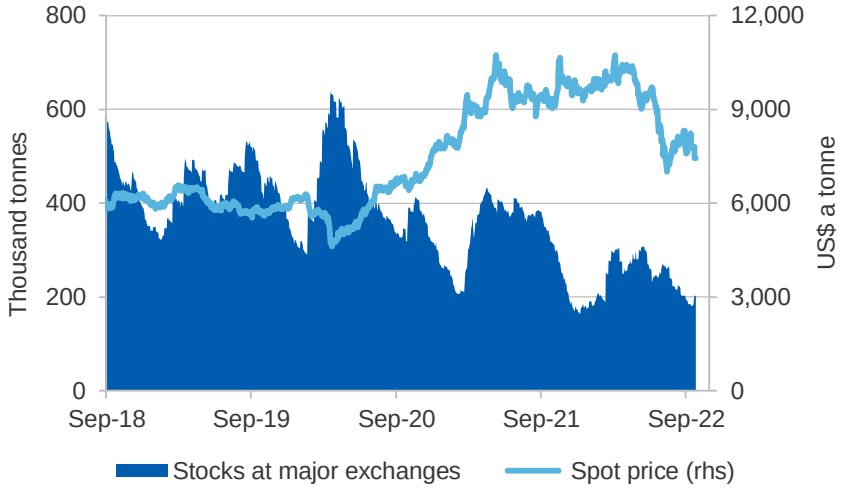
Prices declining from record levels in H1 2022

Copper prices were at record highs at the beginning of 2022, peaking at US$10,730 a tonne in March — an all-time record — and averaging almost US$10,000 a tonne in the March quarter 2022.

Despite averaging US$9,500 a tonne across the June quarter 2022, copper prices fell by more than US$1,000 a tonne across the month of June (Figure 12.3). Key to this price decline was weakening demand as a result of COVID-19 containment measures and weak property markets in China, a strengthening US dollar, and high energy prices in Europe.

The copper price is estimated to average around US$8,300 in the September quarter 2022, but is forecast to rise slightly in the December quarter. Across the full year, copper is expected to average close to US$8,900 a tonne in 2022 — down 4.9% from 2021.

Figure 12.3: Copper exchange inventories and spot price



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

Stockpiles hold steady at low levels

In late 2021, warehouse inventories were drawn down to their lowest levels since 2014 (for the Shanghai Futures Exchange) and 2005 (for the London Metals Exchange). Warehouse inventories recovered in early 2022, however the build-up in inventories has since stalled. As at 26

September, stocks at major exchanges stood at 203,000 tonnes — 31% down from the 296,000 tonnes of stock as at the end of February.

The global copper market is forecast to trend into a modest surplus over the outlook period, putting only minor downward pressure on prices. While inventories will rise, they will remain relatively low. The price of copper is forecast to decline to average US$8,500 a tonne in 2023 and US$8,400 a tonne in 2024. However, upside risks exist if production from Chile and Peru disappoints.

12.5 Australia

Exports steady over the outlook period

Exports rose from $11.4 billion in 2020–21 to $12.3 billion in 2021–22, as record copper prices outweighed the impact of lower export volumes. Over the outlook period, growth in export volumes is likely to offset softer copper prices, with exports forecast to grow to $13.9 billion in 2023–24 (Figure 12.4).

Mine production to grow after 2021–22 disruptions

Australia's copper mine output fell by 10% to 788,000 tonnes in 2021–22. COVID-19 disruptions, extreme weather events and (both planned and unplanned) maintenance were key reasons for the fall.

In the June quarter 2022, Australian mined copper production increased by 4.2%. Newcrest's Cadia mine saw copper production increase by 23% quarter-on-quarter, due to increased mill throughput. Meanwhile, output at Carrapateena (Oz Minerals) fell by 30% quarter-on-quarter, attributed to belt splice delamination issues, equipment availability and workforce absenteeism.

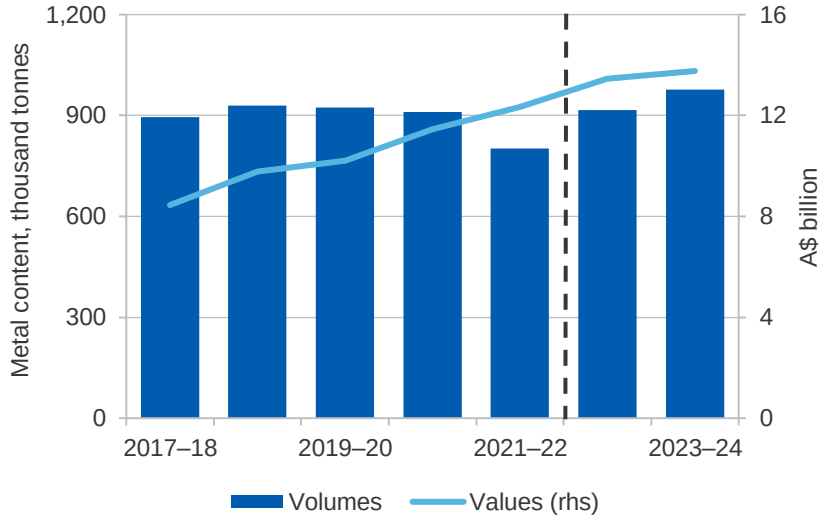
Completion of major maintenance, fewer COVID-19 workforce disruptions and new projects means that mined copper production is forecast to increase over the outlook period. Mined production is expected to grow to 902,000 in 2022–23, and to 963,000 tonnes by 2023–24.

New projects to boost Australian production throughout the outlook period

Several major projects are due to be delivered over the forecast period, while production is set to recover at most existing projects. The Nifty reactivation project (Cyprium) is expected to produce in 2023, while Oz Minerals reached a final investment decision on its West Musgrave project in September 2022.

The two-stage Cadia Expansion Project is expected to be complete by the end of September 2022. This is expected to increase the mill throughput rate to 35Mtpa in the December quarter 2022.

Figure 12.4: Australia's copper export volumes and values

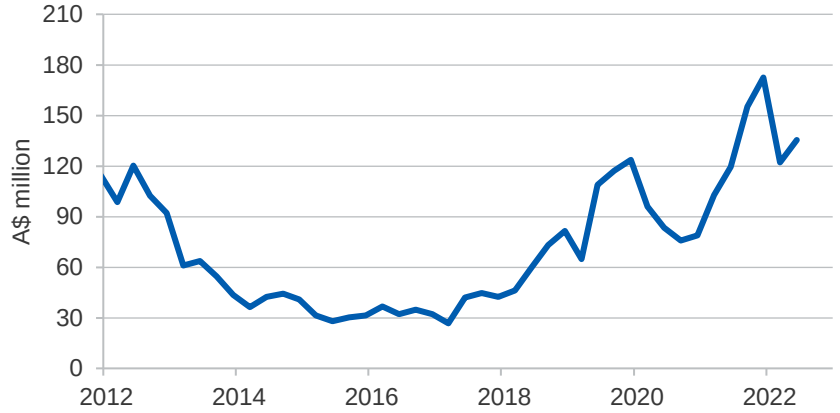


Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2022)

Copper exploration falls, but still historically high

Copper exploration expenditure grew by 11% quarter-on-quarter, and reached $136 million in the June quarter 2022 (Figure 12.5).

Figure 12.5: Australian copper exploration expenditure



Source: ABS (2022)

Revisions to the outlook

Since the June 2022 *Resources and Energy Quarterly*, the forecast for Australia's copper export earnings in 2022–23 and 2023–24 have been revised down by $0.3 billion and $1.0 billion respectively, as a result of downward revisions to copper price forecasts.

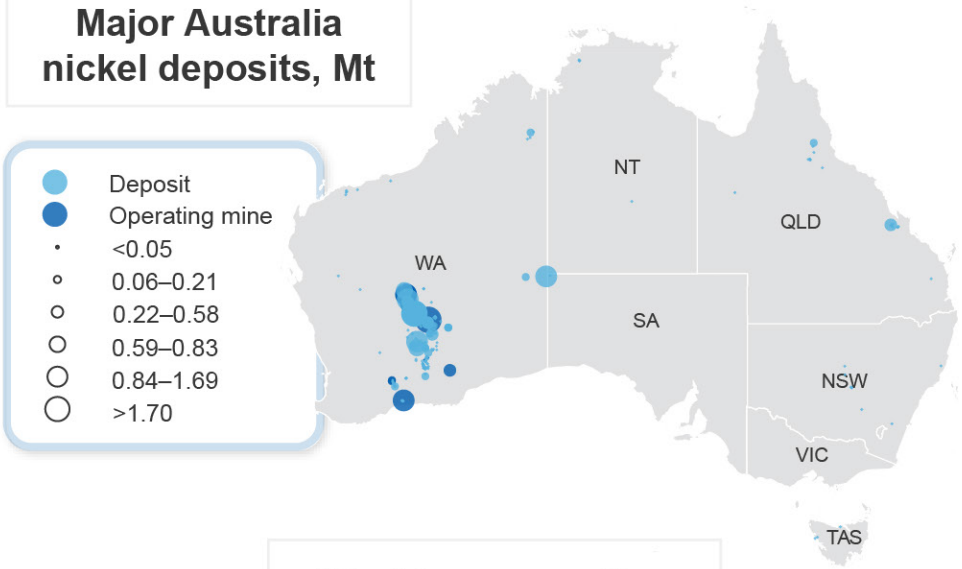
Table 12.1: Copper outlook

						Annual percentage change		
World	**Unit**	**2021**	**2022[s]**	**2023[f]**	**2024[f]**	**2022[s]**	**2023[f]**	**2024[f]**
Production								
– mine	kt	21,025	22,161	23,180	24,015	5.4	4.6	3.6
– refined	kt	25,015	25,548	26,340	26,893	2.1	3.1	2.1
Consumption	kt	25,251	25,545	26,483	27,297	1.2	3.7	3.1
Closing stocks	kt	1 148	942	1 348	1 595	-18	43	18
– weeks of consumption		2.4	1.9	2.6	3.0	-19	38	15
Prices LME								
– nominal	US$/t	9,315	8,856	8,453	8,259	-4.9	-4.6	-2.3
	USc/lb	423	402	383	375	-4.9	-4.6	-2.3
– real[b]	US$/t	10,032	8,856	8,203	7,838	-12	-7.4	-4.5
	USc/lb	455	402	372	356	-12	-7.4	-4.5
Australia	**Unit**	**2020–21**	**2021–22**	**2022–23[f]**	**2023–24[f]**	**2021–22**	**2022–23[f]**	**2023–24[f]**
Mine output	kt	878	788	902	963	-10	14.5	6.8
Refined output	kt	452	349	444	448	-23	27	0.8
Exports								
– ores and concs[c]	kt	1,672	1,666	1,795	2,020	-0.4	7.7	13
– refined	kt	420	330	413	416	-21	25	0.8
– total metallic content	kt	910	802	916	977	-12	14	6.7
Export value								
– nominal	A$m	11,440	12,339	13,631	13,905	7.9	11	2.0
– real[d]	A$m	12,785	13,202	13,631	13,342	3.3	3.3	-2.1

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.
Source: ABS (2022) International Trade, 5465.0; LME (2022) spot price; World Bureau of Metal Statistics (2022); Department of Industry, Science and Resources (2022).

28 Ni 58.693 Nickel

Major Australia nickel deposits, Mt



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

World consumption

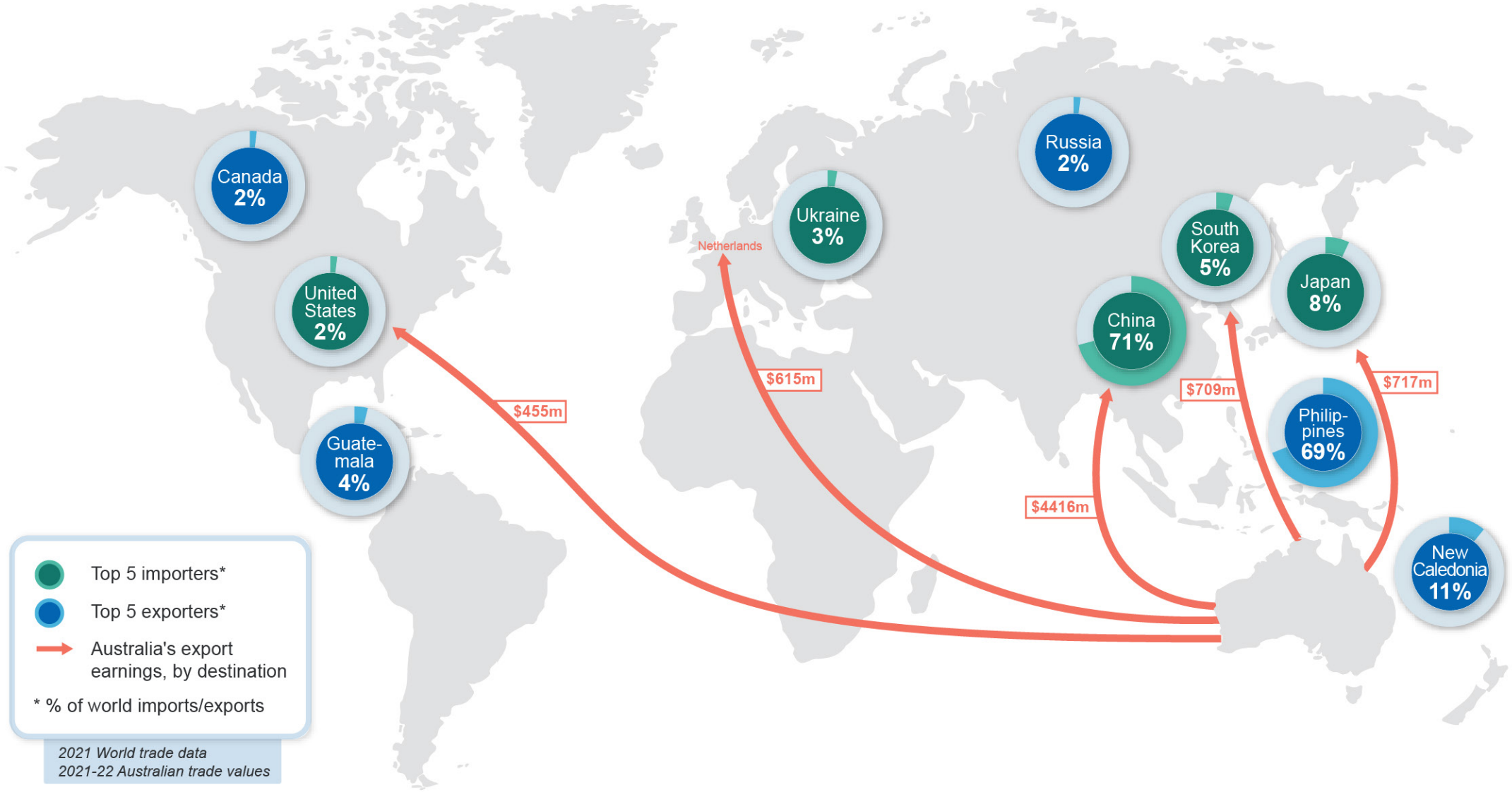
- **70%** Stainless steel
- **8%** Alloys
- **8%** Plating
- **8%** Casting
- **5%** Batteries
- **1%** Other

Australia's nickel

- **22%** of world **nickel resources**
- **200,000 tonnes** **typically produced** over a year
- **$7.5 billion** contributed to the **economy** last year

28 Ni 58.693 Nickel

Trade map | September 2022



13.1 Summary

- Nickel prices are expected to average US$24,900 a tonne in 2022, boosted by the fallout from the Russian invasion of Ukraine. Prices are expected to ease over the outlook period, as a result of increased Indonesian production and improving liquidity in the LME nickel market.
- Recent high prices have boosted Australia's nickel export earnings, which reached $4.4 billion in 2021–22. Export earnings are forecast to rise to $5.1 billion in 2022–23, before easing to $4.6 billion in 2023–24.
- Australia's export volumes are estimated to rise from 157,000 tonnes in 2021–22 to 202,000 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 a short term drag on nickel demand

Global headwinds and a price spike have seen nickel consumption weaken over the past year. In the June quarter 2022, global nickel consumption rose 0.8% on the March quarter, but was 3.8% lower than in the June quarter 2021. Chinese consumption fell 5.9% year-on-year, with European consumption also falling 5.0% year-on-year.

Global nickel consumption is expected to exhibit stronger growth over the rest of the outlook period. This is largely due to its use in stainless steel for consumer white goods, dwellings and infrastructure, as well as its use in batteries — as electric vehicles (EV) gain popularity.

Nickel demand is forecast to be 3.3% higher year-on-year, at almost 2.9 million tonnes in 2022. Nickel consumption is subsequently expected to grow strongly over the next two years, increasing by 5.3% in 2023 and by 4.2% in 2024, when consumption will be 3.0 million tonnes and 3.1 million tonnes, respectively.

Stainless production contracts in major economies

Global nickel consumption saw strong growth in 2021, as the world recovered from the economic effects of COVID-19 — with a large focus on infrastructure spending to stimulate the economy.

However, stainless steel production has hit hurdles in recent months. Chinese stainless steel production undershot production guidance by around 100,000 tonnes in June, leaving national output around 10% lower than in May. In 2022, Chinese stainless output is expected to fall by 2% from 2021 levels.

US and European stainless steel production are also expected to be weak in 2022, with annual stainless steel production likely to be around 3% and 5% lower than 2021 production, respectively.

Meanwhile, Indonesia continues to ramp up stainless steel production, with growth in stainless steel expected to be around 4% this year, before surging by 27% in 2023. With most of Indonesian production being exported to China, downside production risks start to emerge if weakness in the Chinese economy extends into next year.

EV sales accelerating, but race against LFP is present

Sales of EVs hit 6.8 million units in 2021 — more than double the number of sales in the previous year. This growth is set to continue, with EV sales forecast to grow to 11 million units in 2022. Nickel use in batteries is expected to grow 33% this year as a result.

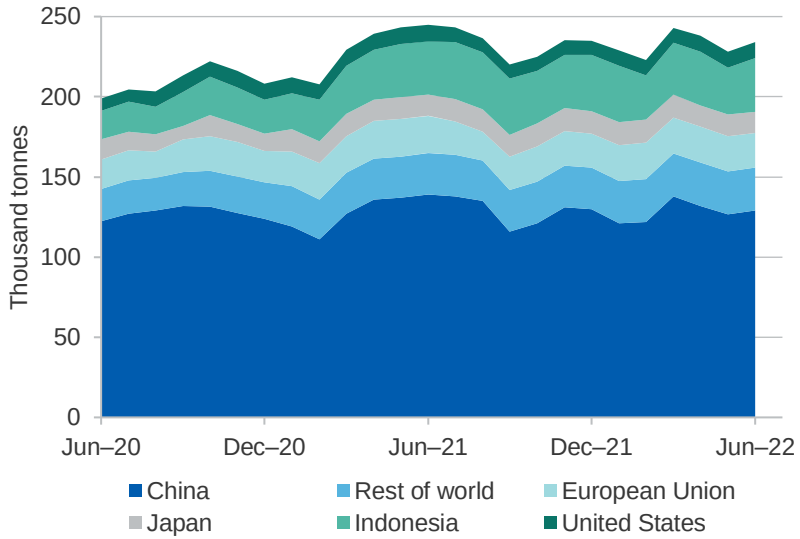
However, lithium iron phosphate (LFP) batteries are starting to emerge as a strong contender to nickel-based battery technology. While nickel-based chemistries provide higher energy density, LFP batteries are cheaper, less prone to thermal runaway and often have a longer shelf life. Further, the resources needed to produce the battery are much more readily available than nickel.

So far, LFP batteries have largely been limited to Chinese automotive manufacturers, with Western manufacturers preferring nickel-based batteries. Given that China accounts for the majority of EV sales growth, combined with the fact that 60% of Chinese EVs are sold with an LFP battery, nickel consumption in batteries will likely grow more slowly than total EV sales.

However, more manufacturers outside of China are gaining exposure to LFP battery technology. In July, Ford announced a major supply deal with China's Contemporary Amperex Technology Co. Limited (CATL) for use in some of its Mustang Mach-E (2023) and F-150 Lightning (2024) vehicles. Further, CATL has announced its new LFP/LMFP battery improves energy density by 15% over traditional LFP batteries, while being comparable on cost.

In the near term (over the outlook period), such announcements are unlikely to dampen forecast demand for nickel, given the dominance of nickel-based technologies and the consistent upward revisions of EV sales.

Figure 13.1: Composition of world nickel consumption



Source: International Nickel Study Group (INSG); Wood Mackenzie; Department of Industry, Science and Resources (2022)

13.3 World production

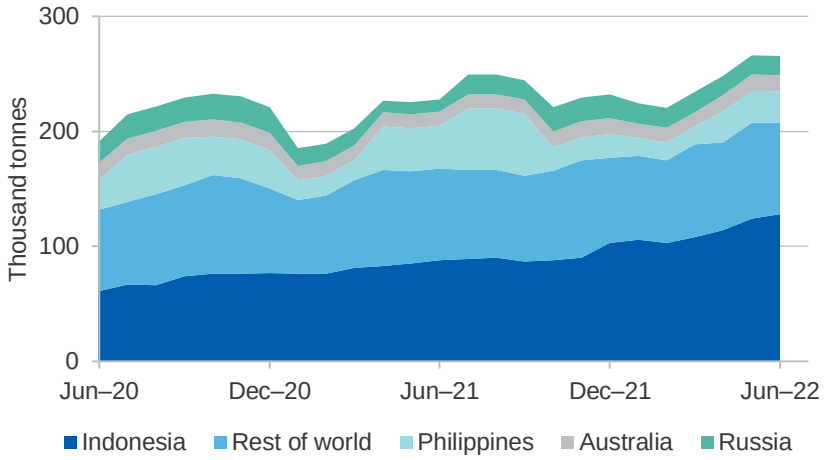
Indonesia extends its lead in mine production

Global mined production of nickel has continued to surge, with June quarter 2022 production up by 15% year-on-year. Global mine production is expected to reach 3.0 million tonnes in 2022, and is forecast to grow further to 3.4 million tonnes in 2024.

Indonesian mined production increased to 1.0 million tonnes in 2021, up by over one third from the previous year (Figure 13.2). Indonesian mined production has continued its steep upward trajectory so far in 2022: first half production is up 40% year-on-year compared to the first half of 2021.

Canadian mined nickel output showed signs of improvement after several disappointing quarters, with June quarter 2022 production recording a quarter-on-quarter growth of 34%. New Caledonia also showed strong quarter-on-quarter growth (of 16%) in the June quarter 2022.

Figure 13.2: Composition of world mined nickel production



Source: International Nickel Study Group; Department of Industry, Science and Resources (2022)

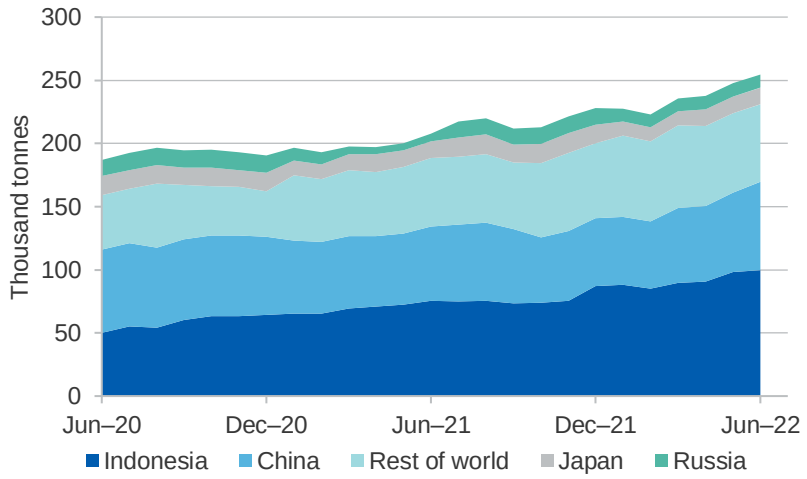
Indonesia continues growth in refined production

As with mined nickel, Indonesia is leading the way in terms of refined production growth (Figure 13.3). Production of primary nickel in Indonesia grew by 32% in the first half of the year, while production of nickel intermediates grew by 150%. This growth has been supported by a total of 40 additional furnaces being brought online since the start of the year, with another 37 furnaces planned in the second half of 2022.

While nickel pig iron still accounts for the lion's share of production, there has been considerable growth in mixed hydroxide precipitate (MHP) and nickel matte output. Most MHP and matte is being shipped to China and South Korea, where it is refined into nickel sulphate for use in batteries. MHP now accounts for 40% of the nickel used to make nickel sulphate for batteries, which is expected to rise to close to 50% by the end of the outlook period.

Indonesian refined output is expected to ramp up to about 1.1 million tonnes in 2022, and is forecast to grow to about 1.4 million tonnes in 2024.

Figure 13.3: Composition of world refined nickel production



Source: International Nickel Study Group; Department of Industry, Science and Resources (2022)

Global refined nickel production will grow as a result, increasing 11% year-on-year to 2.9 million tonnes in 2022. Refined nickel production is expected to grow by 8.8% in 2023 and 7.7% in 2024, when it is forecast to reach 3.4 million tonnes. However, with growth heavily dependent on growth in Indonesian supply, risks are skewed to the downside. Firstly, there are reports of supply infrastructure bottlenecks emerging for nickel ores. Secondly, since Indonesian nickel output largely serves the Chinese market, lower end-use demand (due to new COVID-19 outbreaks) could induce producers to ease back on planned supply growth.

13.4 Prices

Prices fall, but remain above 2021 levels. How low can nickel go?

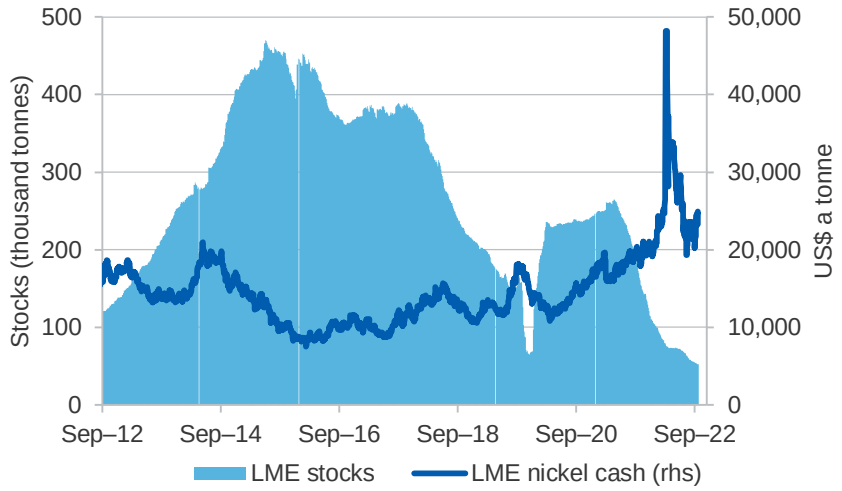
In the June quarter 2022, prices fluctuated between a high of almost US$34,000 a tonne (on 21 April) and a low of less than US$23,000 a tonne (on 30 June), averaging US$28,867 a tonne. Despite briefly dipping below US$20,000 a tonne, prices appear to have stabilised somewhat, averaging around US$22,000 a tonne in recent months.

There are several convincing reasons to think that nickel prices will come down much further. First, a hard landing in the global economy remains a significant risk; surging energy prices and tighter monetary conditions in many economies are affecting investment and spending, compounded by soft Chinese growth (resulting from ongoing lockdowns and a depressed property sector). Second, while MHP and nickel matte are not deliverable on the LME, users of first class nickel could be tempted to switch to these products if the price is right.

However, there are several factors which may support prices from falling further. First, it is possible that sanctions on Russian nickel exports might be applied if the Russia-Ukraine conflict worsens. Second, the LME market remains relatively illiquid, after LME Open Interest fell following the short squeeze event. Third, LME stocks remain at historically low levels. And fourth, global energy prices remain extremely high, placing cost pressures on metal refiners/smelters.

Near term price forecasts are relatively unchanged from the June 2022 REQ forecasts. However, prices in late 2023 and into 2024 have been revised down slightly, to account for surging Indonesian supply. This takes the price forecasts to US$21,250 a tonne on average in 2023, and US$20,250 a tonne in 2024.

Figure 13.4 Nickel spot price and stock at exchanges



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

13.5 Australia

Export earnings to grow as production increases

Export earnings grew to $4.4 billion in 2021–22 — a rise of 37% year-on-year (Figure 13.5) — thanks to significantly higher prices for nickel exports. Export earnings will grow further — to around $5.1 billion in 2022–23 — as higher production benefits export volumes, before falling back to $4.6 billion as prices ease in 2023–24.

Export volumes are set to increase, from around 157,000 tonnes in 2021–22 to surpass 200,000 tonnes in 2023–24.

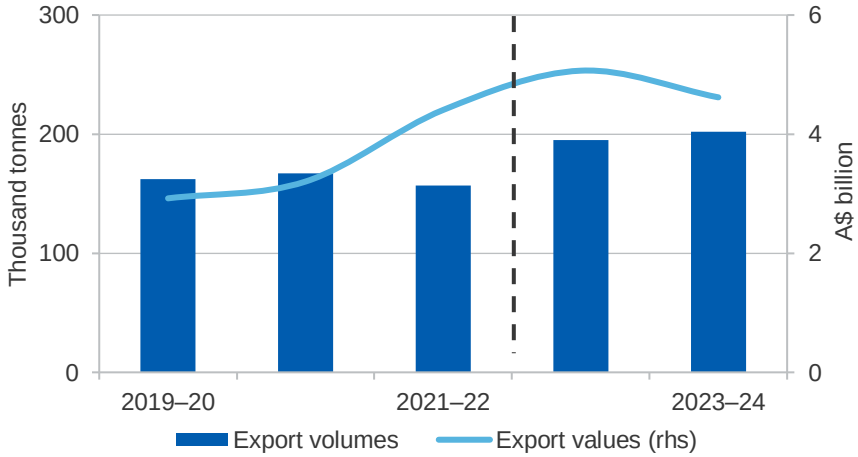
Australia's production set to expand as new production comes online

Australia's mined nickel production fell modestly in 2021–22, as COVID-19 absenteeism, workforce shortages and planned maintenance affected mine outputs. Total output for 2021–22 was 154,000 tonnes, or 4.9% less than the previous year's output.

These issues should resolve over 2022–23, and mine output is forecast to increase sharply as a result. Mine output is forecast at 204,000 tonnes in 2022–23 (+33% year on year) and 228,000 tonnes in 2023–24 (+12% year on year).

Mallee Resources has commenced ore stockpiling from its recently acquired Avebury mine in Tasmania. After being dormant for 13 years, the mine restart has ore throughput capacity of 900,000 tonnes a year when complete, at an expected ore grade of 1.0% nickel. While outside of the outlook horizon, Oz Minerals has made a final investment decision on its West Musgrave copper-nickel project. Targeting concentrate production from 2025, it will add 35,000 tonnes of nickel a year to Australia's nickel production.

Figure 13.5: Australia's exports to grow over the outlook period



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

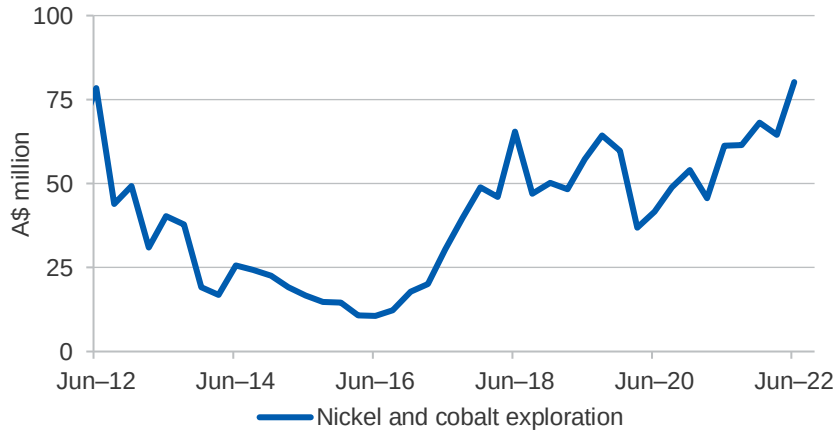
Australia's refined output is forecast to be steady over the outlook period, at 105,000 tonnes in both 2022–23 and 2023–24. However, increases in refined nickel production may occur if nickel prices are higher than expected over the outlook period.

Exploration expenditure hits 14 year high

Compared to the June quarter 2021, nickel and cobalt exploration expenditure increased 31% to $80 million in the June quarter 2022 (Figure 13.6). This is the highest exploration expenditure since the September quarter of 2008.

Looking forward, BHP has committed to increasing its exploration expenditure at its Nickel West facility. Exploration expenditure at Nickel West is expected to hit its highest level since 2005, to take advantage of current high prices driven by concerns over Russian supply.

Figure 13.6: Nickel and cobalt exploration still strong



Source: Source: ABS (2022) International Trade in Goods and Services, 5368.0

Revisions to the outlook

The Office of the Chief Economist has recently revised its nickel export methodology. The previous methodology referenced international trade data sources, due to the lack of availability of Australian refined and intermediate nickel export data. In recent years, the gap between international trade data sources and domestic production data sources has increased significantly. Consequently, the methodology for estimating nickel exports has been revised to match domestic production levels.

As a result, historical export volumes and earnings estimates have been revised down. In 2021–22, the downward revision was 102,000 tonnes and $2.3 billion. Forecasts for the outlook period have also been revised down by $2.3 billion in 2022–23 and $2.1 billion in 2023–24.

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	2,683	3,057	3,283	3,430	13.9	7.4	4.5
– refined	kt	2,606	2,901	3,157	3,401	11.3	8.8	7.7
Consumption	kt	2,772	2,862	3,013	3,138	3.3	5.3	4.2
Closing stocks	kt	591	631	774	1,037	6.6	22.8	34.0
– weeks of consumption		11.1	11.5	13.4	17.2	3.0	16.6	28.6
Prices LME								
– nominal	US$/t	18,468	24,883	21,250	20,250	34.7	-14.6	-4.7
	USc/lb	838	1 129	964	919	34.7	-14.6	-4.7
– real [b]	US$/t	19,891	24,883	20,621	19,217	25.1	-17.1	-6.8
	USc/lb	902	1 129	935	872	25.1	-17.1	-6.8
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	204	228	-4.8	33	12
– refined	kt	105	98	105	105	-6.5	6.6	0.0
– intermediate		29	31	29	29	7.5	-7.4	-0.6
Export volume [dg]	kt	167	157	195	202	-6	25	3.5
Export value[g]								
– nominal value	A$m	3,204	4,406	5,066	4,618	37	15	-8.8
– real value [e]	A$m	3,581	4,715	5,066	4,431	32	7.4	-13

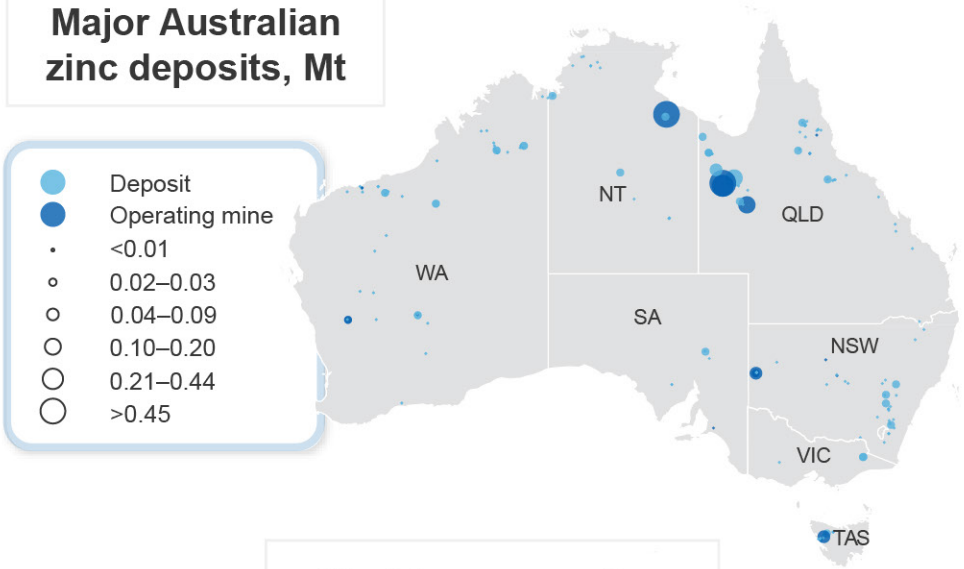
Notes: **b** In 2022 calendar year US dollars; **c** Nickel content of domestic mine production; **d** Includes metal content of ores and concentrates, intermediate products and nickel metal; **e** In 2022–23 financial year Australian dollars; **f** Forecast; **g** OCE estimates based on publicly available data.

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

30 Zn 65.38

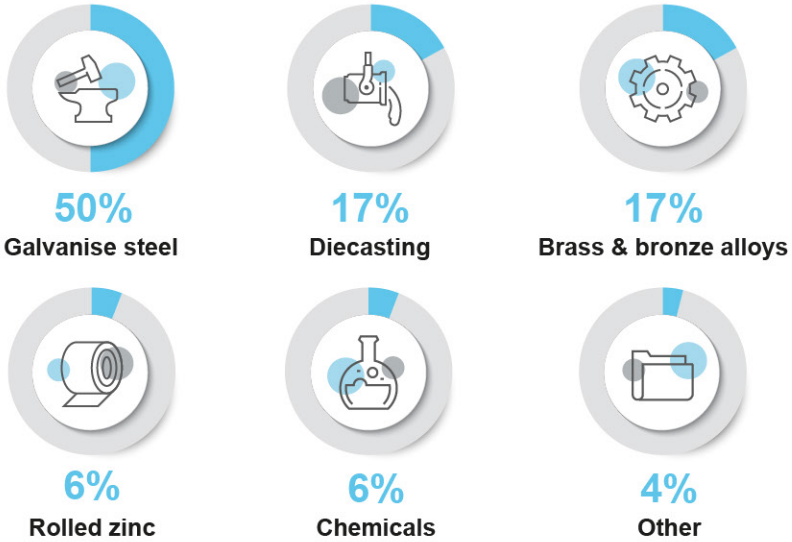
Major Australian zinc deposits, Mt



Zinc facts

- **Zinc ore** was used in ancient Greece to produce brass
- Zinc **fights infection** in our bodies and is used in wound-care & sunscreen
- World consumption per capita is **2kg**
- Zinc is an **emerging battery mineral**

World consumption

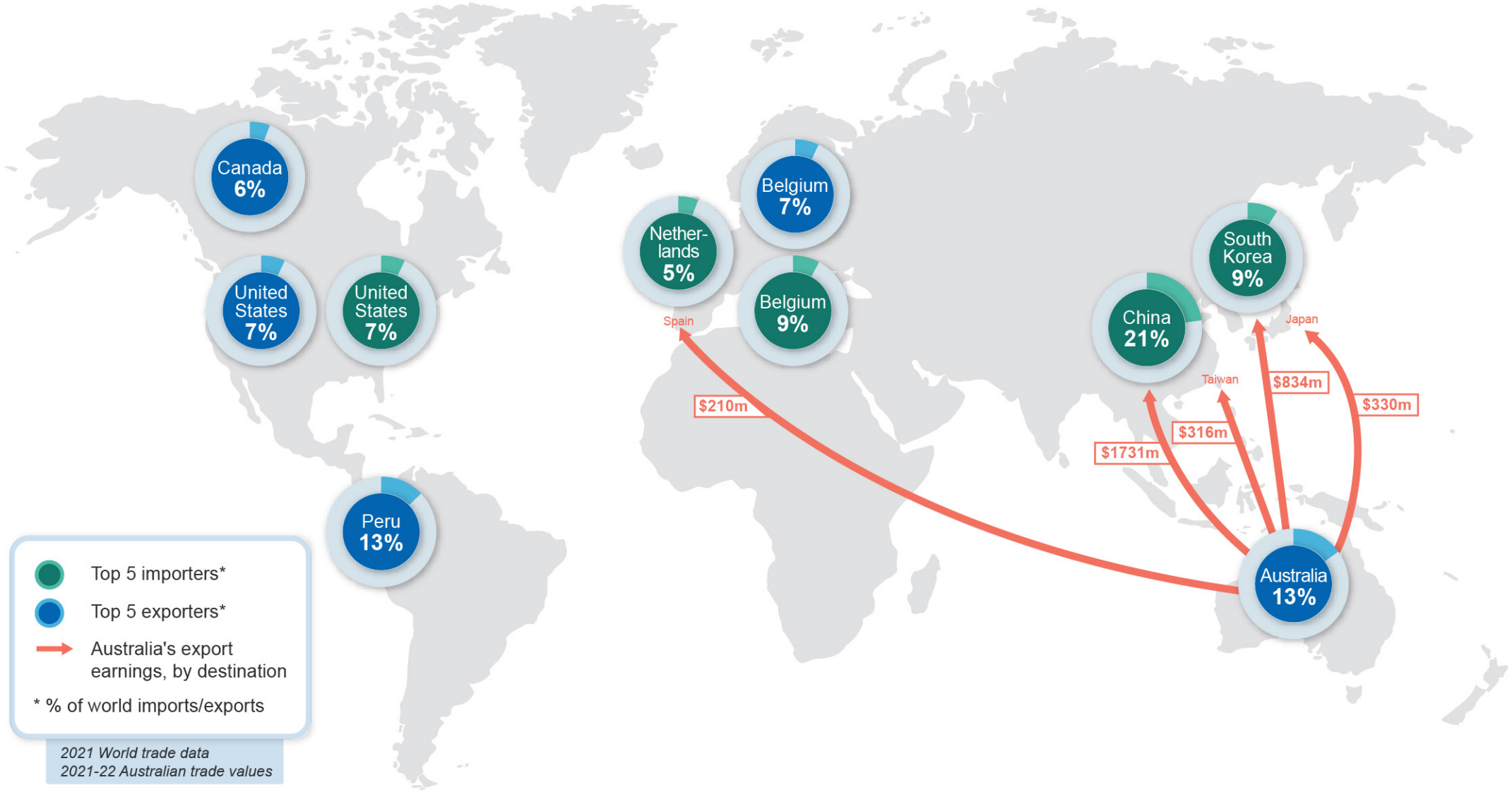


Australia's zinc

- **3rd largest producer** in the world in 2021
- **29%** of world's known **zinc resources** held
- **2nd largest exporter** in the world in 2021

Zinc

Trade map | September 2022



14.1 Summary

- The LME zinc spot price is forecast to average around US$3,600 a tonne in 2022, with supply pressured by reduced production of refined zinc in Europe. Prices are forecast to ease over the outlook to around US$3,000 a tonne by 2024, as supply pressure ease.
- Encouraged by high prices, Australia's zinc production is forecast to rise by 5.0% per year to around 1.4 million tonnes by 2023–24 (see Australia section).
- Australia's zinc export earnings are forecast to peak at $5.3 billion in 2022–23, before easing in 2023–24 to $4.7 billion.

14.2 World consumption

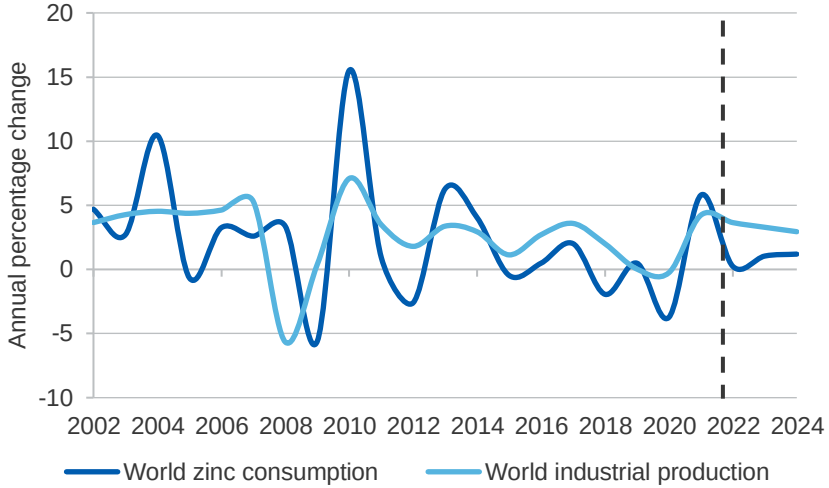
Diminishing global growth weakens world zinc demand

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 construction and vehicle production. World refined zinc consumption fell by 3.0% year-on-year in the June quarter 2022, as industrial activity in China and Europe slowed. Year-on-year consumption fell in China (12.5%), the EU (1.8%) and ex-China Asia (1.8%), but rose in the United States (7.7%).

The outlook for industrial growth has weakened since the June 2022 REQ (see *Macroeconomic Outlook* chapter), and this will weigh on zinc demand during the outlook period.

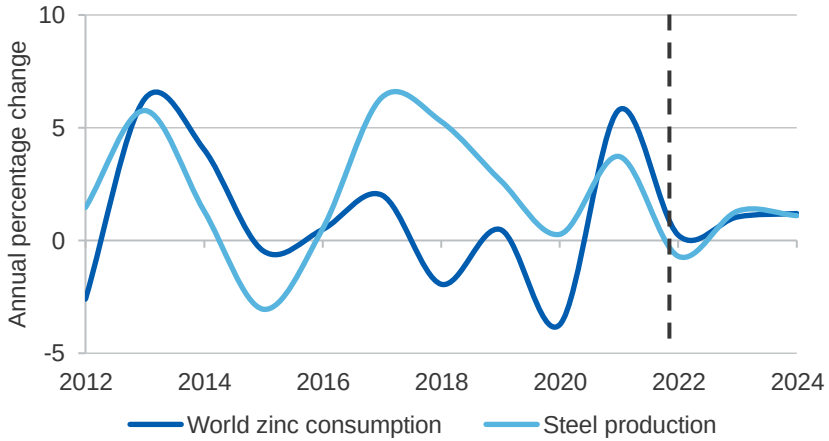
Consumer demand is softening, as most central banks around the world hike rates to rein in inflation. The Chinese residential property sector has continued to struggle, and it weakened further during the middle of 2022, as the government's zero COVID policy triggered a slowdown in the Chinese economy. Falling demand for new residential property has created cash flow issues for many Chinese property developers, in some cases forcing work to be paused for construction projects. The Chinese authorities have recently taken further measures to support the sector.

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).

Global vehicle sales fell 16% year-on-year in the June quarter 2022. Sales and production for the automotive sector was slowed by lockdowns in China over the quarter — Shanghai recorded no new vehicle sales over the month of April. However, the sector is likely to rebound in the second half of 2022, supporting zinc demand. Semiconductor prices, which rose sharply over the COVID-19 pandemic, began to normalise as global demand for consumer electronics slowed, easing supply bottlenecks. While consumer confidence has weakened globally, pent up demand for consumer vehicles will sustain sales, as manufacturers catch up to long backlog of orders. Over the longer term, the adoption of electric vehicles is expected to support sales

Demand for zinc from infrastructure spending is softening the fall in demand from other sectors. China has issued RMB 3.4 trillion of special-purpose local bonds over the first half of 2022 to fund additional infrastructure spending to stimulate its slowing economy. Infrastructure spending relating to the global energy transition is rising globally, with policies such as the US Inflation Reduction Act and the EU Next Generation package are driving investments. These investment is expected to support demand for zinc, which is a key input to wind turbines and solar panels. Interest in zinc batteries is on the rise and have the potential to drive additional demand.

Over the outlook period, world zinc use is forecast to grow an average of 0.9% per year, from 14.0 million tonnes in 2021 to 14.4 million tonnes in 2024 (Table 14.1). Demand growth will be driven by higher infrastructure spending and by the global transition to low emissions technologies.

14.3 World production

Global mine production falls from COVID related disruptions

World mine zinc production fell 2.9% year-on-year in the June quarter 2022, driven by declines in Peru, China and Australia.

Peruvian mine production fell by 21% year-on-year in the June quarter 2022, due to lower ore grade at the Antamina and Cerro Lindo mines, and the closure of the Iscaycruz mine last year.

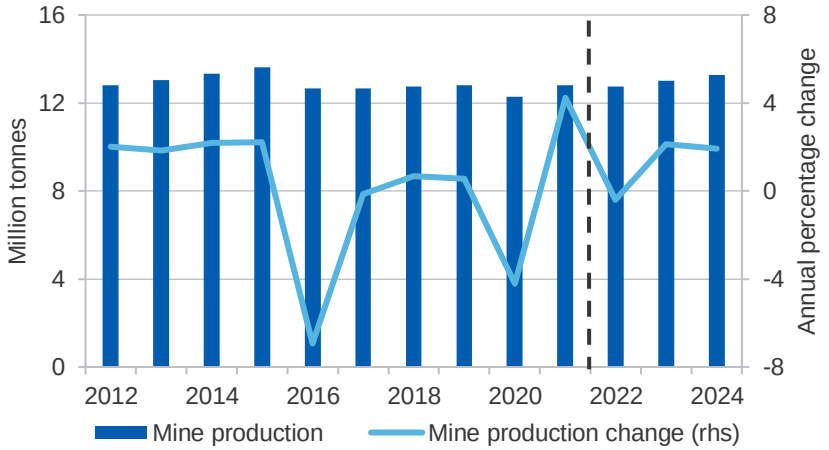
Chinese mine production fell by 5.4% year-on-year in the June quarter 2022, impacted by containment measures associated with the country's zero COVID policy.

Zinc output from Australian mines rose 3.3% quarter-on-quarter but fell by 9.3% year-on-year. Output has been impacted by high levels of COVID related absenteeism since the Omicron outbreak in the March quarter.

Mine production to rise over the outlook period

World mine output is forecast to fall to 12.7 million tonnes in 2022. Over the outlook period, mine output is forecast to rise by an average of 1.3% per year to 13.3 million tonnes by 2024, as miners respond to elevated zinc prices and face fewer COVID-related operational disruptions (Figure 14.3). Global mine production capacity is expected to increase over the outlook period, as new mines and mine expansions come online.

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. China, the world's largest producer of zinc ore, is also expected to expand production across smaller mines.

The Ozernoye mine in Russia is expected to begin operating in 2023, and by 2024 could be producing up to 330,000 tonnes of zinc per year — about 2.6% of global zinc ore production in 2021. While some markets may be closing to Russian ore exports, more can be sold to Chinese and Indian refiners.

Kazzinc's Zhairem mine in Kazakhstan began operating in 2021. The mine is expected to ramp up to its nameplate capacity of 160,000 tonnes of zinc per year by 2023.

Grupo Mexico's Buenavista mine in Mexico is expected to begin operating in 2023, ramping up to its maximum capacity of 120,000 tonnes of zinc per year by 2025.

New Century Resources' Century mine in Australia restarted in 2018, and has since produced 120,000 tonnes of zinc per year. An expansion project is underway to boost output to 230,000 tonnes of zinc per year by 2024.

World refinery production falls as energy price rises

World zinc refined production was unchanged in quarterly terms in the June quarter 2022, but fell by 2.4% year-on-year to 3,385 kilo tonnes. The fallout from the Russian invasion of Ukraine threatens to create a global energy shortage over the Northern Hemisphere winter and has pushed up global energy prices. Zinc refining capacity is being taken offline in Europe, as the continent absorbs the brunt of the energy price shock.

Production fell by 8.7% year-on-year in the European Union in the June quarter 2022. Smelters that have temporarily ceased production include the Portovesme smelter in Italy, which closed in November 2021, and the Budel smelter in the Netherlands, which closed in September 2022. Other European smelters are operating at reduced capacity, and tight energy supply over the Northern Hemisphere winter could result in more closures.

China, the largest zinc refiner globally, recorded a fall of 0.8% year-on-year in production over the June quarter 2022, with output affected by the country's zero COVID policy. Refined zinc production in China is expected to be depressed through to the September quarter 2022, with ongoing localised COVID lockdowns affecting production. Additionally, the drought and heatwave in south-western China has reduced hydropower generation and raised energy demand for cooling. This has led to power rationing and the temporary closures of zinc smelters in the Sichuan province.

In 2022, refined output is forecast to grow by 0.2% to 13.9 million tonnes, with refined production constrained as a result of high energy prices, particularly in Europe. Over the outlook period, refined production from primary and secondary sources is expected to increase by 1.4% a year, reaching 14.4 million tonnes in 2024. The majority of new capacity added is expected to be in China, but smelters reopening in Europe will also contribute to growth in production.

14.4 Prices

Tight supply to sustain high prices

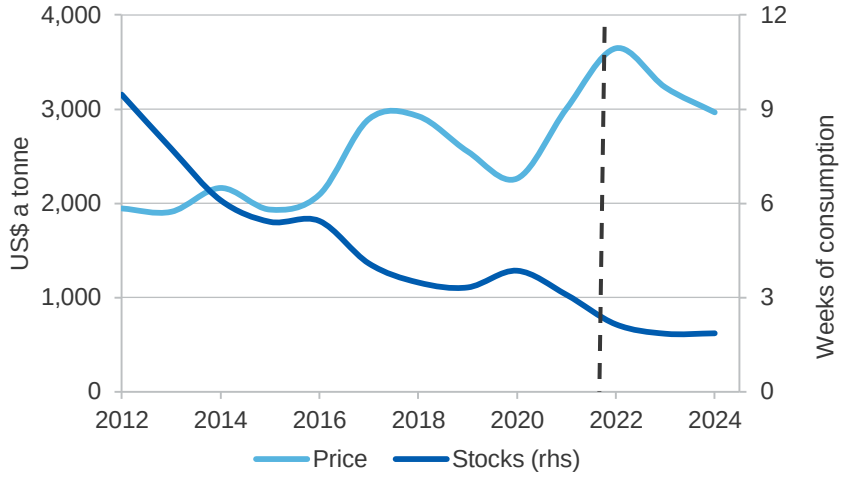
The London Metal Exchange (LME) spot zinc price fell to US$2,900 a tonne in early July, over concerns of a weakening macroeconomic environment. This was a drop of US$1,000 a tonne from the peak in early June. However, the price rallied to US$3,600 a tonne in early August, as the outlook for mine supply deteriorated and as high energy prices threatened further zinc refining closures/cutbacks in Europe.

Mine supply showed ongoing weakness, as output from major producers fell due to COVID-related disruptions (Figure 14.4). High energy prices have kept benchmark treatment costs of zinc concentrates to remain at $230/t in the June quarter 2022, which may rise further if energy costs lift.

LME stocks fell below 70 kilo tonnes in early August, from 81 kilo tonnes at the end of the March quarter 2022. Stocks are low in the US and Europe, with the vast majority of inventory stored in Asian warehouses.

With supply likely to remain tight, the LME zinc spot price is forecast to average US$3,600 a tonne in 2022, falling to $3,000 a tonne by 2024. Prices are expected to decline from the current high levels, as more mining and refining capacity comes online.

Figure 14.4: Zinc prices and stocks



Source: LME (2022); International Lead Zinc Study Group (2022); Department of Industry, Science and Resources (2022).

14.5 Australia's exports and production

High prices to drive export earnings over the outlook period

Australia's combined export earnings for both concentrates and refined metals are estimated to have reached $4.5 billion in 2021–22. Higher zinc prices in the first half of 2022 have boosted export values.

Australia's export earnings are forecast to increase to around $5.3 billion in 2022–23 due to high prices, increased production and lower shipping costs, before falling to around $4.7 billion in 2023–24, as improving zinc supply on the global market pushes down prices.

Australia's mine production falls due to COVID workforce disruptions

COVID cases continue to create workforce disruptions in Australian mines over the June quarter 2022. As a result, Australia's mined zinc output fell by 9.3% 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 12% year-on-year to 141 kilo tonnes in the June quarter 2022. The fall was mainly due to COVID-related workforce disruptions.

Production for MMG's Australian operations, including Dugald River in Queensland and Rosebery in Tasmania, fell by 8.0% year-on-year to 53 kilo tonnes over the June quarter 2022. Production fell at the Rosebery mine, due to COVID-related workforce disruptions and lower ore grades.

In the June quarter 2022, production at New Century's Century Tailings Reprocessing rose by 9.8% quarter-on-quarter, after the ball mill motor was repaired in late February. Production was virtually unchanged over the year, at 32 kilo tonnes.

South32's Cannington operation in Queensland fell by 21% year-on-year to 15 kilo tonnes in the June quarter 2022, due to planned maintenance.

Concentrate exports rose while refined exports declined

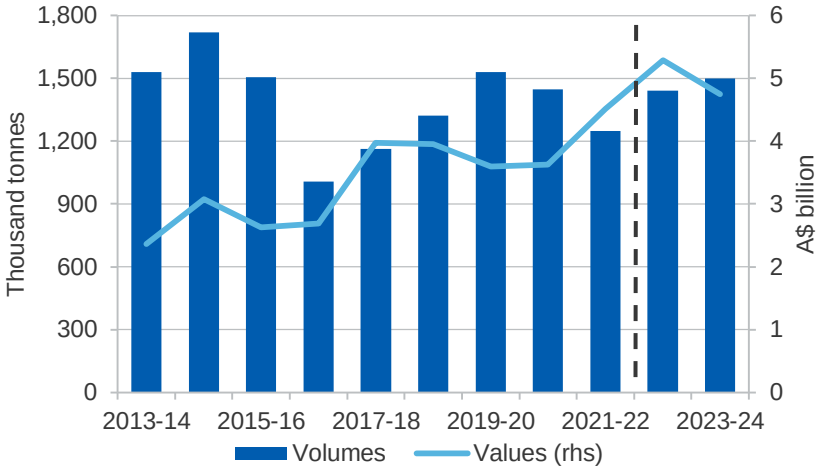
In the June quarter 2022, Australia's zinc concentrate export volume fell 22% year-on-year to 197 kilo tonnes, and refined zinc export volumes fell 34% year-on-year to 69 kilo tonnes (Figure 14.5). However, the value of zinc concentrate exports rose by 15.1% year-on-year to $723 million, and zinc refined export value rose 8.9% year-on-year to $417 million.

China is the largest market for Australian zinc concentrate exports. In the June quarter 2022, the value of Australia's concentrate exports to China was virtually unchanged year-on-year at $278 million.

Low refined zinc demand in China and closures of zinc refineries in Europe saw increasing refined zinc trade flow to European and US markets. The value of refined zinc exports to China fell 80% year-on-year in the June quarter 2022 to $25 million.

Australian refined zinc found other buyers: the value of refined zinc exports to the US rose to $74 million in the June quarter 2022, compared to an average of $3 million per quarter in 2021. Taiwan became the largest market for Australian refined zinc, with the value of refined zinc exports rising by 22% year-on-year to $85 million.

Figure 14.5: Australia's zinc exports, metallic content



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

Australia's mine production is expected to increase over the outlook period

Australia's output is expected to grow over the outlook period, with mine output forecast to lift from 1.3 million tonnes in 2021–22 to 1.4 million tonnes in 2023–24. The gains will be driven by higher production at operations at Dugald River, Golden Grove, and the Century mine.

Project development

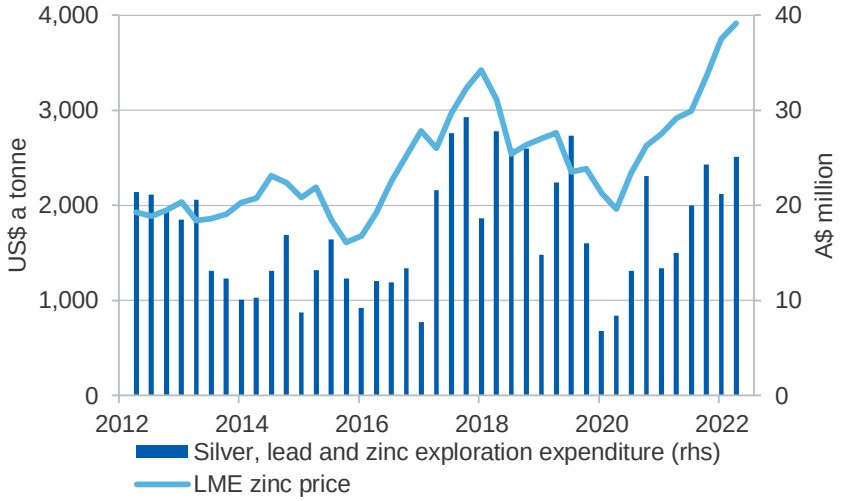
New Century is examining several hard rock resources beyond the current tailings retreatment operation, which is due to end in 2027. New Century believes hard rock resources have the potential to extend mine life to 2030, and are mostly contained on the existing mining lease.

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 financial investment decision in the second half of 2022, and possible first production in the second half of 2023. The company estimates the project will generate additional zinc production of 35 kilo tonnes a year.

Exploration expenditure increased significantly in 2021-22

Exploration expenditure for silver, lead and zinc rose 67% year-on-year in the June quarter 2022 (Figure 14.6). Exploration expenditure slumped in 2020 — due to the COVID pandemic — but recovered as zinc prices rose over 2021 and 2022. Exploration expenditure is expected to see continued strength with zinc prices expected to remain high over 2022 and 2023.

Figure 14.6: Quarterly exploration expenditure and zinc price



Source: ABS (2022) Mineral and Petroleum Exploration, Australia, 8412.0; Company reports; Department of Industry, Science and Resources (2022).

Revisions to the outlook

Compared with the June 2022 *Resources and Energy Quarterly*, forecasts for zinc export revenue are up 15% to $5.3 billion in 2022–23, and up 24% to $4.7 billion in 2023–24. The increases are due to the upward revision to forecasts for zinc prices and export volumes over the outlook period.

Additionally, we have revised our historical refined zinc export volume and values. We have conducted a routine reassessment and updated how we map the export statistical items under the Australian Harmonized Export Commodity Classification to the revised series.

Table 14.1: Zinc outlook

						Annual percentage change		
World	**Unit**	**2021**	**2022[f]**	**2023[f]**	**2024[f]**	**2022[f]**	**2023[f]**	**2024[f]**
Production								
– mine	kt	12,778	12,746	13,016	13,266	-0.3	2.1	1.9
– refined [a]	kt	13,841	13,875	14,153	14,413	0.2	2.0	1.8
Consumption	kt	14,033	14,080	14,227	14,397	0.3	1.0	1.2
Closing stocks	kt	809	603	530	545	-25.4	-12.2	2.9
– weeks of consumption		3.0	2.2	2.0	2.0	-25.2	-10.9	-1.2
Price								
– nominal	US$/t	3,005	3,643	3,231	2,966	21.2	-11.3	-8.2
	USc/lb	136	165	147	135	21.2	-11.3	-8.2
– real [b]	US$/t	3,237	3,643	3,135	2,815	12.5	-13.9	-10.2
	USc/lb	147	165	142	128	12.5	-13.9	-10.2
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	1,337	1,395	-5.3	6.3	4.3
Refined output	kt	458	490	500	500	7.0	2.1	0.0
Export volume								
– ore and concentrate [c]	kt	2,118	2,033	2,158	2,282	-4.0	6.2	5.8
– refined	kt	496	313	443	444	-36.8	41.6	0.0
– total metallic content	kt	1,447	1,249	1,442	1,500	-13.7	15.5	4.0
Export value								
– nominal	A$m	3,623	4,509	5,284	4,746	24.4	17.2	-10.17
– real [d]	A$m	4,049	4,824	5,284	4,554	19.1	9.5	-13.8

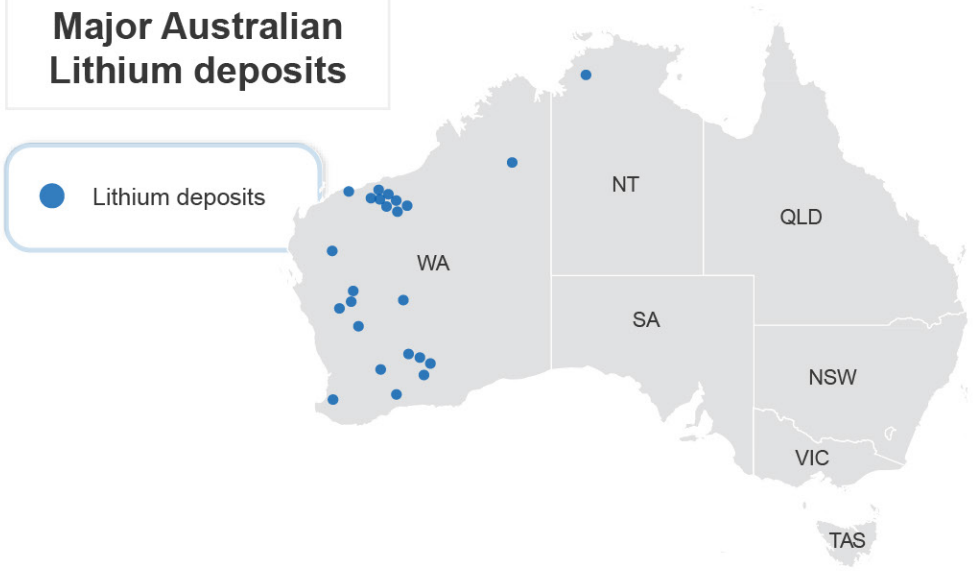
Notes: **a** Includes secondary refined zinc; **b** In 2022 US dollars; **c** Quantities refer to the gross weight of all ores and concentrates; **d** In 2021–22 Australian dollars; **f** Forecast.

Source: ABS (2021) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Science and Resources (2021); International Lead Zinc Study Group (2021); Wood Mackenzie (2021); LME (2021).

Lithium

3 Li 6.94

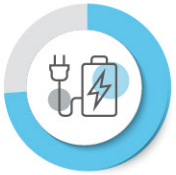
Major Australian Lithium deposits



Lithium facts

- Lithium metal is **so light it floats on water**
- **Electric vehicle sales** are expected to grow tenfold by 2030
- Australian lithium exports will more than double over the next 5 years
- May 2022: Australia's 1st continuous **production of lithium hydroxide**

World consumption



75%
Rechargeable batteries

13%
Ceramics & glass

8%
Other uses

4%
Greases & polymers

Australia's lithium

Biggest exporter in the world

46% of **world's lithium production,** 2020

In 2022/23 production ramp up planned for 2 refineries

15.1 Summary

- Spodumene prices are forecast to rise from an average US$598 a tonne in 2021 to US$2,730 a tonne in 2022, and US$3,280 a tonne in 2023 before moderating to US$2,490 in 2024. We expect lithium hydroxide prices to lift from US$17,370 a tonne in 2021 to US$38,575 a tonne in 2022 and US$51,510 in 2023, and moderate to US$37,650 by 2024.
- Australia's lithium production is forecast to grow from 247,000 tonnes of lithium carbonate equivalent (LCE) in 2020–21 to 387,000 tonnes in 2022–23 and 469,000 tonnes of LCE in 2023–24.
- Australia's lithium export earnings are forecast to increase by more than ten-fold in just two years from $1.1 billion in 2020–21 to $13.8 billion in 2022–23, and ease to $12.9 billion by 2023–24.

15.2 World demand

Global demand for lithium grows as electric vehicle sales take off

Global lithium demand continued to grow strongly in the June quarter 2022, driven by rising demand for electric vehicle batteries. Despite faltering global economic growth in the June quarter, sales and production of electric vehicles (EVs) continued their rapid growth trend.

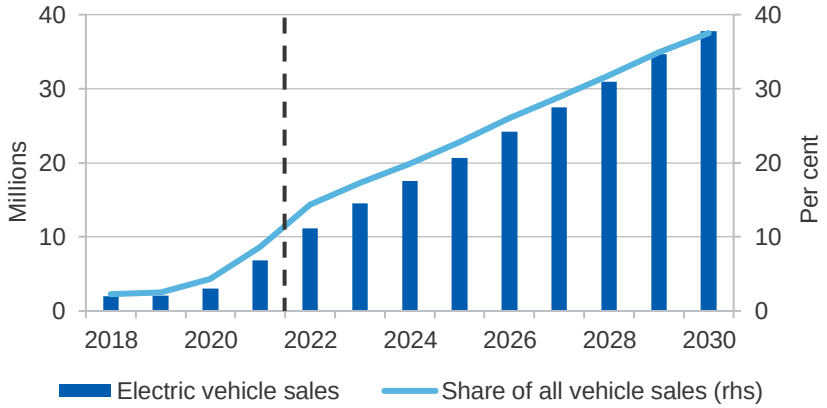
Global sales of all types of EVs increased 36% in the year to June 2022 compared with the same period in 2021 — with Chinese sales up 110%, European sales up 6%, and North American sales up 27%.

In China, total EV sales have averaged almost half a million vehicles a month so far in 2022, reaching a peak of 650 thousand vehicles in June. Overall, auto production and supply chains in China have now largely recovered from the COVID lockdowns, when EV sales fell to just over 300 thousand vehicles in April 2022.

In May, the Chinese Government cut purchase taxes on some low-emission passenger vehicles by 50%, while some municipal governments have also provided subsidies and incentives to encourage EV purchases. 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 hit 11.2 million in 2022 and 14.5 million in 2023 (Figure 15.1).

Key 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 vehicle sales annually by 2030.

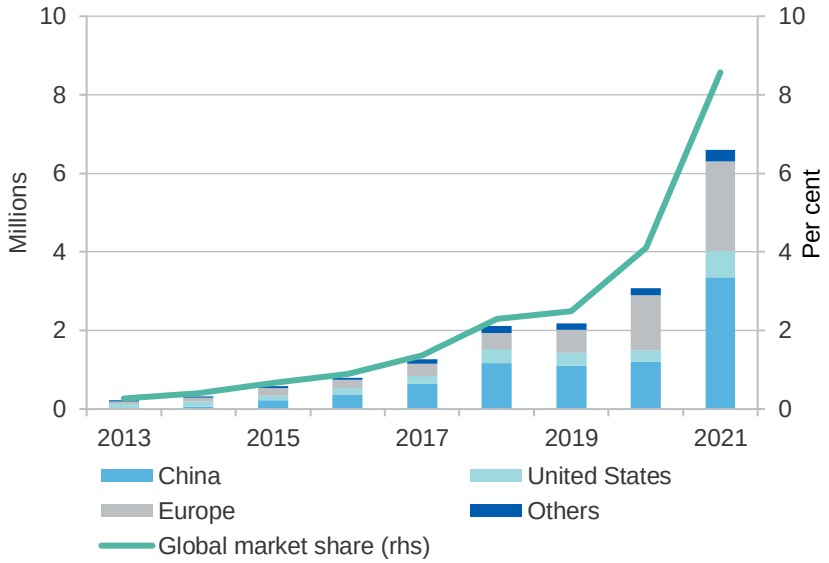
Figure 15.1: Long term electric vehicle sales projections



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

World demand for lithium is estimated to increase from 583,000 tonnes of lithium carbonate equivalent (LCE) in 2021 to 724,000 tonnes in 2022 (Table 15.1). Over the following two years, demand is forecast to rise by over 40%, reaching 1,058,000 tonnes by 2024. Asia remains the major source of demand for lithium, despite the spread of new battery manufacturing capacity into Europe and the US.

Figure 15.2: Electric vehicle sales by country



Source: IEA (2022).

China's EV subsidy program for passenger vehicles, which had been scheduled to conclude by the end of 2021, was extended to the end of 2022 earlier this year. Compared to a similarly priced internal combustion engine (ICE) passenger car model, the Chinese government subsidy provides a saving to customers of about 10,000 yuan. It has been reported that the Chinese government is now looking to continue the incentives next year.

Supply chain issues that plagued EV manufacturers and battery makers late in 2021 and earlier this year have eased somewhat. But supply remains tight, with reports of delivery timeframes for key EV models being pushed well into 2023. Higher prices for lithium as well as other key battery materials (such as nickel, graphite and cobalt) are putting pressure on battery costs.

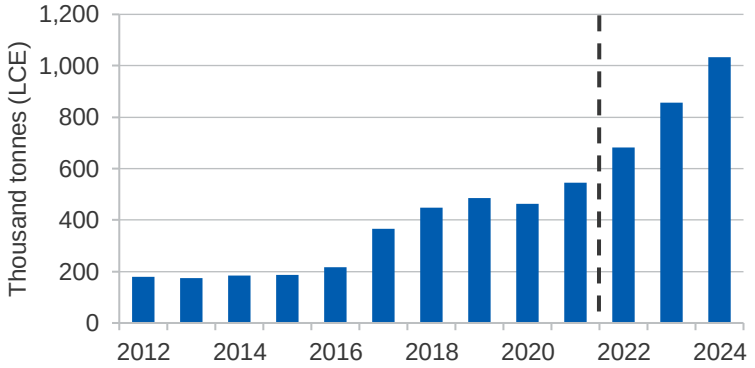
15.3 World production

Global lithium production rising, but supply gap remains

World output was 546,000 tonnes LCE in 2021, and is forecast to reach 682,000 tonnes in 2022 and 1,034,000 tonnes in 2024 (Figure 15.3). This rapid growth — of over 80% in three years — is forecast to be met by gains in output by Australia (see section below), Chile (via expansions to Albemarle and SQM brine operations) and Argentina (via new and expanded brine operations by Livent, Allkem and Minera Exar).

Total supply from mine and brine operations is currently insufficient to meet demand. While new lithium projects are being developed, the supply gap will take time to close. Stockpile size is hard to ascertain, with some estimates of 4-8 weeks for spodumene. Ongoing tight supply conditions are forcing lithium processors and battery makers to pay record prices.

Figure 15.3: Global lithium production



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

Global race for new lithium production speeds up

A number of expansions and new projects have been announced in recent months. 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.

In Canada, three new lithium projects in Quebec are expected to start production in 2023, with a combined production of over 50,000 tonnes of LCE. Looking further ahead, the reopening of the Whabouchi mine, also in Quebec, is expected to add production of 52,500 tonnes a year from 2025. Mexico has created a state-run company to mine lithium after nationalising lithium resources in April. The company is scheduled to start operations within the next six months. While several companies hold contracts to explore potential lithium deposits, Mexico does not yet produce lithium.

Europe and North America are looking to reduce their dependency on Chinese imports and develop their own lithium production. In August, the US Government's *Inflation Reduction Act of 2022* came into effect. The Act contains provisions to promote the clean energy transition including significant incentives to purchase EVs.

Under the 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 recycled in North America. This content requirement applies only to the minerals in the batteries, rather than the entire EV, and includes minerals such as lithium, nickel, cobalt and graphite. The content requirements increase progressively over time, reaching 100% by 2029. From 2024 onwards, the Act also stipulates that eligibility for the tax credits also depends on battery minerals or components not being sourced from 'foreign entities of concern'.

Zimbabwe's Premier African Minerals is expected to start shipping spodumene concentrate from its Zulu lithium mine to China by March 2023, with the long-term goal of producing around 50,000 tonnes a year.

In July, Argentina's Government revealed that Ultra Argentina SRL and China's Zangge Mining have committed $290 million to explore, develop and process the nation's lithium deposits. The Government expects about $4.2 billion of investment in its lithium sector over the next 5 years, which would help double output in 2023, and reach 175,000 tonnes in 2025.

Interest in recycling continues to rise, with recycling projects announced in many nations. However, large scale operations will take time to establish. Stronger lithium prices, combined with rising volumes of used EV batteries, should improve the economics of recycling projects.

15.4 Prices

Record spodumene spot prices rolling into contract prices

Shortages of spodumene, lithium hydroxide and lithium carbonate continue to push spot prices to new records. Spot spodumene concentrate averaged about US$4,720 per tonne in August 2022 (SC6.0, CIF China).[1] This was up slightly from July, representing a ten-fold increase from the US$418 a tonne recorded in January 2021.

Spot prices for lithium hydroxide (delivered to China) averaged US$70,300 a tonne in August 2022, down slightly from the April peak of US$74,688, but still more than eight times the US$7,984 average of January 2021.

Supply disruptions in August (due to extended power cuts in Sichuan province, amidst an intense heatwave) added pressure to lithium prices in China. Sichuan produces more than 20% of China's lithium.

As most Australian producers have historically utilised long term contracts, prices received take time to adjust to shifts in spot prices. High average prices reported by Australian producers indicate spot prices are now flowing more rapidly into contract prices. ABS trade data indicate that average realised prices (which reflect a mix of contract and spot priced exports) have increased strongly so far in 2022, as processors seek to ensure supply is sufficient to meet expected demand.

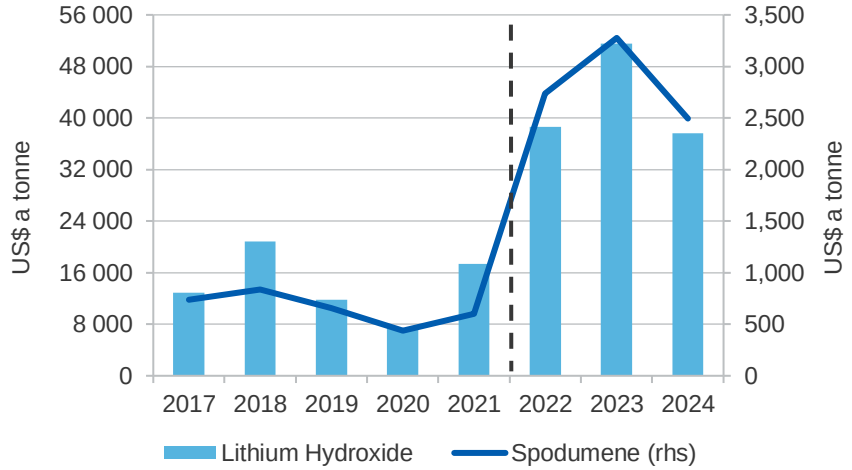
Spodumene prices are forecast to rise from an average of US$598 a tonne in 2021 to US$2,730 a tonne in 2022, as record spot prices feed through

[1] The SC6.0 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 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.

into contract prices (Figure 15.4). Prices are expected to remain high in historic terms over the outlook, averaging US$3,280 a tonne by 2023 before moderating to US$2,490 in 2024.

The lithium hydroxide price is forecast to rise from US$17,370 a tonne in 2021 to US$38,575 a tonne in 2022. Prices are expected to peak in 2023 at over US$50,000 a tonne before moderating to average around US$37,600 in 2024.

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).

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 rapidly than recent IMF forecasts suggest it will.

15.5 Australia

Lithium set to become a $10 billion-plus export industry within a year

Record spodumene prices are estimated to have lifted export revenue from $1.1 billion in 2020–21 to $4.9 billion in 2021–22. Production from lithium hydroxide refineries is forecast to steadily add to earnings over the outlook period, lifting total annual lithium export revenue to an estimated $12.9 billion in 2023–24.

The emergence of what is likely to be Australia's newest $10 billion-plus export industry occurred in three quite distinct stages (Figure 15.5).

From 2013–14 to 2017–18 the industry built capacity. Production volumes and export revenues rose from under $200 million to $1.7 billion — a more than eightfold increase.

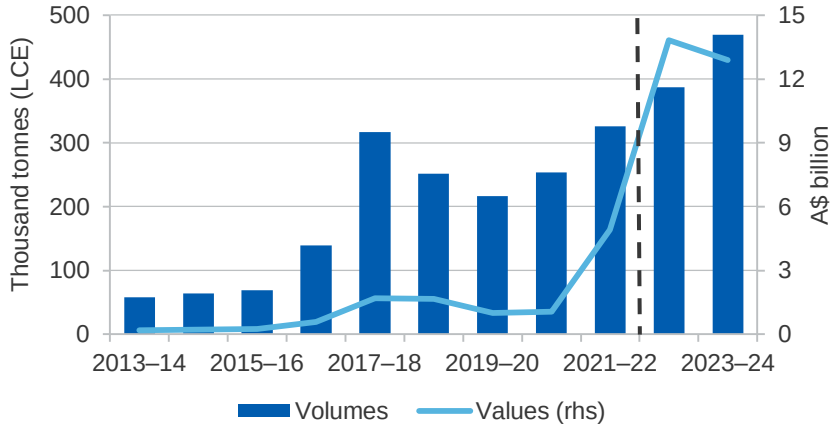
Over the next three years, global demand lost momentum and prices and revenues plunged. This fall tested the resilience of businesses, with some facilities relegated to care and maintenance.

But as global battery manufacturers and automakers reassessed their requirements over the course of 2021, demand for lithium took off again. This third stage holds even stronger growth prospects than the first, with Australia's lithium export revenues forecast to grow from $1.1 billion in 2020–21 to $13.8 billion in 2022–23 — a tenfold increase in just two years.

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 20% a year will see production rise from 247,000 tonnes of LCE in 2020–21 to 387,000 tonnes in 2022–23, and 469,000 tonnes in 2023–24 (Figure 15.5).

Over the forecast period, export volumes of spodumene concentrate are forecast grow by more than one-third. From 2.3 million tonnes in 2021–22, spodumene concentrate exports are forecast to increase to 3.2 million tonnes in 2023–24.

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).

Producers ramp up production and exports

Talison Joint Venture's three operational plants at Greenbushes produced a combined total of 338,000 tonnes of spodumene concentrate in the June quarter 2022. This was up by 25% from the March quarter 2022. Tailings Retreatment Plant production continued to ramp up following completion of construction in the March quarter. The company has announced that chemical grade plant 2 has also continued to ramp up, with improved throughput, recovery and production. Further ramp up and optimisation is expected in coming quarters.

Pilbara Minerals produced 127,236 dry metric tonnes (dmt) of spodumene concentrate output in the June quarter 2022. This was an increase of 56% from the March quarter (81,431 dmt). The company stated the strong quarterly result was achieved despite being impacted by COVID-19 and associated labour shortages across the mining sector. Total spodumene produced in 2021–22 was 377,902, a 34% gain from 2020–21.

The company states that following completion of the Pilgan Plant improvement project, production capacity is now estimated to be in the range of 360–380 kilotonnes per annum (ktpa) of spodumene. The Ngungaju Plant produced first concentrate from the fines circuit in early June. Ore throughput has continued to increase and ramp up to the planned 180–200ktpa (dmt) concentrate production rate is expected to be achieved during the September quarter 2022.

Final investment decision was taken for a $300 million incremental 100ktpa capacity increase for the Pilgan plant during the June quarter — which will bring total production up from 580 ktpa to 680 ktpa. The 'P680' Project includes $50 million of pre-investment capital to assist with the proposed next phased expansion – with a targeted production capacity of up to 1Mtpa. FID for the P1000 Project is targeted for late December 2022.

Pilbara Minerals stated that the average realised spodumene sales price achieved in the June quarter 2022 was US$3,911 per dmt (6% CIF China basis). This was a substantial increase on the March quarter 2022 price of around US$2,650/dmt. The June quarter average price excludes a 5,000 dmt cargo sold via pre-auction on the Battery Metal Exchange in late June 2022 for just over US$7,000 dmt (6% CIF China basis), with shipment for this cargo expected in August 2022. Pilbara Minerals sold another 5,000 dmt cargo at auction for around US$7,700 in September 2022.

IGO states that it expects the chemical grade spodumene concentrate transfer price for the September and December quarters this year to be US$4,187. This is more than double the price of US$1,770 a tonne for the March and June quarters.

Output from Mt Marion (owned 50% by Mineral Resources and 50% by Jiangxi Ganfeng Lithium Co. Limited) totalled 128,000 dmt of spodumene concentrate in the June quarter 2022, with an average realised price of US$2,645 a tonne (up about 35% on the March quarter). In April 2022, the joint venture announced a decision to lift spodumene production at Mt Marion from 450,000 to 600,000 tonnes per annum of mixed-grade concentrate, targeting an annual plant capacity of 900,000 tonnes by end 2022 (equal to 600,000 tonnes of 6% spodumene concentrate).

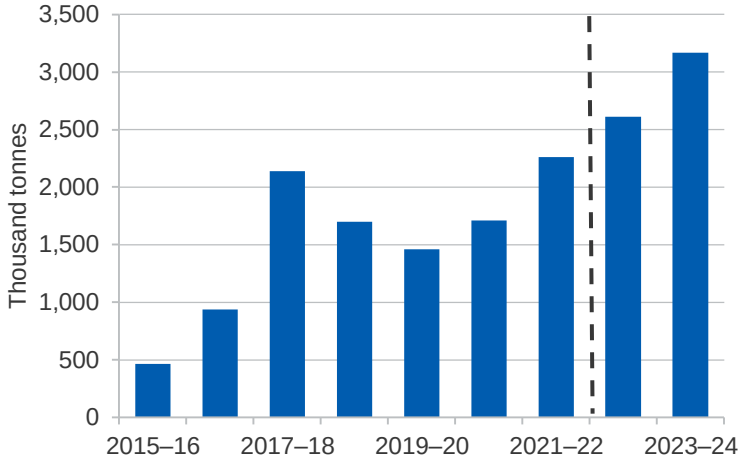
Mineral Resources and Albemarle stated that the restart of Wodgina saw first spodumene concentrate from Train 1 delivered in May, with 20,000 dmt produced in the June quarter. The restart of Train 2 progressed as scheduled, with first spodumene concentrate delivered in July.

Allkem's Mt Cattlin mine produced 24,845 dmt of spodumene concentrate in the June quarter, contributing to the record financial year production of 193,563 dmt in 2021–22. The average spodumene realised price received in the June quarter was US$4,992 per dmt, more than double the price of US$2,178 achieved in the March quarter.

Site construction continues at Core Lithium's Finniss Project near Darwin, following receipt of environmental approval for the BP33 underground mine. The project is expected to produce 160 ktpa of spodumene concentrate, and has offtake agreements with Ganfeng Lithium, Sichuan Yahau and a binding term sheet with Tesla. In July, the company reported a 28% increase in the Mineral Resource Estimate following drilling and exploration undertaken in the 2021 drilling season. The company reports that development is on schedule for first export of lithium ore by the end of 2022, and first spodumene concentrate production in 2023.

Liontown's Kathleen Valley deposit near Kalgoorlie received FID in the June quarter 2022. The project is expected to deliver about 500 ktpa of spodumene concentrate in the first year, rising to about 700 ktpa by year 6. Production is expected to start in the June quarter 2024. Offtake agreements are in place for about 90% of Kathleen Valley's start-up capacity, including tier-1 customers Ford, Tesla and LG Energy Solution.

Figure 15.6: Spodumene exports



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

Australia's hydroxide refineries on verge of commercial production

Following the key milestone of first production of battery grade lithium hydroxide in May, the Kwinana lithium hydroxide refinery (51% Tianqi and 49% IGO) recommenced production in June after a planned three-week shutdown. IGO stated that production of battery grade hydroxide has allowed the start of the product qualification process with offtake partners, with an expected completion time of 4-8 months.

The company expects Train 1 production to ramp up concurrently with the qualification process over the coming quarters, in anticipation of the plant reaching commercial production during 2022–23. Construction of Train 2 has been partially completed, with the decision for the recommencement of construction to be made by the end of 2022. Each train has a capacity of 24,000 tonnes a year.

First product from Train 1 of the Kemerton lithium hydroxide plant (Albermarle 60%, Mineral Resources 40%) was delivered in early July 2022. Mechanical completion and commencement of production at

Kemerton's Stage 2 — which will produce an additional 25,000 tonnes a year — is targeted for the December quarter 2022.

Pilbara Minerals' joint venture with POSCO for the production of lithium hydroxide in South Korea was completed in April. During the June quarter, detailed engineering, procurement, site preparation and road works commenced. The joint venture plans to source over 300,000 tonnes a year of spodumene concentrate from the Pilgangoora operations.

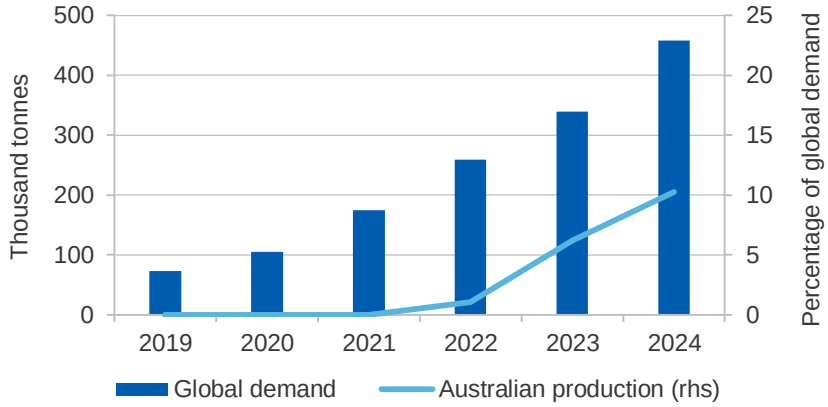
Construction of Covalent Lithium's (Wesfarmers 50%, SQM 50%) Kwinana lithium hydroxide refinery progressed in the June quarter 2022. The refinery is forecast to start in 2024 — making 50,000 tonnes of lithium hydroxide a year. The refinery will source spodumene from Mt Holland, where construction of the village and aerodrome has been completed, and pre-strip mining and construction of the concentrator is underway.

By 2024, Australia may have about 10% of global lithium hydroxide refining capacity (Figure 15.7), rising to about 20% of global lithium refining by 2027. There are a number of risks to the strong forecast growth for Australian lithium production and revenue over the outlook. Delays to approval and construction of new mine and processing plants, as well as difficulties achieving ramp up to full output, would see slower growth in spodumene output volumes and export values. For Australia's emerging lithium hydroxide refining sector, more unanticipated delays or technical challenges associated with achieving required product grade, purity and consistency, could delay output and exports.

China dominates the EV battery supply chain, producing three-quarters of all lithium-ion batteries, and holds around 70% of cathode production capacity and 85% of anode production (Figure 5.8). Over half of lithium, cobalt and graphite processing and refining capacity is located in China. This situation is not expected to change rapidly. The IEA states that the majority of the supply chain is likely to remain Chinese through to 2030. In the case of battery production, China accounts for 70% of new global production capacity announced for the period to 2030 (IEA 2022).

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 15.9).

Figure 15.7: World and Australian lithium hydroxide output

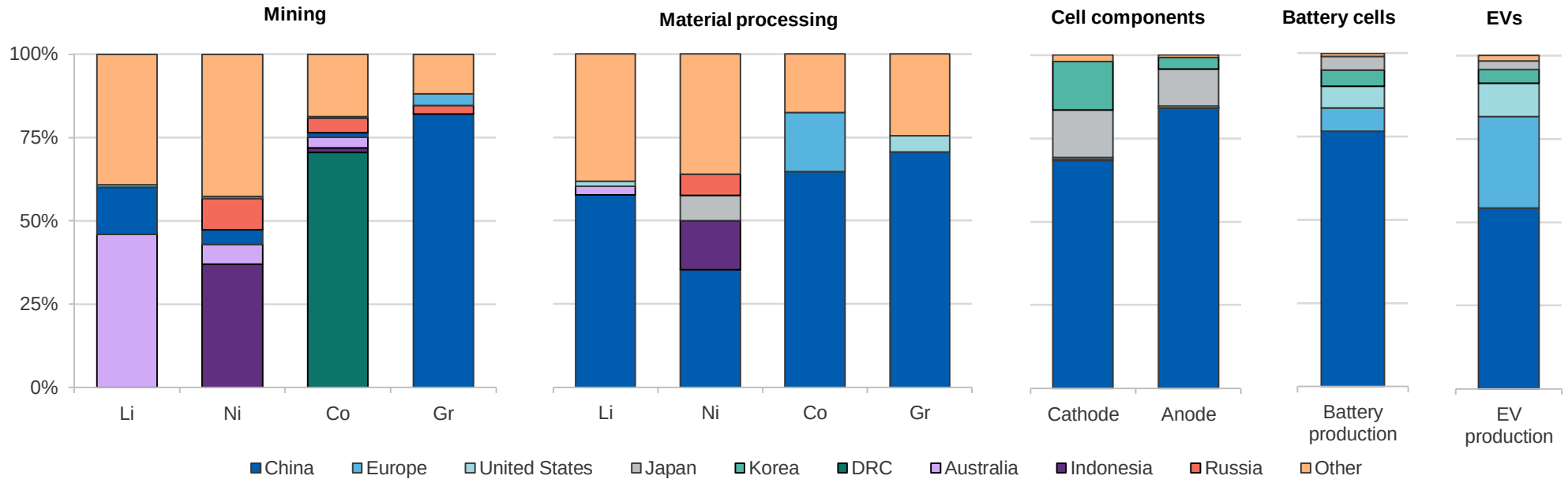


Source: Wood Mackenzie (2022); Department of Industry, Science and Resources (2022)

Revisions to the outlook

Forecast export revenue over the outlook has been revised up substantially. This reflects sustained record prices, faster than expected pass-through of spot prices to contract prices and new Australian production and trade data. Export revenue in 2021–22 has been revised up, from $4.1 billion in the June 2022 *Resources and Energy Quarterly* to $4.9 billion. Further out, 2022–23 has been lifted from $7.8 billion to $13.8 billion, and 2023–24 from $9.4 billion to $12.9 billion.

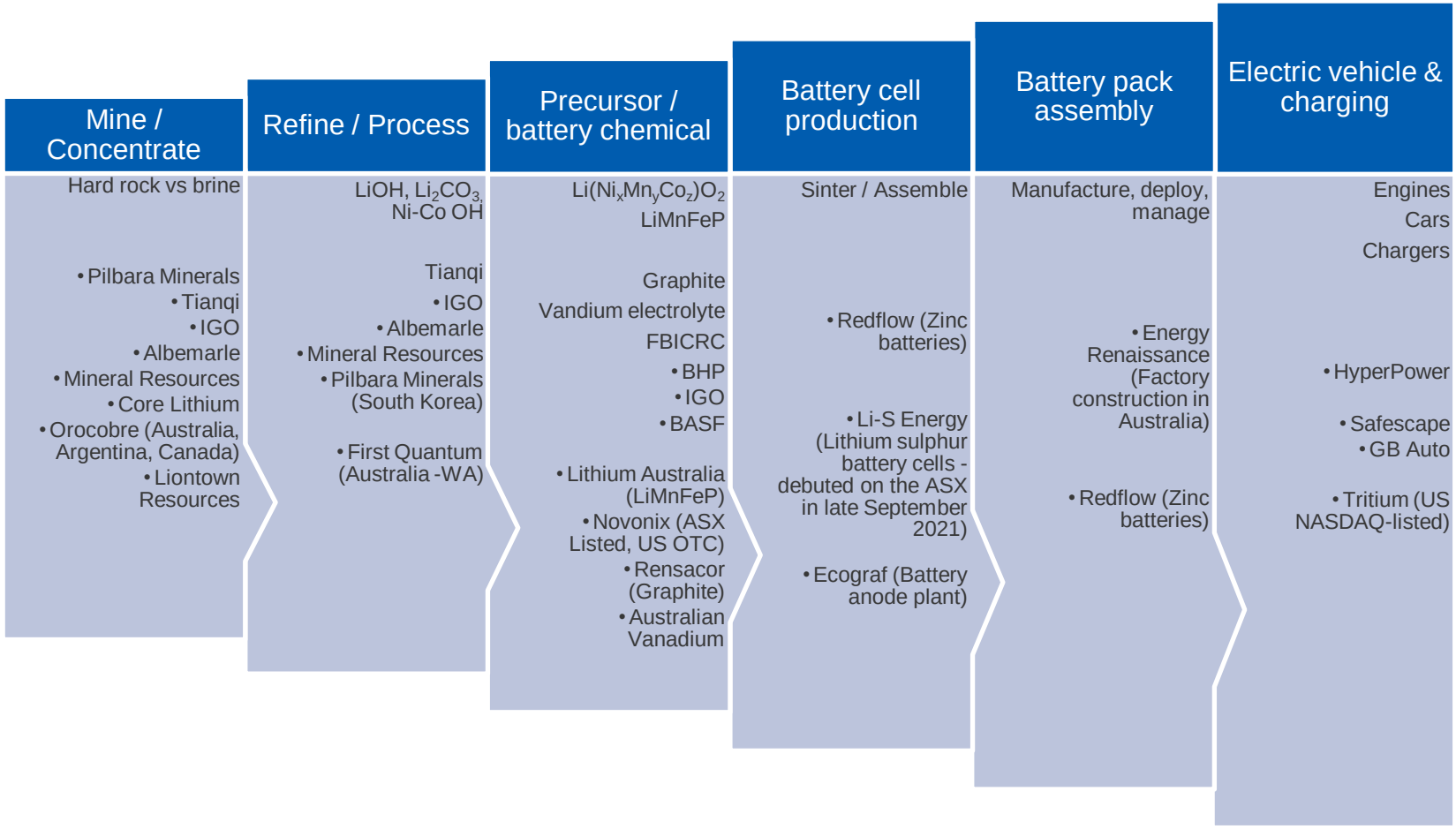
Figure 15.8: Geographical distribution of the global EV battery supply chain



Notes: Li = lithium; Ni = nickel; Co = cobalt; Gr = graphite; DRC = Democratic Republic of Congo. Geographical breakdown refers to the country where the production occurs. Mining is based on production data. Material processing is based on refining production capacity data. Cell component production is based on cathode and anode material production capacity data. Battery cell production is based on battery cell production capacity data. EV production is based on EV production data. Although Indonesia produces around 40% of total nickel, little of this is currently used in the EV battery supply chain. The largest Class 1 battery grade nickel producers are Russia, Canada and Australia.

Source: IEA 2022, *Global Supply Chains of EV Batteries*. DISR 2022 (global lithium mining shares).

Figure 15.9: 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

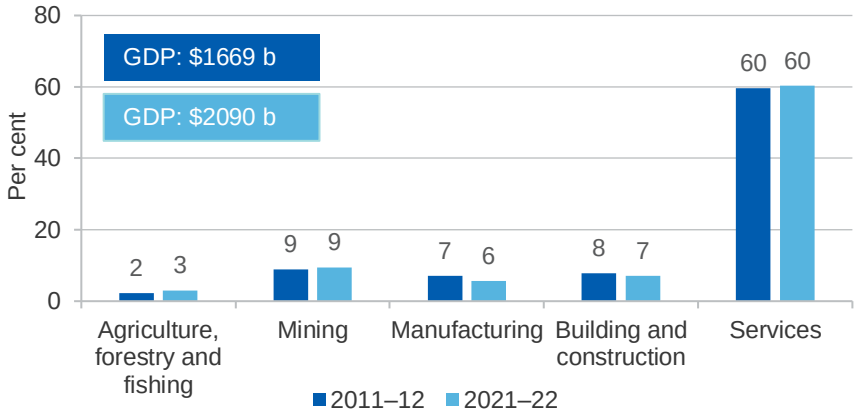
						Annual percentage change		
World	**Unit**	**2021**	**2022[s]**	**2023[f]**	**2024[f]**	**2022[s]**	**2023[f]**	**2024[f]**
Lithium production [a]	kt	546	682	856	1,034	24.9	25.6	20.7
Lithium demand	kt	583	724	864	1,058	24.2	19.3	22.5
Spodumene price								
– nominal	US$/t	598	2,730	3,280	2,490	357.0	19.8	-23.8
– real [b]	US$/t	644	2,730	3,180	2,370	324.3	16.3	-25.5
Lithium hydroxide price								
– nominal	US$/t	17,370	38,575	51,510	37,650	122.1	33.5	-26.9
– real [b]	US$/t	18,710	38,575	49,990	35,730	106.2	29.6	-28.5
Australia	**Unit**	**2020–21**	**2021–22[s]**	**2022–23[f]**	**2023–24[f]**	**2021–22[s]**	**2022–23[f]**	**2023–24[f]**
Mine production [a]	kt	247	335	387	469	35.9	15.3	21.3
Spodumene export volume [c]	kt	1,711	2,264	2,609	3,166	32.3	15.3	21.3
Export value								
– nominal value [d]	A$m	1,055	4,907	13,836	12,877	365.2	182.0	-6.9
– real value [e]	A$m	1,179	5,250	13,836	12,355	345.4	163.5	-10.7

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 Li_2O 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).

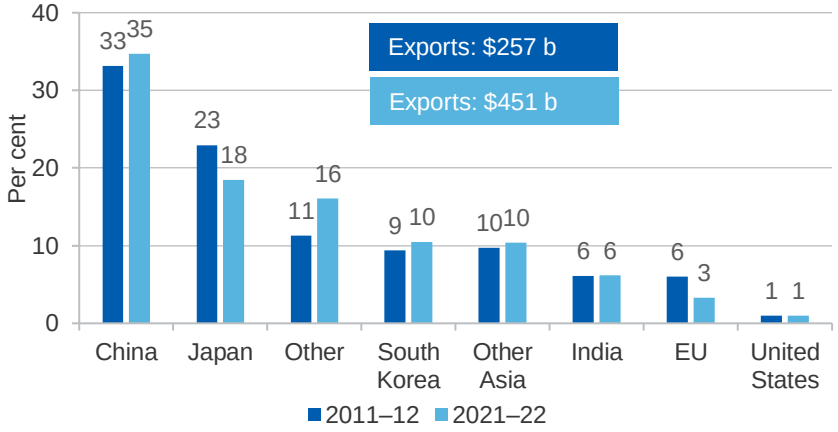
Trade summary charts and tables

Figure 16.1: Industry shares of GDP



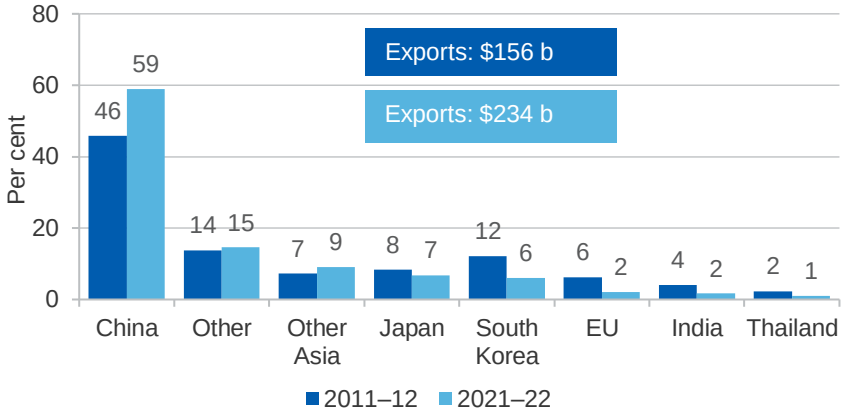
Source: ABS (2021) Australian National Accounts, National Income, Expenditure & Production, 5204.0

Figure 16.2: Principal markets for Australia's resources and energy exports, 2022–23 dollars



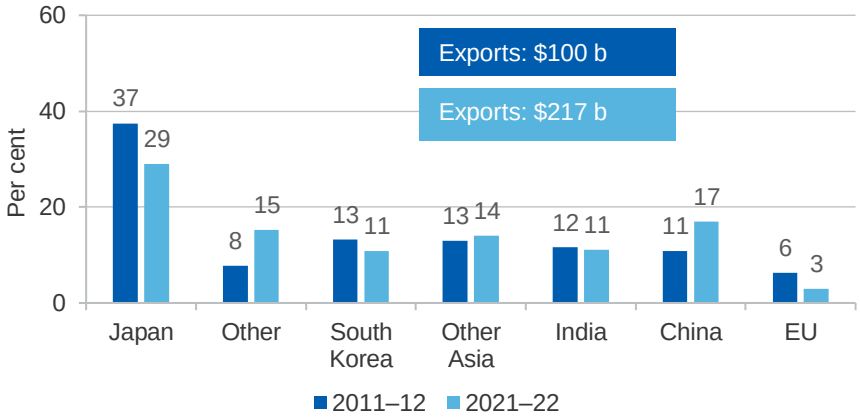
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.3: Principal markets for Australia's resources exports, 2022–23 dollars



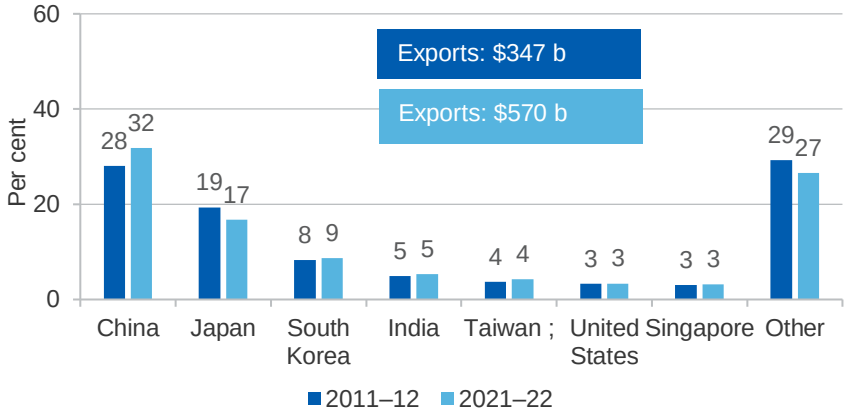
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.4: Principal markets for Australia's energy exports, 2022–23 dollars



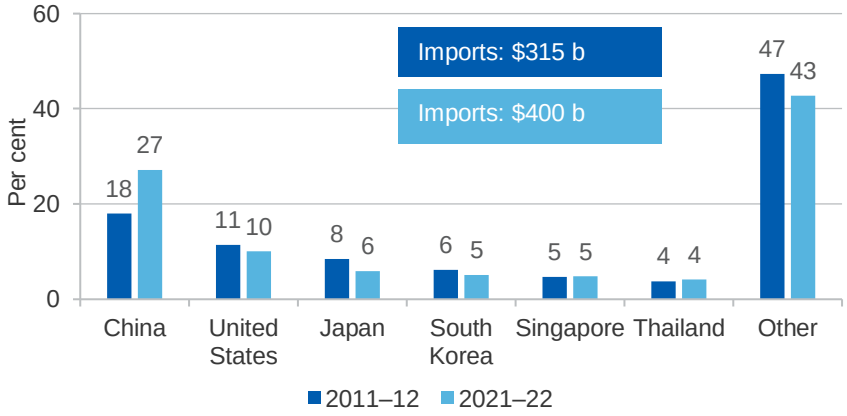
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.5: Principal markets for Australia's total exports, 2022–23 dollars



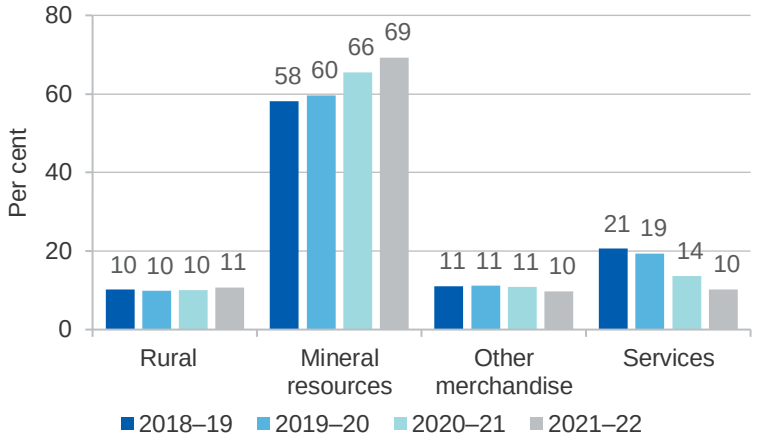
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2022) International Trade in Goods and Services, 5368.0

Figure 16.6: Australia's total imports by country of origin, 2022–23 dollars



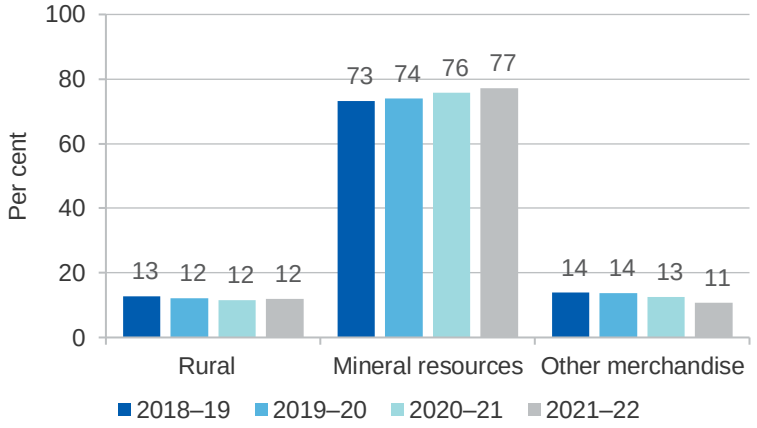
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2022) International Trade in Goods and Services, 5368.0

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	11,507	13,384	9,479	7,833	25,438
South Korea	$m	3,476	4,387	3,228	2,870	7,446
Taiwan	$m	3,007	3,639	2,709	2,302	6,723
Vietnam	$m	149	764	1,182	795	1,826
Malaysia	$m	874	1,041	607	625	1,532
Thailand	$m	433	461	490	579	865
Total	**$m**	**26,420**	**29,873**	**23,139**	**17,890**	**49,223**

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	11,092	12,938	8,505	8,471	21,942
Japan	$m	8,497	8,812	6,909	5,301	14,883
South Korea	$m	4,290	4,630	3,445	3,053	9,969
Netherlands	$m	2,095	2,062	1,410	989	4,201
Taiwan	$m	2,261	2,989	2,264	1,489	4,117
China	$m	9,799	11,381	11,103	1,864	0
Total	**$m**	**44,209**	**50,217**	**38,889**	**25,911**	**71,084**

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	1,078	1,847	2,911	2,186	3,539
Thailand	$m	1,891	2,033	1,381	1,444	2,682
South Korea	$m	895	1,362	788	1,621	4,255
China	$m	1,082	1,648	1,770	318	1,241
Indonesia	$m	1,470	846	1,227	718	1,173
Malaysia	$m	755	991	1,007	453	265
Total	**$m**	**8,139**	**10,439**	**10,231**	**8,308**	**15,003**

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	16,975	24,409	22,630	13,018	28,852
China	$m	11,183	20,118	18,484	12,713	18,247
South Korea	$m	4,313	6,107	5,861	3,735	12,998
Taiwan	$m	874	2,697	2,945	2,500	8,577
Singapore	$m	1,328	1,423	1,180	970	2,599
Malaysia	$m	425	1,004	1,653	558	719
Total	**$m**	**36,153**	**57,226**	**53,970**	**34,058**	**75,378**

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	58,627	73,038	96,285	139,486	117,027
Japan	$m	6,236	6,625	7,992	10,147	11,036
South Korea	$m	4,219	5,371	7,066	10,094	8,839
Taiwan	$m	1,444	2,035	2,130	3,431	2,987
Indonesia	$m	52	50	31	45	41
India	$m	351	273	23	10	37
Total	**$m**	**71,814**	**89,248**	**116,812**	**170,950**	**142,996**

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	1,607	1,519	1,154	1,068	1,611
South Korea	$m	987	883	1,293	1,012	1,105
Taiwan	$m	383	337	409	466	661
United States	$m	217	968	280	287	643
Thailand	$m	438	451	329	390	558
Indonesia	$m	214	138	108	124	175
Total	**$m**	**4,695**	**4,794**	**4,193**	**4,205**	**6,122**

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	4,407	4,150	4,301	3,070	2,105
South Korea	$m	340	786	739	1,469	1,604
Malaysia	$m	1,018	1,428	936	950	1,028
India	$m	980	511	526	700	1,007
Japan	$m	1,784	2,110	2,414	19	19
Philippines	$m	195	704	409	-	-
Total	**$m**	**9,885**	**11,243**	**11,593**	**12,785**	**13,202**

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	3,437	5,837	935	2,266	8,751
Hong Kong	$m	9,410	5,029	3,794	1,576	5,236
India	$m	856	665	75	1,647	2,063
Switzerland	$m	1,280	1,336	2,156	2,111	2,009
Singapore	$m	1,354	1,829	1,616	3,278	1,722
United States	$m	86	146	3,497	4,400	1,478
Total	**$m**	**22,568**	**21,712**	**27,702**	**29,172**	**24,828**

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