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Office of the Chief Economist

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Contents

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Executive Summary

The outlook for Australian resource and energy commodity exports has improved slightly since the June 2023 *Resources and Energy Quarterly* (REQ). In the September quarter, commodity prices held up better than we expected in the June REQ, adding to the positive impact on export revenues of the weaker AUD/USD. Australian exports are forecast to fall to $400 billion in 2023–24, down from a record $467 billion in 2022–23. Exports are forecast to decline further to $352 billion in 2024–25.

Economic growth in Western economies is holding up better than expected in the June REQ, outweighing worries over the outlook for the Chinese economy — the world's largest consumer of resource and energy commodities and Australia's largest export destination. Relatively slow growth in the Chinese economy in 2023 reflects a range of cyclical factors — including the slowdown in Western economies in 2023 and a downturn in the Chinese property sector — and structural factors — such as the growing share of consumption in GDP. Weaker economic growth in China has led to bouts of weakness in iron ore and base metal prices, but recent Chinese stimulus measures and low global inventories of most base metals have helped limit price falls.

Energy prices have normalised relative to 2022, as global trade has now largely reorganised in response to the sanctions placed on Russian exports. However, prices remain above levels traded pre-Russian invasion of Ukraine: some Russian fossil fuel output remains stranded, limiting world supply. Europe is likely to be the main driver of global LNG demand over the outlook period, as the region continues to replace Russian pipeline gas with LNG, mainly from the US. World oil stocks are low, making oil prices vulnerable to supply shocks.

The end of both the La Niña weather episode and major COVID-related workforce disruptions have also helped improve world supply of most resource and energy commodities. With high chances of drier than normal conditions in eastern Australia over the next 6-9 months, the risk of mines and transport routes being flooded are sharply reduced. But an El Niño-driven drought in Indonesia would lower river levels, making thermal coal difficult to barge.

Following the end of Chinese restrictions on Australia coal imports, Australian thermal coal exports to China have returned to previous levels. However, Australian metallurgical coal has struggled to regain Chinese market share: new rail links have facilitated a recent surge of Mongolian metallurgical coal exports to China in the past year or so, and Russia has been able to divert some of its coal exports to China (and India) from the Western nations which have banned Russian exports.

Since the June REQ, there have been major developments in battery chemistry, with driving ranges rising and "refuelling" times falling towards levels comparable with internal combustion engines. This quarter's special topic chapter explores the global battery value chain. So far, lithium remains a central element in the improved battery chemistries and demand outlook for lithium remains strong. Lithium prices have fallen from the peak in late 2022 as the global supply outlook has improved, but remain well above levels in recent years. In volume terms, Australian exports are expected to growth further, with lithium hydroxide making up an increasing share of exports.

Global investment continues to surge in all stages of the supply chain of low emission and critical technologies, underpinned by government assistance in many nations. Government actions are being driven by concerns over both supply chain security and carbon emissions. Investment is likely to pick up even further if interest rates start to fall.

Overview

Australia's mining sector

Contributes to around **13.6% of GDP**

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

The resources sector directly employs **more than 300,000** people

Outlook

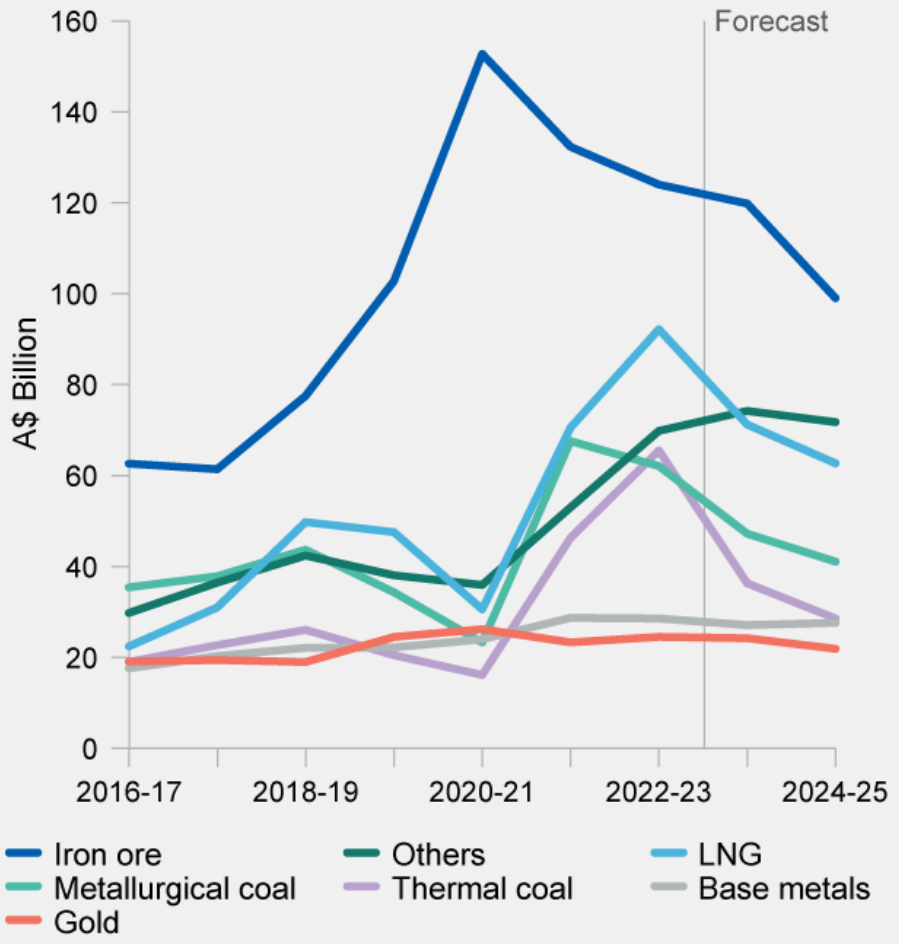
Commodity export earnings set a new record: **$467 billion** in 2022-23

Earnings record reflects improving **supply conditions**, lower **Russian exports** and a **falling $A**

Prices and earnings **likely to ease** as the global economy slows, but the volume outlook **remains solid**

Around **$1 billion** invested in exploration in the June quarter

Australia's resource and energy exports



SOURCE: ABS; DISR; OCE

1.1 Summary

- Resource and energy commodity prices fell (further) in the September quarter 2023, driven by supply and demand factors mostly pushing in the same direction. However, supply cuts by some major oil producers are helping to stabilise oil prices, and inventory replenishment by consumers is also helping support the prices of oil and other commodities.
- Australia's resources and energy export earnings during the outlook period are expected to be broadly in line with projections in the June quarter 2023 *Resources and Energy Quarterly* (REQ). After a record $467 billion in 2022–23, weaker growth in world demand and improving world commodity supply will cut prices and thus earnings to $400 billion in 2023–24, with another significant fall likely in 2024–25.
- Despite the end of COVID restrictions, structural and cyclical factors are causing China's growth to remain relatively weak. A weaker outlook for China is weighing on demand and commodity prices.

1.2 Macroeconomic, geopolitical and policy factors

World economic growth has steadied at a relatively low rate

The global macroeconomic backdrop remains less ebullient than in the period when the worst of the pandemic had passed. Since the June REQ, Western central banks have been forced to tighten monetary policy further in order to rein in inflation. But the key development has been the lack of a solid recovery in China after COVID restrictions ended in late 2022.

The pace of monetary tightening in major Western countries has slowed considerably in recent months, as the monetary authorities assess whether previous interest rate hikes have been sufficient given long and variable lags in the monetary policy transmission mechanism. Labour markets continue to lose some of their extreme tightness, reducing upward pressure on wages. Services inflation in Western economies now appears to be subsiding, but energy prices appear to have stopped falling.

World economic growth steadied at relatively low levels in the June quarter 2023. The IMF now forecasts world GDP growth of 3.0% in 2023 and 2024, down from growth of 3.5% in 2022. Growth in developed nations is expected to slow from 2.7% in 2022 to 1.5% in 2023 and 1.4% in 2024. China is (still) forecast to grow by 5.2% in 2023 and by 4.5% in 2024.

Chinese recovery stalls on a mix of cyclical and structural influences

Chinese growth has proven slower than hoped in 2023, as cyclical and structural factors weigh on the post-COVID recovery. The COVID pandemic left households and the private sector in worse shape, and confidence has been slow to recover. In addition, slowing global growth is weighing on demand for Chinese exports. These cyclical factors are compounded by structural factors, such as the increasing share of consumption in Chinese output, slowing urbanisation and population growth, the oversupplied housing sector and the diversification of supply chains. For more detail see *Macroeconomic Outlook* and *Box 2.1.*

Global trade still re-organising as a result of Russia's invasion of Ukraine

As a result of the Russian invasion of Ukraine, Western Europe has moved away from Russia toward the US as a commodity supply source. Gas supply is the most affected; lower Russian pipeline supply coincides with a surge in US LNG output, with the US set to become the leading LNG exporter in the outlook period. Russia is sending more commodities to China and India but is hitting transport capacity constraints.

The global energy transition picks up pace

Despite some regression in 2022 (in response to the fallout from the Russian invasion of Ukraine), the trend away from fossil fuels to achieve net zero by 2050 remains intact. According to the IEA, global investment in clean energy is expected to reach US$1.74 trillion in 2023, bringing total energy investment in 2023 to US$2.8 trillion. Annual clean energy investment has risen by 53% from 5 years ago, when investment in clean energy and fossil fuels was roughly equal.

Global investment continues to surge in all stages of the supply chain of low emission and critical technologies, helped in some nations by government assistance aimed both at lowering carbon emissions and securing supply chains — domestically and/or in friendly nations. Australia appears to be enjoying its share of this investment, especially at the

upstream stage. We can expect this type of investment to pick up even further in many nations once interest rates start to fall: lower borrowing costs will raise the net present value of investment projects, dragging some of them over the line. Surging investment on low emission and critical technologies in the US may exaggerate global investment: some investment in the US may merely be displacing investment elsewhere.

Thermal coal sales to China back to pre-ban levels

Australian thermal coal exports to China have returned to levels reached in 2019–20 — before trade impediments started in October 2020. In the wake of the trade impediments, Australian coal miners were able to pivot away from China to nations such as India and South Korea. These exports filled the gap that opened when Indonesian supply switched to China to replace Australian exports.

New rail links have facilitated a recent surge of metallurgical coal exports from Mongolia to China, limiting a recovery in Australia's share of Chinese metallurgical coal imports. Australian miners pivoted to India and other customers when the impediments were imposed. China and India have recently lifted their imports of Russian coal, as bans on Russian exports by some nations affect coal sales.

AUD weakness mainly due to China worries

The AUD/USD has shown bouts of fresh weakness since the publication of the June REQ, mainly driven by growing concerns over the pace of growth in the Chinese economy. The currency market is also looking at the likely peak in Australian versus US official cash rates over the outlook period. The consensus forecast adopted is for the AUD/USD to lift modestly during this time.

Risks are evenly balanced

Risks appear evenly balanced. While the outlook for the world economy is still for only relatively modest growth in the outlook period, unemployment remains low in historical terms, helping to sustain household consumption and profitability. Unemployment may rise as the more recent official interest rate hikes impact fully. Persistent inflation would require interest rates to stay high for longer, possibly raising unemployment. The Russia-Ukraine conflict aside, geopolitical tensions have recently eased slightly.

The emerging El Niño weather episode has the potential to impact thermal coal markets. While Australian miners are less likely to be affected by the flooding of mines and transport routes that impacted during the La Ni a of the 2020-23 period, drought in Indonesia will see river levels fall and create difficulties with barging — a very common way of accessing ports that are deep enough for large cargo ships used in export trade.

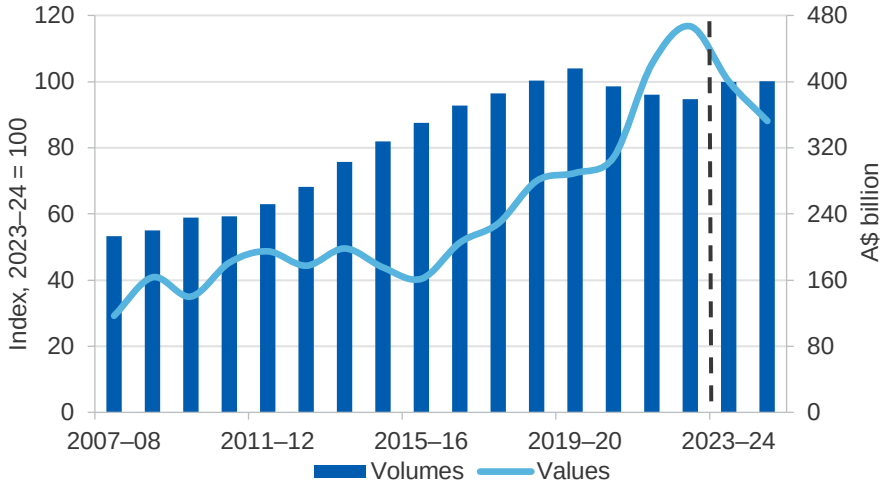
1.3 Export values

Australia's export values are forecast to be $400 billion in 2023–24

The world economic slowdown and fewer supply disruptions has generally reduced commodity prices over the past quarter. The Resources and Energy Export Values Index fell 20% from the September quarter 2022: a small rise in volumes partly offset the impact of a sharp fall in prices.

Resource and energy exports are forecast at $400 billion in 2023–24, down from a record $467 billion in 2022–23 (Figure 1.1).

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



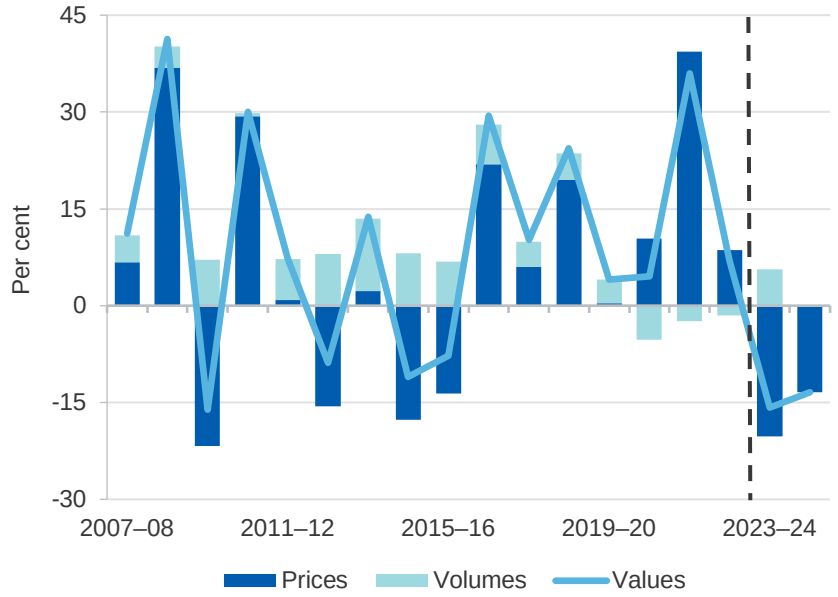
Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2023)

Weak demand and improved global supply of commodities is likely to depress prices. A modest rise in export volumes will be too small to offset the impact of prices sharply lower than in 2022–23 (Figure 1.2).

Export values are forecast to fall by 12% to $352 billion in 2024–25: prices will fall but volumes will be flat.

Australian energy export earnings are set to fall sharply. LNG earnings are forecast to fall by $21 billion to $71 billion in 2023–24, as prices settle well below 2022 levels. A further fall of $8 billion is forecast in 2024–25. Thermal coal exports are forecast to fall even more sharply, from $66 billion in 2022–23 to $36 billion in 2023–24 and $28 billion in 2024–25.

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



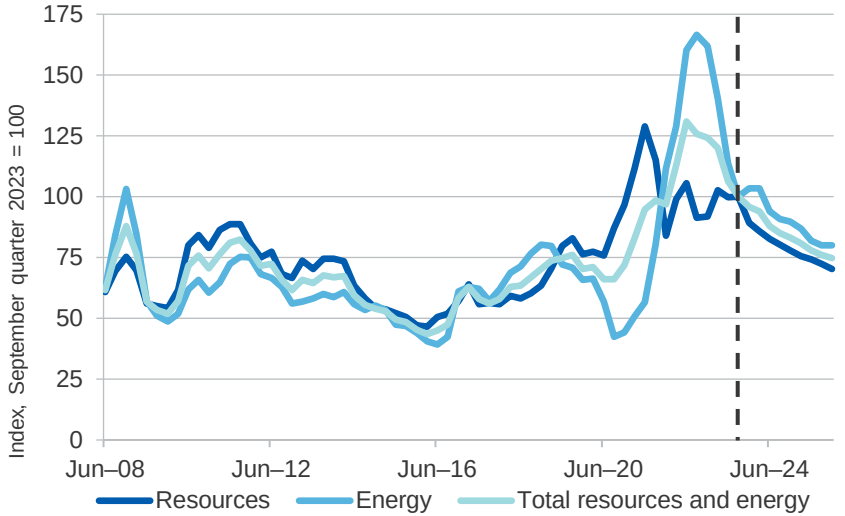
Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2023)

1.4 Prices

Since the June 2023 *Resources and Energy Quarterly*, most resource and energy prices have fallen in US$ terms, as fears rise over the slow pace of economic growth in China. The fall in prices broadly line up with the June REQ forecasts when worries about growth in Western nations dominated. While prices are generally likely to fall further over the outlook period, the steepest drops seem behind us: the rate of recovery in supply has likely peaked and OPEC+ will likely keep cutting supply to support prices.

In Australian dollar terms, the Resources and Energy Commodity Price Index fell by 6% (preliminary estimate) in the September quarter 2023, to be down 21% on a year ago. In US dollar terms, the index fell by 8% in the quarter, to be down 24% on a year ago. Resource export prices (in A$ terms) rose by 10% in the year to the September quarter 2023, while energy prices fell by 40% (Figure 1.3).

Figure 1.3: Resource and energy export prices, A$ 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.

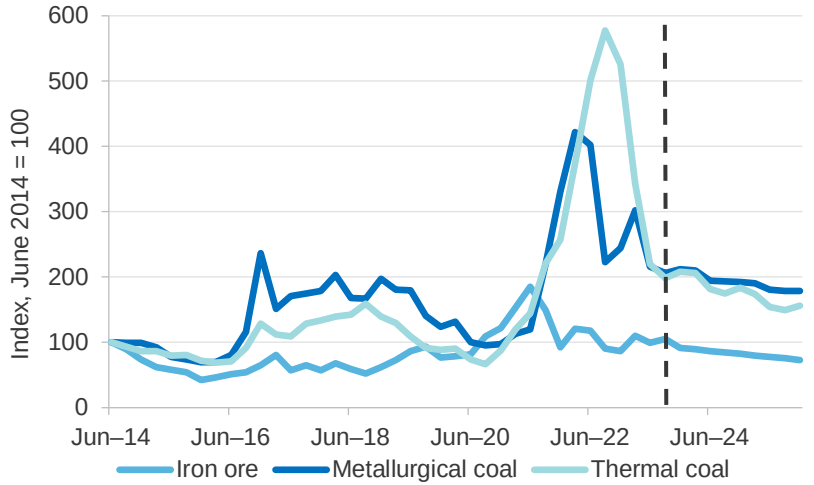
Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2023)

The **iron ore** price rose in the first half of September after worries over Chinese demand saw it drop noticeably in August (Figure 1.4). The market is watching for signs of enforced cuts in steel output by the Chinese government. **Metallurgical coal** prices have edged down as worries over low demand from Asian steel makers have added to the impact of improving supply. Prices remain above pre-war levels, as some Russian supply remains stranded from world markets. **Thermal coal** prices have held steady above pre-war levels, as better demand largely offsets the impact of improved supply. Worries over supply are likely to see Asian stockpiling ahead of the Northern Hemisphere winter.

Oil prices have recently lifted to the top end of the US$70-90 a barrel range traded since the start of 2023. Driving the rise has been supply cuts by Saudi Arabia. The US Administration has delayed replenishing the strategic reserves by 6 million barrels, waiting for prices to fall to about US$70 a barrel. Chinese imports have been strong, but it appears that some of this demand has been stockpiled rather than turned into gasoline and diesel. **LNG** prices are forecast to fall over the outlook period, as trade flows re-organise further and supply lifts. The US is set to surpass Qatar and Australia to become the world's biggest LNG exporter during the outlook period, replacing Russian (pipeline) gas supply to Europe.

In net terms, the **gold** price has softened since the last REQ as interest rates have lifted: higher interest rates raise the opportunity cost of holding gold. The prospect of interest rates staying high for longer is also harming gold's relative attractiveness as an asset. Worries over debt defaults in the Chinese property market could boost Chinese demand. **Base metal** prices have softened, as weaker growth in world economic activity — particularly the sluggish rebound in the Chinese economy — adds to the impact of improved supply (Figure 1.5). Prices are expected to be soft over the rest of 2023, but low inventories for most metals have/will put a limit on falls. Price could pick up sharply once there are signs that China's economy has taken on a healthier hue. Since the last REQ, **lithium prices** (spodumene and lithium hydroxide) have given up some more of the large gains of recent years. Supply is starting to respond to the high prices of 2022/early 2023. Prices are expected to soften further but stay above 2020 levels.

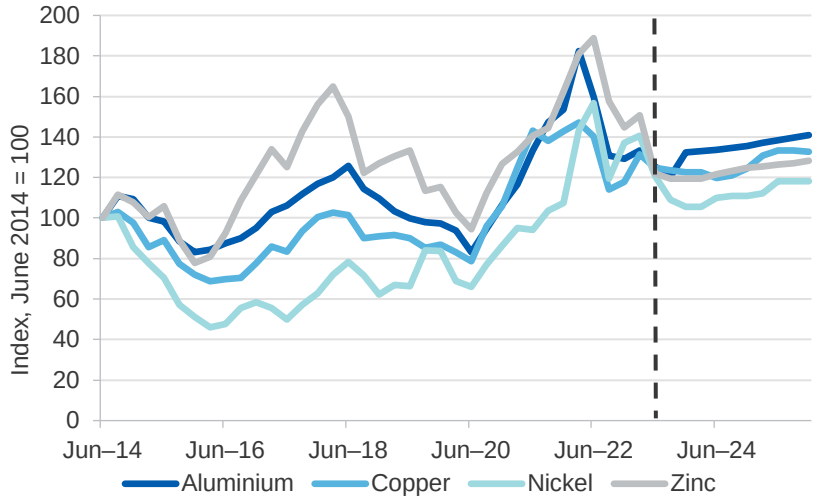
Figure 1.4: Bulk commodity prices



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

Source: Bloomberg (2023); Department of Industry, Science and Resources (2023)

Figure 1.5: Base metal prices



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

Source: Bloomberg (2023); Department of Industry, Science and Resources (2023)

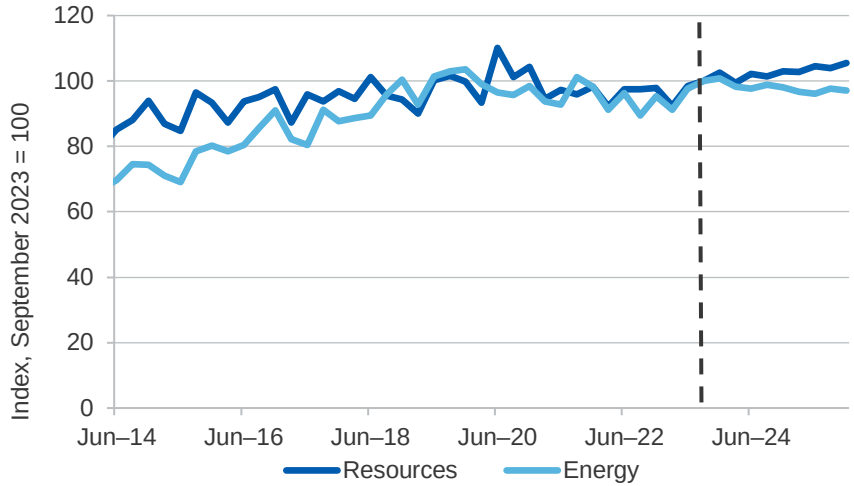
1.5 Export volumes

September quarter export volumes rose

The Resources and Energy Export Volumes Index (preliminary estimate) rose 2% in the September quarter 2023 from the June quarter, to be up 8% on a year ago. Resource commodity volumes rose by 2.5% in the year to the September quarter 2023, while energy export volumes rose by 11.9% (Figure 1.6). Base effects had an impact here: transport and production problems (associated with the weather and COVID) saw energy exports hit a 4-year low in the September quarter 2022.

In volume terms, most resource exports are likely to show significant growth over the outlook period, as the global energy transition accelerates. Energy exports will level out in 2024, as the sharp price falls of the past year temper production and encourage delayed maintenance to occur. There are high odds of an El Niño climate episode starting in the next few months, and the Indian Ocean Dipole recently breached the 0.4 threshold (and hit a 4-year high). Both phenomena dramatically lower the chances of the type of wet weather disruptions that hampered the production and transportation of Australian mining products in the two years before 2023.

Figure 1.6: Resource and energy export volumes



Source: Department of Industry, Science and Resources (2023)

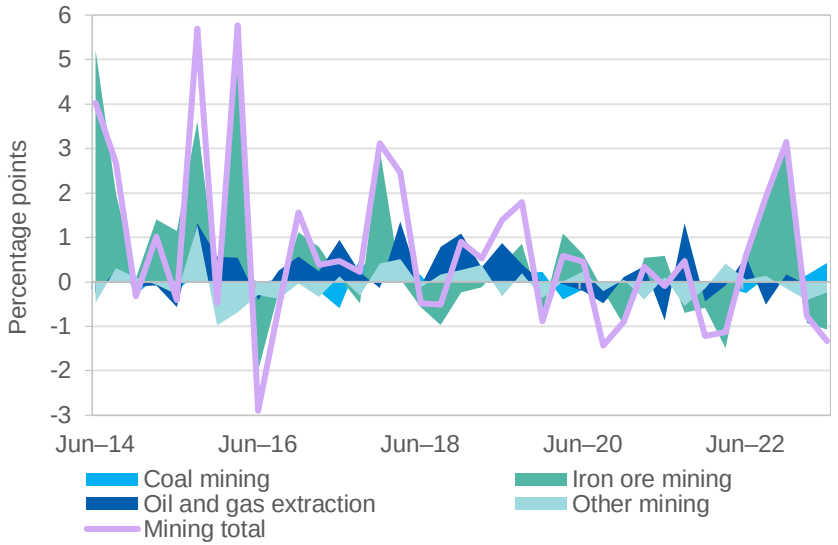
1.6 Contribution to growth and investment

Mining output fell while the overall economy grew modestly

Australia's real GDP rose by 0.4% in the June quarter 2023, to be up 2.1% from a year before. Mining value-added fell by 1.3% in the June quarter but was still 2.9% higher than in June 2022 (Figure 1.7). The quarterly fall was driven by weaker Iron Ore Mining (down by 1.8% due to Cyclone Ilsa) Oil and Gas Extraction (down 1.4% due to maintenance) and Other Mining (down by 2.5%). The falls were partly offset by a rise in Coal Mining (up by 5.8%) as the end of the La Nina episode improved production/transport.

In the coming two years, while the resource sector will likely contribute to real GDP growth, the energy sector's contribution will be modest at best (Figure 1.6). The major production/transport disruptions of the past few years — arising from the COVID-19 pandemic and weather-related issues — now seem well behind us. The output of metals should grow. Coal producers will benefit from modest volume gains and prices that are still high in historical terms. LNG exports are likely to be little changed.

Figure 1.7: Contribution to quarterly growth, by sector



Source: ABS (2023) Australian National Accounts, 5206.0

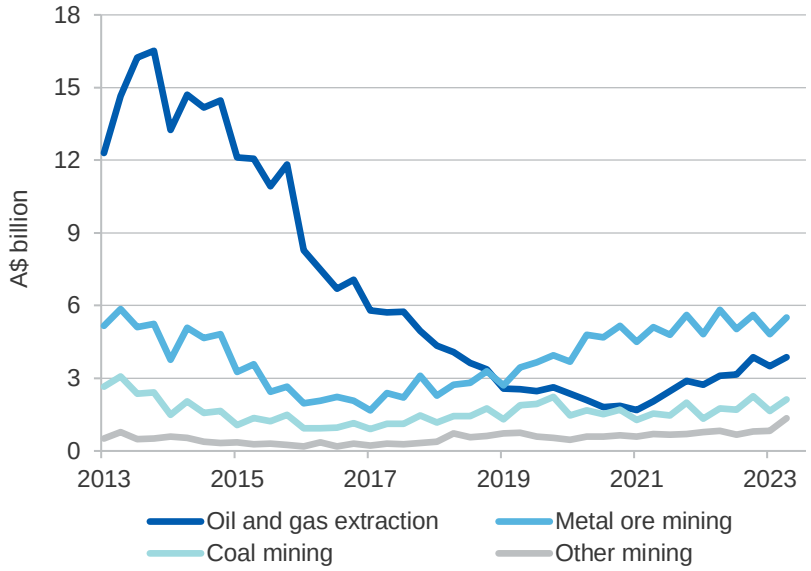
Mining investment is picking up year-on-year

The latest ABS Private New Capital Expenditure and Expected Expenditure survey shows that Australia's resources industry invested $12.8 billion in the June quarter 2023, up 11.9% from the June quarter 2022. In quarterly terms, investment rose across the board, with particularly notable growth in 'other mining', which includes lithium and some other critical minerals (Figure 1.8).

Expenditure for buildings and structures rose by 4% in the June quarter, while investment in equipment, plant and machinery edged back by 1% (Figure 1.9).

Spending on plant and machinery has accounted for a steadily rising share of total investment spending since 2017, but spending on buildings and structures is now growing steadily.

Figure 1.8: Mining capex by commodity, not seasonally adjusted



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

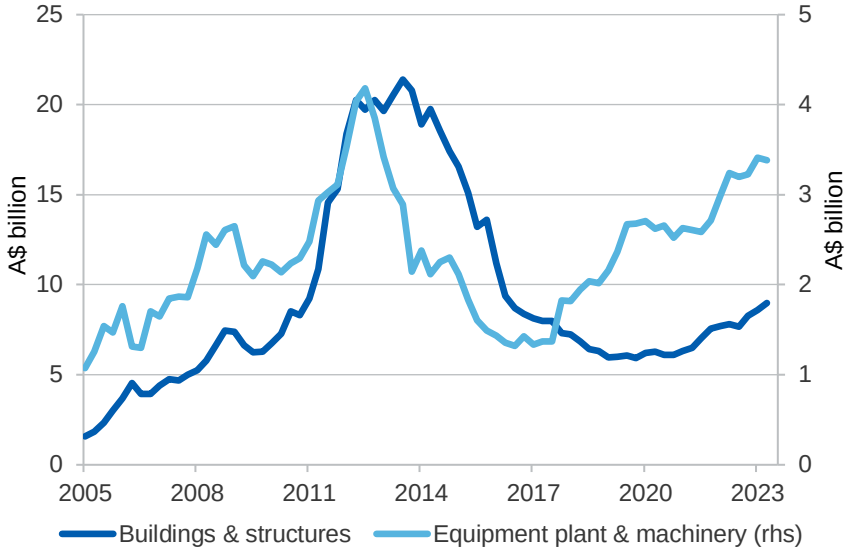
Source: ABS (2023) Private New Capital Expenditure and Expected Expenditure, 5625.0

Forward expectations suggest that total mining industry investment in 2023–24 will be little changed (Figure 1.10). The third estimate for 2023–24 suggests the mining industry will invest $47 billion during the financial year. This is around 10% higher than the second estimate for 2023–24.

The latest data on investment among individual commodities shows 'other mining' (including lithium) is undergoing rapid growth in capital spending, and this may be driving the recent upward revisions to future spending estimates across the mining sector.

Workforce shortages appear to be easing, and inflation in construction costs appears to be coming down. This should assist investment over the outlook period.

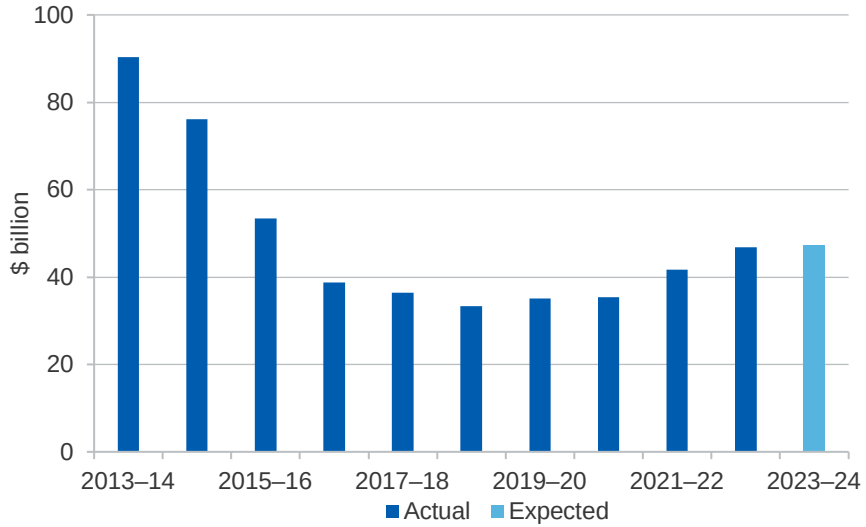
Figure 1.9: Mining industry capital expenditure by type, quarterly



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

Source: ABS (2023) Private New Capital Expenditure and Expected Expenditure, 5625.0

Figure 1.10: Mining industry capital expenditure, fiscal year



Notes: Chart data is in nominal terms

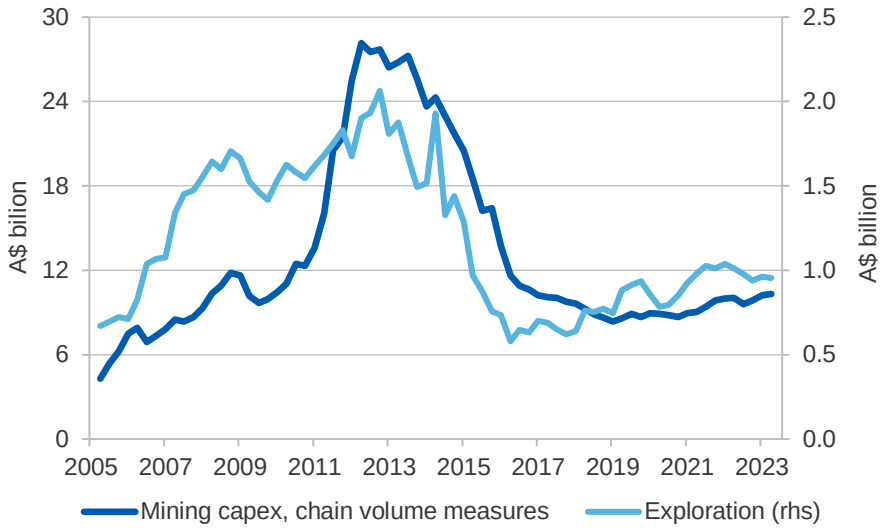
Source: ABS (2023) Private New Capital Expenditure and Expected Expenditure, 5625.0

Exploration expenditure (adjusted for inflation) edged down to $952 million in the June quarter 2023. In trend terms, exploration is rising, encouraged by relatively high commodity prices and the need for minerals vital to the global energy transition (Figure 1.11).

Industries recording significant growth in exploration expenditure include iron ore (up by 31% in the June quarter), copper (up by 30%), gold (up by 14%), nickel (up by 7%), and 'other minerals' (up by 13%), which includes lithium, other base metals and other metals (Figure 1.12).

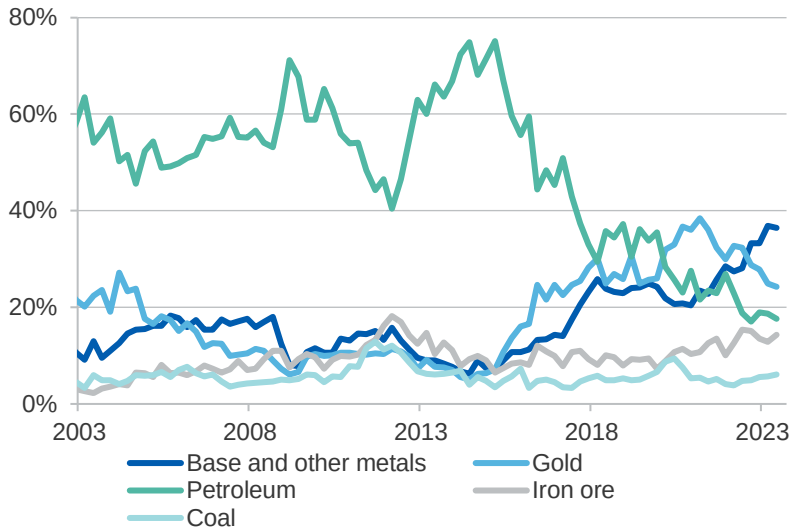
Exploration spending is a leading indicator of broader capital investment, and recent growth suggests interest is rising in base metals and critical minerals following recent strong price outcomes. Given the typical lags involved, we could expect capital spending by resource and energy companies to continue to lift over the next few years.

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



Source: ABS (2023) Private Capital Expenditure Survey, Chain Volume measure, 5625.0

Figure 1.12: Shares of exploration expenditure by commodity type

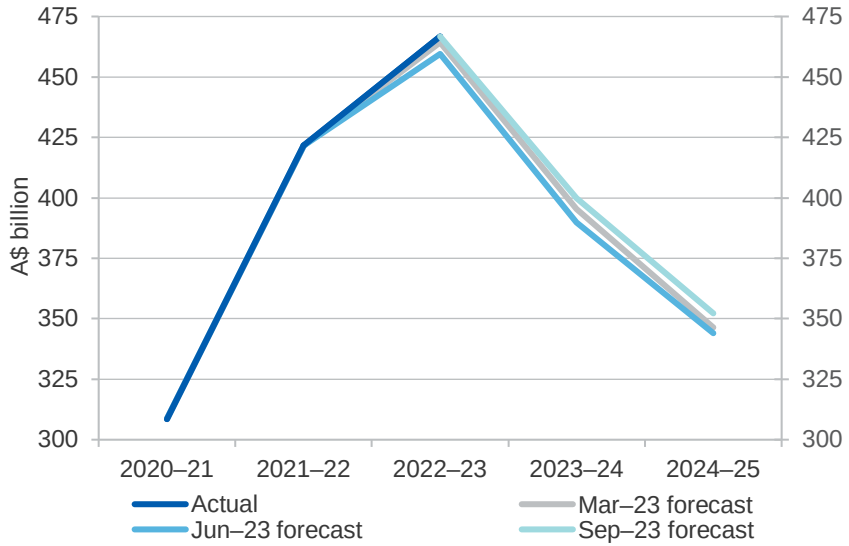


Source: ABS (2023) Private Mineral and Petroleum Exploration, 8412.0

1.7 Revisions to the outlook

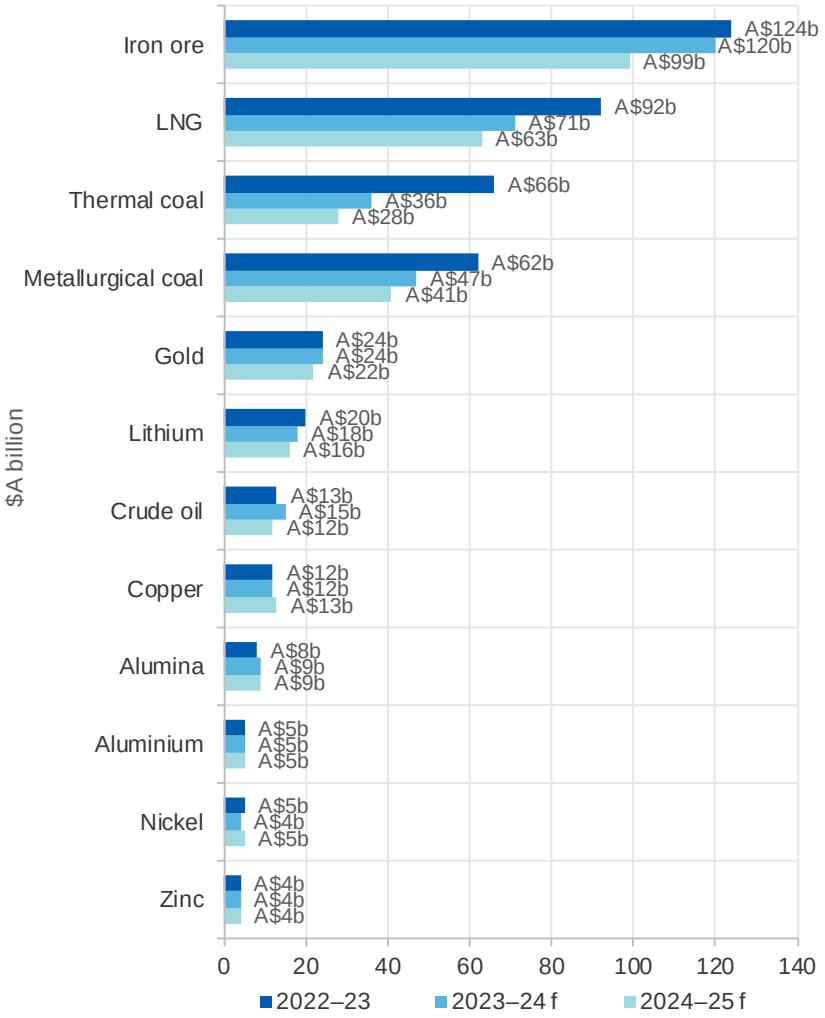
The forecast for Australia's resources and energy exports in 2023–24 is $10 billion higher than the forecast contained in the June 2023 *Resources and Energy Quarterly*. The forecast for 2024–25 (nominal prices) is $8 billion higher than the same report (Figure 1.13). The 2023–24 revisions have largely been driven by a stronger than expected iron ore price and the impact of a weaker than expected exchange rate against the US dollar (AUD/USD).

Figure 1.13: Resource and energy exports, by forecast publication



Source: Department of Industry, Science and Resources (2023)

Figure 1.14: Australia's major resources and energy commodity exports, nominal



Annual per cent change

2023–24 f			2024–25 f		
volume	EUV	value	volume	EUV	value
▲ 3	▼ -6	▼ -3	▲ 1	▼ -19	▼ -17
→ 0	▼ -23	▼ -23	▼ -3	▼ -9	▼ -12
▲ 11	▼ -50	▼ -45	→ 0	▼ -22	▼ -21
▲ 10	▼ -31	▼ -24	→ 0	▼ -13	▼ -13
▲ 16	▼ -15	▼ -1	→ 0	▼ -9	▼ -10
▼ -1	▼ -11	▼ -12	▲ 22	▼ -26	▼ -10
▲ 5	▲ 5	▲ 10	▼ -7	▼ -12	▼ -18
▲ 5	▼ -4	▲ 1	▲ 3	▼ -1	▲ 2
▲ 6	→ 0	▲ 6	▲ 2	▼ -3	▼ -1
▼ -2	▼ -6	▼ -7	→ 0	▼ -2	▼ -2
▲ 8	▼ -20	▼ -14	▲ 11	▼ -4	▲ 6
▲ 4	▼ -19	▼ -16	▲ 5	▼ -1	▲ 3

Notes: f forecast; s estimate. EUV is export unit value.
Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2023)

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

Exports (A$m)	2021–22	2022–23	2023–24[f]	2024–25[f]	2021–22	2022–23	2023–24[f]	2024–25[f]
Resources and energy	421,691	466,737	399,981	352,336	36.7	10.7	–14.3	–11.9
– real[b]	469,739	485,784	399,981	341,210	30.9	3.4	–17.7	–14.7
Energy	204,056	239,023	175,415	150,023	151.2	17.1	–26.6	–14.5
– real[b]	227,306	248,778	175,415	145,286	140.5	9.4	–29.5	–17.2
Resources	217,635	227,713	224,566	202,312	–4.2	4.6	–1.4	–9.9
– real[b]	242,433	237,006	224,566	195,924	–8.3	–2.2	–5.2	–12.8

Notes: **b** In 2023–24 Australian dollars; **f** forecast; **g** growth rate on 2022-23 levels.
Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2023)

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

	Prices				Export volumes				Export values, A$b		
	Unit	2022–23	2023–24[f]	2024–25[f]	Unit	2022–23	2023–24[f]	2024–25[f]	2022–23	2023–24[f]	2024–25[f]
Iron ore	US$/t	95	92	80	Mt	895	920	933	124	120	99
LNG	A$/GJ	21.4	16.6	15.1	Mt	82	81	79	92	71	63
Thermal coal	US$/t	302	144	124	Mt	182	202	203	66	36	28
Metallurgical	US$/t	278	232	213	Mt	157	172	172	62	47	41
Gold	US$/oz	1,831	1,914	1,851	t	228	265	265	24	24	22
Lithium	US$/t	5,174	3,119	2,254	Kt	3,333	3,316	4,031	20	18	16
Crude oil	US$/bbl	87	88	83	Kb/d	282	295	274	13	15	12
Copper	US$/t	8,289	8,284	8,649	Kt	853	899	928	12	12	13
Alumina	US$/t	343	340	350	Kt	16,566	17,494	17,788	8.3	8.8	8.7
Aluminium	US$/t	2,333	2,336	2,453	Kt	1,441	1,418	1,419	5.3	4.9	4.8
Nickel	US$/t	23,911	19,863	20,875	Kt	161	174	192	5.0	4.3	4.5
Zinc	US$/t	2,981	2,488	2,592	Kt	1,247	1,298	1,358	4.3	3.6	3.7
Uranium	US$/lb	51	61	63	t	5,485	5,855	6,060	0.8	1.0	1.0

Notes: **a** Export data covers both crude oil and condensate; **f** forecast; **s** estimate. **Price information:** Iron ore fob (free-on-board) at 62 per cent iron content estimated netback from Western Australia to Qingdao China; Metallurgical coal premium hard coking coal fob East Coast Australia; Thermal coal fob Newcastle 6000 kc (calorific content); LNG fob Australia's export unit values; Gold LBMA PM; Alumina fob Australia; Copper LME cash; Crude oil Brent; Aluminum LME cash; Zinc LME cash; Nickel LME cash; Lithium spodumene ore.
Source: ABS (2023) 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 (2023)

Macroeconomic Outlook

Global GDP and economic change in 2022

Country	China	US	EU	India	ASEAN	Japan	S Korea	Taiwan	**Australia**
Per cent share of global GDP (PPP)	**18**	**16**	**15**	**7**	**5**	**4**	**2**	**1**	**1**
Yearly change	▲ 3.0%	▲ 2.1%	▲ 3.7%	▲ 7.2%	▲ 5.3%	▲ 1.0%	▲ 2.6%	▲ 2.5%	▲ **3.7%**
Share of Australia's two-way trade	30%	6%	9%	4%	10%	12%	7%	4%	–

Global overview

- In 2022, global economic activity increased by **3.4%**. Growth is expected to slow to **3.0%** in 2023 and 2024.
- **Tighter fiscal and monetary conditions** in most major economies are expected to **slow global economic growth** over 2023 and early 2024.

Global risks

The balance of risks facing the macroeconomic outlook has deteriorated slightly through the middle of 2023. The key risks to the outlook are:

- **Tighter monetary policy for longer** if inflation pressures, particularly in services, remain persistent
- Cyclical and structural **slowing of the Chinese economy**

SOURCE: IMF; ABS; OCE

2.1 Summary

- The balance of risks surrounding the global macroeconomic outlook have deteriorated slightly since the June 2023 *Resources and Energy Quarterly*. While the core outlook for global growth has improved, there is a mounting risk China's growth could be weaker-than-expected.
- Continued tight fiscal and monetary conditions in most major economies are expected to further slow global growth over H2 2023 and into 2024.
- Slowing growth in the Chinese economy is due to a combination of cyclical and structural factors. *Box 2.1* explores three key structural challenges to China's growth outlook.

2.2 World economic outlook

Tighter fiscal and monetary conditions weighing on global growth

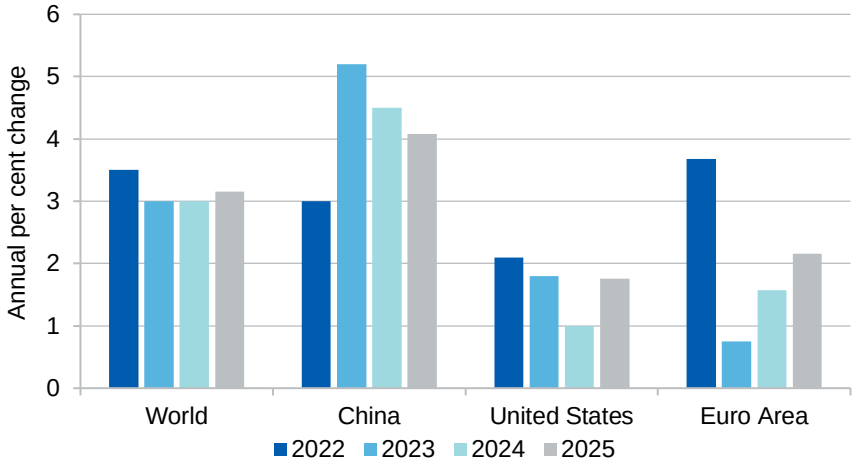
The International Monetary Fund (IMF) forecasts the world economy to grow by 3.0% in both 2023 and 2024, then rising to 3.2% in 2025 (Figure 2.1). Compared to the April 2023 World Economic Outlook, this represents an upward revision of 0.2 percentage points for 2023 but no change for 2024 and 2025.

The IMF continues to expect a notable divergence to emerge over the next two years between the performance of advanced and emerging economies. After recording growth below the global average in 2022 — for the first time in over 40 years — the IMF expects China's economy to grow by over 5% this year. However, the US and European economies are expected to slow in 2023, under the weight of tighter monetary policy.

Whilst global growth forecasts have been revised upward due to stronger than expected consumption growth over the June quarter 2023 in most advanced economies, additional downside risks to the global outlook have emerged in recent months. Headline inflation has continued to moderate in most economies this year — due to lower energy and food prices — but there has not been a sufficient decline in core inflation.

Despite still-tight labour markets, reduced consumption in advanced economies — due to inflation and tighter monetary policy — is driving

Figure 2.1: GDP growth forecasts



Source: IMF (2023)

expectations for slower global growth over the remainder of the year.

Weaker consumer demand for goods relative to services in the US and Europe will also weigh on the economic growth of manufacturing exporters — including China, Japan and Korea.

The IMF notes that tighter monetary policy is a key risk to the outlook if inflation pressures, particularly in services, prove more persistent than expected. This could lead to the emergence of further financial sector vulnerabilities, tightening global financial conditions. Additional sources of global economic vulnerability include possible escalations in the Ukraine war, geopolitical fragmentation and increasing trade restrictions.

An additional risk the IMF has emphasised is the potential for China's economic recovery to disappoint if the contractions of its property sector and consumer demand continue. China's recent economic data releases have been weaker than was expected earlier this year with near-zero inflation, weak investment and construction activity related to its property sector. Longer-term, structural challenges to China's growth outlook are discussed in *Box 2.1*, while shorter-term, cyclical drivers of China's growth are discussed in the *Major trading partners' economic outlook* section.

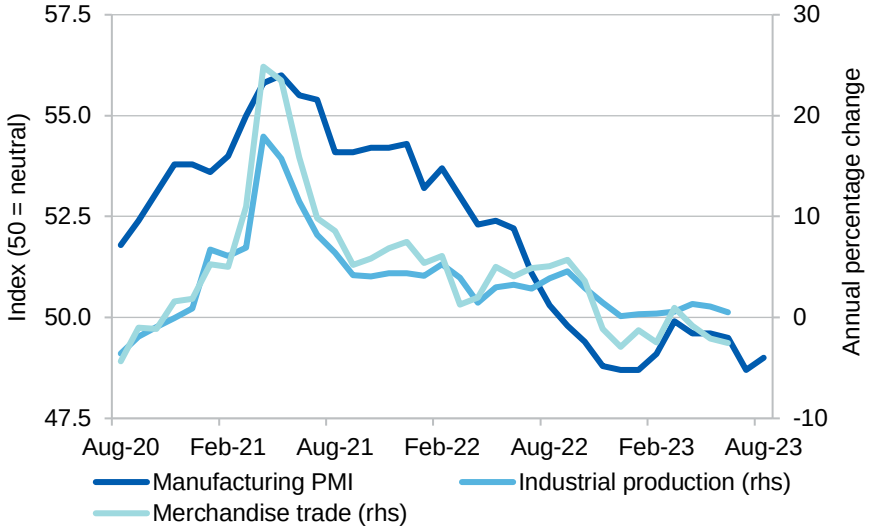
Global industrial production and trade weaken as orders drop

Global industrial production (IP) declined over the June quarter 2023, but was 1.0% higher year-on-year. Quarter-on-quarter declines were driven by the slowing of China's economic rebound and the continued contraction in Europe's industrial sector. World IP growth remained positive year-on-year due to increasing US industrial output and base effects — given COVID-related declines for China in June quarter 2022.

Global merchandise trade volumes declined in the June quarter 2023 to be 1.8% lower year-on-year (Figure 2.2). Weaker demand for goods in advanced economies, especially electronic equipment, has driven exports from Japan, South Korea and emerging Asia lower year-on-year.

Forward indicators of manufacturing activity indicate a contraction so far in 2023. The JP Morgan Global Manufacturing Purchasing Managers Index (PMI) was 49 in August 2023, and has remained in contractionary territory (less than 50) since September 2022.

Figure 2.2: World industrial production, trade and PMI



Notes: PMI data is up to August 2023; IP and trade data only available to June 2023.

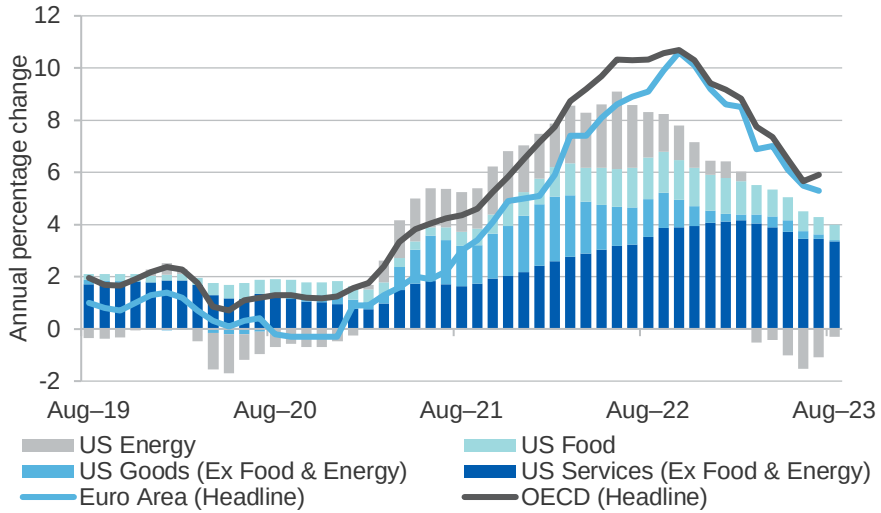
Source: IHS Markit (2023); CPB Netherlands Bureau for Economic Policy Analysis (2023)

Global manufacturing activity has declined through the middle of 2023 due to weakening activity in Asia and a sharp downturn in the European manufacturing sector. Global manufacturing orders declined in August, signalling a further deterioration in the demand for goods — linked to pressures from inflation and monetary policy — as well as a post-pandemic preference for services consumption.

As headline inflation pressures ease, the focus shifts to core inflation

While headline inflation measures have continued to decline, persistent core inflation remains a concern for the pace of further declines, with inflation still well above most central bank targets. US inflation, for example, measured 3.6% in August 2023, after declining to a 2-year low of 3.0% in June 2023 (Figure 2.3). US core inflation — which excludes food and energy — has been slower to decline as housing and consumer service inflation were above 6% until June 2023. Eurozone inflation, while still high, has declined notably from its peak in October 2022, due largely to falling energy prices this year.

Figure 2.3: Consumer Price Indices — US, Europe and OECD



Source: Bloomberg (2023); Board of Governors of the Federal Reserve System (2023); U.S. Bureau of Economic Analysis (2023); OECD (2023)

On the other hand, Eurozone core inflation in August was only 0.4% below its peak of 5.7% in March 2023.

In July 2023, the IMF forecast global inflation would fall from 8.7% in 2022 to 6.8% in 2023 and 5.2% in 2024. Compared to the April 2023 outlook, the forecast for 2023 was revised down by 0.2 percentage points, largely based on low inflation in China. The forecast for 2024 was revised up by 0.3 of a percentage point due to higher-than-expected core inflation.

Global clean energy investment driving additional commodity demand

According to the IEA, global investment in clean energy is expected to reach US$1.74 trillion in 2023, bringing total energy investment in 2023 to US$2.8 trillion. Annual clean energy investment has risen by 53% from 5 years ago, when investment in clean energy and fossil fuels was roughly equal. Recent growth in clean energy investment has been dominated by advanced economies and China, collectively accounting for 90% of the growth since 2021.

This growth in clean energy investment has increased demand for many non-ferrous and critical minerals, of which Australia has abundant resources. As a result, non-ferrous and critical minerals accounted for the largest share (43%) of Australian mineral and petroleum exploration expenditure in 2022–23. Ongoing investment into clean electrification, transmission and energy storage will continue to underpin additional demand for Australian non-ferrous metals and critical minerals over the medium- and long-term.

2.3 Major trading partners' economic outlook

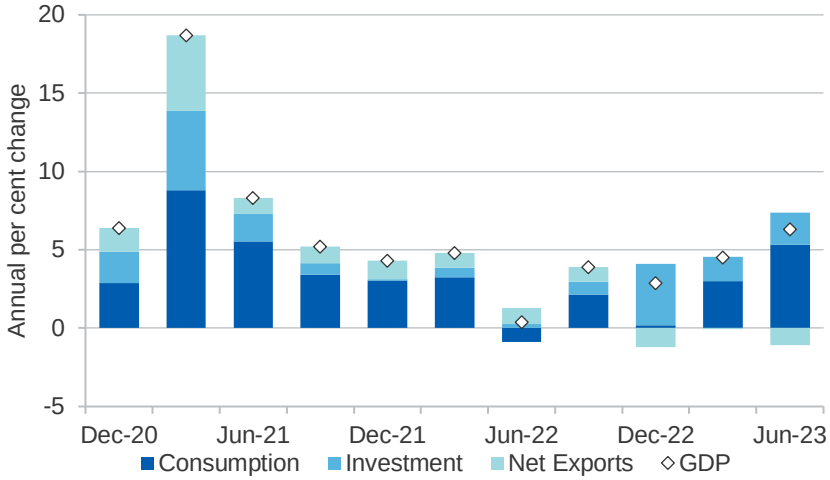
The outlook for Australia's major trading partners remains weak, with their GDP growth in 2023 forecast by the RBA in August to be around 3.25%, well below its pre-pandemic decade average and lower than the May 2023 forecast. Slower growth in Australia's major trading partners is expected to reduce demand for Australia's exports. With that said, the IMF expects a recovery in China's economy and ongoing development in India to contribute about half of global economic growth this year. Growth from these key markets should support growth in their trade partners' economies, underpinning Australian resource and energy export earnings over the outlook period.

Weakening balance of risks facing China's growth outlook

China's economy grew by 0.8% in the June quarter 2023, with GDP 6.3% higher year-on-year (Figure 2.4). Fixed asset investment in infrastructure and manufacturing was a key driver of China's economic growth in this period. GDP was affected by weakness in the property sector and softening global demand for manufactured goods, with exports falling for the fourth straight month by 8.8% year-on-year in August. The strong rebound in consumption demand — following the relaxation of COVID-related restrictions — has faded since the March quarter 2023, raising concerns over China's growth expectations for the rest of the year.

To date in the September quarter 2023, key indicators of economic growth have remained subdued, though an uptick in latest figures suggest China's slowing growth may be stabilising under government stimulus measures. Retail sales grew by 4.6% year-on-year in August, accelerating from 2.5%

Figure 2.4: China contributions to quarterly real GDP



Notes: Consumption is made up of both household and government sectors.
Source: Bloomberg (2023); National Bureau of Statistics of China (2023)

growth in July, but remained below historical consumption levels. China's growth in industrial production rose from 3.7% in July to 4.5% in August, the strongest rate since April 2023. The Caixin General Manufacturing Purchasing Managers' Index (PMI) rose to 50.1 in August, signalling the sector's return to expansion after a slump in July. Output growth increased but continued to be offset by a decline in new export orders. Business sentiment, while positive, fell to an 11-month low amid concerns over weak domestic and foreign market conditions.

The official manufacturing PMI, which is more orientated to large businesses, indicated a fifth consecutive month of contraction, with a moderating decline in sales. Notably, the official PMI reading for the services sector fell from 51.5 to 50.5, its lowest rate since China's economic reopening. The construction index rose to 53.8 in August, following four months of decline, suggesting increased infrastructure spending by local governments.

Despite positive signs in the March quarter 2023, the recovery of China's property sector has taken a deepening downturn in recent months. Year-to-date growth in property investment declined to 8.8% year-on-year in August 2023. Floor space of newly started residential property declined by 25% year-on-year in August 2023, while residential property sales year-to-date fell by 1.5% year-on-year. Financial stability concerns have heightened as Evergrande — formerly China's second largest and now heavily indebted property developer — has filed for bankruptcy and the country's largest developer Country Garden may be at risk of default on its bond payments. Adding to this, consumer credit growth has remained subdued, posing a downside risk to near-term improvements in the sector.

Following efforts to support the economy throughout 2022 and in the March quarter 2023 (see March 2023 *Resources and Energy Quarterly*), Chinese authorities have further loosened monetary policy to support the announced 2023 GDP growth target of 5%. In addition to loan rate cuts, the People's Bank of China (PBoC) introduced lower minimum mortgage rates and down payment requirements in August. In September, the PBoC reduced reserve requirement ratios for the second time in 2023.

The IMF forecasts Chinese GDP growth of 5.2% in 2023, reflecting improved mobility compared with COVID-related disruptions in 2022. It is anticipated that growth will be powered by continued infrastructure investment and further supportive fiscal and monetary policy measures. The IMF forecasts growth to decline to 4.5% in 2024 and 4.1% in 2025, in line with a long-term trend towards structurally lower growth.

Japan and South Korea facing weaker external demand

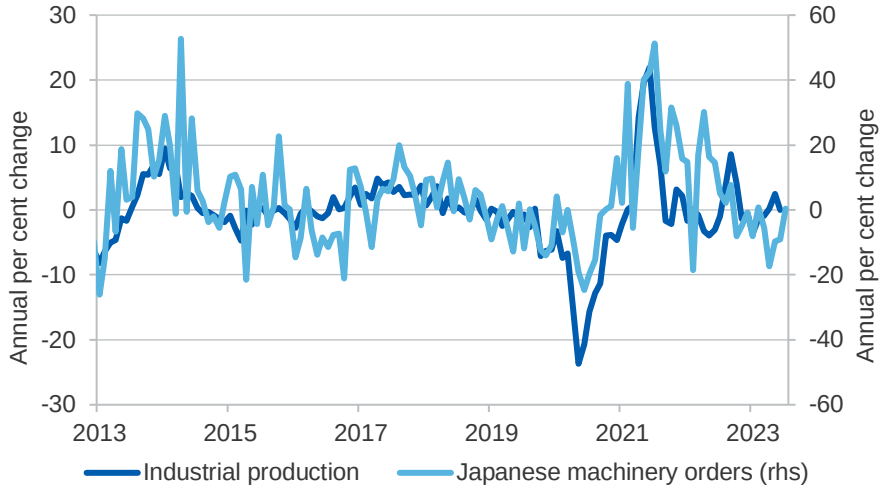
Japan's GDP increased by 1.5% in the June quarter 2023, resulting in 2.1% growth year-on-year. Net exports were the key driver of the strong quarterly growth result, with exports increasing by 3.2% while imports declined for a third consecutive quarter. Private consumption declined by 0.5% quarter-on-quarter due to cost pressures on consumers — for example, food inflation averaged 8.5% over the June quarter 2023. Gross fixed capital formation increased by 3.2% year-on-year, due mostly to strong growth in September quarter 2022 and March quarter 2023.

Slowing growth in Japan's major trading partners is a key issue for its economy, particularly its industrial sector. Japanese industrial production tracked flat year-on-year in June 2023, recovering from 6 months of annual declines that ended in April. Machinery orders have, on average, decreased at an annual rate of 7.0% since October 2022 (Figure 2.5).

The Jibun Bank Japanese Manufacturing PMI was unchanged at 49.6 in August, marking 7 months of contraction so far in 2023. The contraction in manufacturing activity was driven by declines in new orders and output, amid cooling demand both domestically and internationally. Business sentiment remained high as surveyed firms expect demand conditions to improve as COVID- and inflation-related impacts subside. However, confidence levels have fallen since the June quarter 2023.

Japan's core inflation — which excludes fresh food but includes fuel costs — was 3.1% in July 2023, still exceeding the Bank of Japan (BoJ) inflation target of 2%, but down markedly from 4.2% in January.

Figure 2.5: Japan industrial production and machinery orders



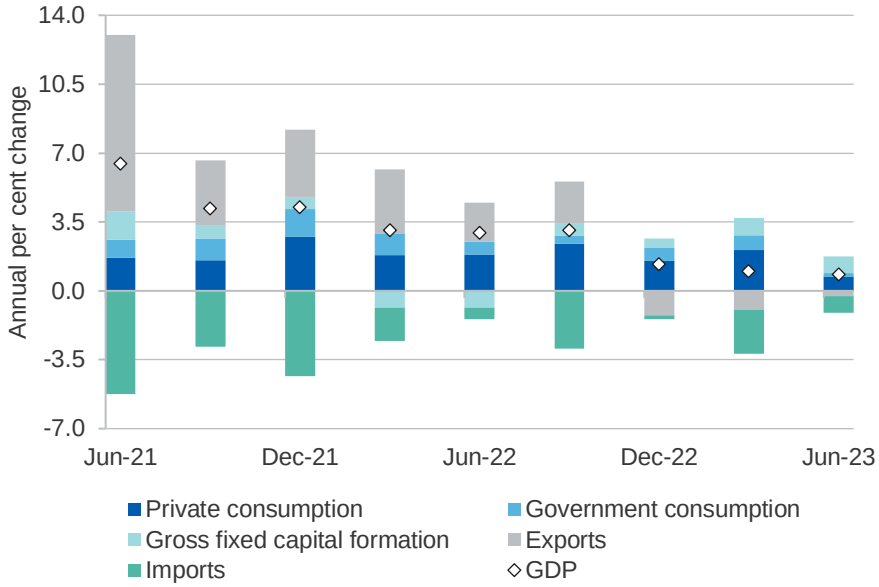
Source: Bloomberg (2023)

The BoJ has maintained its accommodative monetary policy and continues to target the 10-year Japanese Government Bond yield at 0%, now with an allowance for yields to exceed 0.5% before intervening.

Looking ahead, the IMF forecasts Japan's economic growth to rise to 1.4% in 2023, on the back of pent-up demand and supportive fiscal and monetary policy. As the effects of past stimulus efforts fade, Japan's economic growth is expected to slow to 1.0% in 2024, before slowing further to 0.6% in 2025.

South Korea's GDP grew by 0.8% year-on-year in the June quarter 2023, the lowest annual growth rate since December quarter 2020. Annual growth was supported by positive contributions from private consumption and gross fixed capital formation. Net exports were a key dampener on growth, with weaker exports and stronger imports driving a 16% year-on-year decline in the country's trade balance (Figure 2.6).

Figure 2.6: South Korea contributions to quarterly real GDP



Source: Bloomberg (2023)

South Korea's industrial production declined in the month of June 2023 to be 5.6% lower year-on-year. While output of semiconductors rose by 3.6% over the month, production of automobiles and oil refining both fell by over 10%. Exports of semiconductors declined by over 33% year-on-year in July, due to declining global demand. South Korea's manufacturing PMI declined in August to remain in contraction territory for a 14th consecutive month. The negative August result was due to declines in output and new orders, due to weak domestic and global demand. Positive signs emerged for business sentiment as employment growth was stable and the year-ahead production outlook improved to its best in over a year.

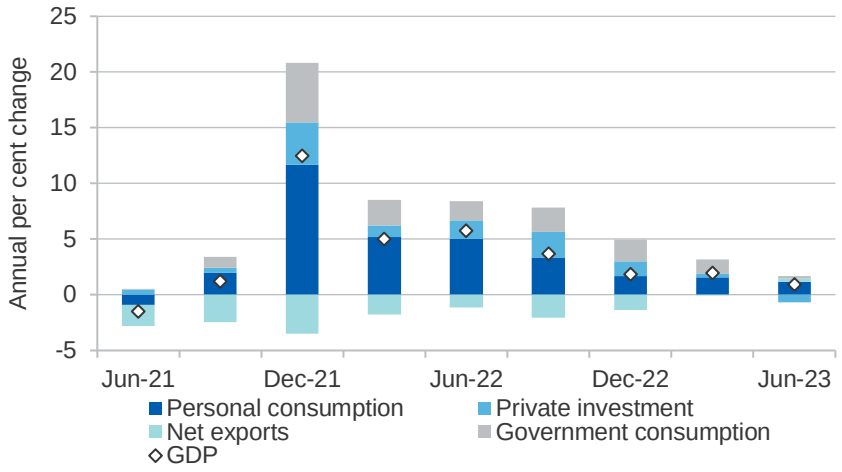
In July, the IMF forecast South Korean economic growth of 1.4% in 2023 — a slight downward revision from April — and 2.4% in 2024. In April, the IMF noted that the downturn in the technology cycle is expected to erode the nation's growth momentum in the short-term.

Resilient US labour market and strong investment supporting growth

In year-on-year terms, the US economy grew by 0.9% in the June quarter 2023, driven strongly by 0.6% quarter-on-quarter growth. This growth was driven by personal consumption of goods and services, though goods consumption growth has eased in 2023. Net exports contributed positively to US GDP growth, as exports rose by more than imports (Figure 2.7).

A notable source of recent growth has been private non-residential investment, which rose by 4.6% year-on-year in the June quarter 2023. Annualised US private investment in manufacturing structures rose by 69% year-on-year in the June quarter 2023, driven by sharp growth in computers, electronics and electrical manufacturing. Major policies such as the US Inflation Reduction Act (IRA) and the CHIPS & Science Act have provided strong incentives for investment into clean energy and semiconductor manufacturing within the US. Macquarie Research reported about US$269 billion of private sector investment plans relating to clean energy — namely EVs and batteries — have been announced since the US IRA was enacted. Another US$231 billion of manufacturing investment in semiconductor/electronics production was associated to the CHIPS Act.

Figure 2.7: US contributions to quarterly real GDP



Source: Bloomberg (2023)

US industrial production declined by 0.2% year-on-year in July 2023, with a sizeable 1.0% month-on-month increase offset by weaker growth previously. The US Manufacturing PMI remained in contractionary territory at 47.6 in August, bringing the contraction in the US manufacturing sector to a 10th consecutive month. The continued deterioration in manufacturers' operating conditions reflects sharp falls in new orders as both domestic and external demand weaken.

US labour market resilience continues, with the unemployment rate remaining low at 3.8% in August 2023. However, employment growth appears to have slowed in recent months, with nonfarm payroll employment rising by 187,000 in August 2023, below the average monthly increase of around 257,000 over the past 12 months.

The resilient US labour market continues to support spending, with retail trade showing improved growth through the middle of 2023. Total inflation-adjusted spending on goods and services increased month-on-month in June 2023, to be 2.3% higher year-on-year. Advance indicators for inflation-adjusted retail sales in July suggest retail trade also increased over the month to be flat when compared year-on-year. Strength in the retail trade outlook has supported the ongoing narrative for the US economy to avoid recession.

In July 2023, the IMF upgraded its forecast for US economic growth in 2023 by 0.2 percentage points to 1.8% on account of resilient consumption and ongoing labour market tightness. The resolution of US debt ceiling talks and easing concerns over banking sector turmoil, have improved the balance of risks facing the US economy. Growth is still forecast to ease to 1.0% in 2024, with tightening monetary and financial conditions expected to slow private consumption — reducing labour market tightness and moderating wage growth.

Eurozone economies face slower growth, manufacturing downturn

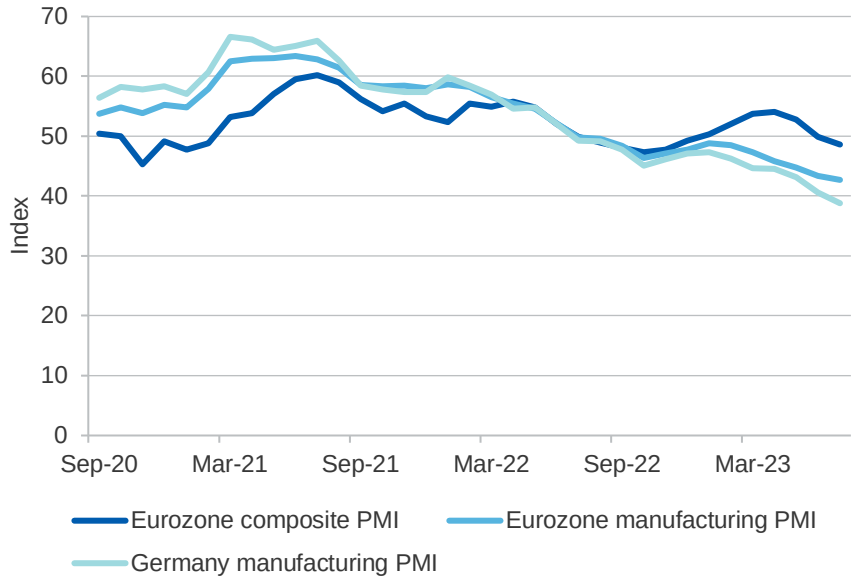
Eurozone GDP growth was 0.3% over the June quarter 2023, after zero growth in the March quarter 2023. This brought GDP growth to 0.6% year-on-year, its weakest since the 2020–21 recession. Among the larger economies, Spain grew by 0.4% over the quarter, while France grew by

0.5%. Italy's economy unexpectedly contracted by 0.3% over the quarter, while Germany's economy did not grow — bringing its annual GDP growth to -0.2%.

In August 2023, the Eurozone Composite PMI Index decreased to 46.7, signifying the worst slump in private sector activity since November 2020 (Figure 2.8). The third consecutive month of decline reflected a further deterioration in manufacturing conditions and the contraction of the services sector for the first time in 2023.

Industrial production in the Eurozone declined by 2.2% year-on-year in July 2023. Declining durable and capital goods production month-on-month offset continued increases in energy production. Industrial production in major producer Germany was down by 0.8% month-on-month.

Figure 2.8: Eurozone composite and manufacturing PMIs



Source: Bloomberg (2023)

The Eurozone manufacturing PMI recorded a reading of 43.5 in August, with declines in output, new orders, employment and purchasing activity. Within this, Germany's manufacturing sector continued its deepest contraction since May 2020 with a PMI reading of 39.1 in August. This reflected a deterioration in demand conditions, with output and demand facing their sharpest contractions since the Global Financial Crisis (excluding pandemic- and lockdown-affected months). Declining input prices and weak demand led to a third month of discounting final products and the strongest decline in output prices in almost 14 years.

In its July update, the IMF forecast Euro Area growth to be slightly higher than previously expected: at 0.9% in 2023 and 1.5% in 2024. In line with current economic conditions, growth in services- and tourism-driven economies (such as Italy and Spain) was revised up, while the weak outlook for manufacturing resulted in a downgrade to growth in Germany (now -0.3% in 2023).

India's GDP growth to be relatively resilient

India's GDP growth increased to 7.8% year-on-year in the June quarter 2023, up from 6.1% in the March quarter. This annual growth figure was in line market expectations and was driven by strong growth in consumption expenditure and fixed capital formation.

India's manufacturing PMI continued to be strongly expansionary in August 2023 at 58.6. Accelerated growth was reported in both output and new orders, with manufacturers citing strong demand conditions. Surveyed firms broadly expected demand to remain elevated over the next year, citing increasing new order commitments in the coming months.

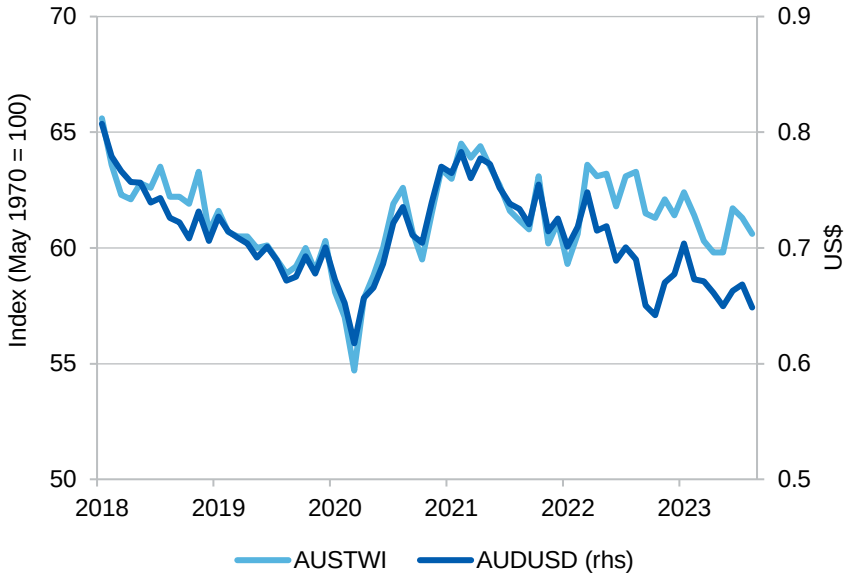
The IMF forecasts India's economic growth to slow to 6.1% in 2023, revised up from 5.9% in April, due to stronger-than-expected domestic investment. Growth is down from 7.2% in 2022 as domestic demand is pressured by tighter monetary policy. Growth is expected to pick up to 6.3% in 2024. From 2024 onwards, household spending is expected to pick up as pressures from inflation and monetary policy ease.

Exchange rate assumption revised lower

Over the past quarter, the Australian dollar has fallen slightly relative to the US dollar but held constant on trade-weighted terms (Figure 2.9).

The AUD/USD exchange rate assumption has been revised lower by US$0.02 in 2023 and US$0.03 in 2024 compared with the June 2023 *Resources and Energy Quarterly*, in line with changes in market consensus (surveyed by Bloomberg) on the outlook for the exchange rate. The median consensus on 27 August 2023 for the AUD/USD exchange rate was an average of US$0.67 during the second half of 2023, US$0.70 in 2024 and US$0.74 in 2025.

Figure 2.9: Australian trade-weighted index and AUD/USD



Source: Bloomberg (2023)

Box 2.1: Structural challenges to Chinese growth

In their 2022 Article IV Consultation report on China, the IMF forecast China's GDP growth to decrease below 4% over the medium-term due to weakening factors on both supply and demand in the economy (IMF, 2023a). Demographic headwinds have been compounded by declining productivity growth and business dynamism, resource misallocation through continued high investment in sectors with declining productivity, and foreign export markets close to reaching saturation.

China was the largest export market for Australian's resources and energy exports in 2021-–22, accounting for more than 35% of export earnings, and it is also one of the largest consumers of energy and metals globally. As such, Chinese demand has a strong influence on commodity prices, so a weaker outlook for Chinese outlook implies weaker Australian's export earnings over the long term.

This box highlights 3 key structural drivers of declining growth potential for China's economy: (1) slowing demographics, urbanisation and residential property sales, (2) a shift in growth towards domestic consumption and services, (3) declining returns on investment and lower foreign investment.

China' property market faces falling population and oversupply

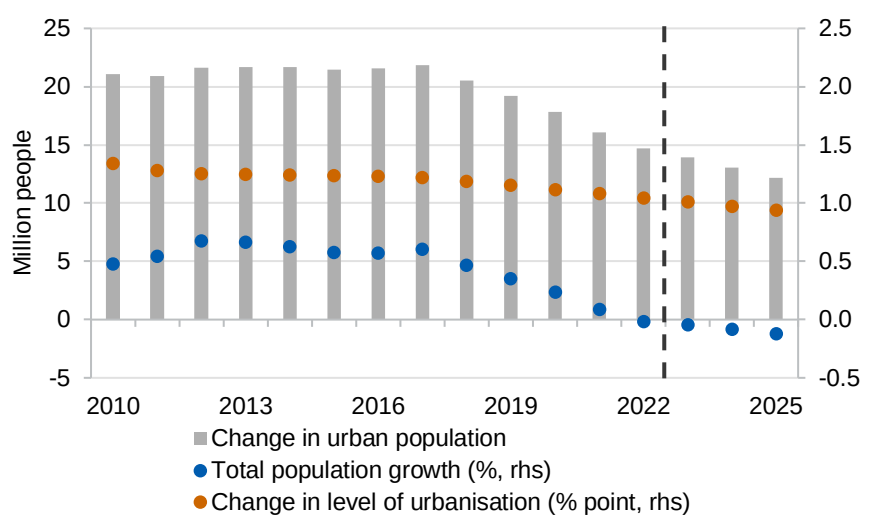
China's residential property sector is facing a substantial mismatch in supply and demand, driven by falling population, overinvestment, and a financing model past its time. This fundamental mismatch in supply and demand suggests the collapse in residential construction activity since 2020 reflects a structural rather than cyclical decline, noting that the decline was initially triggered by the introduction of the "three red lines" policy in 2020 under the principle of "housing is for living in, not for speculation". This reduction in activity will weaken China's commodity demand, as its residential construction sector is a major end user of commodities such as steel and non-ferrous metals.

The slowdown in China's residential construction sector has triggered a broader slowdown in other parts of the economy. China's investment in residential buildings was about 10% of its GDP in 2020 and the real estate

sector has been estimated through input-output modelling, including construction, equipment, furnishing and real estate services, contributed up to 29% of China's final demand in 2016 (Rogoff and Yang, 2021).

The property boom in China in the first two decades of the 21st century was underpinned by a growing population and large-scale urban migration. Between 2002 and 2018, the growth in China's urban population was stable at 20-22 million people each year (Figure 2.11). However, an apparent slowing in the rate of rural migration to cities, as well as a slowdown in fertility rates to 1.1 births per woman in 2022, has slowed overall urban population growth. In 2022, China's urban population only increased by 15 million and the outlook suggests urban population growth will fall to 12 million by 2025.

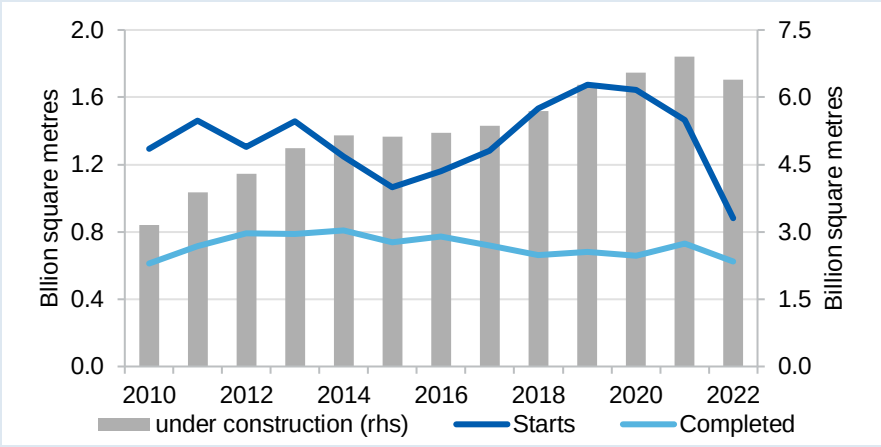
Figure 2.11: China urban population growth



Notes: The outlook for China's population growth is adopted from the International Monetary Fund's World Economic Outlook (April 2023), while the outlook for China's change in level of urbanisation is produced by the Department of Industry, Sciences and Resources.

Chinese residential property investment ramped up even as urban population growth began to fall from 2017. Chinese households demonstrated a strong preference for investing in domestic property, as other Chinese assets historically had poor returns and tight capital controls restrict investing abroad (Glaeser et al., 2017). In 2017, housing wealth made up 78% of all Chinese assets, compared to 35% in the United States (Rogoff and Yang, 2021). Much of this investment is funded by a pre-payment model, where properties are sold off the plan and paid in full by mortgage prior to completion. This resulted in a significant oversupply of new dwellings. Between 2010 and 2020, on average there were 1.4 billion square metres of residential construction starts each year, while only 0.7 billion square metres of residential construction was reportedly completed. As a result, over the 12-year period, the floor space of buildings under construction has doubled (Figure 2.12) while urban population growth fell by a third.

Figure 2.12: China residential construction by floor space



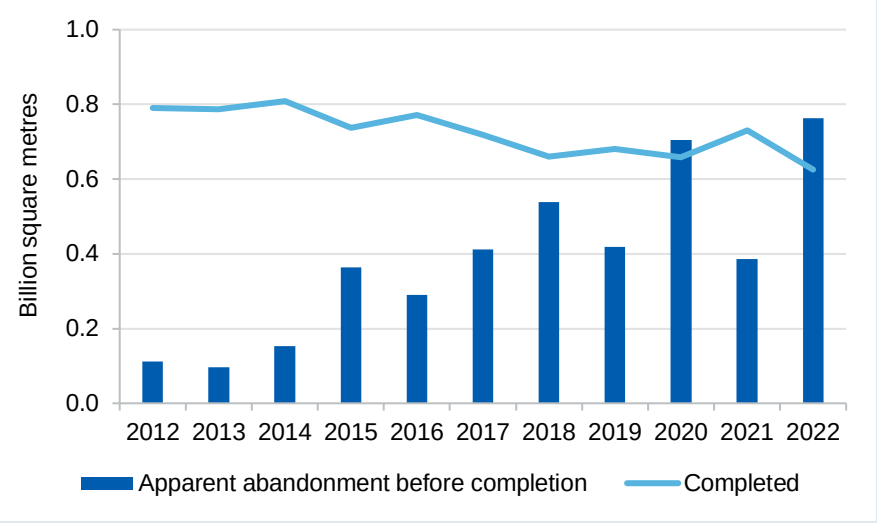
Source: National Bureau of Statistics of China (2011-2023)

The supply-demand imbalance is acute in small- to medium-sized 'tier 3' cities, which exclude cities given privileged administrative status as classified by Rogoff and Yang (2023). Rogoff and Yang further estimated that residential construction in tier 3 cities accounted for 80% of the national total in 2020, and that housing stock in tier 3 cities rose from 32 to 43 billion square metres between 2011 and 2020. Population growth in tier 3 cities averaged -0.1% over the same period, driven in part by accelerating population outflows.

When the Chinese property developer Evergrande defaulted on debt obligations in 2021, house price declines in tier 3 cities were particularly large. Rogoff and Yang (2023) estimates that from February 2021 to June 2022, house prices in tier 3 cities fell by almost 20%, while prices in tier 1 and 2 cities rose slightly, although it should be noted that prices are often subject to regulation. Confidence in the sector fell, resulting in slowing sales which triggered a liquidity crunch, as pre-sales made up the largest source of financing for Chinese real estate developers between 2016 and 2020 (Kemp et al., 2020). This resulted in a wave of defaults amongst other builders and left work on many existing, often already paid for, projects to cease.

Apparent floor space abandonment before completion exceeded floor space completed in 2020 and 2022, underlining the extent of China's property market downturn, although the magnitude may be partly due to statistical discrepancies between the different measures (Figure 2.13).

Figure 2.13: Apparent abandonment vs completion, residential



Notes: Apparent abandonment before completion of residential floor space is estimated by subtracting the change in floor space under construction from the difference between floor space started and completed for each year.

Source: National Bureau of Statistics of China (2011-2023)

China's transition from real estate and manufacturing-led growth

A second structural trend is the slow decrease in the share of exports in the Chinese economy over time. China's integration into the global economy is largely bedded down, and the export-driven, high growth era of the Chinese economy has largely run its course. This occurred despite relatively low per-capita income in China, but foreign markets are reaching saturation, with China's share in global manufacturing exports reaching 17% by 2016 (Deb et al., 2019). Growth is increasingly driven by domestic consumption, and China's industries are relying less on exports, with exports of goods and services as a percent of GDP falling from 36% in 2006 to 21% by 2022. New opportunities to export manufactured goods to foreign markets may diminish given global concerns around national security and government policies focused on de-risking supply chains.

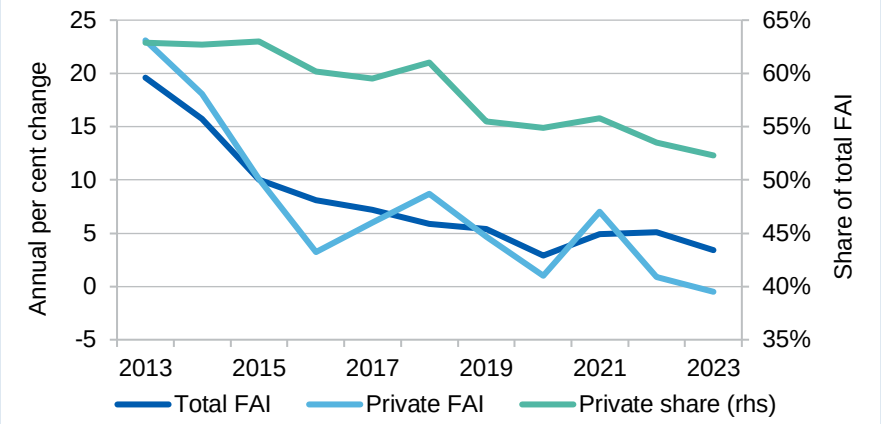
Services may not be able to replace manufacturing and real-estate led growth in China. A large services sector in middle income countries has been observed to lead to lower rates of economic growth (Bulman et al., 2014), and the services sector is less tradeable across borders. A domestically focused Chinese manufacturing industry has shown some ability to remain dynamic and innovative, but recent evidence remains mixed. A notable example is recent success and technical advances in electric vehicle production, largely driven by strong domestic demand and government support. But as the size of the manufacturing sector diminishes, so does its ability to drive a high level of economic growth. China's services sector has contributed more to GDP growth than its manufacturing sector since 2011. Capital investment in real estate and infrastructure has also driven growth, but the bulk of productive investment in the space - particularly in real estate – is likely to be already complete.

Declining returns to investment and lower foreign investment

The third trend of note is a decline in Chinese productivity growth, related to falling investment including foreign direct investment. China's investment — measured by gross fixed capital formation — peaked at just below 47% of GDP in 2011. Growth in fixed asset investment (FAI), has been declining since that peak: from around 20% in 2013 to 3.4% in

2023 year-to-date (Figure 2.14). This has coincided with declining private sector investment and a rising share of FAI from state-owned enterprises (SOE). As SOE's have been less productive than private companies, declining private sector investment means decreasing capital productivity (IMF, 2023a). A further consequence of declining private sector activity has been declining business dynamism, also linked to lower productivity.

Figure 2.14: Fixed asset investment (FAI) in China



Notes: 2023 data is for January-July 2023.

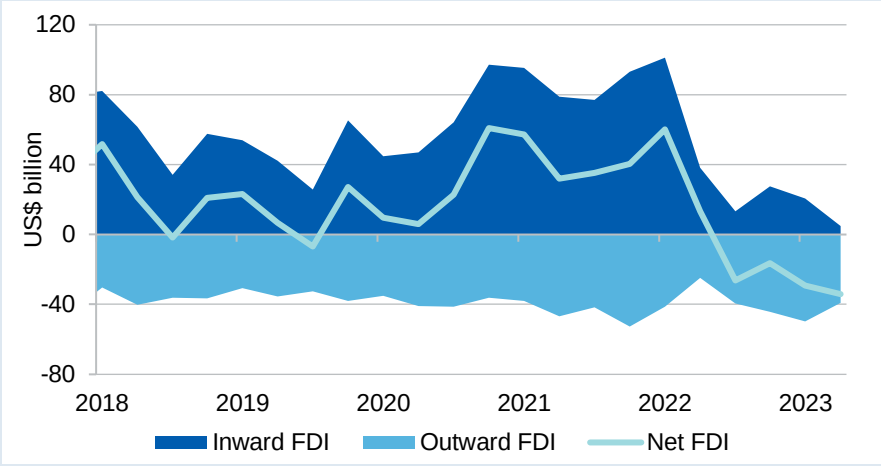
Source: Bloomberg (2023); National Bureau of Statistics of China (2023)

Foreign direct investment (FDI) into China — which has traditionally been considered a key channel of technology transfer — also fell substantially between 2015 to 2022: by around 60% in selected strategic sectors (IMF, 2023b). This has intensified since mid-2022; FDI flows into China fell by 82% year-on-year in H1 2023 to be US$25.4 billion (Figure 2.15). Recent declines in FDI align with weakening investment sentiment in Asia, driven by factors such as rising interest rates, slowing global growth — especially in Asia's export markets — and greater economic uncertainty.

Political factors may also work to lower FDI into China, including the widespread desire to diversify supply chains. Analysis by Exante Data indicates recent declines have largely been the result of multinational companies repatriating their Chinese earnings, rather than reinvesting their earnings within China.

This could be indicative of fundamental shifts in investment or risk sentiment, rising interest rates, or changing business conditions in China. 'Greenfield' investment has also declined, but to a lesser extent — year-to-date utilised foreign capital fell 9.8% year-on-year in July 2023. Supporting this analysis, some surveys suggest investment sentiment for US and European businesses operating in China has declined notably over the past year (AmCham 2023, EU Chamber of Commerce in China 2023).

Figure 2.15: Quarterly FDI flows into and out of China



Source: CEIC (2023); OECD (2023)

If foreign direct investment into China continues to fall or remain low, structurally lower foreign investment will lead to lower economic growth and productivity going forward. The IMF has assessed that fragmentation of global FDI arising from geopolitical blocs could result in greater declines in vertical (knowledge intensive) FDI flows globally, with permanent losses of around 2% to Chinese GDP (IMF, 2023b).

Noting softer foreign direct investment flows recently, China's State Council in August issued 24 guidelines to optimise foreign investment. These guidelines intend to increase protection of intellectual property rights of foreign investors and encourage R&D activity within the country. An increasingly complicated external environment could affect China's access to foreign investment and technical expertise going forward.

2.4 References for Box 2.1

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Table 2.1: IMF annual GDP growth projections for major trading partners

	2022	2023[a]	2024[a]	2025[a]
World [b]	3.5	3.0	3.0	3.2
China [c]	3.0	5.2	4.5	4.1
Japan	1.0	1.4	1.0	0.6
South Korea	2.6	1.4	2.4	2.3
India[d]	7.2	6.1	6.3	6.2
ASEAN-5[e]	5.3	4.9	5.3	5.2
Eurozone	3.7	0.8	1.6	2.2
United States	2.1	1.8	1.0	1.8

Notes: **a** Assumption. **b** Calculated by the IMF using purchasing power parity (PPP) weights for nominal country gross domestic product. **c** Excludes Hong Kong. **d** Based on fiscal years, starting in April; **e** Indonesia, Malaysia, Philippines, Thailand and Vietnam.
Sources: IMF (2023) World Economic Outlook; Bloomberg (2023)

Table 2.2: Exchange rate and inflation assumptions

	2022	2023[a]	2024[a]	2025[a]
AUD/USD exchange rate	0.69	0.67	0.70	0.74
Inflation rate[b]				
United States	8.0	4.4	2.8	2.1
	2021–22	**2022–23[a]**	**2023–24[a]**	**2024–25[a]**
Australia	4.4	7.0	4.1	3.3

Notes: **a** Assumption; **b** Average CPI growth over the specified year (fiscal or calendar).
Sources: ABS (2023) Consumer Price Index, 6401.0; Bloomberg (2023); Department of Industry, Science and Resources; RBA (2023); IMF (2023)

Steel

Australia's steel sector

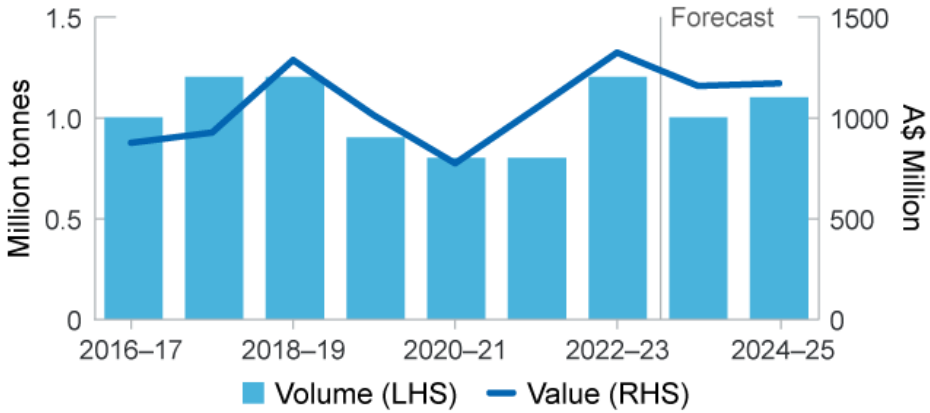
5m+ tonnes
produced each year

100,000+
employed in the steel industry

Significant
export markets
- China
- Japan
- South Korea
- Taiwan
- India

Refinery locations

Australian steel exports



Outlook

Global steel production facing **weaker second half** of 2023

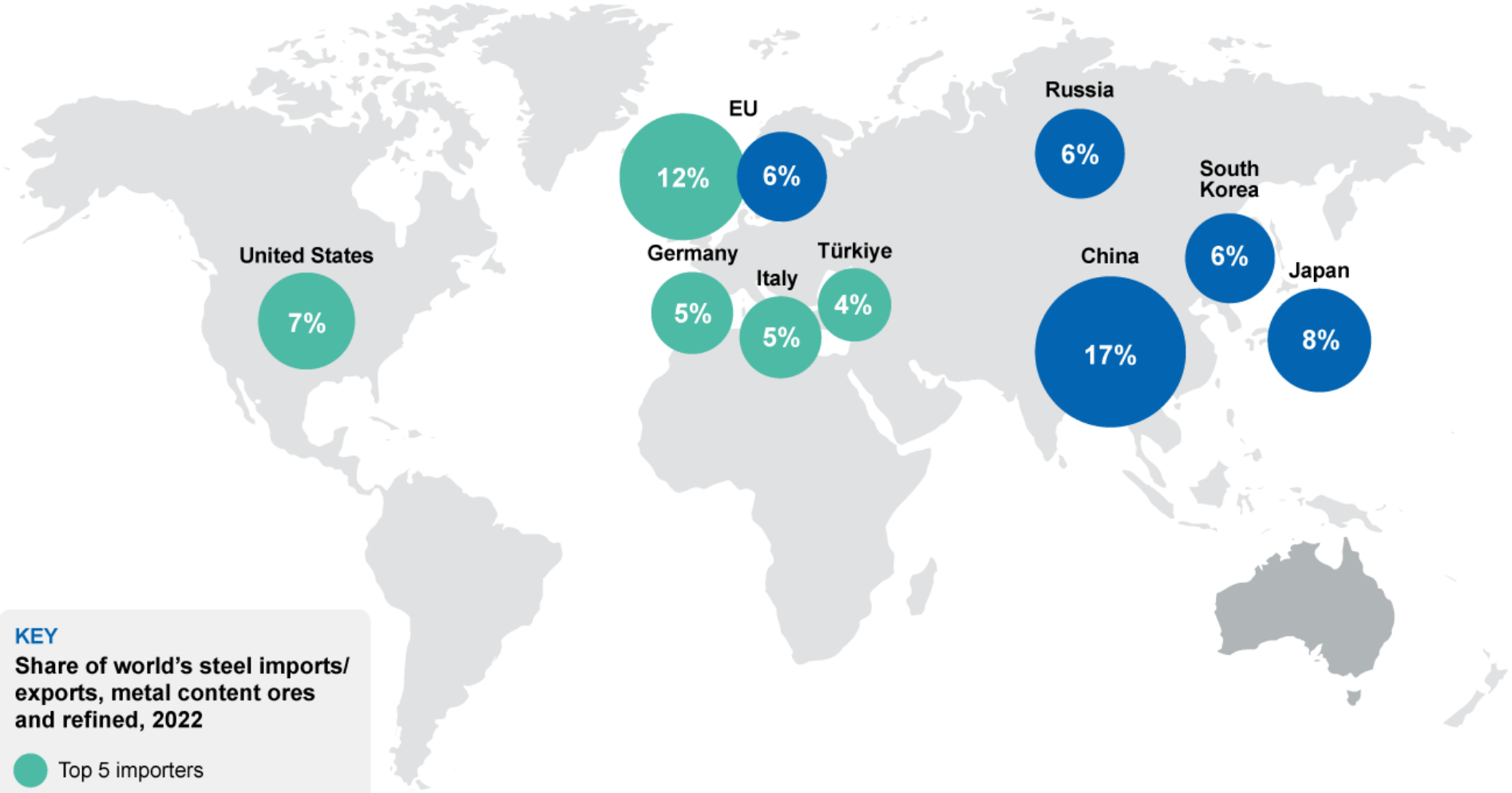
China's **property sector weakness** continues

Australian export values expected to **fall by 12%** in 2023-24

Russian invasion of Ukraine continuing to **restrict global steel supply**

SOURCE: GA; DISR; OCE

Steel TRADE MAP



SOURCES: World Steel Association

3.1 Summary

- Global steel demand has continued to slow, driven by China's ongoing property sector weakness, as well as lower demand from European manufacturing and construction.
- Global steel producers are expected to face subdued demand and moderating prices over the rest of 2023. Weak residential construction and falling industrial output in advanced nations is likely to be only partly offset by growth in infrastructure and non-residential construction activity.
- Many steel producers have already cut back production and global production is expected to remain relatively subdued through 2023 and into 2024. Steel production growth is expected to be strongest in countries/regions such as India, South-East Asia and the Middle East.

3.2 World production and consumption

Global steel production facing weaker second half of 2023

Global steel production in H1 2023 was around 950 million tonnes. While this was at the upper end of the global (2017 to 2021) range, it was slightly below the corresponding period in 2022 (Figure 3.1).

World steel production is expected to record year-on-year growth of 1.2% in 2023. This predominantly reflects the comparatively weak global steel production that occurred in the second half of 2022, which reduced full year growth substantially.

Chinese steel production in the second half of 2022 was heavily affected by outbreaks of the COVID-19 pandemic and ongoing weakness in the nation's residential property sector. Higher energy prices (resulting from Russia's invasion of Ukraine) also forced output cuts amongst large steel makers — such as the EU, US, and Japan (Figure 3.2).

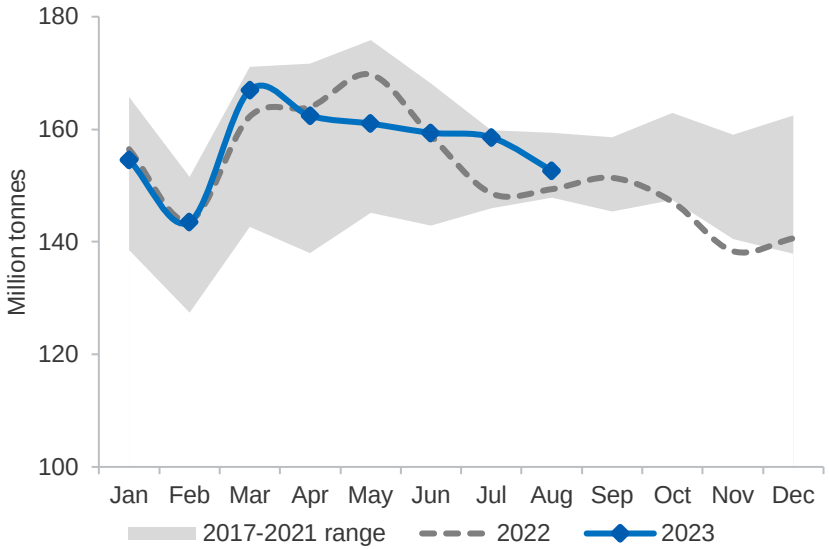
Subdued demand resulting from monetary policy tightenings by major central banks over the past year — in response to rising/high inflation — is expected to continue to adversely impact economic growth, and consequently demand for steel, across most major economies over the rest of 2023.

An expected stabilisation and gradual pickup in growth in global industrial production over the rest of the outlook period, particularly in late-2024, and 2025, combined with further stimulus-related infrastructure projects is expected to support stronger growth in steel demand. World steel production is projected to grow by 1.7% in 2024 and 1.4% in 2025, to reach just under 2 billion tonnes by the end of the outlook period.

Over the next couple of years, growth in world steel production will be supported by substantial growth in new capacity — either underway or planned — with projects in the pipeline in Asia, North America, Europe and the Middle East.

Blast Furnace-Basic Oxygen Furnace steelmaking (favouring iron ore and metallurgical coal as inputs) is expected to make up around 58% of new global supply, and more than 85% of new capacity built in Asia over the next few years.

Figure 3.1: Global monthly steel production

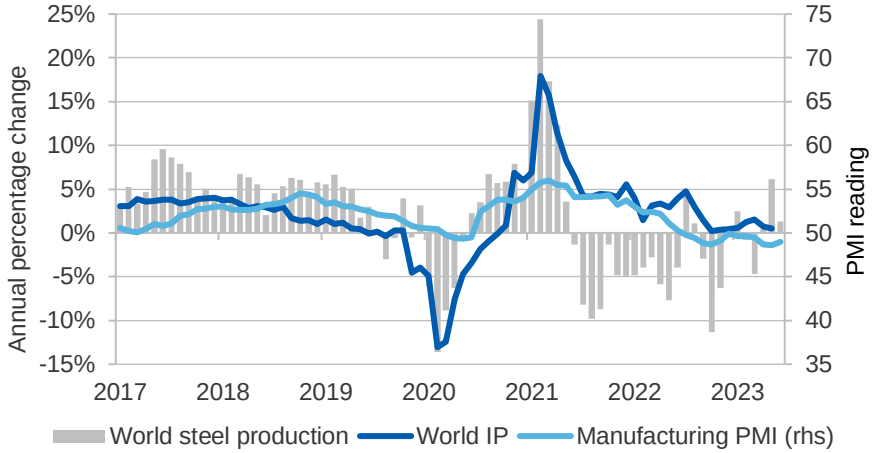


Source: World Steel Association (2023); DISR (2023)

Weak global industrial production in 2023 to weigh on steel demand

Growth in global industrial production — a key driver of steel consumption — is expected to remain weak for the remainder of 2023 as world economic growth slows. Global industrial production growth was 0.5% in July year-on-year, down from over 3% last year (Figure 3.2). This will likely further dampen the recovery in global steel demand in 2023. Global steel consumption is projected to grow by 0.5% in 2023, following a fall of 2.6% last year.

Figure 3.2: World manufacturing PMI, IP and steel 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 (2023); S&P Global (2023); Bloomberg (2023)

Risks continue to be skewed to the downside. Contractionary monetary policy across most major economies remains a key challenge, particularly through its impact on private sector spending and residential investment. Elevated energy prices continue to adversely impact steel demand and remain a key risk.

Global construction activity — representing about 50% of world steel demand — continues to register modest growth. The Global Construction Activity Index posted its third successive quarter of growth in the June quarter. With higher interest rates dampening private sector residential activity, global construction continues to be driven primarily by infrastructure. The Middle East and African regions registered the strongest conditions, while activity deteriorated in a number of European countries. Results for the Asia Pacific region were mixed. India recorded its strongest construction outlook in 5 years. Finally, global credit conditions have continued to deteriorate, pointing to a further tightening in coming months in the lending environment for new construction projects.

After sharp improvements in early 2023, global manufacturing activity has since weakened, with the JP Morgan Global Manufacturing PMI reading at 49.0 in August. This was the 12th successive month in which conditions have been in contractionary territory.

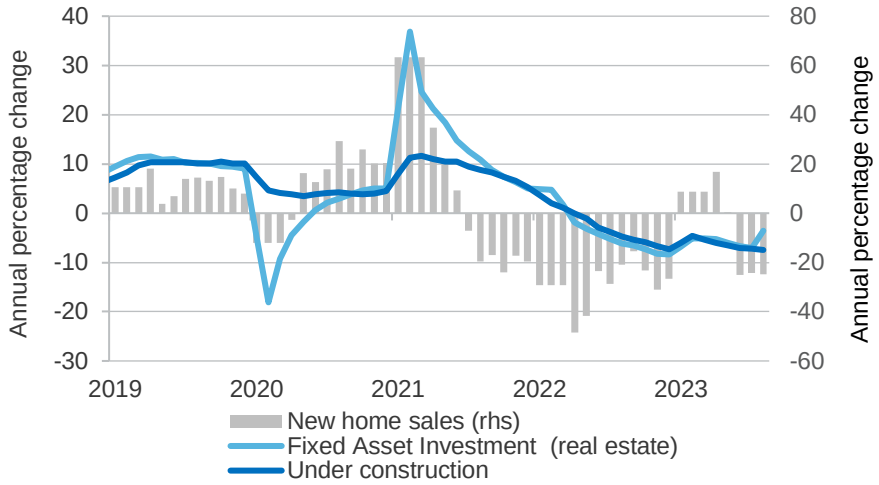
A further recovery is expected in the global auto industry over the rest of 2023 and in 2024, despite ongoing challenges from supply chain disruptions and slowing global growth. S&P Global Mobility forecasts a 4.0% increase (year-on-year) in units produced in 2023 driven by 2 years of pent-up-demand. However, a return to pre-pandemic production levels is not expected until 2025 at the earliest. Recent improvements in availability notwithstanding, semi-conductor shortages are expected to remain a challenge over the next few years. Weaker global auto demand remains a key risk over the next year.

China's property sector weakness continues

Despite some promising signs in the March quarter 2023, the expected stabilisation and turnaround of China's now multi-year property sector decline has not eventuated (Figure 3.3). As a result, demand for steel in China has been weak, reducing Chinese steel mills' profit margins. China's total steel output in the June quarter was below 2022 levels after strong output growth in the March quarter (Figure 3.4).

However, other sources of demand have been supporting the Chinese steel sector. These include strong growth in steel exports as well as machinery manufacturing, automobile output, and white goods such as fridges and washing machines for export. Chinese infrastructure investment is also contributing — particularly investment in Chinese railways, which is up 25% year-on-year in the 7 months to July 2023.

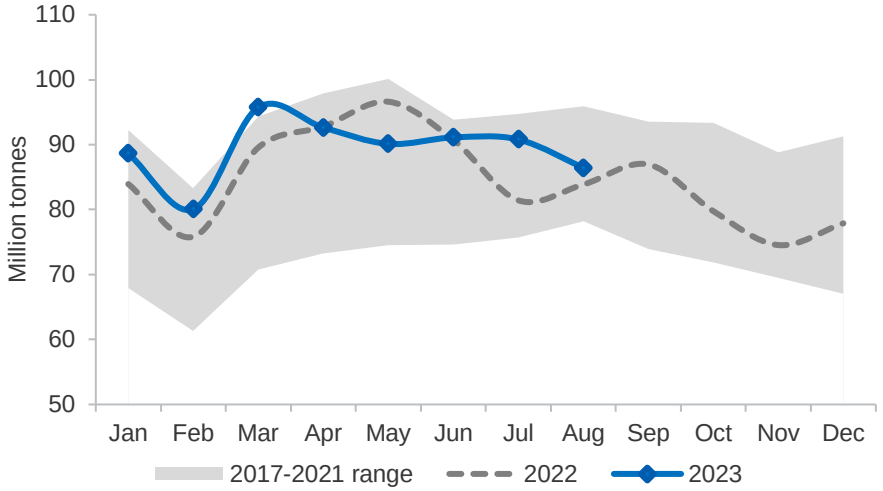
Figure 3.3: China's residential property sector pipeline



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

Source: NBS (2023); Bloomberg (2023)

Figure 3.4: China monthly steel production



Source: World Steel Association (2023); Department of Industry, Science and Resources (2023)

Overall, China's steel production in 2023 is expected to be around 1.4% higher than in 2022. This follows the sharp falls in Chinese steel consumption last year due to China's dynamic zero-COVID policy — which substantially curbed industrial activity and domestic travel. The recovery in Chinese steel consumption seen in the June quarter has also lost momentum in recent months. China's steel consumption in the 8 months to August 2023 was 580 million tonnes, up 0.7% from the corresponding period in 2022 (Figure 3.5).

An uncertainty surrounding the rate of China's steel output growth in 2023 is whether, and to what extent, the Chinese Government chooses to cap steel production levels over the rest of 2023. Given the relatively strong start to the year, if production caps were to be set at 2022 levels, this would imply sharp falls in production for the last quarter of 2023. A more moderate production cap would see China's 2023 steel output reach levels above the weak 2022 result, but likely below the strong production levels achieved in 2021.

Turning to the rest of the outlook period to 2025, China is projected to see a mild fall in steel production, with annual falls of 0.6% projected in 2024 and 2025. While China has nominated 2030 as its target date for peak steel (output), the peak is expected to be achieved before that — as structural factors temper steel demand (see *Iron Ore* chapter).

Infrastructure spending is expected to provide some support to China's economy in H2 2023. As much as RMB4.76 trillion (US$680 billion) in local government special purpose bonds — primarily used for infrastructure spending — were issued in 2022. Chinese authorities have also instructed the various policy banks (

to

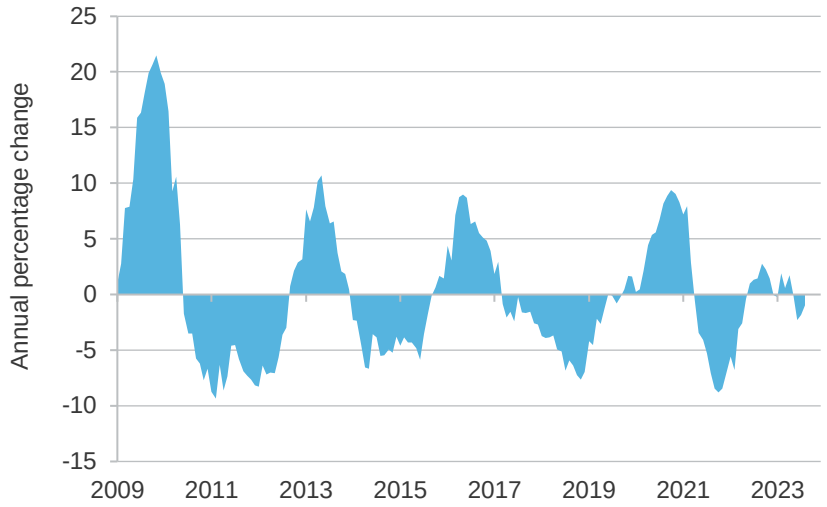
increase lending for infrastructure projects.

As discussed in the *Macroeconomic outlook* chapter, Chinese monetary policy has eased to support demand. While the lags involved in some of the policy changes should help underpin Chinese commodity usage in 2024, there is yet to be a meaningful pick up of credit growth in the broader economy.

Figure 3.5: China's monthly steel consumption

Notes: Annual percentage change based on cumulative steel consumption April to March each calendar year.
Source: Bloomberg (2023); NBS (2023)

Figure 3.6: China credit impulse



Source: NBS (2023); Bloomberg (2023)

Bloomberg's China's Credit Impulse (measuring new loans compared with broader GDP) returned to negative territory in the June quarter after tentative signs of a recovery in late 2022 and early 2023 (Figure 3.6).

Russian invasion of Ukraine continuing to restrict global steel supply

In the first half of 2023, Ukraine's steel production was 2.8 million tonnes. This represented a fall of around 38% (1.7 million tonnes) from the same period last year, and a fall of 74% (8 million tonnes) compared to the comparable period in 2021 (prior to the Russian invasion). The ongoing war is delaying the process of rebuilding and economic recovery. Russia's control of the Black Sea over the past year and strikes on improvised supply chain networks, continue to restrict the export capability of major Ukrainian steel producers. Any recovery in ferrous metal exports is expected to be partial and will be played out over several years.

Russian steel output is also down, but by much less than Ukraine. Russian output was up 3.9% in the year to August 2023 compared to the comparable period in 2022 (Figure 3.10), but remains about 2% below pre–invasion levels.

The war's impact, including the broader sanctions, has posed a range of challenges for the Russian economy. Russia is diverting more exports of iron ore and steel toward Asia and away from Europe due to EU sanctions. Russian iron ore and steel exports to China and India rose sharply in 2022. Russian industrial production fell consistently for the first 12 months following the invasion, with March 2023 marking the first positive growth (year-on-year) since February 2022. Russia's June quarter industrial production rose 6.3% year-on-year.

Ex-China steelmaking cut back in response to weaker demand

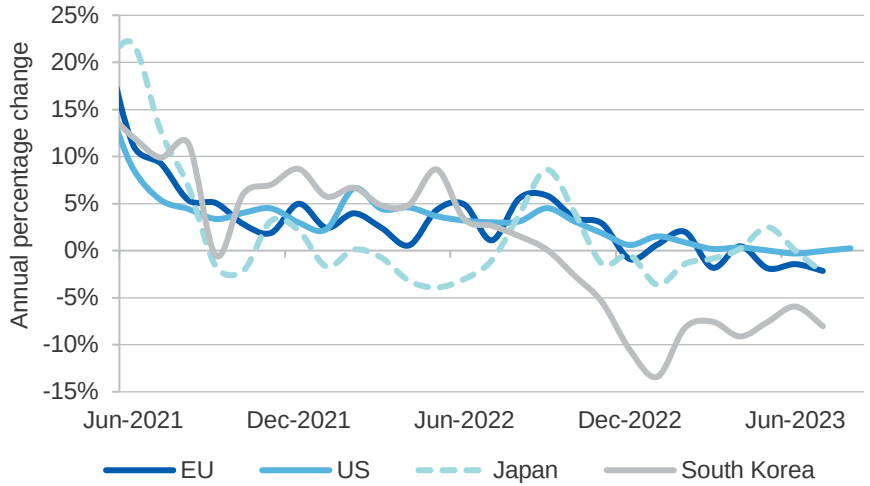
Moderating global demand as economic growth slows, as well as higher energy and input costs, continue to impact manufacturing activity across many major economies. Industrial production has been particularly weak in the EU, Japan and South Korea during 2023 (Figure 3.7).

The softening in global steel demand seen in the June quarter has moderated slightly in some markets in recent months, with a slight pickup

in steel prices in China and a stabilisation in southern European markets in July, particularly flat steel products such as hot-rolled coil (HRC) (Figure 3.8).

US prices for HRC have continued to ease in recent months following the strong rebound in late 2022 and early-2023 — down to US$810 a tonne in August. US reinforcing bar ('rebar') prices have remained at high levels so far in 2023, supported by infrastructure and non-residential commercial construction. This has opened up a substantial price differential with other markets. Rebar prices have continued to ease in other major markets, including China and southern Europe, but they remain above pre-pandemic levels (Figure 3.9).

Figure 3.7: Industrial production — EU, US, Japan and S Korea

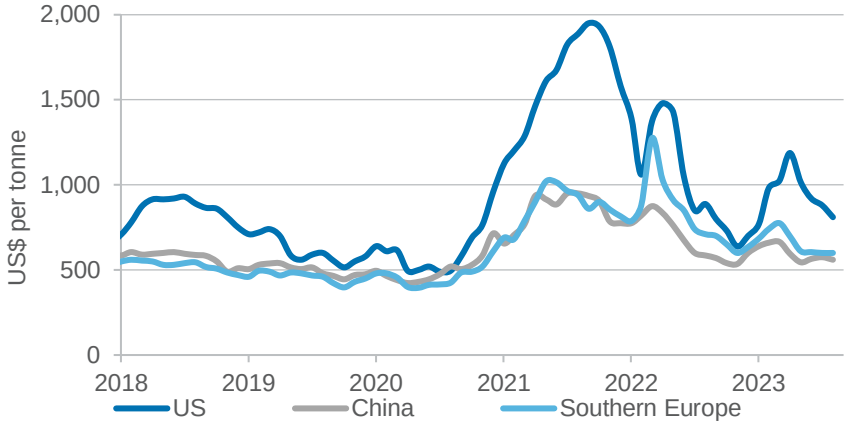


Source: Bloomberg (2023)

European construction sector weakens again in the June quarter

Weakening demand has seen the Eurozone construction sector slide into deep contraction over the past six months. The HCOB Eurozone Construction PMI remained in negative territory in August 2023, for the 16th consecutive month. The August result was the sharpest fall in construction activity since late-2022.

Figure 3.8: HRC steel prices



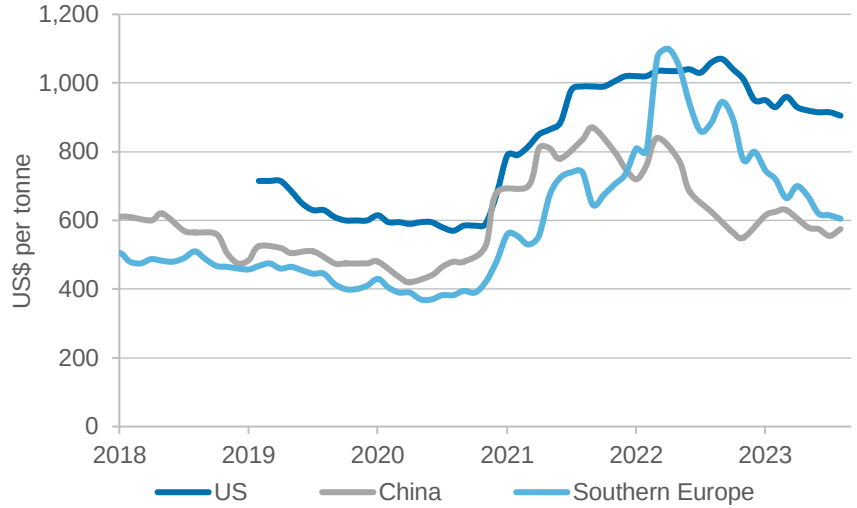
Source: Bloomberg (2023)

All three broad areas of construction recorded falls in activity (housing, commercial and infrastructure). Residential construction recorded the biggest fall in over three years, while commercial construction and infrastructure declined at softer rates. New business orders fell sharply in August, the 17th consecutive monthly fall. Price pressures remain modest due to reduced demand for inputs and greater material availability.

Slowdowns in construction activity were substantial and widespread across Europe, with the steepest reductions in Germany and France. Public construction works and government housing schemes are providing some support to the sector. However, the outlook for European construction over the next 6-12 months remains bleak, as higher interest rates continue to hurt residential and commercial construction.

Steel output in the EU — the world's second largest steel-producing region — fell by 11% year-on-year in the first half of 2023 (and remained 13% below pre-COVID 2019 levels) to reach around 62 million tonnes. EU steel production is forecast to see a modest rate of growth over the outlook period to 2025, though production levels are forecast to remain below the pre-pandemic peak. Most of the EU's current or planned steel capacity developments are aimed at replacement (rather than additional) supply, with a focus on the shift toward EAF-based, lower-emissions facilities.

Figure 3.9: Rebar steel prices



Source: Bloomberg (2023)

India's steel sector continues to build momentum

Indian steel output reached 68 million tonnes in the first half of 2023, a rise of 7.4% year-on-year (Figure 3.10). Total production is forecast to grow 6.8% in 2023 (to 134 million tonnes).

India's economic outlook remains healthy, with strong demand for steel expected from the manufacturing and construction sectors. As noted above, India recorded its strongest construction outlook in 5 years. India's manufacturing PMI remained strongly positive in August, with strong growth reported in both output and new orders. The manufacturing demand outlook remains positive over the next year, with businesses reporting rising future orders. However, the sharp rise in India's inflation in July to 7.4% — the highest level in 15 months and above the Reserve Bank of India's target range of 4-5% — raises the possibility of monetary tightening if price pressures remain elevated.

India is projected to see some of the strongest growth in steel output globally over the outlook period (Table 3.1). Following the Indian Government's target to double national production capacity to 300 million tonnes by 2030–31, more than 60 million tonnes of new steel production capacity is expected to be added over the next few years. The $1.5 trillion National Infrastructure Pipeline is expected to support growth in India's residential and commercial sectors to 2025, as well as a ramp up in infrastructure spending. Sustained growth in private consumption is expected to drive healthy growth in automotive and consumer durables.

South East Asia is also expected to see a substantial increase in total steel output, with annual growth of around 10% expected over the outlook period to 2025. New steel production capacity expected includes sizeable projects in Vietnam, Philippines, and Malaysia.

Japan and South Korean steel output contracted in H1 2023

In the first half of 2023, steel output in Japan and South Korea contracted by 4.7% and 0.5%, respectively. In Japan, despite strong GDP growth (2.1% year-on-year) in the June quarter 2023, the country's manufacturing conditions remain subdued, due to slowing growth in its major trading partners and cooling domestic demand. Industrial production was flat in June following monthly declines through most of 2023. The Jibun Bank Japanese Manufacturing PMI returned to contractionary territory in July, with the decline driven by falls in new orders and output. Japan's JFE Steel Corporation stopped blast furnace production at the Keihin plant in September. Over the outlook period to 2025, Japan's steel production is expected to remain flat (Table 3.1).

South Korea's economy continues to slow, with GDP easing to growth of just 0.8% year-on-year in the June quarter. Net exports were a key factor in the slowdown (down 16% year-on-year), and domestic industrial production also declined (down 5.6% year-on-year in June).

With South Korean growth expected to slow further in H2 2023, a rebound in the nation's steel output is expected to be very limited. The global economic slowdown is forecast to continue to weigh on Korea's export-oriented industries, while tightening monetary conditions are expected to further dampen residential construction activity. Over rest of the outlook period, South Korean steel output is forecast to grow modestly (Table 3.1).

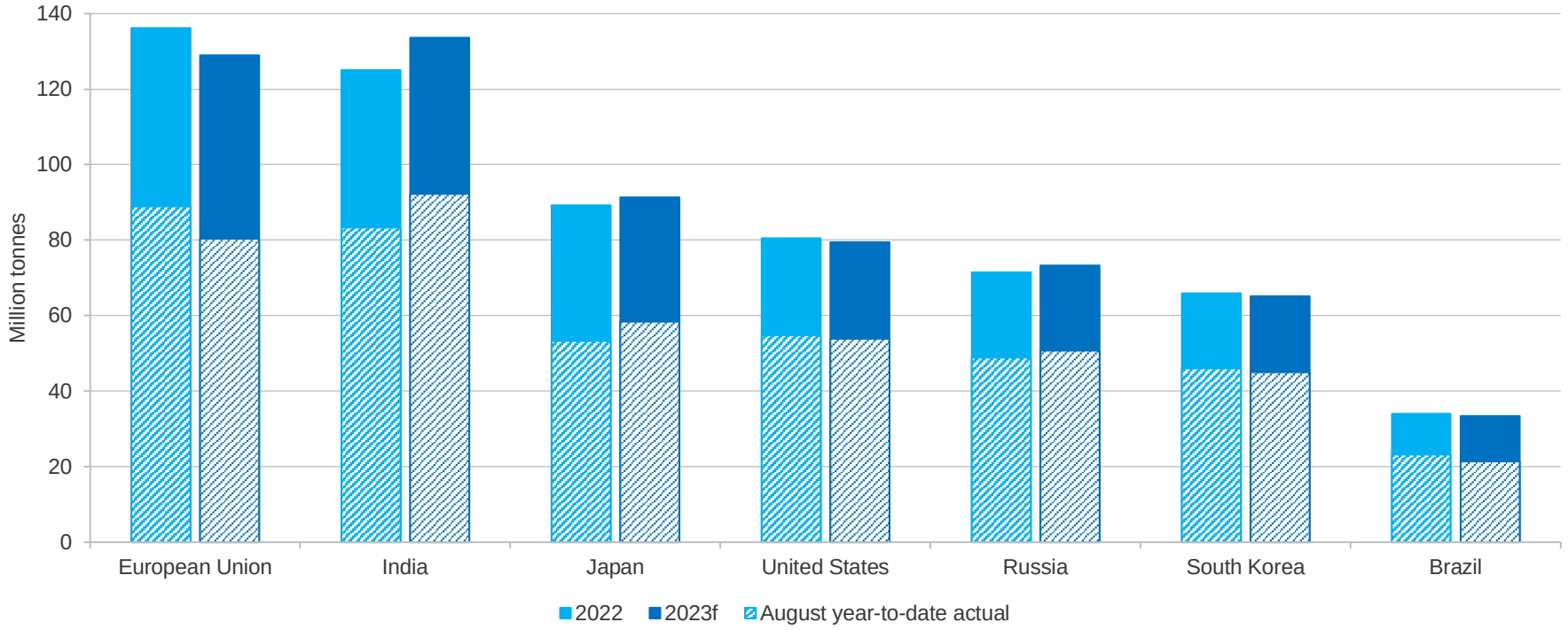
US factory construction surges while residential construction weakens

US steel production has been relatively weak so far this year. In the first half of 2023, production was down 2.9% compared with the corresponding period in 2022. This result reflects slowing industrial and manufacturing activity. Manufacturing output fell 0.7% year-on-year in July 2023. Similarly, annual growth in industrial production has steadily deteriorated: from rates of 3-4% in 2022 to falls in recent months — with July industrial production down 0.2% year-on-year.

Inflationary pressures and tightening monetary conditions have weighed on US construction activity — particularly the residential property sector. But private non-residential investment has recorded strong growth. Real manufacturing construction spending has doubled since end 2021, driven by construction of computer, electronic, and electrical manufacturing.

The outlook for US steel demand in the second half of 2023 contains downside risks. Residential construction is facing increasing headwinds from rising interest rates and higher land and material costs. Government initiatives such as the *Inflation Reduction Act* and the CHIPS Act should support manufacturing activity. However, the US Manufacturing PMI remained in contractionary territory in August. The ongoing deterioration in manufacturers' operating conditions reflects falls in new orders as domestic and external demand weaken. US steel production is projected to record moderate growth over the outlook period to 2025 (Table 3.1).

Figure 3.10: Steel production – other major producers



Source: World Steel Association (2023); DISR (2023)

Table 3.1: World steel consumption and production

	Million tonnes				Annual percentage change		
Crude steel consumption	**2022**	**2023[f]**	**2024 [f]**	**2025 [f]**	**2023 [f]**	**2024 [f]**	**2025 [f]**
China	965	965	967	961	0.0	0.2	-0.6
European Union	159	156	162	165	-2.1	4.0	2.0
India	118	122	129	138	3.9	5.4	7.6
United States	102	104	108	112	1.4	4.0	3.3
Other Asia[a]	114	115	119	121	1.3	3.0	2.2
Japan	62	61	63	64	-1.2	3.7	1.4
Middle East	56	57	59	61	1.0	3.8	3.1
South Korea	54	53	54	55	-1.4	2.1	1.4
Russia	43	42	41	42	-1.9	-2.7	1.4
World steel consumption	1,895	1,904	1,943	1,971	0.5	2.1	1.4
Crude steel production	**2022**	**2023 [f]**	**2024 [f]**	**2025 [f]**	**2023 [f]**	**2024 [f]**	**2025 [f]**
China	1,018	1,032	1,026	1,020	1.4	-0.6	-0.6
European Union	136	129	134	135	-5.4	4.0	0.7
India	125	134	142	151	6.8	6.2	6.3
Japan	89	91	93	92	2.4	1.7	-0.7
United States	81	80	81	83	-1.3	2.1	2.6
Russia	71	73	74	74	2.6	1.0	0.1
South Korea	66	65	67	68	-1.0	3.3	1.4
Other Asia[a]	66	67	76	85	2.0	12.1	12.0
World steel production	1,885	1,908	1,941	1,968	1.2	1.7	1.4

Notes: **a** Asia ex. China, India, Japan, South Korea and Taiwan; **f** Forecast; **r** Annual percentage change

Source: World Steel Association (2023); Department of Industry, Science and Resources (2023)

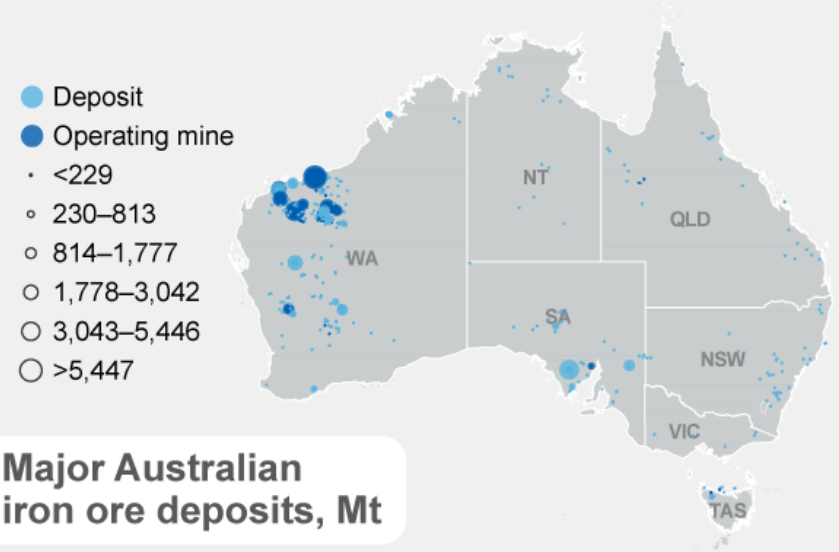
Iron Ore

Australia's iron ore sector

World's no.1
for iron ore **resources**

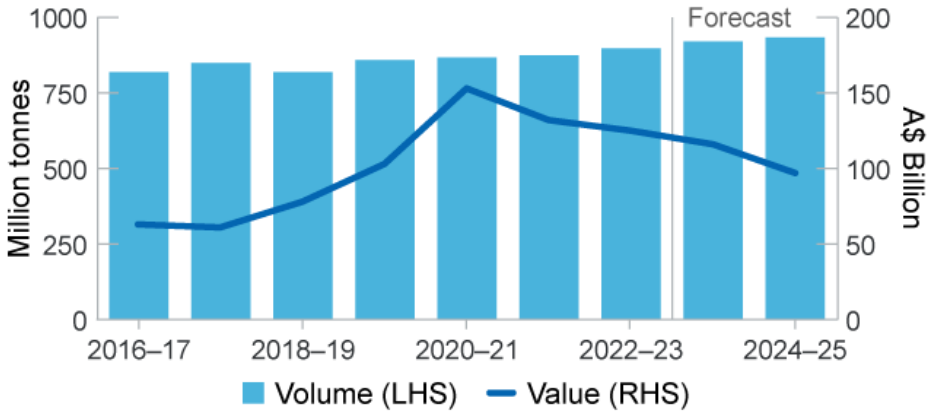
Largest
iron ore producer in the world

$124 billion
earned in exports in 2022–2023



Major Australian iron ore deposits, Mt

Australian iron ore exports



Outlook

Iron ore prices have moderated since 2022, but **remain volatile**

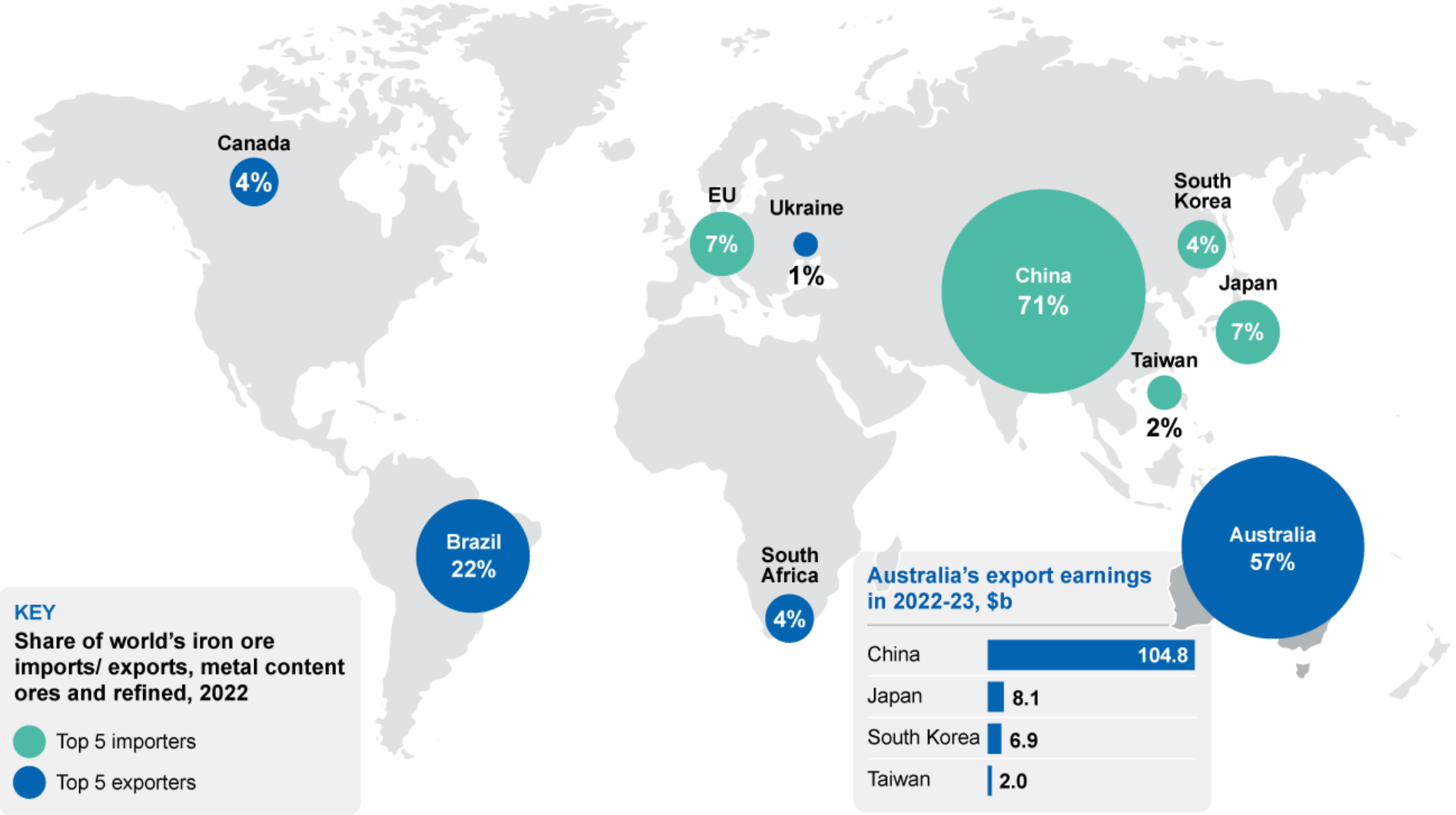
Future export earnings to **fall** as **prices decline**

Australian **export volumes rising**, with further greenfield supply expected

Exploration expenditure **remains strong**

SOURCE: GA; ABS; DISR; OCE

Iron Ore TRADE MAP



SOURCE: ITC Comtrade; ABS

4.1 Summary

- Spot iron ore prices have been volatile in the September quarter, but have generally moderated since the start of the year, driven by slowing global economic growth and China's property sector weakness.
- Australian export volumes remain strong, with further greenfield supply from established and emerging producers expected to come online in the next few years.
- Australia's iron ore export earnings are expected to decline from $124 billion in 2022–23 to $120 billion in 2023–24, and to $99 billion in 2024–25 — driven by lower prices over the outlook period.

4.2 Prices

Iron ore prices have been volatile in the September quarter

Iron ore prices have been volatile in recent months, with prices easing from the end of the June quarter, due to slowing global economic growth and an expectation of slowing Chinese steel production over the remainder of 2023. Following a strong rebound in iron ore prices to a peak of over US$120 a tonne in the June quarter, the benchmark iron ore spot price (basis 62% Fe fines CFR Qingdao) fell to around US$108 a tonne in August 2023 (Figure 4.1). The price fall reflected slackening demand from Chinese steel mills.

Despite the worsening outlook for global steel demand, iron ore prices strengthened again in September. The resilience in prices appears to reflect improved market sentiment due to the potential for new government measures to support China's economy.

More broadly across China, the recovery in steel consumption seen in the June quarter has also lost momentum in recent months, with year-on-year declines in steel consumption registered in June and July. This weakness comes on top of the large falls in Chinese steel consumption in 2022.

Iron ore imports from Australia increased by 6.9% year-on-year in June 2023, following a fall of 6.1% in May (Figure 4.2). This reflects a pickup in steel production in China at the end of the June quarter following weakness in April and May.

Figure 4.1: Iron ore price, monthly

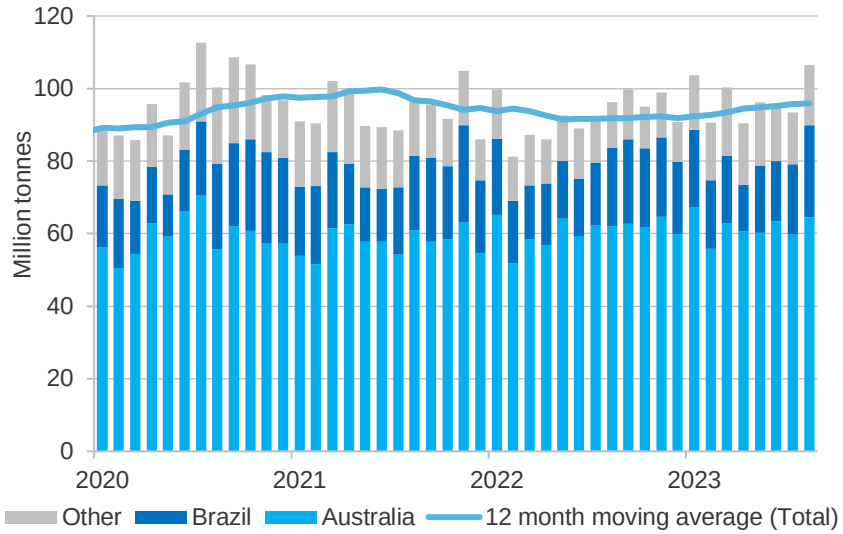
Notes: China import Iron ore fines 62% Fe spot (CFR Tianjin port)
Source: Bloomberg (2023) China import prices

The Chinese property sector faces a number of challenges which include demographic and structural components (see Box 2.1).

New infrastructure investment — resulting from substantial levels of funding allocated in 2022 — as well as new government policies intended to alleviate property sector weakness, should provide support for construction activity and hence steel and iron ore demand in China from late 2023 and 2024 (see *Steel* chapter).

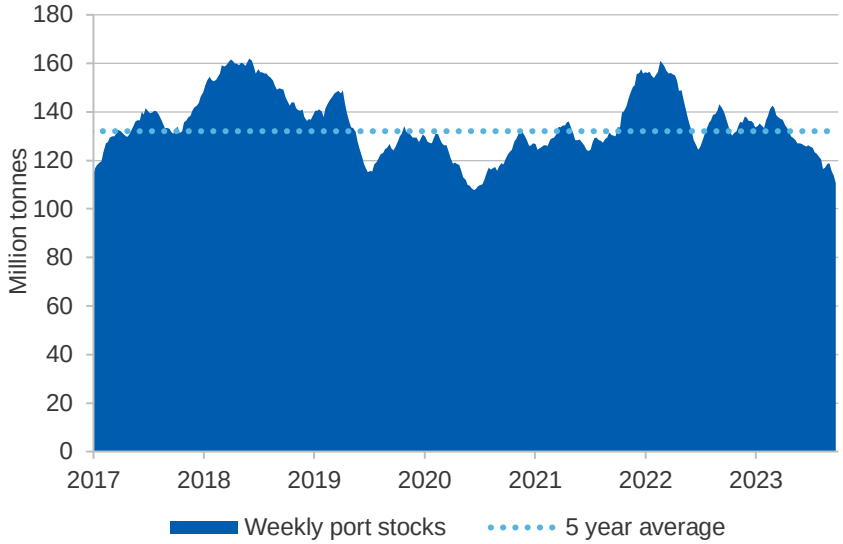
Restocking of iron ore and steel inventories by Chinese steel mills is also expected to provide some support for iron ore demand in coming months. In late September, China's portside iron ore inventories had fallen to around 15% below historic averages (Figure 4.3). Reported inventories in Chinese steel mills have also remained low compared with previous years, with planned purchases by mills persisting at subdued levels in recent months.

Figure 4.2: China's iron ore imports, monthly



Source: Bloomberg (2023)

Figure 4.3: China's weekly iron ore port stocks



Source: Bloomberg (2023)

This is likely to reflect Chinese steel mill margins remaining weak due to low steel prices in recent months. Steel margins reportedly moved back into negative territory in early August. This likely contributed to a continuation of the decline in spread for premium 65% pellet, as well as maintaining downward pressure on premiums for high-grade iron ore fines, as mills seek to reduce operating costs (Figure 4.4). However, winter output curbs to address emissions and oversupply expected from late-November may see a recovery in demand for higher grade ores as mills seek to maximise output yield.

Following last year's production falls, ex-China steelmaking is expected to make a modest recovery in the second half of 2023. This pickup should provide support for iron ore demand and prices. This is expected to include a rise in iron ore imports for major purchasers in Europe and North America, as well as East and South-East Asia and the Middle East.

There are substantial risks to the global demand outlook. A more pronounced global economic slowdown will exacerbate weak conditions in the steelmaking sector. Slowing growth in the Chinese economy has tilted the balance of risks towards the downside.

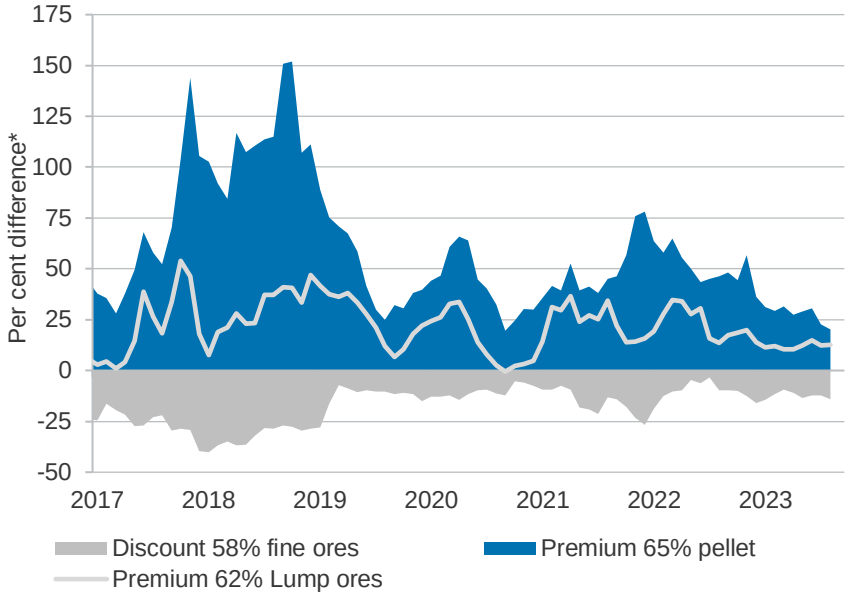
The spot price for 62% Fe iron ore fines (FOB) for calendar 2023 is estimated to average around US$100 per tonne (Figure 4.5).

Prices to further moderate over outlook as global demand softens

China is projected to see a modest fall in total steel output over the outlook period to 2025. As China accounts for almost 60% of global iron ore demand, this is expected to soften the rate of growth in global iron ore demand in the coming years, driving iron ore prices down.

Several structural drivers are expected to contribute to this lower growth in China's iron ore demand (see Box 2.1).

Figure 4.4: Iron ore price spreads between grades

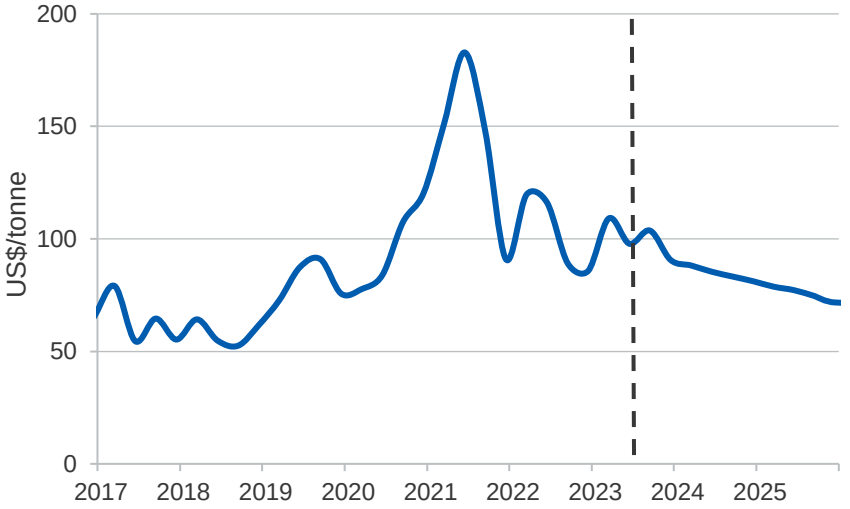


Notes: *Difference to 62% benchmark iron fines CFR; all grades reflect Chinese import prices
Source: Bloomberg (2023)

Strong growth in ex-China iron ore demand over the outlook period is expected from rising steel demand and production capacity in regions such as emerging Asia and the Middle East. This includes over 100 million tonnes of integrated (Blast Furnace-Basic Oxygen Furnace) steelmaking capacity, expected to come online in the next few years in Asia alone.

On the supply side, the world's two largest producers — Australia and Brazil — are expected to continue to collectively grow export volumes by 3.4% per annum over the outlook period to 2025. This follows a ramp up of greenfield projects for major Australian miners, and significant expansions planned by Brazilian producers Vale, CSN and others. New supply from emerging producers in Africa will also contribute to the growth in global trade of iron ore (see *World trade* section).

Figure 4.5: Iron ore price outlook, quarterly



Notes: China import iron ore fines 62% Fe spot (FOB)
Source: Bloomberg (2023); Department of Industry, Science and Resources (2023)

From an estimated average price of around US$100 per tonne (FOB) in 2023, the benchmark iron ore price is projected to steadily fall to an average of about US$76 per tonne by 2025 (Figure 4.5).

Portside sales of iron ore in China are expected to continue as a relatively small, though important, form of access for global trade of iron ore over the outlook period. The settlement of trades in Chinese renminbi (as opposed to US dollars) will likely continue to grow. Last year, BHP delivered its first shipment of a spot trade of RMB-based iron ore, with other major producers (such as Rio Tinto and Fortescue) also reporting a substantial increase in portside sales. This, along with the introduction of a new RMB-backed futures contract for China portside fines by CME Group, is consistent with the broader objective set out by China in its current 5 year plan: to promote the international use of the RMB, particularly in the trade of commodities.

4.3 World trade

Global iron ore supply improved in June quarter

In the June quarter 2023, combined shipments for Australia, Brazil, South Africa and Canada — representing more than 80% of global seaborne supply — were estimated at around 348 million tonnes. This was a 9.8% rise quarter-on-quarter, reflecting an improvement in weather conditions in Australia and Brazil (following a typically wet March quarter) which are set to continue with projected El Nino effect.

In the first half of 2023, total shipments for the four major exporting-countries were around 666 million tonnes, a rise of 4.4% compared with the same period in 2022.

Steady growth in global iron ore trade expected the outlook

Global trade is expected to grow by 2.6% annually over the outlook period to 2025, with new supply coming online in Australia, Brazil and Africa over that time. Australia is projected to see continued ramp up of greenfield projects from established producers such as Rio Tinto, BHP and Fortescue, as well as emerging producers such as Mineral Resources Limited and Atlas Iron. Over the outlook period, Australia's iron ore exports are projected to rise at an average annual rate of 2.3% to reach 946 million tonnes by 2025 (see *Australia* section for more detail).

Total iron ore shipments from Brazil increased by 12.1 million tonnes year-on-year in the June quarter 2023. This was driven by a 6.3% rise in output of Vale, Brazil's largest producer, with strong production increases in most of its mines including S11D. This reflected efforts to improve asset reliability and the installation of new crushers in 2022. Production increases also reflected improved output from the Itabira, and Vargem Grande complexes.

Vale's guidance for 2023 production remains 310–320 million tonnes (compared with 310 for 2022). Late last year, the company also stepped away from its aim to return to pre-2019 production levels of 400 million tonnes per annum. Instead, the company has released production guidance of 340–360 million tonnes per annum by 2026, and continues to emphasise a 'quality over quantity' approach to its production. In May 2023, Vale also announced in that it will be working with French DRI producer GravitHy to develop a carbon-neutral steelmaking process using Vale's iron ore briquettes technology. The companies will jointly evaluate the construction of a plant located at Fos-sur-Mer (France) to produce direct reduction briquettes from Vale's iron ore feedstock.

Over the outlook period to 2025, Brazil is still expected to grow iron ore exports by around 6% annually. This will include Vale's S11D expansion, as well as new and expanded output by a number of other producers, including CSN's Casa de Pedra mine

Global iron ore exports (ex-Australia and Brazil) are projected to grow by around 3% over the outlook period to 2025. Global supply will be bolstered by additional supply from Canada and new projects coming out of Africa, including the 150 million tonne per annum plus Simandou mine which is targeting first production in 2025–26.

CMRG exploring ways to work with buyers procuring spot iron cargoes

It has been reported that around 30 Chinese steel mills have signed 2023 iron ore procurement contracts through China's new state-owned company China Minerals Resources Group (CMRG). To date CMRG has focussed on contracts for volumes under long-term contracts. However, recent reports indicate CMRG is exploring ways to cooperate with market participants on procuring spot iron ore cargoes.

Over the outlook period, CMRG is expected to play an increasing role in contract negotiations and price setting in the global iron ore market. The latest reported move into the spot iron ore market would expand the capacity of CMRG in this role. It is unclear how quickly this reported push into the spot market will occur, and how it will affect the CMRG's ability to negotiate lower prices for Chinese mills.

CMRG started negotiations in 2023 on iron ore supply on behalf of a number of China's major steelmakers. The Group was established in July 2022 and was widely seen as an effort by the Chinese government to

guarantee the supply of important mineral resources — including the establishment of a single, central purchasing platform for iron ore.

CMRG is expected to manage purchases on behalf of China's largest steelmakers, who account for the majority of the country's annual steel production. This includes purchase discussions with major producers, such as Rio Tinto, Vale and BHP.

While information on CMRG activities remains limited, additional clarity is expected as negotiations for next year's purchasing contracts begin over coming months.

Infrastructure cost sharing agreed for Guinea's Simandou mine

Progress on Guinea's Simandou 150-200 million tonne mine continued in the September quarter, with Rio Tinto announcing in August that it had reached agreement with the Guinean Government and Winning Consortium Simandou to develop the 600 kilometre rail line required to transport the iron ore to the port.

The latest agreement establishes that the infrastructure capacity and associated cost will be shared equally between the two controlling groups. The Simandou mine is divided into 4 blocks, with 2 blocks controlled by Rio and Aluminum Corp of China, and the remaining 2 blocks owned by the Winning Consortium Simandou, backed by Chinese and Singaporean companies.

The latest announcement builds on the establishment of the governance and operations model for development of the mine infrastructure earlier this year. The Guinean Government is targeting completion of infrastructure by 2024, and commercial production in either late 2025 or early 2026.

India's iron ore and pellet exports fell in the June quarter

India's iron ore and pellet exports reached 10.4 million tonnes in the June quarter 2023, down 10% from the 11.6 million tonnes in the March quarter 2023. In June this year, India's iron ore exports fell by 6% month-on-month and pellet exports fell by 46%.

As India's steelmaking capacity continues to grow in the coming year, this is likely to reduce the quantity of iron ore available for export. In November 2022, the Indian government cut the tax rate (from 50% to 30%) for iron ore concentrates and scrapped the 50% export tax on low grade (<58% Fe) iron ore it introduced in early 2022. The higher tax rates were seen at the time as an effort by the government to manage input prices and retain iron ore for India's domestic industry. However, as India has historically been seen as a price-sensitive iron ore exporter — with domestic miners incentivised to export in times of high seaborne prices — the lower export tariffs are not expected to lead to a significant boost in India's iron ore exports over the outlook period.

4.4 Australia

Export volumes surge in first half of 2023

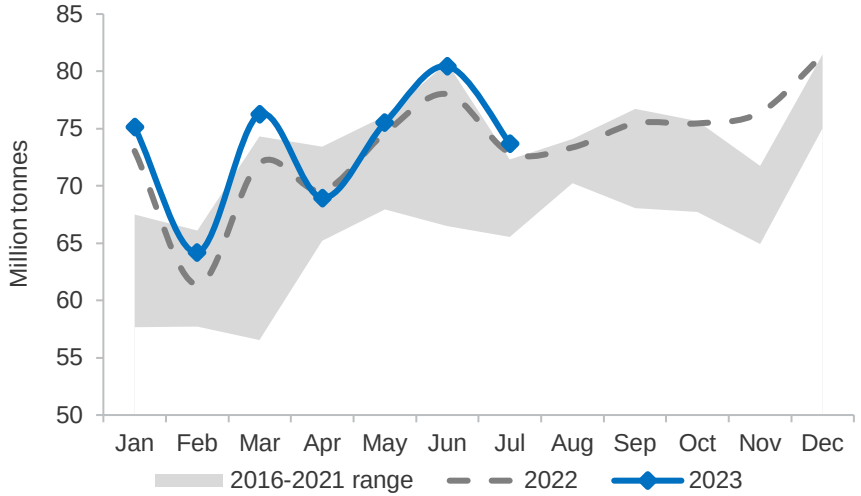
Australia's iron ore export earnings were $32.5 billion in the June quarter 2023, a 5.5% (or $1.9 billion) decrease year-on-year. The decrease reflected weaker iron ore prices, with the unit export price in the June quarter averaging around $145 per tonne — 7% lower compared with the same period in 2022.

Australia exported 225 million tonnes of iron ore in the June quarter, up 1.2% year-on-year. The strong June quarter results lifted exports for the first half of 2023 to 440 million tonnes (Figure 4.6). The strong result reflected the ongoing ramp up of BHP's South Flank, Fortescue's Eliwana and Rio Tinto's Gudai-Darri operations.

Rio Tinto shipped 79.1 million tonnes of iron ore in the June quarter, down 1% year-on-year. This was largely due to planned major maintenance at the Dampier Port and a train derailment on 17 June. The rail line was reopened on 21 June. During the quarter, the new Gudai-Darri mine achieved sustained nameplate capacity.

Rio Tinto guidance for 2023 remains at 320–335 million tonnes. With ongoing operational improvements across the Pilbara system, the company advises that full-year shipments are expected to be in the upper half of the range.

Figure 4.6: Australian monthly iron ore export volumes



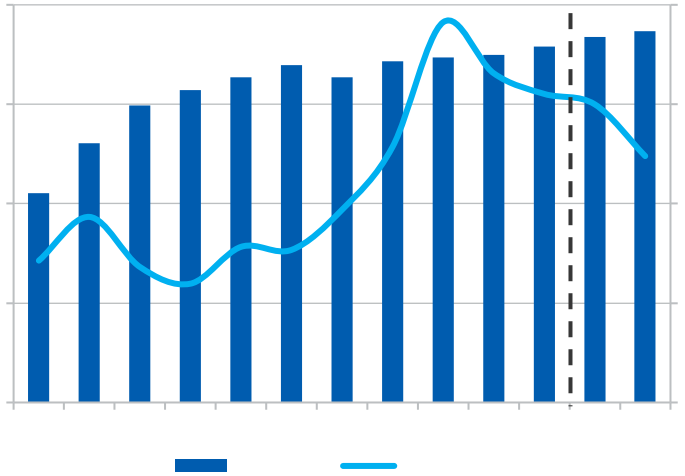
Source: ABS (2023) International Trade, Australia, 5368.0; Department of Industry, Science and Resources (2023)

In June, Rio Tinto and China Baowu Group signed a memorandum of understanding (MoU) relating to a series of projects to help decarbonise the steel value chain. The projects include efforts to optimise pelletisation technology for Australian ores as a feedstock for direct reduction.

BHP's iron ore output was 65.3 million tonnes in the June quarter, up 2% year-on-year. The company provided 2023–24 production guidance of 254–264.5 million tonnes (equating to 299–311 million tonnes on a 100% basis). This includes the further ramp up of South Flank, which BHP expects to reach nameplate capacity (of 80 million tonnes per annum) by the end of the June quarter 2024, as well as its port debottlenecking project (PDP1).

Fortescue's total iron ore shipments were 48.9 million tonnes in the June quarter 2023, a 6% increase quarter-on-quarter. Total shipments of 192 million tonnes for the 2022–23 financial year represented a 2% gain year-on-year. This was at the top of the company's guidance and was the fourth consecutive year of record shipments.

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



Source: ABS (2023) International Trade, Australia, 5368.0; Department of Industry, Science and Resources (2023)

Fortescue has set its 2023–24 fiscal year production guidance at 192–197 million tonnes. First production of the 22 million tonnes per annum Iron Bridge Magnetite project was achieved during the June quarter. All concentrate produced to date has been at or above 67% Fe magnetite, with first concentrate loaded for shipping in July.

Mineral Resources' iron ore shipments were 4.3 million tonnes in the June quarter 2023 and 17.5 million tonnes for 2022–23. This was in line with guidance of 17.2–18.8 million tonnes. All major approvals have been received for the Onslow Iron project. The first ore-on-ship delivery is expected in June 2024. The company is targeting exports of 30 million tonnes per annum, with infrastructure capable of 35 million tonnes per annum.

Export values to ease over outlook on moderating prices

Australia's iron ore export earnings are estimated to have reached $124 billion in 2022–23, down from $132 billion in 2021–22. Higher production volumes were offset by lower prices. Moderating prices over

the outlook period are forecast to lead to lower iron ore earnings, with exports of $120 billion in 2023–24, and $99 billion in 2024–25 (Figure 4.8).

Exploration rose in June quarter 2023

A total of $186 million was spent on iron ore exploration in the June quarter 2023 (Figure 4.9). This was 31% higher compared with the previous quarter, and 8% lower than the same period in 2022. Exploration has fallen from near decade highs last year. However, the latest results continue the broad upward trend in iron ore exploration which was triggered by the historical high iron ore prices of above US$200 a tonne reached in the first half of 2021.

Revisions

Export earnings in 2023–24 have also been revised up from the June 2023 *Resources and Energy Quarterly;* we now expect earnings of almost $120 billion rather than $110 billion, reflecting a lower-than-expected exchange rate, slightly higher prices and a small increase in volumes. Earnings in 2024–25 are around $6 billion higher than forecast in the June 2023 *Resources and Energy Quarterly*.

Figure 4.8: Australian iron ore exploration expenditure

Source: ABS (2023) Catalogue 8412.0

Table 4.1: World trade in iron ore

	Million tonnes				Annual percentage change		
	2022	2023 f	2024 f	2025 f	2023 f	2024 f	2025 f
World trade	1,574	1,646	1,672	1,699	4.6	1.6	1.6
Iron ore imports							
China	1,108	1,162	1,129	1,101	4.9	-2.9	-2.5
Japan	107	109	111	110	2.4	1.7	-0.7
European Union	114	100	113	115	-12.4	13.5	1.4
South Korea	69	71	73	74	3.3	3.1	1.3
Rest of Asia[a]	63	61	74	94	-3.2	20.1	27.9
India	7	27	36	51	289.6	30.2	42.8
Iron ore exports							
Australia	884	906	917	946	2.5	1.2	3.1
Brazil	344	365	388	411	6.1	6.3	5.9
South Africa	58	59	60	61	1.7	1.7	1.7
Canada	55	57	59	61	3.6	3.5	3.4
India	16	28	30	32	74.1	7.1	6.6

Notes: **a** Excludes China, Japan, South Korea, Taiwan and India; **s** Estimate; **f** Forecast; **r** Annual percentage change

Source: World Steel Association (2023); International Trade Centre (2023); Department of Industry, Science and Resources (2023)

Table 4.2: Iron ore outlook

				Million tonnes			Annual percentage change	
World	**Unit**	**2022**	**2023[f]**	**2024 [f]**	**2025 [f]**	**2023[r]**	**2024 [f]**	**2025 [f]**
Prices [a]								
– nominal	US$/t	103	100	84	76	-2.3	-15.8	-10.6
– real [b]	US$/t	107	100	82	72	-6.6	-18.1	-12.4
Australia	**Unit**	**2021–22**	**2022–23**	**2023–24 [f]**	**2024–25 [f]**	**2022–23**	**2023–24 [f]**	**2024–25 [f]**
Production								
– Steel [c]	Mt	5.8	5.6	5.8	5.8	-2.6	2.7	0.0
– Iron ore [g]	Mt	929	955	985	1,014	2.9	3.1	2.9
Exports								
Steel [c]	Mt	0.81	1.21	1.00	1.10	49.6	-17.5	10.6
– nominal value	A$m	1,047	1,326	1,167	1,166	26.7	-12.0	0.0
– real value [i]	A$m	1,166	1,380	1,167	1,130	18.3	-15.4	-3.2
Iron ore [h]	Mt	874	895	920	933	2.4	2.7	1.4
– nominal value	A$m	132,489	124,167	119,981	99,123	-6.3	-3.4	-17.4
– real value [i]	A$m	147,585	129,234	119,981	95,993	-12.4	-7.2	-20.0

Notes: **a** Spot price, 62% iron content, fob Australian basis; **b** In 2023 US dollars; **c** Crude steel equivalent; Crude steel is defined as the first solid state of production after melting. In ABS Australian Harmonized Export Commodity Classification, crude steel equivalent includes most items from 7206 to 7307, excluding ferrous waste and scrap and ferroalloys; **f** forecast; **g** In wet metric tonnes; **h** In dry metric tonnes**; i** In 2023–24 Australian dollars; **r** Annual percentage change**; s** Estimate
Source: ABS (2023) International Trade in Goods and Services, Australia, 5368.0; Bloomberg (2023); World Steel Association (2023); company reports; Department of Industry, Science and Resources (2023)

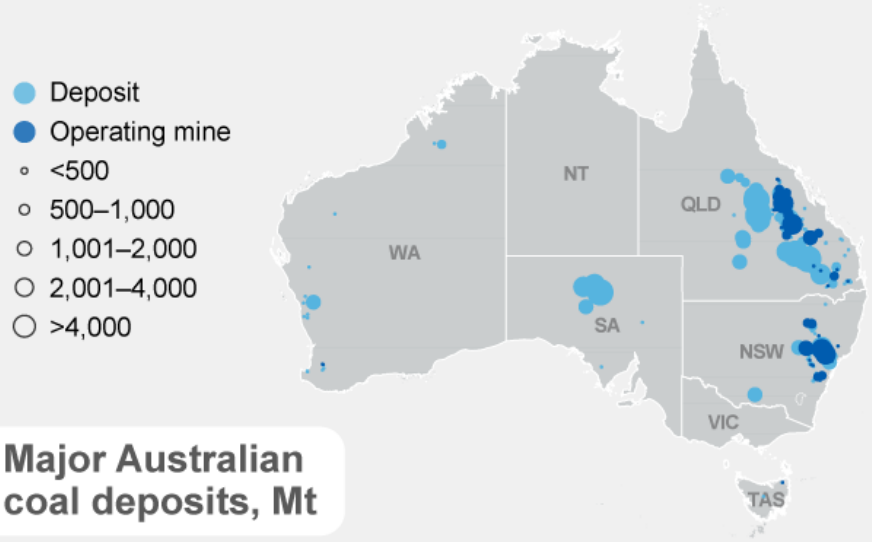
Metallurgical Coal

Australia's metallurgical coal sector

Largest
exporter, around **170Mt** exported annually

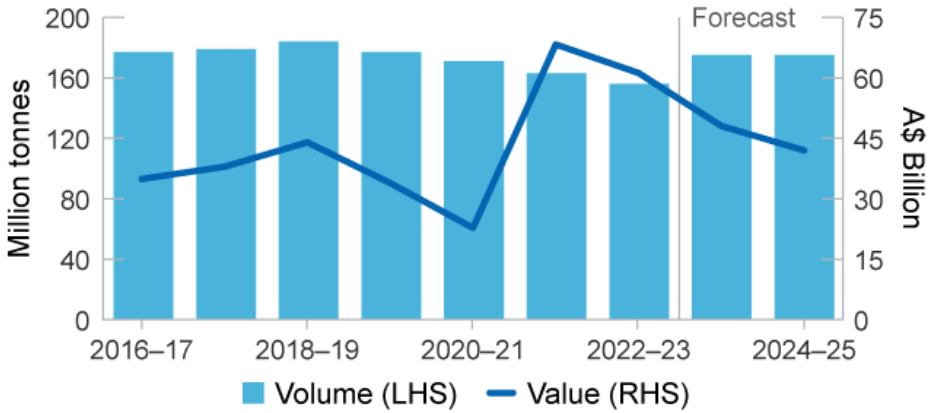
Strong growth
in exports to **India, Japan and South Korea** in recent years

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



Major Australian coal deposits, Mt

Australian metallurgical coal exports



Outlook

Metallurgical coal **prices have stabilised** after a decline in early 2023

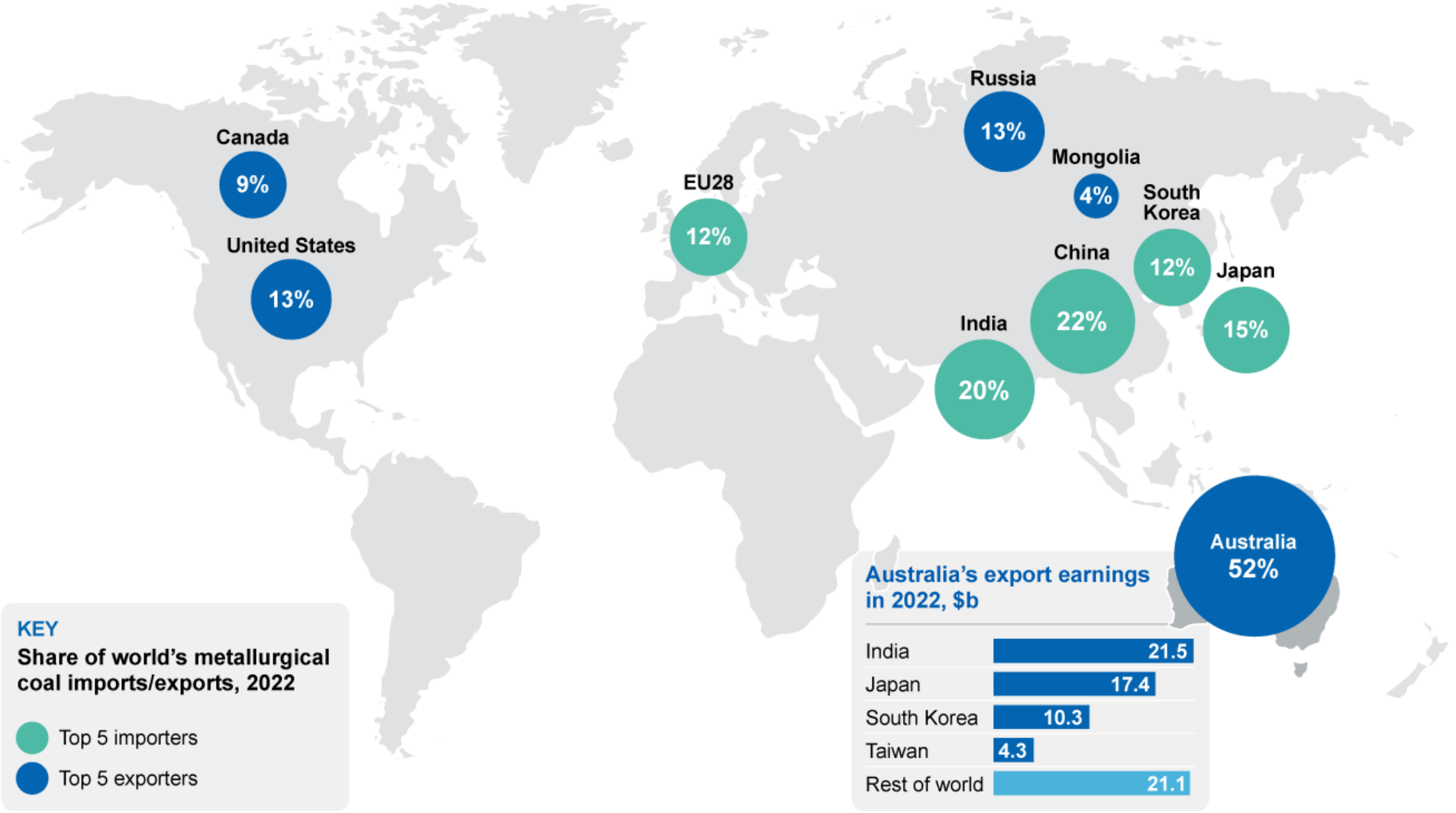
Earnings are **expected to decline** over time as prices continue to ease off their 2022 peak

Volumes should lift as weather disruptions ease and new mines commences in Qld

Exploration spending rose in quarterly and through-the-year terms

SOURCE: World Steel; GA; DISR; OCE

Metallurgical Coal TRADE MAP



SOURCE: WSA; ABS

5.1 Summary

- Metallurgical coal prices remain well above their pre-2019 level, and have held up in recent months despite a softening global economic outlook. The Australian premium hard coking coal price is expected to average US$265 a tonne in 2023, easing to around US$200 a tonne by 2025, as supply conditions improve.
- Australia's exports are forecast to lift from an estimated 157 Mt in 2022–23 to 172 Mt in 2024–25, as several new mines open (see Australia section).
- As prices decline, the value of Australia's metallurgical coal exports is forecast to fall from $62 billion in 2022–23 to $41 billion in 2024–25.

5.2 World trade

Demand for metallurgical coal held up through the September quarter. Markets appear to have stabilised, with demand matched by more reliable supply as weather disruptions eased following the end of the La Niña weather episode affecting Australia.

Looking forward, world metallurgical coal trade is forecast to increase from 312 Mt in 2022 to 316 Mt by 2025, led by rising demand in India (Figure 5.1). The current supply gap in metallurgical coal markets is expected to close during the outlook period, as supply firms and demand growth cools slightly amidst a temporary downturn in global economic conditions. However, there are significant risks in both directions.

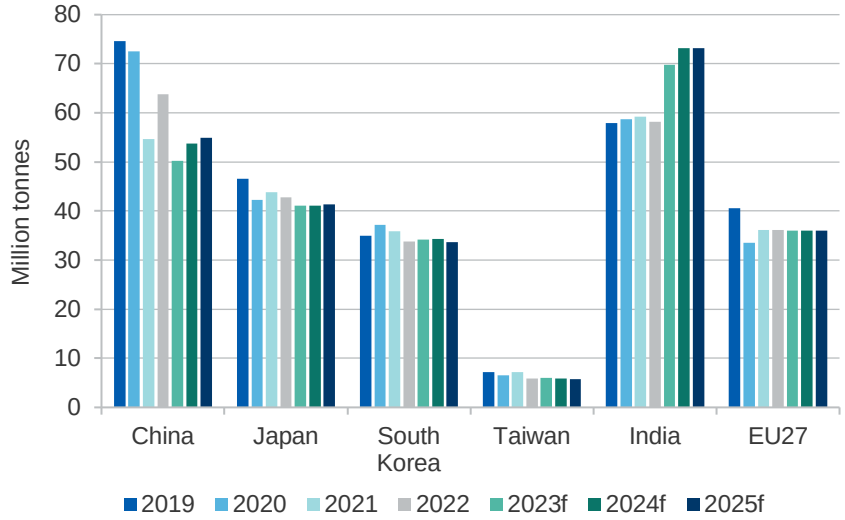
Steelmaking in Europe and Asia remains relatively soft, but with significant potential to ramp up. In total, European countries have re-opened around half of the 25 Mt of blast furnace capacity they previously closed when metallurgical coal and electricity prices surged in the wake of the Russian invasion of Ukraine. A further decline in input prices (or growth in prices for steel) could trigger further reactivation of offline capacity. New facilities continue to open in India and other parts of South Asia, where expanding steel production remains a widespread policy goal. Further ramp-ups in capacity across Europe and Asia provide an upside possibility to demand in 2024 and 2025.

Prices are expected to remain elevated during the outlook period. Underinvestment has not affected metallurgical coal supply to the same extent as thermal coal, but metallurgical coal demand also remains subject to higher expected growth rates. Over time, rising steel requirements in Asia may drive investment in more risky deposits, adding to potential volatility and market uncertainty.

The recent fall in thermal coal prices should also help to reduce pressure on metallurgical coal prices. As thermal coal prices have declined, the incentive to sell unwashed metallurgical coal into thermal markets has dwindled, improving the stability of supply to steelmakers.

Chinese official policy remains a significant variable for metallurgical coal markets. Chinese steel production has often been subject to government intervention, and any new production cap could drive a significant cut in metallurgical coal prices, potentially encouraging steel production in Europe and elsewhere to reopen.

Figure 5.1: Metallurgical coal imports



Notes: **f** forecast **s** estimate

Source: McCloskey (2023); Department of Industry, Science and Resources (2023)

5.3 World imports

Chinese metallurgical coal imports likely to ease

China's steel production has grown significantly relative to its steel demand in recent quarters. Steel output was up by 11.5% over the year to July, despite some recent restrictions in provinces affected by air pollution. At the same time, Chinese steel demand has been losing pace as a result of slowing residential building activity, completion of infrastructure projects and slower growth in the economy.

As a result, Chinese steel production has become more aligned towards the export market in recent months (see *Steel chapter*). This makes China more vulnerable to potential shifts in world steel demand and a softening global economic outlook. This may be corrected by a change to China's steel production targets, which would bring production for 2023 closer to the levels of 2022.

Chinese metallurgical coal output edged back in July as heavy rains disrupted some mines. A series of safety inspections also briefly slowed work at some sites. However, coal output has been stable through the year, and is expected to grow in the latter half of the September quarter.

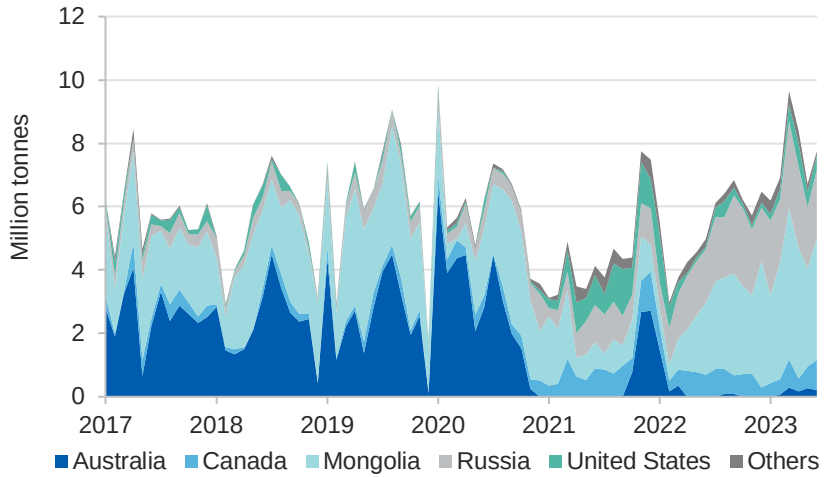
China imported just over 7 Mt of metallurgical coal in July, above the level of a year ago but down by almost 8% from June. Higher domestic coal output and slowing domestic demand should continue to reduce China's supply gap and pull back imports over the rest of 2023.

Imports from Australia are yet to rise substantially, with Chinese users capitalising on relatively low domestic prices and new rail links from Mongolia. China (and India) have also lifted imports of Russian coal, following bans on Russian exports by some Western nations (Figure 5.2). However, the Chinese Government has recently encouraged use of higher quality metallurgical coal, which could potentially lift demand for Australian output in the future.

Chinese policy will remain highly influential in the immediate term, but longer-term structural changes are also likely to moderate China's import requirements. Other long-term influences include higher investment in domestic output and internal transportation.

Chinese metallurgical coal imports are expected to remain below the 2022 level through the full outlook period, affected by softer conditions in Chinese steelmaking and across the wider Chinese economy. However, economic recovery is expected to eventually gather pace, allowing for modest growth in imports towards the end of the outlook period.

Figure 5.2: Chinese metallurgical coal imports, monthly



Source: McCloskey (2023)

India's metallurgical coal imports are growing on structural factors

Indian metallurgical coal imports rose steadily through H1 2023, and were around 15% higher over the year to June. This comes despite a general softening in the global steel outlook and reflects years of investment intended to build up steel production within India.

India's metallurgical coal needs are expected to soften slightly in the second half of 2023, with seasonal factors such as monsoon season appearing to be relatively mild thus far. The substantial new NMDC integrated steel plant is expected to increase India's metallurgical coal requirements from 2023.

India's steelmakers have announced detailed proposals for investments worth over US$11 billion. Some of these projects are expected to come online over the outlook period, adding to metallurgical coal imports (Figure 5.1). India's steel production remains closely correlated with urbanisation and industrial development, but also has links to global economic growth, which could see steel production drop off in the event of any global economic downturn. It is expected that Indian metallurgical coal imports will lift steadily from 58 Mt in 2022 to 73 Mt by 2025, though risks are tilted to the downside.

Japanese metallurgical coal imports have steadied

A recovery in Japanese steelmaking pushed up imports of metallurgical coal during the early part of 2023, but imports have since stabilised. Shipments were unchanged (at just under 4 million tonnes) in June, with growth from Canada and USA offsetting a fall in imports from Australia.

Japanese imports are expected to decline over the longer term as some steelmaking capacity retires. Japan's JFE Steel Corporation closed a significant plant in the September quarter, reducing the nation's ongoing metallurgical coal needs.

5.4 World exports

Global exports of metallurgical coal have firmed up in the aftermath of the La Niña climate episode. Structural shortfalls in metallurgical coal markets have mostly eased, but a small shortfall is likely to persist for at least another year, as some Russian supply remains stranded from world markets.

On the demand side, a fall in the outlook for global steelmaking is likely to ease price pressure. Any further downturn in global steelmaking (or policy changes in China) could result in a surplus of metallurgical coal supply, potentially lowering prices.

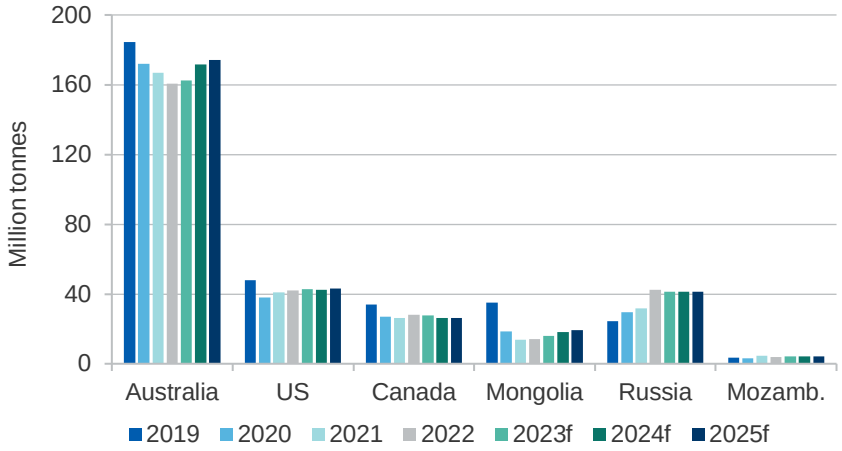
US producers have benefited from the removal of Russian supply

US suppliers are benefiting from improved transport and the removal of competing Russian supply due to sanctions by many Western nations.

Coal exports from the US have been relatively strong since mid-2022, and have been supported recently by the resolution of several infrastructure faults. US metallurgical coal resources include significant quantities at the higher grades traditionally supplied by Russia, and exports to the EU are expected to remain healthy in the near-term.

US metallurgical coal exports are generally high-cost, but remain profitable for the time being. Over the outlook period, US exports are expected to edge back as prices fall and marginal or cost-sensitive exporters withdraw from the seaborne market.

Figure 5.3: Metallurgical coal exports



Notes: f forecast s estimate
Source: IEA (2023); Department of Industry, Science and Resources (2023)

Mongolian exports have increased following expansion of rail capacity

Mongolian coal exports have benefited from a Chinese-directed infrastructure program and the completion of three substantial railway lines. These lines have made Mongolian coal exports (to China) much more scalable and efficient, reducing costs and expanding capacity.

The easing of COVID-19 disruptions has also helped Mongolian exporters, who are expected to rapidly increase their export volumes between 2023 and 2025 (Figure 5.3).

Canadian exports are nearing their peak

Canadian output is expected to remain largely steady through the outlook period, with falling output at ageing mines offset by ramp-ups at Canada Coal's re-opened Grand Cache mine. The mine previously produced around 2 Mt annually, and is expected to match this level again by 2024.

Montem Resources has decided not to proceed with its proposed Tent Mountain metallurgical coal mine. The Albertan State Government previously proposed removing a ban on open cut coal mines across the Rockies, but withdrew its proposal as a result of protests and low public support. Tent Mountain was one of only four open cut mines capable of proceeding in the wake of that government decision. The mine would have produced around 1.1 Mt of metallurgical coal annually.

Exports from Mozambique are growing, supported by improved transport

In the early stages of the COVID pandemic, Mozambique's exports fell temporarily, as low prices forced much of the nation's high-cost production out of the market. Exports are forecast to recover to 7 Mt by 2024, supported 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 7 Mt of metallurgical coal (annually) is expected over the longer term.

Military escalations in the Black Sea region are affecting Russian exports

Russia's invasion of Ukraine has resulted in a dramatic decline in thermal coal exports — and a more modest easing in metallurgical coal output — from the region. The war has recently escalated around the Black Sea area, where significant quantities of seaborne coal have traditionally been loaded and shipped. The Ukrainian Government has designated several significant Russian Black Sea ports (including Novorossiisk, Taman and Tuapse) as 'war risk areas', causing insurance costs to surge and many vessels to cease service to the ports. This follows a similar Russian declaration targeting Ukrainian-controlled ports, which disrupted grain and coal shipments from the area. Russian shelling of ports in the area has stepped up in recent months and is likely to see metallurgical and thermal coal exports reach a new low in the September quarter.

The impact of sanctions and military escalations in coal export regions has been exacerbated by operational issues. These include a fire at Russia's Novorossiisk terminal which affected transport of cargo to bulk vessels.

Russia's efforts to circumvent sanctions and redirect coal to other markets have become increasingly hampered, and eastbound rail (to China) remains backlogged. Thermal coal exports have borne the brunt of the resulting export decline, but metallurgical coal exports are expected to face some weakness through and beyond the outlook period.

5.5 Prices

Metallurgical coal prices set to decline further

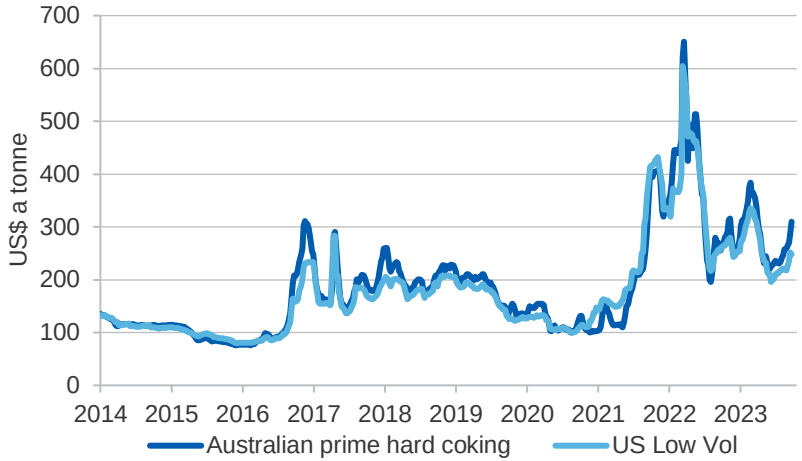
After falling through the March quarter, metallurgical coal prices stabilised in late April, with premium hard coking coal prices holding at around US$230 a tonne (Figure 5.4). Price pressures have edged up in recent weeks amidst escalating military tensions around the Black Sea region.

Most structural factors point to a softening outlook for growth in metallurgical coal demand. Global steelmaking is expected to lose some momentum, while supply from Australia is likely to grow following the end of the La Niña cycle. Chinese steelmaking remains subject to downside risks, and domestic prices for metallurgical coal in China have fallen recently. The removal of China's informal import restrictions on Australian coal will allow trade to reorient in more efficient patterns, though metallurgical coal shipments between the two countries remain nascent at the time of writing.

Prices may edge up following the passing of the latest monsoon season, which could result in a brief surge in imports to India. Structural expansion of steelmaking in the country may also add a long-term price push. The South Asian region has generally moved on from COVID-19 containment measures, making global steelmaking less vulnerable to Chinese policy than in the past.

On balance, steadier supply and weaker demand should result in a modest but noticeable decline in prices, though weather events and conflict around the Black Sea region add to upside risks. Prices for Australian metallurgical coal are forecast to decrease from US$264 a tonne in 2023 to around US$200 a tonne by 2025 (Figure 5.4). Risks around the price outlook are broadly balanced.

Figure 5.4: Metallurgical coal prices — Australian vs US, FOB



Notes: 'Low Vol' is low volatility coking coal.
Source: McCloskey (2023); Department of Industry, Science and Resources (2023)

5.6 Australia

Metallurgical coal export volumes are growing, offsetting lower prices

Australian metallurgical coal output steadied and then began to rise as persistent disruptions from weather and COVID finally eased (Figure 5.5). The new El Niño season is likely to bring about sustained dry conditions over the remainder of 2023, though summer storms remain a risk factor for ports and shipping.

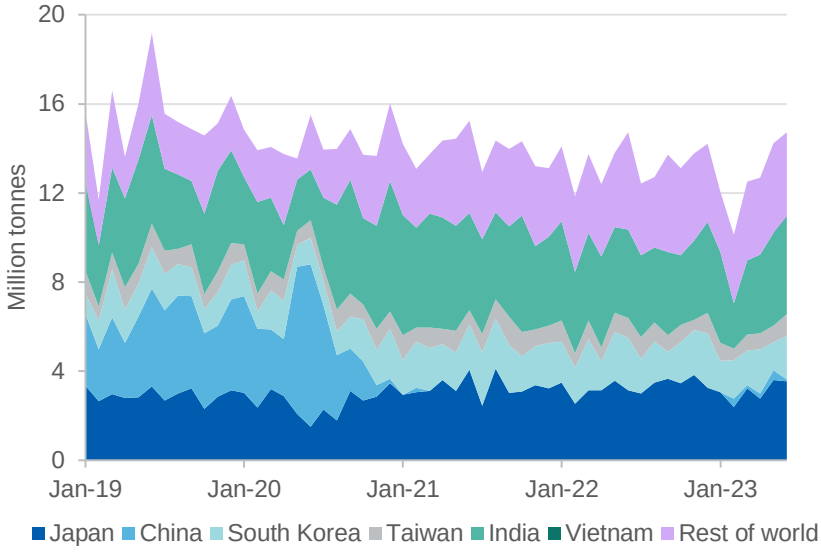
An emerging issue around labour shortages could constrain metallurgical coal production through the outlook period. Labour shortages are affecting mine sites but are also creating problems with rail shipment in parts of Queensland. The impact of this is likely to grow over time if not mitigated.

Metallurgical and thermal coal producers face growing constraints on availability of finance. Banks have increasingly sought to pivot away from all forms of coal in favour of renewables and related commodities. Hopes among some producers that metallurgical coal would be unaffected have not been entirely borne out. This is likely to place some further constraint on metallurgical coal investment over coming years.

Growth in production is nonetheless expected over the outlook period. Mine openings are set to exceed closures, with metallurgical coal exports on a stronger trajectory than thermal coal. This will position Australia to meet the demand of emerging steel markets in the region, including India.

New mines opening in the near future include the Maxwell and Vickery mines in NSW, and the Burton, North Goonyella, Hillalong, Wilton Fairhill and Olive Downs projects in Queensland. Sojitz Blue has also received approval for its Gregory Crinum open cut coal extension, which could now potentially run for another 50 years.

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



Source: ABS (2023) International Trade, Australia (trade tables subscription)

In February 2023, BHP announced plans to divest its Daunia and Blackwater metallurgical coal mines in Queensland, but has yet to announce a buyer.

Exports will be affected in the September quarter by industrial action at South32's Appin mine. Workers at the site (including site safety managers) voted to take the action following a breakdown in salary negotiations.

Global demand for Australian metallurgical coal remains ample, supported by the high quality of Australian product and by the removal of some (competing) Russian coal from global markets. China's trade impediments targeting Australian coal have ended, but exports to China remain marginal — around 200,000 tonnes of metallurgical coal were exported in July 2023, compared to a monthly average of 3.6 million tonnes during 2019.

Higher production in New South Wales and (especially) Queensland is expected to lift Australia's exports from a weather-affected 157 Mt in 2022–23 to 172 Mt by 2024–25. Metallurgical coal export earnings are expected to ease from $62 billion in 2022–23 to $41 billion by 2024–25 (Figure 5.6), with higher volumes partly offsetting falling prices.

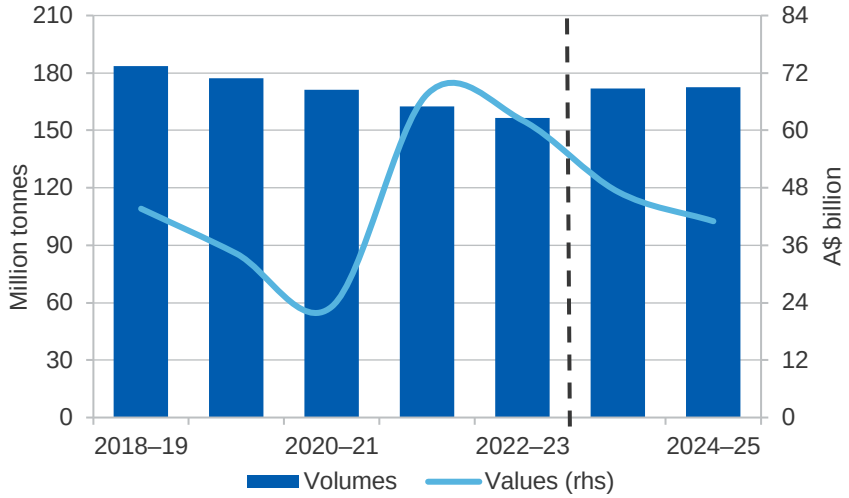
Coal exploration expenditure has increased

Australia's coal exploration expenditure rose to $80 million in the June quarter, growing 30% through the year (Figure 5.7). Record prices have encouraged exploration, but capital issues may be constraining growth to a degree. Spending remains well below 2011 levels, when a more modest price peak pushed exploration above $200 million for several quarters.

Revisions to the outlook for Australian metallurgical coal exports

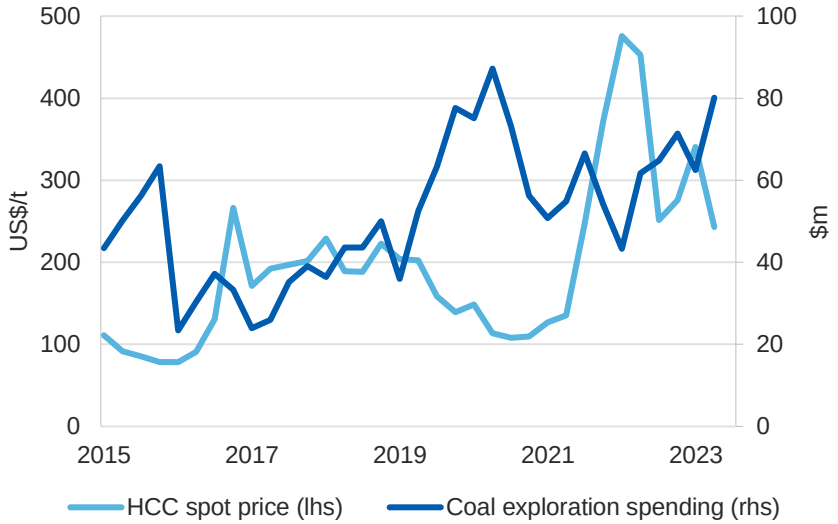
The earnings forecast for 2023–24 has been revised down by around $1 billion from the June 2023 REQ, as a downturn in global steelmaking eases price conditions. The forecast for 2024–25 is largely unchanged.

Figure 5.6: Australia's metallurgical coal exports



Source: ABS (2023) International Trade, Australia 5454.0; Department of Industry, Science and Resources (2023)

Figure 5.7: Australian coal exploration expenditure and prices



Source: ABS (2023); McCloskey (2023)

Table 5.1: World trade in metallurgical coal

	Unit	2022	2023[s]	2024[f]	2025[f]	Annual percentage change 2023[s]	2024[f]	2025[f]
World trade	Mt	312	299	310	316	-4.3	3.7	2.1
Metallurgical coal imports								
China	Mt	64	50	54	55	-21.3	6.9	2.2
India	Mt	58	70	73	73	20.1	4.7	0.0
Japan	Mt	43	41	41	41	-4.0	0.2	0.5
European Union 28	Mt	36	36	36	36	-0.2	0.0	0.0
South Korea	Mt	34	34	34	34	1.2	0.1	-1.8
Metallurgical coal exports								
Australia	Mt	161	163	172	174	1.4	5.4	1.5
United States	Mt	42	43	42	43	1.5	-1.2	2.3
Canada	Mt	28	28	26	26	-0.7	-6.0	-0.2
Russia	Mt	42	41	41	41	-2.8	0.0	0.0
Mongolia	Mt	14	16	18	19	14.0	13.8	6.1
Mozambique	Mt	4	4	4	4	6.7	0.0	0.0

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

Source: IEA (2023) Coal Information; IHS (2023); Department of Industry, Science and Resources (2023)

Table 5.2: Metallurgical coal outlook

World	Unit	2022	2023[s]	2024[f]	2025[f]	Annual percentage change 2023[s]	2024[f]	2025[f]
Contract prices[e]								
– nominal	US$/t	372	267	225	207	-28.0	-15.9	-8.1
– real[d]	US$/t	388	267	219	197	-31.1	-18.2	-10.0
Spot prices[g]								
– nominal	US$/t	364	264	223	205	-27.6	-15.4	-7.9
– real[d]	US$/t	380	264	217	196	-30.6	-17.7	-9.8
Australia	**Unit**	**2021–22**	**2022–23**	**2023–24[f]**	**2024–25[f]**	**2022–23**	**2023–24[f]**	**2024–25[f]**
Production	Mt	168	168	178	178	0.1	5.6	0.2
Export volume	Mt	163	157	172	172	-3.7	9.9	0.2
– nominal value	A$m	67,588	62,078	47,168	41,014	-8.2	-24.0	-13.0
– real value[i]	A$m	75,289	64,612	47,168	39,719	-14.2	-27.0	-15.8

Notes: **d** In 2023 US dollars. **e** Contract price assessment for high-quality hard coking coal. **i** In 2023–24 Australian dollars. **s** Estimate **f** Forecast. **g** Hard coking coal fob Australia East Coast ports. **s** Estimate.

Source: ABS (2023) International Trade in Goods and Services, Australia, 5368.0; Department of Industry, Science and Resources (2023)

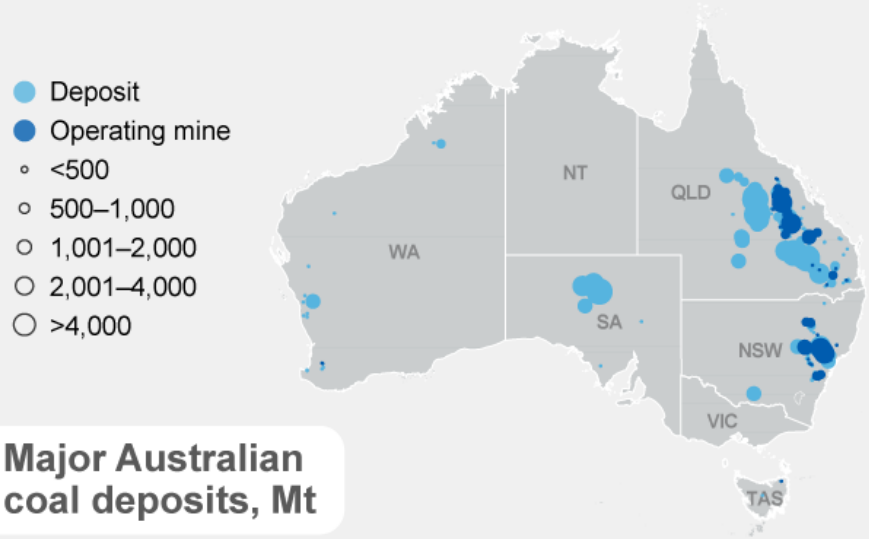
Thermal Coal

Australia's thermal coal sector

World's 2nd largest thermal coal **exporter** & **4th largest** black coal resource

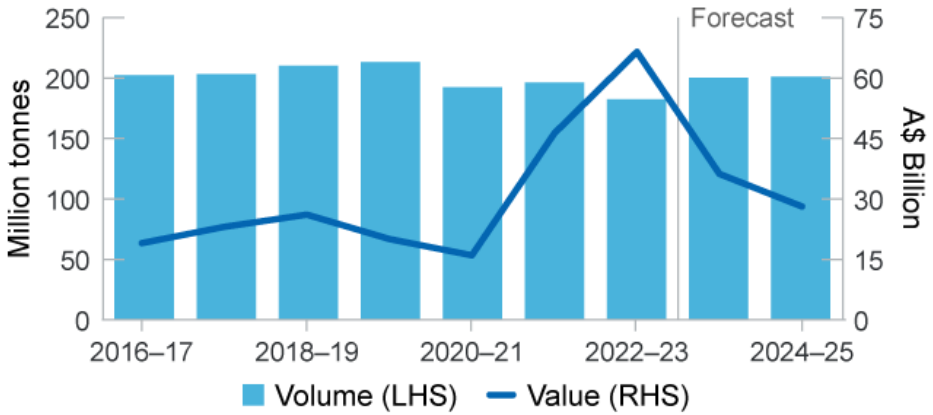
Strong growth in exports to **India, Japan and South Korea** in recent years

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



Major Australian coal deposits, Mt

Australian thermal coal exports



Outlook

Prices **well below** 2022 peaks as **supply conditions improve**

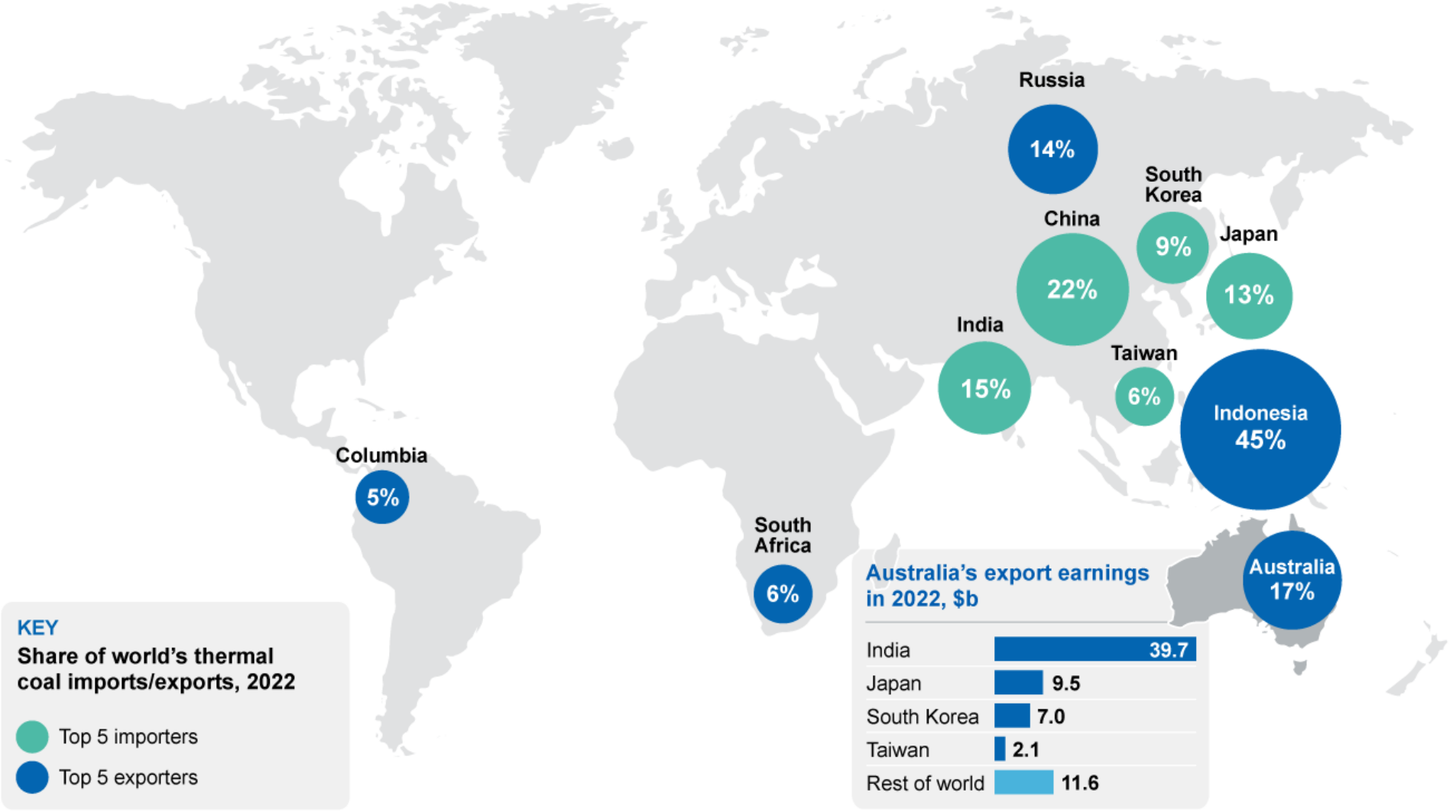
Earnings remain on a **downward trajectory**, as prices **continue to ease**

Volumes should lift as **weather disruptions ease** and **new mines** ramp up

Supply shortages are expected to drive **strong prices** over the longer term

SOURCE: GA; DISR; OCE

Thermal Coal TRADE MAP



SOURCE: IEA; ABS

6.1 Summary

- After an extraordinary spike in 2022, thermal coal prices fell back sharply in H1 2023, but have since stabilised, with prices for higher grade coal lifting slightly in recent weeks. As global supply recovers, the Newcastle benchmark price (6,000 kcal) is forecast to decline from almost US$180 a tonne over 2023, to around US$115 a tonne by 2025.
- A gradual recovery from recent supply outages is expected to see Australian thermal coal exports rise from 182 Mt in 2022–23 to 203 Mt by 2024–25 (see Australia section).
- As prices decline, export values are forecast to fall from a peak above $65 billion in 2022–23 to around $28 billion by 2024–25.

6.2 World trade

This year's Northern Hemisphere summer brought unusually intense heat across several highly populated countries and regions, resulting in higher thermal coal demand for generating power to cool dwellings/offices. In China, high temperatures through July and early August kept Chinese imports near the strong levels of early 2023, maintaining pressure on the seaborne coal market. Elsewhere in Asia, coal demand remains mixed, with India showing some decline from a peak in May.

Europe also experienced sustained higher-than-average temperatures over recent months, but large European gas reserves (and relatively low gas prices) kept coal demand reasonably contained. European nations built high coal stockpiles following Russia's invasion of Ukraine, and these stocks will likely reduce pressure on coal imports even if gas reserves fall.

European countries have made significant investments in new gas sources and renewable energy since the Russian invasion of Ukraine. New LNG terminals have been constructed at an extremely rapid pace, nuclear power targets and operational timetables have expanded, and government support has increased for renewable energy. A complete and sustained reorientation away from Russian gas may take a bit longer, and European coal use (especially in the industrial sector) may grow in the short-term if new energy sources prove to be volatile or short of requirements.

However, the likelihood is that the long-running European energy linkages to Russia will soon be obsolete.

Coal use across Europe remains locked into broad long-term decline. European countries committed to full phase-outs by 2030 include Finland, Denmark, France, the Netherlands, Italy, and Spain. The UK is expected to close its final coal plant by 2024, with coal capacity brought online briefly during the 2022–23 winter now set to be closed permanently.

With trends in China and Europe offsetting each other, overall thermal coal demand held up through the September quarter. However, coal supply has also firmed up in recent months. Congestion at Australian ports has largely cleared, and the end of the La Niña cycle has driven stronger exports from Australia and Indonesia. South African and Russian exports have edged back a bit amidst temporary transport delays and logistics problems.

With demand and supply relatively balanced, prices stabilized in June and July at around US$130 a tonne for Newcastle 6,000kcal thermal coal. Despite the sharp declines of late 2022 and early 2023, prices are still relatively high in historical terms. Some further modest easing in prices is expected over the coming quarters as Chinese demand softens with the change of seasons.

It is expected that existing mine capacity will be broadly sufficient to meet demand through the rest of the 2020s. After this, supply is expected to start declining structurally due to the relative lack of new thermal coal projects. The pace of decline on the demand side is less clear, with rises in demand within developing Asia offsetting falling use across most OECD nations. If global usage falls more slowly than global supply, prices will rise. This price rise could reduce the competitiveness of coal and help to bring usage more in line with supply. However, markets would also likely become more unpredictable and volatile while adjustments to supply and demand occur.

Uncertainties regarding long-term transition in coal markets will affect investment in coal supply during the immediate outlook period, adding an upward skew to prices. This skew may be exacerbated as ageing mines

become subject to higher maintenance costs for ageing equipment and capital. Underinvestment should not noticeably affect output during the outlook period, but this underinvestment could become 'baked in', adding to the risk of supply shortfalls and price spikes further out. Existing coal producers will benefit from these trends, but the overall stability of coal markets may depend on the ability of countries to reduce dependency on thermal coal by investing in other energy sources.

6.3 World imports

Global imports of thermal coal are on track to edge down by around 2.5% in 2023 as demand for seaborne coal from China declines. Increases in demand for India and Other Asia offer a partial offset.

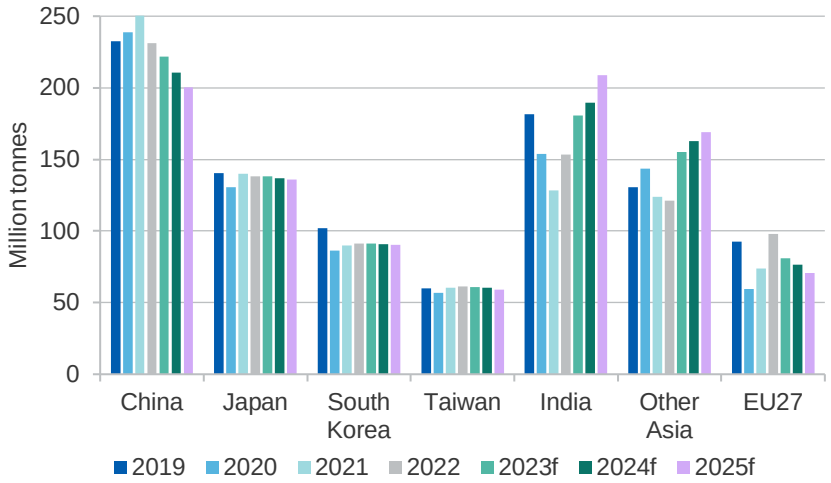
Chinese seaborne imports are declining as domestic production grows

Chinese thermal coal use remains strong despite slower than expected economic growth (Figures 6.1 and 6.2), but policy factors may weigh on coal use in the near-term. The Chinese Government remains committed to reducing coal imports and becoming more energy independent. China has invested heavily in nuclear power, renewables, and domestic coal production. Investment has also risen in energy transportation, including freight rail transport and coal-by-wire technology. These measures are expected to constrain thermal coal imports during the outlook period.

China's coal pipeline has proven resilient at a time when other Asian countries have curbed their coal expansions considerably. China retains more than 100GW of coal-fired power capacity under construction. However, much of this is replacement capacity for older and less efficient plants, and improved domestic supply is expected to keep pace with any additional coal needs. Coal imports thus remain on a declining path over the longer term, eventually becoming limited to niche industrial uses such as coal-to-liquid fuel production in coastal manufacturing hubs.

Chinese policy remains a significant variable. The need to reconcile China's ongoing coal plant constructions with its commitment to net zero emissions by 2060 could result in unpredictable policy pressures. This may add volatility to the outlook for thermal coal demand.

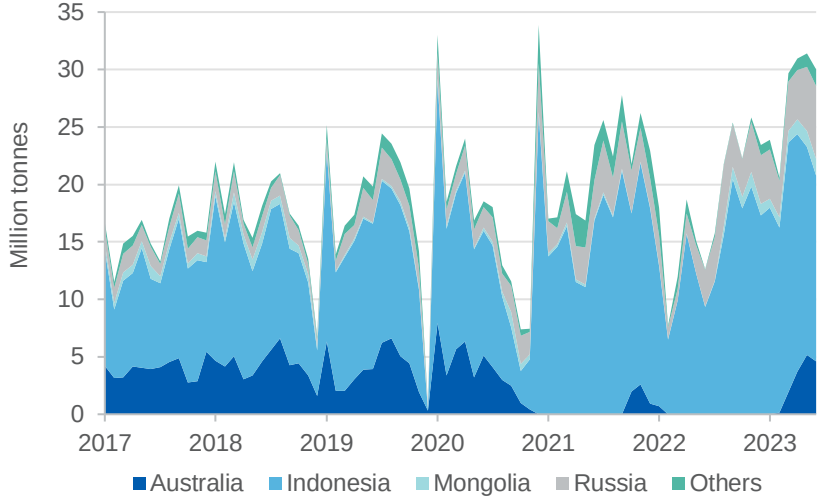
Figure 6.1: Thermal coal imports



Note: **e** Estimate **f** Forecast

Source: McCloskey (2023); IEA (2023) Coal Market Report; Department of Industry, Science and Resources (2023)

Figure 6.2: China's thermal coal imports, monthly



Source: McCloskey (2023)

Hong Kong continues to transition its energy use ahead of mainland China. Hong Kong's Castle Peak and Lamma coal-fired plants are being converted to gas-fired generation plants, with further conversions possible over coming years. Imports to Hong Kong have declined sharply since the outbreak of the COVID-19 pandemic and are expected to fall to negligible levels by 2030. Expertise and technology developed in this process could be exported to broader China to aid in meeting its 2060 net zero targets.

On balance, it is expected that weather conditions will continue to exert upward pressure on imports, though a recent softening in domestic prices suggests market conditions may be easing. Structural factors should result in declining imports from late 2023 out to 2025 and beyond. The combination of uncertain domestic demand and strengthening domestic supply is expected to reduce Chinese seaborne imports from 231 Mt in 2022 to 200 Mt by 2025 (Figure 6.1).

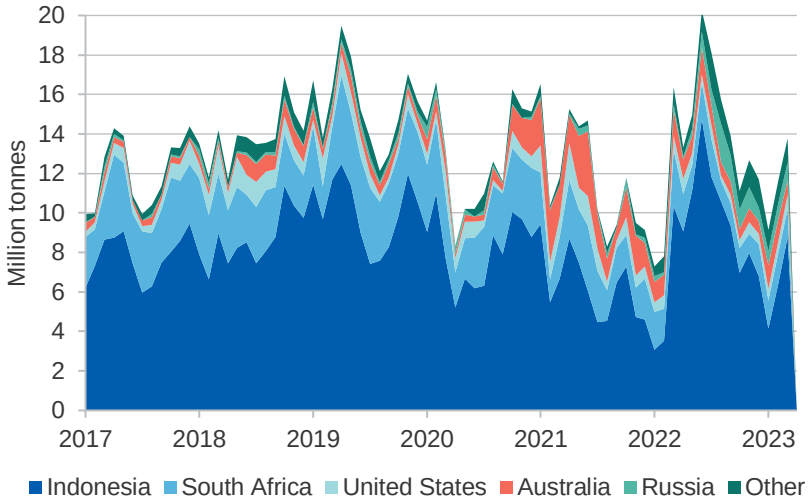
India's coal imports are rebounding as industrial and consumer use rises

The pace of recent thermal coal use has accelerated in India following the conclusion of COVID containment measures. India remains the most significant growth market for thermal coal, with a substantial rise in imports expected through the outlook period. This growth will be supported by rising industrial use and higher electricity requirements in the consumer sector as more users are connected to electricity grids. Higher use also reflects government mandates for blending at least 6% imported coal in thermal plants. The mandate was introduced following shortages in 2022 and has recently been extended from September 2023 to March 2024.

The Indian Government has sought to meet its coal requirements through increased domestic supply as it seeks to become more self-sufficient. A total of 87 coal blocks were auctioned in recent years to encourage more domestic mining. Auctions on a further 106 blocks commenced in March 2023, but the take-up rate is unclear at the time of writing.

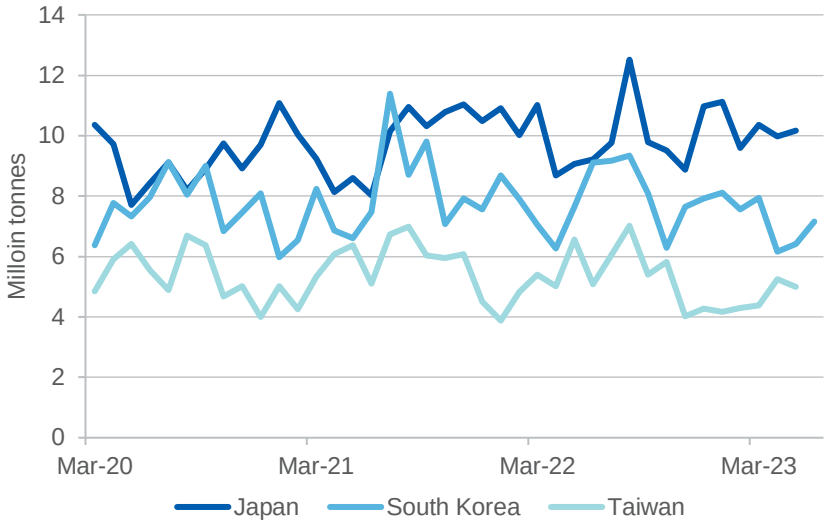
The Indian Government is also undertaking infrastructure upgrades to support domestic production. These include upgrades of the country's freight rail network, with much of this new capacity completed by September 2023.

Figure 6.3: India's thermal coal imports, monthly



Source: McCloskey (2023)

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



Source: McCloskey (2023)

Further expansions are due to commence from 2024 and 2025. Around 90,000 new railcars are expected to be added to India's rail network by 2025, though this capacity will be multipurpose.

Indian import needs have risen recently (Figure 6.3) and are expected to keep expanding through the outlook period, despite government efforts to grow its domestic supply. On balance, Indian imports are expected to rise from 153 Mt in 2022 to 209 Mt by 2025 (Figure 6.1). The pace of growth is expected to slow after 2025, with imports stabilising in the early 2030s and starting to fall a few years later.

Japan's coal imports are expected to remain strong in the short-term

Japan is expected to remain a significant thermal coal importer over the outlook period. The Japanese Government remains committed to its 2050 net zero targets but has recently pivoted its policy towards technologies to reduce coal-generated carbon emissions. These measures include ammonium co-firing and greater use of hydrogen storage, as well as broader research into carbon capture & storage technologies.

Previously announced plans to close 100 coal plants by 2030 remain in effect, but precise timetables and methods for energy substitution are not yet fully developed. Substitution of nuclear energy for coal is ongoing. Nuclear plants are being reconnected to the grid more rapidly, and the Japanese Government has announced new plans to extend the operating life of its nuclear fleet beyond 60 years.

Japan's energy sanctions on Russia could add to the difficulty of broader energy transition. Imports from Russia to Japan have dwindled sharply in recent months, with the deficit partly made up through imports from Australia, which grew by 17% in June.

Japanese coal imports remain solid (Figure 6.4) but are expected to decline slightly through the outlook period, with nuclear reconnections and renewable energy deployments making modest inroads into coal use. The pace of decline may pick up further towards the end of the 2020s as policy measures aimed at reducing coal use take full effect.

Taiwan's imports are falling as policy measures ramp up

Taiwan has well-developed plans for its transition away from thermal coal. The Taiwanese Government has pressed for proposed coal-fired power plants and upgrades to be cancelled, and has released an energy plan which would reduce coal from around 42% of generation to 30% by 2025.

Coal imports to Taiwan are expected to decline steadily through the outlook period, reaching zero by the 2030s.Taiwanese coal plants are mostly more than 30 years old, and new coal plants are not expected to progress at a scale to match closures.

South Korean coal imports have steadied

South Korea's latest energy plans include proposals to cut coal-fired power generation by around half (to 22%) by 2030, eliminating it entirely by 2050. In contrast, nuclear generation, previously targeted for phase-down, is now set to be phased up from 27% to 30% of total generation. The South Korean Government is also seeking to substitute for imported coal with gas and renewables.

Recent spikes in gas prices have slightly complicated the transition from coal, but all previously announced policy measures remain in effect. South Korea retains plans to adjust some coal plants to use ammonia co-firing, which will reduce coal use while retaining generation capacity.

South Korean thermal coal imports remain solid (Figure 6.4), but policy pressure is expected to constrain imports over the outlook period. Imports are expected to hold at around 90 million tonnes annually through to 2025.

South and South East Asian imports are set to peak around 2030

Asian countries represent the last significant growth spots for thermal coal. The pipeline of proposed coal plant capacity across South Asia fell by 63% between 2015 and 2021, but a sizeable number of plants remain under construction. Nations in the region are estimated to have collectively imported about 155 Mt of thermal coal in 2022, and this is expected to rise above 175 Mt by 2024 (Figure 6.5). Some South Asian countries may not see their demand peak until 2040.

No further coal power is expected to be built in Malaysia, but the scale and newness of its existing plants should see coal use and imports hold steady through the outlook period. Malaysia has large, modern coal plants, whose competitiveness improved during the 2022 spike in global gas prices.

A decline in imports to Malaysia is likely over the medium term. Prospects are growing that some coal capacity could close ahead of its previously expected end-of-life period. Tenaga Nasional Berhad, Malaysia's primary electric utility, has announced plans to reduce its coal capacity by 50% by 2035, which would require plant closures ahead of schedule. It should also begin to exert pressure on coal imports from the early 2030s.

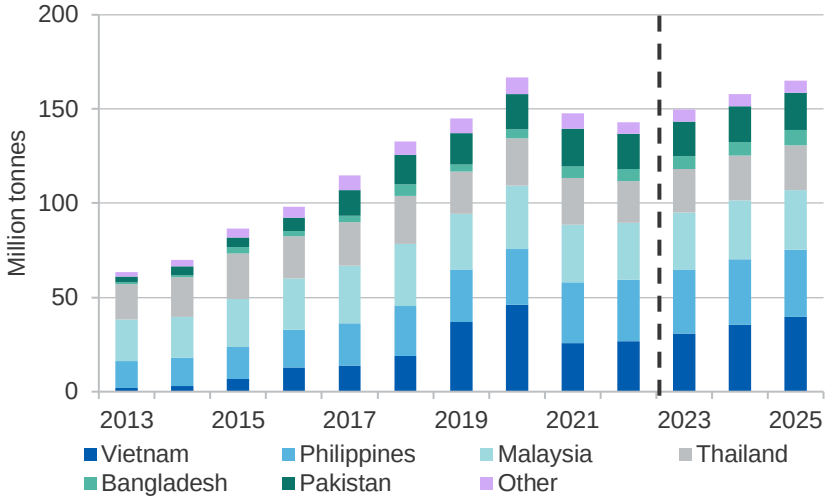
The Philippines is expected to deploy significant new coal power, with coal use forecast to double by its estimated peak around 2030. Coal plant constructions were disrupted by the COVID-19 pandemic, but these disruptions are expected to pass.

Imports to Thailand are expected to grow through the outlook period, supported by the country's industrial output goals. However, prospects for remaining coal plant constructions remain uncertain. Government proposals initially called for cancellation of all proposed plants and a full substitution with gas, but it now appears that two coal plants could be built as a replacement for older lignite burning plants in the country's north. At least two other coal projects remain in the pipeline for future development but are not expected to ultimately proceed.

Import growth is expected to slow after 2025, with official plans to reduce coal-fired power generation (from 20% of total generation in 2018 to 10% by 2030) still in effect. This final 10% is expected to primarily serve industrial users who require highly reliable supply.

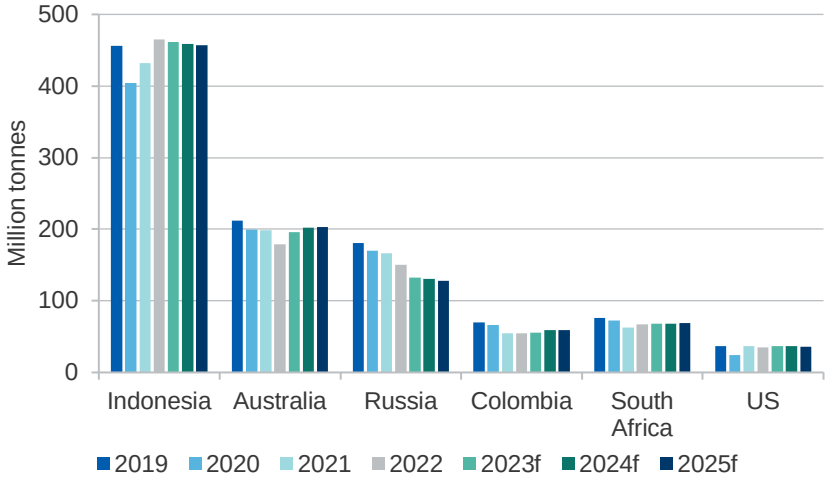
Vietnamese coal imports are expected to grow rapidly through the outlook period. Vietnam was a net exporter of coal until 2015 but has pivoted to become a significant net importer in recent years. Coal plants constructed in the country have generally been designed to use Indonesian output, and Indonesian coal is expected to support most of the growth in overall Vietnamese coal imports over the next few years.

Figure 6.5: South and South-East Asia thermal coal imports



Source: IEA (2023) Coal Information; Department of Industry, Science and Resources (2023); McCloskey (2023)

Figure 6.6: Thermal coal exports



Notes: **e** Estimate **f** Forecast.
Source: McCloskey (2023); IEA (2023) Coal Information; ABS (2023); Department of Industry, Science and Resources (2023)

There is a prospect that coal plant construction in Vietnam could peak earlier (and at a lower level) than previously expected. This reflects the impact of COVID disruptions and lack of access to funding, which have seen proposed plants falling behind schedule. Vietnam's energy plan calls for an increase of 40% in coal-fired power generation capacity by 2030. The nation could still bring about 10GW of coal capacity online, but the risk of falling short of this target has risen significantly over recent quarters.

Some import growth is still expected through the outlook period, but with coal-fired power plant constructions becoming increasingly stalled, it is likely that a larger share of growth in the electricity generation sector after 2025 will be made up of gas and renewables.

6.4 World exports

Exports from Australia are expected to grow in 2023 as floods and rainfall ease with the passing of La Niña. However, exports elsewhere may be constrained by weather issues (affecting Indonesia and the US) and military conflict (affecting Russia).

Indonesia's exports are facing a new cycle of weather disruptions

Weather conditions have improved for some Indonesian miners, with the end of the La Niña cycle resulting in fewer operational disruptions. But the emerging El Niño is bringing new difficulties, with dry weather causing shallower drafts and river transport disruptions in Central and East Kalimantan. A slowdown in loading and transportation backlogged about 50 vessels at the Muara Berau anchorage. Loss of depth in the Kedang Kelapa River is affecting coal miners in surrounding areas, and falling water levels are also affecting barging on the Barito and Mahakam Rivers.

Indonesian output is expected to remain slightly constrained in the short-term, with El Niño conditions likely to persist for 3-4 quarters. Exports over the outlook period are expected to edge back from 465 Mt in 2022 to 457 Mt by 2025. (Figure 6.6). Shifting demand patterns have seen prices for lower grade Indonesian coal falling relative to prices for higher grades. This is likely to curb revenue for Indonesia's coal sector, with export earnings falling through and beyond the outlook period.

The war in Ukraine has placed Russian exports under additional pressure

Russian exports — already affected by sanctions following the country's invasion of Ukraine — faced further trouble during the September quarter. The conflict zone has recently expanded to encompass a larger area of land bordering the Black Sea, with military skirmishes shutting down activity at some ports. At other ports, insurance costs have increased, and some shipping companies have pulled out due to risk.

Alternative routes, such as rail to the east, remain constrained by backlogs and prioritization of other cargoes. Efforts to expand shipment capacity to India and China have been hampered by a lack of essential equipment.

Russian suppliers are starting to face cost issues. Sanctions have reduced Russian coal prices to under US$100 a tonne (and even under US$90 a tonne at some points). The recent sustained weakening in the value of the Ruble adds to the cost to replace equipment, adding further to the limitations imposed by sanctions. The combined effect of lower prices and higher costs is forcing higher cost Russian producers out of the thermal coal market.

Russia is also dealing with some new weather hazards. A dam breach in Siberia resulted in water damage to parts of the Baikal-Amur Mainline — a significant freight rail line used to service Pacific markets. There is no prospect for coal to be transported via an alternative line given pre-existing rail backlogs and capacity shortages.

Hampered by sanctions, lower prices, and rising costs, Russian exports are expected to fall from an already low 151 Mt in 2022 to 128 Mt by 2025.

US exports remain hampered by weather conditions and high costs

US thermal coal exports remain relatively strong, supported by higher demand from the Middle East and Europe, and by retirements among some domestic coal plants. Units set to retire include AES Hawaii, Barry unit 5, and the Guayama Puerto Rico plant.

Weather and infrastructure problems continue to hamper US efforts to capitalise on recent high coal prices. In recent months, these disruptions

have included a new wave of flooding, which blocked interstate road transport to the Long Beach export terminal.

Structural problems with US coal (its high production cost, moderate quality and long distance from ports) are likely to reassert their influence in the absence of high prices, bringing exports down slightly despite a likely improvement in weather conditions.

A major Colombian port has declared force majeure

Colombia's Puerto Bolivar coal terminal has declared 'force majeure' following a string of recent protests which blocked the feeder rail line connecting the port to Glencore's Cerrejón mine. Seven vessels with 900,000 tonnes of capacity are now sitting at the terminal waiting to be loaded. The Cerrejón mine has regularly faced protests from the traditional owners of the land on which the mine operates, with a surge in protest activity significantly reducing output over the last twelve months.

Although protests at the site are likely to persist, broader weather disruptions appear to be easing following the end of the La Niña cycle. Rain previously blocked the largest rail lines (at Cerrejón and Fenoco), but this is now mostly resolved. Exports are expected to partially recover through the rest of 2023 and 2024. However, with some mines now permanently closed and others disrupted, it is not expected that Colombia will reach its pre-COVID export levels.

South African exports are facing cost pressures

Lower prices have begun to affect higher-cost coal producers in South Africa, resulting in less usage of the more expensive forms of transportation. Coal truck volumes to South African ports were down by over 30% in July relative to January 2023. Rail transport is largely unaffected, but use of rail is generally dominated by the nation's larger/wealthier mining companies.

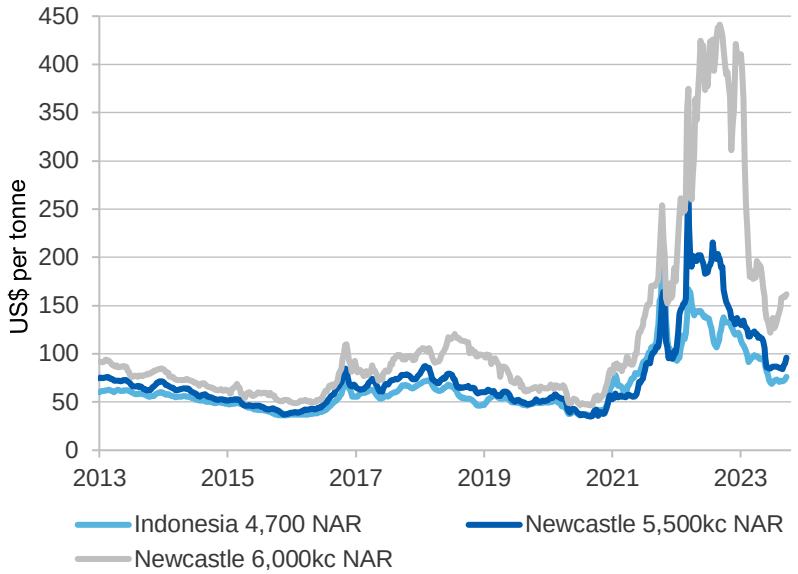
South Africa continues to press on with transportation upgrades, seeking new equipment from China to upgrade supply chains and terminals. This is not expected to increase exports in the near future, but supply could be pushed up beyond the outlook period. South African exports are forecast to hold at just under 70 Mt over the next two years.

6.5 Prices

Prices have stabilised following a sustained decline

Thermal coal prices fell sharply through the first half of 2023 but have held generally steady from June, with a rise in recent weeks (Figure 6.7). Price growth in the second half of 2023 is possible, with recent growth in gas prices improving the competitiveness of thermal coal, particularly in the Asian region. The northern winter could also add an upside to thermal coal demand towards the end of 2023, though inventories (especially in Europe) remain strong. Most factors point to a decline in prices after 2023. Supply has not yet fully recovered from La Niña disruptions, and there is capacity to bring additional supply into markets over coming months.

Figure 6.7: Thermal coal prices — Australian vs Indonesian



Source: McCloskey (2023). NAR = Net as received.

The end of the Northern Hemisphere winter will likely place downward pressure on thermal coal demand from early 2024, and a rise in gas supply should reduce pressure on thermal coal markets from 2025.

However, prices are not expected to decline to 2019 levels. A range of structural price pressures are likely to linger and even intensify over time. Supply remains constrained by low capital availability, labour shortages, loss of Russian supply following the invasion of Ukraine, and rising global freight costs. High profits typically drive investment in extra production, but this relationship appears to be breaking down for thermal coal, with coal miners instead seeking to pay down debt, expand dividends, and engage in share buybacks.

The price differential between high and low-grade thermal coal has contracted in recent quarters (Figure 6.8) but is expected to grow again as demand for lower calorific thermal blends loses steam. Chinese demand pivoted towards lower grade Indonesian coal following the commencement of trade impediments targeting Australia. However, Chinese buyers are shifting back towards traditional mixes as trade resumes between the nations.

Price risks remain somewhat balanced. Thermal coal demand faces downside risks, with weaker Chinese recovery and a mild Northern Hemisphere winter potentially constraining coal use. However, weather disruptions and potential summer storms could impact on the supply side, potentially pushing prices up. Price risks remain on the upside over the longer term because structural decline in supply is likely to lead declines in demand. However, both supply and demand are expected to remain relatively steady and well-matched over the near-term part of the outlook period.

Coal prices are expected to converge towards costs in some producing nations over the outlook period, as prices edge down and capital and labour shortages push costs up. If costs rise significantly over coming years, this will effectively place another floor under coal prices.

The 6,000 kcal Newcastle coal price is expected to decline from just under US$180 a tonne over 2023 to around $US115 a tonne by 2025. This is still well above the 2019 average (of US$76 a tonne), and prices retain significant potential to vary in either direction.

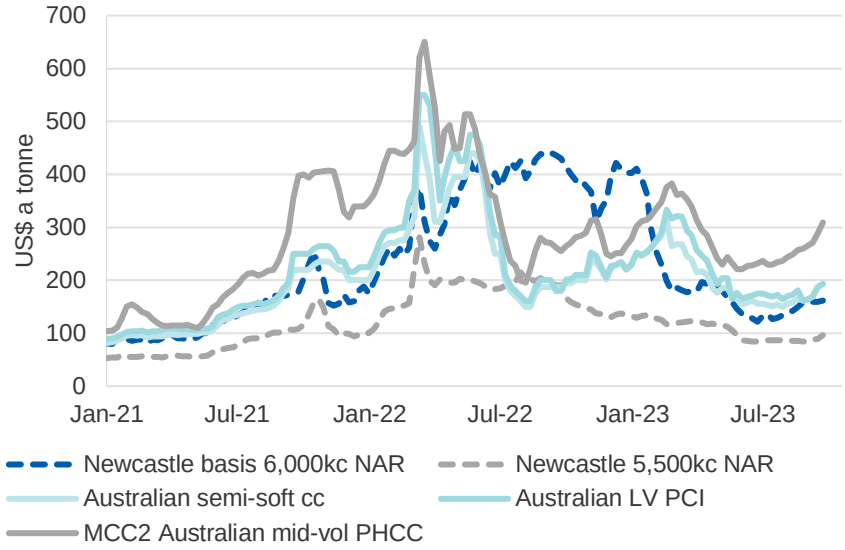
6.6 Australia

Australian thermal coal export volumes are set to rise

Australian thermal coal exports remain in high global demand, but supply disruptions have hampered capacity to meet it. These disruptions have included COVID-19 impacts, weather issues, and labour shortages. Labour issues are expected to grow over time, but thermal coal output is still expected to recover in the short-term as weather conditions improve.

Mine expansions and closures are expected to largely balance out over the outlook period. Whitehaven's Vickery project is expected to proceed soon, after the company stated that $150 million would be used to start up a small-scale version of the mine. Output will be limited to about 15% of that originally mooted, but the board retains an option to lift output to the original level (about 8 Mt annually) at a cost of about $1 billion. A decision on the capacity upgrade will likely be made by early 2024.

Figure 6.8: Prices for thermal and low-grade coking coals



Source: McCloskey (2023)

New Hope has announced that the stage 3 extension for its New Acland mine has been completed. Production at the site is expected to recommence in the September quarter following a $556 million investment by the company. Output at the mine is expected to ramp up steadily, reaching 5 Mt annually from 2025.

In Queensland, the Carmichael mine is now mostly ramped up, with shipments to eastern ports of India now occurring on a regular schedule. Around 7 million tonnes were shipped over the 12 months to March 2023, with Adani building towards a 12 million tonne annual target.

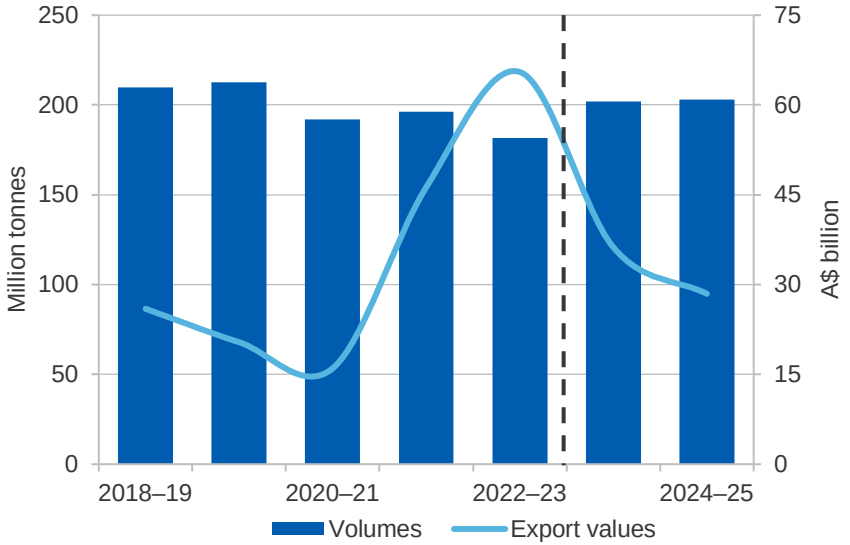
A number of thermal coal mines are scheduled to close over the coming years as deposits run short or become too costly to operate. These include Muswellbrook, Bloomfield and Springvale in NSW, with the Newlands mine in Queensland having already closed earlier in 2023.

Access to finance continues to constrain coal investment, with banks and some large, diversified miners shifting away from exposure to thermal coal markets. With prices now lower, other forms of finance could also withdraw, constraining capital spending for the thermal coal sector. This lack of new investment could see thermal coal output/exports start to fall beyond the outlook period, though the exact rate of decline is unclear.

The flow of thermal coal exports to China continues to rise following the removal of informal trade restrictions imposed by the Chinese Government. Exports to China grew from nil in December 2022 to 6.4 Mt by June 2023, exceeding the average monthly level of 2019 (4.2 million tonnes). In value terms, thermal coal exports to China exceeded $1 billion in June, marking a new record. (Japan — traditionally the largest export market for Australian thermal coal — was pushed to second place in June.) This rapid growth may start to ease over coming months in line with broader Chinese coal usage.

On balance, it is expected that export volumes will grow through the outlook (Figure 6.9) as weather conditions improve and output ramps up at several mines. Thermal coal exports are forecast to rise from 182 Mt in 2022–23 to 203 Mt by 2024–25. Ebbing prices are expected to lead to a decline in export values from $65 billion in 2022–23 to $28 billion by 2024–25.

Figure 6.9: Australia's thermal coal exports



Source: ABS (2023); Department of Industry, Science and Resources (2023)

Revisions to the outlook for Australian thermal coal exports

The forecast for export earnings has been revised down by around $2 billion in 2023–24 and 2024–25 from the June REQ. The results reflect a slight weakening in global demand conditions flowing through to lower prices over the outlook period.

Table 6.1: World trade in thermal coal

	Unit	2022	2023[s]	2024[f]	2025[f]	Annual percentage change 2023[s]	2024[f]	2025[f]
World trade	Mt	1,043	1,017	1,019	1,026	-2.5	0.1	0.7
Thermal coal imports								
Asia	Mt	796	849	851	863	6.6	0.3	1.4
China	Mt	231	222	210	200	-3.9	-5.2	-4.8
India	Mt	153	181	190	209	17.8	4.9	10.0
Japan	Mt	138	138	137	136	0.0	-0.9	-0.8
South Korea	Mt	91	91	91	90	0.0	-0.5	-0.5
Taiwan	Mt	61	61	60	59	0.0	-1.1	-2.5
Thermal coal exports								
Indonesia	Mt	465	462	459	457	-0.7	-0.5	-0.4
Australia	Mt	179	196	202	203	9.5	3.5	0.4
Russia	Mt	151	133	130	128	-12.0	-1.7	-1.5
Colombia	Mt	54	56	59	59	2.7	5.4	0.0
South Africa	Mt	67	68	68	69	1.5	-0.6	1.3
United States	Mt	35	36	36	36	4.6	0.1	-0.6

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

Source: International Energy Agency (2023); IHS Markit (2023); Department of Industry, Science and Resources (2023)

Table 6.2: Thermal coal outlook

						Annual percentage change		
World	**Unit**	**2022**	**2023[s]**	**2024[f]**	**2025[f]**	**2023[s]**	**2024[f]**	**2025[f]**
Contract prices[b]								
– nominal	US$/t	395	200	160	132	-49.4	-20.0	-17.6
– real[c]	US$/t	410	200	156	126	-51.2	-22.1	-19.3
Spot prices[d]								
– nominal	US$/t	359	176	135	115	-51.0	-23.1	-15.1
– real[e]	US$/t	375	176	132	109	-53.1	-25.2	-16.8
Australia	**Unit**	**2021–22**	**2022–23**	**2023–24 [f]**	**2024–25 [f]**	**2022–23**	**2023–24 [f]**	**2024–25 [f]**
Production	Mt	236	216	252	253	-8.6	16.8	0.4
Export volume	Mt	196	182	202	203	-7.4	11.2	0.5
– nominal value	A$m	46,258	65,511	36,230	28,463	41.6	-44.7	-21.4
– real value[h]	A$m	51,528	68,185	36,230	27,564	32.3	-46.9	-23.9

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 2023 US dollars; **f** Forecast; **h** In 2023–24 Australian dollars; **s** estimate

Source: ABS (2023) International Trade in Goods and Services, Australia, Cat. No. 5368.0; IHS (2023); NSW Coal Services (2023); Queensland Department of Natural Resources and Mines (2023); Company Reports; Department of Industry, Science and Resources (2023)

Gas

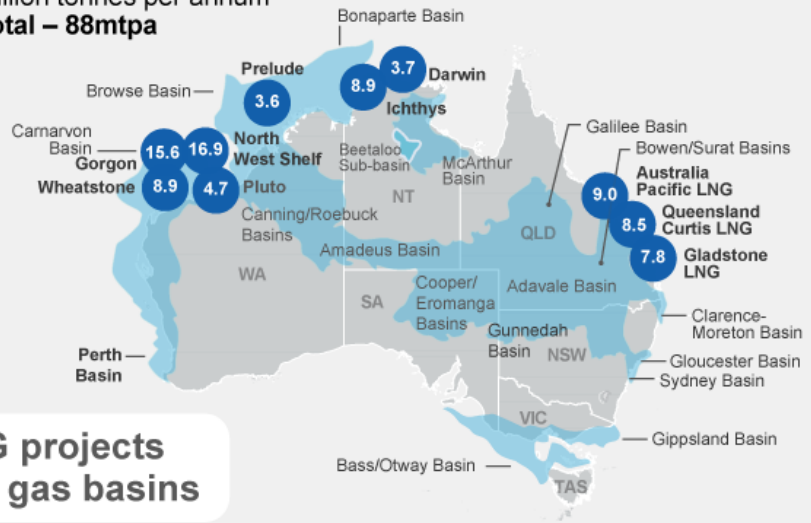
Australia's LNG sector

81m tonnes
exported in 2022-23, **valued at $93bn**

80%
of Australian LNG exports sold to **Japan, China and Korea**

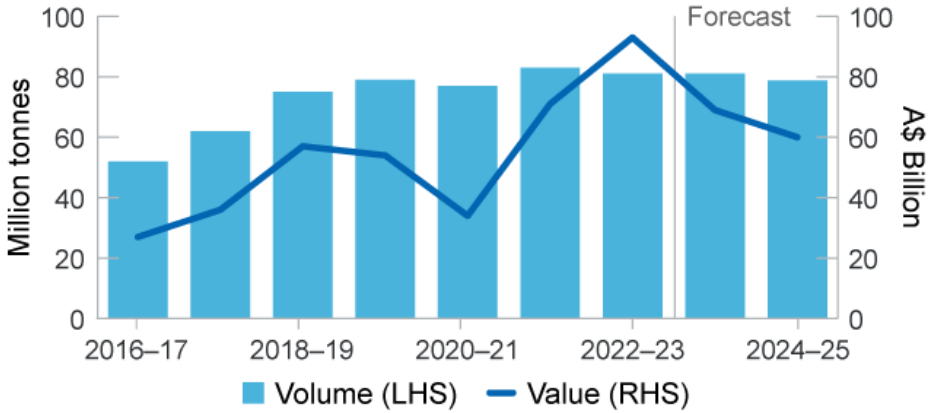
Around 3/4
sold on **long-term contracts**

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



LNG projects and gas basins

Australian LNG exports



Outlook

Earnings **set a record in 2022-23** due to volatile energy prices

Future **earnings to fall,** price pressures ease given high European storage inventories

Volumes facing downside risks due to industrial action

Expenditure on exploration **remains subdued**

SOURCE: IEA; GIIGNL; NexantECA; ABS; DISR; OCE

7.1 Summary

- Australia's LNG export revenues hit a record high of A$93 billion in 2022–23 but are forecast to ease to A$71 billion in 2023–24 as the spike in global energy prices set off by the Russia/Ukraine war unwinds.
- Asian LNG spot prices stabilised at around US$12 per MMBtu over the September quarter as European storage inventories neared capacity. Volatility increased marginally at the end of the quarter due to industrial action (since resolved) at Australian export facilities.
- Global LNG markets are likely to tighten over the December and March quarters as winter in the Northern Hemisphere raises gas demand for space heating.

7.2 World trade

Trade grows as European and South East Asian demand surges

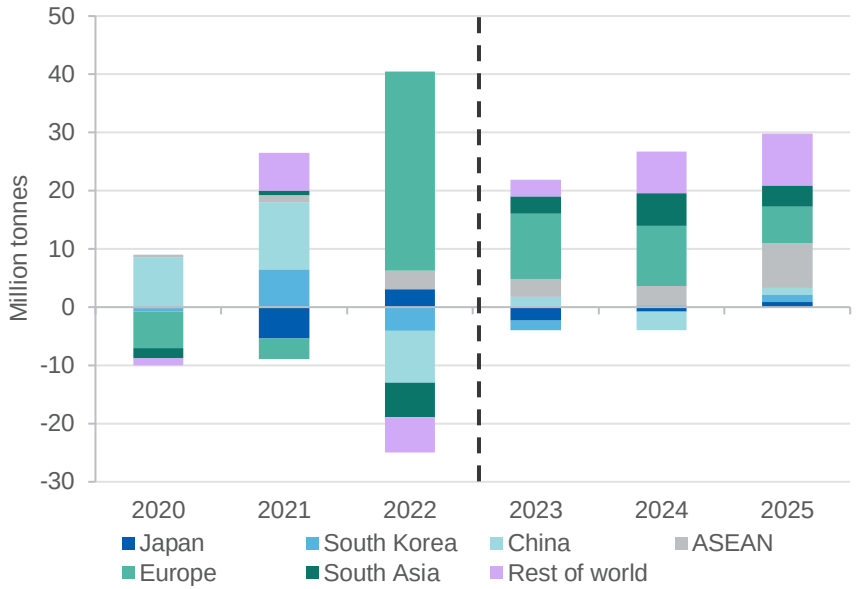
Global LNG trade is expected to grow rapidly by 13% or 52 million tonnes (Mt) over the next two years, reaching 455 Mt by 2024–25. While North-East Asia will remain the centre of gravity in the global LNG trade — importing 208 Mt (just under half of all global volumes) — it will no longer be the engine of global growth.

Europe is now forecast to be the driver of global demand over the outlook period, as the region continues to replace Russian pipeline gas with LNG. European imports are forecast to grow by 17 Mt to 140 Mt by 2025, while ASEAN, Australia's closest export market, will become the second largest source of demand growth. ASEAN's imports are forecast to rise by 11 Mt by 2025 — which will represent a doubling of the region's imports in just under three years (Figure 7.1).

Roughly half of the growth in the world LNG trade (26 Mt) over the forecast period will be supplied from newly commissioned US LNG facilities in the Gulf of Mexico, while Russia and Nigeria will contribute 9 Mt and 7 Mt, respectively (Figure 7.2). Critically, two new LNG facilities will be constructed by 2025 on the west coast of North America (in Canada and Mexico) whose distance from Northeast Asian markets will be comparable to that of Australian facilities (see Table 7.1). Beyond the outlook period, these new North American facilities could begin to erode Australia's market share in North-East Asia.

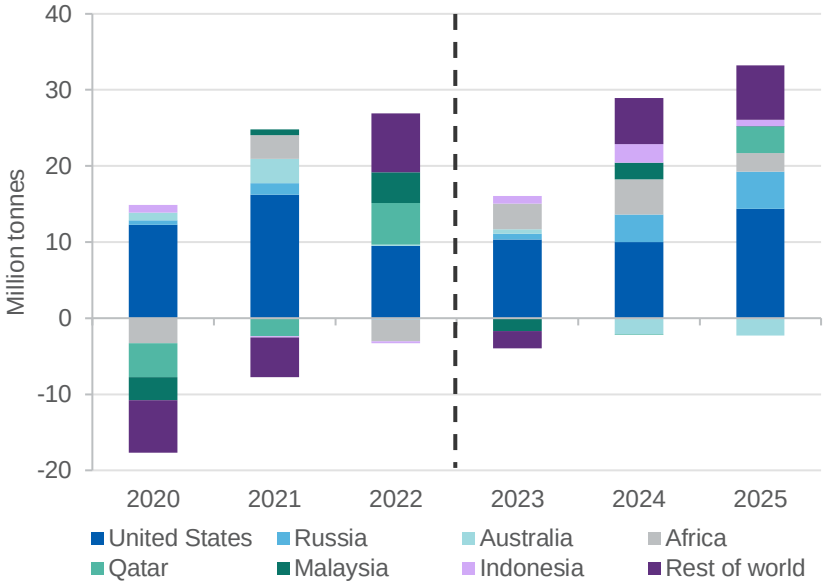
Over the short term, there is a high likelihood that European gas storage inventories will reach full capacity before the onset of the Northern Hemisphere winter. This could result in a (short-lived) LNG glut between the shoulder of the September and December 2023 quarters. However, Europe's storage inventories are only capable of meeting a third of the continent's winter gas demand, and the occurrence of El Niño conditions in the Pacific makes it more likely that Northern Europe will face a colder and drier winter. As such, LNG demand is likely to remain robust across the December and March quarters, which in turn will support healthy demand over the summer refilling period in 2024.

Figure 7.1: Global LNG demand growth forecasts, 2020–25



Notes: 2020, 2021 and 2022 figures based on historical data.
Source: Department of Industry, Science and Resources (2023), Nexant ECA (2023)

Figure 7.2: Global LNG supply growth forecasts, 2021–25



Notes: 2020, 2021 and 2022 figures based on historical data.
Source: Department of Industry, Science and Resources (2023); Nexant ECA (2023)

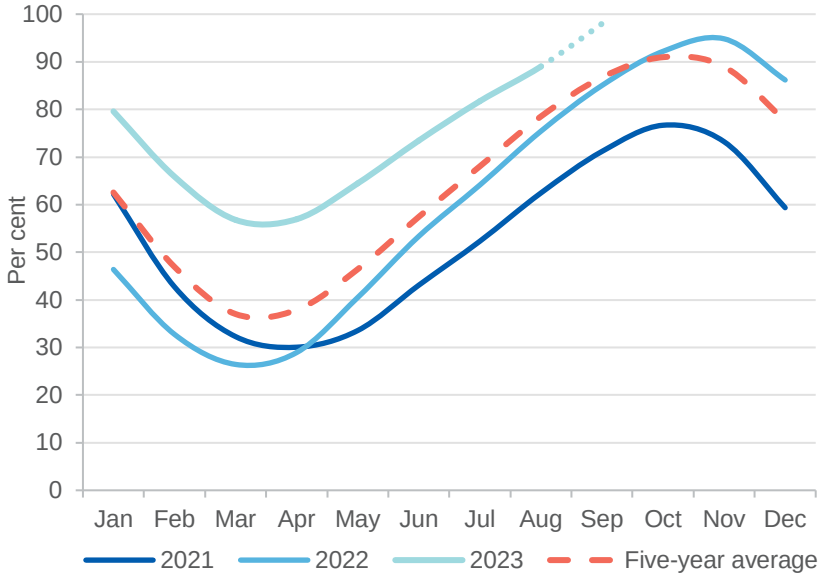
7.3 World imports

European imports break quarterly record as inventories approach capacity

European LNG imports broke an all-time record in the June quarter 2023, hitting 31 Mt. This represented 8% year-on-year growth in Europe's imports and can be largely attributed to the rapid build-out of regassification terminals since Russia's invasion of Ukraine.

The steady flow of LNG imports has helped buttress Europe's gas inventories, which were at 94% capacity as of 11 September (Figure 7.3). Inventories are now forecast to reach 100% by the beginning of the December quarter, assuming future injections are in line with the historical averages.

Figure 7.3: European storage inventories, 2021–23

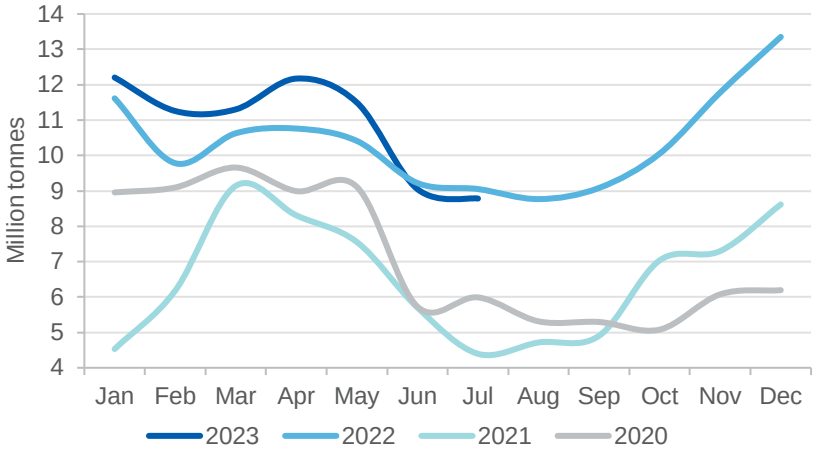


Note: Five-year average calculated between 2016 and 2020. Dotted blue line is a forecast.
Source: Bloomberg (2023); Eurostat (2023).

While Australia does not export significant volumes of LNG to Europe, Europe is a significant global consumer of LNG. Europe is Asia's primary competitor for flexible LNG cargoes, which means price pressures in the European market can be transmitted to Asian LNG markets through buyer competition and vice versa.

Over the two-year outlook period, Europe is forecast to capture the largest share of the world's growing LNG supply (Figure 7.1). The continent's imports are forecast to grow from 112 Mt in 2022 to 140 Mt by 2025 as Germany, Belgium, Italy, and Greece commission new LNG import facilities to offset the loss of Russian pipeline gas supply. Europe has had to rely heavily on LNG imports since Russia began curtailing the continent's pipeline gas supply in 2022 (see *Russia* section). European imports of LNG rose by 66% in 2022, from 68 Mt in 2021 to 112 Mt (Figure 7.4).

Figure 7.4: European LNG imports, 2020–23



Source: Kpler (2023)

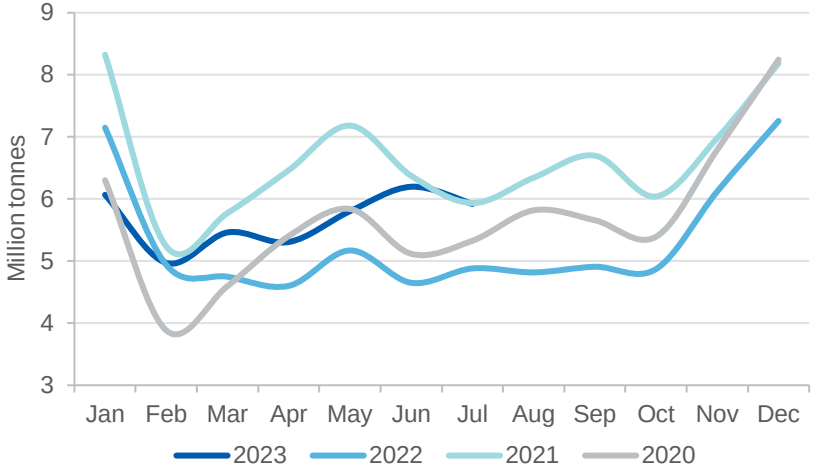
China's imports to remain flat out to 2025

Chinese LNG demand rebounded noticeably in the June quarter 2023 as global LNG prices began to ease. China's quarterly imports were 20% higher year-on-year at 17 Mt. Higher spot prices over the previous financial year had weighed on China's gas use for electricity generation and created strong incentives to on-sell surplus contracted volumes to European buyers (Figure 7.5).

In 2022–23, Australia exported an estimated 22 Mt of LNG to China, down 25% on 2021 22. However, the lower volumes were more than offset by higher energy prices, which pushed up Australia's China earnings to A$20 billion, only marginally below earnings in 2021 22 of A$21 billion. China is the second largest destination for Australian LNG (by volume and value), and Australia remains China's largest source of LNG, accounting for one-third of its LNG imports since 2020.

China's LNG demand is forecast to remain flat at 70 Mt over the two-year outlook period. A larger proportion of Chinese gas demand is likely to be serviced by pipeline imports from Russia and slower economic growth will weigh on gas demand more generally (See *China* box).

Figure 7.5: China's monthly LNG imports, 2020–2023



Source: Kpler (2023)

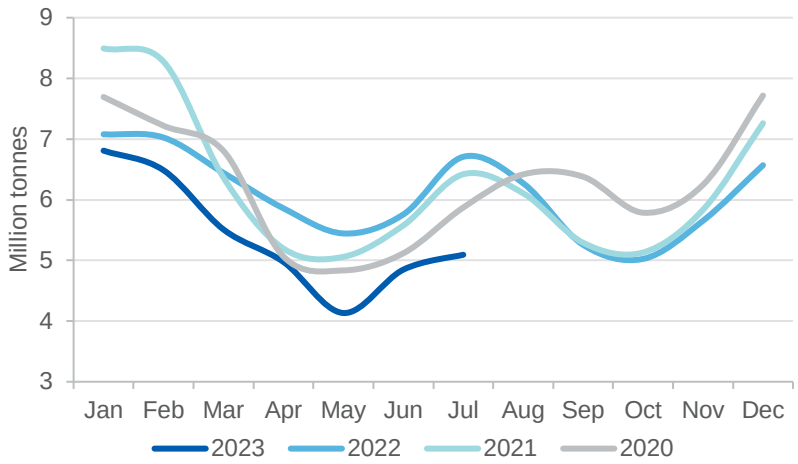
The increase in pipeline deliveries is the result of Russia ramping up flows along the Power of Siberia 1 pipeline. These flows are expected to peak at 24 billion cubic meters per year in 2024, with capacity on the pipeline having increased by 50% since 2022. The higher flows come off the back of Russia's successful commissioning of the Kovykta field in Irkutsk, Far Eastern Siberia.

Unlike other Asian countries, China is not wholly reliant on LNG for its gas needs. China has the world's seventh largest proven gas reserves, and the largest unconventional reserves after the US. China's geography also allows for the importation of natural gas via pipeline from large gas producers in Russia (to its north) and Central Asia (to its West).

Japan's LNG imports fall in June as nuclear power ramps up

Japanese LNG imports fell 18% year-on-year in the June 2023 quarter to 14 Mt (Figure 7.6). The result marks Japan's lowest quarterly LNG imports in over 15 years and can be largely attributed to the restart of several nuclear reactors which displaced gas-powered generation in Japan's electricity market (see *Uranium* chapter).

Figure 7.6: Japan's monthly LNG imports, 2020-2023



Source: Kpler (2023)

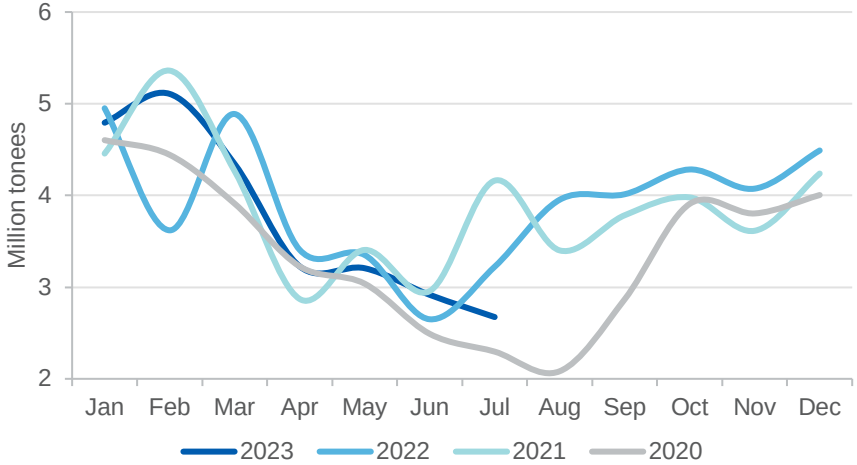
Despite the fall, Japan remains the largest destination for Australian LNG. In 2022–23, Australia exported an estimated 29 Mt of LNG to Japan worth about A$16 billion, roughly 37% of Australia's total LNG revenues. Australia is also Japan's largest source of LNG, accounting for 40% of LNG imports since 2020.

Japan's LNG imports are forecast to fall to 73 Mt in 2023 and remain at that level through to 2025 as gas-powered generators face increased competition from nuclear and coal-fired power. According to Japan's Ministry of Energy, Trade and Industry, the share of total electricity generation supplied by gas may fall from 38% in 2022 to 27% by 2030, with the share of nuclear power lifting from 6% to 22%.

South Korean imports likely to soften as nuclear power generation rises

South Korea's LNG imports were relatively stable, rising by 3.5 per cent year-on-year in the June quarter 2023 (Figure 7.7). Australia accounts for about 25% of South Korean LNG imports and has been its largest source of LNG since 2020. South Korean LNG demand is forecast to be relatively flat at 41 Mt annually out to 2025.

Figure 7.7: Korea's monthly LNG imports, 2020-2023



Source: Kpler (2023)

The Ministry of Trade, Industry and Energy is prioritising support for nuclear power and hydrogen. The 10th Basic Plan aims to lift nuclear energy's share of total power generation from 27% to 30% by building additional plants and extending the lifespan of existing plants. The plan also includes a proposal to lift hydrogen targets in co-fired gas power generation. This could lead to the share of LNG in the energy mix decreasing from 29% in 2021 to 23% by 2030.

ASEAN, led by Thailand, pivots to LNG

ASEAN is forecast to be the second fastest growing market for LNG after Europe. LNG import demand is forecast to rise by 63% from 19 Mt in 2023 to 30 Mt in 2025 (Figure 7.1). To date in 2023, Thailand has imported 1.9 Mt from Australia, setting a record for imports within a half-year period. Thailand's share of Australian LNG exports grew year-on-year from 2.9% to 5% in H1 2023, surpassing Singapore as the fifth largest destination for Australian LNG (Figures 7.8-9). The Philippines received its first LNG cargo in April, and Vietnam announced plans to boost renewable and LNG-powered gas generation capacity as part of its Power Development Plan 8.

Despite the increasingly important role of LNG in energy security, ASEAN countries have signalled their intention to continue expanding domestic supply through investment in exploration and upstream production. National oil companies, including Petronas (Malaysia), PTTEP (Thailand) and the Philippines' Department of Energy expect to accelerate the drilling of new production wells, with PTTEP's Montri Rawanchaikul stating that 'every single Btu of gas counts'.

Previously, Indonesia was reported to have been considering limiting LNG exports to safeguard domestic supply needs. Since then, the Coordinating Minister for Maritime Affairs and Investment, Luhut Binsar Pandjaitan, clarified there are no plans to ban LNG exports, but has not ruled out measures to prioritise domestic consumption.

Taiwan's imports to rise

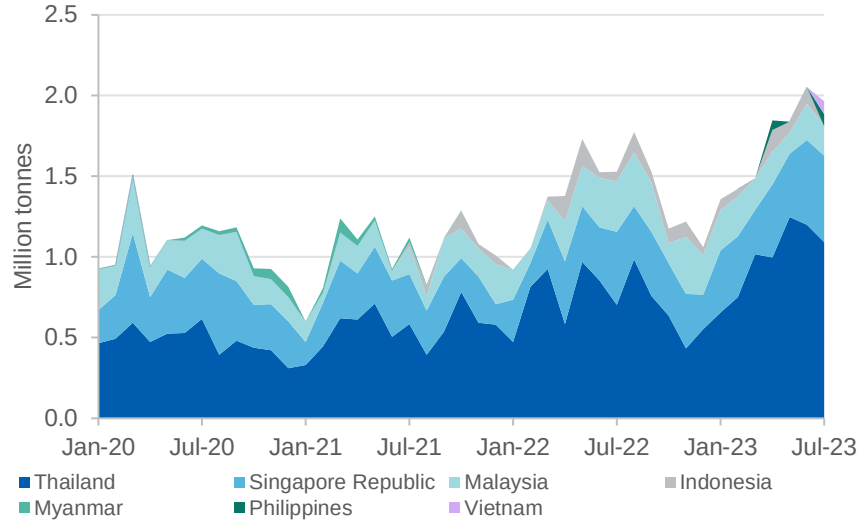
Taiwan's LNG imports rose by 27% year-on-year in H1 2023. Australia is Taiwan's largest supplier of LNG, accounting for over 40% of Taiwan's LNG supply. The majority of LNG is used for power generation and is forecast to rise to 23 Mt in 2025 as new gas-fired generation capacity replaces nuclear power under Taiwan's long-term decommissioning plan.

South Asia looking to secure more long-term supply

Only a marginal amount of South Asia's LNG is imported from Australia, with most delivered from the Gulf region due to its proximity — it takes approximately two days to ship a cargo of LNG from Ras Laffan in Qatar to Gujarat in India (see *Table 7.1*). South Asia's LNG demand is forecast to rise by 14% to 43 Mt by 2025, driven by gas-fired power generation.

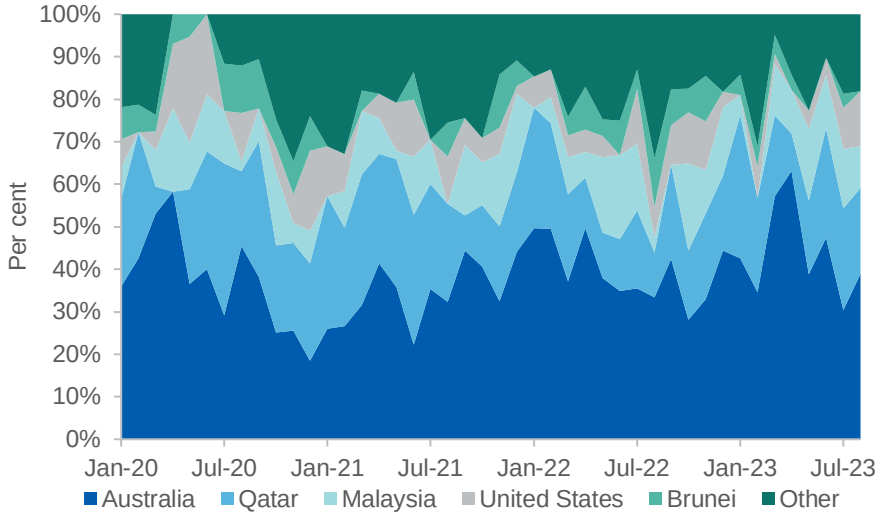
While the region's long-term demand for LNG is forecast to surge, current demand is outpacing the region's contracted LNG positions, lifting South Asia's reliance on the spot market. This is prompting buyers to sign long-term contracts. For example, the Indian Oil Corporation recently announced it had signed two long-term agreements with ADNOC LNG (UAE) for 1.2 Mtpa over 14 years, and TotalEnergies for 0.8 Mtpa over 12 years, both commencing in 2026. Pakistan and Bangladesh have also signed long-term agreements with Azerbaijan and Oman, respectively.

Figure 7.8: ASEAN LNG imports by destination, 2020–23



Source: Kpler (2023)

Figure 7.9: Monthly ASEAN LNG imports by source, 2020–23



Source: Kpler (2023)

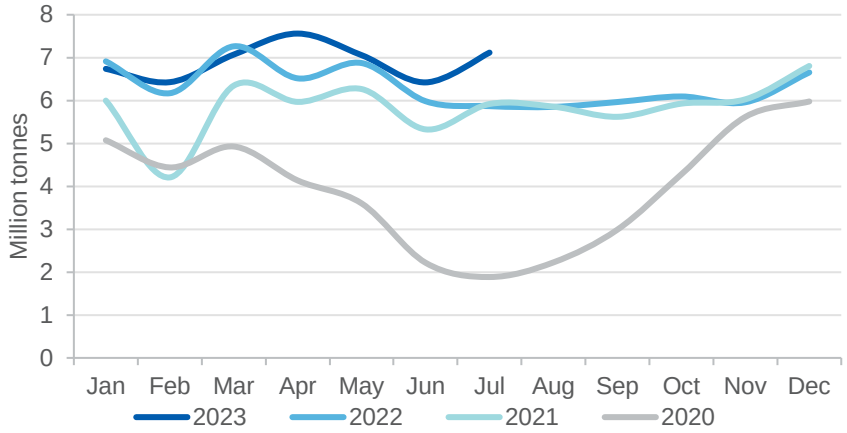
Despite the Indian government's stated intent to pivot the nation to a gas-based economy, the Ministry of Power's 2022–32 National Electricity Plan omits new investment in gas-fired power, instead opting to lift renewable and coal-fired capacity (see *Thermal coal* chapter). If price volatility for commodities and input materials persists, and if financial health remains poor, these issues could extend South Asia's heavy reliance on coal.

7.4 World exports

US takes place as the largest LNG exporter in 2023

US LNG exports remained high year-on-year at 41 Mt in H1 2023 (Figure 7.10), edging out Qatar and Australia as the top exporter. Over 80% of US LNG was exported to Europe in the year to the June quarter 2023, and the trend is expected to hold over the outlook period as Europe further cuts its reliance on Russian pipeline gas.

Figure 7.10: US LNG Exports, 2020–2023



Source: Kpler (2023)

Record levels of cargoes from US LNG export facilities were reported in the first six months of 2023, as Freeport LNG restarted production after an extended outage in 2022. US LNG exports are forecast to reach 85 Mt by the end of 2023 and 109 Mt over the outlook period, as Golden Pass, Plaquemines and Corpus Christi Stage 3 come online.

With Europe capturing a larger share of US LNG, exports to Asia decreased by 25% year-on-year (Figure 7.11). This trend is likely to persist given severe drought conditions affecting the Panama Canal — the major route for Asia-bound US LNG cargoes. With drought conditions impacting water levels in the Panama Canal, increased bottlenecks have led to diversions via the Cape of Good Hope, raising shipping costs and times to Asia (Table 7.1).

By the end of the outlook period, North American West Coast LNG projects are set to intensify competition in the Asia-Pacific market. The Canada and Saguaro Energía (Mexico Pacific) LNG projects (both with nameplate capacity of 28 Mt) are scheduled for completion by 2025. In contrast with American projects in the Gulf of Mexico, these projects will take advantage of significantly reduced shipping times and costs into Asian markets, avoiding transit risks associated with the Panama Canal (see Table 7.1). The prospects for growth, underpinned by the relatively low cost of production and comparable shipping times to Asia, will lift competition with Australian LNG by the end of the outlook period.

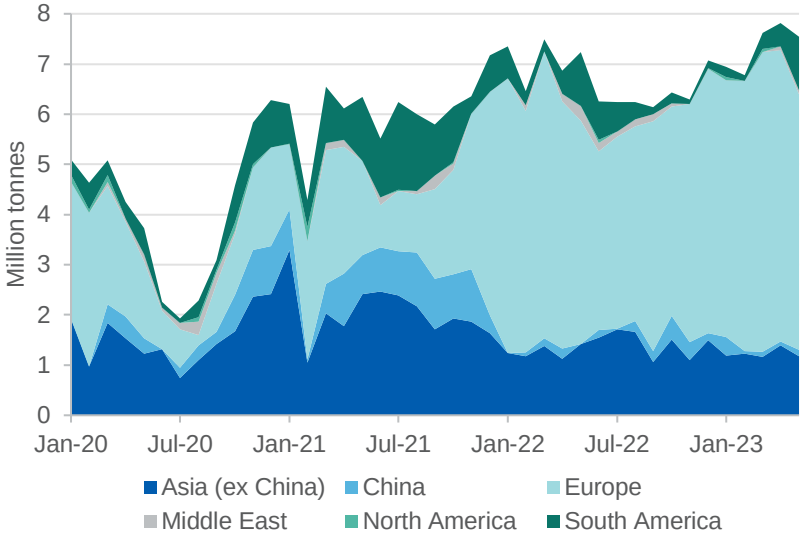
Table 7.1: Average LNG Shipping Duration, by LNG region

Days	China (Shanghai)	Japan (Tokyo)	Korea (Incheon)	India (Gujarat)
Western Australia	8	7	8	9
Queensland (Australia)	8	9	9	14
US Gulf Coast (via Panama Canal)	20	22	21	21
US Gulf Coast (via Cape of Good Hope)	36	34	35	24
American West Coast	10	9	9	19
Qatar (Ras Laffan)	14	12	13	2

Notes: Days shipping is based on a vessel at maximum speeds of 19.5 knots.

Source: WA Department of Jobs, Tourism, Science and Innovation based on information from Shipscene and the International Group of LNG Importers (GIIGNL). US Gulf Coast (via Cape of Good Hope) and North American West Coast estimated from S&P and Shell reports.

Figure 7.11: Monthly US LNG exports by destination, 2020–23



Source: US Energy Information Agency (2023)

Larger Qatari volumes on the horizon

The volume of Qatari exports has been stable at approximately 80 Mt for the last decade. 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.

In the coming years, Qatar is projected to expand its LNG export capacity by constructing six additional LNG trains at Ras Laffan. The new trains, fuelled with gas from Qatar's North Field East, are projected to raise Qatar's LNG exports from 79 Mt in 2023 to 105 Mt by 2026. Demand for Qatar's new volumes has been high, with Qatar's Energy Minister, Saad Bin Sherida Al-Kaabi, predicting that all the new volumes will be contracted out by the end of 2023.

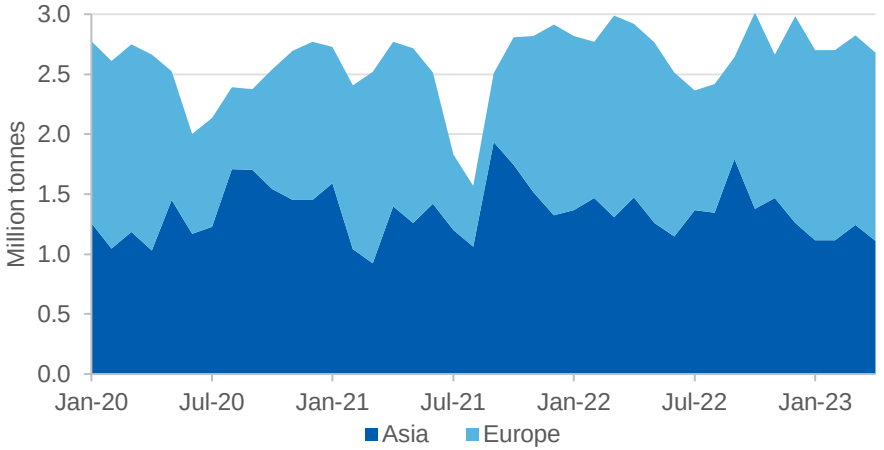
Russian gas stranded and unlikely to be redirected during outlook period

After Russia invaded Ukraine in February 2022, the nation began to repudiate its contractual obligations to supply Europe with pipeline natural gas. Russia has historically been the world's largest natural gas supplier, but a large portion of its gas is now stranded as infrastructure constraints prevent Russia from redirecting the gas elsewhere (see *China box*).

Russia is seeking to address some of these constraints over the next few years, and Russia's LNG exports are forecast to increase from 31 Mt in 2023 to 39 Mt in 2025 (Figure 7.1). Russia only has two LNG terminals: Yamal LNG, which supplies Europe, and Sakhalin LNG, which supplies Asia from Russia's far east (Figure 7.12). Russia is currently constructing a third large scale LNG facility, Arctic LNG-2, which is forecast to start producing by the end of the year.

Russia is also expected to commence construction of the Power of Siberia 2 pipeline in 2024. When the pipeline is completed after 2029, it will allow stranded Russian gas from Western Siberia to be sold into the Chinese market. But even if Russia can build the pipeline in the face of a depreciating currency and heavy sanctions on machinery and equipment, it will only be able to transport one-third of the volumes (around 50 bcm) previously exported via pipeline to Europe.

Figure 7.12 Russian LNG exports by destination, 2020–23



Notes: Russia has two LNG facilities: Yamal in Europe and Sakhalin in Asia. Russia can only economically redirect European imports to Asia during the Northern Hemisphere winter.
Source: Kpler (2023)

Risks to the Russian forecast remain skewed to the downside, due to the impact sanctions may have on Russia's ability to sustain existing LNG facilities — let alone construct new ones — given LNG facilities' reliance on sophisticated technology.

7.5 Prices

Prices moderated over the September quarter

Global LNG prices picked up mildly in the September quarter as countries rebuilt their gas storage inventories following a mild 2022-23 Northern Hemisphere winter. Prices averaged a relatively low US$12 per MMBtu over the quarter, compared to US$19 per MMBtu over the same period in 2022 (Figure 7.13).

Prices edged up to US$12 per MMBtu in July as summer cooling demand picked up in Northern Asia, before eventually subsiding back to the US$11 band in early August. However, unease over industrial action (since resolved) across two of Australia's largest LNG production facilities saw prices edge back up to US$13 per MMBtu over the month of September.

Asian LNG spot prices to remain volatile until 2025

LNG spot prices in Asia are forecast to rise to US$15/MMBtu over the December quarter as winter heating demand rises (Figure 7.13). However, there remains a distinct possibility that once European inventories are full, global markets will experience a temporary glut until the seasonal conditions change.

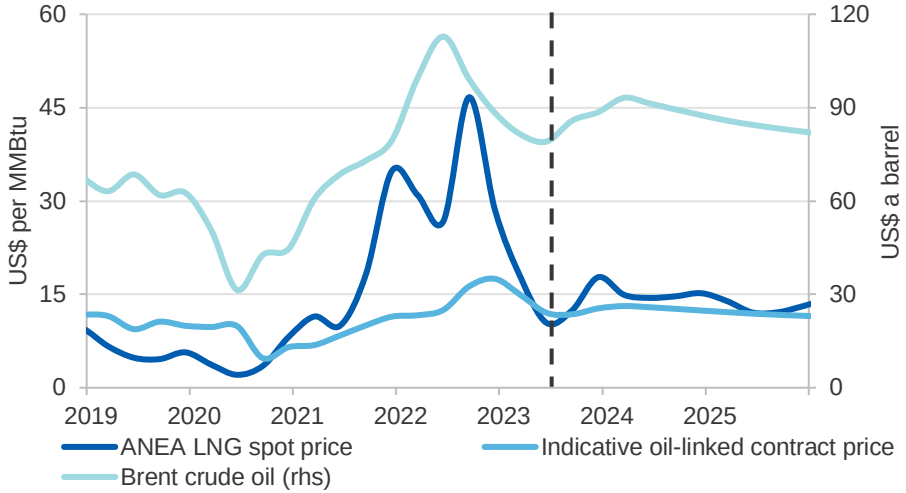
The outlook for prices beyond the December quarter remains uncertain and will largely be shaped by seasonal conditions. Northern Hemisphere winter gas demand will influence the level of European LNG imports needed to refill its inventories over 2024, which could increase competition for spot LNG cargoes in the Asian market. Futures contracts for the delivery of LNG into Asia over the December 2023 and March 2024 quarters are currently priced at US$15 and US$18 per MMBtu, respectively.

El Niño-type conditions have already made some impact, with gas demand in parts of Europe surging due to summer heatwaves with anticipated implications for the upcoming Northern Hemisphere winter. Despite occurring in the Pacific Ocean, El Niño can impact Europe's climate by shifting global jet streams south. As jet streams shift southwards, rain clouds from the Atlantic make landfall closer to southern Europe, which can leave Northern Europe exposed to drier and colder winter conditions.

Beyond the upcoming winter, prices are forecast to average US$15/MMBtu in 2024 (assuming normal Northern Hemisphere winter conditions) before easing in 2025 to US$13/MMBtu, as new liquefaction facilities come online in the United States (Figure 7.13).

Key risks to the forecast include the intensity of the coming Northern Hemisphere winter, which is skewed to the upside due to the evolving El Niño conditions and any unplanned outages that could disrupt global LNG supply.

Figure 7.13: LNG spot and contract prices, 2019–25



Source: Bloomberg (2023); Department of Industry, Science and Resources (2023)

High oil prices continue to support LNG contract earnings

The price of oil is important for Australia's LNG earnings. Around 80% of Australian LNG exports are sold under long-term contracts that link the price of LNG to the Japanese Customs-Cleared Crude (JCCC) oil price (with a 3-6 month lag, depending on contractual arrangements). Oil-linked LNG contract prices are forecast to average US$13/MMBtu in the 2023 to 2025 period, based on an oil price of US$83 per barrel (Figure 7.13).

Since 2021, oil-linked contract prices have been selling at a discount to spot prices. However, in May 2023 this trend was reversed, with the OCE's indicative oil-linked contract price achieving parity to LNG spot prices. Between 2021 and 2022, higher relative spot prices incentivised buyers holding contracts with Australian facilities to increase LNG volumes bought under their agreements; both to limit their exposure to spot markets and arbitrage the differential between the two prices.

7.6 Australia

Australia's LNG export volumes ease amidst retrofits

Australia exported 19 Mt of LNG in the June quarter 2023, compared to 20 Mt in the same quarter last year. The decline was due to maintenance at Pluto and Gladstone LNG, and the winding down of operations at Darwin LNG. Lower export volumes from those two operations were partially offset by higher production from QCLNG on the East coast, and from Prelude FLNG on the West Coast.

Santos reported Darwin LNG's production cease in mid-2023, with the last cargo shipped in June. Woodside installed new infrastructure at Pluto LNG to enable the facility to process new gas from the Scarborough Field, temporarily weighing on output. Santos's East Coast facility, Gladstone LNG, also underwent maintenance in June, and the company is reported to have reduced its output to ensure greater volumes of natural gas were available to the domestic market during peak winter heating demand.

Quarterly production from Prelude FLNG is estimated to have reached its highest level since the facility commenced operations in 2019, with output estimated at just under 1 Mt of LNG in the June quarter 2023. Chevron commenced production from Gorgon Stage 2 in the June quarter 2023. The project involved the installation of 11 additional wells in the Gorgon and Jansz-lo fields off the coast of West Australia.

Ichthys LNG is expected to ship a record 132 LNG cargoes in 2023, up 18% from 112 cargoes in 2022, as it starts working on debottlenecking the facility to boost production. The project aims to build a framework capable of a stable supply of 9.3 Mtpa in 2023, by upgrading cooling systems for liquification and taking measures against vibration.

Workers at the West Coast's Gorgon and Wheatstone LNG facilities launched industrial action during the month of September, temporarily affecting spot prices. The parties reach a successful resolution to the dispute after the Fair Work Commission released a series of recommendations without any material impact on Australia's LNG exports.

Australian volumes to ease as Darwin LNG goes offline

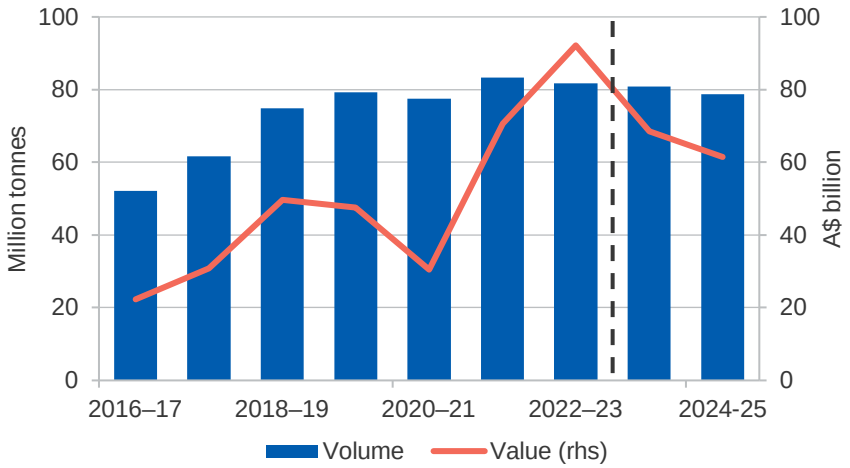
Australia is forecast to export 81 Mt of LNG in 2023–24, slightly lower compared to 2021–22 (82 Mt), as Darwin LNG suspends production while being backfilled from the Barossa field. Volumes are forecast to fall 2 Mt to 79 Mt in 2024–25, on lower North West Shelf output (Figure 7.14).

Several projects are underway that are likely to support Australian production over the longer term. These projects include Woodside's Scarborough Gas Project which will provide additional feedgas to Pluto LNG's second liquefaction train; Santos' Barossa Gas Project which will backfill Darwin LNG; INPEX's Ichthys upgrade which will boost its output; and Tamboran Resources' recently proposed NTLNG facility, which would produce LNG alongside the Darwin and Ichthys LNG facilities in Darwin.

Woodside is progressing with its Scarborough and Pluto train 2 projects, which are now 38% complete. First LNG shipments from Pluto's new train are targeted to begin in 2026. Santos has also reported that the Barossa backfill of Darwin LNG continues apace, with the project now 60 per cent complete. However, drilling operations remain suspended pending an assessment of their environmental plan by the regulator. Santos is targeting first production to begin in 2025.

Tamboran Resources has announced a proposal to construct a new LNG plant in Darwin (NTLNG) by 2030. The proposed plant would have an initial nameplate capacity of 7 Mt per year, with feedgas sourced from the Beetaloo Basin. Tamboran Resources has signed a non-binding Memorandum of Understanding (MOU) with both Shell and BP for 2.2 Mtpa over 20 years.

Figure 7.14: Australia's LNG exports by value and volume



Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2023)

Australia LNG earnings at record levels in 2023, but falls are likely

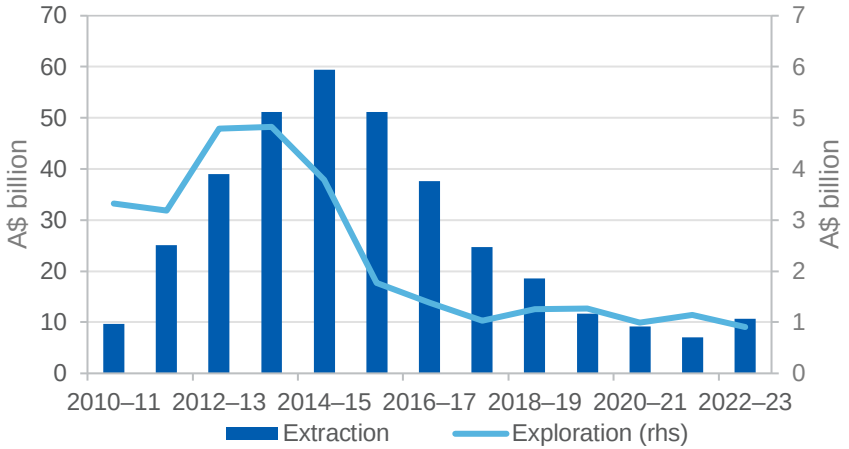
Australia's LNG earnings increased by 31% in 2022–23: to A$93 billion from A$71 billion in 2021–22. Australian LNG export earnings in the June quarter 2023 fell to A$18 billion, down 23% from the March 2023 quarter and 11% year-on-year after several quarters of record earnings. The high earnings were driven by record spot LNG and oil price-linked contract prices in the second half of 2022, with prices since falling sharply.

Australia's LNG earnings are forecast to decline over the outlook period as global energy markets continue to reorganise in response to the fallout from Russia's invasion of Ukraine. Earnings are forecast to fall to A$71 billion in 2023–24, easing to A$63 billion in 2024–25 due to lower commodity prices (Figure 7.14). Key risks to the forecast include seasonal demand fluctuations that could raise spot sales earnings and OPEC production cuts that could increase prices sold under oil-linked earnings.

Exploration expenditure remains subdued despite high energy prices

Exploration expenditure fell by 21 per cent from $1.1 billion in 2021–22 to $907 million in 2022–23 (Figure 7.16). Expenditure in the June quarter 2023 fell slightly to $230 million, down 6% year-on-year. The declines were driven by weaker offshore expenditure (which fell by 21 per cent year-on-year to $84 million), partly offset by onshore expenditure which increased by 5% to $145 million. Despite high energy prices, exploration and development have not lifted: higher operational and labour costs are constraining producers' profit margins, discouraging prospective work.

Figure 7.16: Petroleum expenditure, extraction and exploration



Notes: Extraction expenditure consists of all expenditure on buildings and structures, plant and machinery equipment associated with Oil and Gas extraction.
Source: Australian Bureau of Statistics (2023) Private New Capital Expenditure and Expected Expenditure, 5625.0; and Mineral and Petroleum Exploration, 8412.0

Revisions to the outlook

Australian LNG export earnings for 2023–24 and for 2024–25 have been revised up by A$2 billion, on account of higher oil prices, which will lift the value of Australia's LNG export earnings.

Table 7.2: Gas outlook

World	Unit	2022	2023[g]	2024[g]	2025[g]	Annual Percentage Change 2023[g]	2024[g]	2025[g]
JCCC oil price[a]								
– nominal	US$/bbl	102.7	85.0	83.6	76.9	-17	-1.7	-8
– real[i]	US$/bbl	107.2	85.0	81.3	73.3	-21	-4.4	-10
Asian LNG spot price								
– nominal	US$/MMBtu	33.2	13.6	14.9	13.1	-59	10	-12
– real[h,i]	US$/MMBtu	34.7	13.6	14.5	12.5	-61	7	-14
LNG trade	Mt[e]	385.3	403.2	425.5	455.6	5	5.5	7.1
Gas production	Bcm	4,057	4,038	4,132	4,214	-0.5	2.3	2.0
Gas consumption	Bcm	4,044	4,036	4,132	4,223	-0.2	2.4	2.2
Australia	**Unit**	**2021–22**	**2022–23**	**2023–24[g]**	**2024–25[g]**	**2022–23[g]**	**2023–24[g]**	**2024–25[g]**
Production[b]	Bcm	162.0	164.5	164.0	158.4	1.5	– 0.3	– 3.4
– Eastern market	Bcm	59.5	57.8	57.4	54.3	– 2.9	– 0.6	– 5.4
– Western market	Bcm	85.6	91.0	90.0	85.8	6.3	– 1.1	– 4.7
– Northern market[d]	Bcm	16.8	15.1	16.3	17.3	– 10.3	8.2	6.1
LNG export volume	Mt[e]	83.2	81.5	81.3	78.7	– 2.0	– 0.3	– 3.2
– nominal value	A$m	$70,571	$92,261	$71,235	$62,678	31	-23	-12
– real value[f]	A$m	$78,612	$96,026	$71,235	$60,699	22	-26	-15
LNG export unit value[h]								
– nominal value	A$/GJ	16.1	21.4	16.6	15.1	33.4	– 22.6	– 9.1
– real value[f]	A$/GJ	17.9	22.3	16.6	14.6	24.7	– 25.6	– 12.0
– nominal value	US$/MMBtu	12.3	15.2	11.9	11.5	23.8	– 22.1	– 2.9
– real value[i]	US$/MMBtu	13.7	15.9	11.9	11.2	15.7	– 25.1	– 6.0

Notes: **a** JCCC 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; **c** Gas production from Bayu-Undan Joint Production Development Area is not included in Australian production; **d** Browse basin production associated with the Ichthys project is classified as Northern market; **e** 1 Mt of LNG is equivalent to approximately 1.36 bcm of gas; **f** In 2023–24 Australian dollars; **g** Forecast; **h** 1 MMBtu is equivalent to 1.055 GJ; **i** In 2023 US dollars**; r** Average annual growth between 2021 and 2027 or 2020–21 and 2026–27; **s** Estimate; **z** Projection.
Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2023); Company reports; Nexant (2023) World Gas Model.

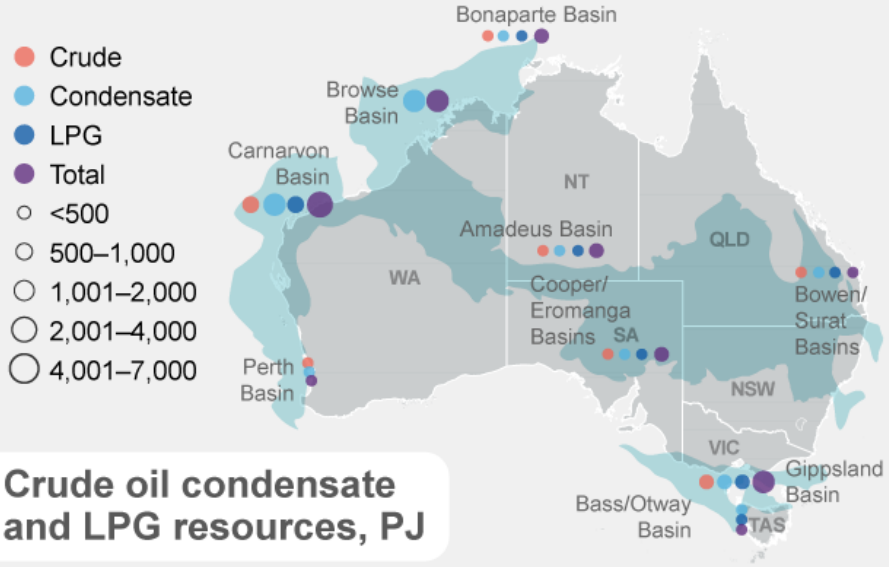
Oil

Australia's oil sector

0.3%
of the world's oil **reserves** and **0.5%** of production

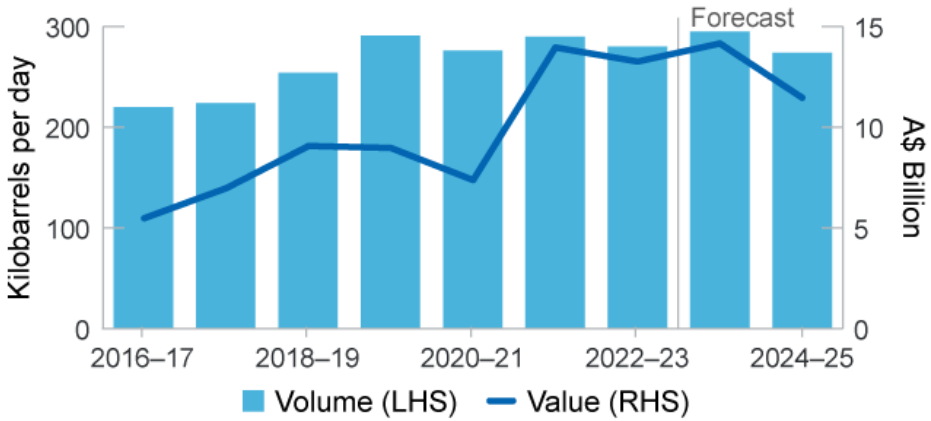
20%
crude & condensate **exported** to Singapore and S. Korea each

Around 2/3
crude & condensate produced at **Carnavon basin,** offshore WA



Crude oil condensate and LPG resources, PJ

Australian oil exports



Outlook

Oil prices **remain elevated** due to OPEC+ production cuts

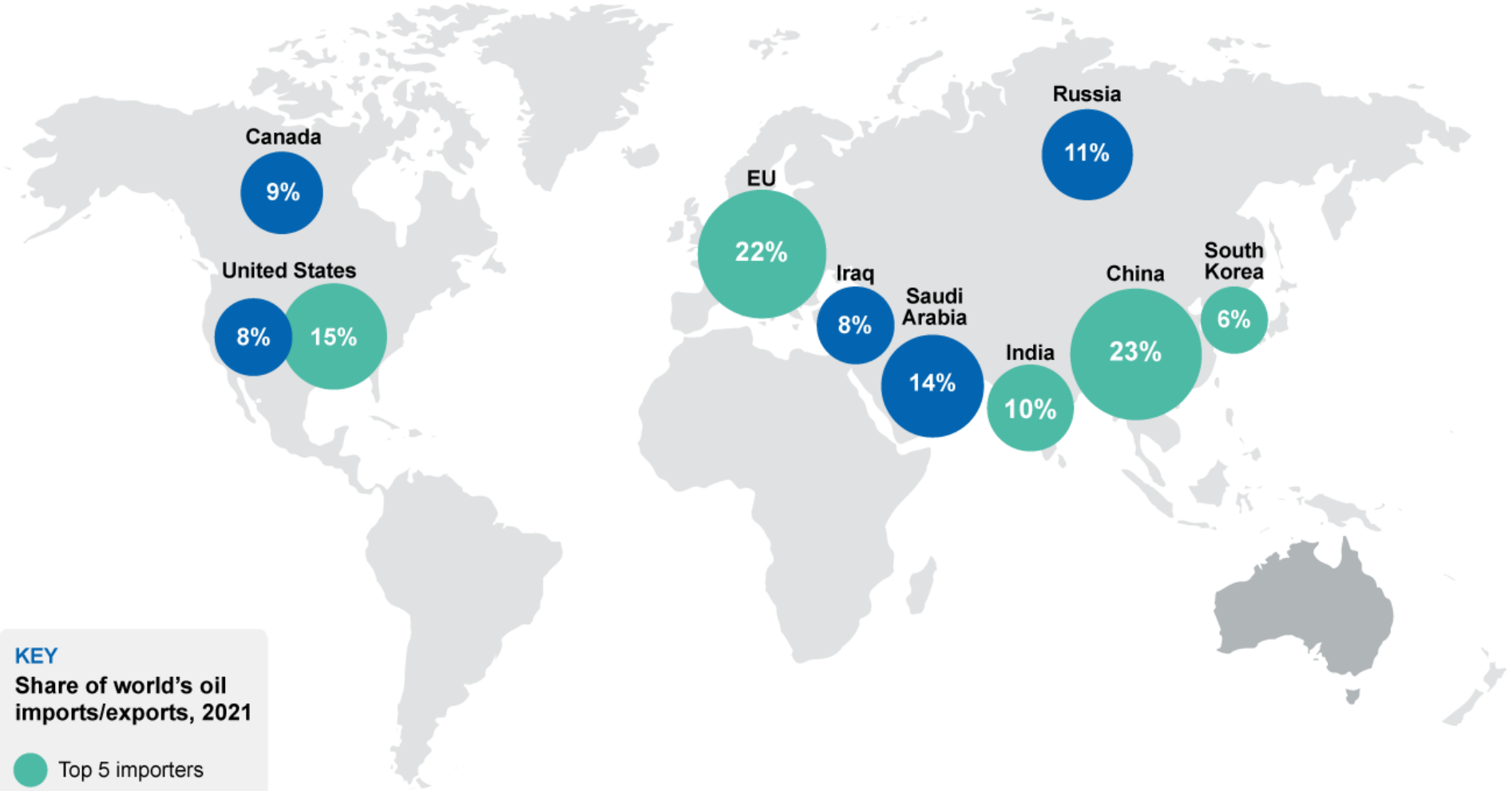
Earnings to **fall by 2024-25** as additional global supply becomes available

Australian production **volumes ease** as offshore fields depletes

Petroleum exploration expenditure **remains subdued**

SOURCE: GA; DISR; OCE

Oil TRADE MAP



SOURCE: International Energy Agency, World Oil Statistics
Note: Trade data includes crude oil, natural gas liquids, refinery feedstocks, addititves and other hydrocarbons

8.1 Summary

- The Brent crude oil price is expected to average US$84 a barrel over 2023, as OPEC+ reduce output while a rebound in global transport demand drives higher oil usage. However, the price is expected to fall to around US$79 a barrel by 2025, as modest market surpluses emerge.
- Australia's crude and condensate production volumes are expected to fall to around 290 kilobarrels per day by 2024-25, as production at the North-West Shelf declines.
- Australia's crude and condensate export earnings are expected to lift to A$14.6 billion in 2023–24 as export volumes rise, before falling to A$11.9 billion in 2024–25 as prices fall and output declines at the North-West Shelf.

8.2 World consumption

China drives global demand recovery while Europe slows

Global oil consumption is estimated by the International Energy Agency (IEA) to have risen by 3.4% year-on-year in the June quarter 2023, as the short run effects of recovery from the pandemic (particularly in China) temporarily offsets a structural slowdown in demand.

Between the June quarter 2021 and the June quarter 2023, Chinese demand rose by an annual average of 3.8%. Year on year, demand rose 17.9%, though this partly reflects pandemic restrictions in the June quarter 2022. China's post pandemic rebound has unleashed strong pent-up demand for services, and the recovery in transport demand for oil has been robust. China's domestic air travel volumes have closed on pre-pandemic levels, but international air travel volumes remained much weaker.

Despite broader weakness in Chinese manufacturing, industrial demand for oil strengthened in the June quarter. Chinese petrochemical plants, which use various refined oil products to make chemicals used to for plastics, ramped up production over the quarter. The magnitude of increase in demand suggests that expansion in Chinese petrochemical plant capacity had been masked by underutilisation over the pandemic period.

Demand from OECD countries rose 1.1% year-on-year in the June quarter. Rising interest rates does not appear to have triggered a recession, as predicted by many analysts, resulting in stronger than expected oil demand.

Amongst OECD countries, air travel continued to recover from the pandemic. Jet fuel demand continued to grow strongly in the June quarter 2023, rising by 11.1% year-on-year, with increased demand across most countries. Offsetting this growth, demand for petrol and diesel fell by 1.2% year-on-year, driven by the rapid adoption of electric vehicles (EVs). Demand for naphtha, typically used as an industrial solvent and in plastic production, fell 7.9% year-on-year, driven almost entirely by weak industrial activity in Europe.

Jet fuel growth to slow while electric vehicles displace demand

Global oil consumption is forecast to rise by 2.3% to 101.7 million barrels per day in 2023, exceeding the pre-pandemic levels recorded in 2019. Consumption growth is expected to be underpinned by the ongoing recovery of global air travel. World oil consumption growth is then expected to slow to an average of 1.3% per year in 2024 and 2025, when the demand recovery from the pandemic period is expected to taper off, and a gradual replacement of internal combustion engine vehicles (ICEs) with EVs will reduce oil demand. Growth in industrial use, particularly from new petrochemical plants in China, will support demand over the outlook period.

EVs are rapidly gaining market share in the global passenger vehicle market (see *Lithium* chapter) as prices fall, driven by improvements in battery technologies, the US Inflation Reduction Act, and the increasing export penetration of cheaper Chinese models. Material cost pressures on batteries, which have slowed EV cost declines since 2021, will ease with lithium prices forecast to fall over the outlook period. The share of EVs sold in the passenger vehicle market is forecast to exceed 20% by 2025, with strong adoption expected in China, Europe and the US. The shift in

the composition of the global vehicle fleet towards EVs will accelerate over time as EVs gain market share in new car sales, resulting in an accelerated fall in demand for petrol and diesel.

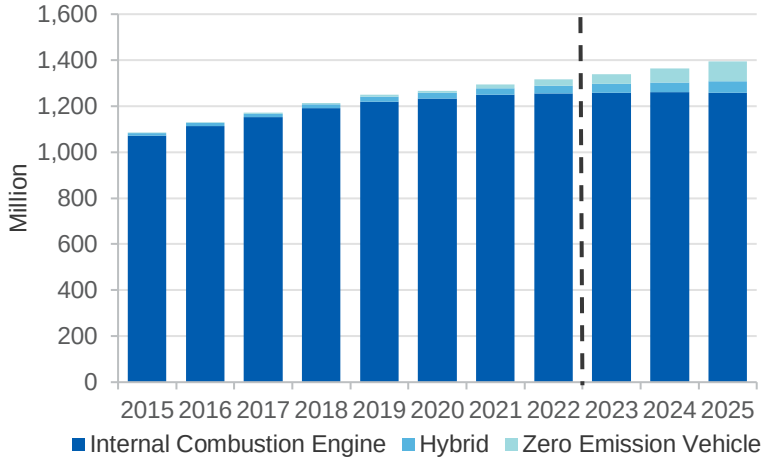
As a result, the global ICE passenger vehicle fleet is forecast to plateau over the next two years (Figure 8.1), having grown at an average annual rate of 3.3% in the four years before the pandemic. Improved fuel efficiency among the ICE vehicle stock will also contribute to declining demand, as retiring ICE vehicles tend to be less fuel efficient than newer models. For OECD countries, consumption of petrol and diesel likely peaked in 2019, with the IEA forecasting consumption in 2023 to be 4.3% lower than in 2019, with a further 1.1% fall forecast for 2024.

Growing demand for jet fuel will support world oil consumption, with most of the rebound likely to taper off by the end of 2023. The IEA estimates global jet fuel consumption will rise by 17% in 2023, and slow to growth of 1.2% in 2024 (Figure 8.2). The International Air Transport Association reported that, globally, kilometres travelled by paying passengers have continued to grow through the June quarter, with the month of June reaching 94% of the volumes recorded in June 2019. While global air travel volumes are closing on 2019 levels, jet fuel consumption remains lower, due to improvements in aircraft fuel efficiency.

Growth in jet fuel consumption will likely settle at a rate slower than the pre-pandemic trend. Growth in recreational air travel heavily depends on rising incomes in middle income countries, so slower economic growth in China has weakened the outlook for jet fuel. Policies targeting aviation emissions in Europe will also likely reduce jet fuel demand, with the EU planning to phase out free allocations of carbon permits for domestic flights by 2026.

Unlike road transport, low-carbon alternatives are unlikely to substitute substantial volumes of petroleum jet fuel over the outlook period. Electric and hydrogen technologies are not viable for air travel (at least in their current design), as the relatively low energy density of batteries, or a tank for hydrogen, adds too much mass to a plane.

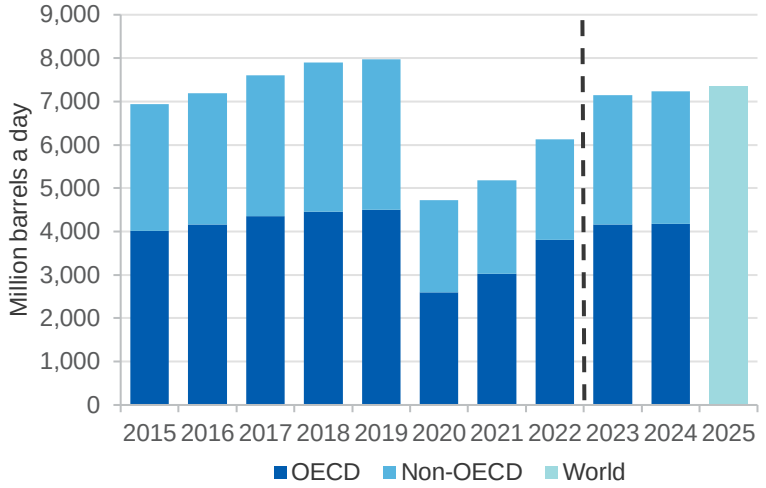
Figure 8.1: Global passenger vehicle stocks



Notes: Zero-emission vehicles includes battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs) and fuel cell electric vehicles (FCEVs), while EVs refers to only BEVs and PHEVs.

Source: Wood Mackenzie (2023)

Figure 8.2: Global jet fuel consumption, OECD and non-OECD



Source: International Energy Agency (2023), Department of Industry, Science and Resources (2023)

8.3 World production

Cuts from OPEC+ drives fall in global supply

World oil production is estimated to have fallen by 0.1% quarter-on-quarter in the June quarter 2023. It is up 2.9% year-on-year, impacted by the Russian invasion of Ukraine in the June quarter 2022. Cuts in output by OPEC and Russia drove the fall, albeit with a partial offset from North American producers, who raised their output.

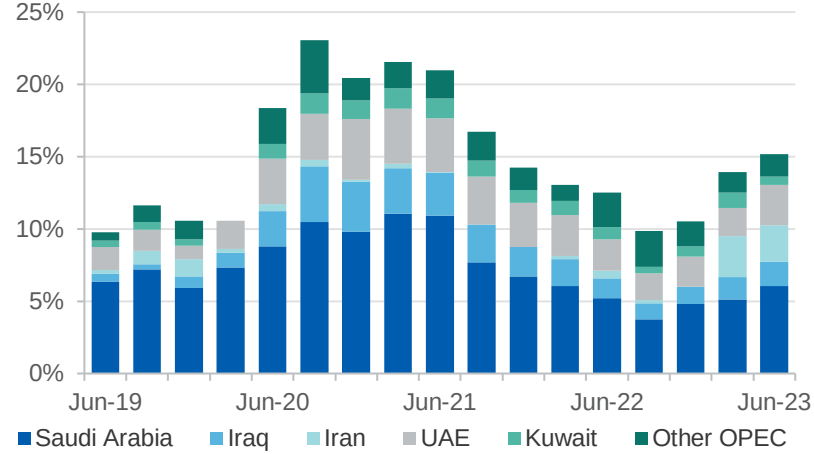
Having kept output targets steady since November 2022, in early April OPEC+ announced that targets would be cut by 1 million barrels a day. In May, Saudi Arabia announced a further voluntary output cut of 1 million barrels a day in July and have since extended the cut until the end of 2023. Spare OPEC crude oil capacity is estimated at 15% for the June quarter 2023 (Figure 8.3), and Saudi Arabia's voluntary cuts will see OPEC spare capacity rise further over the September 2023 quarter. With brent oil price rising above the high-70s seen over the June quarter, further OPEC cuts in 2023 appear unlikely.

Russian exports fall as pressure mounts over war in Ukraine

Russia announced 2 rounds of output cuts in March 2023 and in August 2023 for 500 kilobarrels a day (kb/d) each. Russia further clarified in September that the second round of output cut will be eased to only 300 kb/d from September, to last until the end of 2023. The cuts were enacted as the withdrawal of Western companies, bans on technology exports and labour shortages in Russian industry erodes the productivity of Russian oil fields and delays new projects. A Ukrainian drone attacked a Russian oil tanker in the Black Sea in August, presenting added logistical challenges for Russian exports.

Russian oil trade has increasingly diverted away from OECD countries since the invasion of Ukraine. The G7, EU and Australia all imposed price caps on Russian crude and refined products from 5 December 2022 and 5 February 2023, respectively, by preventing the sale of insurance for Russian oil cargoes if they are sold at a price above the cap. Since the price caps took effect, India, and to some extent China, have become the

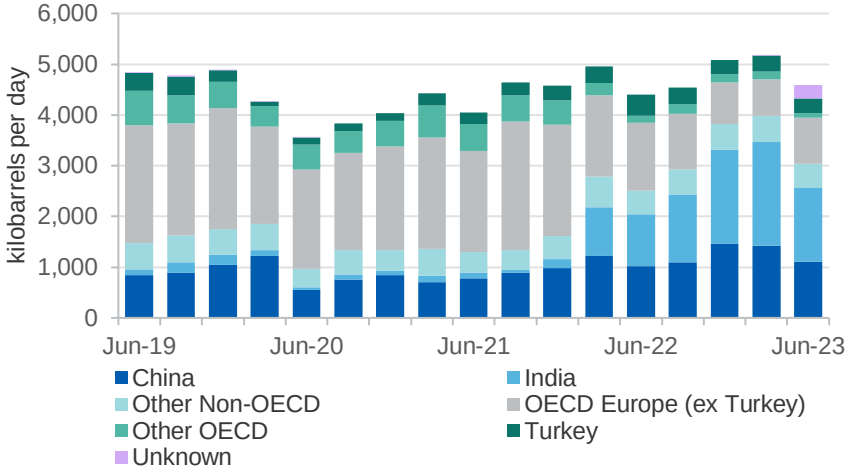
Figure 8.3: OPEC spare crude oil capacity, as a percentage of total



Notes: Spare capacity is the estimated capacity which can produce within 90 days. Condensate excluded.

Source: Wood Mackenzie (2023), International Energy Agency (2023), Department of Industry, Science and Resources (2023)

Figure 8.4: Russian seaborne crude oil exports by destination



Notes: Export volumes are estimated using vessel tracking data and may deviate from customs data.

Source: Kpler (2023)

largest destination for Russian crude exports (Figure 8.4). Russia's refined exports were diverted to the Middle East, Africa, Turkey and other nations.

Russian oil exports are now largely carried by a fleet of older tankers operating outside of the Western shipping system to circumvent the insurance bans and price caps. Where this fleet of ships is not able to provide sufficient capacity to carry Russian products, European vessels subject to the price cap have been engaged as needed.

Russian crude has traded at deep discounts due to the price caps on Russian oil exports, with some portion of Russian crude being sold above the price caps outside Western nations. However, discounts on Russian crude appear to be narrowing. The IEA estimated that the Russian crude export price was about US$57 a barrel in the June quarter, rising from US$52 in the March quarter, while the Brent crude price has fallen over the same period. Minister for Petroleum and Natural Gas Hardeep Puri said on 30 August that Indian demand for Russian crude can be expected to "decrease sharply" in coming months as the discount narrow further.

US and Latin America to drive supply growth

World oil output is forecast to grow by 1.6% in 2023. Higher shale oil production in the US should drive much of this output growth. US Energy Information Administration forecasts that US crude output could grow by about 3% per year over 2023 and 2024 — a rise of about 300 kb/d per year. This growth is much lower than in the peak years of the shale oil revolution, when US crude oil output grew by about 800 kb/d per year (2012-2019), with investors remaining cautious about potential investment in new oil capacity.

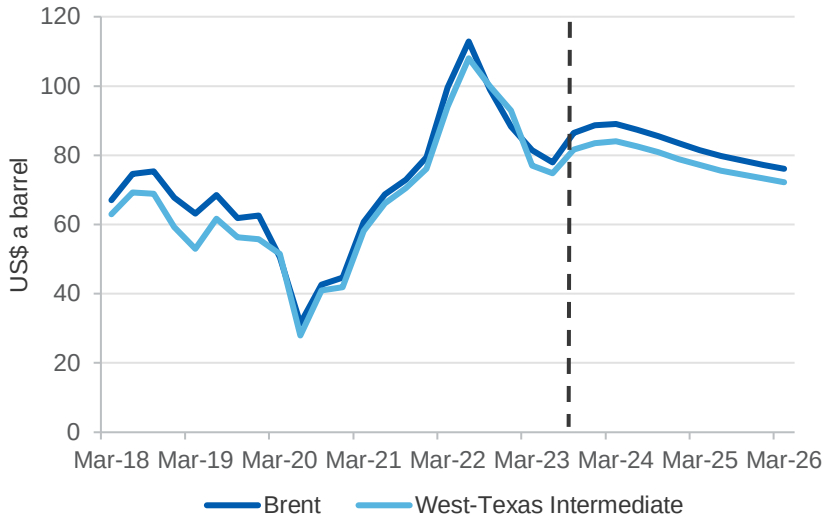
Latin American nations are expected to add to global supply over the outlook period. The IEA is expecting Brazil to add about 240 kb/d to global crude supply in 2024, with Brazil's state-owned oil company Petrobras expected to deploy four new offshore platforms over the next 18 months. New supply is also expected from Guyana. After a series of discoveries from 2008, offshore production in Guyana began in 2019, and output reached 370 kb/d in 2022. Projects currently in the pipeline could more than double production capacity in Guyana by 2025.

8.4 Prices

Oil market to tighten as OPEC+ cuts back supply and demand recovers

Crude oil prices slid over 2022. After peaking early in the year with Russia's invasion of Ukraine, prices fell as pandemic restrictions in China and high energy prices globally drove sharp falls in oil demand. Prices continue to slide in the first half of 2023. China's reopening has proved to be slower than expected as its economy struggles with a weak housing market and consumer demand, while global economic growth slows and interest rates rise. The pace of price falls slowed in the June quarter of 2023 when prices reached US$78 a barrel (Figure 8.5), amidst a series of production cutbacks by various OPEC+ countries.

Figure 8.5: Price outlook

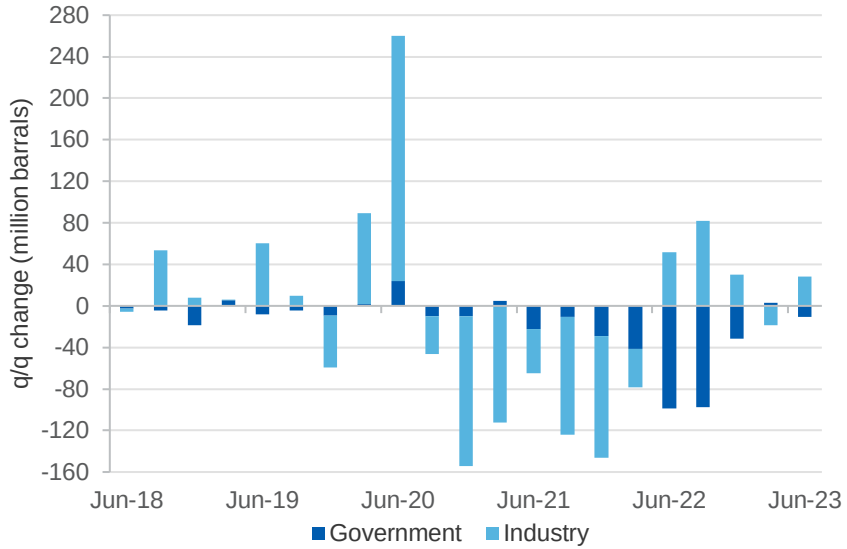


Source: Bloomberg (2023); Department of Industry, Science and Resources (2023)

Prices rallied from June 2023 and are expected to average US$85 a barrel in the September quarter. Production cutbacks from OEPC+ countries have seen supply tighten, while a sharp increase in Chinese industrial consumption and the normalisation in global air passenger volumes drove increases in demand.

OECD industry oil stocks rose in the June quarter 2023 (Figure 8.6) after falling in the March quarter 2023. The increase is unlikely to be sustained as the market tightens over 2H 2023. The US government had delayed plans to restock the Strategic Petroleum Reserve (SPR). Of the 9 million barrels of crude oil which were scheduled for delivery to the SPR between August and November, 6 million barrels had been cancelled.

Figure 8.6: Change in OECD Petroleum Stocks



Source: International Energy Agency (2023)

The Brent crude price is forecast to average US$84 a barrel over 2023, with prices rising marginally over the final quarter of the year, as the market continues to tighten.

The Brent crude is then projected to decline to US$79 a barrel by 2025. The fall is expected to be driven by rising production outside of OPEC, particularly in North America and Latin America, combined with slowing demand growth — as the world gradually transitions to low emission technologies.

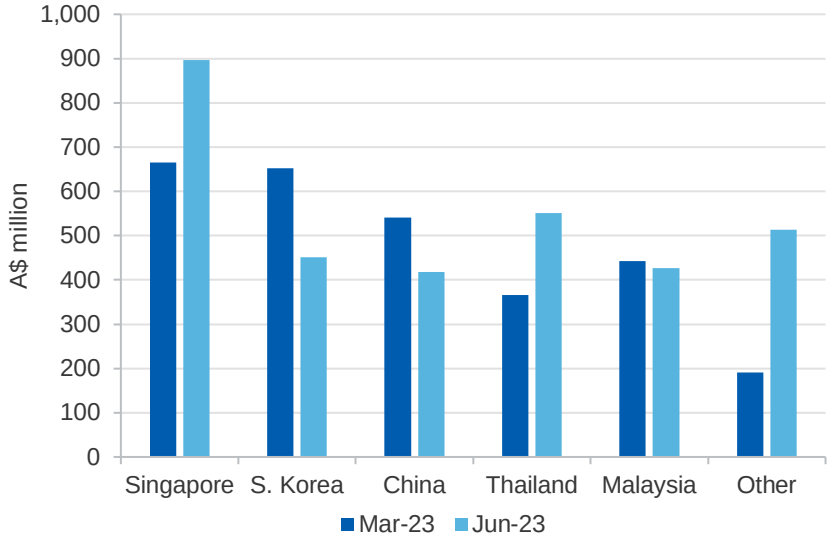
8.5 Australia

Export earnings to fall as prices decline

Australian crude oil and condensate export earnings fell 27% year-on-year to $33 billion in the June quarter 2023, primarily driven by lower prices. The top destinations for Australian exports over the quarter were Singapore, Thailand, and South Korea (Figure 8.7).

Export earnings fell by 4.9% to $13.3 billion in 2022–23 (Figure 8.8) as prices declined from the very high levels seen in the wake of the Russian invasion of Ukraine. Output in H1 2023 was below expectations, impacted by disruptions such as a strike at the Prelude LNG facility. Export earnings are expected to lift to $14.6 billion in 2023–24, with prices rising as global oil markets tighten. Exports are forecast to fall to $11.9 billion in 2024–25.

Figure 8.7: Quarterly Australian crude oil and condensate export value, by destination



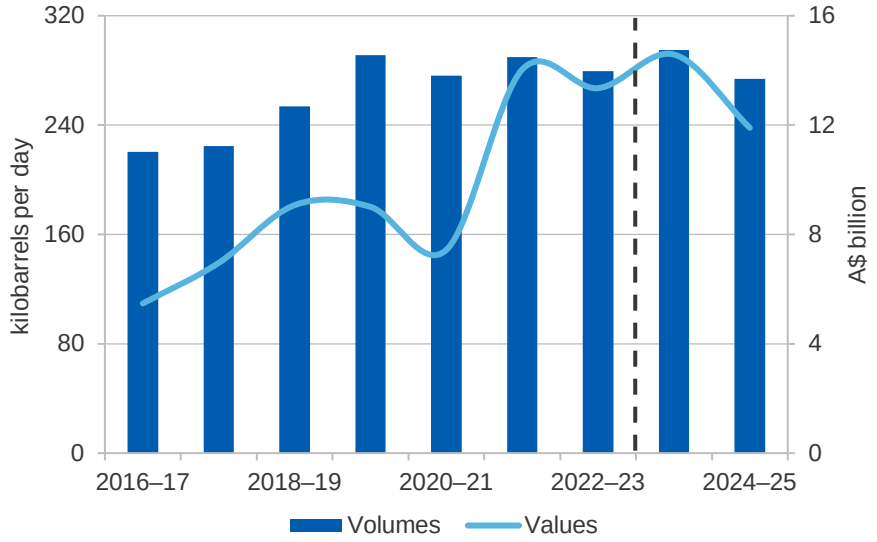
Source: Australian Bureau of Statistics (2023)

Delays over investment decision casts uncertainty over outlook

In the June quarter 2023, Australian crude oil and condensate output fell 10% year-on-year to 301 kb/d. The fall is due to lower production in the Carnarvon basin, which is moving towards end of life. This includes fields such as the North-West Shelf and Greater Enfield. Production is expected to fall further over the outlook period to 290 kb/d in 2024–25, as the fields in the Carnarvon basin continue to move towards end of life.

A final investment decision for the Dorado oil and gas field was expected in the second half of 2022, but the decision has been delayed to 2024, with Carnarvon Energy divesting a 10% stake in the project to Taiwan's CPC Corporation in February 2023. If the project proceeds, it could bring around 90 kb/d of additional production capacity online.

Figure 8.8: Australian crude oil and condensate exports



Source: Australian Bureau of Statistics (2023); Department of Industry, Science and Resources (2023).

Australian refineries to remain open with government support

In 2021, falling demand linked to COVID restrictions resulted in the closure of two of Australia's refineries. The remaining two refineries signed contracts with the Federal Government to remain open until at least 2027, in exchange for a subsidy on each litre of refined product sold. Australia's two remaining refineries are expected to have their operational life extended, with plans to extend the Lytton plant announced in April 2022 and plans to extend the Geelong plant announced in January 2023. Australian refined production is expected to remain at around 250 kb/d over the outlook period. Australia's consumption of refined oil products rose by 6.6% year-on-year in the June quarter 2023, driven by a 30% year-on-year increase in jet fuel sales. This reflected the opening of Australia's international borders in November 2021. Demand for road transport also saw a continuing recovery, with sales of automotive gasoline rising 1.9% year-on-year, and sales of diesel rising 5.4% year-on-year.

Exploration

Australia's petroleum exploration expenditure was $230 million in the June quarter 2023, down 6.2% year-on-year (see Figure 7.16 in the Gas chapter). Offshore exploration fell 21% year-on-year to $84 million, while onshore exploration spending rose by 5.3% year-on-year to $145 million.

Revisions to forecasts

Since the June 2023 *Resources and Energy Quarterly*, the forecast for Australia's crude and condensate export earnings has been revised up 6.1% (to $14.6 billion) in 2023–24 and up 1.3% (to $11.9 billion) in 2024–25. The revisions are due to a combination of a lower AUD/USD exchange rate forecast, higher prices, and higher export volumes.

Table 8.1: Oil Outlook

World	Unit	2022	2023 [s]	2024[f]	2025[f]	Percentage changes 2023[f]	2024[f]	2025[f]
Production[a]	mb/d	100	102	103	105	1.6	1.2	1.7
Consumption[a]	mb/d	100	102	103	104	2.3	1.0	1.6
WTI crude oil price								
– nominal	US$/bbl	95	79	82	75	-16.9	3.8	-7.9
– real[b]	US$/	99	79	79	72	-20.4	0.9	-9.8
Brent crude oil price								
– nominal	US$/bbl	100	84	86	79	-16.2	3.1	-8.2
– real[b]	US$/bbl	104	84	84	76	-19.8	0.3	-10.1
Australia	**Unit**	**2021–22**	**2022–23 [s]**	**2023–24[f]**	**2024–25 [f]**	**2022–23**	**2023–24[f]**	**2024–25 [f]**
Crude and condensate								
Production[ac]	kb/d	336	298	310	290	-11.5	1.8	-6.4
Export volume[a]	kb/d	290	280	295	274	-3.6	5.6	-7.2
– Nominal value	A$m	14,031	13,269	14,580	11,900	-5.4	9.9	-18.4
– Real value[h]	A$m	15,630	13,811	14,580	11,524	-11.6	5.6	-21.0
Imports[a]	kb/d	180	169	188	187	-5.9	11.2	-0.9
LPG production[acd]	kb/d	107	93	107	103	-13.5	15.1	-3.5
Refined products								
– Refinery production[a]	kb/d	266	252	251	249	-5.3	-0.4	-0.9
– Export volume[ae]	kb/d	8	6	5	4	-32.5	-17.1	-13.5
– Import volume[a]	kb/d	743	858	863	869	15.5	0.6	0.7
– Consumption[ag]	kb/d	934	1,021	1,023	1,027	9.3	0.2	0.4

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 2023 calendar year US dollars; **c** Historical production data was revised in the December quarter 2021 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 2023-24 financial year Australian dollars; **r** Compound annual growth rate (per cent), for the period from 2022 to 2028 or for the equivalent financial years. **s** estimate.

Source: ABS (2023) International Trade in Goods and Services, Australia, Cat. No. 5368.0; International Energy Agency (2023); US Energy Information Administration (2023); Department of Industry, Science, Energy and Resources (2023); Department of Climate Change, Energy and Environment (2023).

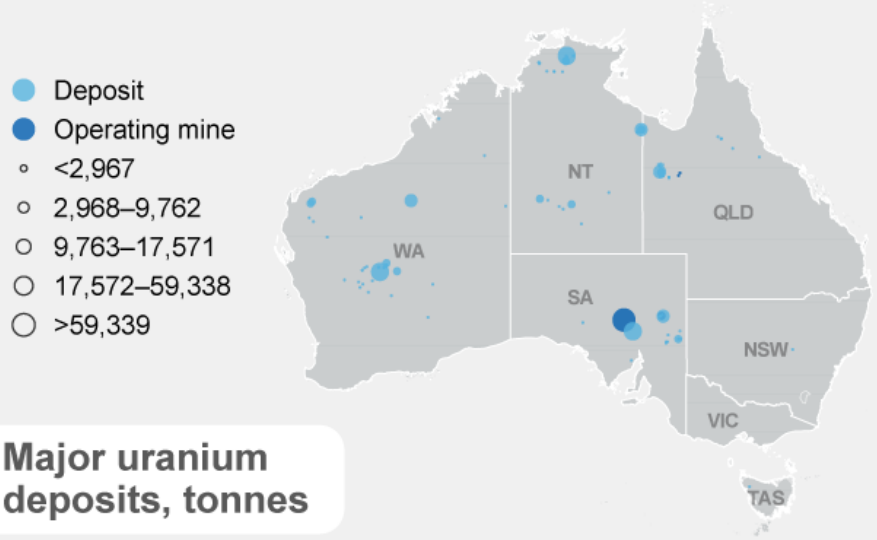
Uranium

Australia's uranium sector

Ranked 1st for uranium **resources, 3rd for exports**

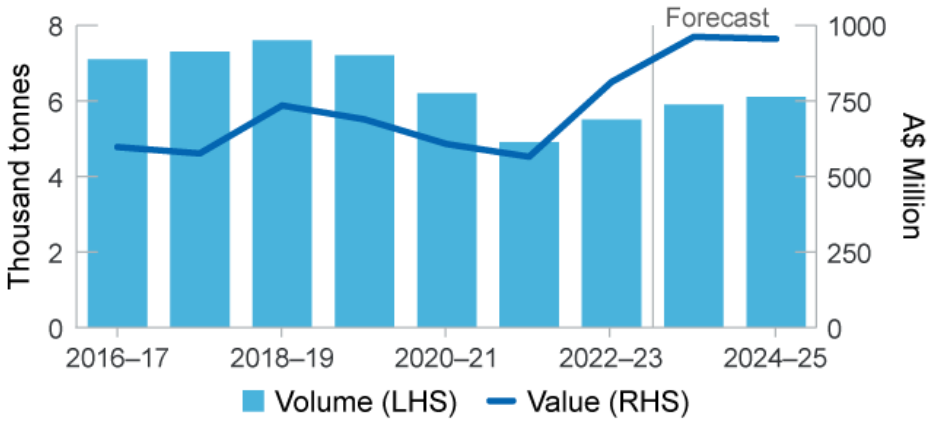
The bulk of uranium exports flow to the **USA, France, and China**

Nuclear deployment **expanding** globally as countries seek emissions targets



Major uranium deposits, tonnes

Australian uranium exports



Outlook

Uranium **prices have steadied**, with further growth expected through the outlook

Earnings **have passed a low point**, with higher prices and volumes in prospect

The opening of the Honeymoon mine in South Australia to **boost exports**

Exploration spending has risen solidly from its low point in 2020 and 2021

SOURCE: DISR; OCE

9.1 Summary

- Uranium prices are forecast to increase from US$50 a pound in 2022 to around US$64 a pound by 2025. Rising prices reflect sustained low investment in new mines and potential emerging shortfalls in uranium supply.
- Australian exports are forecast to increase from around 5,400 tonnes in 2022–23 to around 6,000 tonnes by 2024–25 (see Australia section). The opening of Boss Energy's Honeymoon mine in South Australia is expected to increase output from 2024.
- Price and volume growth are expected to drive uranium export values up from around $800 million in 2022–23 to $950 million by 2024–25.

9.2 World consumption

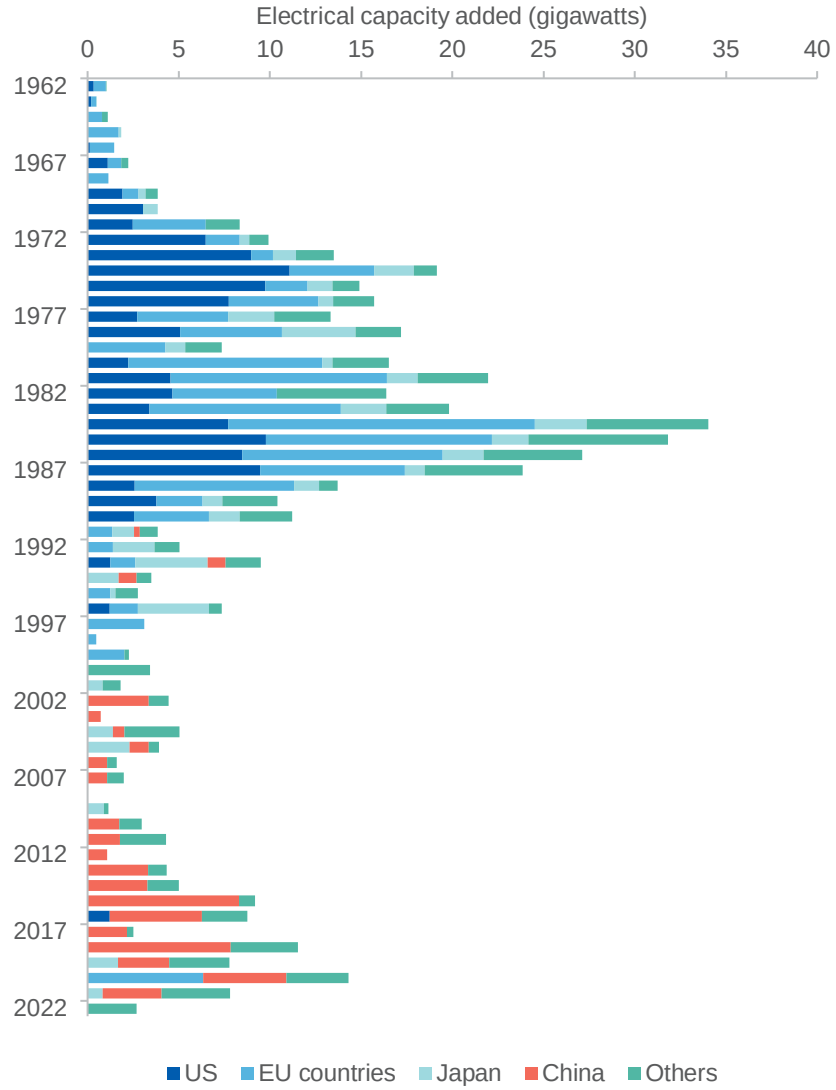
Utility purchases are slowly pushing prices up

Global demand for uranium is rising as nuclear deployments continue to trend up (Figure 9.1) and as utilities seek to build stocks ahead of a potential supply shortfall in the mid-2020s. Uranium consumption is set to be supported by growing demand in China and other parts of Asia, North America and Eastern Europe (Figure 9.2).

Investment in nuclear power is rising in North America after a long period of disinterest. In the US, Georgia Power's Vogtle plant has completed construction of its new reactors and is now providing power to the grid. The new reactors are the first to be constructed in the US since the early 1990s. In Canada, the Ontario Government has announced pre-development on an additional 4800MWe of new capacity at the Bruce site. Canada has not engaged in a large expansion of nuclear power since the 1990s, but proponents of the project have raised the possibility of scaling up further over time.

Japan has connected two further reactors to the grid, with units 1 and 2 of the Takahama nuclear power plant restarting in July and September, after 12 years offline. A total of 12 reactors have now reconnected, with the pace of connections rising as local and national governments respond to high gas and coal prices and attempt to meet targets for lower emissions.

Figure 9.1: Growth in world nuclear power generation



Source: International Energy Agency (2023); World Nuclear Association (2023); Department of Industry, Science and Resources (2023)

China's State Council has approved construction for 6 more nuclear plants. Construction is imminent for units 1 and 2 of the Shidaowan plant in Shandong Province, units 5 and 6 of the Ningde plant in Fujian Province and units 1 and 2 of the Xudabao plant in Liaoning Province.

Poland's plans to build its first nuclear plant recently passed a hurdle, with the country's Ministry of Climate and Environment providing in-principle approval for a project submitted by Poland's state-owned nuclear plant developer. The approval indicates that the project is considered to be in the public interest and in line with the Government's current energy policy.

Türkiye has announced a goal to add 20GW of nuclear power to its grid over the next 30 years. Talks are now underway with South Korea, Russia and China to develop a second and third reactor following the successful construction of its first. Türkiye is also engaged in talks with the UK and US over potential development of small modular reactors.

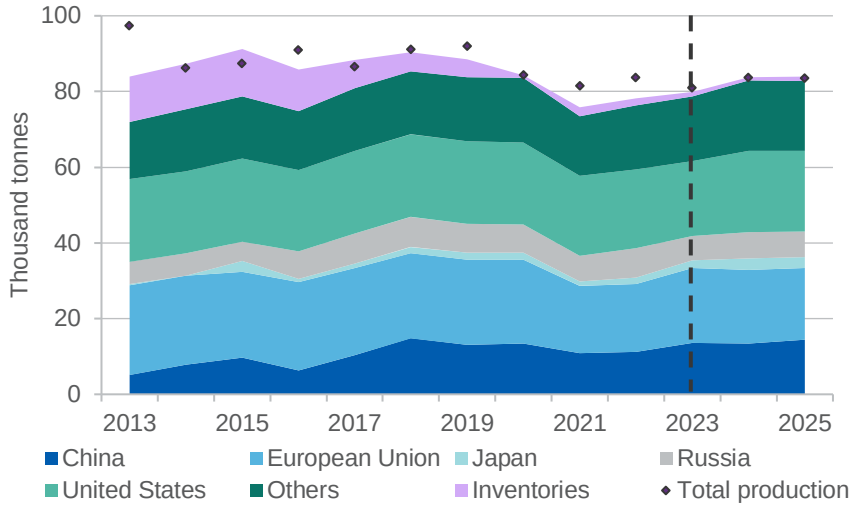
9.3 World production

Production is building, but may reach capacity limits in the 2020s

Higher prices have seen several large companies — including Kazatomprom and Cameco — revise up their sales guidance in recent months. This is feeding into a general rising production outlook as suppliers seek to keep pace with global demand (Figures 9.2 and 9.3). Supply shortfalls remain a risk due to a long period of low investment in new supply, which coincided with a long run of low prices after 2011. New mines in Africa and Asia are likely to be needed to keep demand and supply matched over the longer term.

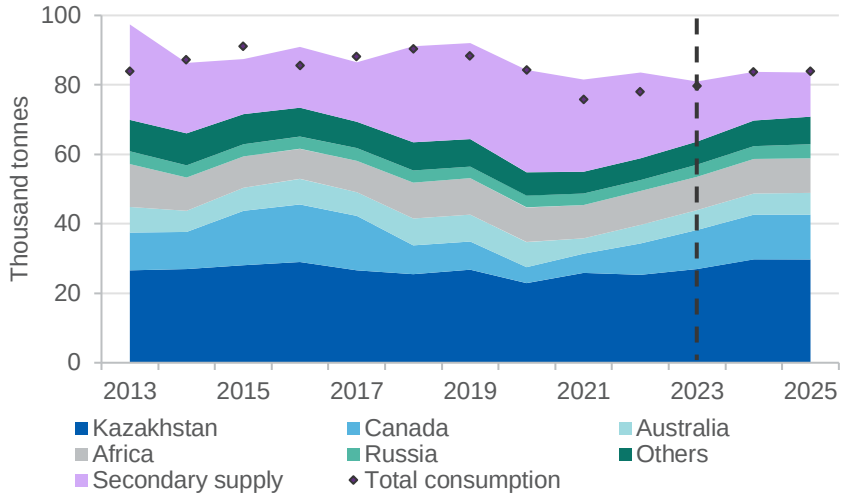
Supply from Niger (currently around 5,000 tonnes per year) faces potential disruptions following the coup d'état in July 2023. At this stage, no impact has been reported at existing mines, but the Global Atomic Corporation has announced that its proposed Dasa mine may be delayed for 12 months. The newly installed junta has also threatened to suspend exports of uranium to France. Niger is the world's seventh largest uranium supplier, but resource extraction in the country has regularly faced opposition and protest action.

Figure 9.2: World uranium consumption and inventories (U3O8)



Source: International Energy Agency (2023); World Nuclear Association (2023); Ux Consulting (2023)

Figure 9.3: World uranium output (U3O8)



Source: International Energy Agency (2023); World Nuclear Association (2023); Ux Consulting (2023)

9.4 Prices

Prices are expected to rise steadily, with upward pressures growing

Exploration and development of new uranium deposits is on the rise globally as stronger prices draw capital towards the sector. This investment is not expected to bring significant new production online during the outlook period. As such prices will likely keep rising as demand grows relative to output. In the short term, sufficient supply capacity exists to hold prices in relative check, but price growth could accelerate from the late 2020s if new supply fails to emerge.

Prices are expected to lift to above US$60 a pound by 2025, with risks weighted to the upside (Figure 9.4).

9.5 Australia

Higher export earnings are expected following the opening of a new mine

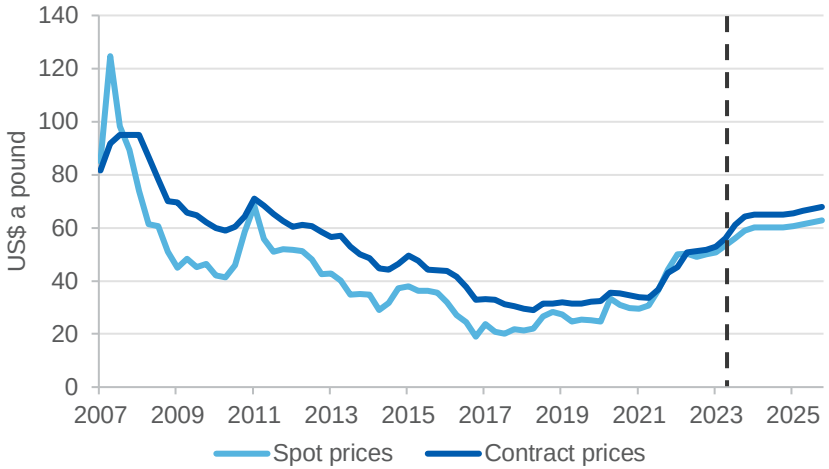
Australian output is currently generated from two mines, with two additional mines in development. Boss Energy's Honeymoon mine is expected to re-open by the end of 2023. The mine has been in care and maintenance since 2013, but is expected to produce around 1,100–1,200 tonnes of uranium per year for at least ten years. Boss Energy recently announced the completion of its first wellfield at the site. Other constructions — including the water treatment plants and gypsum pond — are also close to completion. Following its recent progress, the company noted, '(t)he project development is proceeding to plan and remains on time and on budget'.

Higher prices and production are expected to see export earnings surpass $950 million by 2024–25 (Figure 9.5, Table 1). Prices are also motivating renewed exploration, with exploration spending doubling over the past year, to reach $13 million in the June quarter 2023.

Revisions to the outlook

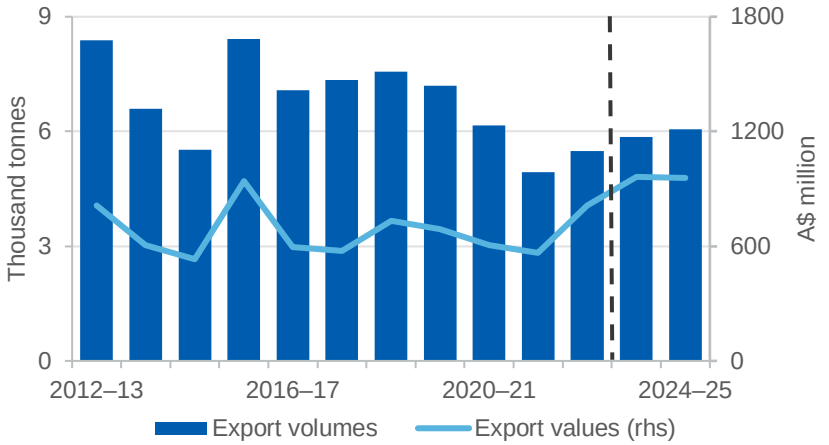
Export earnings forecasts for 2023–24 and 2024–25 have been revised up by $90 million and $35 million (respectively) since the June *Resources and Energy Quarterly*. This reflects a recent strengthening in the price outlook.

Figure 9.4: Uranium price outlook



Source: Cameco Corporation (2023) Uranium Spot Price; Ux Consulting (2023) Uranium Market Outlook

Figure 9.5: Australia's uranium exports



Source: Department of Industry, Science and Resources (2023)

Table 9.1: Uranium outlook

						Annual percentage change		
World	**Unit**	**2022**	**2023 f**	**2024 f**	**2025 f**	**2023 f**	**2024 f**	**2025 f**
Production	kt	58.8	63.5	69.7	70.8	8.0	9.8	1.7
Africa[b]	kt	9.6	9.6	10.1	10.1	0.0	4.7	0.3
Canada	kt	9.1	11.3	12.9	12.9	25.0	14.0	0.0
Kazakhstan	kt	25.4	26.9	29.8	29.7	6.0	10.7	-0.2
Russia	kt	3.1	3.5	3.7	3.9	10.7	7.8	3.6
Consumption	kt	76.3	78.7	82.9	82.7	3.2	5.2	-0.2
China	kt	11.3	13.6	13.3	14.4	20.5	-1.9	8.2
European Union 27	kt	17.8	19.8	19.6	18.9	11.0	-1.1	-3.3
Japan	kt	1.6	1.9	2.9	2.9	18.2	51.4	0.0
Russia	kt	7.9	6.5	7.0	6.7	-17.2	6.3	-3.4
United States	kt	20.7	19.7	21.5	21.3	-4.9	8.8	-0.9
Spot price	US$/lb	49.8	56.2	62.5	64.2	12.8	11.2	2.7
– real[c]	US$/lb	52.0	56.2	60.8	61.2	8.0	8.2	0.6
Australia	**Unit**	**2021–22**	**2022–23**	**2023–24 f**	**2024–25 f**	**2022–23**	**2023–24 f**	**2024–25 f**
Mine production	t	4,485	5,454	5,855	6,060	21.6	7.4	3.5
Export volume	t	4,933	5,485	5,855	6,060	11.2	6.7	3.5
– nominal value	A$m	564	812	962	955	43.8	18.6	-0.7
– real value[d]	A$m	628	845	962	925	34.4	13.9	-3.9
Average price	A$/kg	114.4	147.9	164.4	157.6	29.4	11.1	-4.1
– real[d]	A$/kg	127.4	154.0	164.4	152.7	20.9	6.8	-7.1

Notes: **b** Includes Niger, Namibia, South Africa, Malawi and Zambia; **c** In 2023 US dollars; **d** in 2023–24 Australian dollars; **s** estimate; **f** forecast; **r** Annual growth rate
Source: Department of Industry, Science and Resources (2023); Cameco Corporation (2023); Ux Consulting (2023) Uranium Market Outlook

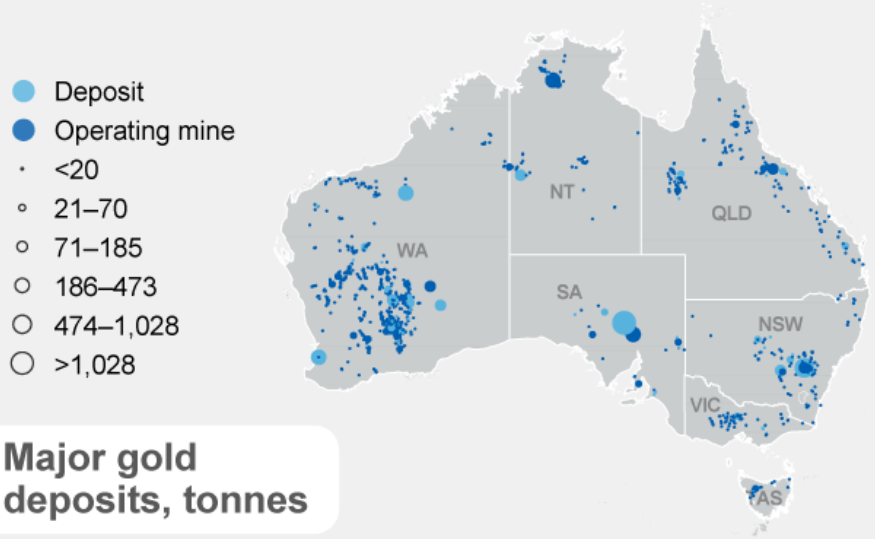
Gold

Australia's gold sector

World's 3rd
largest **producer** of gold, 2022

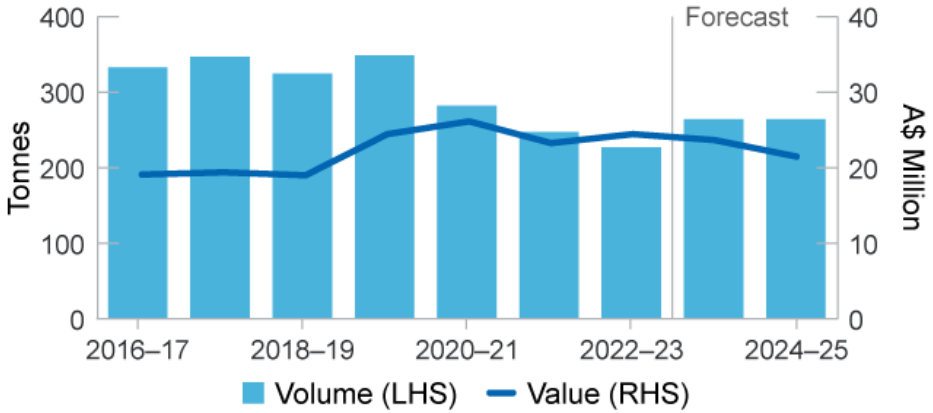
Largest
known share of globally known gold resources, at **22%**

228 tonnes
exported in 2022-23, valued at **$24 billion**



Major gold deposits, tonnes

Australian gold exports



Outlook

Prices expected to **remain elevated before easing** as global inflation declines

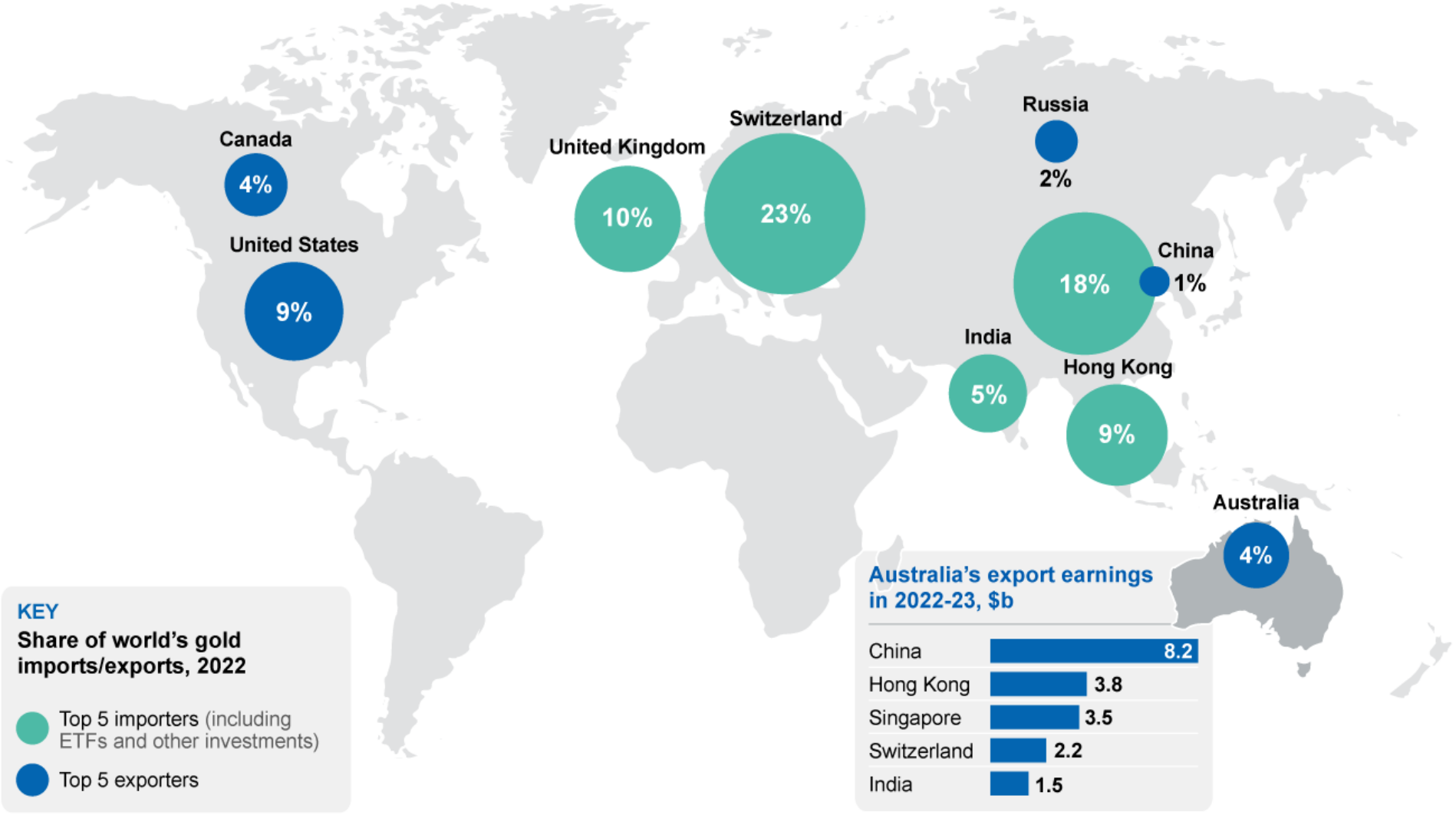
Export earnings forecast to fall as lower prices outweigh higher volumes

Production to increase as expansions and new projects come online

Exploration spending at a **3-year low**, following record highs in 2022

SOURCE: GA; DISR; OCE

Gold TRADE MAP



SOURCE: UN ITC; ABS

Note: Reflects trade in HS code 7108 (gold, inc. gold plated with platinum, unwrought or not further worked than semi-manufactured or powder form)

10.1 Summary

- Gold prices averaged US$1,933 an ounce in the first half of 2023, with support coming from strong safe-haven buying and a slightly weaker US dollar. Over the outlook period, prices are forecast to remain elevated but decline gradually to average around US$1,830 an ounce in 2025.
- Australian gold production decreased to 149 tonnes in the first half of 2023, due to disruption from heavy rainfall. Production is forecast to increase with new projects and expansions (see *Australia section*).
- Gold earnings are forecast to decrease from $24 billion in 2022–23 to around $22 billion in 2024–25, as lower prices outweigh higher volumes.

10.2 World consumption

World gold consumption decreased in the March quarter 2023

World gold demand decreased by 5.6% year-on-year to 2,060 tonnes in the first half of 2023. This was driven by a 31% decline year-on-year in investment demand, partly offset by strong central bank net purchases.

Official sector buying (central banks and other government financial institutions) increased by 61% year-on-year to 387 tonnes in the first half of 2023. Growth was driven by record demand during the March quarter, with net purchases easing to be 35% down year-on-year in the June quarter. According to World Gold Council data for declared purchases, much of the buying was dominated by China (103 tonnes). Singapore (73 tonnes) was the second largest buyer and Poland (48 tonnes) the third largest. Having been a major buyer from December 2021 to February 2023, Türkiye reported 102 tonnes of net sales over the first half of 2023 — a result of strong domestic demand and a temporary ban on gold imports. Notable sales also came from Kazakhstan (38 tonnes), Uzbekistan (19 tonnes) and Cambodia (10 tonnes).

Gold purchases by non-government buyers in the first half of 2023 declined year-on-year, with strong gold demand from consumers (jewellery, gold coins and bars) more than offset by outflows from gold-backed exchange-traded funds (ETFs).

ETF outflows reached 50 tonnes over the first half of 2023, compared to 223 tonnes of inflows a year earlier. Demand declined towards the end of the June quarter, with strong outflows in June — coinciding with price declines and rising equity markets — ending 3 months of inflows.

Retail investment in gold bars and coins rose year-on-year in the first half of 2023, with investors buying 582 tonnes. Demand was supported by strong domestic gold prices in China during its seasonal peak in the March quarter and by a near-record tendency for households to save. Bar and coin demand increased almost five-fold in Türkiye — where negative real interest rates, a weak lira and safe-haven demand motivated gold buying.

Global jewellery demand rose marginally year-on-year in H1 2023, driven by a strong resurgence in Chinese consumption, offsetting weaker Indian consumption. Consumption was resilient given record gold prices recorded in China and India during the June quarter 2023.

Jewellery demand in China rose by 19% year-on-year to 347 tonnes in H1 2023. Growth was particularly strong year-on-year as the first half of 2022 base was affected by COVID-related mobility restrictions. Pent-up wedding demand and economic uncertainty supported jewellery demand, with *gold, silver and jewellery* the strongest growth category of Chinese retail sales over the first half of the year — increasing by 18% year-on-year.

Jewellery consumption in India — along with many other markets — declined year-on-year in the first half of 2023, due to high domestic prices.

Weak demand for consumer electronics over the first half of the year also translated to weak demand for gold in electronics — such as in light-emitting diodes (LEDs) and printed circuit boards. This brought technology demand for gold down by 10% year-on-year to 140 tonnes: the weakest recorded in the World Gold Council's historical data.

Lower official sector demand to push gold consumption down in 2023

After a very strong 2022, world gold consumption in 2023 is forecast to decrease by 9.5% to about 4,300 tonnes. The decline is expected to be mainly driven by lower official sector buying — which will nevertheless remain high in historical terms, at around 750 tonnes (Figure 10.1).

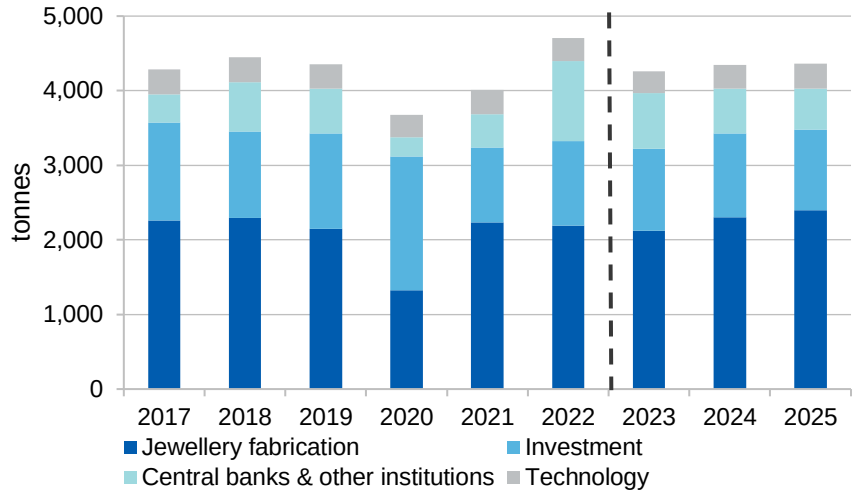
Investment demand (gold-backed ETFs or bar and coin holdings) is expected to decline marginally in 2023 but remain supported by ongoing geopolitical and economic uncertainty.

Jewellery consumption in 2023 is forecast to be slightly below 2022 levels, with strong growth in China offset by high local gold prices constraining demand in other key markets. Consumption growth is expected to remain subdued in key markets such as India and the Middle East, due to the combined effects of high US dollar gold prices and weak local currencies (against the US dollar).

Gold consumption to grow over the medium-term

World gold consumption is forecast to rise gradually after 2023, to reach about 4,400 tonnes by 2025. Demand growth is expected to be largely driven by increasing jewellery consumption, with investment demand and technological usage contributing to a lesser extent (Figure 10.1).

Figure 10.1: World gold demand by sector



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

Source: World Gold Council (2023); Metals Focus (2023); Department of Industry, Science and Resources (2023)

Jewellery consumption is forecast to grow strongly from 2024 onwards, to reach 2,400 tonnes by 2025. Consumption will be supported by improvements in consumer sentiment and rising incomes, particularly in the key markets of China and India. Lower gold prices and a weaker US dollar are expected to drive particularly strong growth in jewellery demand in 2024, with an increase of 11% year-on-year.

Investment demand is forecast to remain relatively steady over the forecast period, at around 1,100 tonnes. As inflation eases towards central bank targets, interest rates are assumed to decline over the medium-term. If interest rates are cut faster than inflation declines over the medium-term, this will support institutional investment and retail demand through lower real interest rates.

Physical (bar and coin) demand is expected to remain strong, as lower forecast prices and economic uncertainty support buying activity near recent elevated volumes.

Official sector demand is projected to moderate to around 550 tonnes a year by 2025. Buying activity is expected to be strongly driven by emerging market central banks, which will continue long-term diversification of their reserves with gold. According to World Gold Council data for declared gold purchases, Russia added 31 tonnes to official reserves in 2022. Given ongoing sanctions on foreign exchange and restricted access to its foreign reserves, it is likely that Russian official sector demand will be strong over the outlook period.

10.3 World production

World supply increased in the first half of 2023

World gold supply increased by 5.3% year-on-year to 2,460 tonnes in the first half of 2023, driven by both higher mine production and recycling.

Global mine production rose by 3.1% year-on-year to a record 1,780 tonnes in the first half of 2023. Growth was led by increased production from the major producers, a ramp-up of new operations in Brazil and Mongolia, and a return to normal operations in South Africa.

Production in China — the world's largest gold producing country — rose by 2.2% year-on-year to 179 tonnes in the first half of 2023, with year-on-year improvement the result of fewer weather- and COVID-related disruptions.

In Australia — the third-largest gold producing country — output decreased by 3.7% year-on-year in the first half of 2023, to 147 tonnes. Australian mine production decreased due to disruptions from heavy rainfall over the quarter and several mine closures (see *Australia section*).

Production from Ghana — the sixth-largest gold producing country — increased by 20% year-on-year in the June quarter 2023, due to the ramping up of production at the Bibiani and Obuasi mines.

Gold recycling in H1 2023 rose to 634 tonnes — the highest first half in seven years — in response to stronger gold prices. Recycling growth was strong in China (supported partly by June quarter 2022 base effects) and India (a highly price-sensitive market).

World supply to stabilise as mine supply growth slows

Global gold supply is forecast to stabilise at around 4,800 tonnes in the period to 2025, with increasing world gold mine production offset by decreasing recycling activity (Figure 10.2).

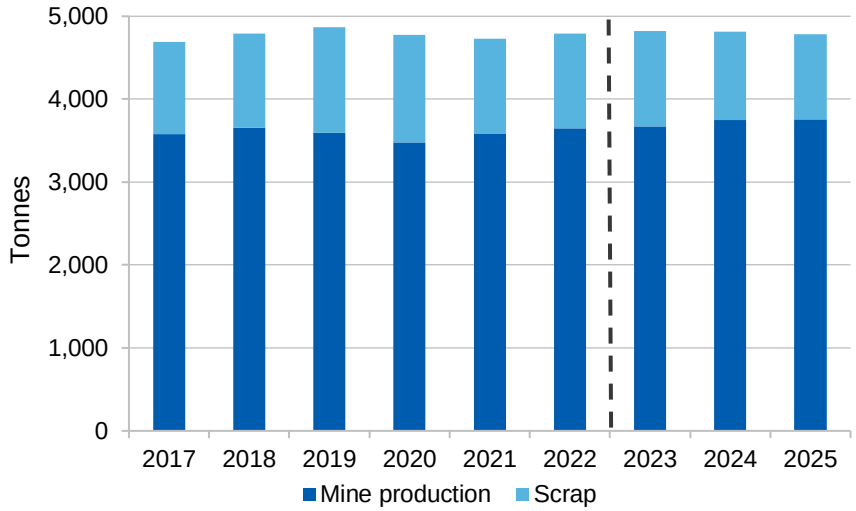
World gold mine production is forecast to rise by 1.2% a year on average by 2025 to 3,760 tonnes, led by increases in Canada, Chile and Brazil.

Canadian mine output is forecast to rise by 24% from 2023 to 2025, to reach 249 tonnes. Canadian production increases will be particularly large, with the 11 tonnes per year Côté project and the 10 tonnes per year Blackwater project commencing operations in the next two years.

Continued environmental regulations and industry consolidation in China is expected to see production fall over the medium-term.

Partially offsetting increases in mine production, gold recycling activity is forecast to decline on average by 5.4% a year by 2025, due to lower forecast gold prices.

Figure 10.2: World gold supply



Note: Net producer hedging is not included.

Source: Department of Industry, Science and Resources (2023); Metals Focus (2023); World Gold Council (2023).

10.4 Prices

Gold prices rose strongly in the first half of 2023

The London Bullion Market Association (LBMA) gold price rose as high as US$2,050 an ounce in May 2023, with prices in the first half of the year averaging US$1933 an ounce — 3.2% higher than in 2022.

Gold prices remained elevated through July 2023 due largely to US dollar depreciation and continuing safe-haven demand. The US dollar declined over July following lower-than-expected inflation data and expectations for higher interest rates in other major currency hubs such as the United Kingdom and Europe. Gold prices then fell consistently throughout August, under pressure from a strengthening US dollar and rising real bond yields (Figure 10.3).

Rising bond yields tend to decrease 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 Treasury (or other credible

government bonds) increase the so-called market “risk-free rate”, and hence the opportunity cost of holding gold (pushing prices down). However, the relationship between real bond yields and gold prices weakened sharply following the Russian invasion of Ukraine — as prices were lifted by heightened safe-haven demand for gold. This has persisted as a driver since, muting the effect of interest rates.

Expectations the US Federal Reserve would hold interest rates higher for longer than previously indicated, due to persistent core inflation or future inflationary spikes, strengthened through August. The US inflation-indexed (“real”) Treasury bond yield rose to a 17-year high of 2.0%. The rise in real yields pushed 10-year Treasury yields to a 16-year high above 4.3% and shorter-dated yields rose as high as 5% over 2 years. Yet, gold prices only fell by US$80 an ounce over the month of August, demonstrating the strength of safe-haven demand supporting gold.

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

Source: Bloomberg (2023)

Another factor could be surging commodity prices. Gold is seen as an inflation hedge. This dates back to the 1970s and 1980s when surging oil prices pushed up inflation. The rise in the gold price at that time, as last year, could have been driven by the recycling of petrodollars rather than higher inflation: high oil revenues and official sector purchases by major oil producers were a feature of 2022 as well as the mid-1970s and early 1980s.

Gold prices to remain elevated after reaching a new high in 2023

Gold prices are forecast to average about US$1,930 an ounce in 2023 — an upward revision compared with the June 2023 *Resources and Energy Quarterly*.

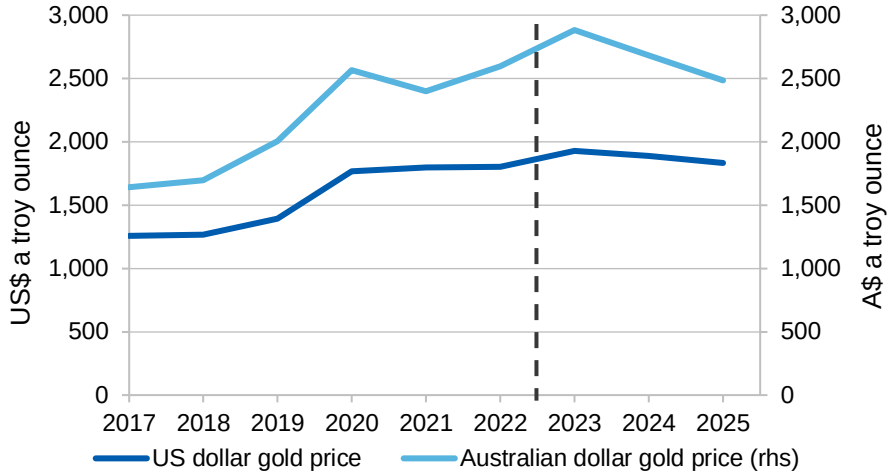
The price forecast for rest of 2023 is centred around a scenario where US economic activity slows (but does not go into recession) and unacceptably high core inflation persists, in line with our expectations in the June 2023 *Resources and Energy Quarterly*. In this scenario, real US interest rates will remain high in line with current market expectations, ordinarily leading to further declines in gold prices. However, price forecasts have been revised up over the short-term, in recognition of ongoing strength from safe-haven and central bank demand. Gold prices have held up remarkably well despite downward pressure from various sources, such as high real yields, a strong US dollar and lower ETF holdings.

If US economic activity declines substantially and interest rate cuts — not currently expected by markets — come to fruition in the first half of 2024, this could create a more supportive environment for gold and see a stronger price outcome than forecast. This would possibly come through lower real interest rates, a weaker US dollar and demand for gold ETFs — as equity markets likely soften.

After 2023, gold prices are forecast to fall by 2.5% a year to an average of around US$1,830 an ounce in 2025, due to pressure from high real interest rates (as global inflation eases) and a gradual easing of safe-haven demand.

In combination with a forecast appreciation in the Australian dollar, the lower US dollar gold price is expected to lower Australian dollar prices from A$2,900 an ounce in 2023 to A$2,500 an ounce in 2025 (Figure 10.4).

Figure 10.4: US and Australian dollar gold prices



Source: Department of Industry, Science and Resources (2023); LBMA (2023) Gold price PM

10.5 Australia's trade, production and exploration

Australian gold exports rose in the first half of 2023

Australia's gold exports increased by 7.6% year-on-year to $13 billion in the first half of 2023. The increase was driven by higher Australian dollar gold prices, which offset a 6.8% decline in export volumes. Export volumes fell in line with lower mine output.

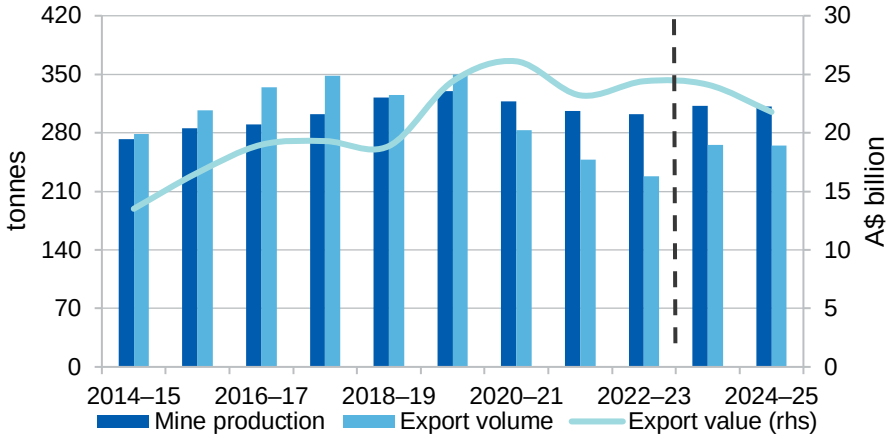
Australia exported $4.1 billion worth of gold to China in the first half of 2023, up by 28% year-on-year. Australian exports to the financial hubs (US, UK, Switzerland, Hong Kong and Singapore) were collectively worth $6.6 billion in the first half of the year — a 6.2% increase year-on-year. Within the financial hubs, exports to the United Kingdom increased to $1.2 billion (from zero in H1 2022) and exports to Singapore increased by 51% to $1.7 billion.

Australian gold export earnings to decline over the medium-term

Australian gold export earnings are estimated to have increased by 5.2% year-on-year to $24 billion in 2022–23, as lower export volumes were offset by stronger Australian dollar gold prices.

Australian gold export earnings are forecast to decline over the next two years — to just above $24 billion in 2023–24 and $22 billion in 2024–25 — as increasing export volumes are more than offset by the impact of lower Australian dollar prices (Figure 10.5).

Figure 10.5: Australian gold exports and mine production



Sources: ABS (2023); Department of Industry, Science and Resources (2023).

Australian gold mine production decreased in the first half of 2023

Australia's gold industry produced 149 tonnes of mined gold in the first half of 2023, down by 2.6% year-on-year. Production was adversely affected by heavy rainfall in the Northern Territory (NT), as well as northern parts of Queensland (QLD) and Western Australia (WA).

Production at Newmont's 15 tonnes per year Tanami project in the NT decreased by 18% year-on-year to 5.9 tonnes in the first half of 2023. Production decreases largely occurred in the March quarter, where record rainfall and associated flooding caused the closure of the main access route and the suspension of milling operations.

Production at Evolution's 2.5 tonnes per year Ernest Henry project decreased by 43% year-on-year to 0.7 tonnes in the first half of 2023. Operations were suspended at the mine in March following heavy rainfall and floods across the northwest minerals province of Queensland. Operations resumed in mid-April and returned to normal levels by the end of the June quarter 2023. Compensating for this, production at Evolution's Cowal operation increased by 29% to 4.6 tonnes in the first half of 2023, as ore production ramped up from Stage H in the open pit, and production commenced from its new underground mine.

Production at Newcrest's 20 tonnes per year Cadia mine in NSW fell by 15% year-on-year to 8.9 tonnes in H1 2023. Lower production was driven by lower grades in both quarters and lower mill throughput — following an unscheduled mechanical breakdown at the Blayney dewatering facility during the March quarter. Cadia delivered first ore from its new panel cave project PC2-3 during the March quarter, with project ramp up progressing as planned through the June quarter. First renewable power from the Rye Park Wind Farm was achieved in July and early supply has commenced to Cadia under its Power Purchase Agreement.

BHP's 4.5 tonnes per year Olympic Dam project has continued to deliver record gold production, following the implementation of initiatives to remove bottlnecks in 2022. Production in H1 2023 increased by 72% year-on-year to 3.0 tonnes.

Australian gold mine production to increase over the next two years

Australian gold production is forecast to rise from 302 tonnes in 2022–23 to 312 tonnes in 2024–25, as significant new projects and mine expansions come online.

Production will continue to ramp up for recently commenced projects, such as Red 5's King of the Hills project, Pantoro's Norseman project, and Calidus' Warrawoona Gold Project.

Bellevue Gold's 5.7 tonnes per year Bellevue gold mine in WA produced first gold from toll treatment in August, with production and processing onsite expected to come online over the second half of 2023.

Newcrest and Greatland Gold's 5.0 tonnes per year Havieron project is expected to come online in 2024, with an updated feasibility study forthcoming.

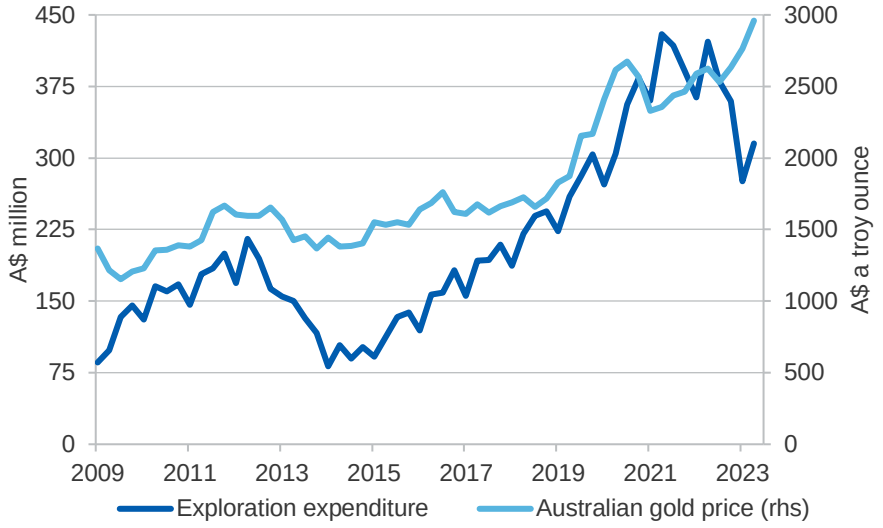
Northern Star Resources' Super Pit (KCGM) gold operation is scheduled to begin long-term expansion in 2024, growing to 675,000 ounces by 2027–28. Northern Star recently committed to a $1.5 billion mill expansion at KCGM to double processing capacity by 2029. This expansion will increase the Super Pit's production to 28 tonnes in 2028–29, compared with 13 tonnes in 2022–23.

Weaker than expected gold prices present a downside risk to the forecasts of Australian gold output (see *Prices section*). Much weaker prices could see high-cost Australian producers cease or cut back their operations.

Gold exploration expenditure declined in the first half of 2023

Australia's gold exploration expenditure decreased by 25% year-on-year to $591 million in the first half of 2023 (Figure 10.6).

Figure 10.6: Australian gold exploration expenditure and prices



Source: ABS (2023)

As a result, gold's share of Australian mineral exploration expenditure declined to an 8-year low of 30% in the first half, down from 41% a year earlier. This decline in exploration occurred despite soaring Australian gold prices, which have historically motivated high exploration expenditure. Western Australia remained the centre of gold exploration activity in Australia, accounting for 69% of total gold exploration expenditure.

Revisions to the outlook

Forecast US dollar gold prices have been revised up across the board, due to persistent strength in prices and a rebalancing of price risks towards the upside. Combining this with a slightly weaker than expected AUD/USD, Australian dollar gold prices have been revised up across the forecast profile.

Australia's forecast gold export earnings have been revised up by 8% in 2023–24 compared with the June 2023 *Resources and Energy Quarterly*. This reflects upgrades made to forecast prices and a weaker assumed Australian dollar. Forecast earnings have been revised up marginally in 2024–25 as higher forecast prices fully offset downgrades to export volumes.

Downgrades to production forecasts (underpinning lower forecast export volumes) are the result of forecast project commencements being delayed, following updated guidance from companies.

Table 10.1: Gold outlook

World	Unit	2022	2023[f]	2024[f]	2025[f]	Annual percentage change 2023[f]	2024[f]	2025[f]
Total demand	tonnes	4,713	4,260	4,345	4,360	-9.5	2.0	0.3
Fabrication consumption [b]	tonnes	2,504	2,410	2,620	2,731	-3.6	8.7	4.2
Mine production	tonnes	3,627	3,675	3,750	3,760	0.7	2.0	0.3
Price [c]								
– nominal	US$/oz	1,801	1,918	1,833	1,828	6.5	-4.5	-0.3
– real [d]	US$/oz	1,880	1,918	1,783	1,741	2.0	-7.1	-2.3
Australia	**Unit**	**2021–22**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**	**2022–23[f]**	**2023–24[f]**	**2024–25[f]**
Mine production	tonnes	306	301	313	312	-1.9	4.2	-0.6
Exports								
– volume	tonnes	248	228	266	265	-7.7	16.6	-0.6
– nominal value	A$m	23,200	24,406	23,673	21,441	5.2	-3.0	-9.4
– real value [e]	A$m	25,844	25,402	23,673	20,764	-1.7	-6.8	-12.3
Price								
– nominal	A$/oz	2,529	2,721	2,767	2,519	7.6	1.7	-9.0
– real [e]	A$/oz	2,817	2,832	2,767	2,050	0.5	-2.3	-25.9

Notes: **b** includes jewellery consumption and industrial applications; **c** London Bullion Market Association PM price; **d** In 2023 US dollars; **e** In 2023–24 Australian dollars; **s** Estimate; **f** Forecast;
Source: ABS (2023); Department of Industry, Science and Resources (2023); London Bullion Market Association (2023) gold price PM; S&P Market Intelligence (2023); World Gold Council (2023).

Aluminium

Australia's aluminium sector

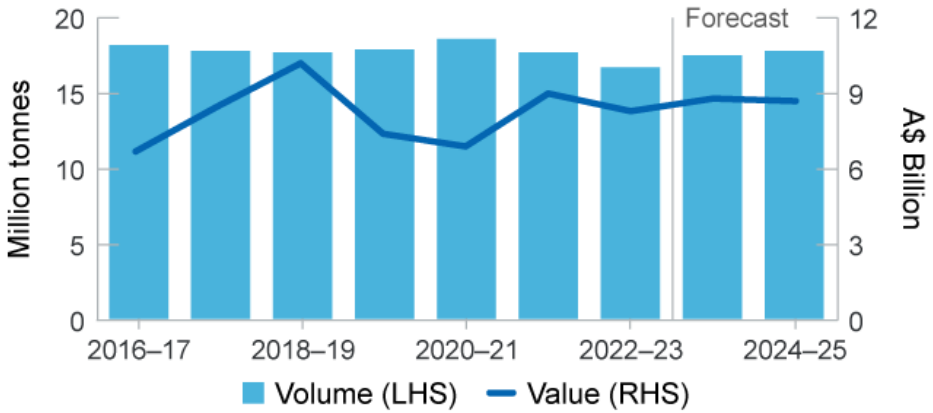
100m tonnes
of **annual bauxite output**, world's 2nd largest producer

$16 billion
primary aluminium, alumina and bauxite **exported,** 2022-23

Around 98%
of Australian bauxite is **exported to China**

Major Australian bauxite deposits, Gt

Australian alumina exports



Outlook

Prices set to rise as energy efficient technology supports aluminimum demand

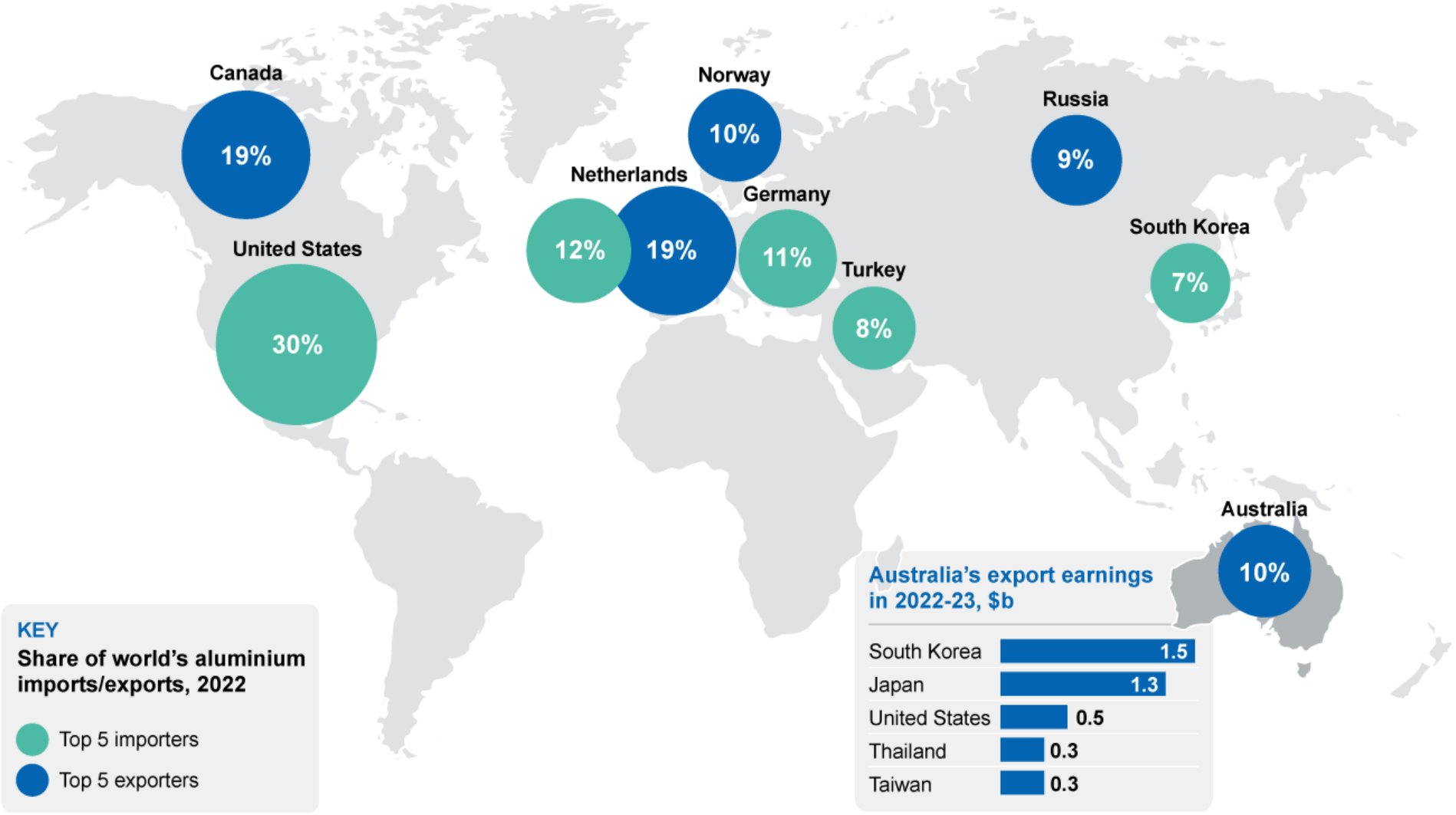
Future earnings for exports of aluminium, alumina and bauxite to **lift as prices rise**

Bauxite export volumes **set to increase** with Indonesia's bauxite export ban on June 10

Demand for new energy efficient cars and technologies **support Australian exports**

SOURCE: DISR; OCE

Aluminium TRADE MAP



SOURCE: WBMS; ABS

11.1 Summary

- Primary aluminium prices declined in the September quarter, on the back of rising supply from China and falling global demand.
- Sluggish global construction activity is expected to be offset by the impact of higher demand from vehicle manufacturers, as output rises and efforts to raise the energy efficiency of vehicles lift aluminium usage over the outlook period.
- Earnings for Australian exports of aluminium, alumina and bauxite are expected to rise from $16 billion in 2023–24 to $17 billion in 2024–25, as prices rise over the outlook period.

11.2 World consumption

Sluggish world economic growth reduced demand in mid-2023

A weak Chinese property sector and relatively tight monetary conditions in Western economies decreased global primary aluminium demand by 0.5% year-on-year in H1 2023 to nearly 34 million tonnes (Mt). In Europe and the US, falling primary aluminium demand (down by 17% and 11% year-on-year, respectively) reflected subdued activity in the construction sector.

In contrast, there is strong demand from the EV sector. Strong electric vehicle (EV) sales in China helped drive Chinese aluminium demand up by 3.1% year-on-year in H1 2023 to nearly 21 Mt. Over this period, sales of new energy vehicles (EVs and plug-in hybrids) rose by 37% year-on-year to 3.1 million units, while internal combustion engine car sales dropped by 8.0% year-on-year.

In the US, improved consumer sentiment has provided the US automotive sector with some support in recent months. It is estimated that vehicle sales will rise from 13.8 million units in 2022 to 15.2 million units in 2023.

The European Union (EU) automotive sector appears to have managed to weather the storms of high inflation and interest rates. EU car registrations grew by 18% year-on-year in H1 2023 to 5.4 million units. In Germany, vehicle output was up by 32% year-on-year in H1 2023 to 2.2 million units.

Higher global primary aluminium production boosted the demand for alumina by 1.1% year-on-year in the first half of 2023 to 67 Mt. Demand in Canada rose by 8.2% year-on-year in the first half of 2023, as Canadian aluminium smelters required more alumina to accommodate increased primary aluminium production.

Lower global alumina production reduced global bauxite usage by 2.9% year-on-year in the first half of 2023.

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

Strong global vehicle manufacturing activity is expected to offset weak construction activity to help drive global aluminium demand up by 1.0% in 2023 to nearly 69 Mt.

In China, the Government is lifting support for the EV sector. In June, the Chinese Government's passenger electric vehicle (PEV) subsidy was extended to 2025, with half of this subsidy available until 2027. This measure will support aluminium demand from the Chinese auto sector.

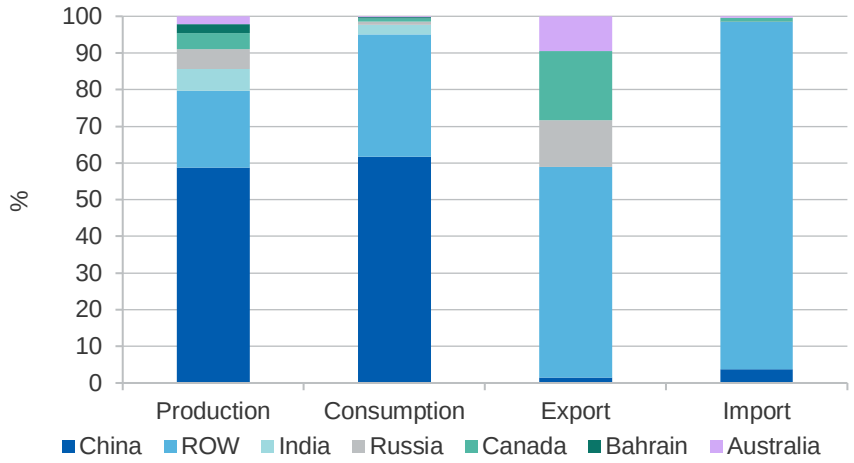
PEV sales in the US are expected to rise in 2023, driven by an improvement in the supply chain. According to AutoForecast Solutions' April 2023 forecasts, North American automotive production is forecast to increase by 9.1% year-on-year in 2023 to 15.6 million units.

Beyond 2023, rising sales of energy-efficient vehicles (which are more aluminium intensive) and lower interest rates in 2024 and 2025, are expected to boost global aluminium demand. In the US and Europe, housing and commercial building activities are expected to recover when interest rates fall, most likely in late 2024 or in 2025.

Electric vehicles drive aluminium demand over the outlook period

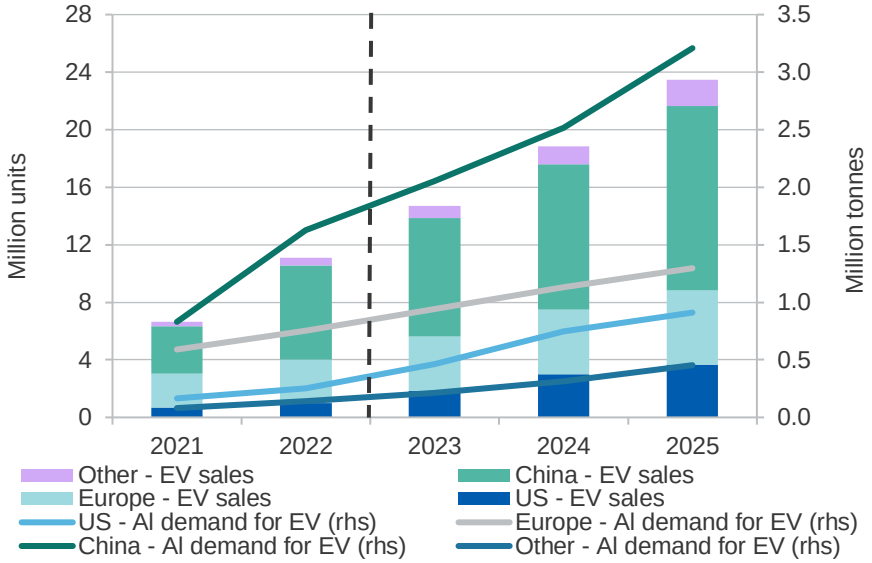
A significant driver of aluminium demand is expected to come from world automakers seeking to reduce vehicle weight by increasing the proportion of aluminium in the vehicle. Aluminium is 10-40% lighter than steel in comparable components. EV makers are particularly focused on reducing vehicle weight, since it impacts heavily on the driving range of the vehicle.

Figure 11.1: Shares of global primary aluminium production, consumption, exports and imports, 2022



Source: ABS (2023); UN Comtrade (2023); World Bureau of Metals Statistics (2023); Wood Mackenzie (2023); Department of Industry, Science and Resources (2023)

Figure 11.2: Electric vehicle (EV) sales and aluminium demand



Notes: EV sales include battery and hybrid EVs. An estimated average aluminium content of 250 kilograms per EV.
Source: Wood Mackenzie (2023); Department of Industry, Science and Resources (2023)

Strong EV sales will boost aluminium demand over the outlook period. It is estimated that EV sales in China will rise from 8.2 million units in 2023 to 12.8 million units in 2025, Europe (from 3.8 million units in 2023 to 5.2 million units in 2025) and the US (from 1.9 units in 2023 to 3.6 million units in 2025) (Figure 11.2). With an average aluminium content of 250 kilograms per EV, aluminium usage in EVs in China is forecast to rise from 2.1 Mt in 2023 to 3.2 Mt in 2025, Europe (from 0.9 Mt in 2023 to 1.3 Mt in 2025) and the US (from 0.5 Mt in 2023 to 0.9 Mt in 2025) (Figure 11.2).

Decarbonisation likely to boost demand for secondary aluminium

Demand from automotive and construction market participants with decarbonization targets will boost demand for secondary aluminium consumption over the outlook period, reaching 28 Mt by 2025. CRU expects secondary aluminium to account for over 50% of US aluminium demand by 2028. Other industrialised nations such as Germany, Japan, Italy and South Korea will also lift their secondary aluminium usage to achieve decarbonisation targets. As a result, world secondary aluminium usage is forecast to rise from 25 Mt in 2023 to 28 Mt in 2025.

An expected rise in global primary aluminium production is likely to drive higher demand for alumina over the outlook period. In line with world primary aluminium production, world alumina consumption is forecast to grow by 2.1% in 2023, 2.3% in 2024 and 1.4% in 2025.

An expected fall in Australia's alumina production is likely to reduce global bauxite consumption by 0.7% in 2023 to 360 million tonnes. Australia is the world's second largest alumina producer, accounting for around 14% of global alumina production. Beyond 2023, an expected improvement in Australia's alumina refining operations will lift global alumina output, and therefore, global bauxite consumption.

11.3 World production

China's restarts boosted global primary aluminium output in H1 2023

The restart of China's major aluminium producing cities largely contributed to a 1.1% year-on-year rise in the global primary aluminium output in the first half of 2023. In Yunnan Province (China's fourth largest producing province), local aluminium smelters have restarted over 1.1 Mt a year capacity since mid-June 2023, as the supply of hydropower improves.

A production lift at Alumar aluminium smelter boosted Brazilian primary aluminium output to 493,000 tonnes in H1 2023, up 39% year-on-year.

Higher production at Rio Tinto's 150,000 tonnes a year Kitimat aluminium smelter boosted Canadian primary aluminium output to 1.6 MT in the first half of 2023, up 8.2% year-on-year.

Lower alumina output in Australia led to a 3.4% year-on-year fall in global alumina output in the first half of 2023 to nearly 69 Mt. Over this period, production in Australia — the world's second largest alumina producer — fell by 2.9% year-on-year to 9.6 Mt, due to lower production at Rio Tinto's Queensland Alumina Limited (QAL) refinery in Queensland.

Indonesia's alumina output rose by 7.3% year-on-year in the first half of 2023, propelled by production ramp-up at the 300,000 tonnes a year Tayan alumina refinery.

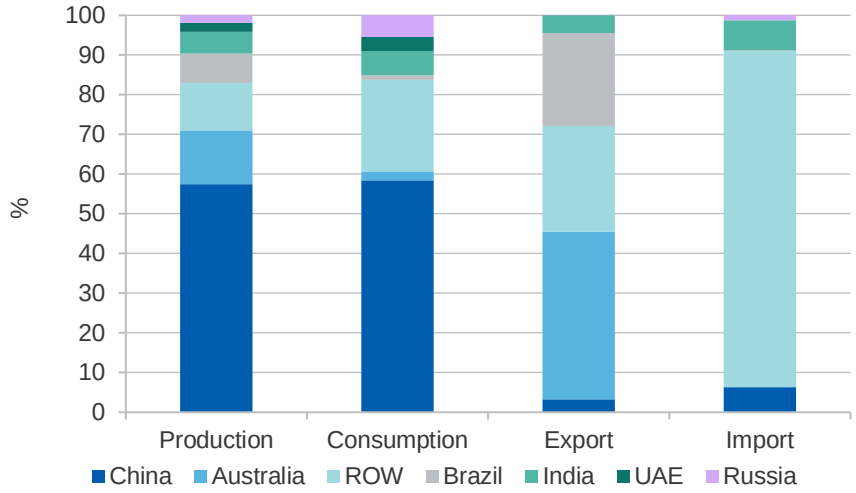
Higher output in Guinea — the world's largest bauxite producer — increased world bauxite production by 0.6% year-on-year in the first half of 2023 to 194 Mt.

Aluminium and alumina output set to rise over the outlook period

Production ramp-ups in China and Brazil and the restart of idled capacity in Europe are expected to drive global primary aluminium output higher in H2 2023 and over the rest of the outlook period. In China, primary aluminium output is forecast to rise from 42 Mt in 2023 to 43 Mt in 2025. By the end of the outlook period, primary aluminium production will edge closer to the maximum production cap of 45 Mt a year set by the Chinese Government in 2017.

Primary aluminium production in Brazil is forecast to increase from 1.2 Mt in 2023 to 1.3 Mt in 2025. In Europe, primary aluminium production is forecast to increase from 6.8 Mt in 2023 to 7.2 Mt in 2025, as lower energy prices support a restart of idled capacity.

Figure 11.3: Shares of global alumina production, consumption, exports and imports, 2022



Source: ABS (2023); UN Comtrade (2023); World Bureau of Metals Statistics (2023); Wood Mackenzie (2023); Department of Industry, Science and Resources (2023)

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

Russian aluminium producer, Rusal, and the Nigerian government have discussed a possible restart of 200,000 tonnes a year Alscon aluminium smelter in Nigeria. The smelter ceased operation in 2012, due to low aluminium prices and a lack of reliable gas supply.

The failure to reach an energy supply deal between Rio Tinto and the energy supplier for its 341,000 tonnes a year Tiwai Point aluminium

smelter in New Zealand is another risk to the assessment. The current energy supply agreement is to expire by end 2024. At the time of writing, both Rio Tinto and energy supplier (Meridian Energy) had not reached a new long term power supply agreement.

Driven by the increasing demand for recycled aluminium, global secondary aluminium output is forecast to rise from 32 Mt in 2023 to 36 Mt in 2025. China accounts for most of this increase, with secondary aluminium production forecast to rise from 12 Mt in 2023 to 14 Mt in 2025.

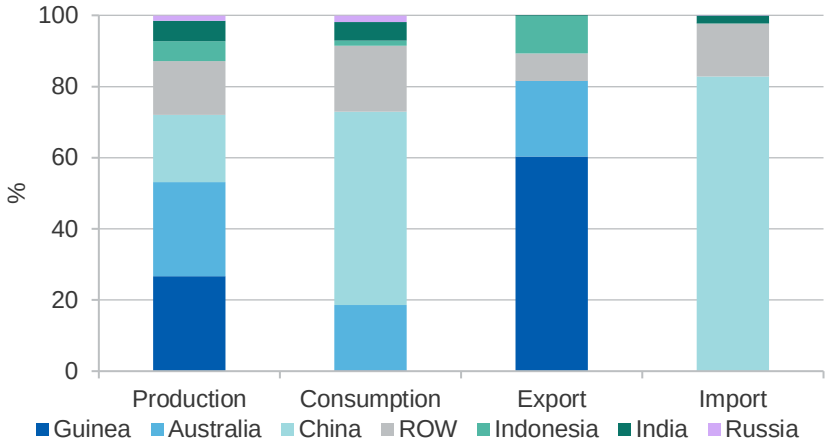
Rio Tinto's 30,000 tonnes a year Arvida recycling facility in Quebec, Canada, is expected to be commissioned in the March quarter 2025. In July 2023, Rio Tinto and Giampaolo Group (one of North America's largest fully integrated metal management businesses) entered into an agreement to form a joint-venture to manufacture and market recycled aluminium products. Hydro's Navarra and Sjunnen recycling facilities in Spain and Sweden are adding 20,000 tonnes a year each more output.

Rising output from new/existing refineries in China, Spain and Indonesia is expected to drive up global alumina output over the outlook period. Around 3.6 Mt of new alumina capacity is expected to come online in 2023. In China, alumina production is expected to continue to rise, worsening the market surplus in 2023. In Spain, Alcoa's 1.2 Mt a year San Ciprian alumina refinery has lifted output. In Indonesia, China Aluminium Company and the Indonesian joint-venture partners' 2 million tonnes a year Mempawah alumina refinery, is expected to come online in 2024. It is expected that eight more alumina refineries will be built in Indonesia in the coming years, with a total capacity addition of around 10 Mt.

In Australia, Rio Tinto has revised its 2023 alumina guidance for its QAL refinery in Queensland down to 7.4 Mt from 7.7 Mt. The downward revision reflects the company's implementation of initiatives to improve the QAL refinery's operational stability.

Global alumina output is estimated to fall by 0.7% in 2023 to 142 Mt, before resuming to grow in 2024 and 2025.

Figure 11.4: Shares of global bauxite production, consumption, exports and imports, 2022



Source: ABS (2023); UN Comtrade (2023); World Bureau of Metals Statistics (2023); Wood Mackenzie (2023); Department of Industry, Science and Resources (2023)

The Indonesian bauxite export ban (commenced in June 2023) is expected to reduce global bauxite production in 2023. Indonesia produced 22 Mt of bauxite in 2022 (accounting for 5.7% of global output, 5th largest producer) and exported 18 Mt of bauxite in 2022 (11% of global bauxite exports, third largest exporter). With the current domestic bauxite consumption of around 9.0 Mt a year, a cut in production seems to be the only viable option for Indonesian bauxite producers.

World bauxite production is expected to grow by 2.1% in 2023, 3.7% in 2024 and 3.5% in 2025. Australia and Guinea are expected to contribute most to this rise. In Guinea, Alliance Mining Commodities launched the 1.5 billion tonnes (estimated reserve) Koumbia bauxite project in mid-February 2023. A recent feasibility study found that the project is commercially viable and will require a capital investment of over US$1 billion.

Vietnam is planning to build three new bauxite mines in the northern region with a combined capacity of 2.0 Mt a year. Vietnam has the second largest bauxite reserves in the world (estimated 5.8 billion tonnes) after Guinea with an estimated reserve of 7.4 billion tonnes.

Green aluminium, alumina and bauxite

Globally, producers are moving with plans to decarbonise aluminium supply chains. In partnership with Sumitomo, and with A$32.1 million co-funding support from the Australian Renewable Energy Agency (ARENA), Rio Tinto will build a hydrogen pilot plant in Gladstone, Queensland, in 2024 to trial lower carbon alumina refining. The plant is a part of Rio Tinto's A$111.1 million Yarwun Hydrogen Calcination Pilot Demonstration Program aimed at demonstrating the viability of using hydrogen as a replacement for natural gas in the alumina calcination process.

In the June quarter 2023, Hydro's Navarra recycling facility in Spain produced the first batch of recycled aluminium using green hydrogen as an energy source.

In India, Hindalco aims to ramp up production of low carbon aluminium output to 30% of its output within the next four years. The 100 megawatt capacity pilot project — where a renewable energy provider to power supply from pumped water storage to its 365,000 tonnes a year Aditya aluminium smelter — is expected to commence operations in 2024.

11.4 World trade

Weak aluminium, alumina and bauxite exports in H1 2023

Lower exports from Russia reduced global primary aluminium exports by 13% year-on-year to 6.5 Mt in H1 2023. Despite no direct sanctions on Russian aluminium by Western nations, Russia's share of world primary aluminium exports fell from 12% in H1 2022 to 7.3% in H1 2023.

Offsetting the fall in aluminium exports from Russia was higher primary aluminium exports from the Netherlands (up 10% year-on-year in H1 2023) and Australia (up 10% year-on-year in H1 2023).

The slower than expected restart of idled primary aluminium capacity in Europe reduced world secondary aluminium exports in the first half of 2023. European aluminium users turned to secondary aluminium as a substitute for primary aluminium. As a result, less secondary aluminium was available for export, which declined by 8.9% year-on-year.

Lower alumina exports from Australia — the world's largest alumina exporter — cut global alumina exports by 7.9% year-on-year in the first half of 2023 to 19 Mt. Over this period, Australian alumina exports to India fell 40% year-on-year, as Indian alumina importers reduced their imports.

Lower bauxite exports from Australia — the world's second largest bauxite exporter — reduced global bauxite exports by 8.8% year-on-year in the first half of 2023 to 76 million tonnes. Over this period, higher than average annual rainfall in northern Australia slowed down bauxite exports from mines in the Northern Territory and Queensland.

Guinea exported 52 million tonnes of bauxite in the first half of 2023, up 6.9% year-on-year.

Lower aluminium imports from Europe and the US

Weak primary aluminium consumption in Europe and the US reduced global primary aluminium imports by 11% year-on-year in the first half of 2023. Over this period, German and Italian primary aluminium imports decreased by 18% and 27% year-on-year, respectively. In the US, primary aluminium imports fell by 1.6% year-on-year in the first half of 2023.

Higher imports by China offset the fall in European and US imports. In H1 2023, China imported 490,000 tonnes of primary aluminium, a rise of 145% year-on-year. Aluminium demand from the automotive and solar energy sectors was the driving force behind China's increased imports.

Lower European imports reduced global secondary aluminium imports by 1.6% year-on-year in H1 2023. Many European countries reduced secondary aluminium consumption to deal with slowing construction activities. In Poland, secondary aluminium imports in the first half of 2023 fell by 16% year-on-year to 168,000 tonnes. Over this period, Italy's secondary aluminium imports fell by 4.9% year-on-year to 97,000 tonnes.

Higher alumina production in India reduced global alumina imports by 6.2% year-on-year in H1 2023. Over this period, India imported 1.2 Mt of alumina (down by 8.8% year-on-year). Russia's alumina import data is not available and is not included in this assessment.

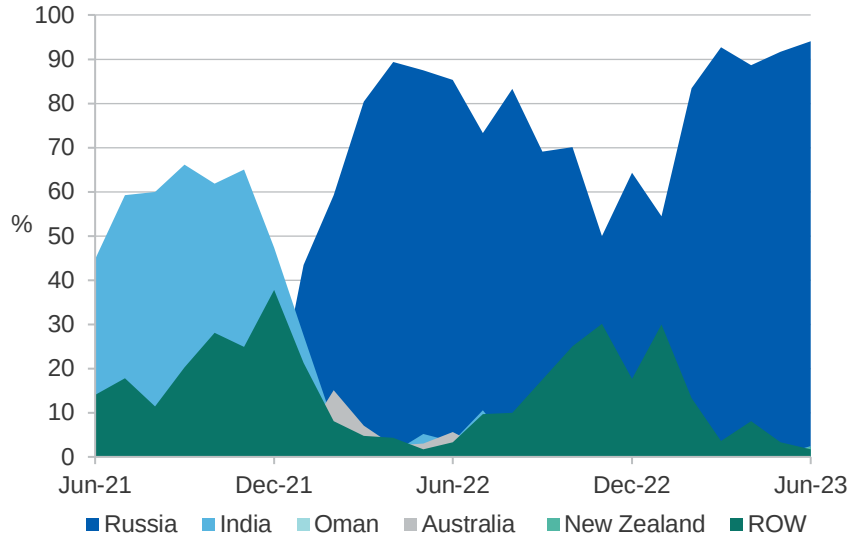
Lower bauxite imports from Europe reduced global bauxite imports by 2.2% year-on-year in H1 2023. Over this period, Spain imported 810,000 tonnes of bauxite (down 59% year-on-year). In Ireland, bauxite imports fell by 57% year-on-year in H1 2023.

More Russian primary aluminium entering Chinese market

China's imports of Russian primary aluminium have increased significantly so far in 2023; from 313,717 tonnes in the second half of 2022 to 416,943 tonnes in the first half of 2023. On a monthly basis, Russia's share of China's total primary aluminium imports reached a record high in June 2023, accounting for 94% of China's total primary aluminium imports (Figure 11.5).

Chinese imports are likely to rise further over the forecast period, as international buyers cease buying Russian aluminium.

Figure 11.5: China's primary aluminium import sources



Notes: ROW: Rest of the world

Source: China Customs

11.5 Prices

Sluggish Chinese economic growth is a headwind to aluminium prices

Rising supply and weak world demand have pushed prices down from levels averaged in the June quarter. Demand has suffered from the impact of tighter monetary policy in the Western economies and sluggish economic growth in China. The London Metal Exchange (LME) spot price for primary aluminium has decreased 5.9% so far in 2023, sitting at US$2,200 a tonne on 22 September 2023 — compared to an average of US$2,830 a tonne in the first nine months of 2022.

Low aluminium stocks have helped prevent deeper price falls as world demand weakens (Figure 11.6). LME stocks have fallen from a 7-month high of 579,525 tonnes in May 2023 to 482,300 tonnes in September 2023. Shanghai Future Exchange aluminium stocks followed the same trend, falling from an eleven-month high of 295,920 tonnes in February 2023 to 90,293 tonnes in September 2023. LME off-warrant stocks fell from a fourteen-month high of 435,869 tonnes in January 2023 to 291,754 tonnes in July 2023.

Figure 11.6: Exchange aluminium stocks

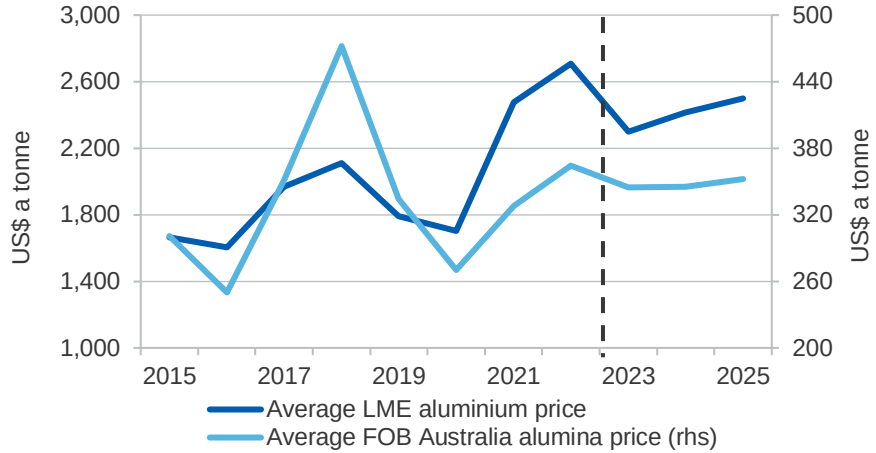
Source: London Metal Exchange (2023); Bloomberg (2023)

The free on board (FOB) Australian alumina price has fallen by 3.6% so far in 2023, at US$341 a tonne on 22 September 2023 — and compares to an average price of US$376 a tonne in the first nine months of 2022.

The prospect of rising Chinese aluminium supply and sluggish Chinese economic growth (see the *Macroeconomic chapter*) is likely to be a headwind to aluminium prices over the rest of 2023. As a result, the LME primary aluminium spot price is estimated to average US$2,300 a tonne in 2023, a fall of 15% year-on-year (Figure 11.7). The LME aluminium price is forecast to average US$2,415 and US$2,500 a tonne in 2024 and 2025, respectively (Figure 11.7).

New alumina capacity additions — about 3.6 Mt of new capacity in 2023 — are likely to put alumina prices under pressure. The free on board (FOB) Australian alumina price is estimated to decrease by 5.5% in 2023 to an average US$344 a tonne (Figure 11.7). Growing global demand for new, energy-efficient cars and technologies will boost aluminium usage and prices over the outlook period. The FOB Australian alumina price is forecast to rise at an average annual rate of 1.1%, averaging US$352 a tonne in 2025 (Figure 11.7).

Figure 11.7: Primary aluminium and alumina prices



Source: Bloomberg (2023); Department of Industry, Science and Resources (2023)

11.6 Australian exports and production

Lower aluminium and alumina prices reduced exports in 2022–23

Lower primary aluminium and alumina prices and alumina export volumes cut Australia's aluminium, alumina and bauxite (AAB) exports by 4.7% in 2022–23 to $16 billion. A 19% year-on-year fall in the LME aluminium price in 2022–23 reduced Australian primary aluminium export values by 7.4% year-on-year to $5.3 billion in 2022–23. Over this period, primary aluminium exports to Japan and the US fell by 13% and 11% year-on-year to $1.3 billion and $0.5 billion, respectively. Largely offsetting the fall in exports to Japan and the US was a 50% year-on-year rise in exports to South Korea to $1.5 billion.

A 10% year-on-year fall in alumina prices reduced Australian alumina export values by 7.1% in 2022–23 to $8.3 billion. In 2022–23, Australian alumina export volumes were down by 6.3% year-on-year to nearly 17 Mt.

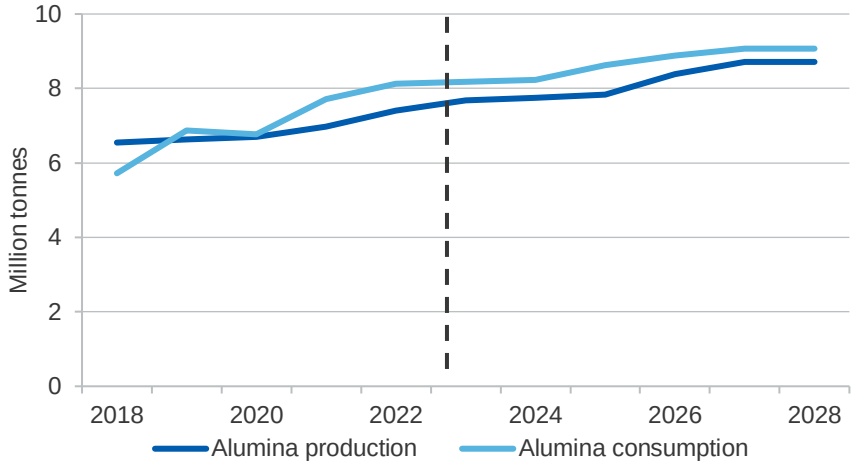
Australian bauxite export values increased by 12% year-on-year in 2022–23 to nearly $1.3 billion, despite a 4.6% year-on-year fall in bauxite export volumes. China accounted for 98% of total Australian bauxite exports in 2022–23. A ban on bauxite exports by Indonesia — which started on 10 June 2023 — seems to have assisted Australian bauxite exporters. Provisional trade data for July 2023 shows a 14% year-on-year or 12% month-on-month rise in Australian bauxite exports to China (Figure 11.8).

Higher alumina, aluminium and bauxite export earnings in prospect

An expected rise in primary aluminium prices and higher alumina and bauxite export volumes are likely to boost Australian AAB export earnings from $16 billion in 2023–24 to $17 billion in 2024–25 (Figure 11.9).

Australian alumina exports to India are expected to rise over the outlook period, as Indian alumina demand exceeds alumina production (Figure 11.10). In 2022–23, Australia exported 682,000 tonnes of alumina to India, accounting for 4.1% of Australia's exports. India is prioritising expenditure on EV and renewable energy infrastructure and battery supply chains.

Figure 11.10: India's alumina production and consumption



Source: CRU (2023); Wood Mackenzie (2023); Department of Industry, Science and Resources (2023)

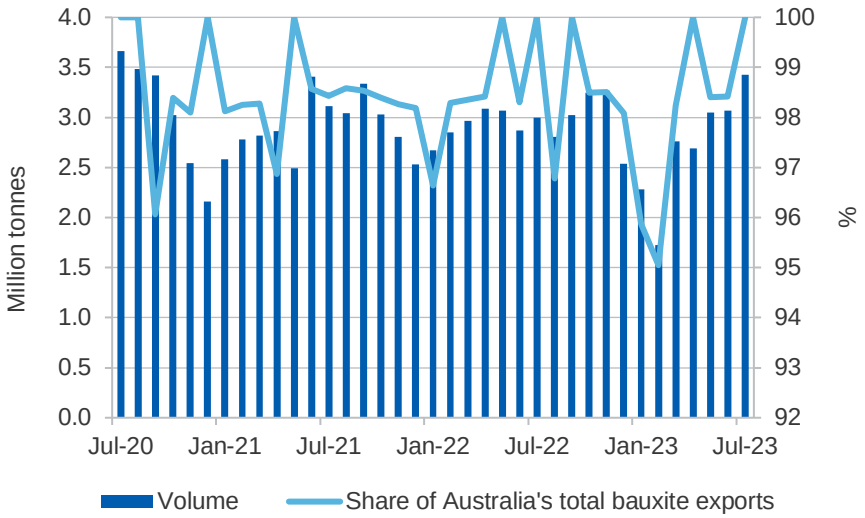
Australia's alumina/aluminium/bauxite production fell in 2022–23

Australian primary aluminium output was virtually flat in 2022–23 at 1.52 Mt. In mid-March 2023, Alcoa announced an immediate 25% production cut at Portland Aluminium amid operational instability.

Unplanned outages and plant reliability issues at Rio Tinto's Queensland Alumina Limited alumina refinery in Queensland cut Australian alumina output by 4.4% in 2022–23 to 19 Mt. In January 2023, Alcoa declared 'force majeure' — triggering a contract clause to remove liability for unforeseeable and unavoidable events that interrupt normal business — due to disruptions in natural gas supply to its operations in WA. About 20% (or 438,000 tonnes) of refining capacity at the Kwinana plant still curtailed. On 26 April 2023, Alcoa lifted the force majeure for its Kwinana operation.

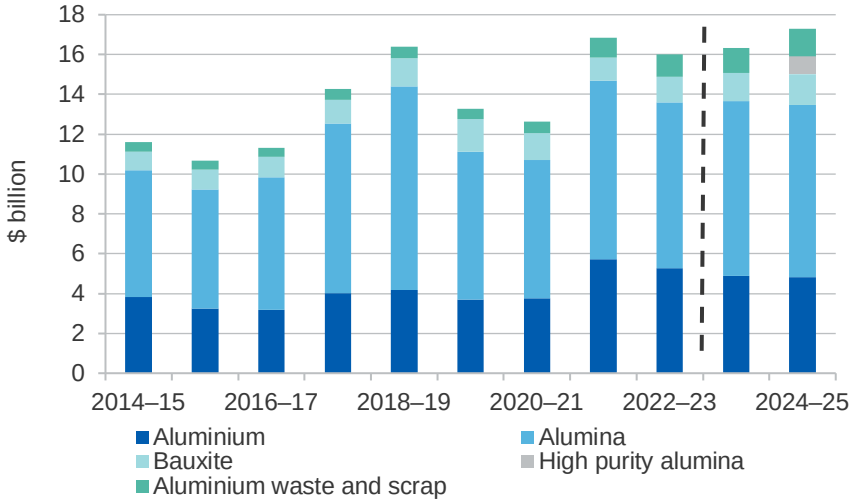
Above average annual rainfall reduced pit access and speed limits for mobile equipment at Rio Tinto's Gove bauxite mine in the Northern Territory and the Weipa bauxite mine in Queensland. As a result, Australian bauxite output fell by 1.8% in 2022–23 to 100 Mt.

Figure 11.8: Australia's bauxite exports to China, monthly



Source: ABS (2023) International Trade in Goods and Services, 5368.0

Figure 11.9: Australian aluminium/alumina/bauxite exports



Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources.

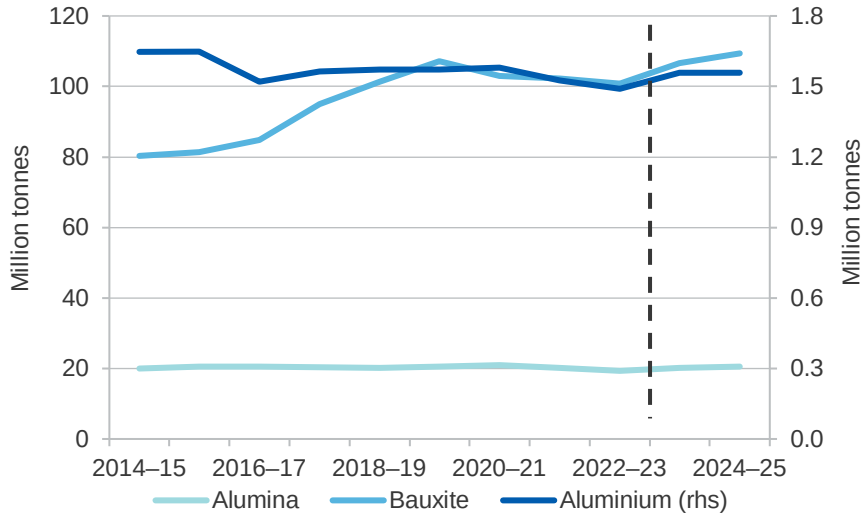
Higher bauxite output over the outlook period

Over the outlook period, an expected improvement in Australian smelting operations is likely to bring Australian primary aluminium output back to normality, at 1.6 Mt of primary aluminium a year (Figure 11.11).

Alcoa Australia has signed a new nine-year agreement with AGL to supply a proportion of the electricity requirement of Portland Aluminium smelter in Victoria to 30 June 2035.

An expected improvement in refining operations in Queensland and in Worsley (WA) offset lower alumina output from Alcoa's refineries in WA. Alcoa is still waiting for approval from the WA government for its Mine Management Program — usually approved annually on a 5-year basis. While waiting for approval, Alcoa will have to mine lower grade bauxite in approved areas until mid-2024. The company's short-term alumina output is expected to vary (to the downside) depending on bauxite grades. As a result, Australia's alumina output is forecast to fluctuate around the 20 MT a year level (Figure 11.11).

Figure 11.11: Australian aluminium/alumina/bauxite output



Source: Department of Industry, Science and Resources (2023)

The expansion of Metro Mining's Bauxite Hills in Queensland from 3.5 Mt a year to 7 Mt a year is forecast to drive Australian bauxite output up by 4.4% a year to 109 MT in 2024–25 (Figure 11.11).

High purity alumina (HPA) projects continue to progress.

The Western Australian Government has allocated $3 million from its Investment Attraction Fund for FYI Resources to develop its 900 tonnes a year HPA project. Alpha HPA will go ahead with its $300 million second stage of its HPA First project in Gladstone, Queensland. In April 2023, the company received a $21.7 million grant from the Queensland Government. Stage 1 of the project has been in operation since late 2022, producing 5N (99.99%) purity aluminium nitrate in commercial quantities. Stage 2 involves the production of aluminium sulfate, HPA, nano HPA and high purity aluminium hydroxides.

Impact Minerals bought an 80% interest in the Lake Hope HPA project in WA. It is a high-grade alumina prospect with an estimated alumina content of at least 775,000 tonnes, most of which can be processed to HPA. Further drilling is occurring, and a pre-feasibility study is ongoing.

Revisions to the outlook

The forecast for Australia's AAB export earnings in 2023–24 has been revised up from the June 2023 REQ — by $376 million. The revision reflects higher forecasts for Australia's alumina export values.

The forecast for Australia's AAB export earnings in 2024–25 has been revised up from the June 2023 REQ by $204 million. The revision reflects lower forecasts for Australian dollar.

Box 11.1: Gallium — A by-product of processing bauxite

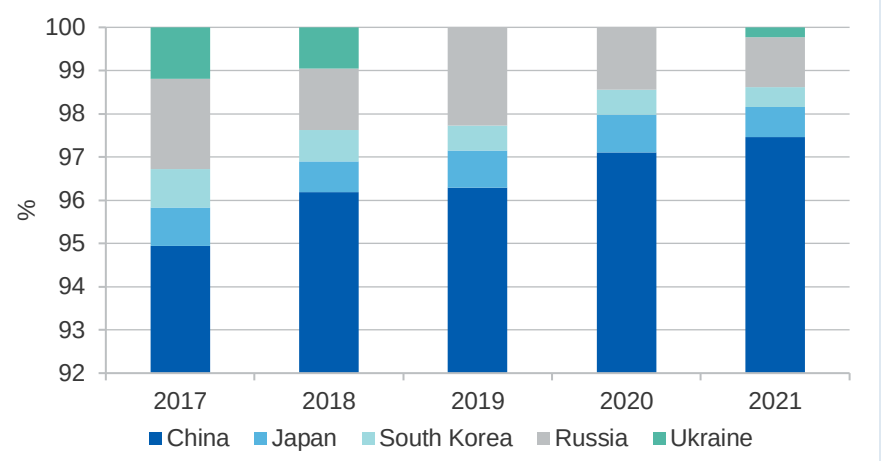
Gallium is a chemical element which has the unusual property of melting at room temperature. Unlike other resource commodities that are extracted directly from the earth, gallium is a by-product of processing bauxite — the main raw material for producing alumina and aluminium.

Gallium plays a critical role in a range of novel technologies, from LED lighting solar cells to high efficiency semiconductors for a range of consumer and defence applications. It is used in phased array radars, electronic warfare systems, satellite communications system, 5G wireless base stations, mobile phones; optoelectronics: LED lighting, lidar, infrared lasers; power electronics: spacecraft power management, fast chargers (EVs and consumer electronics), data centres, power grid management; and clean energy: solar cells, neodymium iron boron magnets for EVs. Gallium nitride is now gaining traction for rapid charging devices. The Navitas Semiconductor company in the US is developing a gallium nitride charging system which could lower the charging time for EVs by 33%.

China's dominance in gallium is closely tied to the growth of its aluminium industry. Chinese aluminium smelters are required to create the capacity to extract gallium. As a result, China produced 423,000 kilograms of gallium in 2021, accounting for 97% of world gallium output (Figure 11.12).

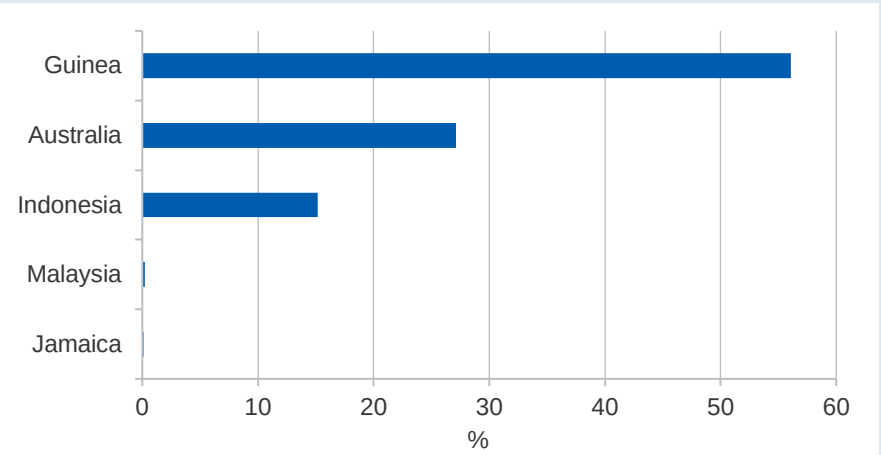
To secure a stable bauxite supply, over the last decade China's private and public sectors have invested to lift Guinean bauxite production capacity — which has the world's largest bauxite reserves. In 2022, Guinea accounted for 56% of China's bauxite imports. Australia and Indonesia (before its bauxite export ban) were the 2nd and 3rd largest source of Chinese bauxite imports in 2022 (Figure 11.13). Australia is the world's second biggest bauxite producer and its 2nd biggest exporter; we are the world's second biggest alumina producer and its largest alumina exporter.

Figure 11.12: Shares of world gallium production



Source: US Geological Survey (2023), 2021 Annual Tables

Figure 11.13: Shares of China's bauxite imports, 2022



Source: Bloomberg (2023)

Source: National Library of Medicine; Forbes, Sourcing gallium for American semiconductor supremacy; The United States Centre for Strategic and International Studies, De-risking gallium supply chains; US Geological Survey, Compilation of gallium resource data for bauxite deposits; Department of Industry, Science and Resources.

Table 11.1: Aluminium, alumina and bauxite outlook

						Annual percentage change		
World	**Unit**	**2022**	**2023 s**	**2024 f**	**2025 f**	**2023 s**	**2024 f**	**2025 f**
Primary aluminium								
Production	kt	68,529	70,301	71,949	72,931	2.6	2.3	1.4
Consumption	kt	68,050	68,734	72,649	73,816	1.0	5.7	1.6
Prices aluminium c								
- nominal	US$/t	2,708	2,300	2,415	2,500	-15.1	5.0	3.5
- real d	US$/t	2,827	2,300	2,349	2,381	-18.7	2.1	1.4
Prices alumina spot								
- nominal	US$/t	365	344	345	352	-5.5	0.2	2.1
- real d	US$/t	381	344	336	336	-9.5	-2.6	0.0
Australia	**Unit**	**2021–22**	**2022–23**	**2023–24 f**	**2024–25 f**	**2022–23**	**2023–24 f**	**2024–25 f**
Production								
Primary aluminium	kt	1,525	1,524	1,558	1,559	-0.1	2.2	0.1
Alumina	kt	20,138	19,242	20,108	20,446	-4.4	4.5	1.7
Bauxite	Mt	102.3	100.4	106.6	109.4	-1.8	6.2	2.6
Consumption								
Primary aluminium	kt	501	314	264	264	-37.3	-16.0	0.0
Exports								
Primary aluminium	kt	1,368	1,441	1,418	1,419	5.3	-1.6	0.1
- nominal value	A$m	5,710	5,283	4,887	4,809	-7.5	-7.5	-1.6
- real value e	A$m	6,360	5,499	4,887	4,657	-13.5	-11.1	-4.7
Alumina	kt	17,739	16,566	17,494	17,788	-6.6	5.6	1.7
- nominal value	A$m	8,977	8,308	8,773	8,664	-7.5	5.6	-1.2
- real value e	A$m	10,000	8,647	8,773	8,390	-13.5	1.5	-4.4
Bauxite	kt	35,957	34,031	40,306	43,181	-5.4	18.4	7.1
- nominal value	A$m	1,177	1,280	1,414	1,538	8.8	10.4	8.8
- real value e	A$m	1,311	1,333	1,414	1,489	1.7	6.1	5.3
Total value								
- nominal value	A$m	16,854	16,007	16,360	17,302	-5.0	2.2	5.8
- real value e	A$m	18,774	16,660	16,360	16,755	-11.3	-1.8	2.4

Notes: Total nominal and real values of Australian exports include primary aluminium, aluminium waste and scrap, alumina, high purity alumina and bauxite. **c** LME cash prices for primary aluminium; **d** In 2023 calendar year US dollars; **e** In 2023–24 financial year Australian dollars; **f** Forecast; **s** Estimate. Sources: ABS (2023) International Trade in Goods and Services, 5368.0; Bloomberg (2023); London Metal Exchange (2023); Department of Industry, Science and Resources (2023); World Bureau of Metals Statistics (2023)

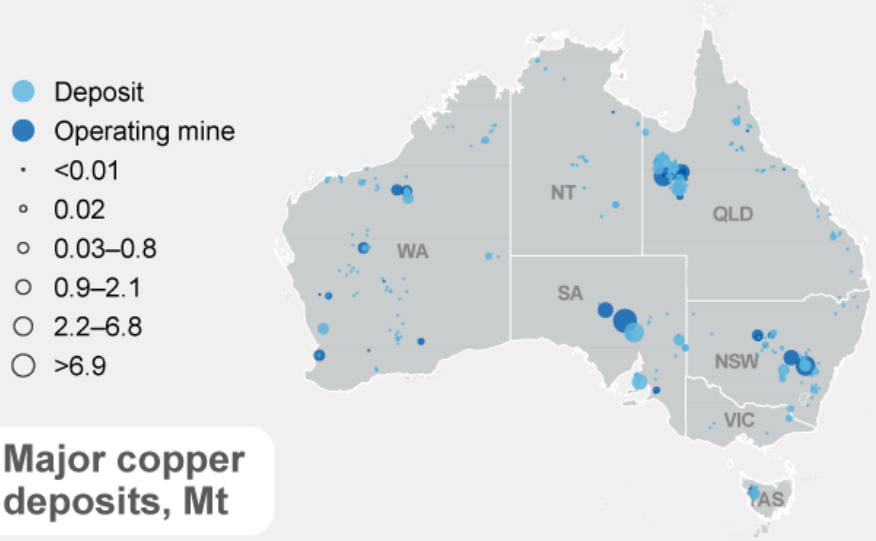
Copper

Australia's copper sector

Ranked 2nd in the world for copper **resources**

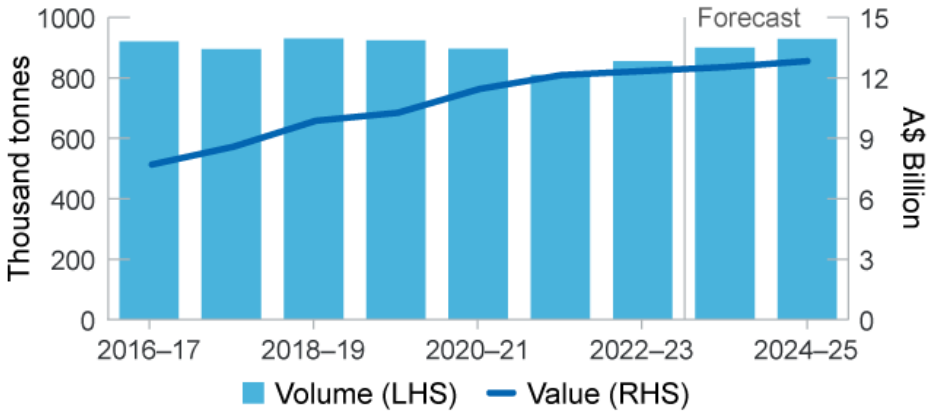
4th largest **exporter** and **8th largest producer** globally, 2022

200k tonnes **produced** per year at Australia's largest mine, Olympic Mine



Major copper deposits, Mt

Australian copper exports



Outlook

China: weaker recovery and ex. manufacturing & trade headwinds **weighing on prices**

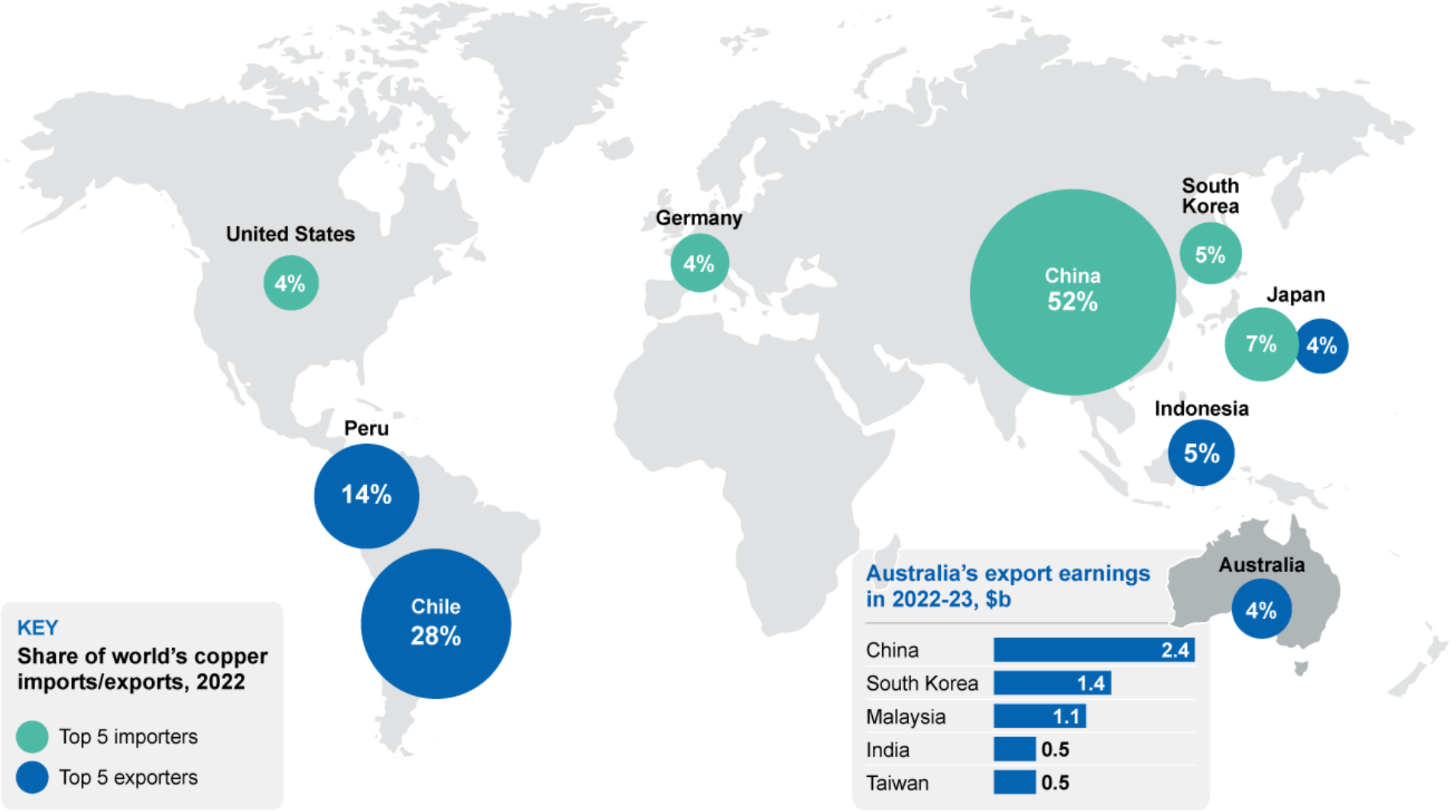
Export earnings stable at **$12 billion** as rising export volumes offset weaker prices.

Exports to **increase** as supply disruptions **ease, growing production** from mid-tier producers

Exploration expenditure **continues to trend higher** in June quarter

SOURCE: GA; DISR; OCE

Copper TRADE MAP



SOURCE: ABS; GA; WBMS

Note: Reflects metal content of ores and concentrates and refined metal, export earnings may not be complete due to partial confidentialisation of trade data

12.1 Summary

- Copper prices have continued to trend lower in recent months. This follows a weaker-than-expected economic recovery in China in 2023, as well as a deteriorating outlook for construction and manufacturing in other major markets such as Europe and ex-China Asia.
- The benchmark LME copper price is expected to average around US$8,300 a tonne for the second half of 2023 (compared with around US$8,700/t in the first six months of this year).
- Global copper consumption is expected to grow by 2.8% in 2023. China is expected to account for the bulk of this growth, with other major markets expected to see low growth or modest declines.
- Australian export earnings of copper are forecast to reach around $12.5 billion in 2023–24. Higher Australian production and export volumes will see export earnings reach $12.8 billion in 2024–25.

12.2 World consumption

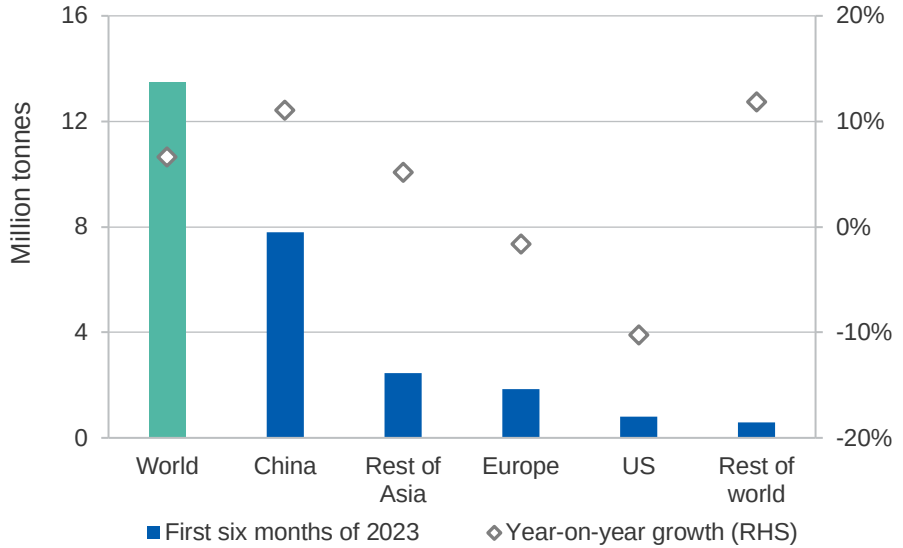
China's below-expectations recovery still boosting copper demand in 2023

Global refined copper consumption grew by 6.6% (year-on-year) in the first half of 2023, to reach more than 13.5 million tonnes (Figure 12.1).

By region, growth in China's consumption (11% increase over the period) and Rest of Asia helped to offset falls in Europe and the United States (down 10%). Global growth in copper consumption is expected to slacken in the second half of 2023, following renewed challenges in China's property sector and softening global growth prospects for other major markets.

Following a rebound in early 2023, China's manufacturing activity has softened in recent months. Weak growth in the industrial sector reflects the sluggish recovery in domestic consumption so far this year, as well as a slowdown in China's global trade. China's construction sector is experiencing continued pressure, with new starts in the year to July continuing to fall year-on-year (see *Macroeconomic Outlook chapter*).

Figure 12.1: Refined copper consumption



Source: World Bureau of Metal Statistics (2023); Department of Industry, Science and Resources (2023)

However, China's copper consumption has been bolstered by its new energy sector, with the central government continuing to make large investments in energy infrastructure (particularly in renewable energy) in 2023. Total investment in this sector in the first half of 2023 increased around 7.8% year-on-year and is expected to account for a rapidly growing share of the country's copper demand in coming years.

China's electric vehicle manufacturing sector has also seen further growth in 2023, with pure EV passenger vehicle production in the year-to-June rising 16% year-on-year. Despite ending subsidies to buyers of EVs at the end of 2022, in June China's central government announced new tax incentives that would exempt taxation on any new energy vehicle purchased through to the end of 2025.

Construction alleviating a weaker manufacturing outlook in ex-China Asia

A progressively weakening global trade environment through 2023 appears to have increasingly dampened manufacturing activity amongst other major industrial economies in Asia. Industrial production in the Advanced Asia region fell 9.1% year-on-year in May, and manufacturing PMIs in July point to near-term contractionary conditions for key producers such as Japan, South Korea, Taiwan and Vietnam.

Meanwhile, construction activity in much of the region continues to bolster overall copper demand, with strong (albeit slowing) growth across all three subsectors (residential, commercial and infrastructure). Countries such as India, Philippines and South Korea continue to show healthy current workloads, which will help to mitigate near-term global headwinds faced by their respective manufacturing sectors.

Europe's manufacturing and construction facing further challenges

Europe's manufacturing sector has continued to experience contractionary conditions in recent months. Industrial production in the Euro Area fell 1.6% year-on-year in July, while the region's manufacturing PMI (42.7 in July this year) represents the weakest reading since 2020 COVID-lows.

Despite an ambitious medium-term outlook for the region associated with its NextGenerationEU plan, the European construction sector also continues to face challenges in 2023. Euro Zone construction output has been flat (in year-on-year terms) for much of the year, while a PMI reading of 43.5 for the sector in July suggests further near-term contractionary conditions in the second half of this year.

Global EV sales a key growth sector for copper demand over the outlook

Global passenger and light duty EV sales are estimated to have reached 5.7 million units in the first half of 2023, around 35% higher year-on-year.

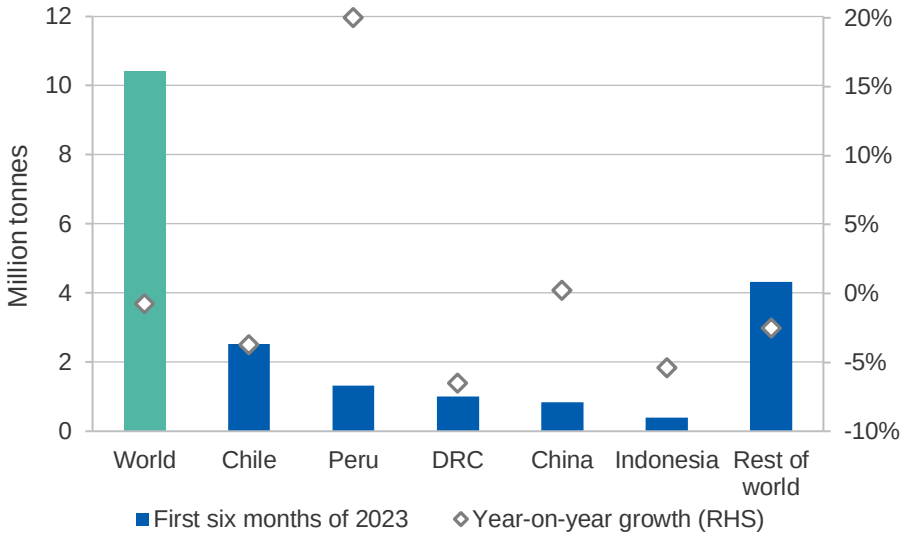
China — representing around 60% of the market in 2022 — continues to see strong growth in 2023, reaching more than 3 million units sold in the first half of the year, at an annual growth rate of more than 30%.

Amongst other major consumer markets, European sales grew by 25%, while the United States saw growth of more than 50% year-on-year. Strong results were also seen in emerging EV consumer markets, included a tripling in collective sales for India, Thailand and Indonesia.

The IEA, as part of its Global EV Outlook 2023 expects a significant ramp up in the second half of the year, with global sales projected to reach 14 million units for the full year 2023. This comes despite lingering weakness in the broader global automotive sector, and would see electric vehicles account for close to 1 in 5 car sales across the full calendar year.

Copper consumption is expected to grow by 1.9% annually to 2025, supported by the considerable infrastructure works planned or underway in key regions (particularly from the energy sector), as well as continuing penetration of EVs in the global automotive sector.

Figure 12.2: Mined copper production



Source: World Bureau of Metal Statistics (2023); Department of Industry, Science and Resources (2023)

12.3 World production

Global mined copper output falls slightly in the first half of 2023

Global mined copper production is estimated to have reached 10.4 million tonnes in the first half of 2023, a fall of 1.0% year-on-year. Amongst major producers, this included year-on-year falls in output for Chile (-4.0%), the Democratic Republic of the Congo (-6.8%) and Indonesia (-5.7%) (Figure 12.2).

Contributing to the fall in Chile's output was Codelco, the world's largest copper miner. The company reported a 12.6% reduction (year-on-year) in output for the first half of 2023, citing operational difficulties due to weather conditions and lower ore grades. This was the company's lowest production result in 25 years. However, this was partially offset by 9% higher (year-on-year) production from the BHP joint venture, Escondida for the full financial year 2022–23, due to improved grades.

Peru was the only major producer to see output rise over the first half of the year, growing 20% year-on-year. This included higher production from Peru's newest major copper mine, Quellaveco. The operation — a joint venture between Anglo American (60%) and Mitsubishi (40%) — hit nameplate capacity during the June quarter 2023 and is expected to reach 300,000 tonnes of output annually by the end of the outlook period.

Mined copper to grow by around 6.3% annually to 2025

Improved growth in mined copper production is expected over the next two years, with the majority of the increase coming from Chile and the Democratic Republic of Congo.

In Chile, the Escondida expansion is expected to add 200,000 tonnes to Chile's copper production from 2024. Teck Resources' Quebrada Blanca Phase 2 operation also produced its first copper concentrate in the March quarter 2023. Due to delays in construction and commissioning, the company has recently guided 80,000 to 100,000 tonnes of production in 2023, but expects to be operating at full production (300,000 tonnes per annum) from 2024.

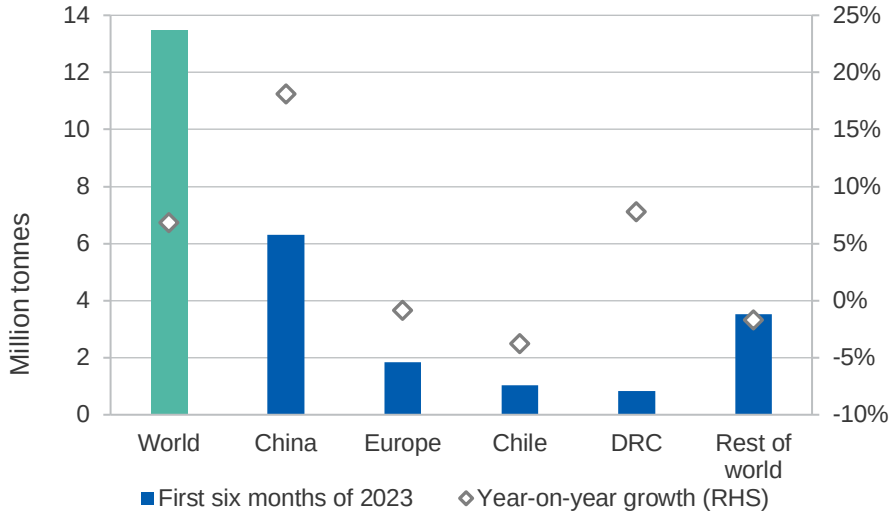
In the Democratic Republic of the Congo, Kamoa-Kakula achieved a quarterly record for production of over 100,000 tonnes in the June quarter 2023. The company, which started production in 2021, is targeting 650,000 tonnes in 2025, which is expected to solidify the DRC as the world's second largest producer by the end of the outlook period.

Despite the positive outlook for global mine production, key downside risks remain around declining ore grades, higher production costs, ageing facilities and increased environmental and social scrutiny for producers.

China leading refined copper production growth

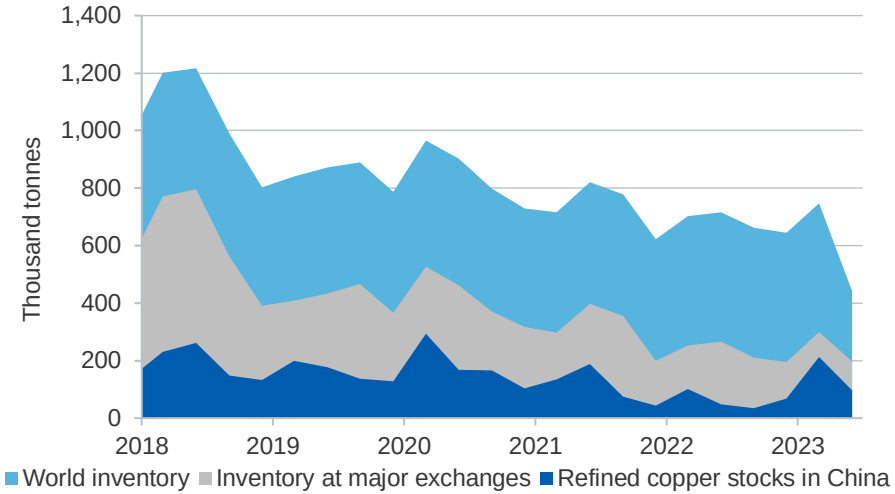
Refined copper production grew 6.9% year-on-year for the first half of 2023, to reach around 13.5 million tonnes (Figure 12.3). This included significant growth in China — the world's largest producer with almost 50% of world refined output — over the period. This helped to offset falls amongst other major producers such as Europe and Chile.

Figure 12.3: Refined copper production



Source: World Bureau of Metal Statistics (2023); Department of Industry, Science and Resources (2023)

Figure 12.4: Global copper inventories



Source: Bloomberg (2023)

Despite the weaker-than-expected rebound in China's economy so far in 2023, domestic refiners significantly boosted production in the first half of the year. While low inventories and stronger refining charges have contributed to this domestic expansion, the significant fall (more than 12%) in China's imports of refined copper over the same period have impeded any significant build-up in inventories so far in 2023 (Figure 12.4). However, the market expectation is for some increase in copper stocks in the rest of the year, as part of China's usual seasonal ramp up in inventories.

Global refined copper production is forecast to reach around 27.1 million tonnes in 2023 and grow by around 0.7% annually through to 2025. This is expected to be led by new capacity build-outs in China and India.

Indonesia is also forecast to drastically increase copper refining output in the next few years to 2025, a consequence of a 2018 government policy to process all ores domestically. The country's largest mine PT Freeport currently has construction underway on its new 600,000 tonne per year Manyar Maju refinery, with first production expected in H2 2024.

12.4 Prices

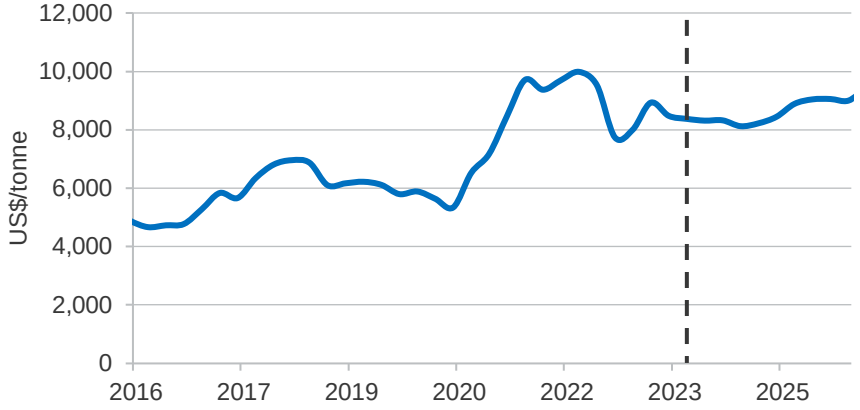
Soft Chinese recovery and global headwinds currently weighing on prices

From a peak of US$8,900 a tonne in March this year, copper prices have continued to trend lower in recent months, averaging US$8,340 a tonne in August. The fall follows the slower-than-expected recovery in China so far in 2023, and a poorer outlook for construction and manufacturing in some other key markets, such as Europe and ex-China Asia.

While Chinese copper consumption had a healthy rise (year-on-year) in the first half of 2023, a significant increase in the country's refined copper production over the same period has helped to maintain a relatively even demand-supply balance. Weakening demand for copper in other major markets (such as Europe and the US) over the first half of the year contributed to recent price falls.

Prices are expected to average around US$8,300 a tonne in H2 2023 (Figure 12.5). Lead indicators suggest near-term weakness in global manufacturing, and in construction activity in key markets such as Europe. China is also expected to face further challenges in its manufacturing and construction sectors in coming months that will act as a further drag on global demand in the near term.

Figure 12.5: Copper price



Source: LME (2023) official cash price, refined

An upside risk to prices remains the historically low levels of inventories globally. Stronger-than-expected demand in coming quarters could be expected to draw inventories further and possibly cause price spikes. However, softer demand growth forecast for 2024 (relative to recent years) should lead to some inventory replenishment over the outlook period.

Expected global surplus to contain copper price gains

Despite solid growth in global copper consumption over the outlook period, increased production from Chile, Peru and Indonesia looks set to push the copper market into a surplus and lead to weaker copper prices over the forecast horizon. The benchmark LME copper price is expected to average around US$8,300 a tonne in 2024 and US$9,000 a tonne in 2025.

12.5 Australia

Falling copper price to offset stronger export volumes to 2024–25

Exports are estimated to have been about $12.3 billion in 2022–23, a 1.5% rise on 2021–22. This follows stronger export volumes for refined copper products, helping to offset lower prices over the period (Figure 12.6).

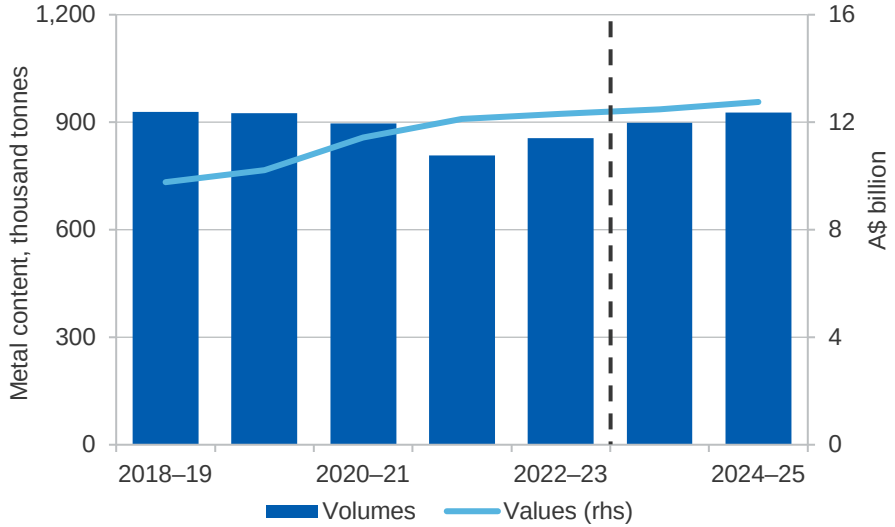
Over the outlook period, export volumes are set to rise further, to reach around 928,000 tonnes in 2024–25. The gains in export volumes are expected to contribute to export earnings of around $12.5 billion in 2023–24 and $12.8 billion in 2024–25.

Production to continue to grow over the outlook period

Mined production in 2022–23 is estimated to have grown to 821,000 tonnes — up 6.2% year-on-year. This included significant increase in existing operations such as Olympic Dam (which delivered record annual output in copper) and Cadia Valley, as well as from emerging producers such as the Anthill mine in Queensland.

Mined production is expected to grow over the outlook period to reach around 877,000 tonnes in 2024–25. These gains are largely due to fewer COVID- and weather-related disruptions (due to the end of the La Niña weather episode), as well as new production from a number of both greenfield and brownfield mid-tier producers.

Figure 12.6: Australia's copper export volumes and values



Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2023)

Australia's refined copper production is also expected to grow by around 8.9% annually to 2024–25, to reach around 540,000 tonnes. BHP's acquisition of OZ Minerals in May this year is expected to significantly increase refined copper output from the company's South Australian operations, now known as Copper South Australia.

Copper exploration very strong through 2023

Copper exploration expenditure rose to $176 million in the June quarter 2023. This was around 30% higher than the comparable quarter in 2022, and continues a general upward trend seen since 2016.

Revisions to the outlook

Since the June *Resources and Energy Quarterly*, the forecast for Australia's copper export earnings in 2023–24 and 2024–25 remain largely unchanged. Downward revisions to the forecast copper price over the outlook period have been offset by downward revisions to the AUDUSD exchange rate, and slightly stronger export volumes.

Table 12.1: Copper outlook

						Annual percentage change		
World	**Unit**	**2022**	**2023[f]**	**2024[f]**	**2025[f]**	**2023[f]**	**2024[f]**	**2025[f]**
Production								
– mine	kt	21,586	22,173	23,914	25,062	2.7	7.9	4.8
– refined	kt	25,786	27,097	27,341	27,478	5.1	0.9	0.5
Consumption	kt	25,842	26,560	26,587	27,600	2.8	0.1	3.8
Closing stocks	kt	942	644	526	655	-32	-18	25
– weeks of consumption		1.9	1.3	1.0	1.2	-33	-18	20
Prices LME								
– nominal	US$/t	8,815	8,524	8,279	8,995	-3.3	-2.9	8.7
	USc/lb	400	387	376	408	-3.3	-2.9	8.7
– real[b]	US$/t	9,203	8,524	8,054	8,570	-7.4	-5.5	6.4
	USc/lb	417	387	365	389	-7.4	-5.5	6.4
Australia	**Unit**	**2021–22**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**
Mine output	kt	773	821	847	877	6.2	3.2	3.5
Refined output	kt	362	457	553	542	26	21	-2.1
Exports								
– ores and concs[c]	kt	1,641	1,525	1,164	1,313	-7.0	-24	13
– refined	kt	330	416	553	542	26	33	-2.1
– total metallic content	kt	808	855	899	928	5.9	5.1	3.2
Export value								
– nominal	A$m	12,128	12,304	12,473	12,753	1.5	1.4	2.2
– real[d]	A$m	13,510	12,807	12,473	12,351	-5.2	-2.6	-1.0

Notes: **b** In 2023 calendar year US dollars; **c** Quantities refer to gross weight of all ores and concentrates; **d** In 2023–24 financial year Australian dollars; **f** Forecast.
Source: ABS (2023) International Trade, 5465.0; LME (2023) spot price; World Bureau of Metal Statistics (2023); Department of Industry, Science and Resources (2023).

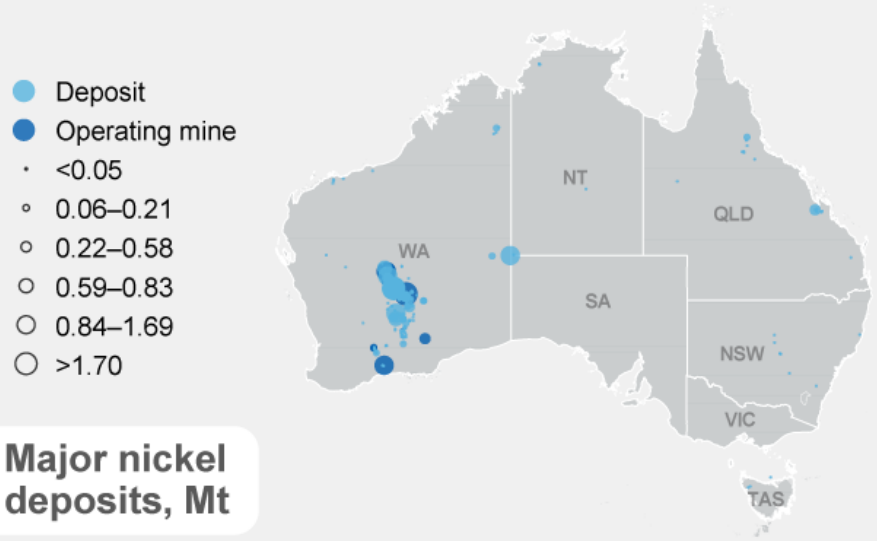
Nickel

Australia's nickel sector

22%
of the world's **resources, largest** global reserve

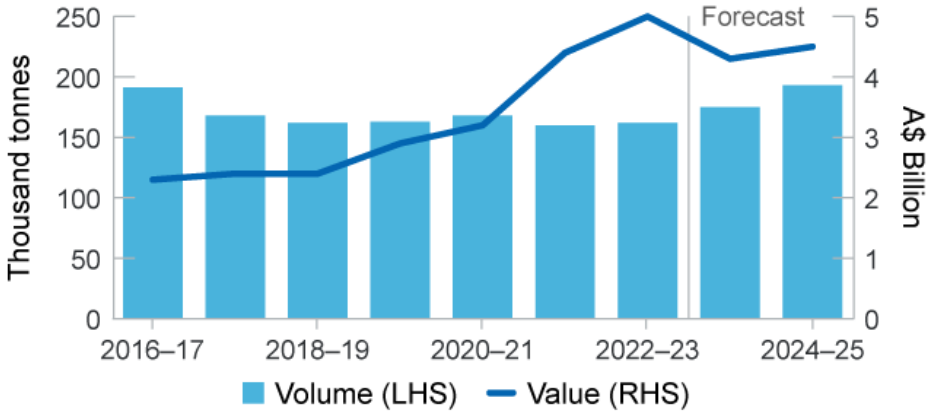
5th largest
nickel **mine and refined producer** globally

16%
of global demand represented by **EV batteries**, other **low emissions tech**



Major nickel deposits, Mt

Australian nickel exports



Outlook

Chinese demand driving **stronger global nickel consumption** so far in 2023

Export earnings to fall to **$4.3 billion** in 2023-24 as record prices ease.

Global **oversupply expected to persist** on Indonesian & Chinese supply growth

Exploration expenditure over the past 12 months **highest since 2008**

SOURCE: GA; DISR; OCE

13.1 Summary

- Chinese demand drove stronger global nickel consumption in the first half of 2023 despite a slower-than-expected economic recovery in China. Rising global macroeconomic headwinds in the second half of the year are expected to contain global growth in nickel consumption to around 3.2% in 2023.
- An oversupply in the global nickel market is expected to persist over the outlook period, driven by growth in Indonesian (and some Chinese) mined and refined production. The existing oversupply in Class II nickel (primarily used for stainless steel) is also expected to spill over into the battery grade nickel market over the outlook period.
- Weaker prices over the outlook period are expected to see Australia's nickel export earnings fall from $5.0 billion in 2022–23 to $4.3 billion in 2023–24. New production capacity in Australia is then expected to see a rebound in forecast earnings to $4.5 billion in 2024–25.

13.2 World consumption

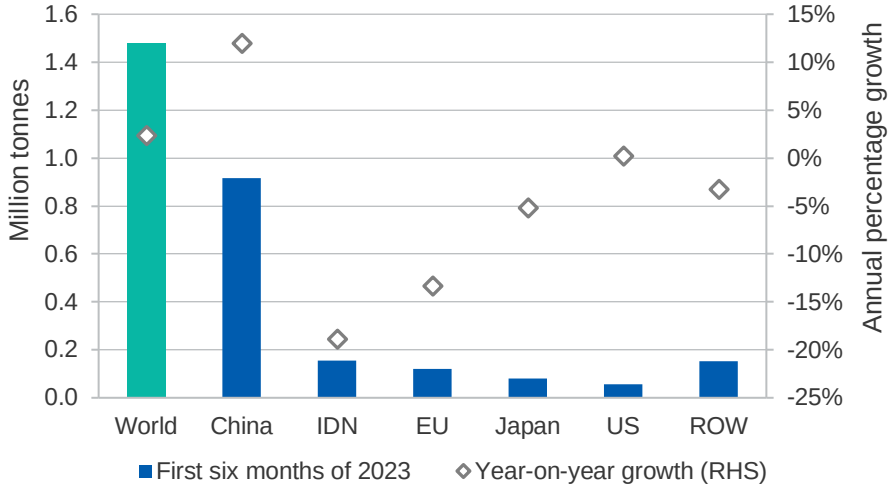
World nickel demand modestly stronger so far in 2023, all due to China

Refined nickel consumption in the first half of 2023 was 2.4% higher year-on-year (Figure 13.1). Despite declines in all other major markets, nickel usage in China rebounded 12% year-on-year.

While China's economic reopening remains weaker than expected so far in 2023, Chinese nickel consumption has risen due to increased stainless steel production (up 6.8% year-on-year for the first six months of 2023) and higher electric vehicle production (with sales up more than 30% over the same period).

By contrast, other major producers such as Japan, South Korea and Europe have cut stainless steel production significantly through the year. This reflects a progressive weakening in the global trade environment through 2023, which has resulted in slowing manufacturing activity amongst other major industrial economies and contractionary conditions in key construction markets such as Europe.

Figure 13.1: World nickel consumption



Note: IDN ~ Indonesia; ROW ~ Rest of World

Source: International Nickel Study Group (INSG); Department of Industry, Science and Resources (2023)

Global refined nickel consumption is forecast to grow to 3.5 million tonnes by 2025, at an average annualised rate of 5.9% year-on-year. This growth in demand is expected to be driven by increasing stainless steel output over the next few years. This in turn will be underpinned by the sizeable infrastructure and non-residential construction planned for key growth sectors such as Emerging Asia (see *Steel chapter*), as well as ongoing development of the industrial and manufacturing sectors in these economies.

Electric vehicle demand to boost nickel consumption, despite LFP gains

The electric vehicle battery supply chain provides another critical — and rapidly growing — source of nickel demand. The IEA is projecting a significant ramp up in EV production in the second half of the year, with global EV sales projected to reach 14 million units for the full year 2023. This represents growth of 35% year-on-year and would see EV's account for close to 20% of sales across the full calendar year.

Over the rest of the outlook period, EV sales are expected to grow from 11 million in 2022 to around 23 million in 2025. EV batteries are forecast to account for around 20% of total refined nickel usage by 2025.

This forecast takes account of the emergence of non-nickel chemistries — such as lithium-iron phosphate (LFP) — in recent years. Between 2019 and 2023 (year-to-May), LFP batteries have increased their market share from 8% to 26%. This has primarily come at the expense of nickel cobalt aluminium batteries (falling from 27% to 16%), with nickel manganese cobalt batteries maintaining around a 60% share of the overall market (Figure 13.2). See *Battery Supply Chain* chapter.

The trend of rising LFP battery deployment is expected to continue over the outlook period, however the dramatic rise in aggregate EV production should support continued healthy growth in nickel demand over that time.

13.3 World production

Indonesia continues to see meteoric rise in mined nickel output in 2023

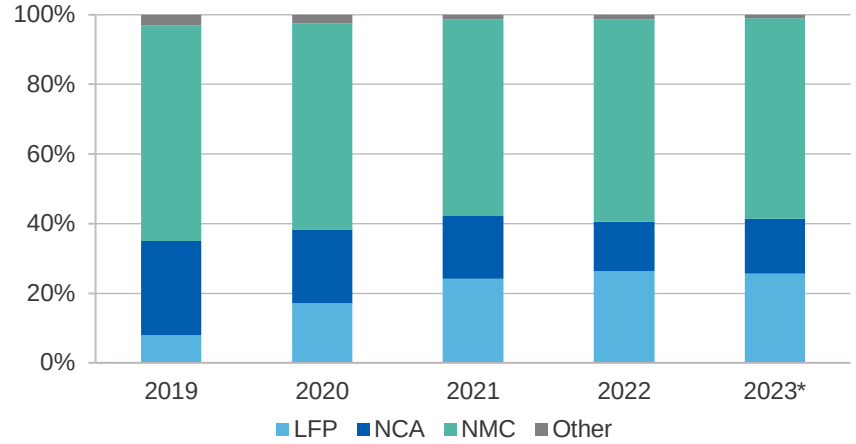
Global mined nickel production in the first half of 2023 was 13.4% higher year-on-year (Figure 13.3). This was primarily due to new supply from Indonesia — already the world's largest producer — where mined output grew by 26% over the period.

World mined nickel production is forecast to rise at an annualised rate of 5.8% to 2025 to reach 3.8 million tonnes. Indonesian output is expected to grow from 1.6 million tonnes to more than 2.2 million tonnes over the same period, and represent close to 60% of global output. Expansions are underway at major operations including Sorowako, Weda Bay and Obi, and greenfield projects such as PT Vale's 80,000 tonnes per annum Bahodopi mine are expected to come online in the next few years.

Indonesia also targeting downstream processing and EV battery sector

Indonesia's substantial growth in mined output in recent years has helped to drive a corresponding increase in the country's production of nickel pig iron (NPI), as well as intermediate products such as nickel matte and mixed hydroxide precipitate (MHP).

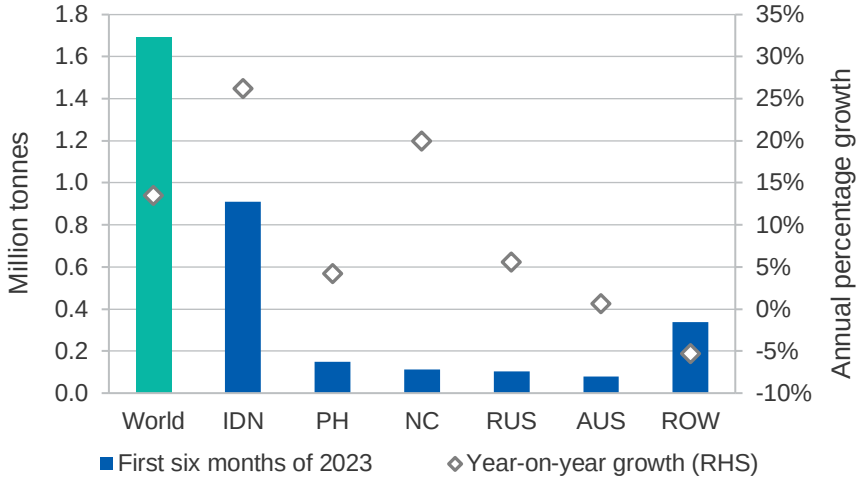
Figure 13.2: Electric vehicle battery installation, by type



Note: Measured in GWh of installation; * Reflects first five months of 2023 only; LFP ~ Lithium Iron Phosphate, NCA ~ Nickel-cobalt-aluminium, NMC ~ Nickel Manganese Cobalt, Other includes lithium ion manganese oxide and nickel metal hydride battery

Source: Wood Mackenzie (2023); Department of Industry, Science and Resources (2023)

Figure 13.3: World mined nickel production



Note: IDN ~ Indonesia; PH ~ Philippines; NC ~ New Caledonia; RUS ~ Russia; ROW ~ Rest of World

Source: International Nickel Study Group (2023); Department of Industry, Science and Resources (2023)

Collectively, Indonesia's output of intermediate products (such as matte and MHP) is estimated to have grown by more than 50% year-on-year so far in 2023. Importantly, these products offer alternative upstream sources for battery-grade nickel for major consumers such as Indonesia and China, and are expected to improve current issues regarding tight supplies in the Class I nickel market.

The substantial ramp up of intermediate (and refined) nickel production follows the Indonesian government's 2020 ban of nickel ore exports, and fits with the nation's broader goals to develop both downstream processing and a domestic EV battery sector in coming years. While the Indonesian government is yet to introduce export restrictions on intermediate nickel products (such as NPI) in 2023, it recently ceased issuing new licenses for NPI smelters, and removed tax incentives for lower quality products.

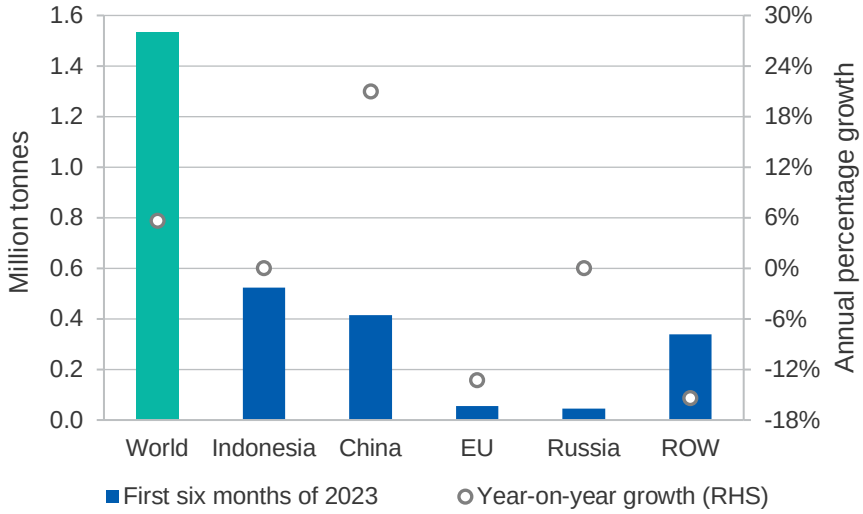
The Indonesian Government oversaw the establishment of the Indonesia Battery Corporation (IBC) in March 2021, and set both ambitious targets for domestic EV production (600,000 cars by 2030) and stringent regulations on the share of BEVs required to have local content (40% currently, 80% after 2026).

Global refined production to grow 6% annually to 2025

Global refined nickel output is forecast to rise to 3.6 million tonnes in 2025. China and Indonesia are expected to account for the vast majority of this increase, with each expected to add 400,000-500,000 tonnes of new capacity in the next few years.

The substantial rise in China's capacity over the outlook is expected to include a large number of Class I facilities, and added capability to produce nickel sulphate (which can accept MHP as a feedstock). The surge in Indonesian production is also expected to be spread across production such as NPI, MHP and matte. The rising adoption of High Pressure Acid Leaching (HPAL) has created significant opportunities to transform the country's vast laterite-based ores into battery grade feedstock. However, managing the complexities of this treatment, as well as the significant environmental impacts, will remain an ongoing challenge for the industry.

Figure 13.4: World refined nickel production



Note: ROW ~ Rest of World

Source: International Nickel Study Group (2023); Department of Industry, Science and Resources (2023)

13.4 Prices

Benchmark nickel price continuing to trend lower through 2023

After a peak above US$30,000 a tonne in January, the benchmark London Metal Exchange (LME) nickel has declined throughout 2023, averaging around US$20,400 a tonne in the month of August. The fall in prices reflects an increasingly challenging global macroeconomic environment in the second half of the year, as well as specific structural changes underway in the global nickel market.

The global macroeconomic environment has been affected by a weaker-than-expected recovery in China, a key driver of waning prices for many base metals in recent months. Despite a rebound earlier in the year, China's manufacturing activity has continued to soften, falling to growth of just 2.5% (year-on-year) in July. This fall has been propelled by a sluggish recovery in domestic consumption and a slowdown in China's global trade.

China's construction sector also continues to face a gloomy near-term outlook, with commercial and residential new starts registering significant year-on-year falls in July (see *Macroeconomic Outlook chapter)*.

The outlook for construction and manufacturing is also deteriorating in several other key markets. Industrial production in regions such as Advanced Asia and Europe has registered significant year-on-year falls in recent months. Lead indicators such as manufacturing Purchasing Managers' Indices (PMI) suggest a further near-term contraction in activity for these regions (and the United States).

With significant growth in mined and refined supply projected over the outlook period, a slackening in demand from key global sectors — such as manufacturing and construction — carries significant downside risks to prices over the next few years.

Structural changes underway in nickel market set to drive prices lower

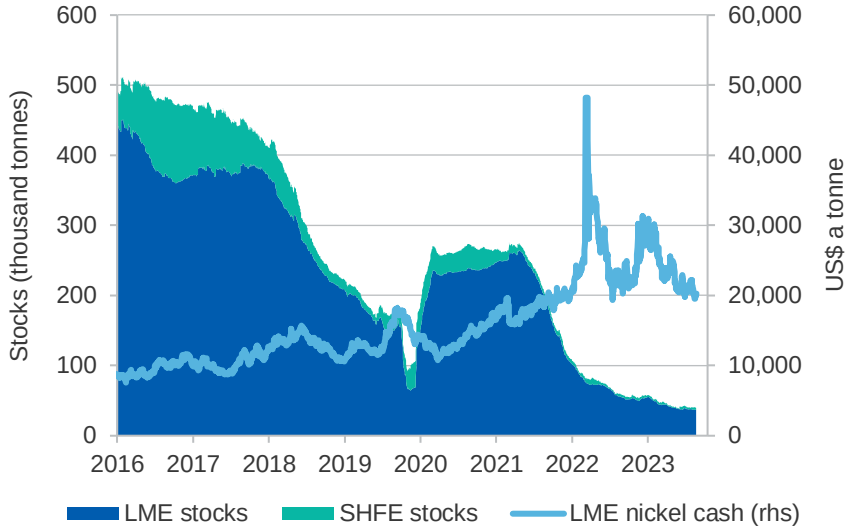
An oversupply in the global nickel market — which led to 18 months of heavy discounts for Class II nickel products (nickel pig iron, or NPI and ferronickel) — now looks set to carry over into class I 'battery grade' products.

A growing supply of intermediate products such as nickel matte and mixed hydroxide precipitate (or MHP) — particularly from the world's largest primary nickel producer Indonesia — offers viable alternatives to Class I products for major nickel refiners. This is expected to lead to a significant boost in battery-grade nickel supply over the next few years, particularly for key importers such as China. The projected increase in nickel refining capacity in China and Indonesia could therefore be set to drive the global nickel market into surplus in 2023 and further out over the outlook period.

Low inventories one impediment to global surplus in 2023 and 2024

While healthy growth in mined and refined nickel supply is expected to create moderate oversupply to 2024, the low levels of inventories seen at major exchanges such as LME and Shanghai Futures Exchange remain a key upside risk to prices in the near term.

Figure 13.5 Nickel spot price and stock at exchanges



Source: Bloomberg (2023); Department of Industry, Science and Resources (2023)

Inventories at LME remain around 40,000 tonnes as of August 2023, below even 2020 COVID levels. While this is consistent with the broader trend of dwindling exchange inventories for a number of key metals, the fall in nickel stocks also reflects the reduced trading volumes on the LME following the 2021 LME nickel trading crisis (where prices breached US$45,000 a tonne and trading was suspended). SHFE inventories also remain at historically low levels (Figure 13.5).

The LME nickel price is forecast to average about US$22,000 a tonne in 2023. A near-term global surplus is forecast to see prices fall further — to around US$20,200 a tonne in 2024 — before a tighter global balance of supply and demand should see prices recover to around US$21,500 by 2025.

13.5 Australia

Falling prices to see moderately lower export earnings over outlook period

Decade-high nickel prices through 2022 and early 2023 helped push nickel export earnings to a record level of $5.0 billion in 2022–23 (Figure 13.6).

Stronger production and export volumes are expected over the outlook period, though this is initially expected to be more than outweighed by falling prices. Export earnings are expected to fall to $4.3 billion in 2023–24 before increasing to $4.5 billion 2024–25. Export volumes are forecast to rise from 161,000 tonnes in 2022–23 to 174,000 in 2023–24 (8.2% growth) and 192,000 in 2024–25 (11% growth).

Australian production volumes to grow strongly to 2024–25

After flat growth in 2022–23, Australian mined nickel production is forecast to grow to 163,000 tonnes in 2023–24 and 187,000 tonnes in 2024–25. Contributing to this increase in mined production will be IGO's Cosmos project, further ramp ups at Kambalda (Mincor) and Avebury (Mallee Resources), as well as the reopened Ravensthorpe mine.

BHP has also advised that its new 35,000 tonne per annum West Musgrave nickel project in Western Australia (following its acquisition of OZ Minerals in May this year) is in early stages of execution after a final investment decision was made in September 2022 (made by OZL prior to BHP's acquisition).

Australian refined nickel production (including refined and intermediate products) is expected to grow over the outlook period, from 135,000 tonnes in 2022–23 to 147,000 tonnes in 2024–25. This is expected to be underpinned by growing output from BHP's Nickel West operation.

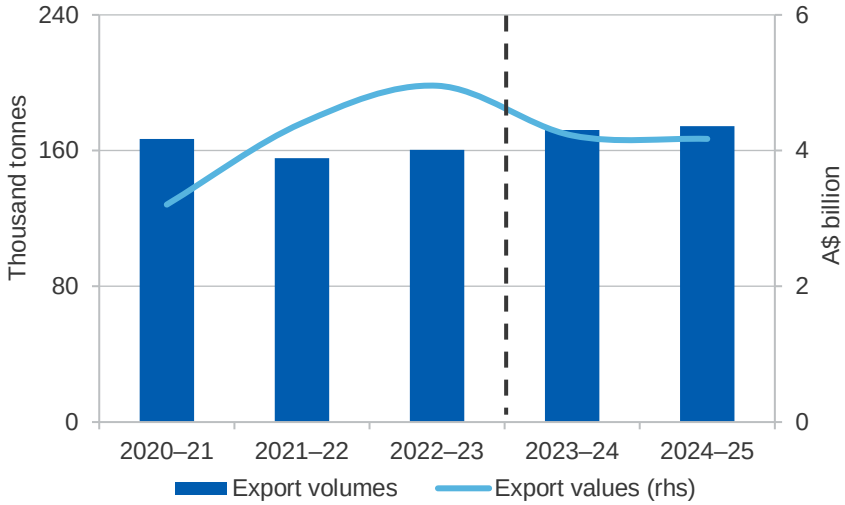
Exploration expenditure hits decade highs

Nickel and cobalt exploration expenditure for the June quarter 2023 was around $84 million. This was 6.7% higher than the comparable period in 2022. Further, exploration in the 12 months to June 2023 was $332 million, the highest since 2008, and demonstrating nickel's growing importance in the global energy transition.

Revisions to the outlook

Compared to the June 2023 *Resources and Energy Quarterly*, nickel export earnings have been revised down by $0.1 billion in 2023–24; and up $0.4 billion in 2024–25. This follows small revisions to projected prices in 2023–24, and upward revisions to refined nickel production over the outlook period.

Figure 13.6: Nickel export volumes and values



Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2023)

Table 13.1: Nickel outlook

						Annual percentage change		
World	**Unit**	**2022**	**2023**	**2024[f]**	**2025[f]**	**2023[s]**	**2024[f]**	**2025[f]**
Production								
– mine	kt	3,204	3,492	3,698	3,789	9.0	5.9	2.4
– refined	kt	3,059	3,313	3,519	3,645	8.3	6.2	3.6
Consumption	kt	2,956	3,051	3,367	3,507	3.2	10	4.2
Closing stocks	kt	694	956	1 107	1 245	38	15.8	12.5
– weeks of consumption		12.2	16.3	17.1	18.5	33	5.0	8.0
Prices LME								
– nominal	US$/t	25,696	21,985	20,200	21,525	-14	-8.1	6.6
	USc/lb	1 166	997	916	976	-14	-8.1	6.6
– real [b]	US$/t	26,827	21,985	19,650	20,508	-18	-11	4.4
	USc/lb	1 217	997	891	930	-18	-11	4.4
Australia	**Unit**	**2021–22**	**2022–23[f]**	**2023–24[f]**	**2024–25[f]**	**2022–23**	**2023–24[f]**	**2024–25[f]**
Production								
– mine [c]	kt	154	152	163	187	-1.4	7.5	14
– refined	kt	98	97	101	104	-1.7	4.2	3.6
– intermediate		31	38	41	43	20	8.5	5.5
Export volume [dg]	kt	155	161	174	192	3.3	8.2	11
Export value[g]								
– nominal value	A$m	4,405	4,956	4,279	4,541	13	-14	6.1
– real value [e]	A$m	4,907	5,158	4,279	4,398	5.1	-17	2.8

Notes: **b** In 2023 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 2023–24 financial year Australian dollars; **f** Forecast; **g** OCE estimates based on publicly available data.

Source: ABS (2023) International Trade, 5465.0; LME (2023) spot price; International Nickel Study Group (2023); Company reports; Department of Industry, Science and Resources (2023).

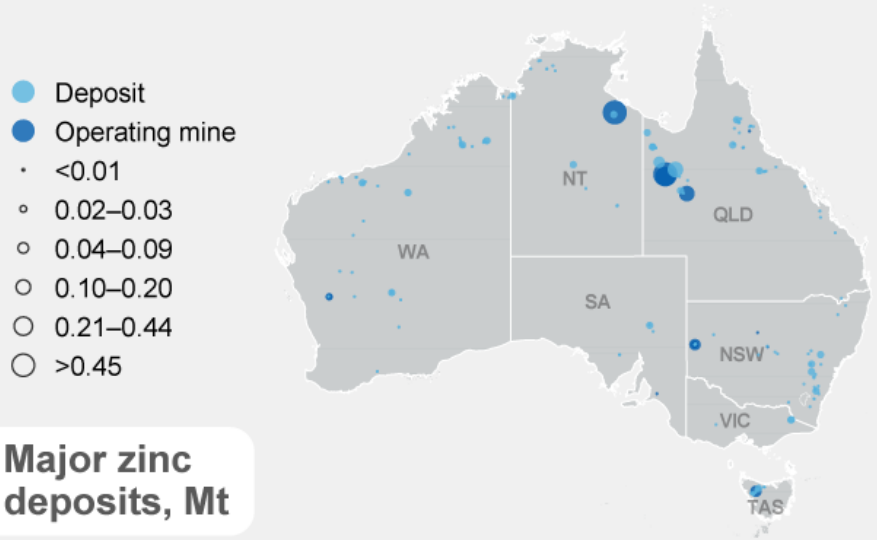
Zinc

Australia's Zinc sector

About 1/3
ores & concentrate production **refined domestically**

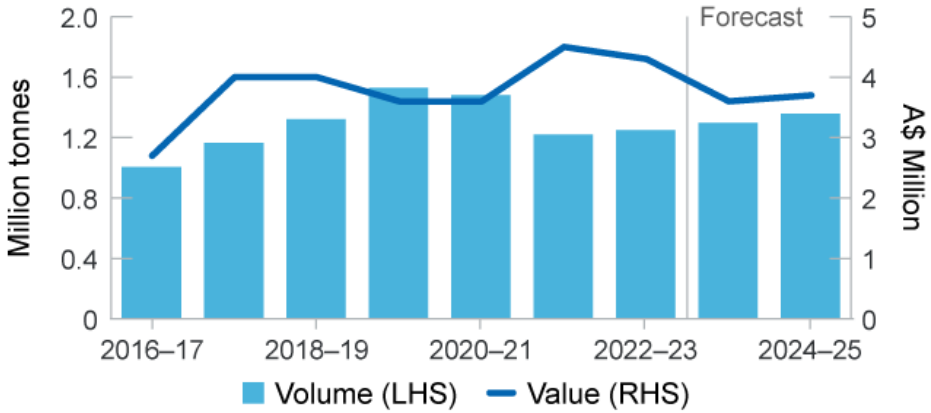
27%
of the world's known **zinc resources**

3rd largest
zinc producer globally in 2022



Major zinc deposits, Mt

Australian zinc exports



Outlook

Zinc prices fell underpinned by weakness in Chinese demand

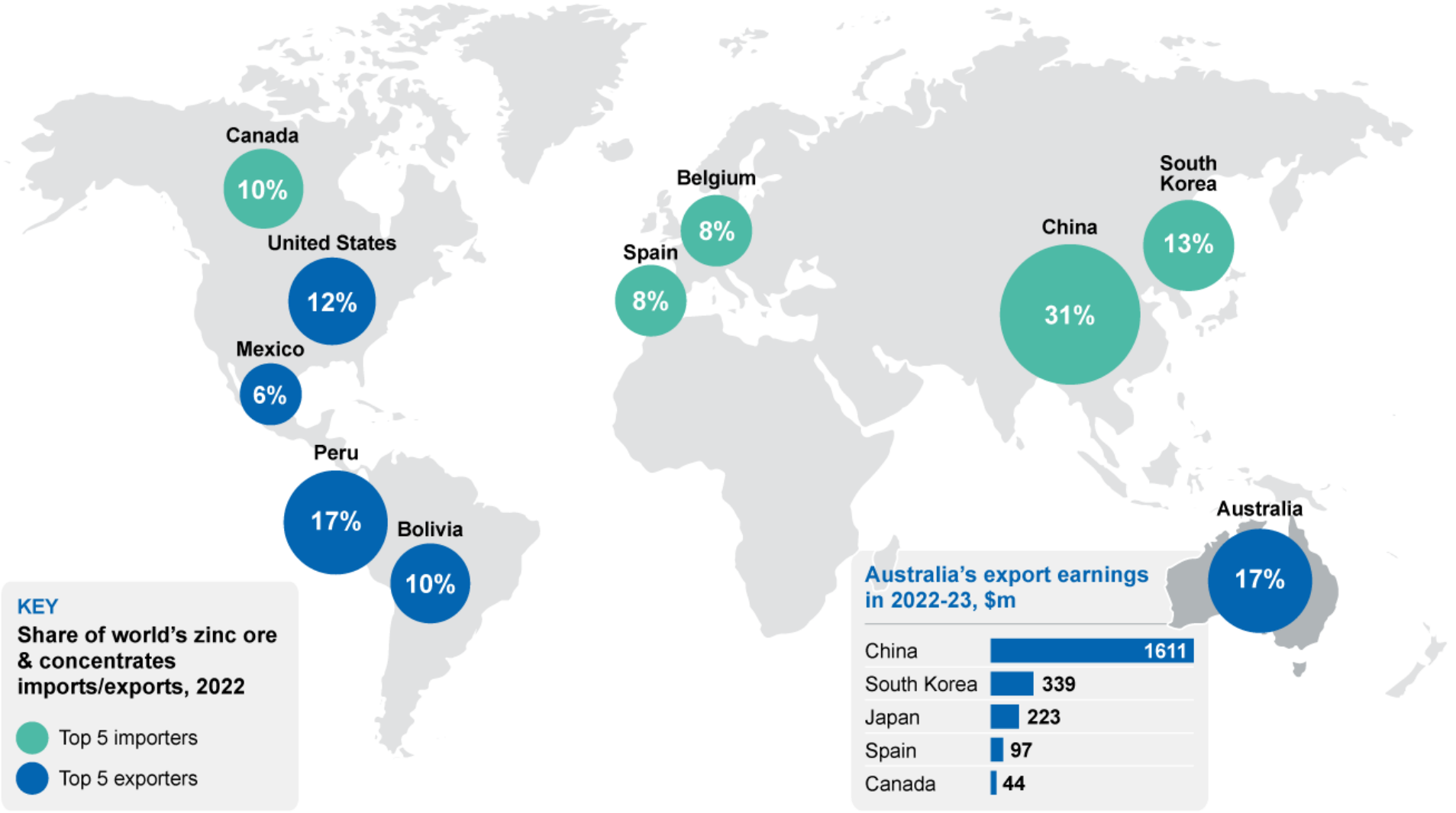
Future earnings to fall as price remains subdued

Australian **production outlook weakened** with the closure of several mines

Zinc **exploration expenditure falls** as global price falls

SOURCE: GA; DISR; OCE

Zinc TRADE MAP



SOURCE: ILZSG; ABS

14.1 Summary

- The zinc price has declined noticeably in the September quarter as Chinese demand disappointed expectations. China's ongoing property crisis has weakened the prospects for demand over the outlook period, with the price forecast to average US$2,600 a tonne in 2025.
- Australia's zinc production is forecast to rise over the outlook period. The closure of several small mines over the June quarter will be offset by an expansion of the Century mine and a recovery in production at existing mines impacted by COVID disruptions.
- Australia's zinc exports are forecast to fall to $3.6-3.7 billion in 2023-24 and 2024-25, with higher volumes partially offsetting lower prices.

14.2 World consumption

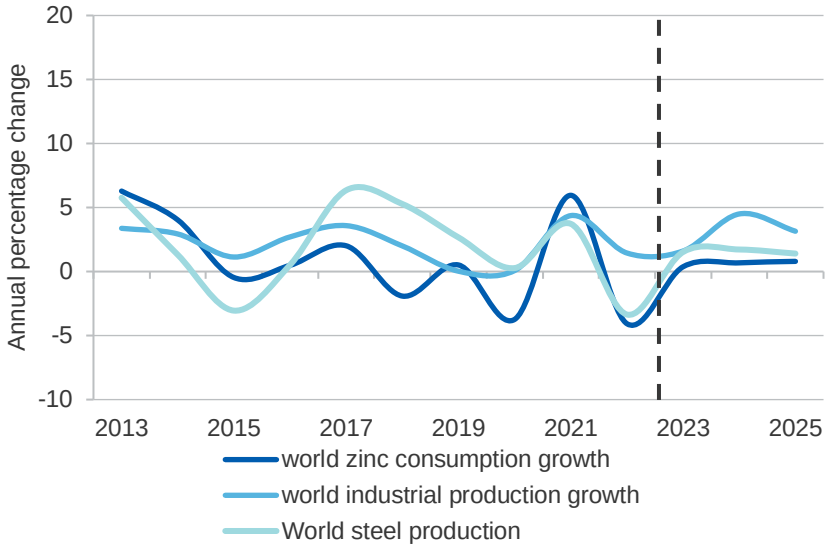
Global zinc consumption remains weak as China's property crisis deepens

Zinc consumption tends to follow the global industrial production cycle, given its primary role in galvanising steel (Figure 14.1), and its heavy use in the construction and automotive sectors. Between June quarter 2021 and June quarter 2023, world demand fell at an annualised average rate of 4.1%. Year-on-year, demand rose 1.5%, impacted by the effects of China's pandemic restrictions in June quarter 2022.

China is the world's largest consumer of zinc. Between June quarter 2021 and June quarter 2023, Chinese demand fell at an annualised average rate of 5.1%. (Year-on-year, demand rose 7.5% to June 2023, impacted by the effects of pandemic restrictions in June quarter 2022.) The two-year annualised fall contrasts with an annual average growth of 4.0% between 2009 and 2019. The fall was driven by China's property market, which weakened further in the June quarter 2023, as residential building sales fell by 20% year-on-year.

Chinese zinc demand is being supported by a strong recovery of Chinese vehicle production. Between the June quarter 2021 and June quarter 2023, China's passenger vehicle production rose at an annualised average rate of 11%. The rise was driven by the emergence of China as a

Figure 14.1: Zinc consumption vs industrial and steel production



Source: International Lead Zinc Study Group (2023); CPB Netherlands Bureau for Economic Policy Analysis (2023); World Steel Association (2023); Department of Industry, Science and Resources (2023).

leading manufacturer of electrical vehicles, which are often less expensive than comparable models from international competitors. In 2022, China overtook Japan as the world's largest exporter of passenger motor vehicles.

Other major passenger vehicle producers also posted production increases as chip shortages eased. In the June quarter 2023, passenger vehicle production in Germany rose by 27% year-on-year, while production in Japan rose 30% year-on-year.

World zinc consumption is forecast to grow on average 0.6% per year over the outlook period, much slower than the pre-pandemic period when, between 2009 and 2019, zinc consumption grew by an average of 2.4% per year. China housing market faces structural decline, with a weak demand outlook and over-investment (see Macroeconomic Outlook chapter, Box 2.1). Growing electric vehicle adoption is also weakening

demand for zinc, as automakers prefer lighter materials to steel (in particular aluminium) to offset the weight of battery packs.

Demand will be supported in the longer term by the global energy transition. Globally, the rollout of renewable energy infrastructure is expected to support demand for zinc, due to its role as a key input to wind turbines, solar panels and transmission towers.

14.3 World production

Global mine production falls as low prices trigger mine closures

Between June quarter 2021 and June quarter 2023, world mine production fell by an annualised average of rate of 2.3%. Year-on-year, production rose 0.9% in the June quarter 2023, impacted by the effects of China's pandemic restrictions in June quarter 2022. China makes up about a third of global zinc mine production, and between June quarter 2021 and June quarter 2023, China's mine production fell at an annualised average rate of 3.2%. Year-on-year, production rose 1.4% in the June quarter 2023.

The sharp fall in zinc prices has led to the closure of a number of zinc mines. Australian production fell 8.3% year-on-year in the June quarter 2023. The unlisted Australian mining company Aurora Metals entered into administration in July, resulting in the closure of Mount Garnet and King Vol mines in Australia. European production fell 9.0% in the same period, with Tara mine in Ireland, the largest European zinc mine, closing in June.

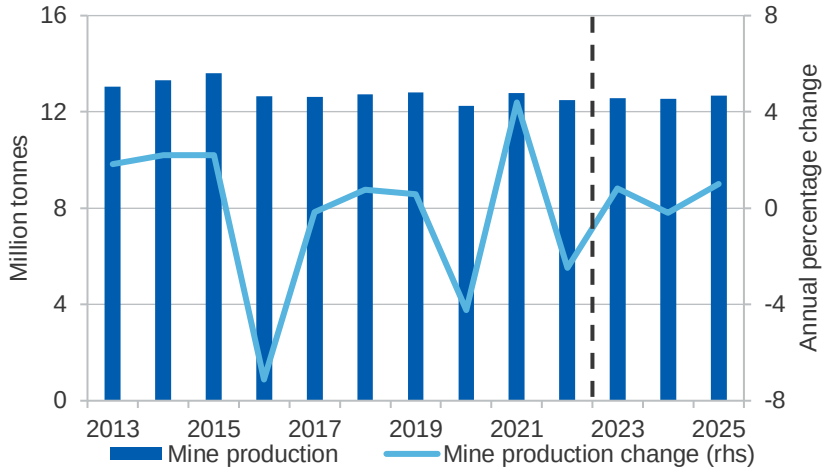
Over the outlook period, world mine output is forecast to average annual growth of 0.5% (Figure 14.3). The zinc concentrate market is in surplus, while the demand outlook for zinc is expected to weaken. This suggests prices could remain low until high-cost capacity is shut. China, Mexico, the Democratic Republic of Congo and Russia are expected to add capacity over the outlook period, which could result in further oversupply.

Supply constraints from limited smelter capacity easing

World refining capacity rose 4.2% year-on-year in the June quarter 2023 as European smelters reopen and China moves away from pandemic lockdowns. Output in China — the largest zinc refiner globally — rose by 4.1% year-on-year in the June quarter 2023. Refined zinc production in the European Union (EU) declined 5.4% year-on-year but rose 8.6% over the quarter, with the Auby smelter reopening in March.

Over the outlook period, refined production from primary and secondary sources is expected to rise by 1.2% a year on average. Most of the new capacity is expected to be in China.

Figure 14.3: World zinc mine production, metallic content



Source: International Lead Zinc Study Group (2023); Department of Industry, Science and Resources (2023).

14.4 Prices

Prices weaken on growing concerns over the demand outlook

The London Metal Exchange (LME) zinc spot price stabilised in the June quarter 2023 at around US$2,500 a tonne. Prices declined from an average of about US$3,100 a tonne in the previous three quarters, when worries over shortages of zinc refining capacity kept prices high.

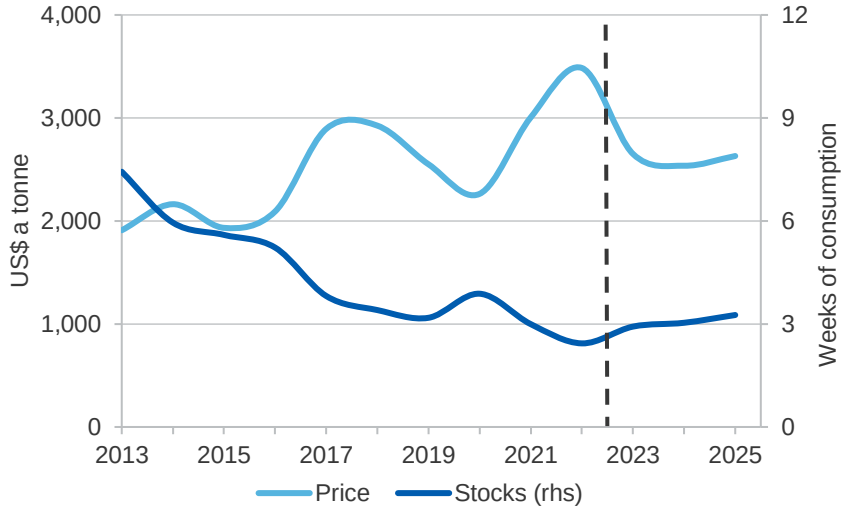
The price falls were triggered by the reopening of some European zinc smelters. However, the fall in price has been sustained by the underlying weakness in demand, as China's reopening from COVID lockdowns has failed to deliver the widely expected recovery in demand.

LME stocks at the end of the March quarter were 45 thousand tonnes, which is relatively low in historical terms. However, stockpiles rose rapidly over the June quarter to reach 81 thousand tonnes, then jumped to 147 thousand tonnes in the second half of August. The rapid increase in stock levels suggests the zinc market has moved into surplus and/or some metal has moved back on warrant.

Zinc treatment costs have fallen as global smelting capacity has risen at a time of falling demand. Some European smelting capacity has re-opened as the cost of energy falls back. Spot treatment costs of imported concentrates in China fell from an average of $263 per tonne in the March quarter 2023 to $195 per tonne by July 2023.

The LME zinc spot price is forecast to average about US$2,700 a tonne in 2023. Prices are forecast to fall to average US$2,500 in 2024 and US$2,600 in 2025, with zinc demand growth expected to remain weak over the outlook period (Figure 14.4).

Figure 14.4: Zinc prices and stocks



Source: LME (2023); International Lead Zinc Study Group (2023); Department of Industry, Science and Resources (2023).

14.5 Australia's exports and production

Export earnings to fall as price declines outweigh growing domestic output

Australia's export earnings for both zinc concentrates and refined zinc (combined) fell 14% year-on-year to $980 million in the June quarter 2023. The fall in the zinc price drove this result: in Australian dollar terms, zinc prices fell 31% year-on-year. Export volumes, in metal content terms, rose 1.2% year-on-year.

The impact of the fall in zinc prices on export values was partially offset by the high proportion of refined zinc — rather than ores — exported. Australian production of refined zinc rose 23% year-on-year in the June quarter 2023. The Townsville refinery completed an expansion project in the March quarter 2023 and is now operating at a higher capacity. Delays with commissioning the expansion project disrupted production in 2022.

Australian mine output fell 8.3% year-on-year in the June quarter 2023. Output rose 15% quarter-on-quarter: heavy rain disrupted mine operations in the March quarter 2023. The unlisted company Aurora Metals entered into administration in the June quarter, and two zinc mines owned by the company have closed as a result. Additionally, the Hera mine, owed by Aurelia metals, closed at the end of March 2023. The decision to close the Hera mine early was made in December 2022 due to low profitability.

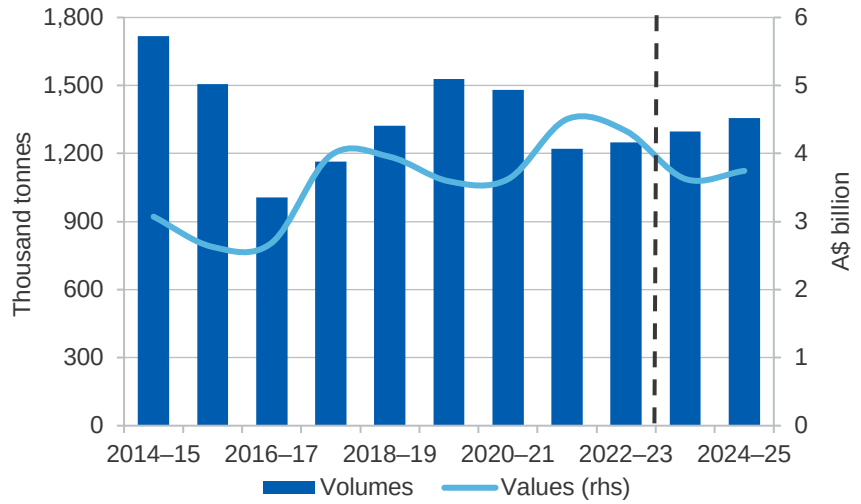
From $4.3 billion in 2022–23, Australia's export earnings for concentrates and refined zinc (combined) are forecast to fall to $3.6 and $3.7 billion in 2023–24 and 2024–25, respectively. Higher production volumes will partially offset the impact of lower forecast prices (Figure 14.5). Growth in Australian mine output is expected to average 4.4% per year over the outlook period. Output growth over the next two years will be driven by the expansion of the Century mine.

Exploration expenditure softens in the March quarter

Exploration expenditure for silver, lead and zinc fell 8.8% year-on-year in the June quarter 2023. Exploration expenditure slumped in 2020 — due to the COVID pandemic — but recovered as zinc prices rose over 2021 and

2022. Exploration expenditure is moderating with zinc prices returning to a lower level.

Figure 14.5: Australia's zinc exports, metallic content



Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2023).

Revisions to the outlook

Compared to the June 2023 *Resources and Energy Quarterly*, export earnings for 2023–24 and 2024–25 have been revised down by 15% and 12% respectively. The zinc price forecast has been revised down due to the weaker global demand outlook, and export volumes had been revised down due to mine closures in Australia.

Table 14.1: Zinc outlook

						Annual percentage change		
World	**Unit**	**2022**	**2023**	**2024 f**	**2025 f**	**2023 f**	**2024 f**	**2025 f**
Production								
– mine	kt	12,476	12,579	12,555	12,681	0.8	-0.2	1.0
– refined [a]	kt	13,342	13,687	13,684	13,824	2.6	0.0	1.0
Consumption	kt	13,506	13,557	13,650	13,758	0.4	0.7	0.8
Closing stocks	kt	630	760	794	860	20.5	4.5	8.3
– weeks of consumption		2.4	2.9	3.0	3.3	20.1	3.79	7.5
Price								
– nominal	US$/t	3,485	2,651	2,536	2,630	-23.9	-4.3	3.7
	USc/lb	158	120	115	119	-23.9	-4.3	3.7
– real [b]	US$/t	3,638	2,651	2,467	2,506	-27.1	-6.9	1.6
	USc/lb	165	120	112	114	-27.1	-6.9	1.6
Australia	**Unit**	**2021–22**	**2022–23**	**2023–24 f**	**2024–25 f**	**2022–23**	**2023–24 f**	**2024–25 f**
Mine output	kt	1,257	1,168	1,212	1,273	-7.1	3.8	5.0
Refined output	kt	435	410	453	505	-5.8	10.4	11.6
Export volume								
– ore and concentrate [c]	kt	2,033	1,886	1,949	1,966	-7.2	3.4	0.9
– refined	kt	313	389	419	471	24.3	7.6	12.5
– total metallic content	kt	1,220	1,248	1,298	1,358	2.3	3.9	4.6
Export value								
– nominal	A$m	4,506	4,330	3,627	3,746	-3.9	-17.8	2.7
– real [d]	A$m	5,020	4,507	3,627	3,628	-10.2	-21.0	-0.5

Notes: **a** Includes secondary refined zinc; **b** In 2023 US dollars; **c** Quantities refer to the gross weight of all ores and concentrates; **d** In 2023–24 Australian dollars; **f** Forecast; **s** Estimated.

Source: ABS (2023) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Science and Resources (2023); International Lead Zinc Study Group (2023); Wood Mackenzie (2023); LME (2023).

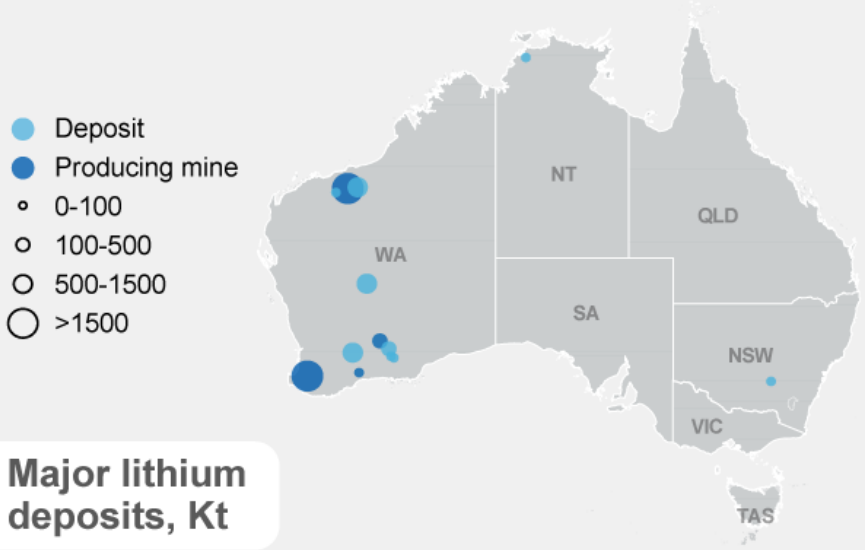
Lithium

Australia's lithium sector

98%
of spodumeme **exported to China**, 2022-23

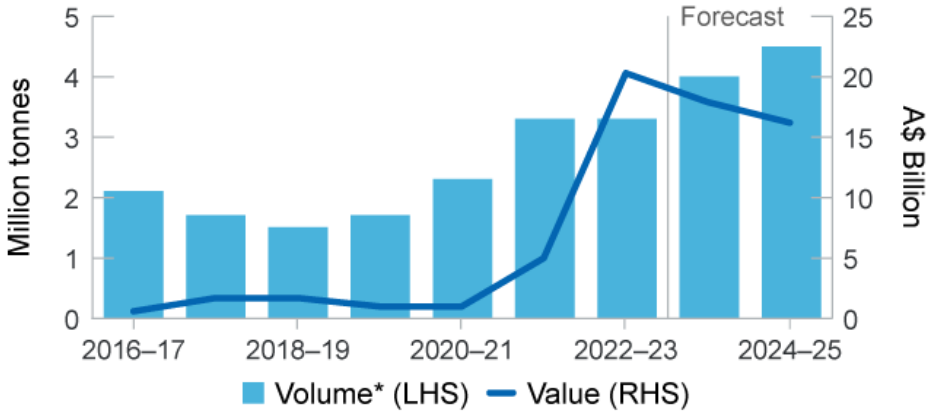
50%
of global lithium **extraction,** with **2nd** most resources

6%
of refining could be in **Australia by 2025**, ranking **4th**



Major lithium deposits, Kt

Australian lithium exports



Outlook

Record earnings in 2022–23, due to global supply deficit resulting in record prices

Future earnings to decrease as prices fall and global supply catches up to demand

Mine production in Australia to **keep growing** due to new mines and expansions

Australia to **refine lithium domestically** as lithium hydroxide takes off

SOURCE: ABS; GA; Wood Mackenzie; WA DMIRS; DISR; OCE

*Volume of spodumene concentrates exported, plus the volume of spodumene concentrate used to produce lithium hydroxide for export

15.1 Summary

- Record Australian lithium exports ($20 billion in 2022–23) are forecast to decrease over the outlook period, as lower prices offset higher export volumes ($16 billion in 2024–25). Prices are expected to fall due to the lithium market entering a sustained period of surplus supply, but remain well above levels prior to 2021.
- Australian lithium mine production continues growing due to expansions and new mines. Australia accounts for half of global lithium extraction and rising production meets growing global battery demand for lithium.
- Australia is developing capacity to refine lithium domestically, with three lithium hydroxide refineries (operating or under construction) and a newly announced lithium phosphate refinery. This contributes to the diversifying global lithium refining and developing Australia's battery value chain.

15.2 World demand

Global lithium consumption maintains high growth outlook

World lithium consumption is expected to maintain a high growth trajectory, due to battery demand for the energy transition alongside the growth outlook for China's Li-ion battery manufacturing. In lithium carbonate equivalent (LCE) terms, global lithium consumption is forecast to increase from 797 thousand tonnes (kt) to 1,428 kt over the outlook period (from 2022 to 2025) (Figure 15.1).

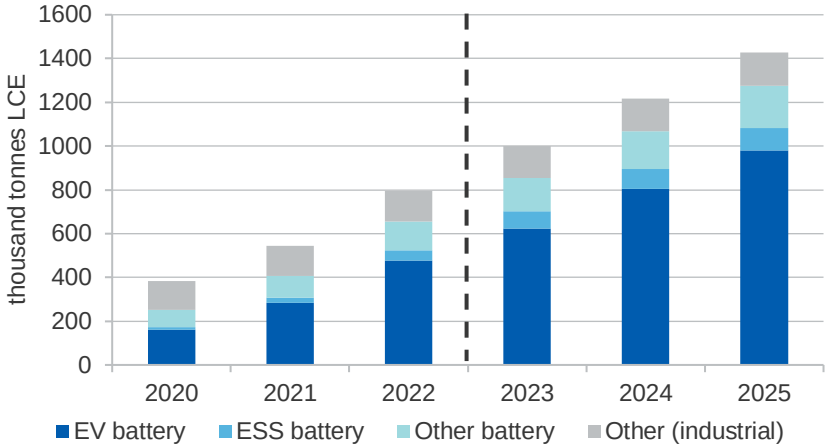
Policy support underpins growth in global electric vehicle sales

The outlook for electric vehicle (EV) demand (60% of global lithium consumption in 2022) remains very favourable due to high policy support that continues to be directed to the sector, particularly in China. The resilience of China's EV sector is underpinned by almost 20 years of industrial support, through consumer subsidies as well as producer tax breaks and finance. Notably, China is now the world's largest automobile exporter (due to the success of the EV sector), surpassing Japan and Germany (in terms of first half 2023 exports).

Other major economies including the United States and European Union have substantially increased support for EVs in recent years. These economies are targeting higher EV uptake in line with emissions reduction targets, as well as the development of domestic EV supply chains. In the short term, EV manufacturing in these economies is expected to remain comparatively low as production ramps up, with world growth continuing to be driven by Chinese EV manufacturing production. Global EV sales are projected to more than double between 2022 and 2025 (11 million to 23 million cars per annum) (see Figure 15.2).

Since the June REQ, the application of improved battery chemistries have seen EV driving ranges rising and "refuelling" times declining towards levels comparable with internal combustion engines. So far, lithium remains a central element in these improved battery chemistries.

Figure 15.1: World lithium consumption, by demand source



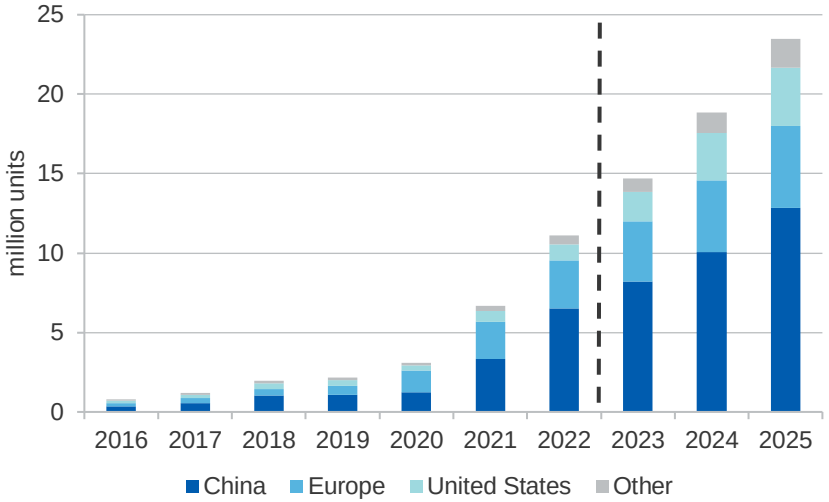
Source: Department of Industry, Science and Resources (2023), Wood Mackenzie (2023)

Energy transition drives investment in utility-scale energy storage systems

Growing lithium demand also reflects government efforts to enable the energy transition and increase investment in utility-scale energy storage systems (ESS). The International Energy Agency (IEA) estimate global

investment in ESS to have more than doubled (year-on-year) in 2022. ESS demand for lithium is expected to more than double between 2022 and 2025, driven by major economies including China, the EU, and the US.

Figure 15.2: Global electric vehicles sales



Note: Electric vehicles are defined to be battery electric vehicles and plug-in hybrid electric vehicles.

Source: Wood Mackenzie (2023)

Increasing electrification to grow other sources of battery demand

Other sources of battery demand for lithium are expected to grow due to the electrification of tools and products (such as electric scooters), alongside growth in portable electronics. Other battery demand is expected to increase by 47% between 2022 and 2025.

Industrial demand for lithium maintains stable growth

The use of lithium is also underpinned by stable growth in areas of industrial demand that are well established, including ceramics, glass-ceramics, and greases. Industrial demand for lithium is expected to grow by 2-3% per annum, in line with historical growth trends.

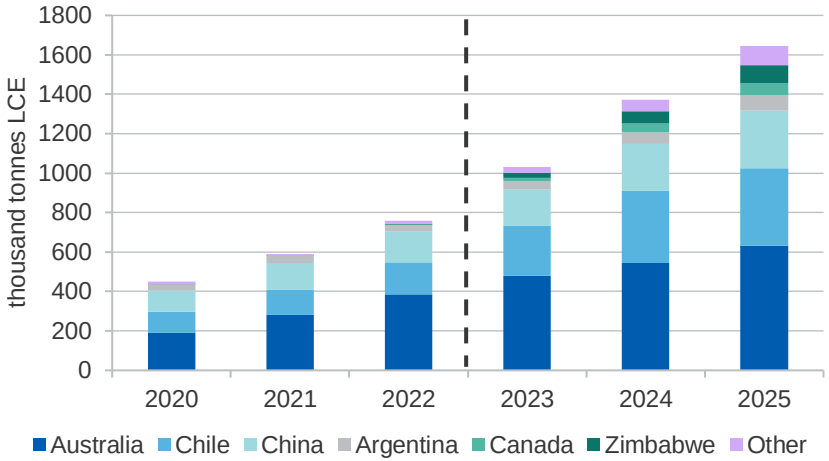
15.3 World production

Global lithium extraction growing rapidly in the short term

Increased extraction of lithium resources reflects higher production across all major producer nations, as well as the emergence of a number of new, smaller producers (Figure 15.3). Higher production is partly in response to lithium prices recovering in 2021 and surpassing record levels in 2022.

Australia continues to lead global lithium extraction, accounting for 51% of global output in 2022). Spodumene production is also forecast to increase from 388 to 632 kt LCE in the 2022–25 period (see Australia section).

Figure 15.3: Global lithium extraction by country



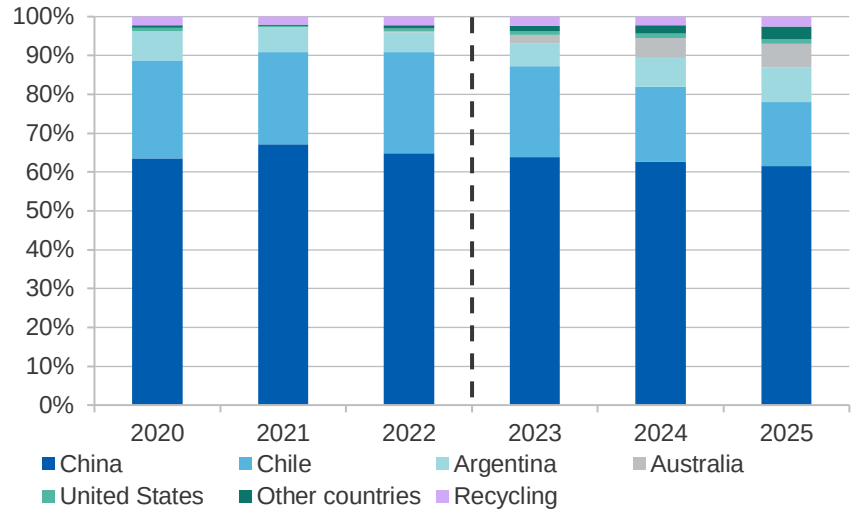
Notes: Global lithium extraction differs from the measure of world lithium production in this report. Lithium production is defined to reflect refined production of lithium chemicals such as lithium hydroxide and lithium carbonate. In contrast, lithium extraction includes lithium resources extracted from brines or mines.

Source: Department of Industry, Science and Resources (2023), Wood Mackenzie (2023)

Amongst other major producers, Chile is expected to see further growth in lithium extraction (from brine sources) over the outlook period. Chile's lithium extraction is forecast to increase from 160 kt to 227 kt LCE over the 2022–25 period. China is also forecast to increase lithium extraction (from brine and mine sources) from 156 kt LCE in 2022 to 291 kt LCE by 2025.

Among other countries, Argentina, Canada and Zimbabwe are expected to significantly increase lithium extraction, and account for a combined 19% share of global extraction by 2025 (from 5.1% in 2022).

Figure 15.4: Share of global lithium refining



Note: This figure reflects the production of global refined lithium, not lithium refining capacity.
Source: Department of Industry, Science and Resources (2023), Wood Mackenzie (2023)

Global lithium refining capacity to expand and diversify over outlook

Global lithium refining currently remains highly geographically concentrated. In 2022, China, Chile and Argentina made up 96% of global lithium refining. By 2025, this is expected to decrease to 87% as lithium refining capacity ramps up in other countries such as Australia and the US.

China is expected to broadly maintain around 60% of global refining capacity to 2025, due to further investments in domestic refining. China's high share of global refining is enabled by imports of lithium ore extracted from Australia, the leading global source of lithium extraction. As Australia ramps up domestic lithium refining, this will increase Australia's share of global lithium refining.

Lithium in Argentina and Chile is extracted from brine sources and must be processed domestically into refined lithium. As a result, the combined share of global refining in these countries will remain largely unchanged (24% by 2025), in line with domestic lithium extraction.

By 2025, investments to develop lithium refining in Australia and the US are expected to lead to market shares of 6.0% and 1.2% respectively. Recycling is expected to make up 2–3% of lithium supply from 2022 to 2025.

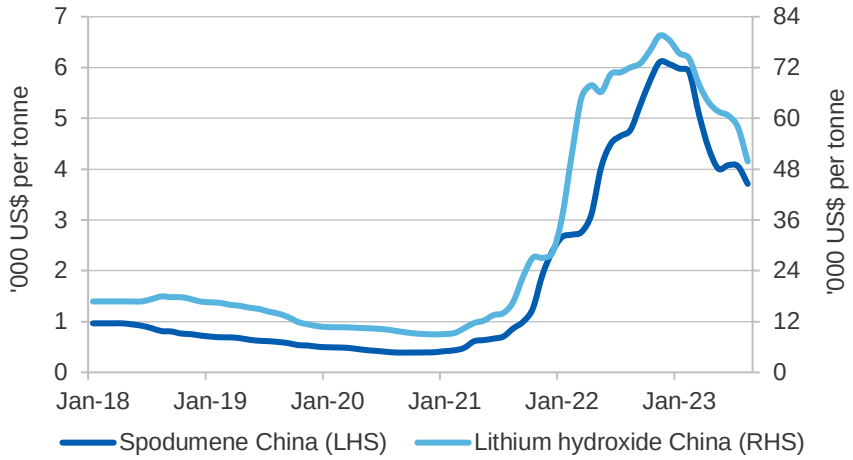
15.4 Prices

Lithium prices to decrease as market enters a period of surplus production

Lithium prices have followed a variable trajectory over recent years due to sharp short-term supply and demand imbalances.

During 2019 and 2020, lithium prices were low due to surplus production, leading several mine operations to become insolvent or being placed under care and maintenance.

Figure 15.5: Average monthly lithium spot prices



Notes: The spodumene price is CIF (cost including freight), with an average grade of 5-6%. The lithium hydroxide price is FOB (free on board). Price series are smoothed.
Source: Bloomberg (2023)

Prices recovered in 2021 and then rose dramatically in 2022 as rapidly growing global demand outpaced supply, leading to a run down in inventories. As the market deficit intensified, lithium consumers increased their inventories to ensure sufficient supplies for continued production and meet downstream contract obligations, placing further upward pressure on prices.

In 2022, spot prices for spodumene (concentrated ore) averaged US$4,364 per tonne, well above the average level of US$663 per tonne over the 3 years to 2021 (Figure 15.6). The spot price of lithium hydroxide (a refined lithium product) averaged US$67,279 per tonne in 2022, dramatically higher than the average price of US$13,656 per tonne over the 3 years to 2021.

In 2023, prices have fallen significantly as the market swings from deficit to being in balance. The high prices in 2021 and 2022 incentivised more investment in lithium production, resulting in global supply catching up to demand. The high prices of the period also drove companies to destock to reduce the cost of carrying inventory — putting further downward pressure on prices.

Prices are forecast to fall further by 2025 as the lithium market enters a period of surplus supply, and is expected to result in rising stockpiles. However, prices are expected to remain well above levels traded in the few years prior to 2021.

The average spot price of spodumene is forecast to be around US$4,190 per tonne in 2023, then decline to around US$2,090 per tonne by 2025. The spot price of lithium hydroxide is forecast to be US$58,225 in 2023, then decline to around US$37,290 per tonne in 2025.

There are likely to be an increased number of price benchmarks for delivery to destinations in Western countries as the bifurcation of lithium markets and supply chains continues: the US and other countries are steadily building supply chains that are less reliant on China — where most lithium is currently refined.

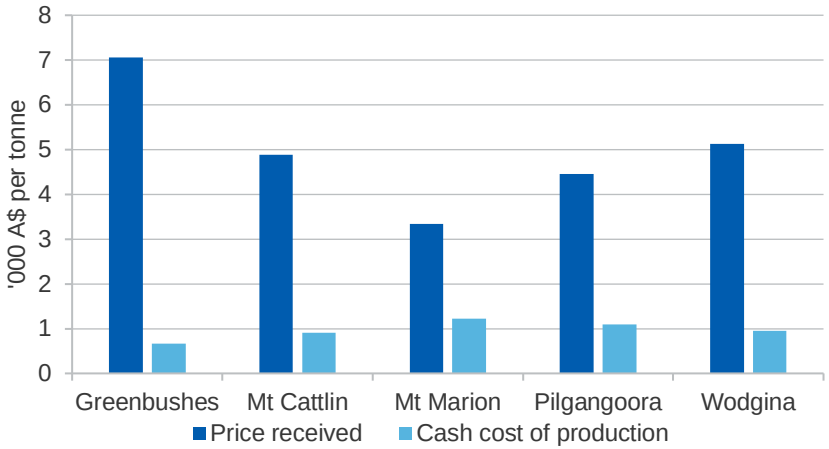
15.5 Australia

Lithium mines expected to continue to increase production over outlook

Australia leads global lithium extraction, and mine production is forecast to continue growing. Mine production of spodumene is forecast to rise to 3.3 million tonnes (Mt) in 2023–24 and 4.0 Mt in 2024–25, up from to 3.1 Mt in 2022–23. Rising mine production will be driven by the expansion of existing mines, including Greenbushes, Finniss, Wodgina, Pilgangoora, Mt Marion and Mt Cattlin. Greenfield production is also due to commence at Mt Holland and Kathleen Valley over the outlook period.

Despite recent price falls, Australian lithium mines are expected to remain highly profitable over the outlook period, with long term prices projected to settle well above reported production costs. For the 2022–23 financial year, Greenbushes, Mt Cattlin, Mt Marion, Pilgangoora, and Wodgina reported the unit cash costs as a share of prices received was 9.5%, 19%, 37%, 25% and 19% respectively (Figure 15.6).

Figure 15.6: Company reported spodumene price received and cost of production, select mines, 2022–23



Notes: Differences in prices received is partly due to differences in the grade of spodumene. For Greenbushes, price received calculated by dividing sales revenue (FOB) by quantity of spodumene concentrate sold.

Sources: Allkem (2023), IGO (2023), Mineral Resources (2023), Pilbara Minerals (2023)

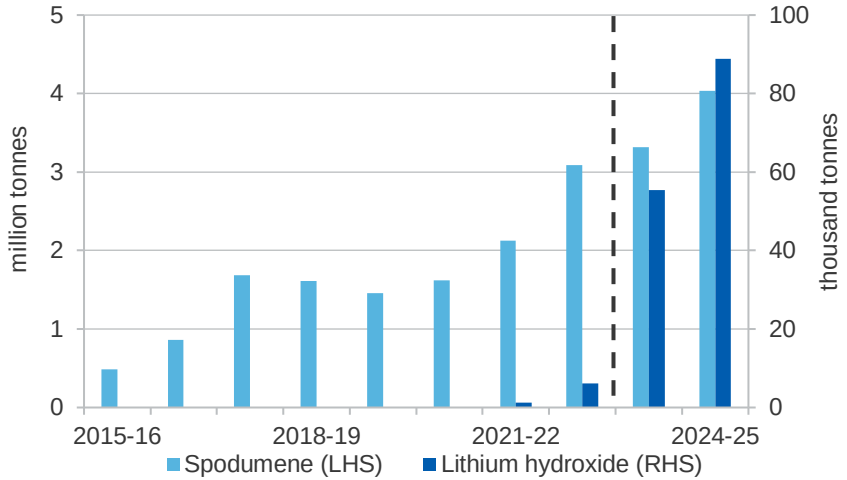
Australia ramping up refining of lithium hydroxide, developing lithium phosphate refining

Australia is continuing to develop downstream lithium refining capacity domestically, including a number of lithium hydroxide refineries and announced investments in emerging products such as lithium phosphate. By 2024–25, Australian lithium hydroxide output is forecast to reach 89 kt, implying that 15% of Australian spodumene will be refined domestically (Figure 15.7).

There are currently three lithium hydroxide refineries either operating or under development (two based in Kwinana and one in Kemerton), alongside one announced lithium phosphate refinery in Pilgangoora.

The first Kwinana refinery is owned by Tianqi Lithium Corporation (51%) and IGO (49%). After facing technical challenges in the June quarter 2023, the facility is now undergoing major work to fix production bottlenecks. The refinery is still ramping up and was reported to be operating at around 20% of nameplate capacity as at the end of July (target 48 kt).

Figure 15.7: Australian production of lithium ore (spodumene) and refined lithium (lithium hydroxide)



Source: Department of Industry, Science and Resources (2023), Wood Mackenzie (2023)

The second Kwinana refinery is under construction and owned by Wesfarmers (50%) and SQM (50%). First production is expected in 2024 and capacity is targeted to be 50 kt.

The Kemerton lithium hydroxide refinery is reported to be operating, also proposed to undergo change in ownership structure to be 100% owned by Albemarle (currently 60% Albemarle and 40% Mineral Resources). Capacity is targeted to be 100 kt.

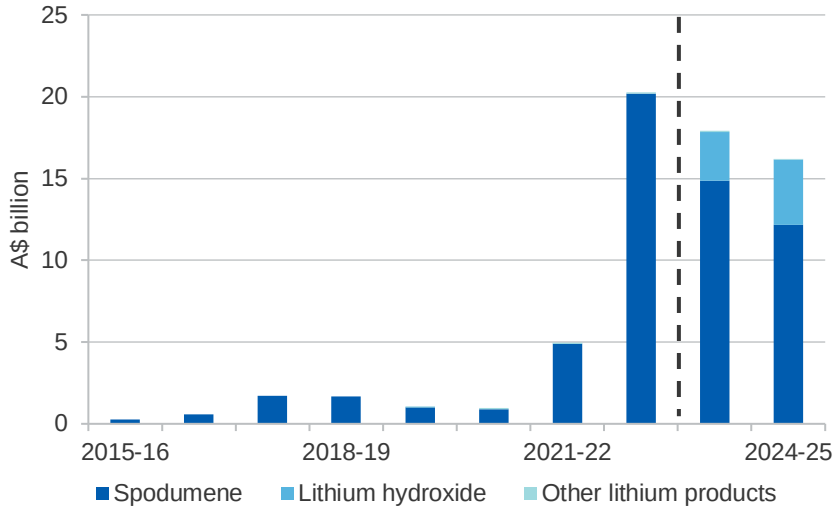
Pilbara Minerals and Calix Limited recently announced final investment decision (FID) on construction of a lithium phosphate refinery at Pilgangoora. This plant will use a patented electric kiln technology that can reduce emission intensity if powered by renewable energy (up to 80% reduction compared to conventional coal/gas kiln). This facility is only expected to produce over 3 kt of lithium phosphate at full capacity, to demonstrate the viability of this type of low emissions refining technology.

Record lithium export earnings to decrease as prices decline

The value of lithium exports is estimated to have reached $20.3 billion in 2022–23, a significant increase from the previous record of $5.0 billion in 2021–22 (Figure 15.8). The increase was driven by a near-tripling in prices over the period, as well as volumes of spodumene exports increasing by 46%. In 2022–23, 98% of spodumene by volume was exported to China., with the remainder exported to countries such as Belgium (1.2%), South Korea (0.5%), and the United States (0.1%).

The value of lithium exports is forecast to decline to $17.9 billion in 2023–24, and $16.2 billion in 2024–25. The declines will be driven by moderating prices over the period, though prices are expected to remain significantly higher than pre-2021 levels. In terms of volumes, spodumene exports are expected to grow at a comparatively slower pace than recent years, which will reflect an increasing share of domestic refining to produce lithium hydroxide.

Figure 15.8: Value of Australian lithium exports



Note: Before January 2021, ABS spodumene exports data was subject to confidentiality. Data prior to this date is sourced from WA Department of Mines, Industry Regulation and Safety.

Source: ABS (2023), Department of Industry, Science and Resources (2023), WA Department of Mines, Industry Regulation and Safety (2022).

Revisions to the outlook

Since the June 2023 *Resources and Energy Quarterly,* the forecast for Australian lithium export earnings has been revised upward by 4% in 2022–23, unchanged in 2023–24 and upward by 8.9% in 2024–25. The upward revision in 2024–25 is due to a change in data source for the lithium hydroxide price (for improved consistency with other reported price estimates).

Table 15.1: Lithium outlook

						Annual percentage change		
World	**Unit**	**2022**	**2023[f]**	**2024[f]**	**2025[f]**	**2023[f]**	**2024[f]**	**2025[f]**
Production [a b]	kt	737	981	1 259	1 511	33.1	28.4	20.0
Demand [a]	kt	797	999	1,217	1,428	25.4	21.8	17.4
Spodumene price								
– nominal	US$/t	4 364	4 194	2 567	2 092	-3.9	-38.8	-18.5
– real [c]	US$/t	4,556	4,194	2,497	1,993	-8.0	-40.5	-20.2
Lithium hydroxide price								
– nominal	US$/t	67,279	58,225	42,292	37,292	-13.5	-27.4	-11.8
– real [c]	US$/t	70,240	58,225	41,140	35,530	-17.1	-29.3	-13.6
Australia	**Unit**	**2021–22**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**
Production								
– Mine (spodumene)	kt	2 130	3 085	3 316	4 031	44.8	7.5	21.5
Export volume								
– Ore and concentrate (spodumene) [d]	kt	2 248	3 292	2 942	3 432	46.4	-10.6	16.7
– Refined (lithium hydroxide)	kt	0	0	55	89	-100.0	NA	60.0
Export value								
– Ore and concentrate (spodumene) [d]	A$m	4 899	20 172	14 858	12 153	311.7	-26.3	-18.2
– Refined (lithium hydroxide)	A$m	0	0	2 988	3 989	-100.0	NA	33.5
– Total (nominal) [d g]	A$m	4 972	20 256	17 906	16 192	307.4	-11.6	-9.6
– Total (real) [d g h]	A$m	5 538	21 083	17 906	15 680	280.7	-15.1	-12.4

Notes: **a** Lithium carbonate equivalent: this is a measure of the quantity of refined product; **b** Refined lithium products include lithium hydroxide and lithium carbonate; **c** In current calendar year US dollars; **d** Prior to January 2021, ABS reported spodumene exports value and volume data was confidential. Data over this period instead sourced from the Western Australia Department of Mines; **g** Revenue from spodumene concentrate, lithium hydroxide and other lithium products; **h** In current financial year Australian dollars; **f** Forecast; **s** Estimate.

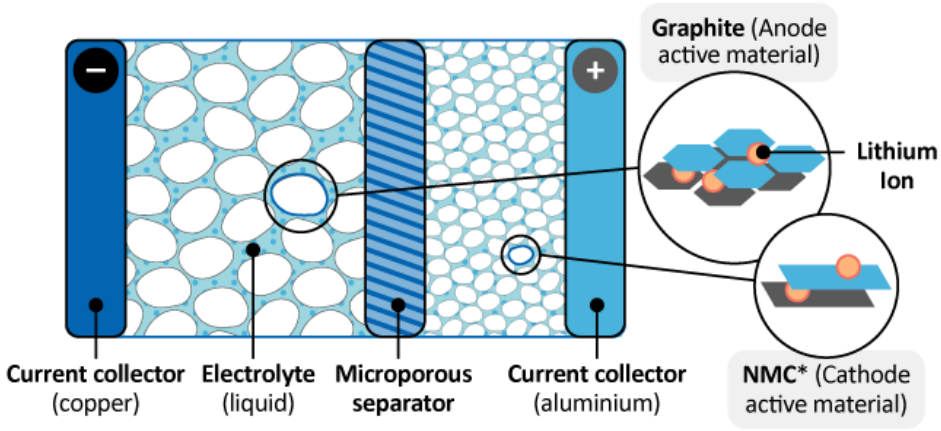
Source: ABS (2023), Company reports; Department of Industry, Science and Resources (2023); Government of Western Australia Department of Mines, Industry Regulation and Safety (2022); Wood Mackenzie (2023).

Battery value chain

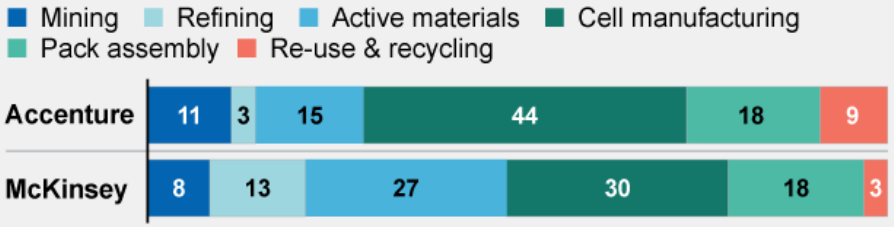
5x
increase in value in the global battery value chain projected by 2030

~90%
revenue opportunities occur downstream of the mining stage

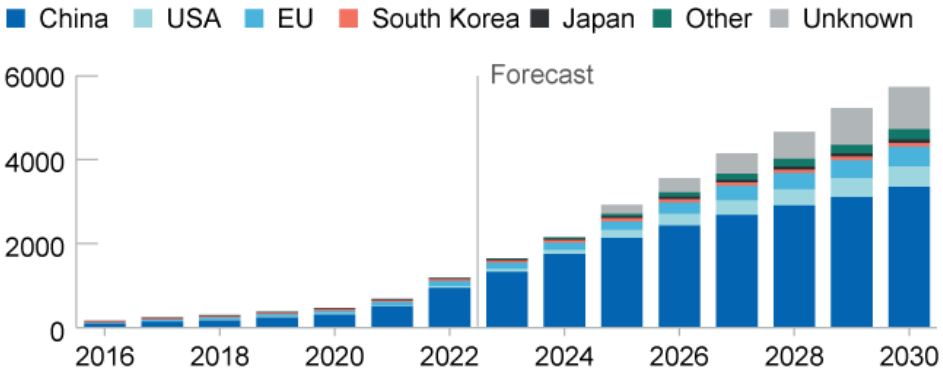
Components of a Li-ion (NMC) battery



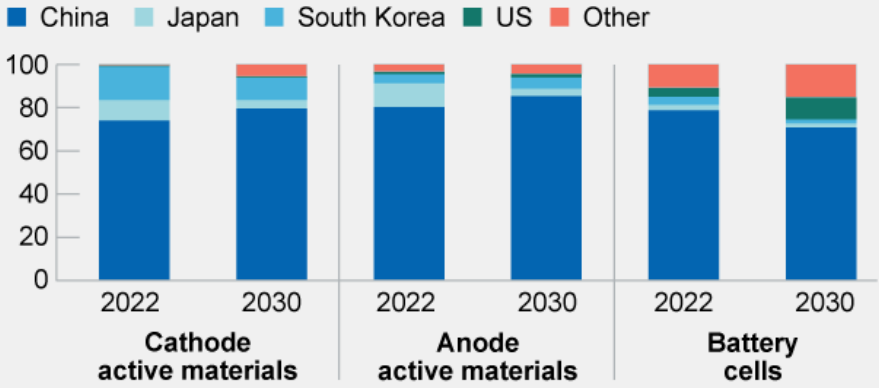
Global battery value chain revenue share 2030, %



Global Li-ion battery cell production, GWh



Share of global production, %



SOURCE: IEA; GA, Wood Mackenzie
*Nickel Manganese Cobalt

16.1 Summary

- Revenue across the global battery value chain is projected to increase five-fold by 2030, with a significant share of the revenue opportunities (around 90%) occurring downstream of the mining stage.
- The current global battery supply chain remains very highly concentrated geographically. Particular stages of the value chain — such as cell manufacturing and pack assembly — are expected to diversify in coming years. However, under current policy settings, other stages such as crucial active material battery components are projected to remain heavily concentrated (predominantly in China) to 2030.
- Australia is a leading global source of battery raw materials (such as cobalt, copper, lithium, and nickel). However, there is an opportunity for Australia to move downstream in the battery value chain.

16.2 The battery value chain

Global efforts to cut emissions by 2030 will drive growing battery demand

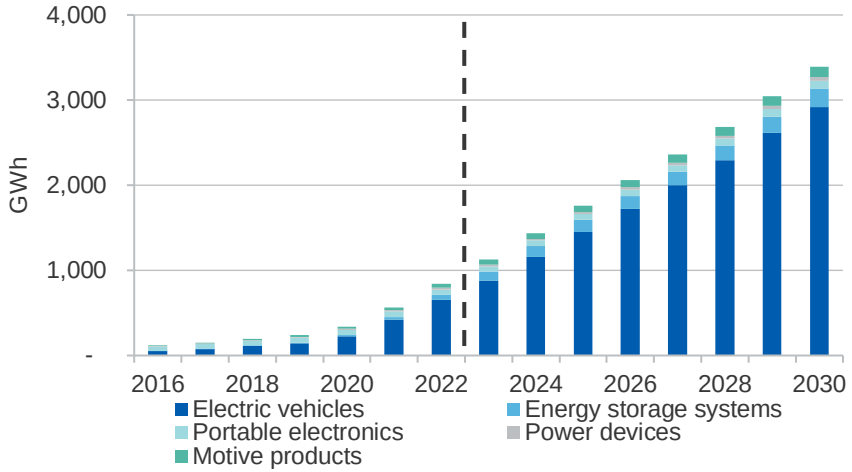
Global demand for Li-ion batteries is projected to more than quadruple (in GWh units) by 2030 compared to 2022 levels (Figure 16.1). Significant growth over this period will be spurred by global efforts to increase electrification to achieve emissions reductions by 2030 in line with government targets. Growth in demand is predominantly due to the uptake of electric vehicles, but other sources of battery demand, including energy storage systems and electronics, will also contribute to this growth.

Li-ion batteries are projected to remain dominant by 2030, making up close to 97% of all batteries. This is because EV batteries make up close to 85% of all batteries, and other battery chemistries are projected to make up less than 1% of EV battery demand. However, there is a greater opportunity for alternative battery technologies in the ESS (energy stationary storage) market (7% of total battery demand). In this market, Li-ion batteries make up 72% of ESS battery demand, with a higher market share for alternative battery technologies including flow batteries (including vanadium flow batteries) (8%) and Na-ion batteries (5%).

Significant revenue opportunities across the battery value chain

The rapid growth of global battery demand presents high revenue opportunities across the battery value chain. Estimates of the value of global battery market by 2030 have been produced by companies including Accenture (A$460 billion) and McKinsey (US$404 billion). McKinsey estimates revenue will increase five-fold relative to 2022 levels, largely explained by projected growth in global battery demand.

Figure 16.1: Global Li-ion battery demand



Note: Motive products include smaller personal devices such as scooters and wheelchairs. Power devices are used for controlling electrical energy. Li-ion batteries make up a significant share of all batteries.

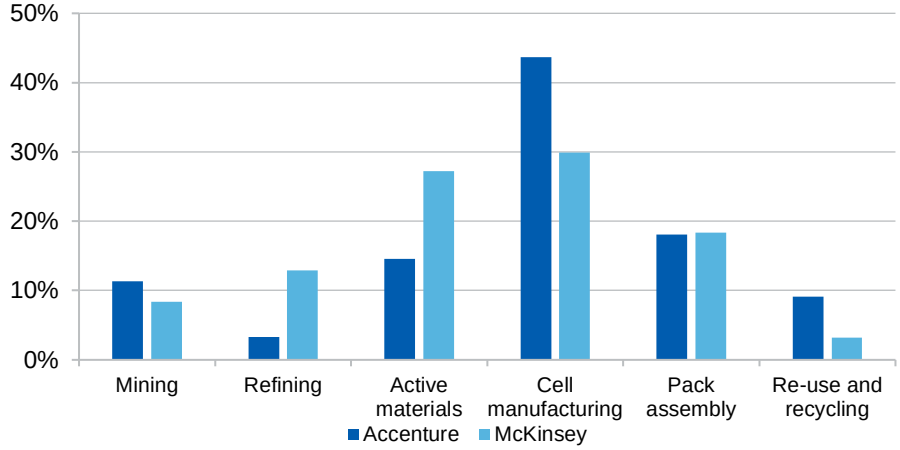
Source: Wood Mackenzie

Most of the revenue for the battery value chain occurs downstream of the mining stage. Analysis by Accenture (2023) and McKinsey (2023) suggest the mining sector makes up roughly 10% of value added in the battery value chain by 2030 (Figure 16.2).

Aside from the pack assembly stage, there is relatively less consensus about how revenue will be distributed across other stages of the battery value chain. Taking the average across these two sources produces the following estimates of the share of value-added revenue by 2030: refining

(8%), active materials (21%), cell manufacturing (37%), pack assembly (18%), re-use and recycling (6%). Given the rapidly changing status of this sector, estimates of the distribution of revenue across the battery value chain are largely indicative.

Figure 16.2: Estimated share of value-added revenue across the global battery value chain, 2030



Note: Total revenue across the battery value chain is calculated in a manner that includes revenue from re-use and recycling.

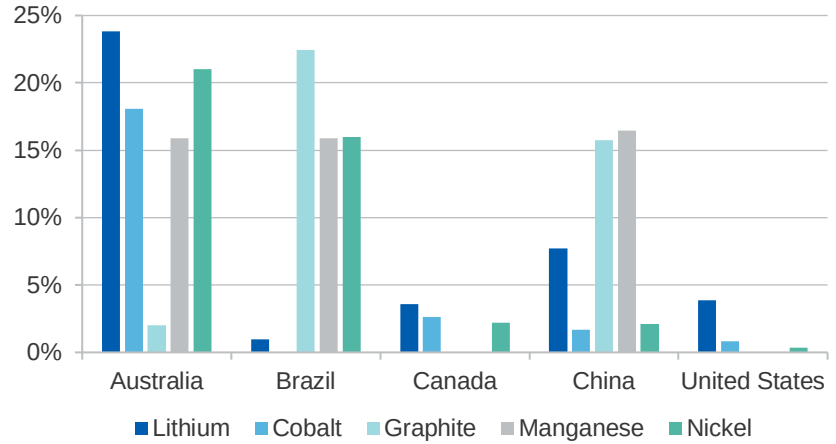
Source: Accenture (2023), McKinsey (2023)

16.3 Mining raw materials

The mining of battery minerals is expected to increase dramatically in line with rapidly growing global battery demand. Countries such as Australia — endowed with a large share of global battery mineral resources — have the opportunity to meet growing demand (Figure 16.3). Importantly, many of these minerals are featured in the list of critical minerals for regions including Australia, Canada, European Union, and United States.

The *Nickel* and *Lithium* chapters of this publication contain discussion of the Australian and global outlook for these minerals. For cobalt, manganese, and graphite, see the *Select Battery Minerals* special topic chapter of the June 2023 *Resources and Energy Quarterly.*

Figure 16.3: Share of global reserves, select countries and battery minerals



Notes: Data not available for nickel in Brazil, cobalt and graphite in Canada, cobalt and graphite in the United States. 'Economically demonstrated resources' as defined by Geoscience Australia is referred to by the United States Geological Survey as 'reserves'.

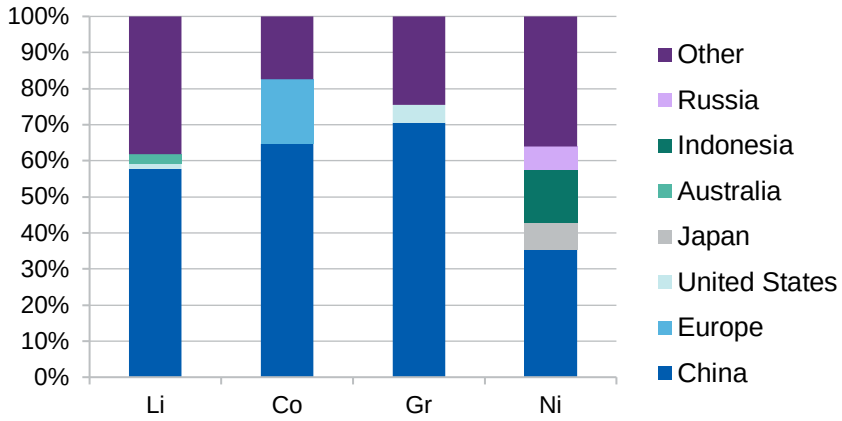
Source: United States Geological Survey (2023), Geoscience Australia (2023)

16.4 Refining

Batteries need high purity materials, making the refining of battery minerals an important stage of the value chain. Examples of refined battery chemicals include lithium hydroxide, nickel sulphate, cobalt sulphate, high purity alumina, and vanadium pentoxide.

The global battery mineral refining market is currently highly geographically concentrated, with China dominating across key materials (Figure 16.4). In Australia, there has been development of lithium hydroxide production, alongside recent development of high purity alumina production. Australia has also traditionally refined the majority of nickel ores and concentrates produced domestically. See the *Aluminium, alumina and bauxite* chapter for analysis of high purity alumina. For refined lithium (e.g. lithium hydroxide and lithium carbonate), see the *Lithium* chapter. For nickel sulphate, see the *Nickel* chapter.

Figure 16.4: Geographical distribution of mineral refining, select battery minerals, 2022



Notes: Data is based on refining production capacity.

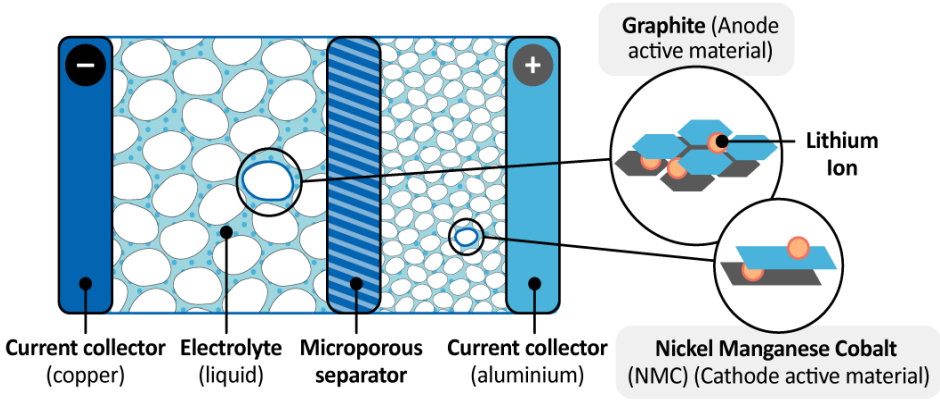
Source: International Energy Agency (2022)

16.5 Battery components (active materials)

Batteries consist of specialised components including the cathode, anode, electrolyte and separator (Figure 16.5). The cathode consists of active materials (battery components that participate in electrochemical charge/discharge reaction) such as lithium-nickel-manganese-cobalt-oxide (Li-NMC), current collector (typically aluminium foil), and other additives (PEM 2019). Importantly, batteries are typically named and categorised according to the cathode composition as it is the primary distinguishing feature (e.g. NMC, LFP, NCA). The anode is made up of active materials including graphite, current collector (typically copper foil), and other additives. The electrolyte consists of conductive salt such as lithium hexafluorophosphate and a chemical solvent (and potentially other additives). For the separator, several production technologies exist with differing material requirements.

The cathode and anode active materials is more complex to process than the other components, and make up a larger share of battery costs. The rest of this section will focus on global output of these active materials.

Figure 16.5: Components of a Li-ion (NMC) battery

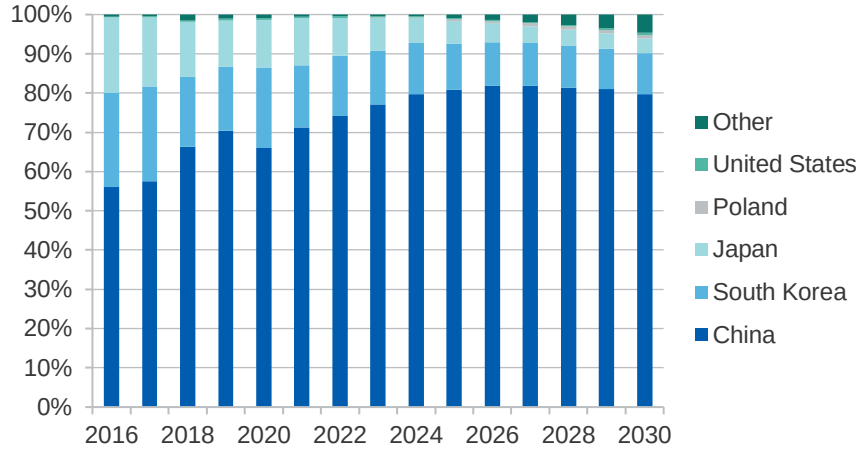


Cathode active material production is geographically concentrated

Cathode active materials are produced industrially via a two-stage process. The first stage (precursor manufacturing) combines and processes high purity battery materials (determined by the cathode chemistry, see Box 16.1) to produce precursor active materials. The second stage mixes the precursor with either lithium hydroxide or lithium carbonate, then undergoes further processing to produce the resulting cathode active materials.

Global production of cathode active materials (the second stage) is geographically concentrated in three countries (Figure 16.6). In 2022, China had the highest share of production (74%), followed by Korea (15%) and Japan (9%). By 2030, China's share of production is currently projected to be increasingly dominant (80%), while Korea (10%) and Japan (4%) lose market share. This is because China is continuing to build processing capacity at a faster pace than other countries. Global production of precursor cathode active materials (the first stage) is very similar in terms of current and projected geographical concentration.

Figure 16.6: Share of global cathode active material production



Notes: Global market share measured in kt units.

Source: Wood Mackenzie (2023)

Anode active material production is relatively geographically concentrated

Production of anode active materials primarily involves the use of either graphite or a graphite-silicon composition. Graphite can be either synthetic or naturally sourced. Natural flake graphite typically undergoes processing to become spherical graphite for use in batteries. Synthetic graphite is typically more expensive and made via refining materials such as coke. In 2022, 63% of graphite was estimated to be synthetic. By 2030, the share of synthetic graphite is expected to be little changed.

Global production of anode active materials is very geographically concentrated (Figure 16.9). A key reason for this is that both natural and synthetic graphite require sophisticated processing to produce the resulting anode active materials.

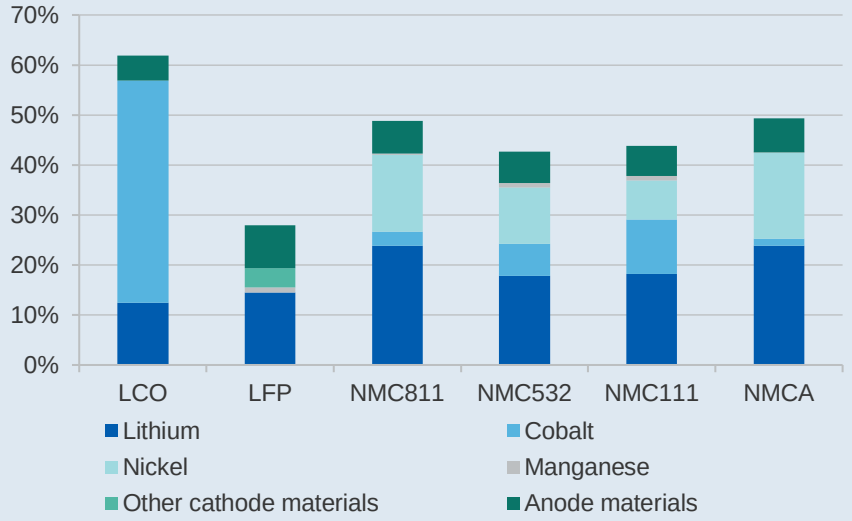
In 2022, China led global production (80%), followed by Japan (11%) and Korea (4%). By 2030, China's share of production is expected to increase to 85%, while Korea (5%) and Japan (3%) is expected to lose market share.

Box 16.1: Trends in battery cathode chemistry

Battery cathode chemistry has important flow-on impacts across the battery value chain, influencing mineral requirements and battery performance.

The mineral composition of the cathode varies significantly across battery chemistries (Figure 16.7M). The three main cathode classes are LFP (lithium iron phosphate), NMC (nickel manganese cobalt oxide), and NCA (nickel cobalt aluminium oxide). The nickel in NMC and NCA cathodes support energy density and longer mileage for electric vehicles. Cobalt adds stability to the battery but is costly. LFP batteries do not use nickel or cobalt, decreasing the material cost of LFP but also leading to lower energy density for the battery. The anode share of battery costs tends to vary less across battery chemistries due to the staple use of graphite.

Figure 16.7: Cathode and anode active materials as a share of total battery costs, select battery chemistries, 2022



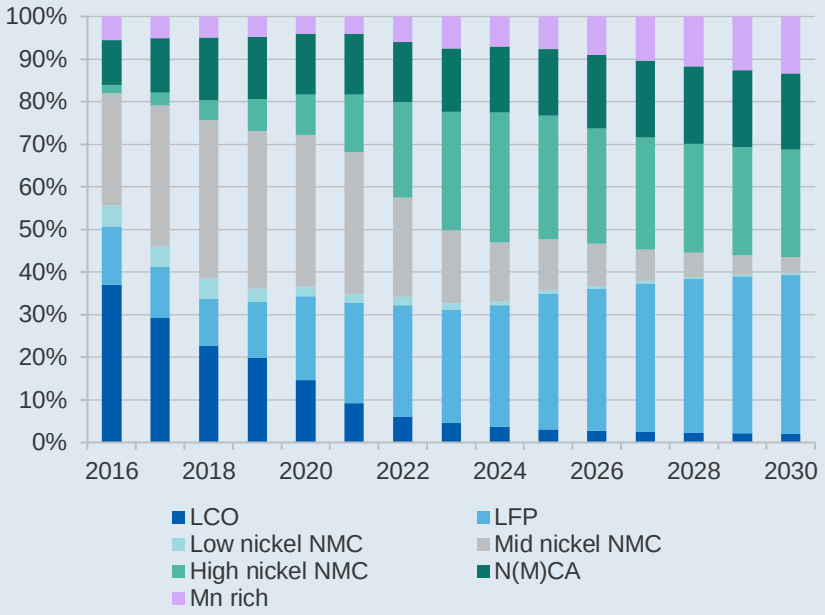
Notes: Other battery costs include: other cell materials, module and pack materials, processing and manufacturing costs, and other costs.

Source: Wood Mackenzie (2023)

The choice of cathode chemistry for battery production is subject to changes in minerals costs and technological developments. Notably, the growing share of LFP in recent years is driven by Chinese technological breakthroughs improving energy density and cycle life. Alongside elevated mineral costs in recent years, this rise in energy density has improved the viability of LFP batteries for EVs and for power sector energy storage.

In 2022, the NMC remains the dominant cathode chemistry (48% combining low, mid and high nickel NMC), followed by L(M)FP (26%) and N(M)CA (14%) (Figure 16.8). By 2030, L(M)FP (37%) is projected to overtake NMC (29% combined), followed by N(M)CA (18%).

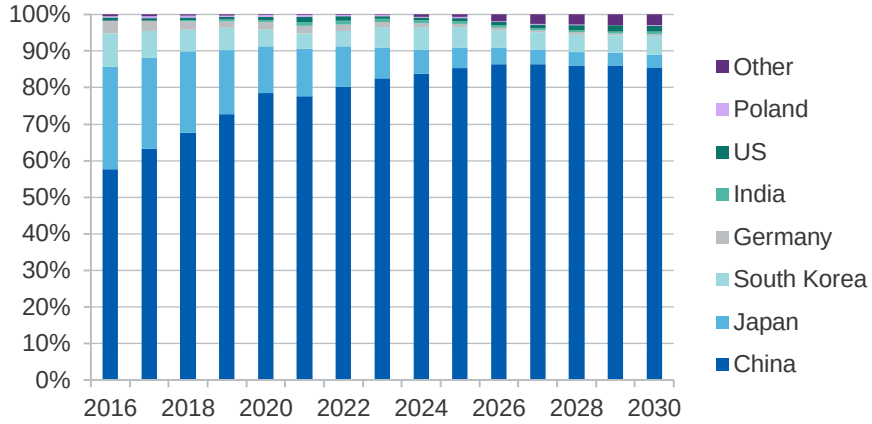
Figure 16.8: Share of global cathode material demand, by cathode chemistry



Notes: Global market share measured in kt units. Excludes Na-ion, solid-state, advanced batteries for simplicity.

Source: Wood Mackenzie (2023)

Figure 16.9: Share of global anode active material production



Notes: Global market share measured in GWh units. Data in terms of production capacity.

Source: Wood Mackenzie (2023)

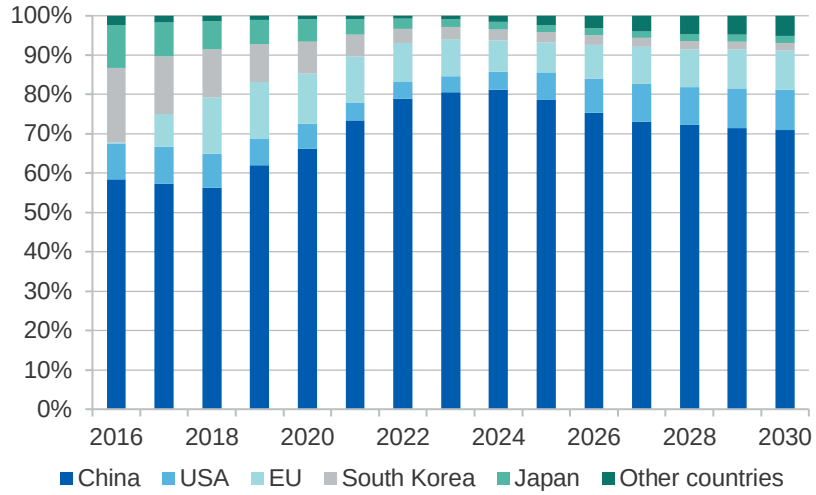
16.6 Battery cell manufacturing

Global battery manufacturing to diversify as new facilities begin production

Battery cell manufacturing can be broadly categorised into two stages. The first stage involves producing the cathode electrode and anode electrode. To produce the cathode (anode) electrode, cathode (anode) active material is mixed with a binder, solvent and additives, before coating the aluminium (copper) current collectors. The second stage produces the resulting battery cells. The electrodes are rolled and then dried. The electrodes are then stacked with a separator in between, creating the cell.

The geographical concentration of global Li-ion battery production is expected to lessen as new battery makers upscale, particularly in Europe and North America. In 2022, China made up 79% of global production, followed by the EU (9.9%), US (4.3%), Korea (3.6%), and Japan (2.5%) (Figure 16.10). By 2030, China's share is expected to decrease to be 71%, followed by the US (10%), EU (10%), Korea (1.9%), and Japan (1.8%). 'Other countries' have less market share than Japan by 2030 (1.5%).

Figure 16.10: Share of global Li-ion battery production



Note: Above market shares assume that any facilities not yet announced will be distributed across countries, consistent with forecast country market shares. Market share based on production capacity in GWh units.

Source: Wood Mackenzie (2023)

Box 16.2: Alternative battery technologies

Technological developments for alternative battery technologies are a likely but uncertain source of disruption for the global battery value chain. The uptake of any battery technology development is broadly dictated by the performance of the next generation battery across five categories: energy density (particularly relevant for EV range), cycle life (influences battery lifespan), cost competitiveness, charge rate, and safety.

Two noteworthy potential technologies include Na-ion batteries and solid state batteries. Notably, the potential disruption due to each of these battery technologies is very different, owing to differences in the material composition and expected performance of these technologies.

Na-ion batteries replace the use of lithium with sodium (as carrier of positive charge), presenting a cost competitive alternative. It is claimed that Na-ion batteries can use current Li-ion battery manufacturing infrastructure with little retro-fitting. The charge rate of Na-ion batteries is also superior. The primary limitation of Na-ion batteries is the lower energy density. As a result, this technology is primarily expected to disrupt battery applications where energy density is less of a priority, such as the low-range EV market and two-to-three wheeler market.

Na-ion batteries may displace global cathode material demand, particularly lessening demand for lithium. Current market estimates of the future cathode material market share of Na-ion batteries by 2030 vary significantly, ranging from 1% to 17%.

Solid state batteries improve energy density and safety but require higher consumption of key minerals including lithium. This technology reduces the liquid content of the battery, impacting the material composition of the electrolyte and anode. In terms of the anode, materials may shift away from graphite and towards more silicon and lithium metal anodes. There is further uncertainty due to the various types of potential solid state technologies (e.g. solid oxide, sulphide, and polymer).

Currently, lithium is predominantly used in the cathode of Li-ion batteries and about 90% of the anode is made with graphite. Solid state batteries present significant upside for global lithium demand since they also need lithium in the battery anode (45-130% more lithium that typical Li-ion batteries). There is likely to be limited commercialisation of this technology by 2030 (virtually no global market share or less than 5%). However, global demand for minerals (including lithium) remains sensitive to potential technological advancements in this sector.

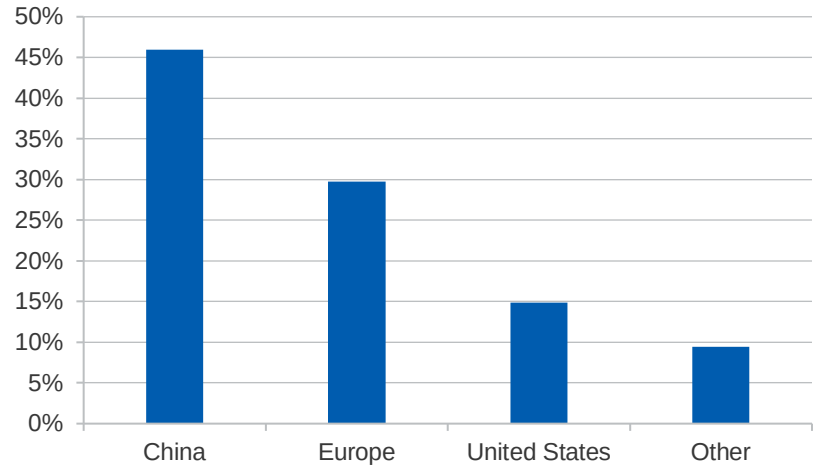
For stationary energy storage (ESS), a wider range of technologies including molten salt batteries and **flow batteries (including vanadium)** are suitable for long durations. Accenture estimates flow batteries could occupy a 4% share of the global ESS market by 2030.

16.7 Battery pack assembly

Global battery pack assembly to be relatively diverse as the sector grows

Battery pack assembly typically involves two distinct stages. Firstly, battery cells are assembled together in frames to form battery modules. Secondly, modules are linked together and enclosed in the battery pack.

Figure 16.11: Projected share of global battery pack assembly revenue, 2030



Notes: Revenue determined on a value-added basis, deducting revenue from upstream stages of the value chain.

Source: McKinsey (2023)

Global battery pack assembly is relatively less geographically concentrated compared to other stages of the value chain. In 2017, the Association of Mining and Exploration Companies estimate Japan leads global battery pack assembly (53%), followed by China (20%), Korea (14%) and the US (9%) (market shares in 2022 are not provided due to lack of sources).

By 2030, China is projected to lead global battery pack assembly (46%), followed by Europe (30%) and the US (15%) (Figure 16.11).

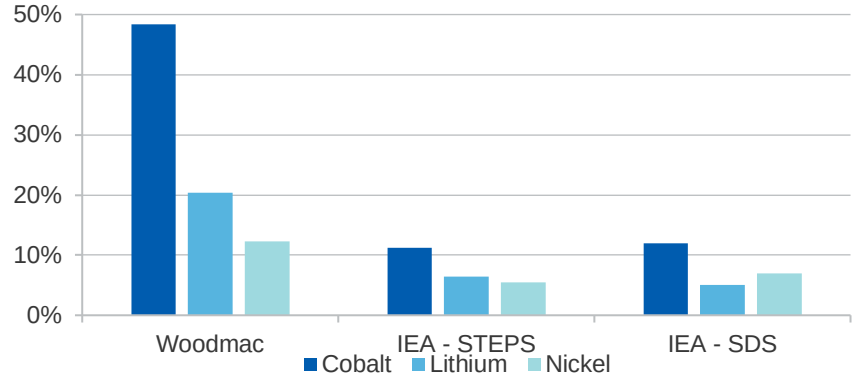
16.8 Battery recycling

Significant potential for battery recycling by 2040, subject to development

There is a significant opportunity for battery recycling as the stock of spent batteries grows alongside global battery demand. In terms of battery recycling, there are various techniques that are now commercial in use or in pilot. Under the IEA's Sustainable Development Scenario (SDS), it is estimated that, by 2040, over 80% of these batteries will come from EVs, and over 10% from two- and three wheelers (IEA 2021). The two main ways to deal with this stock is reuse or recycling. The IEA estimate the reuse of batteries will make up 1-2% of global battery supply requirements by 2040. Several governments have also announced policies relating to battery recycling. For example, the EU Sustainable and Smart Mobility Initiative sets minimum levels of recycled content (12% cobalt, 4% lithium and 4% nickel by 2030) and material recovery (90% cobalt, 90% copper, 35% lithium and 90% nickel by 2026), rising gradually.

Recycling is projected to contribute an important (but uncertain) share of global battery mineral supply by 2040. Based on a battery collection rate of 80%, the IEA SDS projects recycling as a share of global demand to be 12% for cobalt, 5% for lithium, and 7% for nickel (Figure 16.12).

Figure 16.12: Recycling as a share of global demand, 2040



Notes: STEPS = Stated Policy Scenario, SDS = Sustainable Development Scenario.
Source: International Energy Agency (2022), Wood Mackenzie (2023)

Other sources vary in terms of the magnitude of these estimates. By 2030, recycling is expected to be much less than 2040 levels due to a lower stock of spent batteries.

16.9 Australia

Australia is a leading global source of battery minerals, with a high share of the upstream (mining) market

Australia is a leading global exporter of battery minerals such as lithium, cobalt, copper and nickel. This owes much to Australia's high endowment of battery mineral resources (Figure 16.3). Furthermore, Australia has a long history of being a favourable destination for investment in mineral exploration and mining. Most battery minerals mined in Australia are currently exported due to the lack of domestic downstream processing facilities.

Efforts to move downstream in the battery value chain, supported by government

The Australian government has announced upcoming support for Australian battery industries through:

- The National Battery Strategy: to guide governments and industry towards a shared vision of a diverse and competitive battery manufacturing industry.
- Establishing a Battery Manufacturing Precinct: up to $100 million in equity investment to boost domestic manufacturing.
- Establishing a Powering Australia Industry Growth Centre: providing advanced technology and skills development to businesses looking to locally manufacture renewable energy technologies

This support builds on other measures including $6 billion of finance under the National Reconstruction Fund to areas which cut across the battery value chain (comprised of $1 billion for advanced manufacturing, up to $3 billion for renewables and low emissions technologies, $1 billion for value-adding in resources, and $1 billion for critical technologies).

16.10 References

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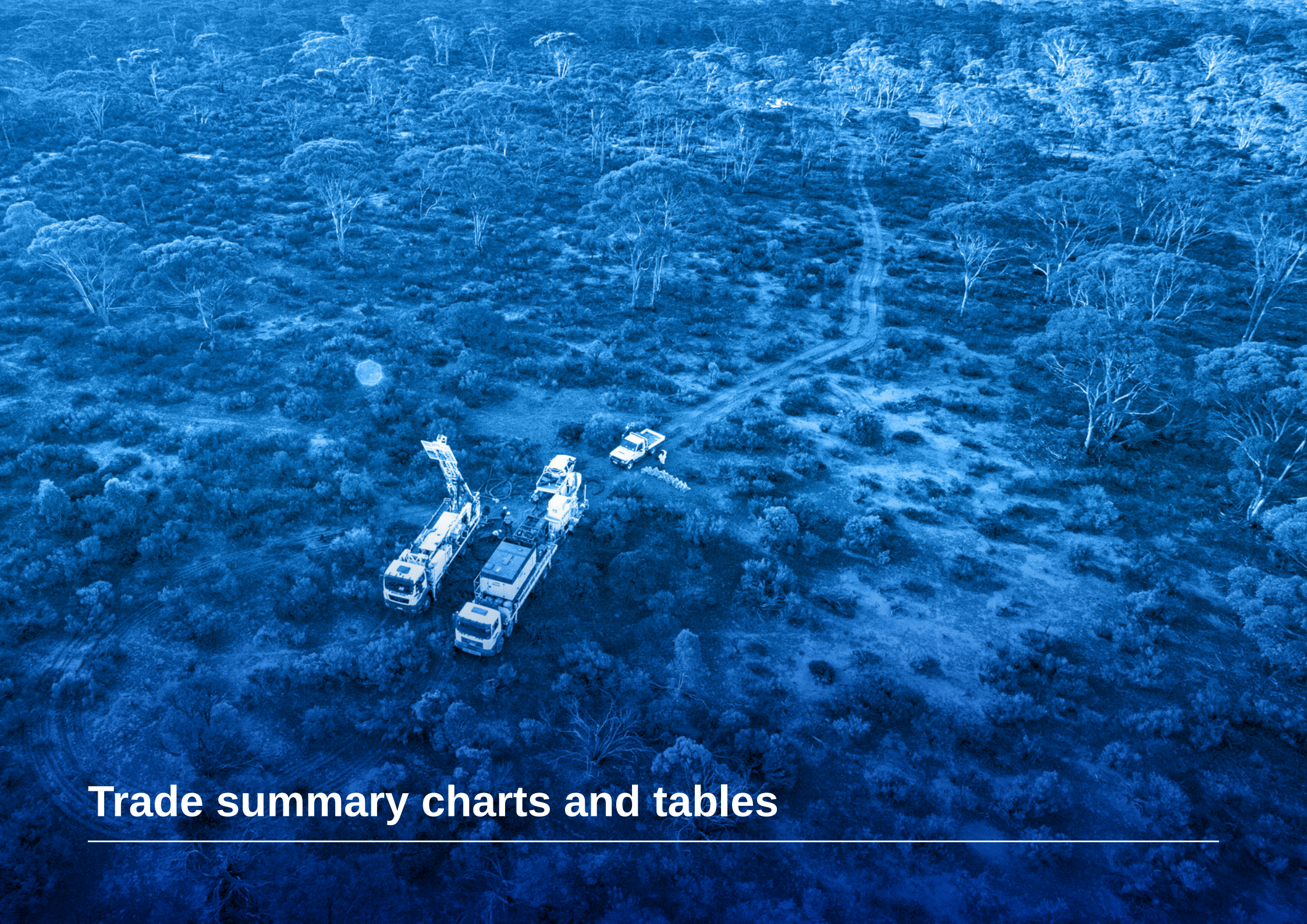
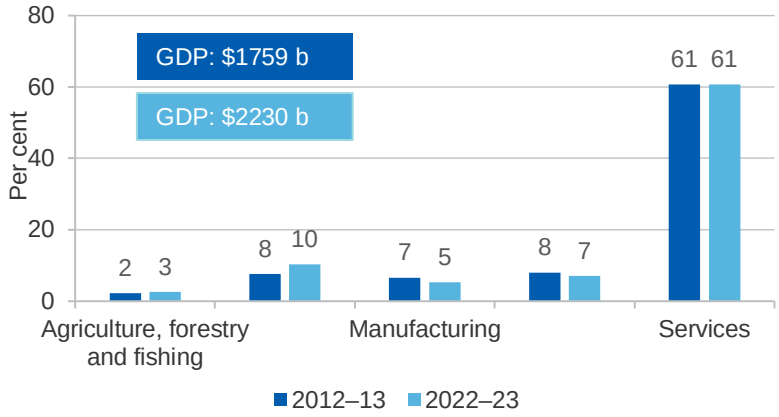


Trade summary charts and tables

Figure 17.1: Industry shares of GDP

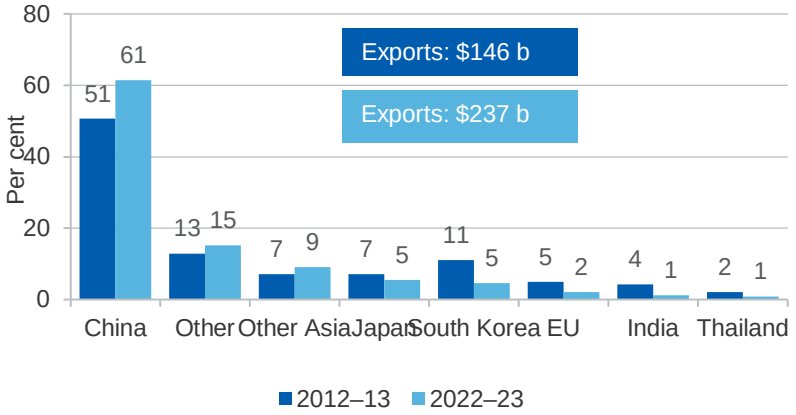


Source: ABS (2023) Australian National Accounts, National Income, Expenditure & Production, 5204.0

Figure 17.2: Principal markets for Australia's resources and energy exports, 2023–24 dollars

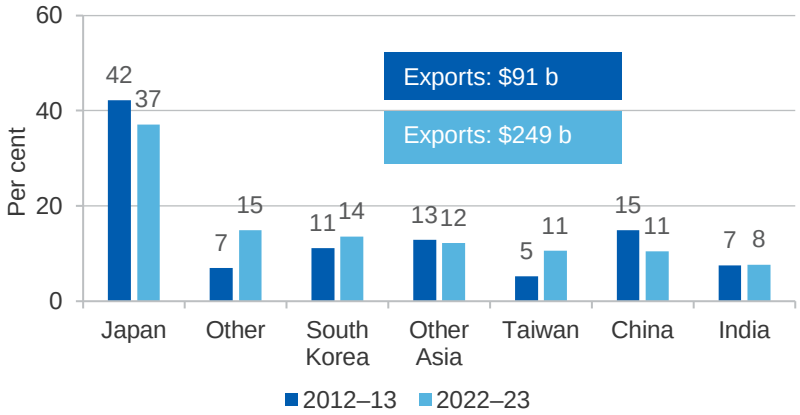
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2023) International Trade in Goods and Services, 5368.0

Figure 17.3: Principal markets for Australia's resources exports, 2023–24 dollars



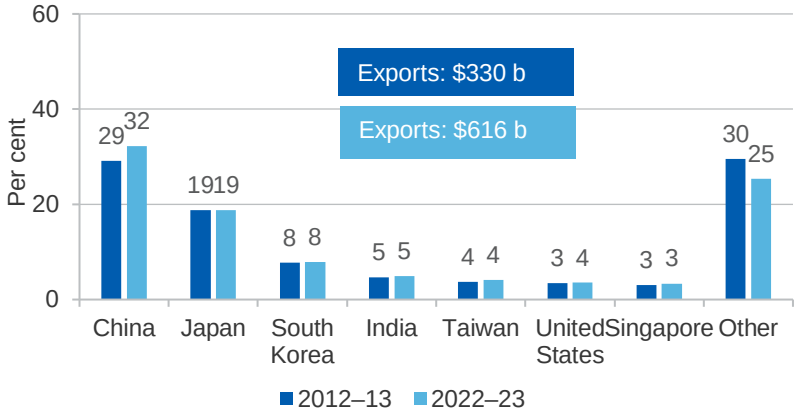
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2023) International Trade in Goods and Services, 5368.0

Figure 17.4: Principal markets for Australia's energy exports, 2023–24 dollars



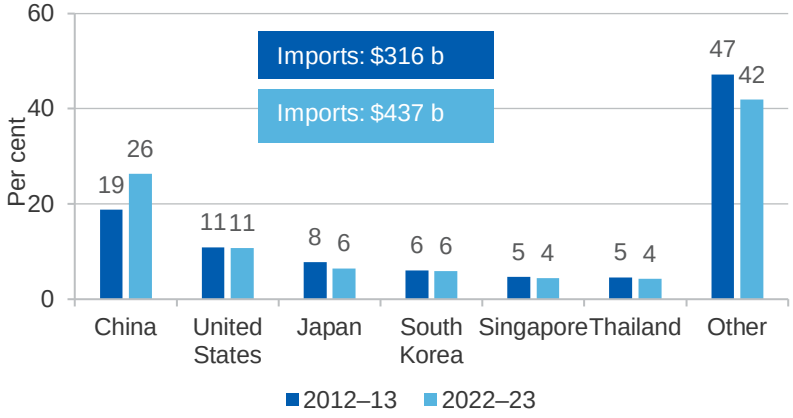
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2023) International Trade in Goods and Services, 5368.0

Figure 17.5: Principal markets for Australia's total exports, 2023–24 dollars



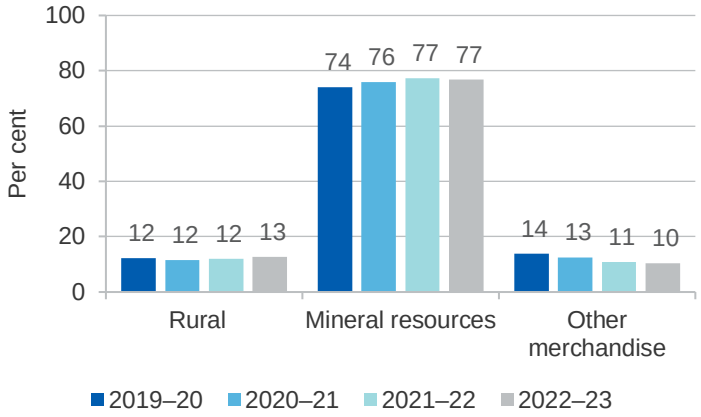
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2023) International Trade in Goods and Services, 5368.0

Figure 17.6: Australia's total imports by country of origin, 2023–24 dollars



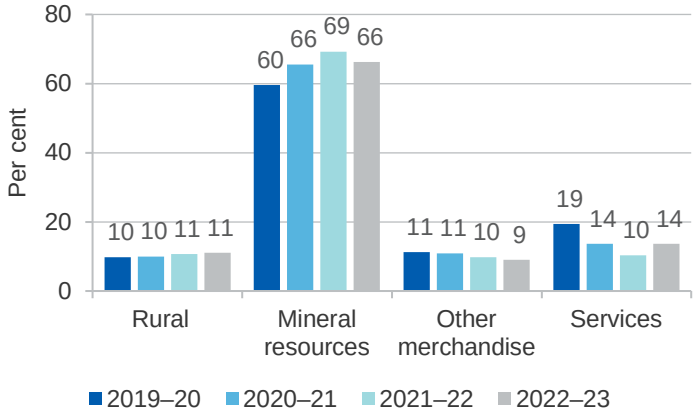
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2023) International Trade in Goods and Services, 5368.0

Figure 17.7: Proportion of goods and services exports by sector



Source: ABS (2023) Balance of Payments and International Investment Position, 5302.0

Figure 17.8: Proportion of merchandise exports by sector



Source: ABS (2023) Balance of Payments and International Investment Position, 5302.0

Table 17.1: Principal markets for Australia's thermal coal exports, 2023–24 dollars

	Unit	2018–19	2019–20	2020–21	2021–22	2022–23
Japan	$m	13,934	9,869	8,155	26,533	39,290
Taiwan	$m	3,789	2,821	2,397	7,392	9,842
South Korea	$m	4,567	3,361	2,988	7,596	4,969
China	$m	5,068	4,646	566	0	3,666
Malaysia	$m	1,084	632	651	1,595	2,463
Vietnam	$m	796	1,231	828	1,881	2,214
Total	**$m**	**31,102**	**24,091**	**18,626**	**51,528**	**68,185**

Source: ABS (2023) International Trade in Goods and Services, 5368.0

Table 17.2: Principal markets for Australia's metallurgical coal exports, 2023–24 dollars

	Unit	2018–19	2019–20	2020–21	2021–22	2022–23
India	$m	13,470	8,855	8,819	23,269	17,800
Japan	$m	9,175	7,193	5,519	15,742	16,342
South Korea	$m	4,821	3,586	3,178	10,504	8,595
Taiwan	$m	3,112	2,357	1,550	4,419	3,912
Netherlands	$m	2,147	1,468	1,030	4,569	3,740
China	$m	11,849	11,560	1,941	0	514
Total	**$m**	**52,283**	**40,489**	**26,977**	**75,289**	**64,612**

Source: ABS (2023) International Trade in Goods and Services, 5368.0

Table 17.3: Principal markets for Australia's crude oil and refinery feedstocks exports, 2023–24 dollars

	Unit	2018–19	2019–20	2020–21	2021–22	2022–23
Singapore	$m	2,331	1,608	1,932	1,685	1,665
South Korea	$m	831	399	104	723	1,148
China	$m	1,208	1,221	188	176	1,062
Thailand	$m	1,342	731	424	0	935
Malaysia	$m	1,965	1,198	765	52	918
Japan	$m	360	162	106	244	231
Total	**$m**	**10,869**	**10,651**	**8,649**	**15,630**	**13,811**

Note: Department of Industry, Science and Resources estimates based on International Trade Centre data.

Source: ABS (2023) International Trade in Goods and Services, 5368.0; International Trade Centre (2023) International Trade Statistics

Table 17.4: Principal markets for Australia's LNG exports, 2023–24 dollars

	Unit	2018–19	2019–20	2020–21	2021–22	2022–23
Japan	$m	25,413	23,561	13,553	27,626	35,916
China	$m	20,946	19,244	13,236	23,861	20,642
South Korea	$m	6,358	6,102	3,889	12,781	19,057
Taiwan	$m	2,808	3,066	2,603	8,378	12,562
Singapore	$m	1,482	1,229	203	2,647	3,294
Malaysia	$m	1,045	1,721	581	623	2,207
Total	**$m**	**59,580**	**56,190**	**35,459**	**78,612**	**96,026**

Note: Department of Industry, Science and Resources estimates based on International Trade Centre data.

Source: ABS (2023) International Trade in Goods and Services, 5368.0; International Trade Centre (2023) International Trade Statistics

Table 17.5: Principal markets for Australia's iron ore exports, 2023–24 dollars

	Unit	2018–19	2019–20	2020–21	2021–22	2022–23
China	$m	76,042	100,246	145,223	120,647	109,106
Japan	$m	6,898	8,321	10,565	11,425	8,460
South Korea	$m	5,591	7,356	10,510	9,238	7,148
Taiwan	$m	2,118	2,218	3,572	3,112	2,060
India	$m	284	24	11	38	69
Indonesia	$m	52	32	47	43	39
Total	**$m**	**92,919**	**121,616**	**177,981**	**147,585**	**129,234**

Source: ABS (2023) International Trade in Goods and Services, 5368.0

Table 17.6: Principal markets for Australia's aluminium exports, 2023–24 dollars

	Unit	2018–19	2019–20	2020–21	2021–22	2022–23
South Korea	$m	920	1,346	1,053	1,146	1,602
Japan	$m	1,581	1,201	1,112	1,676	1,373
United States	$m	1,008	292	298	663	555
Thailand	$m	470	342	406	581	362
Chinese Taipei	$m	351	426	485	688	332
Indonesia	$m	144	113	129	182	149
Total	**$m**	**4,991**	**4,365**	**4,378**	**6,360**	**5,499**

Source: ABS (2023) International Trade in Goods and Services, 5368.0

Table 17.7: Principal markets for Australia's copper exports, 2023–24 dollars

	Unit	2018–19	2019–20	2020–21	2021–22	2022–23
China	$m	4,321	4,478	3,196	2,181	2,461
South Korea	$m	818	770	1,530	1,532	1,480
Malaysia	$m	1,487	974	989	1,070	1,129
India	$m	532	547	729	1,048	476
Japan	$m	2,196	2,514	20	20	1
Philippines	$m	733	426	0	0	0
Total	**$m**	**11,705**	**12,069**	**13,310**	**13,510**	**12,792**

Note: **a** exports of ores and concentrates to these countries have been confidentialised since June 2020.

Source: ABS (2023) International Trade in Goods and Services, 5368.0.

Table 17.8: Principal markets for Australia's gold exports, 2023–24 dollars

	Unit	2018–19	2019–20	2020–21	2021–22	2022–23
China	$m	6,077	974	2,360	9,111	8,474
Hong Kong	$m	5,236	3,950	1,641	5,450	3,932
Singapore	$m	1,904	1,682	3,412	1,790	3,622
Switzerland	$m	1,391	2,245	2,197	2,092	2,330
India	$m	693	78	1,715	2,148	1,570
United States	$m	152	3,641	4,581	1,539	1,302
Total	**$m**	**22,605**	**28,842**	**30,372**	**25,844**	**25,401**

Source: ABS (2023) 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 (2023)

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 (2023)

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 of a five year outlook

About this edition

The *Resources and Energy Quarterly* (REQ) contains 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 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* factors in these changes and makes alterations to the forecasts and projections by estimating the impact on Australian producers and the value of their exports.

The *Resources and Energy Quarterly* 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 22 September 2023.

Resources and Energy Quarterly publication schedule

Publication	Expected release date	Outlook period final year
December 2023	18 December 2023	Australian data: 2024–25 World data: 2025
March 2024	2 April 2024	Australian data: 2028–29 World data: 2029
June 2024	1 July 2024	Australian data: 2025–26 World data: 2026
September 2024	30 September 2024	Australian data: 2025–26 World data: 2026

Source: Department of Industry, Science and Resources (2023)