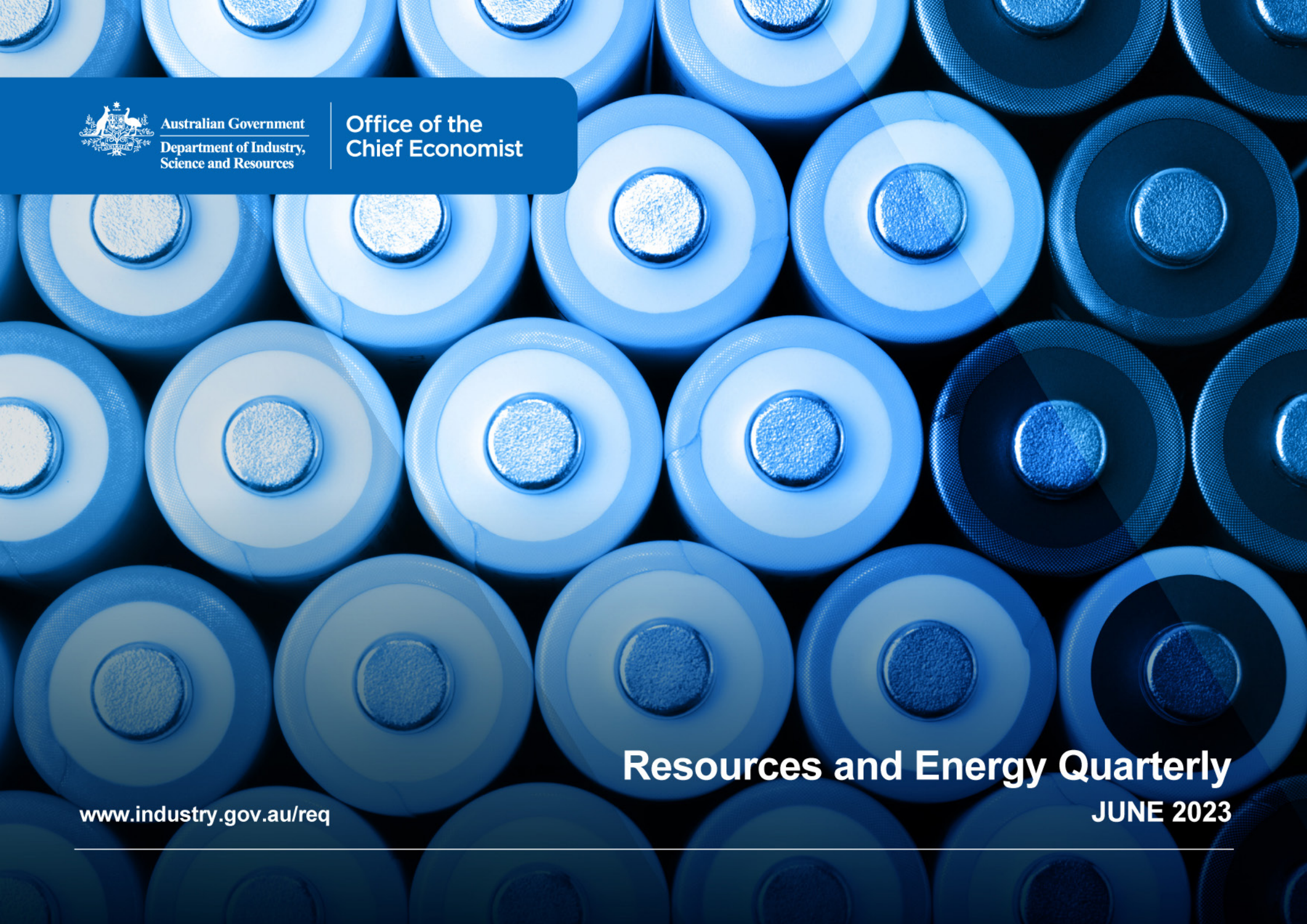

Australian Government
Department of Industry, Science and Resources

Office of the Chief Economist

Resources and Energy Quarterly

JUNE 2023

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Resources insights

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Executive Summary

The continued fallout from the Russian invasion of Ukraine and strength of the US dollar has helped deliver an estimated record $460 billion in earnings for Australian exports of resource and energy commodities in 2022–23. But resources earnings are expected to fall over the next two years, after two years of record earnings.

Export earnings are forecast to fall to $390 billion in 2023–24 and then to $344 billion in 2024–25, as energy prices go back toward levels traded prior to the Russian invasion of Ukraine. The outlook is broadly unchanged from the March 2023 *Resources and Energy Quarterly*.

Australian energy export earnings are set to fall noticeably. LNG earnings are forecast to fall by $24 billion to $68 billion in 2023–24, as LNG prices ease from the record high levels reached in 2022. A further fall of $8 billion is forecast in 2024–25. Thermal coal exports are also forecast to drop sharply, down from $64 billion in 2022–23 to around $38 billion in 2023–24 and $30 billion in 2024–25. Exports of metals used heavily in the energy transition are expected to remain over $40 billion, having doubled since 2021–22.

Slower world economic growth and improving supply conditions are driving most commodity prices lower. Tighter monetary policy is causing a slowdown in economic growth in the major Western economies, where labour markets have been tight. Falling energy prices will take some of the pressure off central banks to keep tightening monetary policy.

The Chinese economy is slowly gathering pace with the cessation of COVID lockdowns. The savings buffer built by Chinese households during the pandemic is estimated to have been much smaller than those built in the Western economies. This suggests that the recovery will be relatively less robust than seen elsewhere, but also less likely to lead to a rise in inflation as experienced in Western economies.

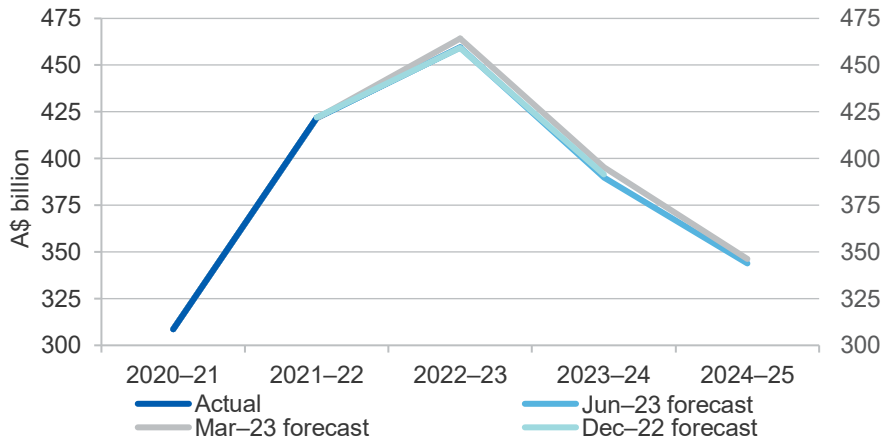
Transport and infrastructure constraints remain a huge obstacle to the full diversion of Russian energy exports to nations with no sanctions. The net result is a fall in world energy supply, as some Russian output is stranded. Energy prices are therefore likely to remain relatively high over the outlook period.

Australian thermal coal exports to China are picking up strongly but are not yet back to levels reached in 2019–20 — before trade impediments were imposed by Beijing in 2020. Chinese buying adds significant competitive pressure to the market for Australian thermal and metallurgical coal, offsetting some of the impact on prices of weaker world economic growth and/or lower energy demand.

Geopolitical tensions continue to escalate the drive for secure supply chain of metals and low emission technologies used to meet ‘net zero’ climate ambitions. The US Inflation Reduction Act (IRA) passed last August will influence the pace of development and location of future supply of key metals. Australia is well placed to seize the opportunities from the IRA and the broader energy transition, given our rich geological reserves, expertise at extracting minerals and track record as a reliable producer and exporter of energy and resources.

A Special Topic chapter examines some metals used in batteries that are central to the global energy transition.

Resource and energy exports, by forecast release



Source: Department of Industry, Science and Resources (2022-2023)

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 250,000** people

Outlook

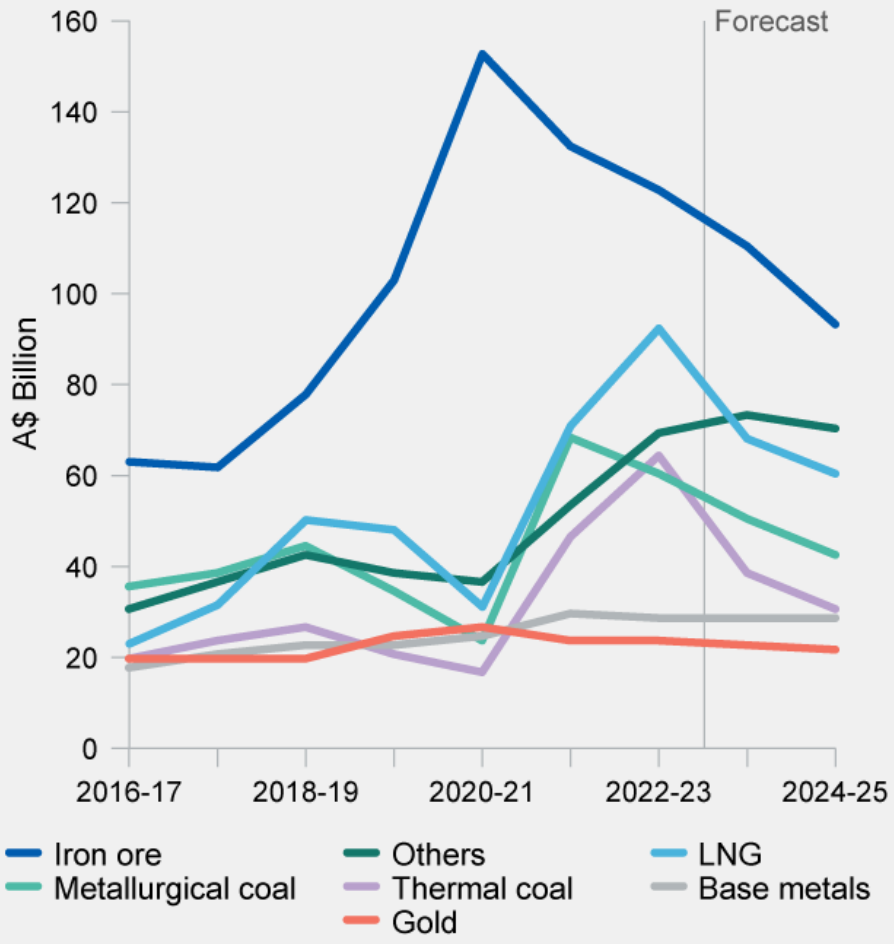
Commodity export earnings are on track for a new record: **$460 billion** in 2022-23

Earnings record reflects **energy price spikes and a strong US$**, which are now unwinding.

Prices are likely to ease as the global economy slows, but the volume outlook remains solid

Exploration spending grew to **$1.3 billion** in the March quarter

Australia's resource and energy exports



SOURCE: ABS; DISR; OCE

1.1 Summary

- Resource and energy commodity prices fell further in the June quarter 2023, as the world economy slowed under the impact of tighter monetary conditions in major Western economies.
- Australia's resources and energy export earnings during the outlook period are expected to be broadly in line with projections in the March quarter *Resources and Energy Quarterly*. After a record $460 billion in 2022–23, weaker world demand, lower energy prices and improving world commodity supply will cut earnings to $390 billion in 2023–24, with another significant fall likely in 2024–25.
- The incentives provided for low emission technologies under the US Inflation Reduction Act (IRA) will shape investment and trade in coming years, especially in commodities important to the global energy transition. With high critical mineral reserves, Australia is well placed to benefit from the IRA and other US incentives, and from the increased focus on supply chain security in the current geopolitical climate.

1.2 Macroeconomic, geopolitical and policy factors

World growth continues to soften

The global macroeconomic backdrop, as presented in the most recent IMF World Economic Outlook, is marginally softer than that presented in the March 2023 *Resources and Energy Quarterly*. The key trend remains a slowing in the global economy. The rebound in Chinese economic activity post-Covid has been weaker than expected, leading the IMF to marginally downgrade their expectations of global economic growth. The impact of higher interest rates in major Western economies is slowing growth, and persistent inflation continues to pose a risk of further monetary tightening.

World economic growth steadied at relatively low levels in the June quarter 2023. The IMF now forecasts world GDP growth of 2.8% in 2023 and 3.0% in 2024, down from growth of 3.4% in 2022. Growth in developed economies is expected to more than halve from 2.7% in 2022 to 1.3% in 2023. China is forecast to grow by 5.2% in 2023 and 4.5% in 2024.

The end of China's dynamic zero-COVID policy in December 2022 has, so far, not seen the strong rebound most expected. Savings accumulated by households in China during the pandemic were nowhere near as large as in many Western nations. Youth unemployment in China has hit a record rate of over 20%, putting pressure on the Government to announce new measures to boost growth. The Chinese authorities are gradually rolling out measures to boost economic activity. While inflation is not as much of a concern as in other major economies, high local government debt remains a major concern. It is likely to take some quarters before China grows strongly enough to give resource and energy commodity prices a meaningful boost. China's economy will likely also continue to be impacted by slow economic growth in the West.

Monetary policy has been tightened further in the major Western economies, as central banks take further measures to address inflation. Labour markets are starting to lose their extreme tightness as economic growth slows, reducing upward pressure on wages. Recent falls in energy prices will also help lower inflation. However, consuming nations' efforts to replenish/fill strategic oil reserves, and output cuts by energy producers, will act to support oil prices.

Risks appear weighted to the downside. Geopolitical tensions are likely to remain an ongoing risk to household and business confidence, and hence the macroeconomic outlook and resource and energy commodity demand. Sanctions on Russian energy exports will see the markets for some energy commodities remain more vulnerable to weather-related demand surges and supply outages. China and India will likely continue to import more Russian fossil fuel products than before the war; as transport constraints ease, Russian supply is likely to account for a larger part of their imports over the forecast period. As a result of the invasion of Ukraine, Russia's dependence on China and India for investment in new/existing mines/wells and associated infrastructure is intensifying.

The AUD/USD has traded in a relatively tight band around US$0.66 since March. Over the outlook period, the consensus forecast adopted is for the AUD/USD to lift modestly.

Overseas and domestic policy developments affecting Australian exports

The US IRA is causing a noticeable reaction in the resource and energy commodity sectors, and likely to have a large impact on trade in various commodities going forward. The US Administration's decision to ask the US Congress to place Australia on par with Canada/US suppliers will benefit investment in parts of the supply chain of low emission technologies (mainly EVs) where Australia has potential.

As trade impediments imposed by the Chinese Government in 2020 are lifted, Australian thermal coal exports to China are picking up strongly. However, they are not yet back to levels reached in 2019–20. Chinese buying is increasing demand in the market for Australian coals, offsetting some of the impact of weaker world economic growth and energy demand.

Box 1.1 gives details of changes to the Safeguard Mechanism commencing on 1 July 2023, after the Safeguard Mechanism (Crediting) Amendment Bill 2023 passed Commonwealth Parliament on 30 March 2023, following the finalisation of the March 2023 *Resources and Energy Quarterly*. The forecasts in this update take account of these changes.

In June 2023, the Australian Government released its Critical Minerals Strategy, outlining the Government's plan to grow the critical minerals industry — particularly downstream processing — to maximise the national benefits from Australia's critical minerals endowments. The Strategy outlines the Government's commitment to ask the Northern Australia Infrastructure Facility (NAIF) to earmark $500 million for projects that align with the Strategy. This is in addition to the funding for critical minerals under the National Reconstruction Fund, including $1 billion for value-add in resources and $3 billion for renewables and low emissions technologies.

In June 2023, the Australian Government announced it had completed the design of the Mandatory Gas Code of Conduct (the proposed Code) which is expected to commence shortly. The proposed Code is intended to support adequate domestic supplies of natural gas at reasonable prices and on reasonable terms to gas buyers in the Australian east coast gas market. Any impacts on the outlook for LNG exports will be considered in future REQ forecasts following the implementation of the proposed Code.

Box 1.1: Safeguard Mechanism reform and the resources sector

The Safeguard Mechanism, in place since 2016, is the policy for reducing emissions at Australia's largest industrial facilities. It applies to facilities which emit more than 100,000 tonnes of carbon dioxide equivalent per year and covers around 28 per cent of national emissions. The majority of the facilities covered by the Safeguard Mechanism are related to the resources sector. Facilities covered under the Mechanism are required to keep their net emissions under a baseline. The affected emissions correspond to the facility's scope 1 emissions[a] less any Australian Carbon Credit Units[b] (ACCUs) surrendered. The baseline is calculated using emission intensity (emissions per unit of output), but also considers site specific factors and arrangements.

Reforms to the Safeguard Mechanism commenced on 1 July 2023 and will ensure that covered facilities contribute to meeting these targets, while strengthening their competitiveness as the world moves to net zero. The reforms lower the baseline emissions of all facilities by 4.9 per cent per year. Baselines will be weighted towards site-specific emission intensity at commencement, and transition to industry-average benchmarks by 2030. A reserve is built into the baseline decline, in order to account for higher-than-expected production growth and higher-than-expected use of trade-exposed baseline adjustments.

The July 2023 reforms introduce the Safeguard Mechanism Credit, issued to facilities emitting below their baselines, with some exceptions. These credits can be sold to, and used by, other facilities to reduce their net emissions. Reducing net emissions using ACCUs will continue to be available. To limit price risk, the government will initially sell ACCUs to facilities for compliance purposes at A$75 per tonne of abatement in 2023–24, increasing with the CPI plus 2 per cent each year.

Other flexible arrangements available to reduce compliance costs include five-year monitoring periods for facilities with a credible plan in place to reduce cumulative emissions.

To manage carbon leakage, where production activity is transferred to other countries, rather than avoiding the emissions, facilities in trade-exposed sectors meeting eligibility requirements may apply for a lower baseline decline rate.

The reforms have been widely anticipated within Australian industry. In the *December 2022 Quarterly Carbon Market Report*, the Clean Energy Regulator reported that "on the back of low trade volumes and some speculative behaviour the ACCU generic spot price reached an all-time high of $57.50 in late January 2022". ACCU prices traded at around A$35 in the month following the 2022 Australian Federal election, and in the first five months of 2023, ACCUs have generally traded in the range between A$35 to A$40.

As the reforms had been anticipated ahead of implementation — and in line with changing investor and customer expectations — many resource companies operating in Australia have pledged to achieve voluntary emission reduction targets prior to the reforms taking legislative effect. To ensure their investment strategies are aligned with these targets, companies have incorporated a range of emissions reduction or offset strategies for new projects to be considered viable. These strategies include electrification, carbon capture and storage, or nature-based carbon offset projects.

The production and exports forecasts presented in the *Resources and Energy Quarterly* incorporate known investment plans of firms in the resources sector, and therefore aligns with how firms in the sector plan to implement voluntary emissions targets and compliance with the safeguard mechanism.

Notes: a Scope 1 greenhouse gas emissions are the emissions released to the atmosphere as a direct result of an activity, or series of activities at a facility level; b The Clean Energy Regulator issues ACCUs for greenhouse gas abatement activities undertaken under the Carbon Credits (Carbon Farming Initiative) Act 2011. Each ACCU issued represents one tonne of carbon dioxide equivalent stored or avoided by a project.

Source: Department of Climate Change, Energy, the Environment and Water (2023), Clean Energy Regulator (2023)

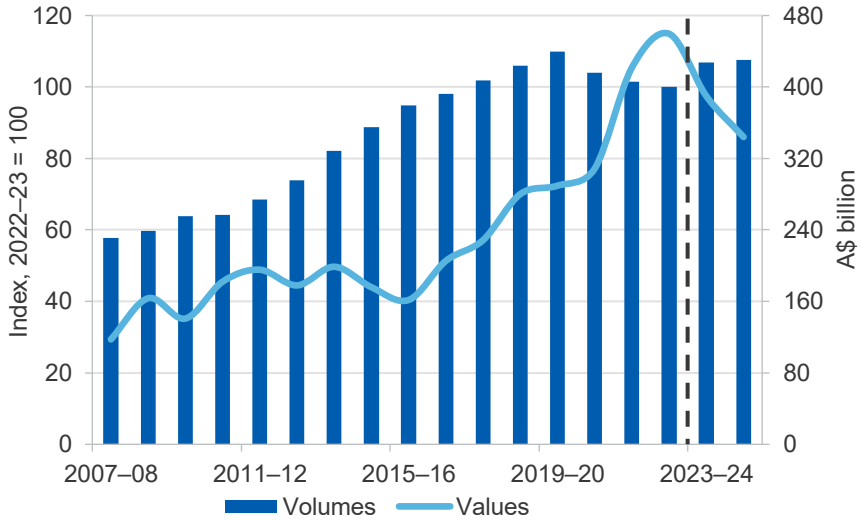
1.3 Export values

Australia's export values are forecast to be $390 billion in 2023–24

The slowdown in the world economy and the re-organisation and improvement in energy commodity supply has generally reduced commodity prices over the past quarter. The Resources and Energy Export Values Index fell 20% from the June quarter 2022: a small rise in volumes partly offset the impact of a sharp fall in prices.

Resource and energy exports are forecast at $390 billion in 2023–24, down from an estimated record of $460 billion in 2022–23 (Figure 1.1). Within this result, weaker demand and improved global supply of resource and energy commodities is likely to depress prices. Forecast growth (of 7%) in export volumes will be too small to offset the impact of sharply weaker prices (Figure 1.2). Exports are forecast to fall by 12% to $344 billion in 2024–25; volumes will be little changed, with lower prices driving the decline in values.

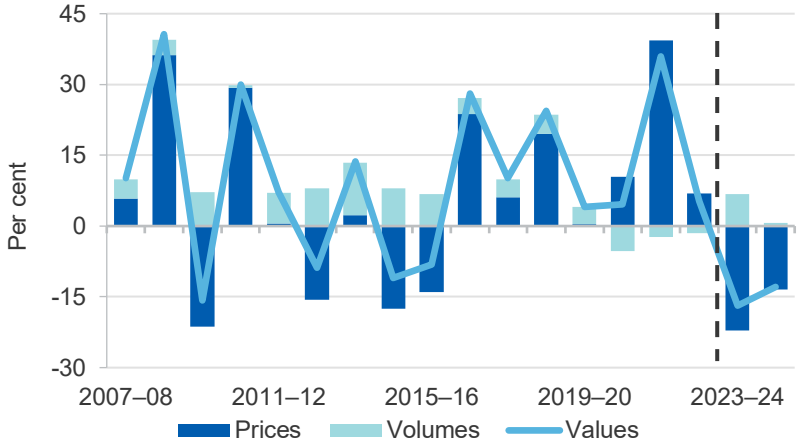
Figure 1.1: Australia's resource and energy export values/volumes



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

In particular, Australian energy export earnings are set to fall sharply. LNG earnings are forecast to fall by $24 billion to $68 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 $64 billion in 2022–23 to $38 billion in 2023–24 and $30 billion in 2024–25.

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



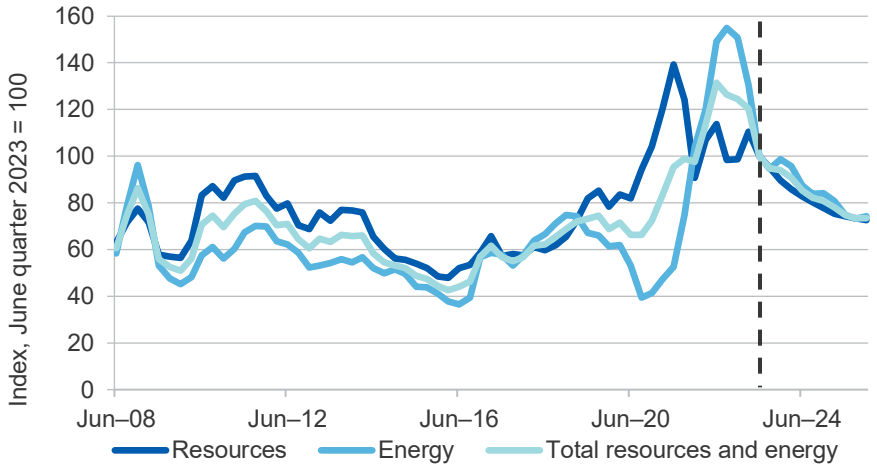
Source: ABS (2023) International Trade in Goods and Services, 5368.0; Department of Industry, Science and Resources (2023)

1.4 Prices

Since the March 2023 *Resources and Energy Quarterly*, resource and energy prices have fallen, as fears grow of a deeper world economic slowdown. The fall in prices was broadly in line with expectations in the March REQ. In general, prices are likely to fall further over the outlook period, as growth in world supply lifts faster than growth in world demand.

In Australian dollar terms, the Resources and Energy Commodity Price Index fell by 17% (preliminary estimate) in the June quarter 2023, to be down 24% on a year ago. In US dollar terms, the index fell by 18% in the quarter, to be down 28% on a year ago. Resource export prices (in A$ terms) fell by 12% in the year to the June quarter 2023, while energy prices fell by 33% (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 has steadied at about US$100 a tonne, still well above the November 2021 cycle low. Demand from Chinese steel mills in the June quarter was not as strong as expected (Figure 1.4). **Metallurgical coal** prices have also fallen on low demand from Asian steel makers. But prices remain above pre-war levels, as some Russian supply is stranded from world markets. Weaker demand and improved supply have recently pushed down **thermal coal** prices, though they are still high historically. Global demand has softened, due to slowing world economic growth and favourable Northern Hemisphere weather. Prices are forecast to fall over the outlook period, as trade flows re-organise further and supply lifts.

Oil prices have recently steadied in a US$70-90 a barrel range. Weaker world demand is being offset by supply cutbacks by OPEC. The US Administration has flagged replenishing the Strategic Petroleum Reserve, which will help underpin prices. Chinese demand hit an all-time high in April, as transport activity recovered after the end of COVID lockdowns. Spot Asian **LNG** prices have dropped below levels traded before the

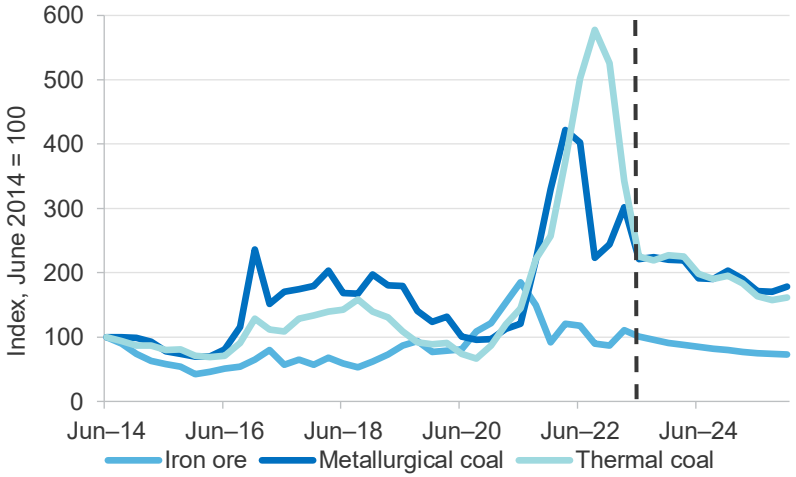
Russian invasion of Ukraine. The risk is for prices to rebound in the outlook period, as Chinese demand lifts and global storage is refilled and/or kept relatively high as a precautionary measure.

The **gold** price briefly pushed above US$2,000 an ounce after the last REQ, on worries over whether the US Congress will raise the US debt ceiling. The price will likely fall, as high interest rates divert funds from non-interest-bearing financial assets.

Base metal prices have softened, as softening 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 could pick up once growth in the global economy stops weakening.

Lithium (spodumene and lithium hydroxide) prices have given up some more of the large gains of recent years. Market deficits (as indicated by anecdotes of declining stockpiles) are steadily being eliminated, largely due to improving supply.

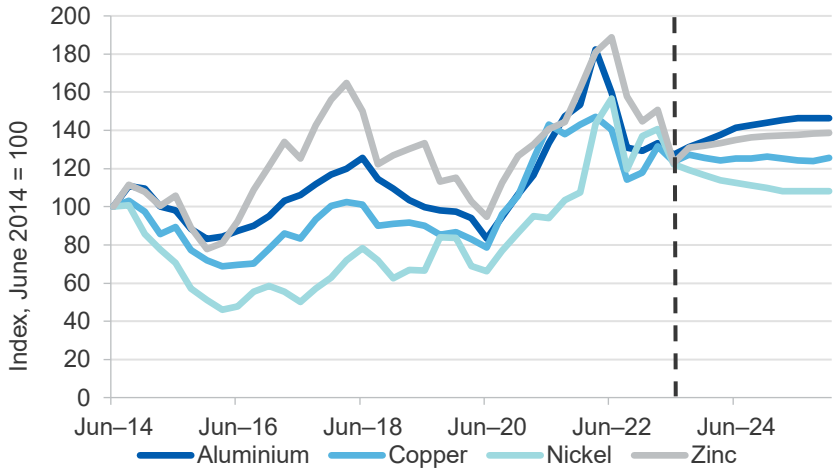
Figure 1.4: Bulk commodity prices



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

June quarter export volumes rose noticeably

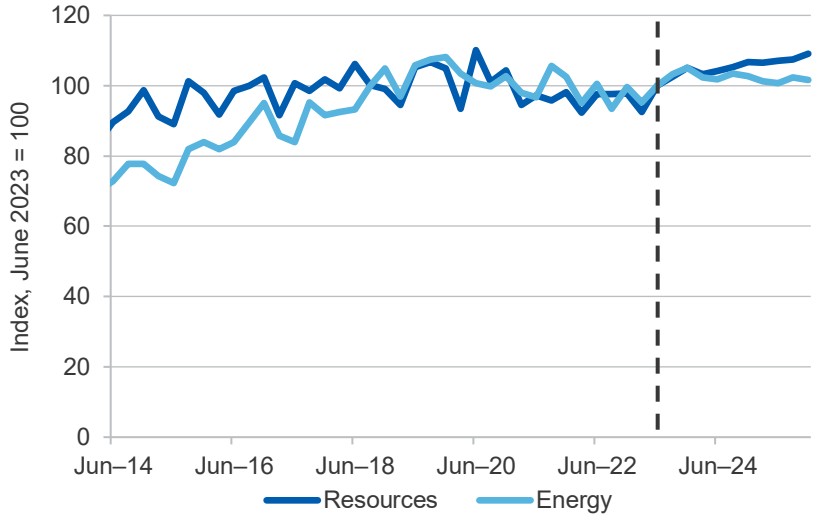
The Resources and Energy Export Volumes Index (preliminary estimate) rose 7.6% in the June quarter 2023 from the March quarter, to be 2% higher than a year ago. Within this total, resource commodity volumes rose by 2.5% in the year to the June quarter 2023, while energy export volumes rose by 1.3% (Figure 1.6). Energy exports were impacted by production and transport problems in the June quarter 2022, lowering the base: operational, weather and COVID-19 related workforce issues were central to these disruptions.

In volume terms, most resource exports are likely to show further significant growth over the outlook period, as the global energy transition accelerates. The volume of energy exports will level out in 2024, in response to the sharp price falls seen over the past year.

Weather risks to mine supply have receded sharply over recent months. Weather forecasters now believe there are above average odds of an El Niño climate episode developing in the coming twelve months. This

dramatically reduces the chance of the type of weather disruptions that have hampered the production and transportation of Australian mining products in the past two years.

Figure 1.6: Resource and energy export volumes



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

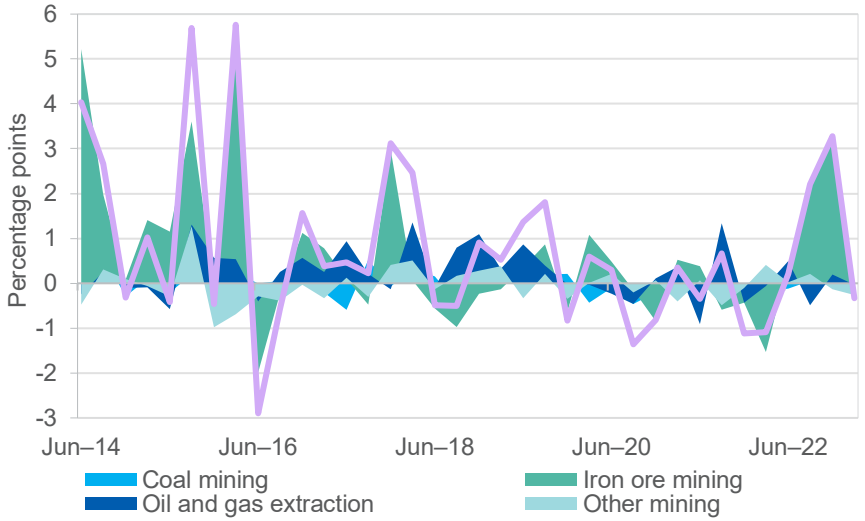
1.6 Contribution to growth and investment

Mining output fell slightly while the overall economy grew marginally

Australia's real GDP rose by 0.2% in the March quarter 2023, to be up 2.3% from a year before. Mining value-added fell by 0.3% in the March quarter but was still 5.4% higher than in March 2022 (Figure 1.7). The quarterly fall was driven by weaker Iron Ore Mining (down by 0.5%), Oil/Gas Extraction (down by 0.2%) and Other Mining (down by 2.6%). The falls were partly offset by a rise in Exploration and Mining Support Services (up by 4.4%) and Coal Mining (up by 0.6%) — the latter less affected by wet weather and flooding on the East Coast. In the coming two years, while the resource sector will likely contribute to real GDP growth, the energy sector's contribution will be minor (Figure 1.6).

The production disruptions of the past few years — arising from the COVID-19 pandemic and weather-related issues — are likely set to ease further. Metal production (ferrous and non-ferrous) should experience continued growth. Coal and gas producers will benefit from prices that are still high in historical terms, although volumes will remain steady.

Figure 1.7: Contribution to quarterly growth, by sector



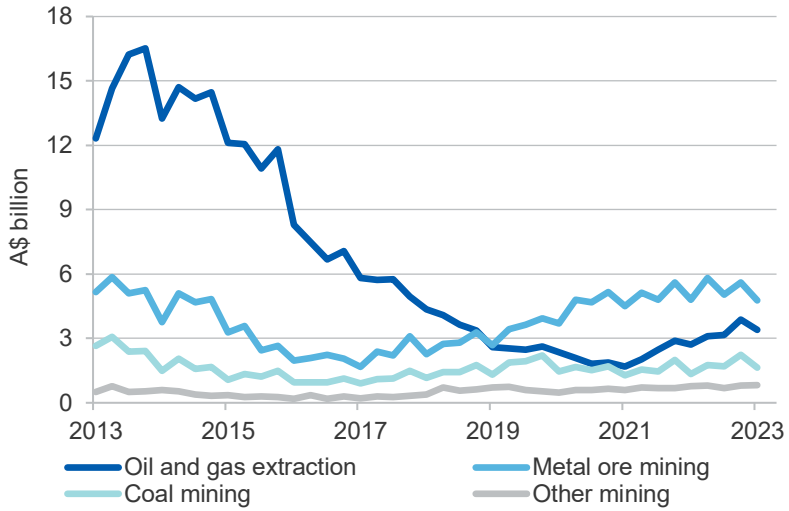
Source: ABS (2023) Australian National Accounts, 5206.0

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 $11.8 billion in the March quarter 2023. This was up 10.7% from the March quarter 2022. In quarterly terms, investment edged down in most categories, growing only in 'other mining' (Figure 1.8).

Expenditure for buildings and structures edged up (1%) in the March quarter, while investment in equipment, plant and machinery rose by 6% (Figure 1.9). Spending on plant and machinery has been steadily growing since 2017, while spending on buildings and structures has grown more slowly and more recently.

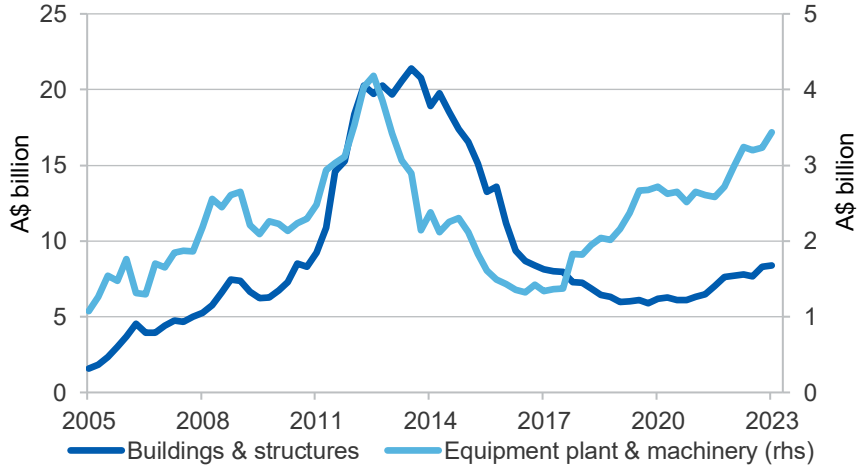
Figure 1.8: Mining capex by commodity, not seasonally adjusted



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

Figure 1.9: Mining industry capital expenditure by type, quarterly



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

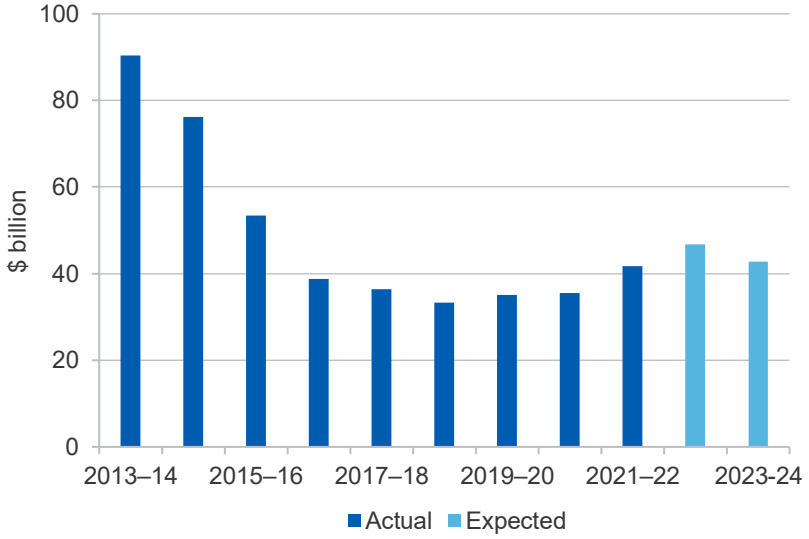
Source: ABS (2023) Private New Capital Expenditure and Expected Expenditure, 5625.0

Forward expectations suggest that total mining industry investment in 2023–24 will be lower than in 2022–23 (Figure 1.10). The second estimate for 2023–24 suggests the industry will invest $42 billion for the year. This is around the same as the equivalent estimate for 2022–23.

Workforce shortages, rising interest rates and construction costs may be impacting on investment. The US Administration has pledged to ask the US Congress to put Australian firms on an equal footing to their Canadian and US counterparts for incentives worth US$750 million (A$1.13 billion) available for critical minerals and low emission technologies under the US Defence Production Act. If the Congress approves legislation to meet this pledge, a boost in investment in the Australian sectors is expected.

Record Australian dollar gold prices will encourage investment in the Australian gold sector. A feature of 2022–23 was consolidation in the sector, and Newcrest's takeover by Canada's Newmont.

Figure 1.10: Mining industry capital expenditure, fiscal year

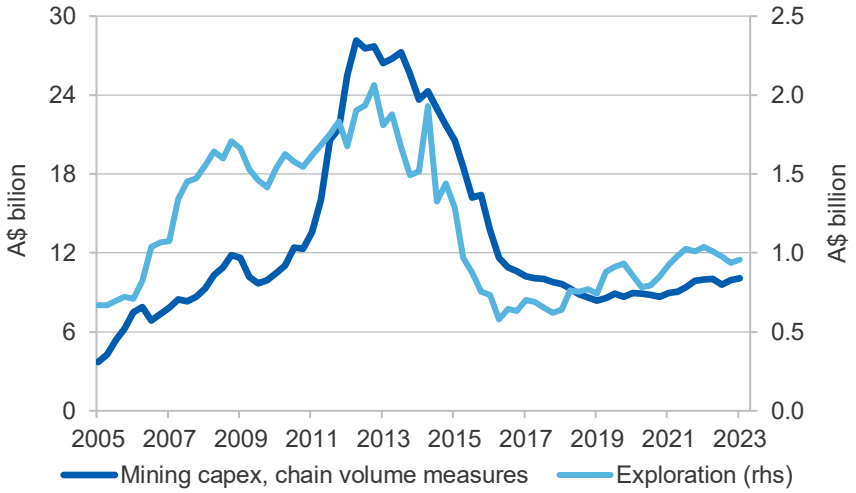


Notes: Chart data is in nominal terms

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

Exploration expenditure (adjusted for inflation) edged up to $957 million in the March 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). 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)



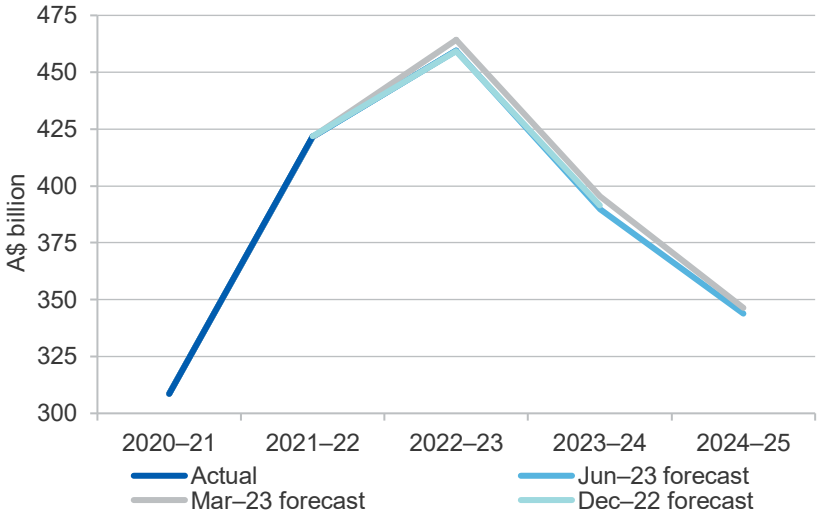
Source: ABS (2023) Private Capital Expenditure Survey, Chain Volume measure, 5625.0

1.7 Revisions to the outlook

The estimate for Australia's resources and energy exports in 2022–23 is $5 billion lower than the forecast contained in the March quarter 2023 *Resources and Energy Quarterly*. The forecast for 2023–24 (nominal prices) is $6 billion lower, while 2024–25 is $2 billion lower from the same report (Figure 1.12). These downward revisions have been driven by weaker than expected prices for most commodities, which have more than offset the impact of a weaker than expected exchange rate against the US dollar (AUD/USD).

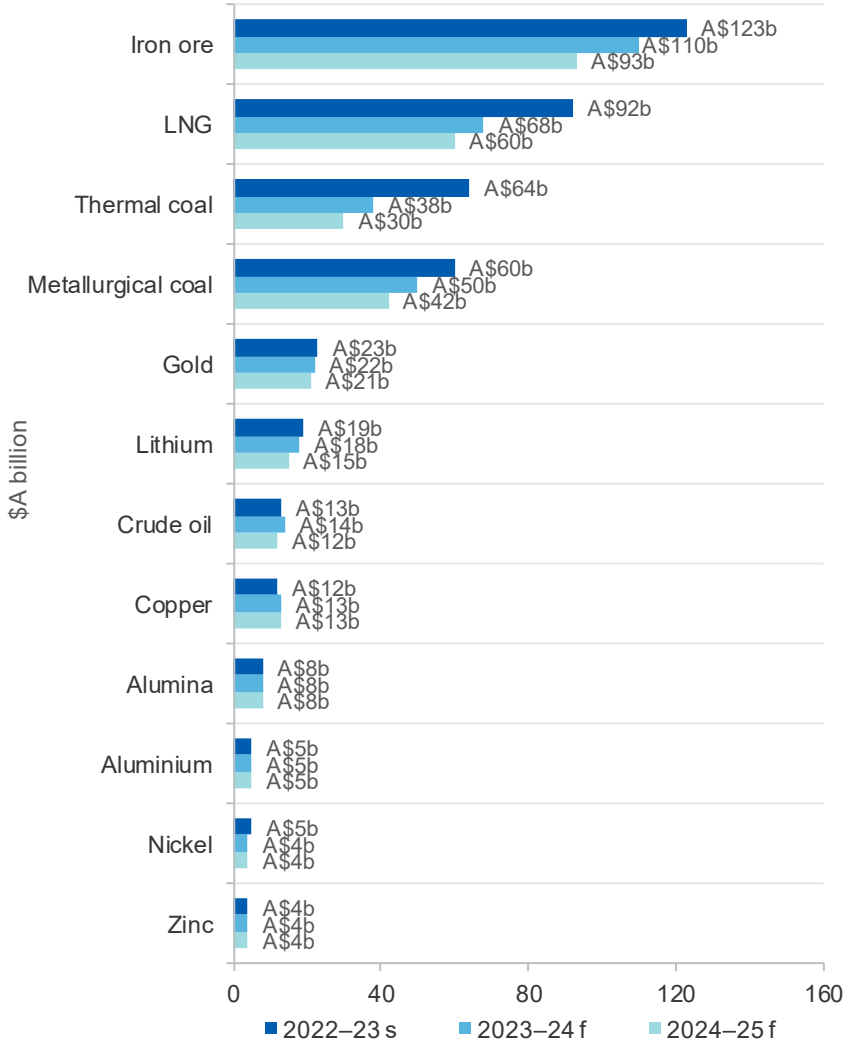
Iron ore earnings in 2023–24 have been revised up by $8 billion, and by $5 billion in 2024–25. The revisions mainly reflect higher prices and forecasts of a shallower recovery in the AUD/USD than envisioned in the March 2023 REQ. More than offsetting this, energy exports (notably thermal coal and LNG) have been revised down significantly in the outlook period.

Figure 1.12: Resource and energy exports, by forecast release



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

Figure 1.13: 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	▼ -13	▼ -10	▲ 2	▼ -17	▼ -16
▼ -1	▼ -26	▼ -27	▼ -3	▼ -9	▼ -11
▲ 13	▼ -47	▼ -40	▲ 1	▼ -21	▼ -21
▲ 11	▼ -25	▼ -17	→ 0	▼ -17	▼ -17
▲ 32	▼ -28	▼ -5	▲ 3	▼ -8	▼ -6
▲ 5	▼ -13	▼ -8	▲ 18	▼ -29	▼ -17
▲ 3	▲ 4	▲ 7	▼ -4	▼ -11	▼ -15
▲ 3	→ 0	▲ 4	▲ 5	▼ -3	▲ 2
▲ 4	▼ -4	→ 0	▲ 2	▼ -3	▼ -1
→ 0	▼ -5	▼ -5	→ 0	▲ 1	▲ 1
▲ 13	▼ -14	▼ -3	▲ 8	▼ -12	▼ -5
▲ 15	▼ -14	▼ -1	▲ 2	▼ -2	→ 0

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[s]	2023–24[f]	2024–25[f]	2021–22	2022–23[s]	2023–24[f]	2024–25[f]
Resources and energy	421,691	459,523	389,736	343,997	36.6	9.0	–15.2	–11.7
– real[b]	451,616	459,523	373,502	319,530	30.8	1.8	–18.7	–14.5
Energy	204,056	235,440	176,169	149,954	151.2	15.4	–25.2	–14.9
– real[b]	218,537	235,440	168,831	139,288	140.5	7.7	–28.3	–17.5
Resources	217,635	224,083	213,567	194,043	–4.3	3.0	–4.7	–9.1
– real[b]	233,080	224,083	204,671	180,242	–8.4	–3.9	–8.7	–11.9

Notes: **b** In 2022–23 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$b		
	Unit	2022–23[s]	2023–24[f]	2024–25[f]	Unit	2022–23[s]	2023–24[f]	2024–25[f]	2022–23[s]	2023–24[f]	2024–25[f]
Iron ore	US$/t	96	89	78	Mt	892	918	933	123	110	93
LNG	A$/GJ	21.4	15.9	14.4	Mt	82	81	79	92	68	60
Thermal coal	US$/t	303	158	133	Mt	178	201	202	64	38	30
Metallurgical coal	US$/t	279	241	213	Mt	157	174	175	60	50	42
Gold	US$/oz	1,827	1,871	1,806	t	247	326	334	23	22	21
Lithium	US$/t	5,173	3,378	2,360	kt	3,252	3,420	4,021	19	18	15
Crude oil	US$/bbl	87	87	81	kb/d	272	280	269	13	14	12
Copper	US$/t	8,264	8,522	8,503	kt	836	865	906	12	13	13
Alumina	US$/t	343	338	348	kt	16,751	17,494	17,788	8.4	8.4	8.3
Aluminium	US$/t	2,341	2,449	2,601	kt	1,422	1,418	1,419	5.2	4.9	5.0
Nickel	US$/t	23,972	21,313	20,188	kt	154	174	188	4.5	4.4	4.2
Zinc	US$/t	2,986	2,754	2,842	kt	1,269	1,456	1,487	4.3	4.3	4.3
Uranium	US$/lb	51	59	61	t	5,560	5,855	6,060	0.8	0.9	0.9

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)	**19**	**16**	**15**	**7**	**6**	**4**	**2**	**1**	**1**
Yearly change	▲ 3.0%	▲ 2.0%	▲ 3.2%	▲ 6.8%	▲ 5.3%	▲ 1.4%	▲ 2.6%	▲ 3.3%	▲ **3.6%**
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 **2.8%** in 2023 and **3.0%** in 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 world macroeconomic environment improved slightly in early 2023, but there are risks to the outlook:

- **Tighter monetary policy for longer** if inflationary pressures, particularly in services, persist
- The **potential for further financial sector vulnerabilities**, tightening global financial conditions.

SOURCE: IMF; ABS; OCE

2.1 Summary

- Global macroeconomic conditions improved by less than expected in early 2023, as tightening monetary policy — aimed at curbing still-high inflation — weakened global demand.
- Tight fiscal and monetary conditions in most major economies are expected to slow global economic growth over H2 2023 and early 2024.
- The outlook for Australia's major trading partners remains weak, with their GDP growth in 2023 forecast by the RBA to be around 3.75%, well below its pre-pandemic decade average.

2.2 World economic outlook

Tighter fiscal and monetary conditions weighing on global growth.

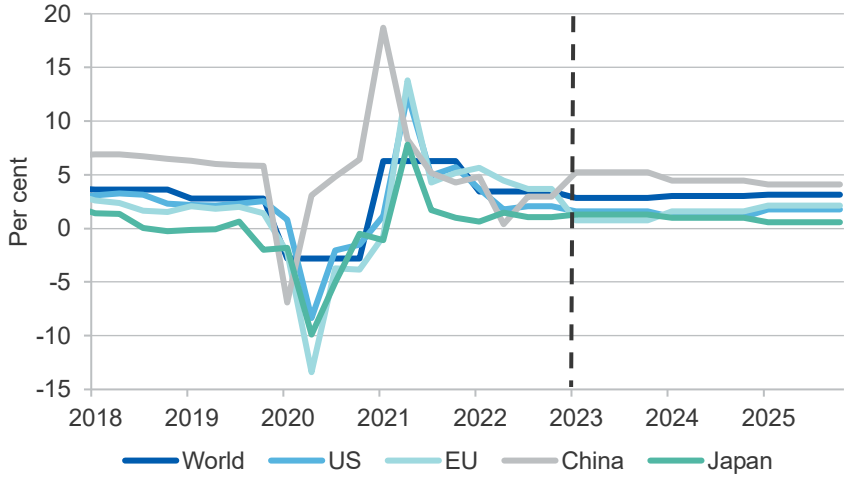
The International Monetary Fund (IMF) forecasts the world economy to grow by 2.8% in 2023, rising to 3.0% in 2024 and 3.2% in 2025 (Figure 2.1). Compared to the January 2023 World Economic Outlook, this represents a downward revision of 0.1 percentage points in 2023 and 2024, and 0.2 percentage points in 2025.

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

China's rebounding economy offers a boost to the growth prospects of its trade partners, but additional risks to the global outlook have emerged in recent months. While headline inflation has continued to moderate in most economies this year — due to lower energy and food prices — there has not been a sufficient decline in core inflation.

Labour markets remain resilient, with near full employment conditions persisting in many major advanced and emerging economies. Labour market tightness has been reflected in decade-high wage growth across

Figure 2.1: GDP growth forecasts



Source: IMF (2023)

advanced economies. However, job vacancy-to-unemployment ratios have moderated across several advanced economies in recent months, pointing to a modest easing in labour demand across economies.

Despite these tight labour markets, reduced consumption across advanced economies — due to inflation and tighter monetary policy — is driving expectations for further slowing of 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.

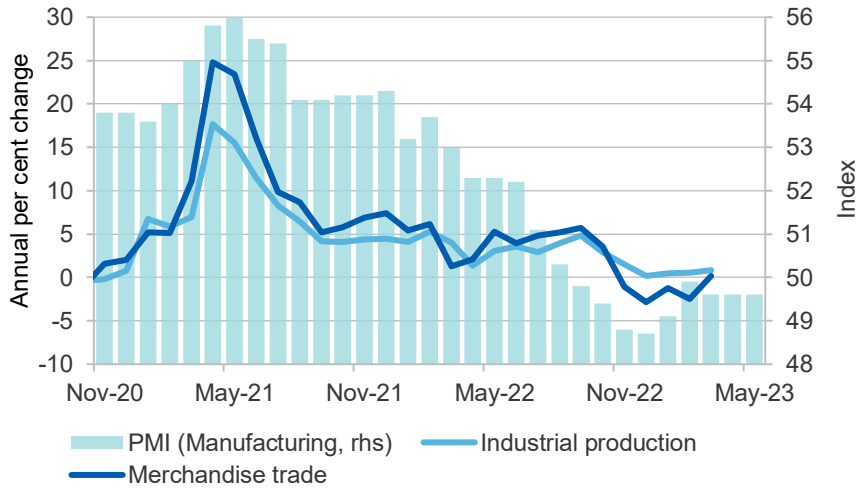
The IMF notes that tighter monetary policy is a key risk to the outlook if inflation pressures, particularly in services, prove more persistent than expected. Another source of global economic vulnerability stems from the possibility of the war in Ukraine escalating, and the potential for further geopolitical fragmentation. An additional risk for the global outlook is the uncertainty surrounding the emergence of further financial sector vulnerabilities, tightening global financial conditions. The IMF's baseline economic forecasts assume recent financial sector stresses are contained.

Global industrial production and trade weaken as orders drop

Global industrial production increased by 1.1% in the March quarter 2023 to be 0.6% higher year-on-year, as the Chinese economy emerged from COVID lockdowns. Industrial production in advanced economies declined, while quarterly growth was 3.3% in emerging Asian economies (excluding China). On the other hand, global trade declined in the March quarter 2023 (Figure 2.2). Weaker demand for goods in advanced economies, especially electronic equipment, has seen exports from Japan, South Korea, and emerging Asian economies fall in recent months.

Forward indicators of manufacturing activity indicate a contraction so far in 2023. The JP Morgan Global Manufacturing Purchasing Managers Index (PMI) tracked flat month-on-month at 49.6 in May 2023 and has remained in contractionary territory (less than 50) for 9 consecutive months. Global manufacturing orders declined in May, signalling a further deterioration in the demand for goods — linked to inflation pressures and a post-pandemic preference for services consumption. Results for individual nations are discussed below. Despite the contractionary reading, positive signs include a fourth consecutive month of output growth, reduced supply chain pressures and a decline in input prices.

Figure 2.2: World industrial production, trade and PMI



Notes: PMI data is up to May 2023; IP and trade data only available to March 2023.
Source: IHS Markit (2023); CPB Netherlands Bureau for Economic Policy Analysis (2023)

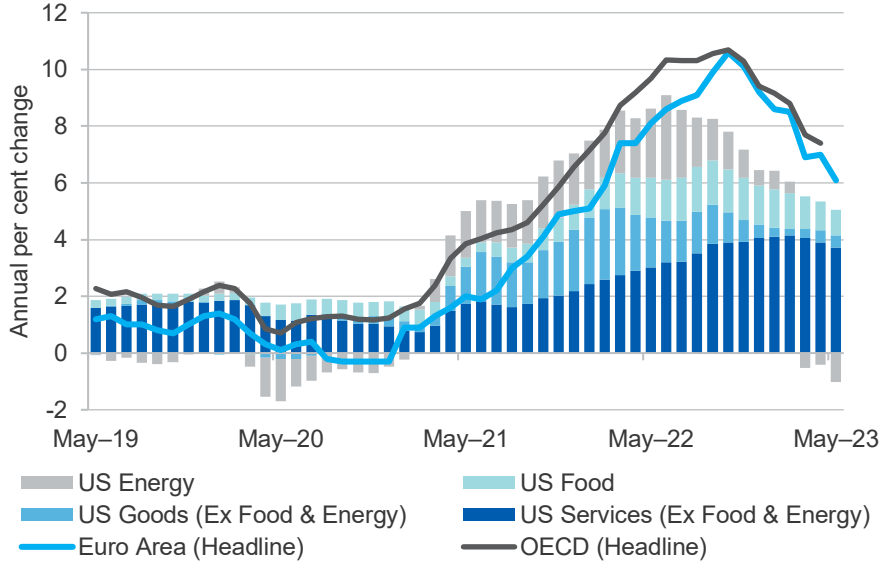
As headline inflation pressures ease, the focus shifts to core inflation

Headline inflation has been falling in major economies, due to reductions in energy and food prices and an easing of supply chain bottlenecks. In April 2023, the IMF forecast global inflation to fall from 8.7% in 2022 to 7.0% in 2023 and 4.9% in 2024 — both upward revisions from forecasts published in January 2023. As inflation continues to be well above central bank targets in most economies, reining it in remains a primary concern for policymakers. While global price pressures are expected to fall further over the year, persistent core inflation is raising uncertainty about the pace of inflation slowdown. Financial markets have had to adjust expectations over how soon central banks will be able to cut policy rates to spur economic activity.

US inflation, for example, has fallen for eleven consecutive months to 4.0% in May from a peak of 9.1% in June 2022. US core inflation — which excludes food and energy — has been much slower to decline as housing and consumer service inflation have mostly remained elevated (Figure 2.3). Eurozone inflation, while still high, has declined notably from its peak in October 2022 due largely to falling energy prices this year. Eurozone core inflation in May was only 0.4% below its peak of 5.7% in March.

There has been a relatively rapid pace and scale of interest rate hikes throughout this tightening cycle (US +500 basis points, EU +400 basis points, UK +490 basis points). Central banks are thus now facing difficult decisions on how much more tightening, if any, will be needed to bring both headline and core inflation back into target ranges in an acceptable timeframe. The US, UK and European central banks each raised their policy rates further by 25 basis points in May. Following the US Federal Reserve's policy decision in June, the committee revised up its expectations for real GDP growth and core PCE inflation in 2023, signalling further increases to the federal funds rate. Market pricing is broadly centred on the expectations that policy rates have peaked or will peak in mid-2023 and then decline later in the 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)

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 to be around 3.75%, well below its pre-pandemic decade average.[1]

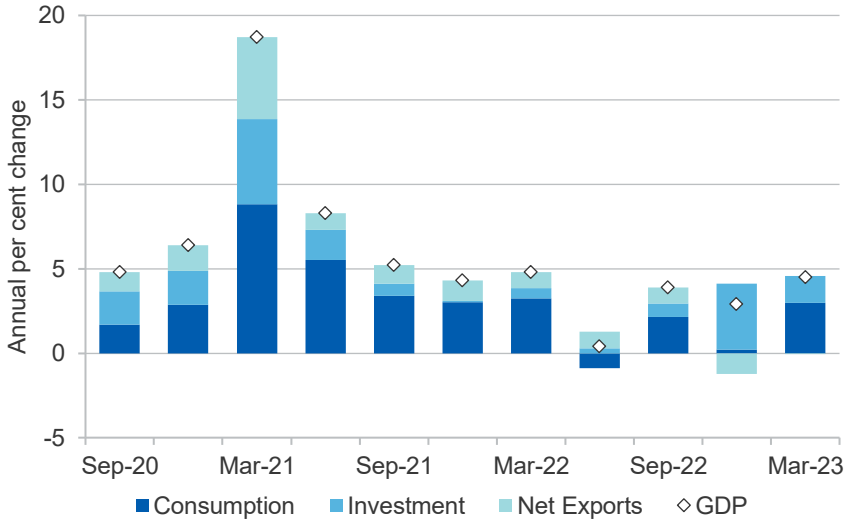
Slower growth in Australia's major trading partners is expected to reduce demand for Australia's exports. With that said, recovery in China's economy and ongoing development in India are expected by the IMF to contribute about half of global economic growth this year. Growth from these key markets should support growth in their trade partners, particularly Australian resource and energy export earnings over the outlook period.

China's growth slows over the June quarter, but further support likely

China's economy grew by 2.2% in the March quarter 2023, with GDP 4.5% higher year-on-year (Figure 2.4). The result was driven by a recovery in household services consumption following the removal of COVID-related restrictions on activity. Fixed asset investment increased by 5.1% over the quarter, due to strong growth in infrastructure spending supported by accommodative fiscal policy.

To date in the June quarter 2023, economic activity has been positive in year-on-year terms, but weaker than anticipated. China's industrial production declined in May to be 3.5% higher year-on-year. While growth was positive, it was the lowest since February as manufacturing output

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)

[1] *RBA Statement on Monetary Policy* — May 2023.

growth slowed to 4.1%, down from 6.5% in April. China's Caixin General Manufacturing PMI rose to 50.9 in May, indicating the sector returned to expansion for the first time in three months. Output growth lifted to its highest rate in almost a year, supported by growth in new business and new orders. Input prices declined for a second month. Despite these positive signals, business sentiment dropped to a 7-month low, due to concerns over the economic outlook, particularly overseas.

Contrary to signals from the Caixin PMI, the official manufacturing PMI measure declined in May to 48.8, below market expectations of 49.5. The official PMI, which is more oriented towards larger businesses, cited declines in output and new orders. Notably, the official PMI reading for construction activity weakened from 63.9 in April to 58.2 in May. While still expansionary, this reduction could reflect further weakening in residential construction, offsetting strong infrastructure construction activity.

Following policy support for China's property sector in late 2022, and positive signs in the March quarter 2023, momentum again appears to be waning. Year-to-date fixed asset investment growth slowed to 4.0% in May 2023, driven by a 7.2% year-on-year decline in property investment. Floor space of newly started residential property declined by 31% year-on-year in May 2023, after falling by 29% year-on-year in April. Financial stability concerns still hang over the indebted property development sector.

Retail sales also fell short of expectations in May, increasing by 0.4% over the month to be 13% higher year-on-year. Consumer confidence has rebounded strongly following the end of COVID lockdowns, but it remains substantially below early 2022 levels (before lockdowns started in earnest). Adding to this, consumer credit growth has remained subdued, in line with the historically weak levels seen throughout 2022. This may indicate tight household balance sheets, posing a downside risk to continued strength in household consumption.

Following efforts to support the economy throughout 2022 and in the March quarter 2023 (see March 2023 *Resources and Energy Quarterly*), the Chinese authorities have signalled a willingness to lend further support to the economy to meet the announced 2023 GDP growth target of 5%.

Facing little pressure from domestic inflation (0.1% in April 2023), Chinese authorities have more monetary policy room to work with than most advanced economies should further stimulus be needed. The People's Bank of China (PBoC) surprised markets with a 10 basis point cut to its official one week rate on 13 June 2023, followed by a 10 basis point cut to its key one-year medium-term lending facility rate on 15 June 2023. This signals a willingness by Chinese authorities to combat slowing economic growth.

The IMF forecasts Chinese GDP growth of 5.2% in 2023, reflecting improved mobility compared with COVID-related disruptions in 2022. While external demand may cause China's industrial exports to decline, 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, in line with a long-term trend towards structurally lower growth.

Japan and South Korea facing weaker external demand

Japan's GDP increased by 0.4% in the March quarter 2023, resulting in 1.3% growth year-on-year. Year-on-year growth was higher than in the December quarter, due in part to base effects — Japan's GDP contracted by 0.5% in March quarter 2022.

Private consumption contributed strongly to economic growth over the quarter, rising by 0.6% as the country's reopening drove a rebound in services consumption. On the other hand, net exports detracted from growth, with exports increasing by much less than imports over the year. Notably, exports fell by 4.2% over the quarter, signalling weaker demand from the nation's major trading partners.

Slowing growth in Japan's major trading partners is a key issue for its economy, particularly industrial production. Japanese industrial production grew by 0.4% year-on-year in April 2023, following 5 months of declines. In addition, machinery orders have, on average, decreased at an annual rate of 6.3% since October 2022 (Figure 2.5).

The Jibun Bank Japanese Manufacturing PMI returned to positive

Figure 2.5: Japan industrial production and machinery orders

Source: Bloomberg (2023)

(expansionary) territory in May, following 6 consecutive months of contraction. The first expansion in manufacturing activity since October was driven by growth in both new orders and output. Input costs also grew at their slowest rate since February 2021, while output cost inflation declined to a 4-month low. While business confidence fell in the month, it remained in positive territory, with firms expecting inflationary pressures to soon ease.

Japan's core inflation — which excludes fresh food but includes fuel costs — was 3.4% in April 2023, exceeding the Bank of Japan (BoJ) inflation target of 2%, but down markedly from 4.2% in January.

The BoJ has maintained its accommodative monetary policy and continues to hold the 10-year Japanese Government bond yield at 0%.

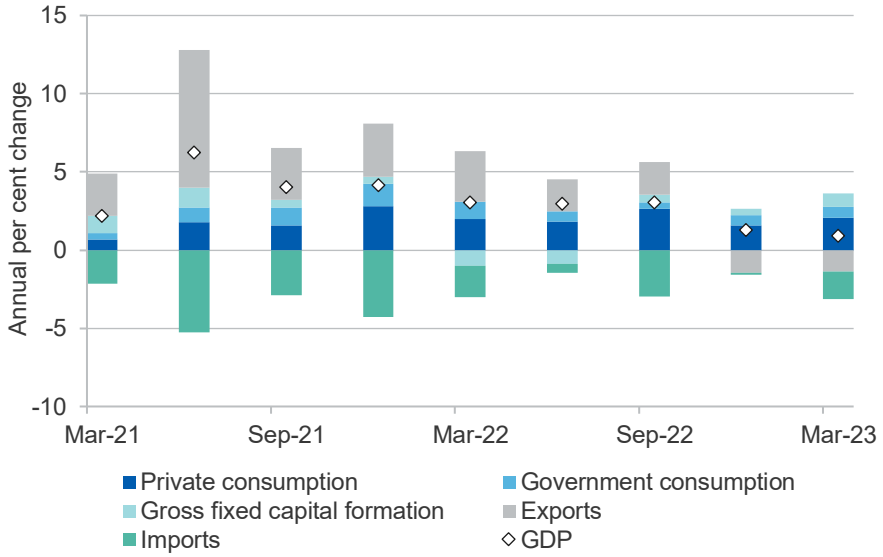
Looking ahead, the IMF forecasts Japan's economic growth to rise to 1.3% in 2023, on the back of continued monetary and fiscal policy support. This forecast represents a downgrade of 0.5% from its January forecasts, driven by weaker external demand and disappointing growth towards the end of 2022.

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 increased by 0.8% year-on-year in the March quarter 2023, its lowest annual growth rate since December quarter 2020. Growth was supported by positive contributions from both private and government consumption. Net exports were a key dampener on growth, with weaker exports and strong imports driving a 39% year-on-year decline in the country's trade balance (Figure 2.6).

South Korea's industrial production declined month-on-month in April 2023, to be 8.9% lower year-on-year. Exports of semiconductors declined by over 36% year-on-year in May, due to declining global demand. South Korea's manufacturing PMI improved slightly in May but remained in contraction for the eleventh consecutive month. The negative May

Figure 2.6: South Korea contributions to quarterly real GDP



Source: Bloomberg (2023)

result was due to declines in output and new orders, due to weak demand in domestic and export markets.

In April, the IMF forecast South Korean real economic growth of 1.5% in 2023 and 2.4% in 2024, representing downward revisions of 0.2 percentage points in each year. The IMF noted that the downturn in the technology cycle is expected to erode the nation's growth momentum. Growth is then forecast to stabilise at around 2.3% from 2025 onwards, a downward revision of 0.3 percentage points.

US labour market resilience continues

In year-on-year terms, the US economy grew by 1.6% in the March quarter 2023. This growth was primarily driven by personal consumption of both goods and services, although there are signs that goods consumption is now easing. Net exports contributed positively to US GDP growth, as exports increased while imports decreased (Figure 2.7).

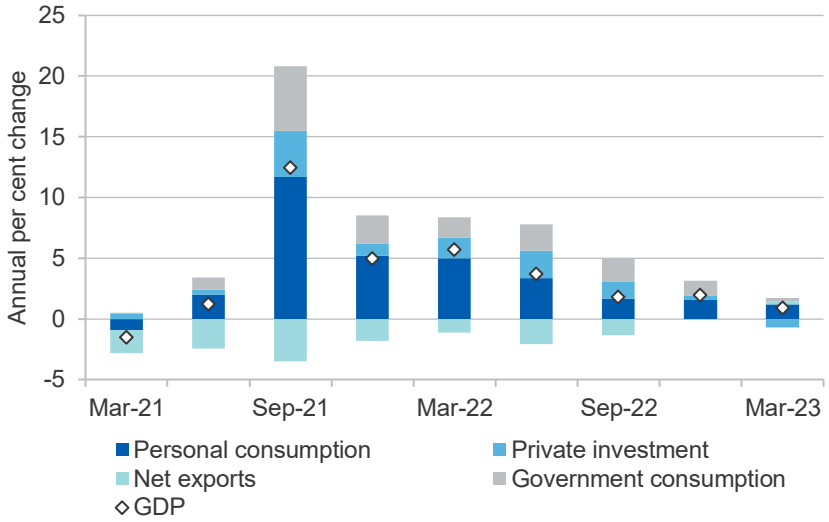
US labour market resilience continues, with nonfarm payroll employment rising by 339,000 in May 2023. The unemployment rate rose slightly to 3.7% in May, the highest since October 2022 but still historically low.

The resilient labour market continues to support spending; however, growth appears to be slowing. Total inflation-adjusted spending on goods and services was flat month-on-month in March 2023, following a small monthly decline in February. Advance indicators for inflation-adjusted retail sales in April suggest retail trade was flat over the month, and 3.2% lower when compared year-on-year.

US industrial production increased by 0.2% year-on-year in April, rising from a 2-year low of 0.1% in March. The US Manufacturing PMI declined to 46.9 in May from 47.1 in April. This result brought the contraction in the US manufacturing sector to a 7th consecutive month. The deterioration in manufacturers' operating conditions reflects sharp falls in new orders, as domestic demand weakens.

In April 2023, the IMF upgraded its forecast for US economic growth in 2023 by 0.2 percentage points to 1.6% and up slightly to 1.1% in 2024.

Figure 2.7: US contributions to quarterly real GDP



Source: Bloomberg (2023)

Tightening monetary and financial conditions in the US are expected to reduce growth in private consumption and investment. This slowing in demand is expected to translate to increasing unemployment, leading to reduced labour market tightness and moderation in wage growth.

Eurozone economies face slower growth

Eurozone GDP growth rose to 0.1% over the March quarter 2023, after zero growth in the December quarter 2022 (Figure 2.8). This brought annual GDP growth to 1.3%, buoyed by quarterly growth of 0.9% in the June quarter 2022. Among the larger economies, France grew by 0.2% over the quarter, while Italy and Spain both grew by 0.5%. Germany's economy did not grow over the quarter, bringing annual growth down to -0.1%.

Despite the moderation in energy prices in recent months, European manufacturers — in particular energy-intensive metal smelting, refining and fabrication operations — remain very exposed to high energy prices.

Industrial production in the Eurozone rose by 0.2% year-on-year in April 2023, up from a 1.4% decline in February.

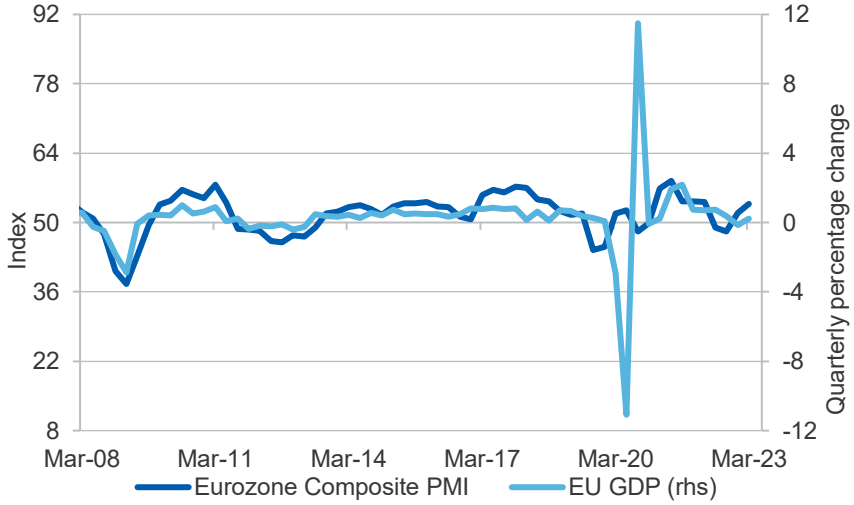
In May 2023, the Eurozone Composite PMI Index decreased to 52.8, down from an eleven month high in April. The improvement reflected strong growth in service sector activity and demand for services, while both manufacturing output and new orders declined.

The Eurozone manufacturing PMI fell to 44.8 — the sharpest contraction in three years — with output declining and new factory orders falling at their sharpest pace in 6 months. This reflected a deterioration in demand conditions, bringing new orders to a twelfth consecutive monthly decline.

Despite the worsening business environment, manufacturers remained optimistic about the year-ahead outlook, and input prices declined at their fastest pace since February 2016.

The IMF forecasts European growth to be 0.8% in 2023, and 1.4% in 2024. Similar to the United States, persistent core inflation and tightening monetary policy are expected to translate to weakening consumption and investment. Economic activity is expected to improve as inflation eases, real incomes start recovering and financial conditions ease.

Figure 2.8: Eurozone GDP and Composite PMI (quarterly)



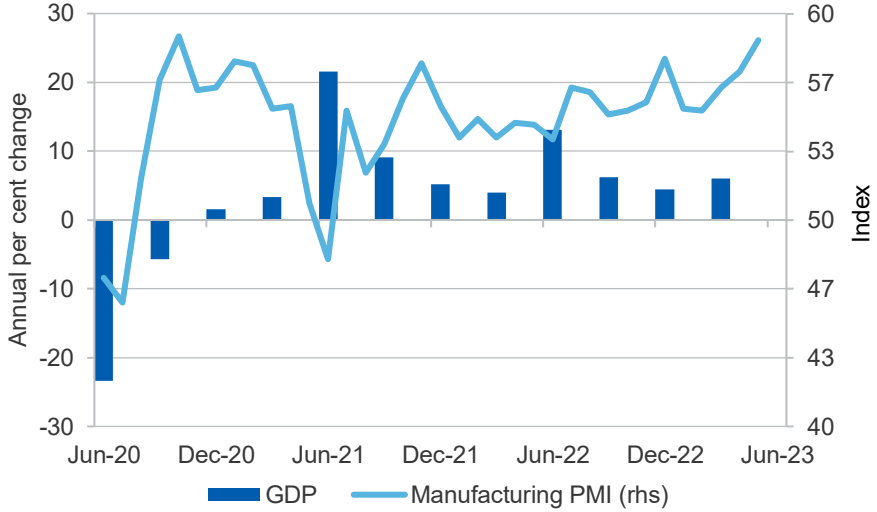
Source: Bloomberg (2023)

India's GDP growth to be relatively resilient

India's GDP growth increased to 6.1% year-on-year in the March quarter 2023, up from 4.5% in the December quarter (Figure 2.9). This annual growth figure was well above market expectations (5.0%) and was supported by growth in fixed capital formation, consumption expenditure and net exports.

India's manufacturing PMI rose in May to 58.7, marking almost two years of consecutive monthly expansions and remained above the long-run average. Growth in both output and new orders rose above 2-year highs, with manufacturers citing strong demand conditions. Easing supply chain conditions contributed to record accumulation in input inventories and slowing growth in input prices.

Figure 2.9: India GDP growth and manufacturing PMI



Notes: GDP growth is quarterly data, the most recent is March quarter 2023. Manufacturing PMI is monthly, the most recent is May 2023.

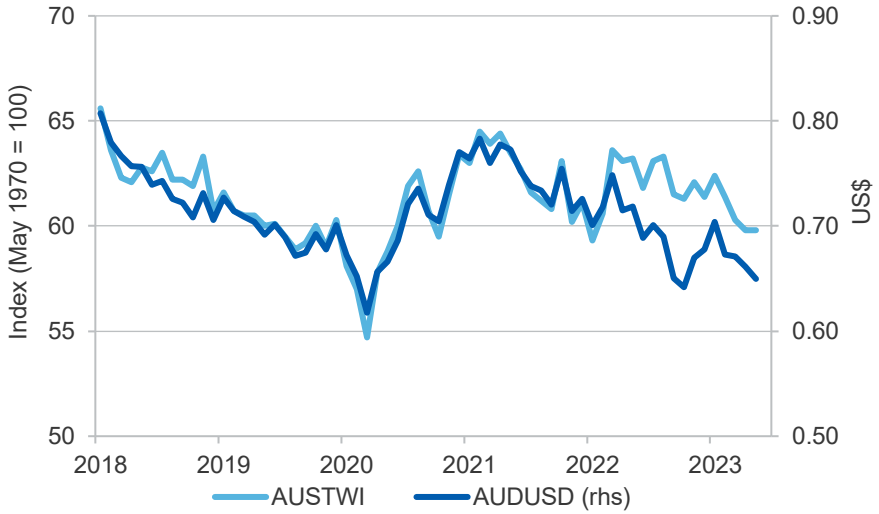
Source: Bloomberg (2023)

The IMF forecasts India's economic growth to slow to 5.9% in 2023, revised down from 6.1% in January. Growth is expected to be slower in 2023 as domestic demand is pressured by tighter monetary policy and pick up to 6.3% in 2024 (down from 6.8% in January). 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 2.10).

Figure 2.10: Australian trade-weighted index and AUD/USD



Source: Bloomberg (2023)

The AUD/USD exchange rate assumption has been revised lower by US$0.02 in 2023 and 2024 compared with the March 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 14 June 2023 for the AUD/USD exchange rate was an average of US$0.69 during the second half of 2023, US$0.72 in 2024 and US$0.76 in 2025.

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

	2022	2023[a]	2024[a]	2025[a]
World [b]	3.4	2.8	3.0	3.2
China [c]	3.0	5.2	4.5	4.1
Japan	1.1	1.3	1.0	0.6
South Korea	2.6	1.5	2.4	2.3
India[d]	6.8	5.9	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	1.6	1.1	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	0.69	0.73	0.75
Inflation rate[b]				
United States	8.0	3.5	2.2	2.0
	2021–22	**2022–23[a]**	**2023–24[a]**	**2024–25[a]**
Australia	7.2	4.6	3.2	2.7

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

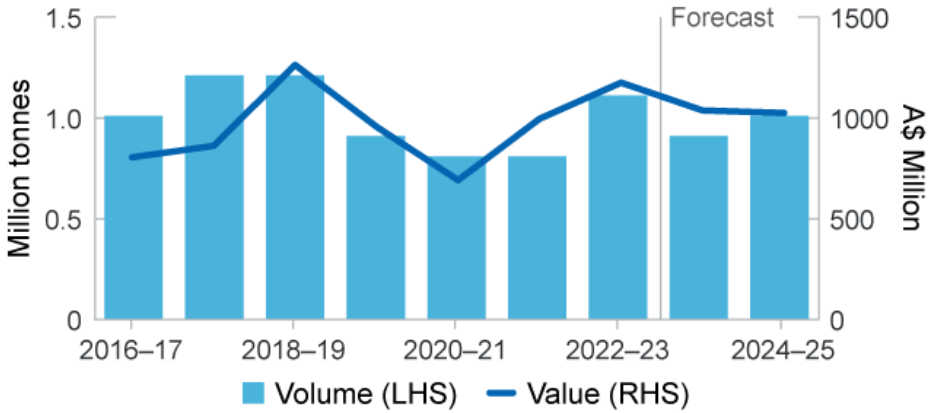
5m+ tonnes
produced each year

100,000+
employed in the steel industry

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

Refinery locations

Australian steel exports



Outlook

Global steel output in 2023 facing **subdued demand** as world economy slows

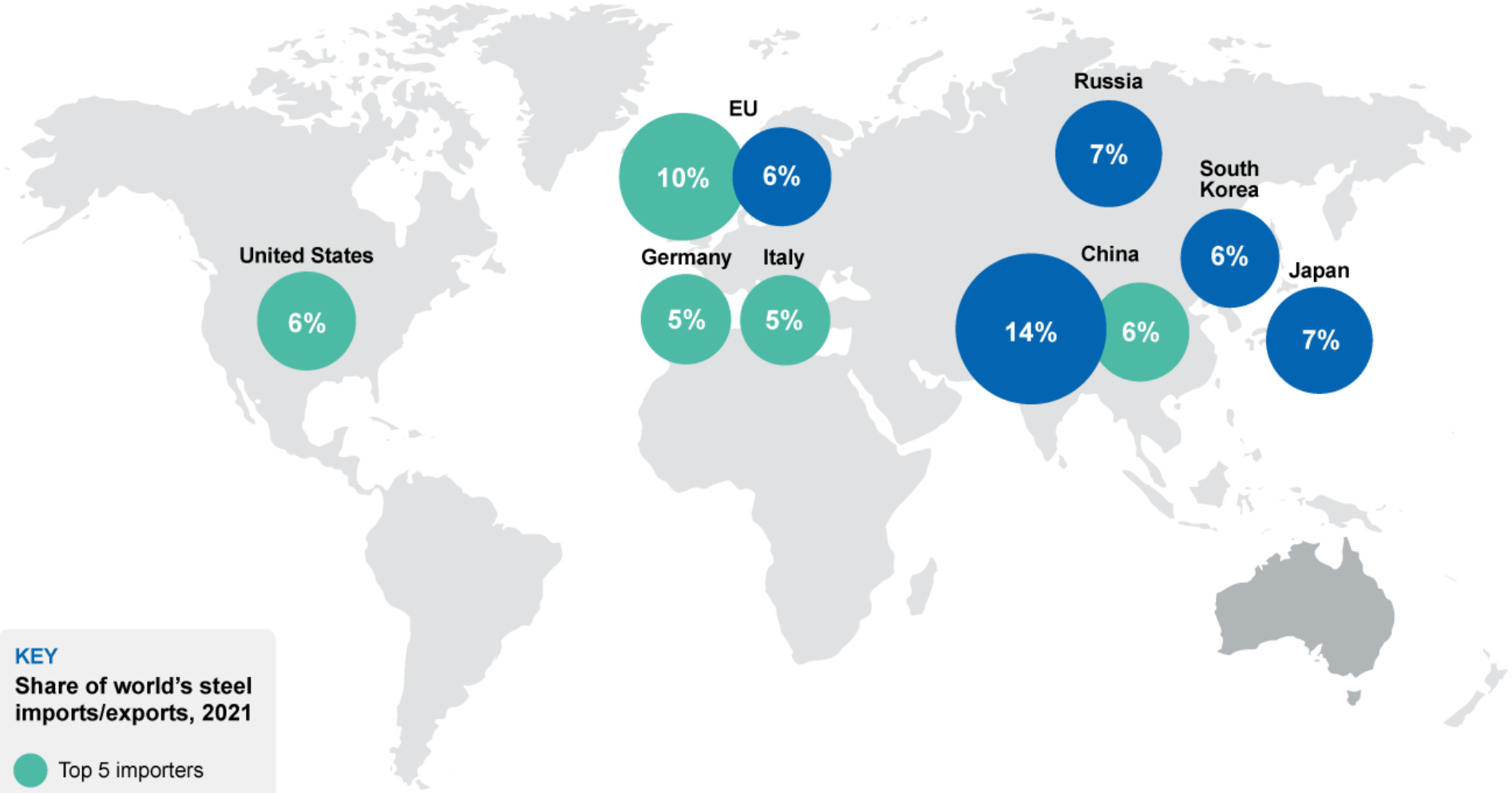
Stabilisation & modest recovery of **Chinese property** should support steel demand

Australian export volumes expected to **grow by 33%** in 2022-23

Russian invasion of Ukraine creating **long-term loss** of steel supply

SOURCE: GA; DISR; OCE

Steel TRADE MAP



SOURCES: World Steel Association

3.1 Summary

- World steel production is facing subdued demand as global economic growth slows. Weak demand from the manufacturing and construction sectors in advanced nations is flowing through to major steel makers.
- An expected stabilisation and modest recovery of the Chinese property sector over the coming year should help to support global steel demand.
- Infrastructure and non-residential construction activity are expected to support world steel demand over the outlook period. Growth in steel production is expected to be strongest in countries/regions such as India, South East Asia and the Middle East.

3.2 World production and consumption

Steel output in 2023 facing subdued demand as global economy slows

Global steel production in the five months to May 2023 was around 785 million tonnes. This was around 1% below the corresponding period in 2022, and at the upper end of the global range from 2016 to 2021 (Figure 3.1).

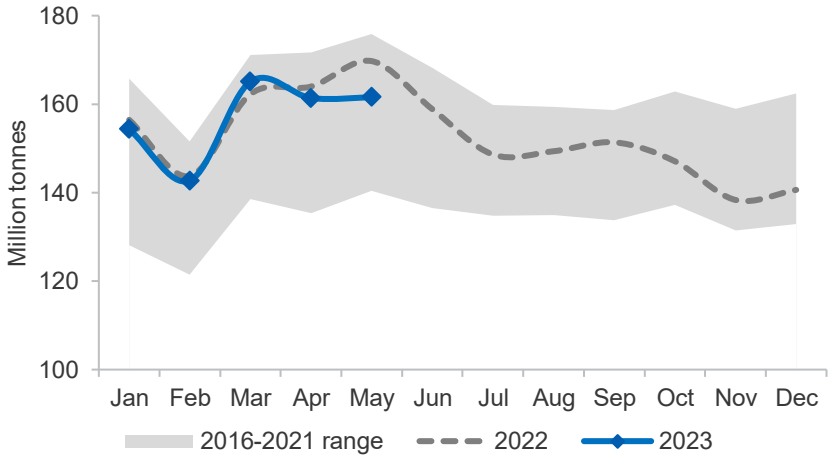
World steel production is expected to record a relatively healthy year-on-year growth of 2.2% in 2023. However, this growth comes off a low base, after global steel output fell by 3.9% in 2022 due to a combination of factors. Chinese steel production H2 2022 was heavily impacted by outbreaks of the COVID-19 pandemic and ongoing weakness in the country's residential property sector. Higher energy prices resulting from Russia's invasion of Ukraine forced output cuts amongst large steel makers — such as the EU, US, and Japan (Figure 3.2).

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

Over 2024–2025, stimulus-related infrastructure projects and a recovery in industrial production, particularly in 2024, are expected to support stronger growth in steel demand. World steel production is projected to grow by 1.8% in 2024 and 1.4% in 2025, to reach just under 2 billion tonnes by the end of the outlook period.

Growth in world steel production over the next couple of years will be supported by new capacity — either underway or planned — with projects slated for Asia, North America, Europe and the Middle East. By process, 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 in Asia over the next few years.

Figure 3.1: Global monthly steel production



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

Moderating global industrial production growth to weigh on steel demand, although infrastructure activity is providing some support

Global steel consumption is projected to grow by 1.5% in 2023, following a fall of 2.6% last year. Growth in global industrial production — a key driver of steel consumption — is forecast to moderate to 2.3% in 2023, as the rebound from the COVID recession continues to fade and world economic growth slows. This will likely further dampen the recovery in global steel demand in 2023 (Figure 3.3).

Risks are skewed to the downside. Tightening monetary policy across most major economies remains a key challenge, particularly its impact on private sector spending and investment. The adverse impact on steel demand of elevated energy prices is another key risk.

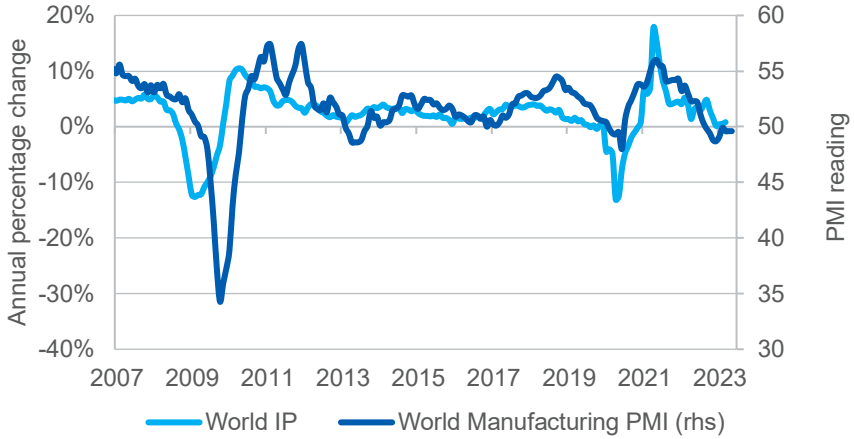
Global construction activity — representing about 50% of world steel demand — picked up in the March quarter 2023, and is expected to recover further over the outlook period. Global construction continues to be driven primarily by infrastructure, with higher interest rates dampening private sector residential activity. The global result was largely driven by stronger construction activity in the Asia Pacific region. The Americas and Middle East and African regions also saw strong overall conditions, while activity in Europe remained weak.

After sharp improvements in early 2023, global manufacturing activity weakened again in May, with the JP Morgan Global Manufacturing PMI reading at 49.6. This was the ninth successive month in which conditions have been in contractionary territory.

Figure 3.2: World industrial production and steel output

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

Figure 3.3: World manufacturing PMI and industrial output



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

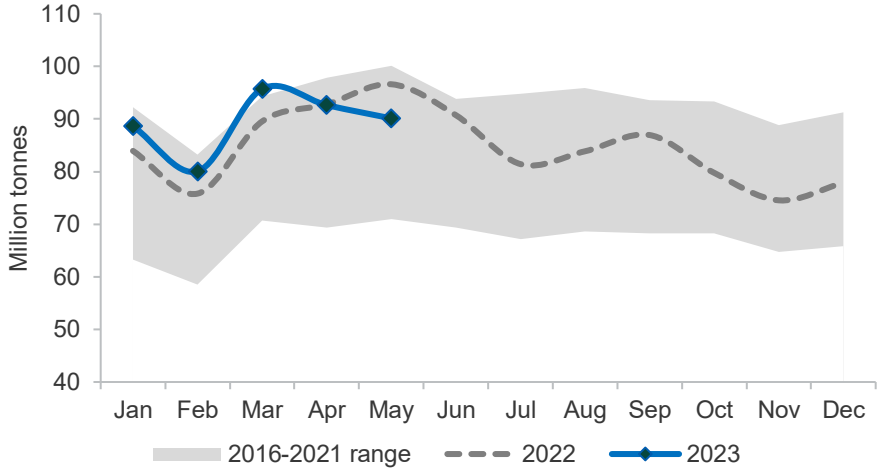
Source: World Steel Association (2023); S&P Global (2023); Bloomberg (2023)

Despite ongoing challenges from supply chain disruptions and deteriorating global economic conditions, a further recovery is expected in the global auto industry over the course of the year. 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. Semi-conductor shortages are expected to remain a challenge over the next few years, despite recent improvements in availability. Weaker global auto demand remains a key risk through this year.

China's recovery slower than expected

A recovery in Chinese steel consumption this year is expected to be driven by a gradual pickup in property investment, new infrastructure projects and a recovery in consumer spending in H2 2023. China's total steel output in the March quarter was above 2022 levels but has dipped back in April and May (Figure 3.4). Overall, for 2023, China's steel production is expected to be marginally stronger than in 2022. This follows the sharp falls in Chinese steel consumption last year, due to China's dynamic zero-COVID policy which significantly curbed industrial activity and domestic travel.

Figure 3.4: China monthly steel production



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

Turning to the outlook to 2025, China is projected to see a mild fall in steel production, with falls of 0.3% projected in 2024 and 0.4% in 2025. While China has nominated 2030 as its target date for peak steel (output), the peak itself is expected to be achieved before that — as structural factors temper the economy's steel demand requirements (see *Iron Ore* chapter).

The anticipated recovery in China's residential property sector — which accounts for around 35-40% of the country's total steel consumption — has been disappointing so far in 2023. Indicators suggest that the next year is likely to be one of consolidation and gradual recovery in China's property sector, rather than a strong rebound. New home sales have been picking up, following a fall of more than 25% year-on-year at the end of 2022 (Figure 3.5). While new home sales recorded around 9% growth year-on-year in the March quarter 2023, the April and May results have seen these gains eroded. New construction starts and fixed asset investment in real estate remain weak, down around 7% year-on-year (Figure 3.6).

Figure 3.5: 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 Jan and February monthly data (reported in February)

Source: NBS (2023); Bloomberg (2023)

Infrastructure spending is expected to be a driver of construction activity in China in the second half of 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. The government has also instructed its various policy banks (the Agricultural Development Bank of China, China Development Bank, and the Export-Import Bank of China) to increase lending for infrastructure projects.

Consumer spending (and the Chinese economy) is expected to pick up slowly in line with easing monetary policy. In June the People's Bank of China reduced key lending rates, including reducing one year medium-term lending facility loan rates to some financial institutions by 10 basis points and cutting the seven-day repurchase rate by the same amount. This follows multiple cuts last year to key policy rates. A Bloomberg survey of economists in May indicated that China's central bank will likely cut the

reserve requirement ratio for major lenders by 25 basis points by the end of the third quarter this year.

However, there is yet to be a meaningful pick up of credit growth in the broader economy. Bloomberg's China's Credit Impulse (measuring new loans compared with broader GDP) has stagnated so far in 2023 (Figure 3.7).

Total social financing (a broad measure of credit in liquidity in the economy) has been volatile, with solid growth in the March quarter 2023 followed by the lowest reading in 6 months in April. Nonetheless, manufacturing output — in particular auto production — returned to positive growth early this year.

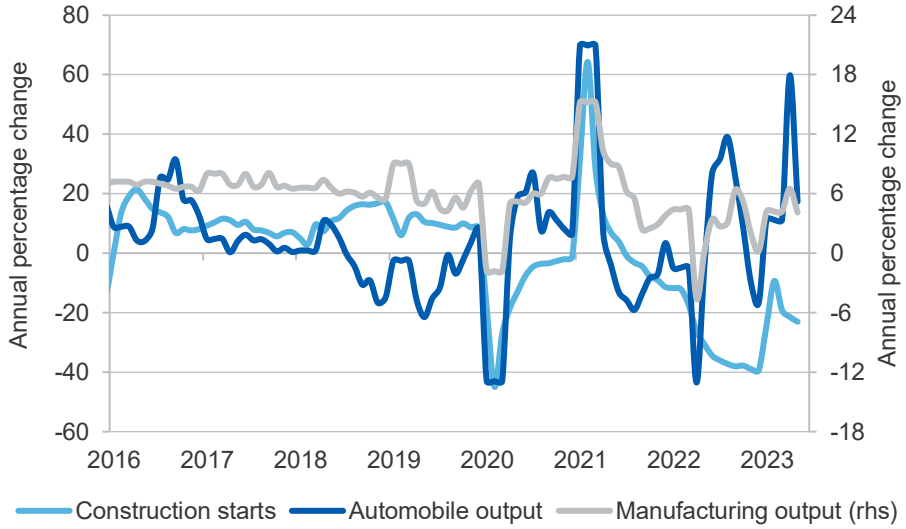
Russian invasion of Ukraine creating long-term loss of steel supply

Russian steel output fell by 7% in 2022, despite support from pipeline projects and residential construction. This trend continued into 2023, with steel output in the five months to May tracking at the same level as the same period last year (Figure 3.11). Russia is increasingly diverting exports of iron ore and steel to Asia away from Europe due to EU sanctions. Russian iron ore and steel exports to China and India both rose strongly last year. Despite the redirection, Russia's total steel exports are estimated to have fallen substantially in 2022.

The war's impact, including workforce leakage due to military mobilisation and broader sanctions, is posing more challenges to Russia's economy. Industrial output rose in the month of April (to be up 1.2% year-on-year), due to growth in 'finished metal goods' — which includes ammunition and arms. However, this was the first monthly growth in over a year, as Russian manufacturers — especially those reliant on imported parts — have cut production.

The continuation of the war is delaying the process of rebuilding and economic recovery. Ukrainian steel demand currently stands at 40% of its pre-war level. 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 exports is expected to be partial and play out over several years.

Figure 3.6: China — major steel end-users



Source: NBS (2023); Bloomberg (2023)

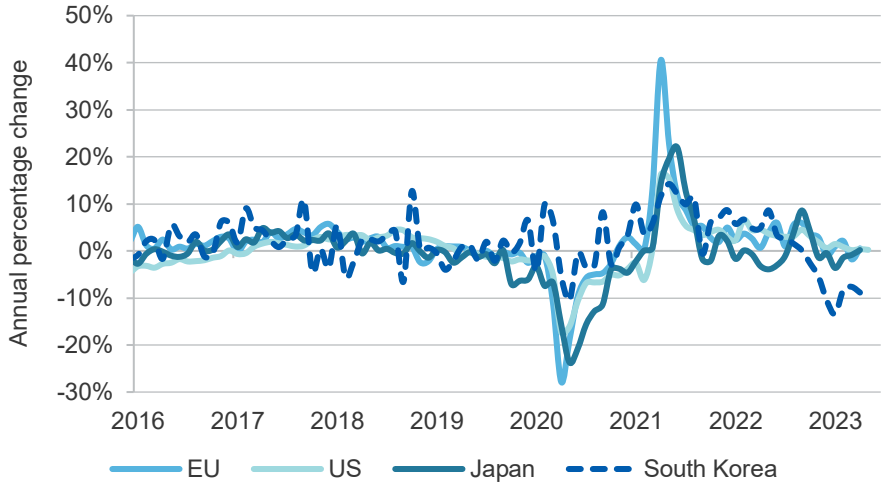
Figure 3.7: China credit cycle

Source: NBS (2023); Bloomberg (2023)

Other major producers impacted by energy and raw materials shortages

Energy and raw material shortages continue to impact manufacturing activity across many major economies. In H1 2023, industrial production has been particularly weak in the EU, Japan and South Korea (Figure 3.8).

Figure 3.8: Industrial production — EU, US, Japan and S Korea

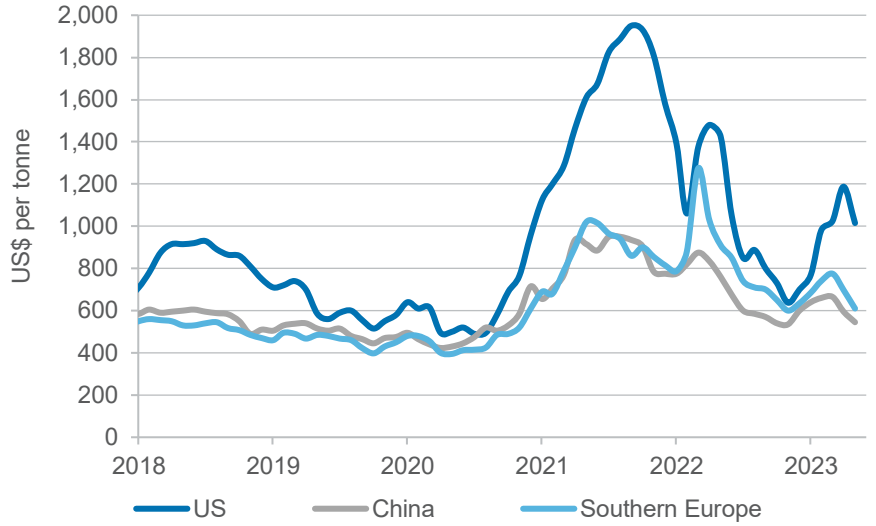


Source: Bloomberg (2023)

Ex-China's steel output is estimated to have fallen by around 5% in the five months to May 2023 relative to the same period in 2022. The loss of momentum in global steel demand in recent months has seen a reversal in the pickup in steel prices for major markets, including China, the US and Southern Europe, particularly flat steel products such as hot-rolled coil (HRC) (Figure 3.9).

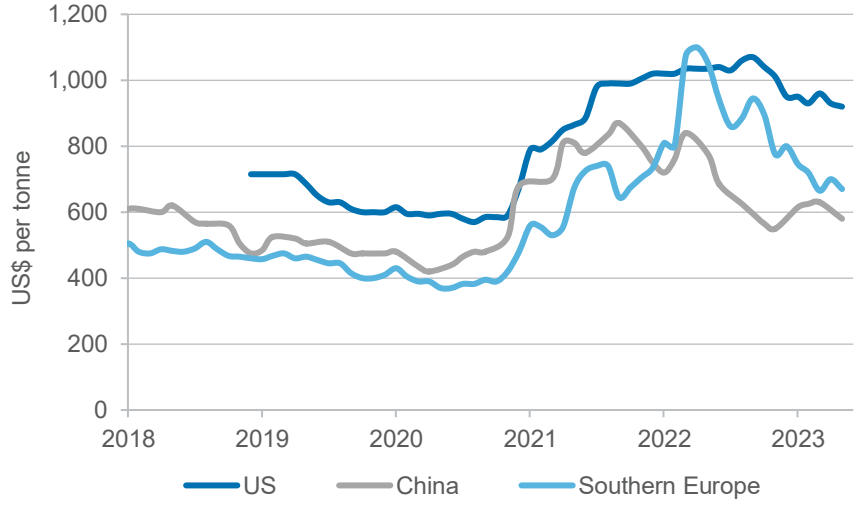
Despite the recent falls in steel prices, US prices for HRC remain high, at around US$1,000 a tonne in May. US rebar (reinforcing bar) prices have also remained at high levels so far in 2023, supported by infrastructure and non-residential commercial construction. While rebar prices have eased over the past 12 months in other major markets, including China and southern Europe, they remain above pre-pandemic levels (Figure 3.10).

Figure 3.9: HRC steel prices



Source: Bloomberg (2023)

Figure 3.10: Rebar steel prices



Source: Bloomberg (2023)

European steel production weakens again in the June quarter

Steel output in the EU — the world's second largest steel-producing region — fell by 10% year-on-year for the five months to May 2023 to reach around 52 million tonnes. As noted earlier, Europe continues to feel the impact of the flow-on effects of the Russian invasion of Ukraine. This has impacted downstream, steel-intensive industries in the region, including the construction and automotive sectors.

Eurozone construction companies are reducing output in response to ongoing deteriorations in demand. The HCOB Eurozone Construction PMI remained in contractionary territory in May 2023, for the 13th consecutive month. All three broad areas of construction recorded falls in activity (housing, commercial and infrastructure). Housing recorded the biggest fall, while commercial construction work declined at the fastest rate in 5 months. New orders fell sharply in May, marking more than a year of consecutive monthly falls. Weakening demand for inputs saw price pressures ease, with the price increase in May the softest in 3 years.

Slowdowns in construction activity were widespread across Europe, with the steepest reductions in France, Germany and Italy. Public construction works and government housing schemes should provide some support in H2 2023. However, higher energy costs (relative to historical levels), and the impact of rising interest rates on residential and commercial construction will hurt activity.

The European auto industry faces challenging conditions over H2 2023. Component shortages, elevated energy prices, and falling global trade continue to affect manufacturers. Weakening demand due to slowing global growth is also expected to overtake component shortages as the major downside influence on production in the Eurozone this year.

Over the outlook period to 2025, EU steel production is forecast to see a modest rate of growth, though production levels are forecast to remain below its pre-pandemic peak. The majority 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.

India projected to see some of the strongest growth in steel output globally

Building on the healthy 5.5% growth last year, India's steel industry has continued to generate momentum, growing by 3.2% in the five months to May 2023 compared with the same period in 2022 (Figure 3.11). This was led by high levels of construction activity across all three sub-sectors (residential, commercial and infrastructure). The sharp fall in India's inflation in April to 4.7% — the lowest level in 18 months — dampened expectations of further rate rises by the Reserve Bank of India.

Over the outlook period, India is projected to see some of the strongest growth in steel output globally (Table 3.1). This follows 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 by 2025. Strong expansions are projected in India's residential and commercial sectors, as well as a ramp up in infrastructure spending — as part of the country's $1.5 trillion National Infrastructure Pipeline to 2025. Automotive and consumer durables output are expected to maintain healthy growth, driven by sustained growth in private consumption.

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.

Weak global demand weighing on Japan and South Korean steel output

In the five months to May, steel output in Japan and South Korea contracted by 5.3% and 0.3%, respectively.

In Japan, construction is expected to expand on the back of civil engineering projects resulting from the Government's *Fundamental Plan for National Resilience*, as well as a recovery in capital investment, and new warehouses and logistics facilities. However, labour shortages continue to constrain construction activities. Japan's manufacturing conditions remain weak, with industrial production falling by 0.6% year-on-year in March. However, easing supply constraints are expected to see growth in the manufacturing and automotive sectors over H2 2023.

The Japanese economy grew by 1.6% year-on-year in the March quarter 2023, the strongest growth in three quarters. However, rising raw material and energy costs, and a depreciating yen are expected to restrain the recovery in steel output this year. Over the outlook period to 2025, Japan's steel production is expected to remain relatively 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 March quarter. Exports were a key factor in the slowdown (down close to 14.2% year-on-year in April), and domestic industrial production also declined (down 7.6% in March).

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

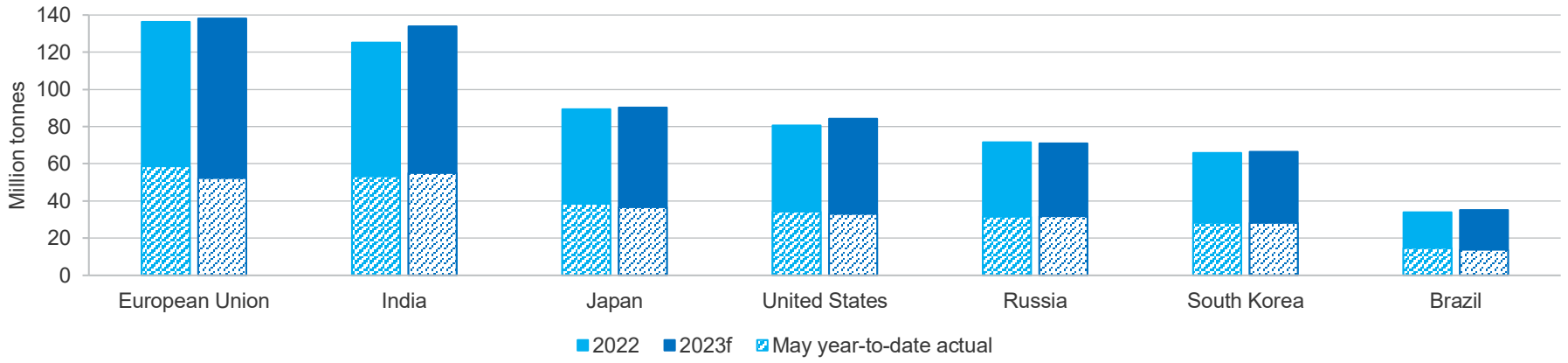
Rising interest rates dampening US residential construction

US steel production has been weak so far this year. In the five months to May 2023 production was down 3.9% compared with 2022. The strong post-pandemic rebound in economic activity is running out of steam. Inflationary pressures, supply chain disruptions and tightening monetary conditions, all weighed on US construction activity — particularly the residential property sector. Manufacturing activity has been losing momentum, falling 0.9% year-on-year in April 2023. Similarly, annual growth in industrial production has steadily fallen from rates of 3-4% in 2022 to close to zero in March and April this year.

The outlook for US steel demand in H2 2023 contains numerous downside risks. Demand destruction — due to the global economic slowdown — continues to be a key risk over the second half of this year. Residential construction is facing increasing headwinds from rising interest rates and higher land and material costs. Easing supply chain constraints and government initiatives — such as the *Inflation Reduction Act* — should lend support to domestic manufacturing activity. However, the US manufacturing PMI fell into contractionary territory again in May — the 6th negative result in the past 7 months — and with new orders slumping, near term challenges remain.

US steel production is projected to record modest, albeit positive, growth over the outlook period to 2025 (Table 3.1).

Figure 3.11: 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	966	974	981	975	0.9	0.6	-0.6
European Union	159	158	165	168	-1.0	4.4	2.0
India	118	123	131	140	4.9	5.8	7.5
United States	103	105	110	113	2.5	4.4	3.2
Other Asia[a]	114	116	120	123	2.4	3.4	2.2
Japan	62	62	64	65	-0.1	4.1	1.4
Middle East	56	57	60	62	2.0	4.3	3.1
South Korea	54	53	55	56	-0.4	2.5	1.4
Russia	43	43	42	42	-0.8	-2.2	1.4
World steel consumption	1,897	1,926	1,975	2,002	1.5	2.5	1.4
Crude steel production	**2022**	**2023[f]**	**2024[f]**	**2025[f]**	**2023[f]**	**2024[f]**	**2025[f]**
China	1,018	1,019	1,015	1,012	0.1	-0.3	-0.4
European Union	136	138	144	145	1.5	4.0	0.7
India	125	134	142	151	7.0	6.3	6.3
Japan	89	90	92	91	1.1	1.8	-0.8
United States	81	84	86	88	4.7	1.8	2.6
Russia	71	71	72	72	-0.6	1.8	0.0
South Korea	66	66	69	70	0.7	3.3	1.4
Other Asia[a]	66	70	78	87	5.3	11.9	11.7
World steel production	1,885	1,927	1,962	1,990	2.2	1.8	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)

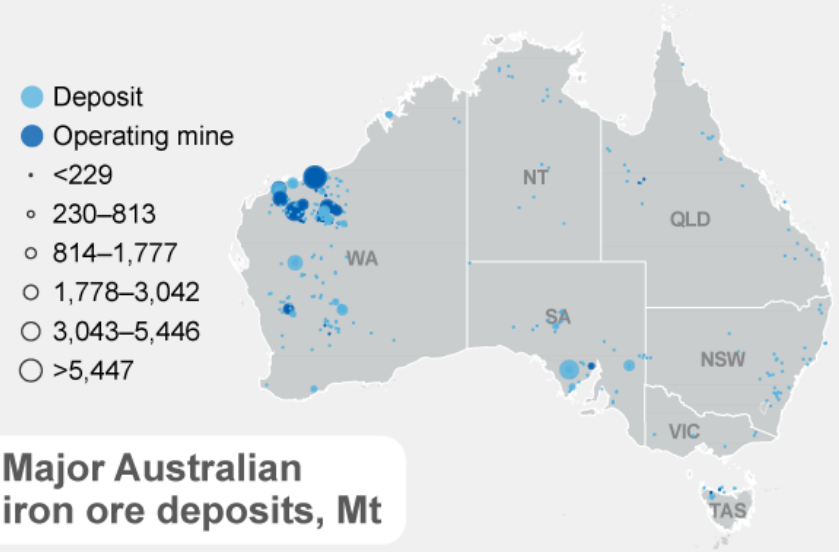
Iron Ore

Australia's iron ore sector

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

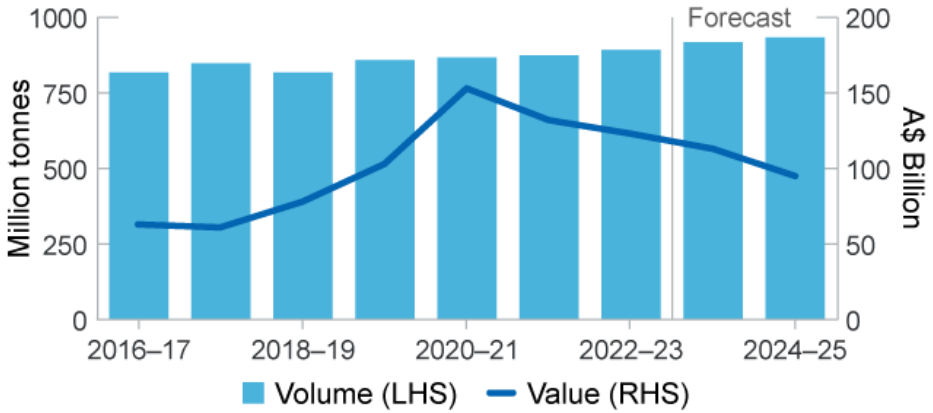
Largest
iron ore producer in the world

$132 billion
earned in exports in 2021–2022



Major Australian iron ore deposits, Mt

Australian iron ore exports



Outlook

Iron ore prices **eased in June quarter** 2023 as global economic growth slows

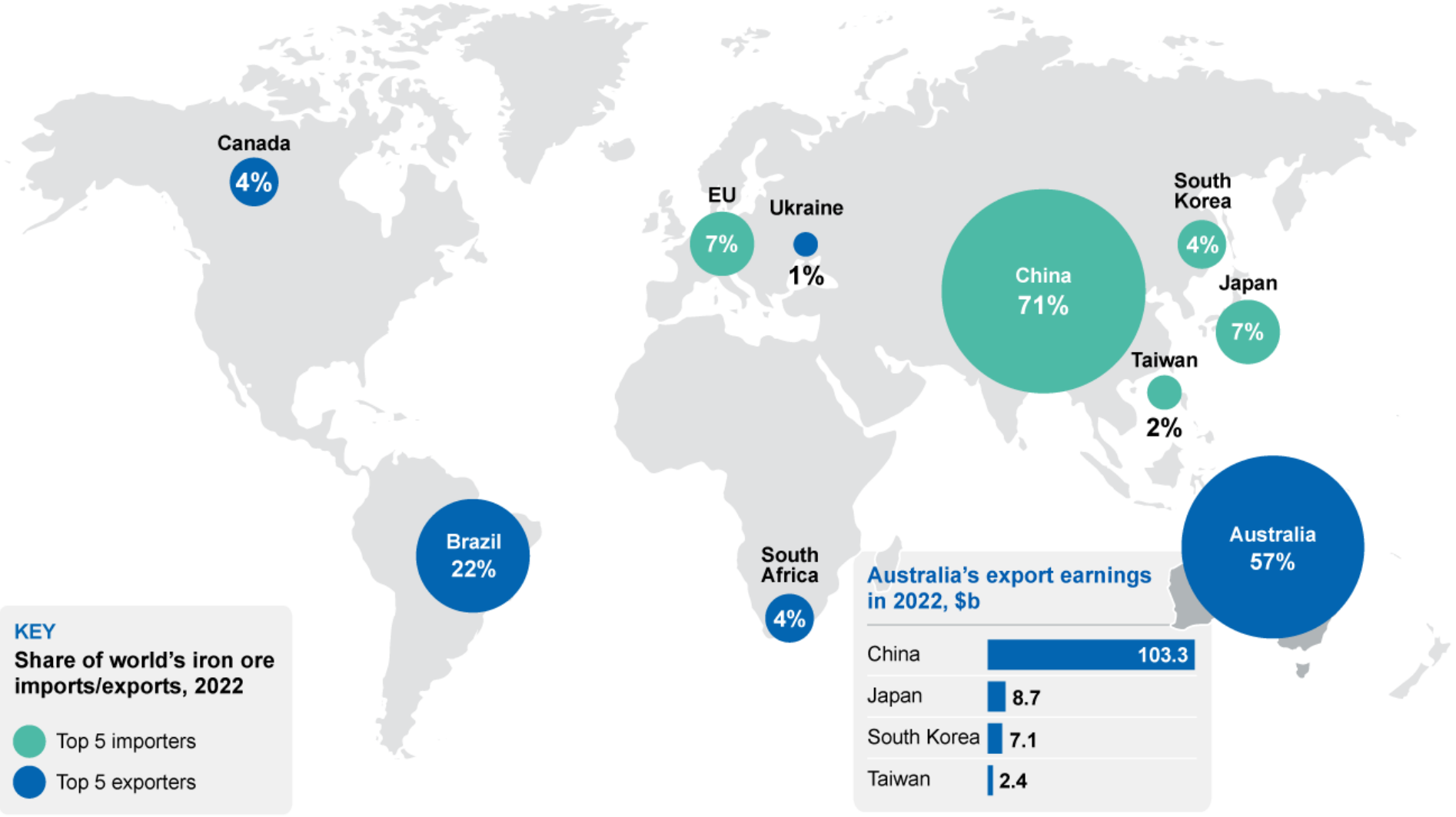
Future **export earnings to fall** as prices decline

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

Exploration spending moderates from near decade highs in 2022

SOURCE: GA; ABS; DISR; OCE

Iron Ore TRADE MAP



SOURCE: ITC Comtrade; ABS

4.1 Summary

- Spot iron ore prices have moderated in the June quarter, driven by the slowdown in global economic growth and an easing in the rate of recovery of Chinese steel production.
- Australian export volumes have been rising steadily in recent years, 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 $123 billion in 2022–23 to $110 billion in 2023–24, and to $93 billion in 2024–25 — driven by lower prices over the outlook period.

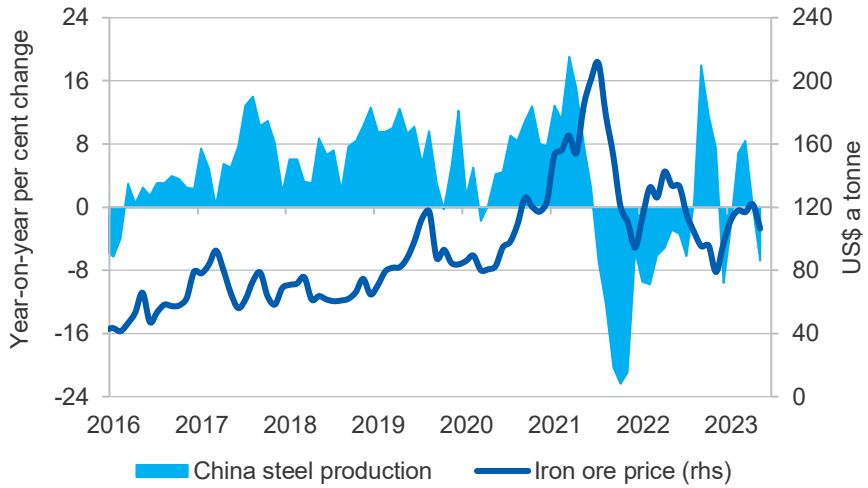
4.2 Prices

Iron ore prices fall in June quarter as China's recovery slows

Iron ore prices moderated in the June quarter, due to slowing global economic growth and an easing in the rate of recovery in Chinese steel production. Following a strong rebound in iron ore prices to a peak of over US$120 a tonne in March, the benchmark iron ore spot price (basis 62% Fe fines CFR Qingdao) has since fallen to around US$105–110 a tonne in June 2023 (Figure 4.1). The recent price falls likely reflect moderating demand from Chinese steel mills — with reports in April of 40% of the steel furnaces going into maintenance in Tangshan, China's largest steel producing city.

More broadly across China, steel consumption has begun to recover from the sharp falls to steel and iron ore demand last year — due to the substantial lost economic and industrial activity resulting from the government's dynamic zero-COVID policy. The impacts of these shocks to steel demand were exacerbated by the protracted weakness in China's residential property sector in 2022. Monthly steel consumption increased by 2.1% year-on-year in May. This was the third consecutive monthly gain and partly reflects base effects due to the large falls a year earlier (Figure 4.2).

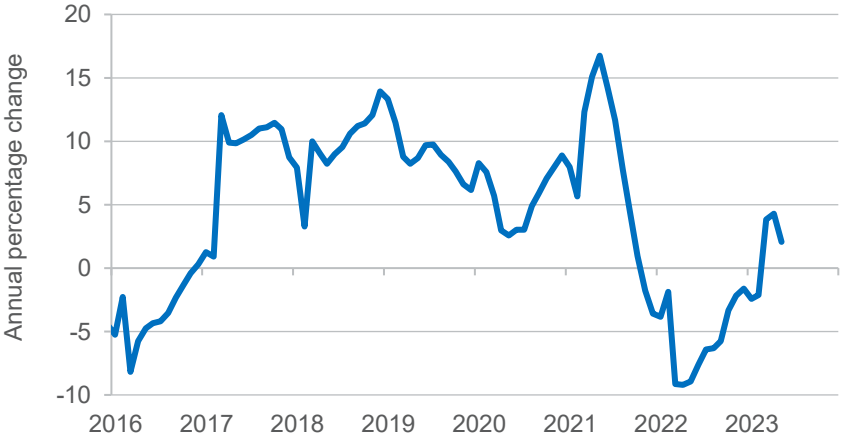
Figure 4.1: Iron ore price and China steel production, monthly



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

Source: Bloomberg (2023) China import prices; World Steel Association (2023)

Figure 4.2: 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)

Iron ore imports from Australia increased by 4.0% year-on-year in May 2023, the 13th consecutive increase since the large fall early last year (Figure 4.3). This reflects a pickup in steel demand, which is boosting broader iron ore imports to China in H1 2023.

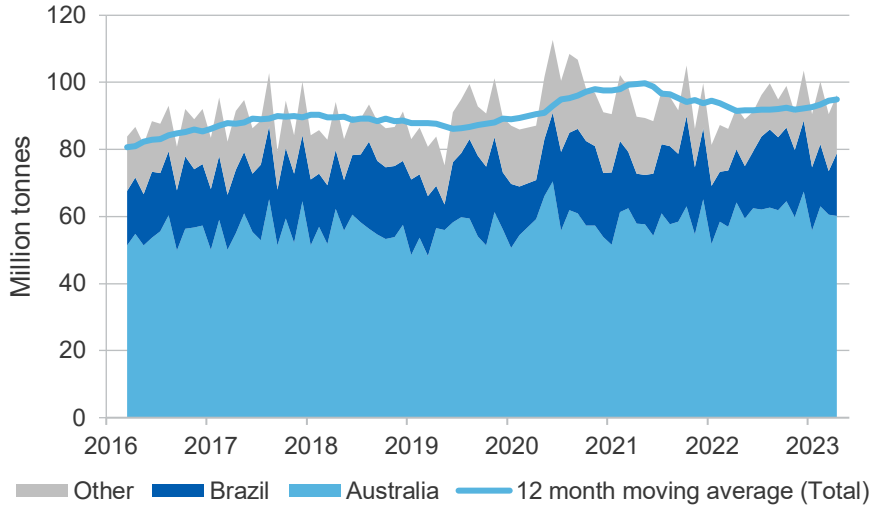
Growth in the Chinese economy is expected to recover over H2 2023. New infrastructure investment — allocated in 2022 — as well as new government policies intended to alleviate weakness in its property sector, are expected to support construction activity. This should lift steel and iron ore demand in China in H2 2023 (see *Steel* chapter).

The expected seasonal ramp up in China's steel production during the peak construction season (between March and May) was anticipated to improve profit margins for mills. However, the growth in demand to date has not met expectations. Restocking of iron ore and steel inventories by Chinese steel mills is expected to provide some support for iron ore demand. In late June, China's portside iron ore inventories had fallen to around 5% below historic averages (Figure 4.4). Reported inventories in Chinese steel mills remained low compared with previous years. And Mysteel data released in late May indicated that only a third of steel firms in China were operating at a profit.

Ex-China steelmaking is expected to make a moderate recovery in the second half of 2023, following falls in production last year. 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, East and South East Asia and the Middle East.

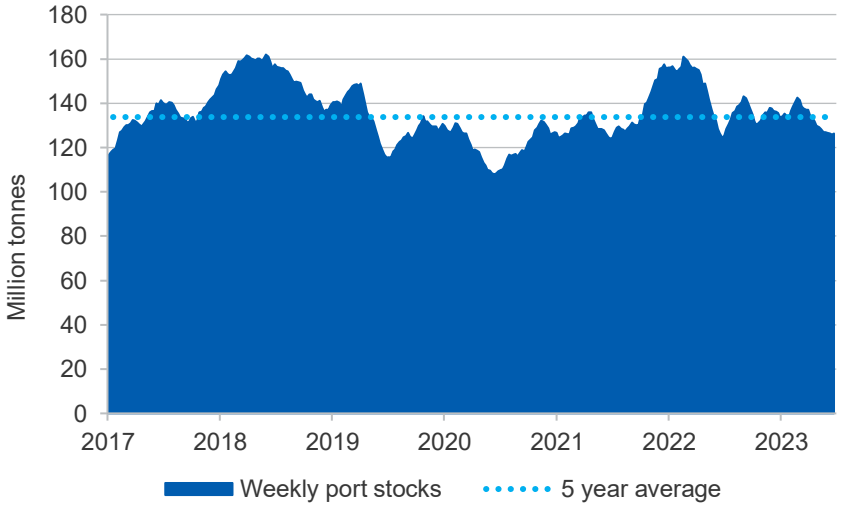
Risks to this global demand recovery remained skewed to the downside, with a more pronounced global economic slowdown risking further weak conditions in the steelmaking sector. The process of further stabilisation and gradual recovery in China's residential property sector will be critical. The spot price for 62% Fe iron ore fines (FOB) for calendar 2023 is estimated to average around US$100 per tonne (Figure 4.5).

Figure 4.3: China's iron ore imports, monthly



Source: Bloomberg (2023)

Figure 4.4: China's weekly iron ore port stocks

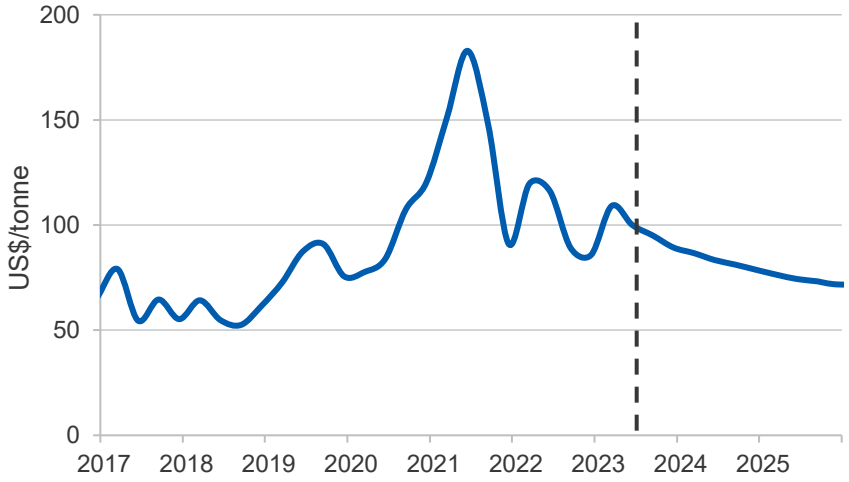


Source: Bloomberg (2023)

Prices to ease over outlook as global iron ore demand softens

China — which accounts for almost 60% of global iron ore demand — is projected to see a modest fall in total steel output over the outlook period to 2025. This is expected to soften the rate of growth (1.1% annually) in global iron ore demand in the coming years, driving iron ore prices down.

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)

China faces a number of key structural drivers that are expected to contribute to this lower growth in iron ore demand. China's stated aim to reach peak steel output by 2030 — as part of a longer-term shift in its economy away from investment-led (and toward consumption-led) growth — is a key driver. A falling population and workforce in China is expected to contribute to more modest rates of economic growth overall, as well as less 'steel intensive' growth — through reduced demand for new residential and infrastructure construction. And with the real estate sector constituting as much as 25% of the Chinese economy, property sector weakness will continue to suppress near-term steel demand.

However, over the outlook period, strong growth in ex-China iron ore demand 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, 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 3.0% per annum over the outlook period to 2025. This follows a ramp up of greenfield projects for major Australian miners, and major 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).

From an estimated average price of around US$98 per tonne (FOB) in 2023, the benchmark iron ore price is projected to steadily fall to an average of about US$74 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 significant 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 rises strongly in the March quarter

In the March quarter 2023, combined shipments for Australia, Brazil, South Africa and Canada — representing more than 80% of global seaborne supply — were estimated at around 320 million tonnes. This was a 4.4%

rise year-on-year, and follows a fall of more than 5% in global trade in iron ore in 2022.

Global iron ore trade to see steady growth over the outlook

Global trade is expected to grow by 2.0% 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 2.1% to reach 941 million tonnes by 2025 (see *Australia* section for more detail).

Total iron ore shipments from Brazil increased by around 4.2% year-on-year in the March quarter 2023. This was driven by a 5.8% rise in output of Vale, Brazil's largest producer, with strong production increases in its south-eastern mines including Minas Centrais and Minas Itabirito (including Fabrica and Pico mines).

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 5% 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, and IndoSino's Amapa high grade

Global iron ore exports (ex-Australia and Brazil) are projected to grow by around 1.3% 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 the June quarter 2025.

Russia's war in Ukraine continues to drive global trade realignment

The Russian invasion of Ukraine has seen both a significant loss of iron ore supply, as well as a reorganisation of supply chains into Europe and Asia. Ukraine's exports of iron ore nearly halved in 2022. While most of the nation's iron ore mines are located outside major conflict zones, Russia's control of several of Ukraine's major steelmaking provinces saw domestic iron ore output increasingly directed towards exports. With Russian iron ore products shunned by European buyers, this saw Ukraine become the European Union's largest supplier of iron ore in the early days of the invasion.

However, Ukrainian ferrous exports have seen a continued decline due to Russian strikes against Ukraine's improvised export network (primarily through Romania and Poland) and ongoing control of the Black Sea. In the March quarter 2023, European Union imports of iron ore and concentrate from Ukraine fell 9.4% year-on-year to 3.7 million tonnes.

Ukraine's iron ore exports are projected to remain below pre-invasion levels in coming years. This is expected to see the loss of around 30% of the global high-grade iron ore pellet market, impacting major export markets for these products, particularly the European Union and China.

An exact estimate of Russia's iron ore exports remains difficult due to the cessation of trade data publications in April 2022. However, corresponding trade data from major partners shows a reorganisation of Russian exports away from Europe and toward new markets in South East Asia, Africa and the Middle East. In addition to iron and steel import bans, a number of major European steelmakers have announced the removal of Russian

materials (such as iron ore) from their steel supply chains. As a result, European Union imports of Russian iron ore fell by an estimated one-third (year-on-year) in 2022.

CMRG likely to play an increasing role in China's contract negotiations

China's new state-owned company China Minerals Resources Group (CMRG) this year commenced negotiations on iron ore supply on behalf of a number of China's major steelmakers. The Group was established in July last year 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 20 largest steelmakers, who account for more than 50% of the country's annual steel production. This includes purchase discussions with major producers, such as Rio Tinto, Vale and BHP.

CMRG is expected to play an increasing role in contract negotiations and price setting in the global iron ore market over the outlook period.

Guinea's Simandou mine aiming for first production in 2025

Development of the Simandou mine in Guinea is expected to resume later this year, following a halt to the project by Guinea's transitional government in July 2022. The halt led to the formation of a joint venture (JV) between Winning Consortium Simandou (WCS), Rio Tinto and the Guinean Government. The JV will oversee the mine's construction and the delivery of a new port and other transport infrastructure.

Preparations for the co-development of project infrastructure progressed in March, with the establishment of the governance and operations model for the infrastructure required to support the development of the mine. This will include more than 650 kilometres of railway and development of a new deep-water port. Next steps include progressing the cost estimates, project schedule and fiscal regime, as well as securing regulatory authority approvals. Upgrade works to camp facilities and other early works were progressed during the March quarter.

Delivery is expected to be bound to the requirements set by the Guinean Government in March last year, with all infrastructure to be finished by 2024, and commercial production to begin by the second quarter of 2025. A ramp up in subsequent years will take the operation toward full production of between 150 and 200 million tonnes.

India's iron ore and pellet exports likely to fall in June quarter

India's iron ore and pellet exports are expected to see a decline in the June quarter, after increasing to about 12 million tonnes in the March quarter 2023. In April this year, India's iron ore exports fell by 10% month-on-month and pellet exports fell by 23%.

In November last year, the Indian government scrapped a 50% export tax on low grade (<58% Fe) iron ore it introduced in early 2022, and also cut the tax rate (from 50% to 30%) for iron ore concentrates. When they were introduced, the higher tax rates were seen as an effort by the government to manage input prices and retain iron ore for India's domestic industry.

Lower export tariffs are not expected to lead to a significant boost in India's iron ore exports over the outlook period. India has historically been seen as a price-sensitive iron ore exporter, with domestic miners incentivised to export in times of high seaborne prices. However, rapid growth in India's steelmaking industry in coming years is likely to reduce the quantity of iron ore available to export.

4.4 Australia

Earnings to fall as easing prices offset production rises

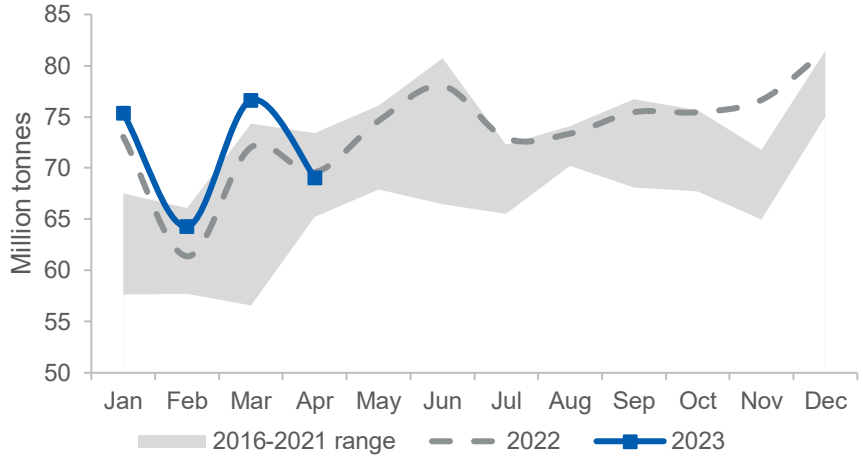
Australia's iron ore export earnings were $32.9 billion in the March quarter 2023, a 5.8% (or $1.8 billion) increase year-on-year (Figure 4.6). The rise reflected slightly stronger iron ore prices, with the unit export price in the March quarter averaging around $152 per tonne — 1% higher compared with the same period in 2022.

Australia exported 222 million tonnes of iron ore in the March quarter, up 7.7% year-on-year. The increase reflected the ongoing ramp up of Rio Tinto's Gudai-Darri, BHP's South Flank and Fortescue's Eliwana

operations. However, exports have since fallen slightly — down 0.8% year-on-year in April — as global steel production has moderated (see *Steel* chapter).

Rio Tinto shipped 82.5 million tonnes of iron ore in the March quarter, up 16% year-on-year. This was a first quarter record, and reflected stronger mine production (up 11% year-on-year) and a drawdown in stocks. As well as further improvements in supply chain performance, the company continues to ramp up its new Gudai-Darri mine.

Figure 4.6: Australian monthly iron ore export volumes



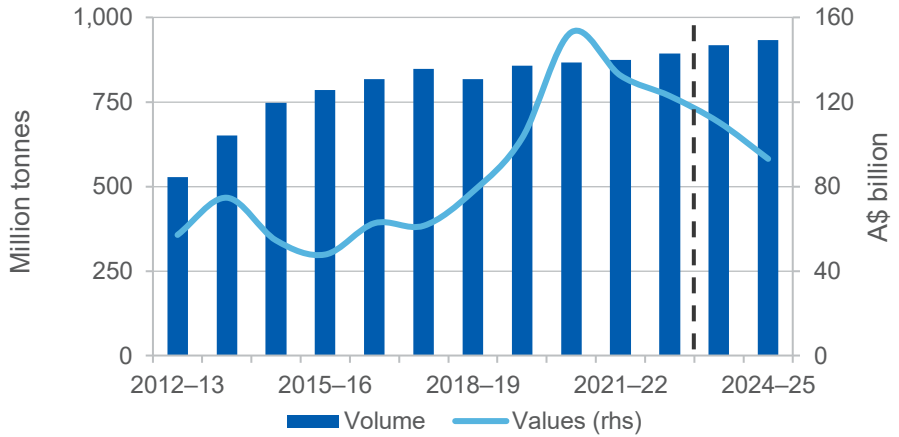
Source: ABS (2023) International Trade, Australia, 5368.0; Department of Industry, Science and Resources (2023)

Rio Tinto guidance for 2023 remains at 320–335 million tonnes (unchanged from 2022). This includes an expectation of Gudai-Darri reaching full capacity during the year.

Rio Tinto is projecting continued expansion of its iron ore production over the outlook period to 2025. During the March quarter, the company formed the Western Range Iron Ore Joint Venture with China Baowu Group Company Limited, following receipt of the remaining regulatory approvals. Construction for the first co-designed mine commenced in the quarter, following the completion of early site works and contractor mobilisation. This project will sustain production from its existing Paraburdoo hub, and is expected to produce 25 million tonnes per year, with first production expected by 2025.

Rio Tinto and China Baowu Group signed a memorandum of understanding (MoU) relating to a series of decarbonisation projects in Shanghai in June. The projects include a pilot-scale electric smelter to produce low-carbon steel using direct reduced iron from low- and medium–grade ores.

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)

BHP's iron ore output was 59.8 million tonnes in the March quarter, unchanged from a year earlier. The company left its 2022–23 production guidance unchanged at 249–260 million tonnes (equating to 293–306 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). The deployment of autonomous haul trucks is expected to be completed by the end of 2023. Through these two projects, the company expects to reach (and exceed) annual shipments of 300 million tonnes over the next few years.

Fortescue's total iron ore shipments were 46.3 million tonnes in the March quarter 2023, down 0.4% year-on-year. Fortescue's Port Hedland operations were briefly suspended due to Tropical Cyclone Ilsa in April 2023 — as were the operations of BHP, Roy Hill, Atlas Iron and Mineral Resources. Fortescue expects to have produced 187–192 million tonnes in 2022–23. First production of the 22 million tonnes per annum Iron Bridge Magnetite project was announced in May, with the first run grade achieving over 68% Fe magnetite.

In February, Fortescue signed an agreement with the Gabonese Government to develop the Belinga Iron Ore Project, which has more than 1 billion tonnes of high-grade iron ore reserves. The project has an initial capacity of up to 2 million tonnes per year, and production is expected to start from the second half of this year. Fortescue also signed an MoU with China Baowu Group in June to explore lower emissions iron making technology at one of Baowu's operations in China using Fortescue iron ore and green hydrogen.

In April, Mineral Resources Limited's $3 billion Onslow Iron project launched its first shallow draft fully enclosed transhipper. Transhippers will be used to transport ore to capesize[1] bulk carriers 40 kilometres off the Pilbara coast. The use of the vessels removes the need for construction of deep-water berths, reducing costs and environmental impacts. First ore from stage one of this project is expected in June 2024. The company is targeting an export rate of 30 million tonnes per year, with infrastructure capable of 35 million tonnes per year.

Moderating prices to see Australian export earnings fall

Australia's iron ore export earnings are estimated at around $123 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 $110 billion in 2023–24, and $93 billion in 2024–25 (Figure 4.7).

Exploration fell in March quarter 2023

A total of $137 million was spent on iron ore exploration in the March quarter 2023 (Figure 4.8). This was 21% lower compared with the previous quarter, and 1.4% lower than the same period in 2022. Exploration has fallen from near decade highs last year, following iron ore prices reaching historical highs in the first half of 2021.

Revisions

Export earnings in 2023–24 have also been revised up from the March 2023 *Resources and Energy Quarterly;* we now expect earnings of $110 billion rather than $103 billion, reflecting higher prices, a lower than expected exchange rate and a small increase in volumes. Earnings in 2024–25 are $5 billion higher than forecast in the March 2023 *Resources and Energy Quarterly*.

Figure 4.8: Australian iron ore exploration expenditure

Source: ABS (2023) Catalogue 8412.0

[1] Capesize is the largest class of bulk ship that can carry any type of cargo — so called due to their inability to pass through the Panama and Suez Canals and hence their requirement to travel around Cape Agulhas or Cape Horn to sail between oceans.

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	1,608	1,648	1,672	2.1	2.5	1.5
Iron ore imports							
China	1,108	1,109	1,105	1,080	0.2	-0.4	-2.2
Japan	107	108	110	109	1.1	1.8	-0.8
European Union	114	115	120	122	0.9	4.1	1.4
South Korea	69	72	75	76	5.1	3.2	1.3
Rest of Asia[a]	63	72	87	107	13.7	20.5	23.9
India	7	16	24	38	128.3	47.6	60.2
Iron ore exports							
Australia	884	902	920	941	2.1	2.0	2.3
Brazil	344	355	378	401	3.2	6.5	6.1
South Africa	58	59	60	61	1.7	1.7	1.7
Canada	55	57	59	61	3.6	3.5	3.4
Ukraine	23	24	25	25	4.3	4.1	0.0

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$/t	103	98	82	74	-4.2	-16.1	-10.4
– real [b]	US$/t	108	98	81	71	-8.5	-18.1	-12.2
Australia	**Unit**	**2021–22**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**
Production								
– Steel [c]	Mt	5.8	5.6	5.8	5.8	-3.3	3.4	0.0
– Iron ore [g]	Mt	929	954	984	1,014	2.7	3.1	3.1
Exports								
Steel [c]	Mt	0.81	1.07	0.93	1.01	32.5	-12.8	8.2
– nominal value	A$m	1,047	1,208	1,084	1,072	15.4	-10.3	-1.1
– real value [i]	A$m	1,121	1,208	1,039	996	7.8	-14.0	-4.1
Iron ore [h]	Mt	874	892	918	933	2.1	2.9	1.6
– nominal value	A$m	132,489	122,825	110,385	93,073	-7.3	-10.1	-15.7
– real value [i]	A$m	141,891	122,825	105,788	86,453	-13.4	-13.9	-18.3

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 2022–23 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)

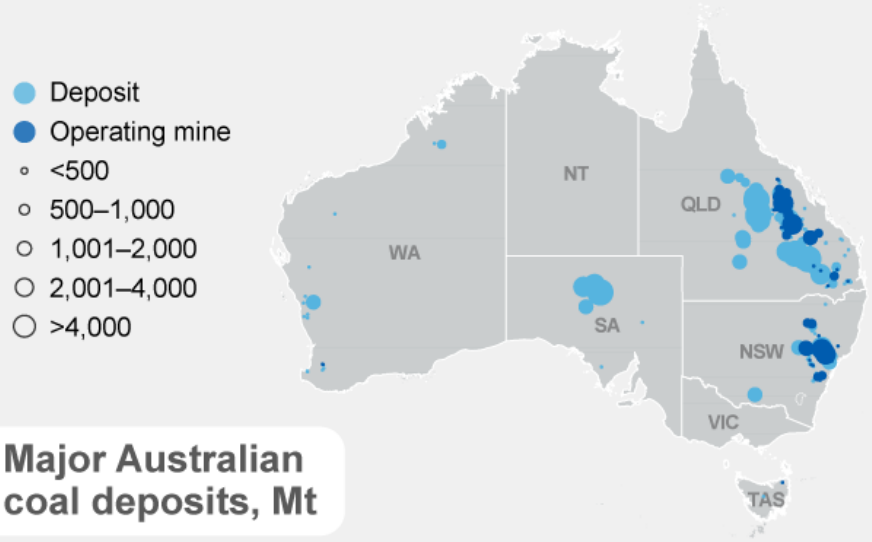
Metallurgical Coal

Australia's metallurgical coal sector

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

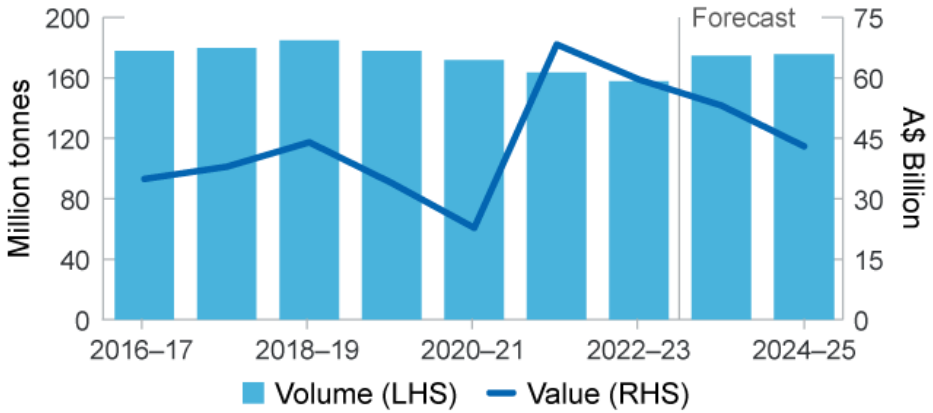
Strong growth
in exports to **India, Japan and South Korea** in recent years

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



Major Australian coal deposits, Mt

Australian metallurgical coal exports



Outlook

Metallurgical coal prices have lost ground as **growth in global steelmaking softens**

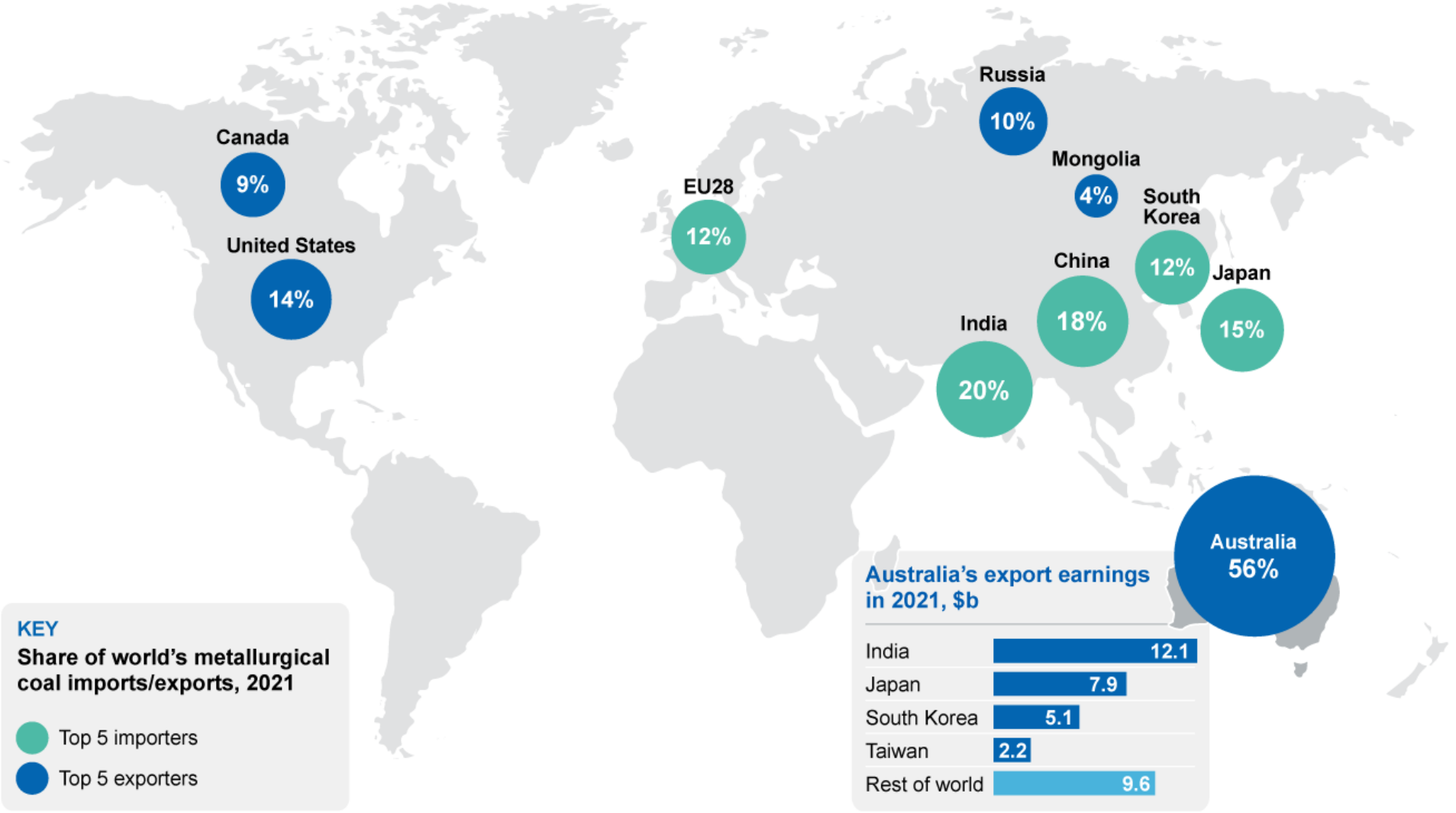
Earnings expected to decline over time as prices continue to ease off their 2022 peak

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

Exploration spending edged back, but remains higher through the year

SOURCE: World Steel; GA; DISR; OCE

Metallurgical Coal TRADE MAP



SOURCE: WSA; ABS

5.1 Summary

- Metallurgical coal prices remain volatile, but are holding well above their pre-2019 level. The Australian premium hard coking coal price is estimated to average US$273 a tonne in 2023, but is forecast to fall 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 175 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 an estimated $60 billion in 2022–23 to $42 billion in 2024–25.

5.2 World trade

After softening in late 2022 and early 2023, metallurgical coal demand has firmed up in recent months, driven by lower prices and higher steel production in Europe and ex-China Asia. Almost 15 Mt of blast furnace capacity has come back online again in Europe. A further 10 Mt or more of capacity remains shuttered, which should provide further growth possibilities over coming years. Many facilities in Europe continue to operate below capacity, and the European Steelmakers' Association has forecast European steel consumption will edge down from 140 Mt in 2022 to 138 Mt in 2023: a lower result than previously expected. Despite the overall yearly decline, growth is expected in the second half of 2023, potentially building further in 2024. New facilities continue to open in India and other parts of South Asia, where expanding steel production remains a significant policy goal.

Global metallurgical coal supply is expected to grow modestly during the outlook period, though low investment in expansions and new mines could act as a constraint. The market is expected to remain in marginal shortfall over 2024 and 2025, keeping prices above their pre-2019 level.

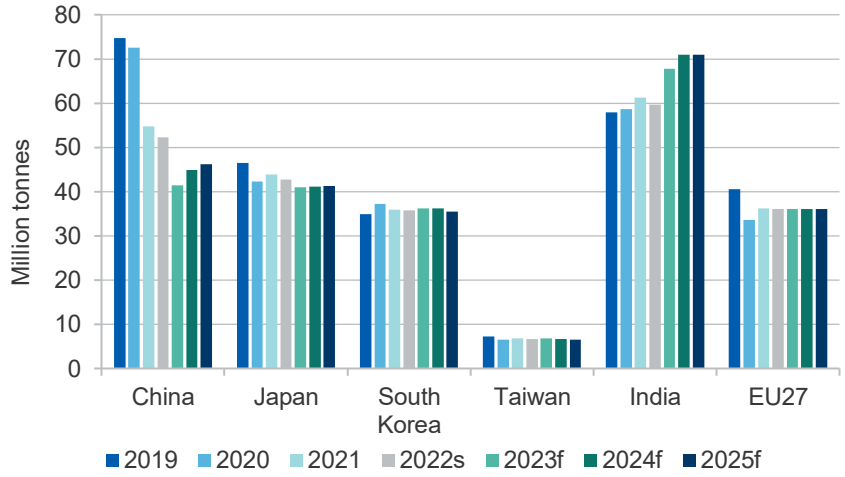
Changes to trading patterns are likely to be modest over the outlook period. More Russian metallurgical coal is reaching China and India, though the volumes are not that large. This growth may not run much further — and may even reverse if Russia runs short of important machinery and equipment as a result of ongoing sanctions.

A cooling in thermal coal demand is likely to reduce some pressure on metallurgical coal prices. As thermal coal prices passed their peak and began to decline, the incentive to sell metallurgical coal into thermal markets has wound back. This should improve stability of supply to metallurgical coal users. Metallurgical supply will also be supported by ongoing drier weather following the end of the La Niña climate episode.

Chinese domestic policy remains a significant variable. In the past, Chinese steel production has been regularly subject to policy interventions. Steel production in China has already flattened off in recent months, and further weakness would likely reduce price pressures significantly, given China's dominant share of global steel production.

On balance, world metallurgical coal trade is forecast to increase from 297 Mt in 2022 to 318 Mt by 2025 (Figure 5.1). However, there are significant risks in both directions.

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 have grown, but remain fragile

Chinese policy continues to exert a significant influence over the global metallurgical coal outlook. The Chinese Government intervenes regularly in China's steel market to set targets for output, and also (albeit more rarely) intervenes in supply decisions. China's informal import restrictions — one such intervention — have now been removed, enabling China's steel mills to access Australian coal again. Thus far, Australian exports to China have stayed relatively low. China's stocks of metallurgical coal are tight, though supply appears adequate for now.

It is possible that Australian exports to China in 2023 will not recover to pre-ban levels. China's supply needs have been partly met through higher imports from Mongolia. These imports have been enabled by the development of rail links which have replaced less efficient and less scalable truck shipments. Russian exports to China have also increased modestly, as metallurgical coal is redirected from European markets. Looking forward, a rise in Chinese domestic supply and/or imports from Russia and Mongolia could prove largely sufficient for China's needs. Moreover, Australian exporters have successfully diverted away from China in recent years.

On the demand side, the possibility of policy intervention (to either increase or decrease steel production) remains a significant variable. A cut in output is considered more likely. Steel production ramped up rapidly during the March quarter 2023, approaching capacity limits in some places. Most of this output has been directed to export markets, so any downturn in global steel demand through the remainder of 2023 could leave China in a position of oversupply, reducing its prices and revenue.

Domestic steel requirements are also somewhat uncertain, in light of declining construction and ongoing problems in China's domestic real estate market. Real estate and infrastructure construction in China remains subject to high indebtedness (local and provincial government and household), with the Chinese Government making further efforts to manage the issue.

Chinese metallurgical coal imports are expected to hold through the second half of 2023 and edge up in 2024 and 2025, but there are significant risks in both directions given the uncertainties over Chinese policy.

India's metallurgical coal imports are in a long-term growth cycle

India's metallurgical coal needs are expected to grow through the outlook period, as long-term investments in new steel production start to pay off. The substantial new NMDC integrated steel plant (likely to commence output in the second half of 2023) will add further capacity. India has already seen its import demand grow by around 10% through the year to March as steel production picked up.

India's metallurgical coal needs are likely to grow further, with the nation's steelmakers pressing ahead with US$11 billion worth of steel projects. Indian metallurgical coal imports are expected to grow through the outlook period (Figure 5.1), but India's steel production remains closely correlated with global economic growth, and would likely drop off in the event of any global economic downturn.

On balance, it is expected that Indian metallurgical coal imports will lift steadily from 60 Mt in 2022 to 71 Mt by 2025, but with risks tilted to the downside.

Japanese steelmaking is recovering

Japanese steelmaking has begun to recover following a long period of softness, which began with the outbreak of COVID-19. Higher domestic steel production pushed Japanese metallurgical coal imports up towards the end of the March quarter 2023, and recent falls in metallurgical coal prices may drive more efforts to build stockpiles in the near term.

Further out, Japanese imports are expected to edge down over time, in line with steelmaking capacity. While some steel capacity is likely to re-open over coming years, some is likely to be lost permanently. Japan's JFE Steel Corporation is expected to close a significant plant in the September quarter, reducing the country's metallurgical coal needs from that point.

5.4 World exports

Global exports of metallurgical coal have shown signs of strengthening in recent months, as weather conditions improved and the La Niña climate episode ended. The structural shortfalls in metallurgical coal markets that produced large price surges in 2022 have now mostly eased, though some small shortfall is likely to persist for at least another year. Any weakening in global economic conditions (or policy changes in China) could result in a surplus developing, lowering prices further.

US producers have struggled to capitalise on high prices

Infrastructure constraints and accidents prevented US metallurgical coal exports from capitalising on the price surges of 2022. With the opportunity to capitalise on record prices now gone, the potential for significant new investment in supply is waning.

US metallurgical coal exports generally remain high cost. 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.

Improved infrastructure will underpin higher exports from Mongolia

Mongolian coal exports face the outlook period on a firmer footing, following the completion of three large new railway lines. These lines are expected to make Mongolian coal exports (to China) more scalable and efficient, reducing shipment costs and expanding capacity. The easing of COVID-19 disruptions has also helped Mongolian exporters, who are expected to more than double their volumes between 2021 and 2025 (Figure 5.2).

Canadian exports will be maintained in near term, but peak in the next few years

Canadian output is expected to hold up through the outlook period, supported by ramp-ups at Canada Coal's reopened Grand Cache mine. The mine previously produced around 2 Mt annually, and is expected to nudge this level of output again by 2024.

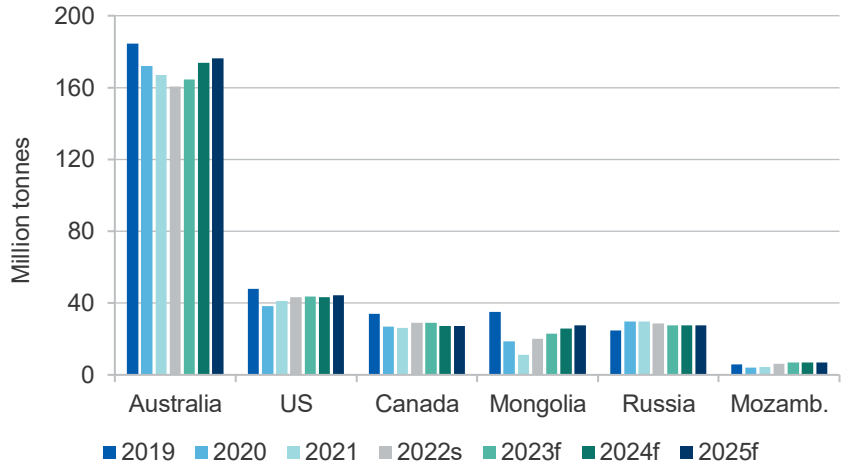
Montem Resources has decided not to proceed with its proposed Tent Mountain metallurgical coal mine. The Albertan State Government previously proposed removing a ban on open cut coal mines across the Rockies, but withdrew its proposal as a result of low public support and strong campaigns against it.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

Exports from Mozambique have risen in response to strong prices

Mozambique's exports fell in the early stages of the COVID pandemic, 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. This growth is expected to be driven by Vulcan Resources' Moatize mine — where work has finished on a preparation plant upgrade — and by upgrades to the Nacala logistics corridor rail line and port.

Higher output at the Moatize site may be temporarily affected by seasonal heavy rainfall, but growth to over 7 Mt of metallurgical coal (annually) is expected over the longer term.

Figure 5.2: Metallurgical coal exports



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

Russian exporters face a difficult outlook

Russian metallurgical coal exports have declined due to Western sanctions. There has been a modest diversion to China and India, but it now seems clear that a large quantity of Russian output will be stranded for the foreseeable future. The modest quantities of coal re-directed may even decline if the Chinese Government opts to curb steelmaking.

Russian production has also faced operational problems. A fire at the Raspadskaya mine in the Kemerovo Oblast delayed several millions of tonnes of metallurgical coal sales, though normal production is now resuming. Rail in the eastern parts of Russia remains bottlenecked, hampering the country's efforts to redirect to new markets. The 2023 shipping quota for Kuzbass — a key metallurgical coal exporting region — appears to have been downgraded from 63 Mt to 56 Mt of metallurgical coal. The owners of the Elga project are seeking to expand their private rail capacity, but will have to deal with sanctions affecting some equipment normally imported from the West.

Russian exports are expected to decline in 2023 and face a prolonged period of structural weakness which will last through the outlook period and beyond. At least 5 Mt of Russian supply is expected to be pushed out of global supply chains, potentially permanently.

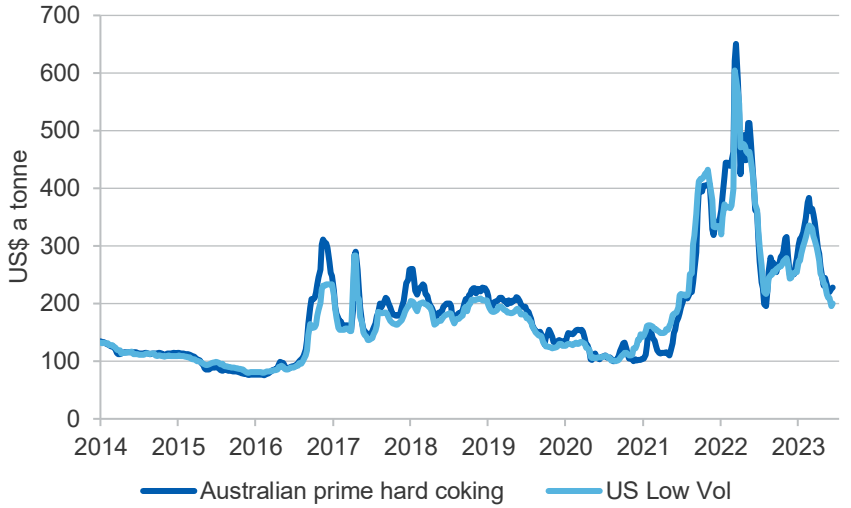
5.5 Prices

Metallurgical coal prices set to decline further

Metallurgical coal prices declined in net terms during the March quarter, and eased further in the June quarter as Australian supply picked up, global steelmaking showed signs of softening and strong post-COVID Chinese demand failed to emerge. Chinese domestic prices — already moderating from recent highs —are expected to fall further. The removal of China's informal import restrictions on Australian coal will allow trade to reorient into more efficient patterns, and see domestic prices in China move more in line with prices elsewhere in the Asian region.

Looking forward, Chinese demand is difficult to predict, with risks evenly balanced. China may soon seek to restock, since inventories are low.

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



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

However, it is also possible that potential mandatory cuts in steel output in China could keep pressure on prices relatively contained.

Indian demand is expected to remain strong unless prices rise rapidly. India's monsoon season is likely to correspond with rapid restocking of coal supplies and rapid growth in real estate markets across South Asia could drive up regional demand for steel further over the outlook period, adding a potential upside to prices. 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.

The loss of Russian output from global markets continues, and is expected to result in a small but consistent shortfall of global supply. It is expected that metallurgical coal prices will remain above the cost of production for the majority of miners over the forecast period.

On balance, prices for Australian metallurgical coal are forecast to decrease from US$273 a tonne in 2023 to around US$200 a tonne by 2025 (Figure 5.3). Risks around this are balanced.

5.6 Australia

Metallurgical coal export volumes to lift, but earnings to fall as prices ease

Shipments from Australia have begun to recover following a long period of weather-related disruptions — most of which abated only in the March quarter 2023 – and the outlook is for greater production and export volumes. The Australian Bureau of Meteorology has announced that drier weather is likely with the end of the La Niña climate episode. This will allow more rapid dewatering and restoration of full coal output across most of NSW and Queensland. The recovery will probably take several more months to complete.

Production at South32's Appin mine has faced significant disruptions due to strata issues, which cut output by around 300,000 tonnes in the March quarter. Overall output at the mine is expected to be around 6.5 Mt in 2023, roughly matching the levels of 2022. Output at this (and other) mines should improve as weather disruptions ease.

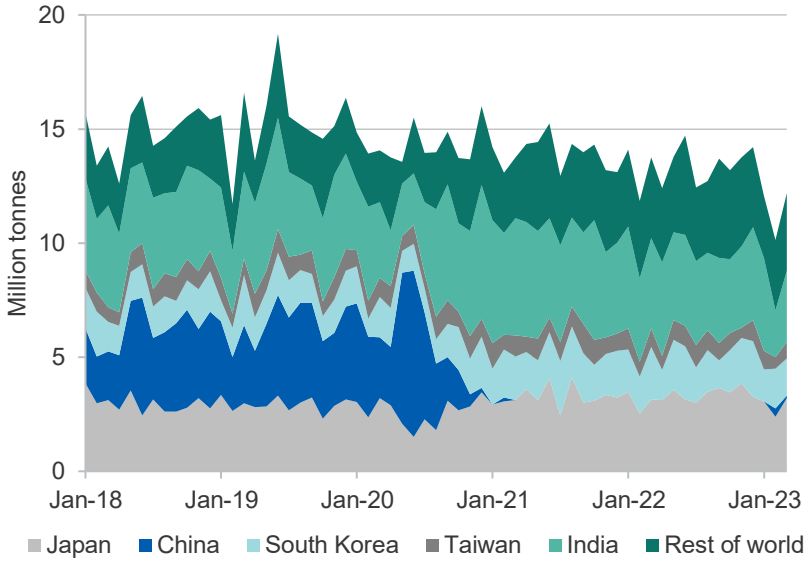
Production from mine openings is also expected to help exports grow through the outlook period. These mines include the new Vickery mine in NSW, and the Ironbark, Burton, North Goonyella, Hillalong, Wilton Fairhill and Olive Downs projects in Queensland.

Malabar Resources' mine at Maxwell has completed primary construction, and shipping is expected imminently. The mine is expected to produce both metallurgical and thermal coal. On the negative side, BHP has announced plans to divest its Daunia and Blackwater metallurgical coal mines in Queensland. The Foxleigh mine, owned by Taurus Funds and Nippon Steel could also be put up for sale in the near future.

While weather conditions are improving, other issues (notably labour shortages and maintenance at ports) could continue to constrain growth in exports in the short term.

The outlook for exports to China also remains uncertain. Exports are starting to flow to China following the removal of informal trade impediments imposed in October 2020 by the Chinese Government (Figure 5.4). However, the latest export level (130,000 tonnes in March 2023) remains well below the 2019 monthly average (of 3.6 Mt). There is evidence that exports may have grown further in April and May, but expansion into the Chinese market could ultimately depend on prices for premium hard coking coal falling: China's domestic prices have recently dropped significantly, amidst rumours of cuts in steelmaking.

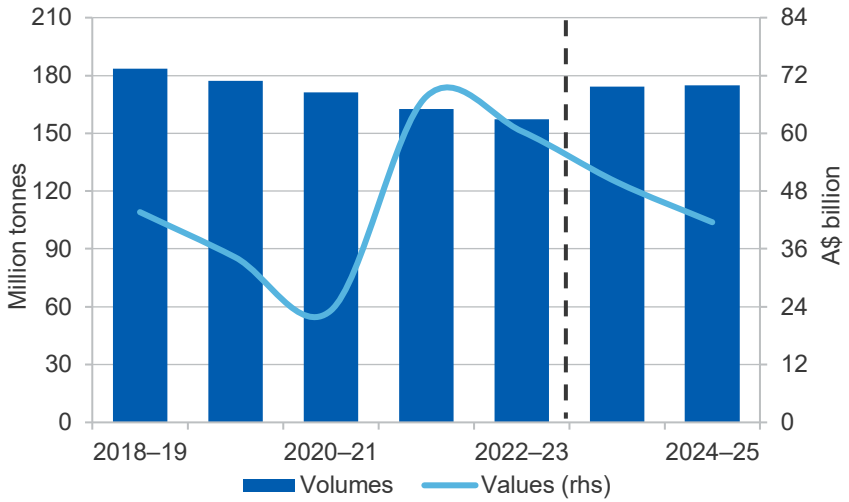
Figure 5.4: Australia's metallurgical coal export volumes, monthly



Source: ABS (2023) International Trade, Australia 5454.0

Australian metallurgical coal export earnings edged back slightly in the March quarter 2023, affected by lower volumes and falling prices. 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 175 Mt by 2024–25. Metallurgical coal export earnings are expected to ease from an estimated $60 billion in 2022–23 to $42 billion by 2024–25 (Figure 5.5), with higher volumes acting as a partial offset to falling prices.

Figure 5.5: Australia's metallurgical coal exports

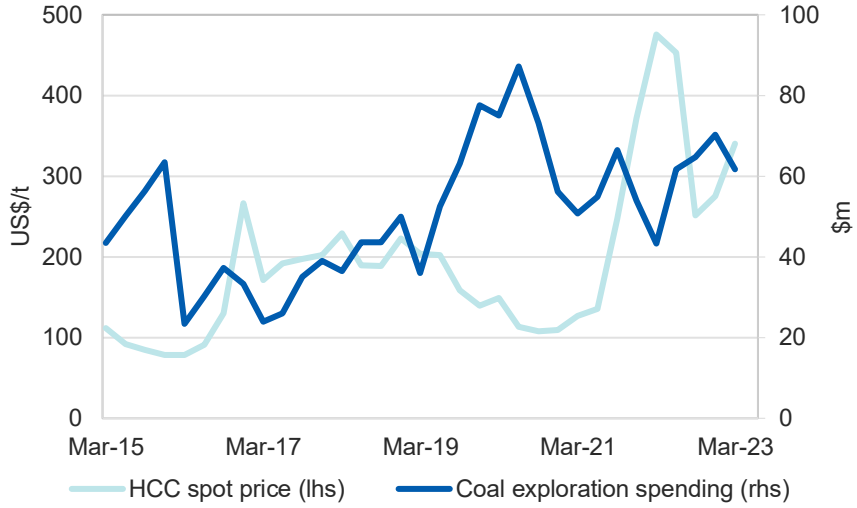


Source: ABS (2023) International Trade, Australia 5454.0; Department of Industry, Science and Resources (2023)

Coal exploration expenditure has increased

Australia's coal exploration expenditure decreased slightly, to $62 million in the March quarter, but remained 42% higher through the year. Through the year growth reflects a period of record prices, which fostered higher exploration in the second half of 2022. It is expected that metallurgical coal will account for the bulk of exploration spending over the outlook period given the challenges thermal coal now faces with finance, insurance and long-term global demand (Figure 5.6).

Figure 5.6: Australian coal exploration expenditure and prices



Source: ABS (2023); IHS (2023)

Revisions to the outlook for Australian metallurgical coal exports

Export earnings forecasts for 2023–24 and 2024–25 are largely unchanged from the March 2023 edition of the REQ.

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	297	298	311	318	0.6	4.1	2.2
Metallurgical coal imports								
China	Mt	52	41	45	46	-20.8	8.4	2.8
India	Mt	60	68	71	71	13.8	4.7	-0.2
Japan	Mt	43	41	41	41	-4.0	0.2	0.5
European Union 28	Mt	36	36	36	36	0.0	0.0	0.0
South Korea	Mt	36	36	36	36	1.2	0.1	-1.8
Metallurgical coal exports								
Australia	Mt	161	165	174	176	2.6	5.5	1.3
United States	Mt	43	44	43	44	1.5	-1.2	2.3
Canada	Mt	29	29	27	27	-0.7	-6.0	-0.2
Russia	Mt	29	28	28	28	-2.8	0.0	0.0
Mongolia	Mt	20	23	26	28	14.0	13.8	6.1
Mozambique	Mt	6	7	7	7	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

						Annual percentage change		
World	**Unit**	**2022**	**2023[f]**	**2024[f]**	**2025[f]**	**2023[f]**	**2024[f]**	**2025[f]**
Contract prices[e]								
– nominal	US$/t	372	274	228	203	-26.2	-16.8	-11.2
– real[d]	US$/t	388	274	223	194	-29.3	-18.7	-13.0
Spot prices[g]								
– nominal	US$/t	364	273	227	200	-25.1	-16.9	-11.6
– real[d]	US$/t	380	273	221	192	-28.3	-18.8	-13.4
Australia	**Unit**	**2021–22**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**
Production	Mt	169	173	180	181	2.6	3.9	0.4
Export volume	Mt	163	157	174	175	-3.2	10.8	0.3
– nominal value	A$m	67,588	60,438	49,868	41,537	-10.6	-17.5	-16.7
– real value[i]	A$m	72,385	60,438	47,791	38,583	-16.5	-20.9	-19.3

Notes: **d** In 2023 US dollars. **e** Contract price assessment for high-quality hard coking coal. **i** In 2022–23 Australian dollars. **s** Estimate **f** Forecast. **g** Hard coking coal fob Australia East Coast ports. **s** Estimate.

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

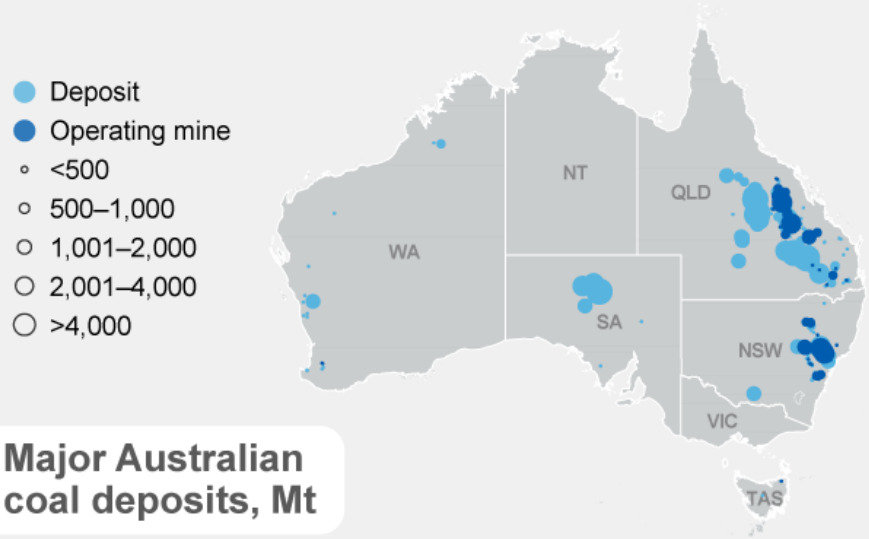
Thermal Coal

Australia's thermal coal sector

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

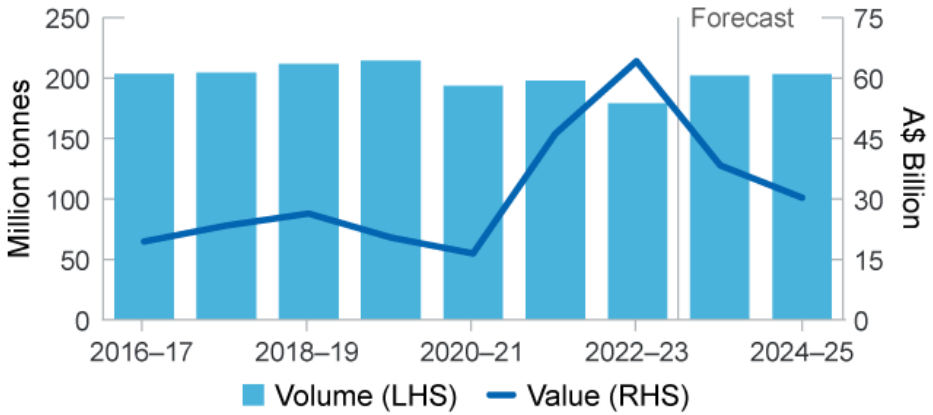
Strong growth in exports to **India, Japan and South Korea** in recent years

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



Major Australian coal deposits, Mt

Australian thermal coal exports



Outlook

Prices **well below 2022 peaks** given high EU storage inventories

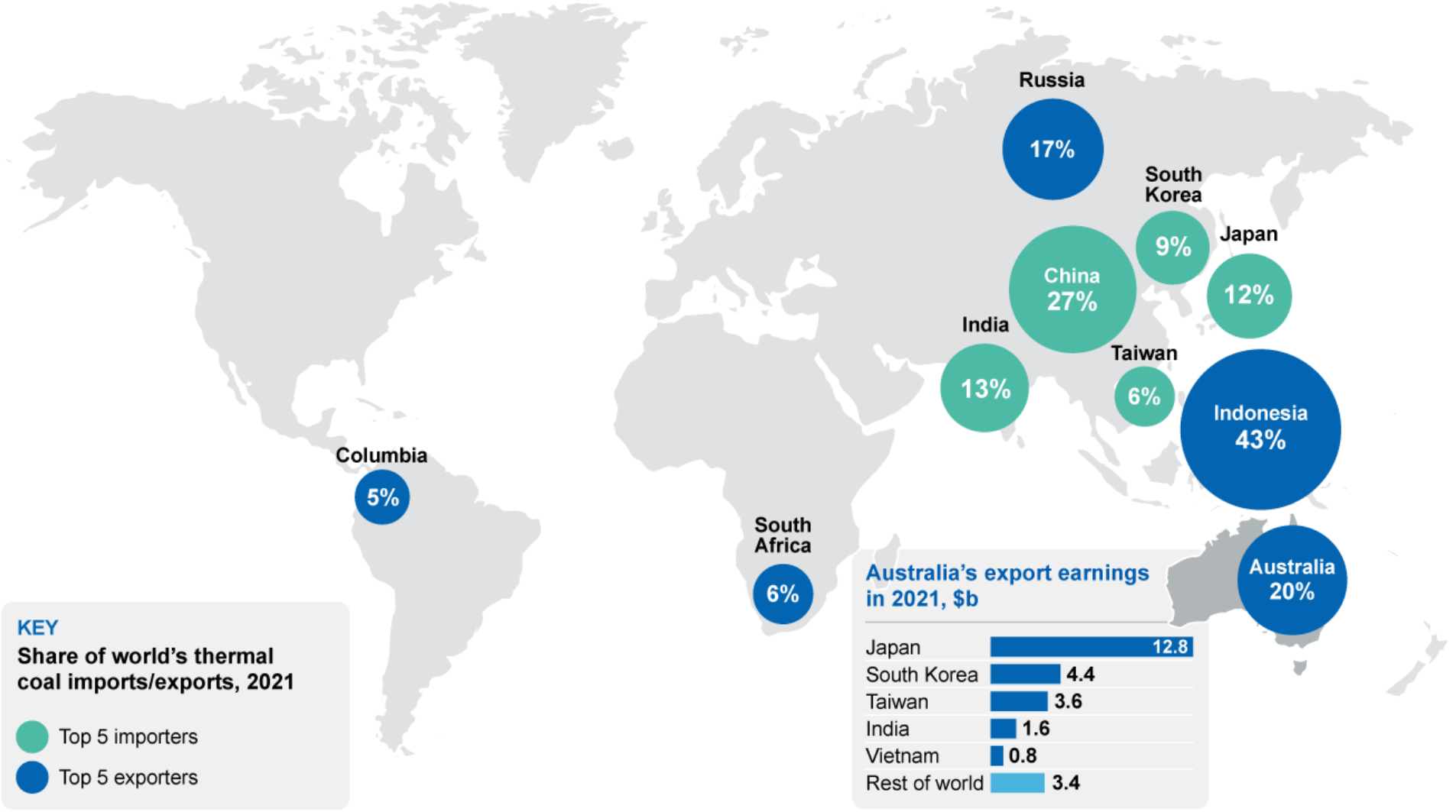
Earnings remain on a **downward trajectory**, as prices continue to ease

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

Exploration spending eased in the March quarter, but remains higher through the year

SOURCE: GA; DISR; OCE

Thermal Coal TRADE MAP



SOURCE: IEA; ABS

6.1 Summary

- Thermal coal prices remain relatively high, despite some easing in May and June as supply conditions improved. The Newcastle benchmark price (6,000 kcal) is forecast to fall from almost US$360 a tonne over 2022, to US$120 a tonne by 2025.
- Gradual recovery from recent supply outages is expected to see Australian thermal coal exports rise from 178 Mt in 2022–23 to 202 Mt in 2024–25 (see Australia section).
- As prices decline, export values are forecast to fall from a peak above $60 billion in 2022–23 to around $30 billion by 2024–25.

6.2 World trade

Supply tightness has eased in thermal coal markets as disruptions linked to weather, the rerouting of trade following the Russian invasion of Ukraine, and the constraints of the COVID-19 pandemic abated. High-calorific thermal coal prices have fallen substantially from a peak in late 2022 of over US$400 a tonne, as European Union stockpiles held up through the winter. Prices stabilized in March and April, but began declining again in May, falling under US$130 a tonne in mid-June.

Overall investment in (thermal and metallurgical) coal mines remains healthy, but with a shift towards less risky brownfield projects, and with less focus on thermal coal.

As short-term supply disruptions ease, the significance of longer-term structural factors affecting the industry will resume focus. These factors include labour and equipment shortages, declining deposit quality, finance and insurance issues, and the ongoing global clean energy transition. Global supply and demand for thermal coal have peaked, but the pace of the declines is likely to be uneven, leading to more market volatility over the longer term. The gradual withdrawal from thermal coal usage is likely to affect lower grade and higher-polluting blends in the first instance, with use of higher calorific coal sustaining for longer in global markets. Demand for thermal coal will also likely moderate as new LNG production targeted for 2025 and 2026 comes online.

It is expected that that demand will soften in the near future. Chinese seaborne and European imports are expected to edge back over the outlook period, but Indian demand is expected to grow. Although thermal coal trade between Australia and China is recovering quickly, the Chinese market faces growing stockpiles at ports and significant economic uncertainties. Efforts by exporting nations to expand further into China will likely be stymied over coming quarters, as imports to the country start to decline from their March peak.

A final wave of thermal coal plant constructions in South Asian nations is likely to partially offset declining coal usage elsewhere. Recent gas/LNG price volatility have encouraged South Asian countries to persist in their remaining coal constructions, though most proposed plants have been progressively cancelled since 2015. Some coal plant retirements may also be deferred in parts of Asia, as a response to the recent swings in gas/LNG prices.

6.3 World imports

Chinese seaborne imports expected to fall given high output and stocks

Chinese thermal coal demand is expected to remain solid over 2023, with a long-term decline commencing in 2024 and 2025. Weak hydro output and strong energy demand fuelled high coal use during the March quarter 2023, and this trend could persist through subsequent months. Domestic coal production, which has risen significantly in recent years, is expected to meet a greater share of domestic needs in 2023. However, a burst of demand in early 2023 has drawn inflows of Australian and Indonesian coal. Chinese imports of Australian product have increased steadily in recent months — from zero in December 2022 to 3.6 Mt in March 2023. This compares to a monthly average of 4.2 Mt over 2019.

China is also drawing in bigger thermal coal cargoes from Mongolia. Truck based shipments have largely been replaced with freight rail, improving scalability and reliability for coal shipments. It is expected that this new freight capacity could virtually double Mongolia's total coal exports to China from the recent average of around 30 Mt a year. Thermal coal flows

from Mongolia are less than one-fifth of this, but are growing rapidly, potentially reducing the market share for seaborne coal to China over time.

Rail shipments within China have increased, with maintenance on the Daqin rail line completed in early May. This should help to balance supply flows inside China and reduce price pressures in parts of the country.

At the same time, China's coal requirements will likely ease modestly given lower gas/LNG prices and less rapid economic growth. Power plants in export hubs like Jiangsu operated at well under full capacity in May. Cement sales in China also appear to be declining in line with broader falls in rates of construction, infrastructure spending, and property sales. China's population declined in 2022 for the first time since the 'Great Leap Forward' period of the early 1960s.

The combination of uncertain domestic demand and strengthening domestic supply is expected to see Chinese seaborne imports decline through the outlook period. Chinese imports are expected to fall from 244 Mt in 2022 to 194 Mt by 2025 (Figure 6.1).

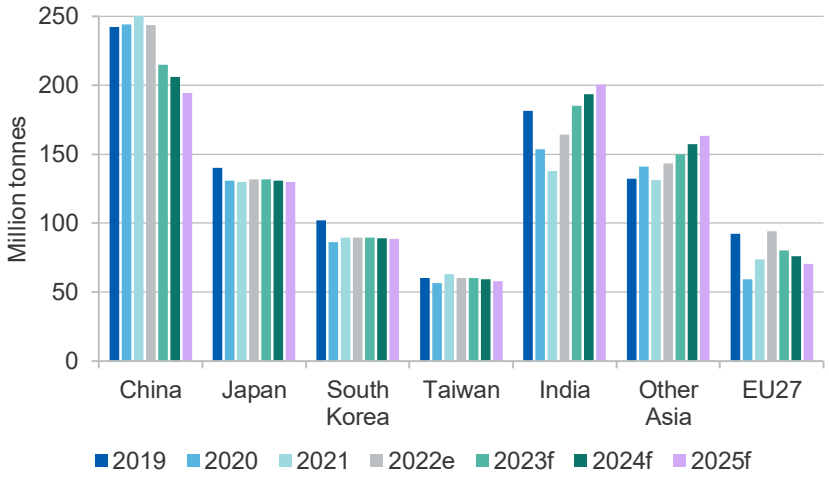
India's coal imports are entering a growth period

Domestic power demand in India grew by more than 5% over the year to the March quarter 2023. This continues a long-term growth pattern for electricity use driven by rapid expansion of India's power grid. Structural growth has been briefly checked by heavy rains, which reduced cooling needs over what would normally be the hottest weeks of the summer period. However, electricity demand continues to grow, and more rapid growth is expected in the near future.

Much of India's higher electricity demand has been met through renewables, with output from renewable sources rising more than 15% over the year to March. However, coal has also played a part.

India's state-owned coal miner (Coal India) managed to surpass its government-set production targets for the first time in the 2022–23 Indian financial year (which ended in April). The company achieved record growth (of 13%) in output compared to the equivalent period of 2021–22.

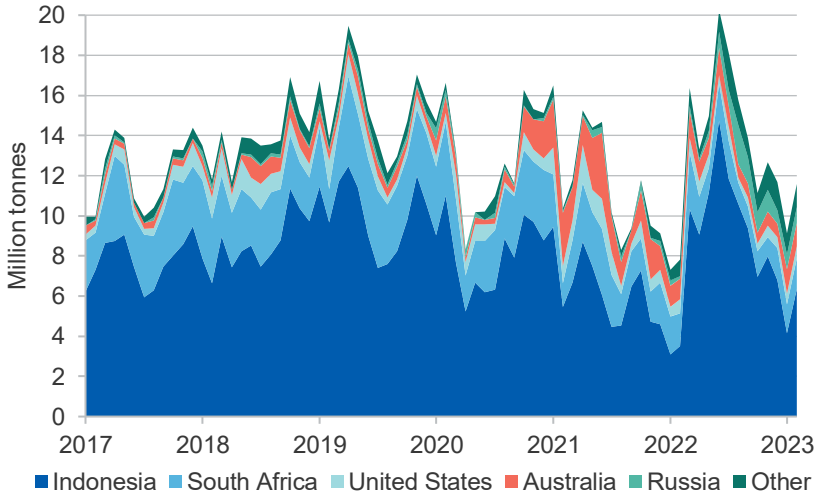
Figure 6.1: Thermal coal imports



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

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

Figure 6.2: India's thermal coal imports, monthly



Source: IHS Markit (2023)

It is not clear that the company will meet its targets again this year: the new target for 2023–24 calls for a further 11% growth in output, which would require extremely rapid progress across a number of coal projects. Success in repeating the growth rates of 2022–23 would significantly reduce import requirements.

Indian thermal coal imports remain high (Figure 6.2) despite ongoing efforts by the Indian Government to reduce dependency. New mandates requiring greater stock at domestic coal plants have played a part in pushing imports up, and could add further to import pressure in the second half of 2023. However, overall coal demand, which has grown rapidly in recent quarters, may ebb somewhat as the post-COVID economic bounce plays itself out. Household demand has eased off somewhat in recent weeks, due to unusually cool summer weather, but there is plenty of scope for demand to pick up again should weather conditions change.

However, new plans for national electricity market could substantially reduce future investment in coal power across India. Media reports suggest that an update to India's national electricity plan has been drafted and is now under consideration. The new draft includes a rejection of all new coal plant proposals for the next five years, with batteries and renewables being substituted.

On balance, Indian imports are expected to rise from 164 Mt in 2022 to 201 Mt by 2025 (Figure 6.1).

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

Japan has been more structurally reliant on coal since the closure of 54 nuclear reactors in the wake of the 2011 Fukushima accident. This reliance has been exacerbated in recent years by spikes in gas/LNG prices, which fuelled demand for high-grade thermal coal, notably from Australia. Contract price agreements between Japan and Australia yielded very high contract prices in 2022–23 — though more recent negotiations have produced a significant correction (see Australia section).

Japanese coal imports remain solid (Figure 6.3), growing by 3% over the year to the March quarter 2023. A mild Northern Hemisphere winter has helped to stem electricity demand, allowing generators to build stockpiles. Imports from Russia declined for several months but rebounded to just under 1 Mt in March. This surge likely reflected a rush to complete deliveries within the 2022–23 Japanese financial year (which ends in March). Many supply contracts between Russia and Japan will have lapsed at the end of the 2022–23 financial year, and are unlikely to be renewed given the sanctions which followed Russia's invasion of Ukraine.

Japanese coal plants have recently succeeded in adjusting their technical settings to allow for more use of 5,800 kcal blends created from mixes of 5,500 and 6,000 kcal coal. This should enable Japan to replace a portion of its high-grade coal with mid-grade coal, potentially taking some pressure off high-grade seaborne coal markets.

Looking forward, thermal coal imports are expected to edge down in 2024 and 2025, as more nuclear plants are reconnected and as gas/LNG prices ease from their previous peaks.

Taiwan's imports grew in early 2023, but are passing their peak

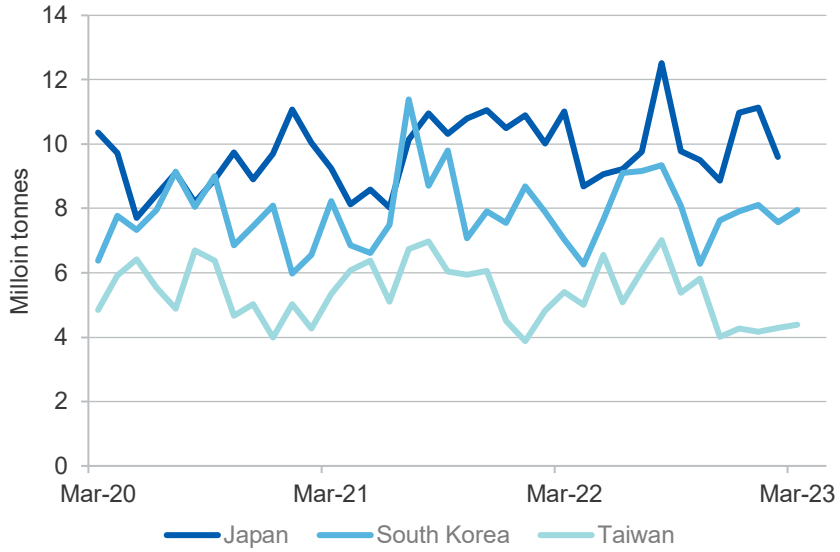
Taiwanese imports grew by around 15% in February, and 12% through the year. This follows an easing in imports late in 2022, with little change expected for 2023 overall. Small falls are expected in 2024 and 2025. Taiwan has abandoned plans to update its coal fleet, and will instead seek to convert existing coal plants to gas.

South Korean coal imports will face growing pressure in the near term

South Korean coal imports surged briefly in early 2023 (Figure 6.3), growing by 5% in March to be 8% higher through the year. This was met in part through import flows from South Africa, which doubled to 0.9 Mt over the year to March. As demand ebbed in Europe, South Africa undertook significant efforts to increase its exports to South Korea and other Asian countries. South Korean imports are expected to hold up in 2023, with declines later in the outlook period.

The South Korean Government has dumped its predecessor's nuclear phase-down policy and, as a consequence, will likely need less imported thermal coal over the longer term.

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



Source: IHS Markit (2023)

South East and South Asia imports are set to grow

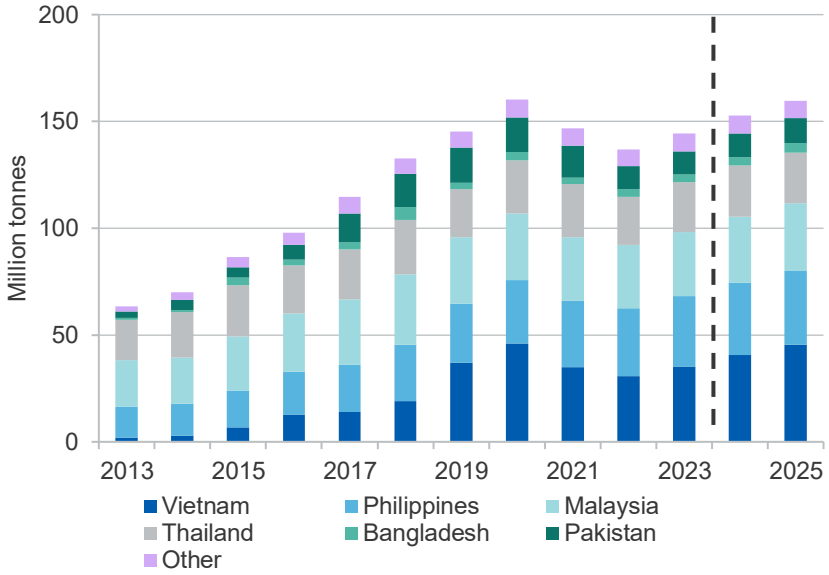
South Asian countries (and India) represent the last significant growth spots for thermal coal. The pipeline of proposed coal plant capacity across South Asia fell by 63% between 2015 and 2021, but a sizeable number of plants remain under construction. Nations in the region are estimated to have collectively imported about 155 Mt of thermal coal in 2022, and this is expected to rise above 175 Mt by 2024 (Figure 6.4). Some South Asian countries may not see their demand peak until 2040.

Filipino coal consumption is expected to double by 2030, with significant new coal capacity expected to come online by 2026. Import growth is expected through the full outlook period and beyond, though the government has also announced plans for a large scale-up in renewable generation, which could reduce pressure for new coal from the late 2020s.

Thailand's coal imports are set to grow modestly as the country pushes to meet industrial output goals (most notably in the cement sector). However, coal plant construction has largely come to a halt, with proposed plants cancelled in the Krabi and South Songkhla provinces. Official policy announcements support a reduction in coal use, though this will not have a noticeable impact on coal imports during the outlook period.

Vietnam's latest energy plan projects an increase of around 40% in coal fired capacity by 2030. However, no coal plants are expected to be built after that, and the Vietnamese Government has announced a phase-out of coal generation in the country by 2050. Vietnam's inaccessible domestic reserves make it highly import dependent, so opportunities are likely to emerge for Australian exporters in the medium term. However, many recently built coal plants have been designed to use Indonesian coal, locking significant parts of the Vietnamese market to Indonesian supply chains. This is already limiting market penetration for some alternative suppliers.

Figure 6.4: South and South East Asia thermal coal imports

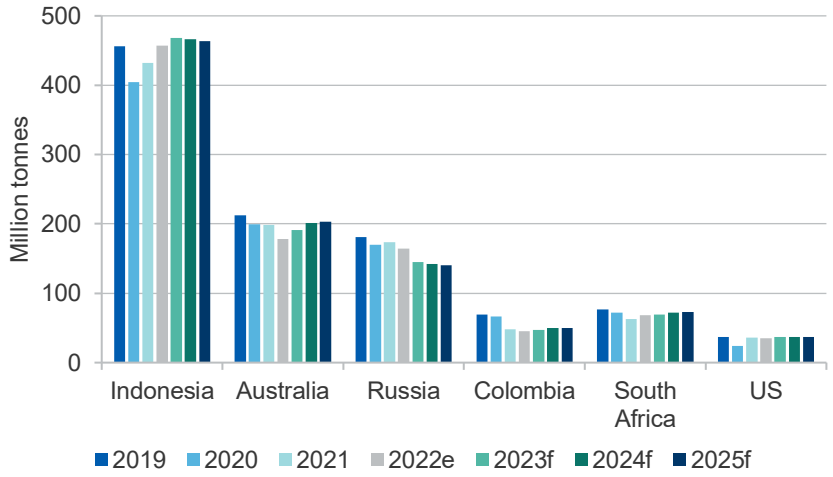


Source: IEA (2023) Coal Information; Department of Industry, Science and Resources (2023); IHS Markit (2023)

6.4 World exports

Thermal coal freight costs have risen in recent years, though some of this is now expected to ease. Growth in freight distance had been linked to Chinese informal trade impediments against Australia — which have now ceased — and to a temporary surge in EU demand following the commencement of sanctions against Russia. However, other costs linked to labour shortages and the difficulty of attracting investment capital are likely 'baked in' over the longer term.

Figure 6.5: Thermal coal exports



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

Indonesia's exports remain solid despite temporary disruptions

Indonesian exports have grown recently, as adverse weather impacts (some linked to the La Niña climate episode) eased in early 2023. Exports in February reached the highest level ever recorded in the month. Miners responded to strong prices and improving weather conditions by deploying new capital and heavy equipment at several sites. Indonesian export flows have grown to India (primarily) and Vietnam, with some flows of higher grades of coal also reaching Japan and Europe.

Indonesian coal output was strong in the March quarter 2023, growing by 17% (provisionally) over the year. Output is expected to remain strong through 2023, despite heavy rain in April in some parts of the nation. The La Niña climate episode has ended, and miners are not expected to face the same policy issues as in 2022, when a brief export ban early in the year compounded the impact of COVID disruptions and poor weather.

April rainfall was limited, and several dry months are expected in mid-year, when Indonesia typically records seasonally high output. The primary limiting factor on exports over the rest of 2023 is likely to be domestic demand, but the higher reserves now held at power plants should act as a buffer against any policy shifts that could affect exports.

In volume terms, Indonesian exports are expected to rise from 457 Mt in 2022 to a peak of 468 Mt in 2023, before edging back over the rest of the outlook period (Figure 6.5). Revenue will be affected by falling prices in the short-term, and by falling demand beyond the outlook period.

Russian exports have severely reduced following its invasion of Ukraine

European sanctions initially locked at least 70 Mt of Russian thermal coal out of its traditional markets. A portion of this tonnage has since been redirected to Asian countries (notably India and China), but limits on transport and shipping capacity have constrained this diversion. An improvement in infrastructure links between Russia and India could eventually see 20-25 Mt of displaced Russian coal reaching Indian markets, but redirection on this scale will take time.

Other South Asian nations may also find ways to lift imports of Russian coal. However, it is not expected that much additional Russian coal will be directed to China, given the latter's increasingly successful efforts to reduce import dependency. It thus appears that significant Russian coal exports will remain locked out of markets for the foreseeable future.

Russian output has dropped in line with global demand. Output from the Kuzbass Basin (Russia's largest coal region) fell by 9% over the year to the March quarter. Coal railings to western ports have declined since the commencement of sanctions.

The recent fall in the value of the rouble will improve the competitiveness of Russian coal. However, the physical capacity to capitalize on this remains limited, and hampered by the sanctions which restrict the flow of technology and equipment into Russia. Russian exports are expected to decline from 174 Mt in 2021 to 140 Mt by 2025.

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

While weather disruptions have eased for some coal exporters, issues have persisted in the US. Heavy rainfall in the Mississippi basin has shut down or delayed rail transport close to the river. Water levels appear to be peaking, and some of the resulting disruption could ease over the coming months. Prior to the downpour, rainfall was well short of expectations, with low water levels in the Ohio River delaying coal barges. The effects of successive weather events have been exacerbated by recent declines in US domestic coal usage, which increased reliance on export markets. Domestic coal use continues to decline despite some coal generators engaging in higher burning to manage inventories.

Weather and infrastructure problems prevented US producers from fully capitalising on the price booms of 2022. 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.

Colombian exports are growing following a period of disruption

Colombian exports rose in March, supported by higher trade with Japan. This comes despite lingering issues at some facilities, including the Cerrejón mine, which has faced persistent blockades and protests over environmental issues and dust spread from its coal stocks.

The end of the La Niña cycle should provide some broad relief for Colombian producers, who faced high rainfall during parts of 2022. Rain blocked the largest rail lines (at Cerrejón and Fenoco), though this blockage has now been largely resolved. Exports are expected to recover in 2023 and 2024. Long term prospects depend on the success of the Colombian Government in fostering expanded mine operations, and on the efforts of Colombian exporters to find alternatives to European markets. However, with some mines having been permanently closed, it is not expected that Colombia will reach its pre-COVID export levels.

South African exports are returning to more typical trade patterns

South African exports remain relatively solid despite a decline in exports to Europe, which fell from 3.4 Mt in September 2022 to 0.9 Mt in February 2023. This decline has been partly made up through higher exports to India and other Asian countries (including South Korea).

Rainfall, which disrupted output in 2022, has eased in 2023. South African exports faced relatively minimal weather problems early in the year, and the dry period is expected to persist through the June quarter. South Africa is seeking to acquire transportation equipment and parts from China to assist in improving capacity and reliability for its supply chains and terminals — though this will likely not produce a significant gain in exports over the outlook period. Improved weather conditions and reduced infrastructure disruptions should see South African exports grow from 68 Mt in 2022 to 73 Mt by 2025.

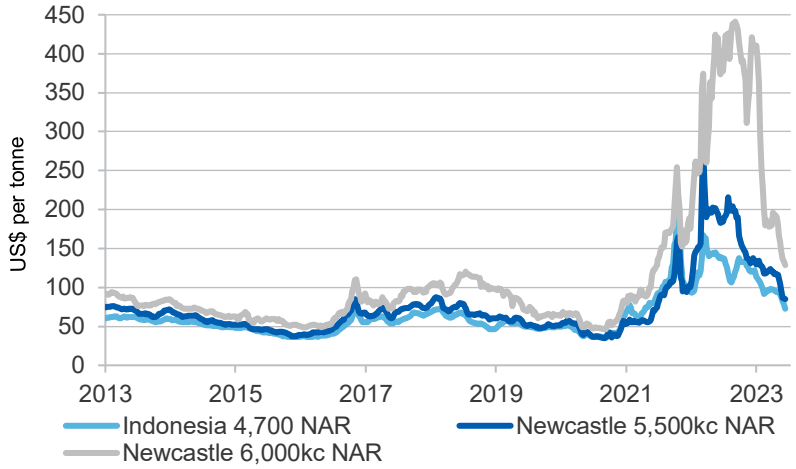
6.5 Prices

Prices have abated, but remain high in historical terms

Thermal coal markets remain in an unstable position, facing a mix of short-term factors (war, pandemic, and weather disruptions) and long-term changes linked to net-zero targets and shifting policy measures. Shorter-term influences have become less significant in recent quarters, allowing price volatility to ease, but also allowing longer term pressures to become more apparent. A ‘base case’ thermal coal price remains hard to determine with all the variables currently in play.

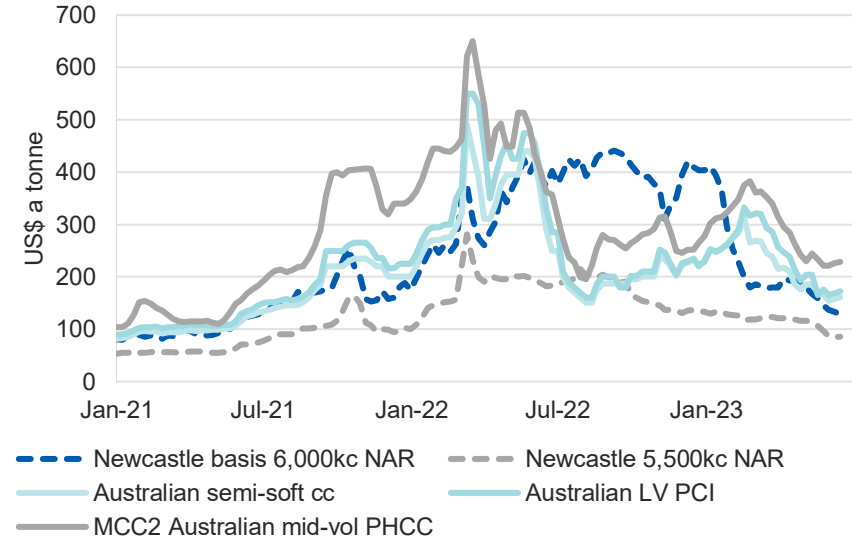
Higher grades of coal are expected to continue attracting a solid price premium as net-zero policies and tightening pollution controls press hardest on global demand for lower-grade coals. However, European coal demand was overestimated by much of the EU in early 2023, resulting in the creation of very expensive stockpiles. This drove some correction from the record price premiums previously recorded, though the premium

Figure 6.6: Thermal coal prices — Australian vs Indonesian



Source: IHS Markit (2023). NAR = Net as received.

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



Source: IHS Markit (2023)

accruing to 6,000 kcal Newcastle product (relative to most lower grades) remains high by historical standards. It is not expected that the price premium will fall much further given the long-term sidelining of significant quantities of high-grade Russian product.

Thermal coal demand in Europe and elsewhere is expected to remain steady, but with supply pressures easing as weather disruptions in Australia and elsewhere abate. A modest decline in prices for all coal grades is expected over the outlook period. Risks remain finely balanced, with a potential global economic slowdown presenting a downside possibility for thermal coal prices.

The 6,000 kcal Newcastle coal price is expected to decline from US$189 a tonne in 2023 to around $US120 a tonne by 2025. This is still relatively high by historical standards, reflecting growing challenges with access to finance and insurance, and concerns over the robustness of long-term demand — all of which have made supply side responses slow and uncertain. These influences will likely become more forceful over time, putting the sector into a permanently higher price phase.

This will provide strong profits to many producers, but may also reduce the competitiveness of thermal coal relative to other energy sources over the longer term.

6.6 Australia

Australian thermal coal exporters have picked as rainfall eases

Australian thermal coal exports rose — from 13.5 Mt in February to 16.3 Mt in March — as drier weather supported higher production and easier transportation. The March result was notably above the 2022 monthly average (of 14.9 Mt), and around 20% higher than in March 2022. This may hold or increase further, with dry weather expected to persist.

The flow of exports to China continues to rise following the removal of informal trade impediments by the Chinese Government. Exports to China grew from nil in December 2022 to 3.6 Mt by March 2023, coming close to

their pre-2020 level. Japan still remains the largest customer for Australian thermal coal, importing 5.9 Mt in March.

Coal supply chains to ports are also functioning better as rainfall disruptions ease, allowing more efficient freight rail transportation across large areas of NSW and Queensland. Recovery from years of rainfall disruptions is ongoing, with dry weather helping to speed up the work. Major miners, including Yancoal, Glencore and Whitehaven, reported lower output than usual in the March quarter, but all are expected to have seen output lift in the June quarter.

Nonetheless, rainfall continues to disrupt mines and ports, including Blair Athol in the Bowen Basin, where ship loading has run behind schedule. The Dalrymple Bay coal terminal, which handles significant output from the area, was forced to declare force majeure in January due to ongoing wet weather. Coal exports through the port of Newcastle continue to face disruption due to poor weather. And rainfall has impacted production at Curragh Mine in the March quarter, exacerbating the effects of ongoing maintenance and a train derailment.

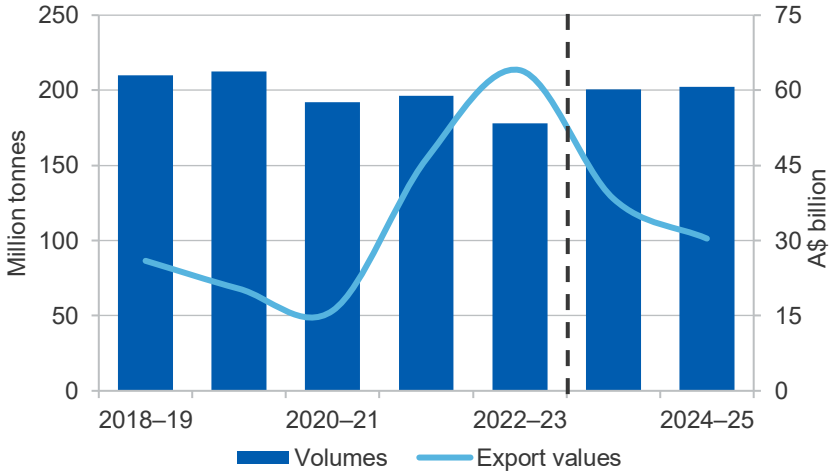
Some new mines are progressing. Whitehaven's Vickery project is expected to proceed soon, after the company announced that $150 million would be used to start up a small scale version of the mine. Output will be limited to around 15% of that originally mooted, but the board retains an option to expand output to the original level (around 8 Mt annually) at a cost of around $1 billion. A decision on this will likely be made by early 2024.

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.

A new coal price contract of US$200 a tonne has been negotiated between Tohoku Electric and Glencore. The new contract covers the 2023–24 Japanese fiscal year, and reflects the sharp drop in coal prices from the peaks of 2022 (Figures 6.6 and 6.7). The contract price is well below the US$395 a tonne recorded for the 2022–23 fiscal year, but also well above the $109.97 negotiated in the year before that. The Tohoku-Glencore contract price provides an important benchmark for contract price negotiations in the Asian region.

On balance, it is expected that export volumes will grow through the outlook (Figure 6.8) as weather conditions improve and output ramps up at several mines. Thermal coal exports are forecast to rise from 178 Mt in 2022–23 to 202 Mt by 2024–25. Ebbing prices are expected to lead to a decline in export values from $64 billion in 2022–23 to $30 billion by 2024–25.

Figure 6.8: 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 $5.5 billion in 2023–24 and $4.1 billion in 2024–25. The impact of a weaker AUD/USD has been more than offset by a downward revision to the expected price.

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	1,036	1,016	1,018	1,011	-2.0	0.2	-0.7
Thermal coal imports								
Asia	Mt	833	832	836	835	-0.1	0.5	-0.2
China	Mt	244	215	206	194	-11.8	-4.2	-5.6
India	Mt	164	185	193	201	12.9	4.4	3.7
Japan	Mt	132	132	131	130	0.0	-0.9	-0.8
South Korea	Mt	90	90	89	89	0.0	-0.5	-0.5
Taiwan	Mt	60	60	59	58	0.0	-1.1	-2.5
Thermal coal exports								
Indonesia	Mt	457	468	466	464	2.5	-0.5	-0.4
Australia	Mt	179	192	201	203	7.3	4.9	0.9
Russia	Mt	164	145	142	140	-12.0	-1.7	-1.5
Colombia	Mt	46	47	50	50	2.7	5.4	0.0
South Africa	Mt	68	69	72	73	1.5	4.2	1.3
United States	Mt	35	37	37	37	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[f]**	**2024[f]**	**2025[f]**	**2023[f]**	**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	157	126	-51.2	-21.7	-19.3
Spot prices[d]								
– nominal	US$/t	359	184	147	121	-48.7	-20.3	-17.5
– real[e]	US$/t	375	184	143	116	-51.0	-22.1	-19.2
Australia	**Unit**	**2021–22**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**
Production	Mt	237	231	250	253	-2.6	8.5	1.1
Export volume	Mt	196	178	201	202	-9.3	12.8	0.9
– nominal value	A$m	46,258	64,021	38,383	30,403	38.4	-40.0	-20.8
– real value[h]	A$m	49,540	64,021	36,784	28,240	29.2	-42.5	-23.2

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 2022–23 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

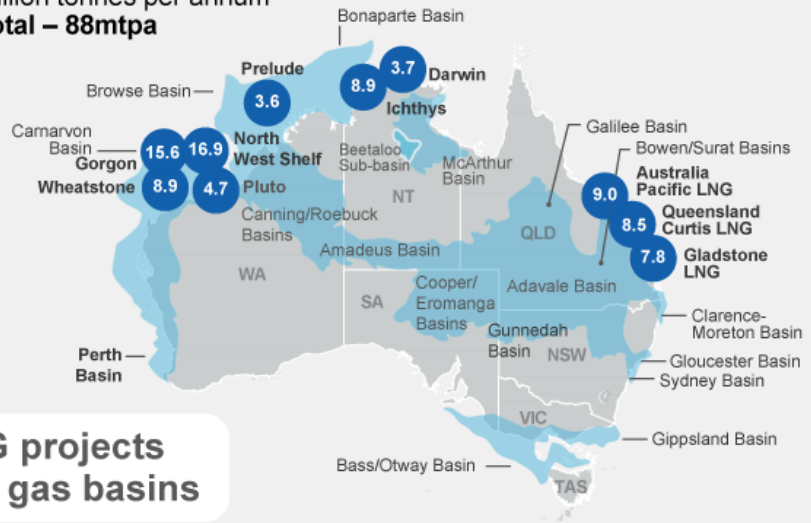
Australia's LNG sector

82m tonnes
exported in 2022, **valued at $91bn**

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

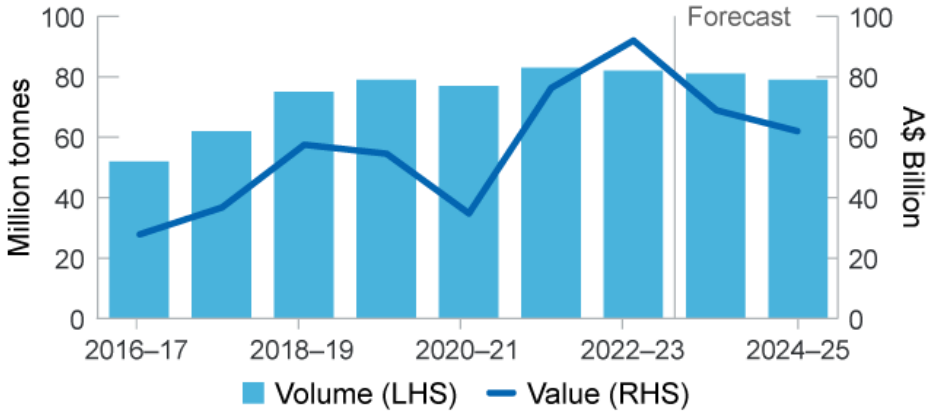
Around 3/4
sold on **long-term contracts**

- Gas basin
- Namplate 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

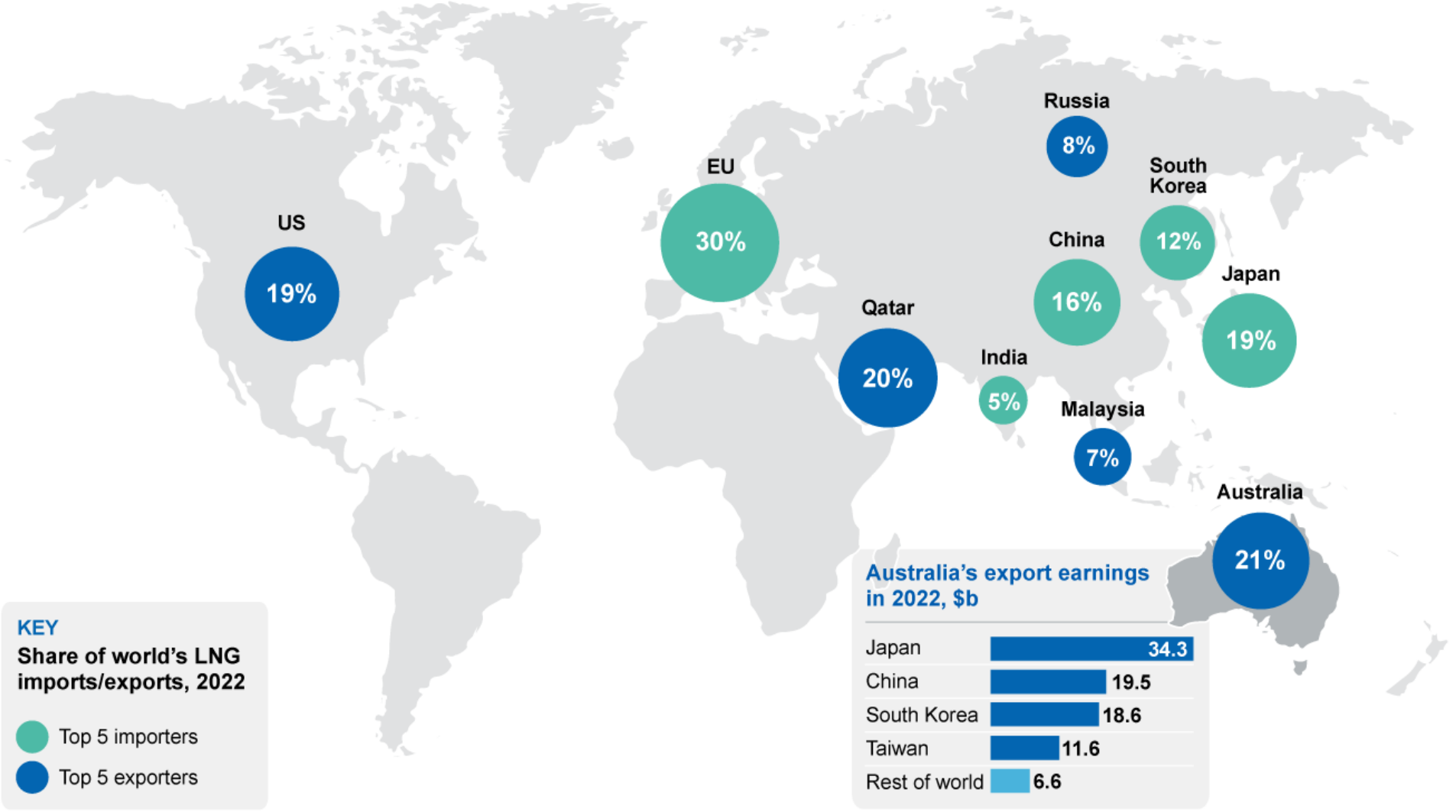
Future **earnings to fall** as price pressures ease off high European storage inventories

Volumes set to ease gradually as offshore fields deplete

Expenditure on exploration **remains weak**

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

LNG TRADE MAP



SOURCE: World Gas Model; DISR; ABS

7.1 Summary

- LNG prices have fallen to US$10 per million British thermal units (MMBtu) over the June quarter, after warmer than normal temperatures during the Northern Hemisphere winter limited the drawdown of European storage inventories (now safely around 78%).
- European competition for uncontracted LNG cargoes will likely ease at the end of the September quarter if storage inventories are filled, which could place downward pressure on prices in Asian markets.
- While volatility in LNG markets could re-emerge over the Northern Hemisphere winter and boost spot sale earnings, the base case is that lower energy prices will cause the value of Australian LNG exports to fall to A$60 billion by 2024–25, with volumes also easing to 79 million tonnes (Mt) over the same period.

7.2 World trade

Global LNG trade to increase with strong demand from Europe and increasing supply from the US

LNG prices have fallen further in the past quarter after a mild Northern Hemisphere winter kept storage inventories well above seasonal averages. Higher storage inventories in the March quarter have lowered Europe's demand for LNG during the summer refilling period.

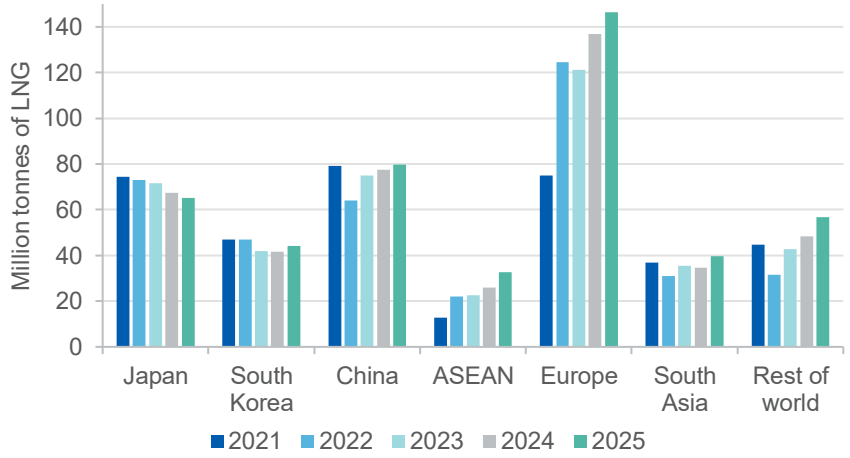
However, given the inherent seasonal variability in European gas consumption (driven by heating demand), there remains a risk of further price volatility as seasonal conditions change. Europe currently lacks the firm LNG contracts needed to fully offset lost Russian volumes, which will force the bloc to source its marginal LNG supplies from global spot markets when needed.

As such, LNG markets are expected to remain in moderate shortfall over 2024 and early 2025, as Europe continues to replace lost Russian pipeline gas with LNG imports (figure 1) . Our base case is for Asian spot prices to average US$14/MMBtu over the outlook period, with risks skewed to the upside for the reasons mentioned above. While this price is well below levels averaged over 2022 (US$33/MMBtu), it is still double the five year, pre-2020 average of US$7/MMBtu.

Global LNG trade is expected to grow by 13%, or 51 Mt, over the two-year outlook relative to 2022. Almost half of the growth (24 Mt) will come from newly commissioned US LNG plants, while facilities in Nigeria will also contribute 7 Mt. Forecasts indicate that most of the new production should be sold to Europe, which is expected to increase its LNG imports from 121 Mt to 147 Mt between 2023 and 2025, respectively. But ASEAN, Australia's closest export market, will likely be the second largest source of demand growth as Vietnam and the Philippines start importing LNG, with total ASEAN demand rising by 11 Mt over the outlook period.

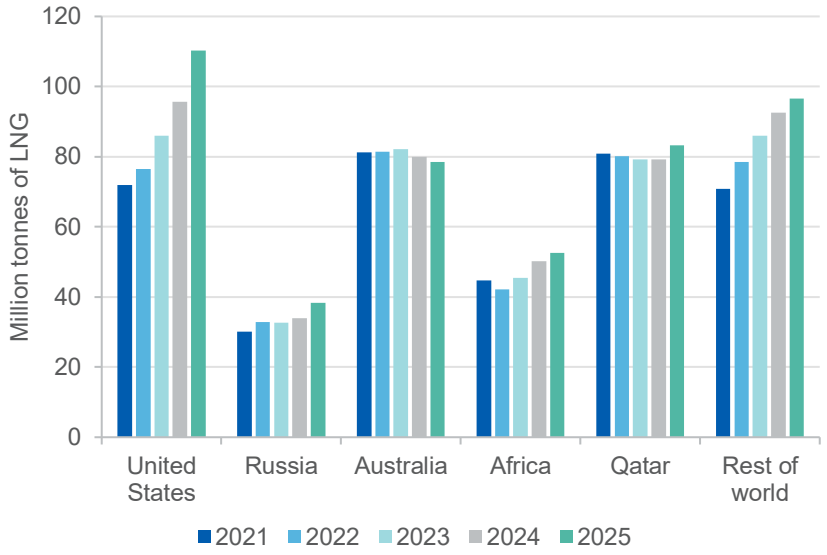
Despite the favourable environment for LNG producers, the outlook for Australia is mixed. Australian LNG exports are forecast to fall marginally, as existing facilities face difficulties backfilling their operations with gas from new reserves (Figure 7.2). At the same time, investment in offshore exploration remains low despite high commodity prices, which could impact Australian gas production beyond the outlook period (Figure 7.17).

Figure 7.1: Global LNG demand forecasts, 2021–25



Notes: 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 forecasts, 2021–25



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

7.3 World imports

European inventory cycles and winter weather conditions will continue to drive global demand

While Australia does not export significant volumes of LNG to Europe, Europe is still a significant global consumer of LNG. Europe is Asia's primary competitor of flexible US LNG cargoes, which means price pressures in the European market can be transmitted to Asian LNG markets through buyer competition (Figure 7.15).

To safeguard its energy security, Europe has had to rely heavily on LNG markets after Russia began curtailing the continent's pipeline gas supply in 2022 (see Russia section). Russia previously supplied Europe with a two-fifths of its gas supply. As a result, European imports of LNG rose by 66% in 2022, from 68 Mt to 113 Mt (Figure 7.5).

However, a steady flow of US LNG and record-high winter temperatures reduced the call on storage inventories over the 2022–23 heating season. According to Eurostat data, Europe only withdrew ~28 Mt of LNG equivalent gas from storage facilities through the winter, compared to an average winter withdrawal of ~38 Mt (Figure 7.3).

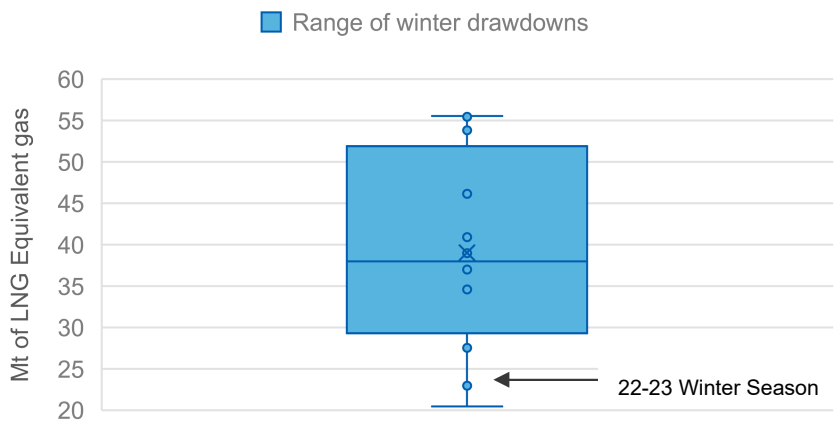
Europe is now forecast to reach full storage capacity sometime in the mid-September quarter 2023 (see Figure 7.4). Once these inventories are full, Europe's ability to import additional LNG cargoes will be restricted until the start of the 2023–24 winter season.

Thereafter, European heating demand (and the subsequent gas storage withdrawals) will be a key driver behind LNG market developments for the remainder of the outlook period. Over a typical heating season, European storage withdrawals range between 29 and 52 Mt of LNG equivalent gas (see Figure 7.3), a figure roughly comparable to 7% and 13% of annual global LNG production in 2022, respectively.

Over the two-year outlook, Europe is forecast to capture the largest share of the world's growing LNG supply. The continent's imports are forecast to grow to 147 Mt by 2025 as Germany, Belgium, Italy, and Greece commission new LNG import facilities to offset lost Russian pipeline gas, and as more typical winter conditions prevail.

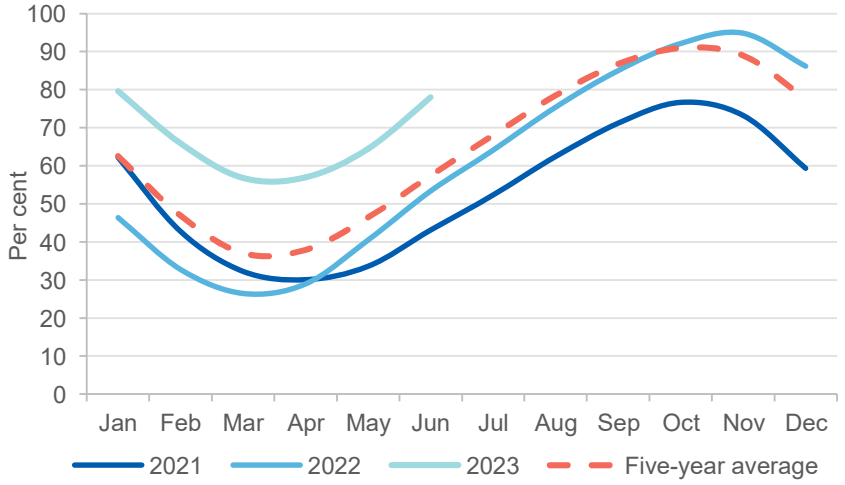
However, several sources of uncertainty could impact the outlook for European demand. One source of uncertainty is the extent to which Europe will underwrite investment in LNG export facilities by signing long-term sale and purchase agreements with LNG suppliers. Additionally, Europe and the G7 have proposed measures that would prevent the resumption of Russian pipeline gas exports on pipelines that Russia has curtailed. If successful, the move will eliminate the possibility that historical pipeline flows resume and will entrench Europe's dependence on US LNG imports for its gas supply (which remain largely uncontracted).

Figure 7.3: European Winter Storage Drawdowns, 2010–2023



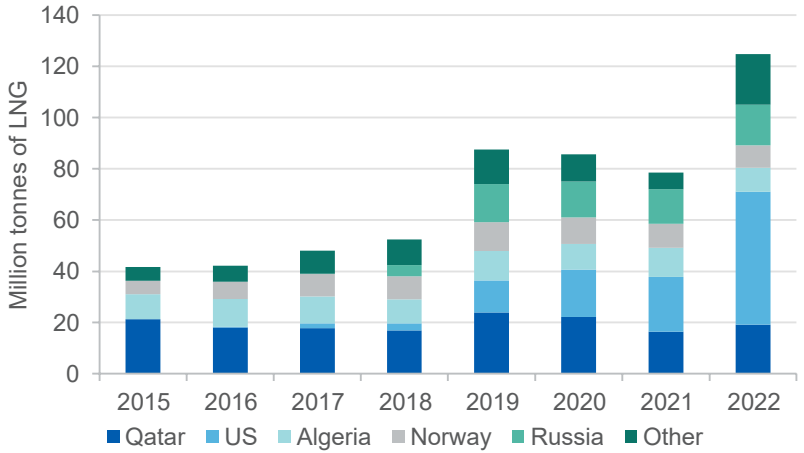
Notes: Drawdowns since 2010. Mt of LNG Equivalent gas is indicative only.
Source: DISR calculations of Eurostat data (2023)

Figure 7.4: European Storage Inventories, 2021–22



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

Figure 7.5: European LNG imports by source, 2020–22



Notes: Other producers include Nigeria and Trinidad and Tobago.
Source: Kpler (2023)

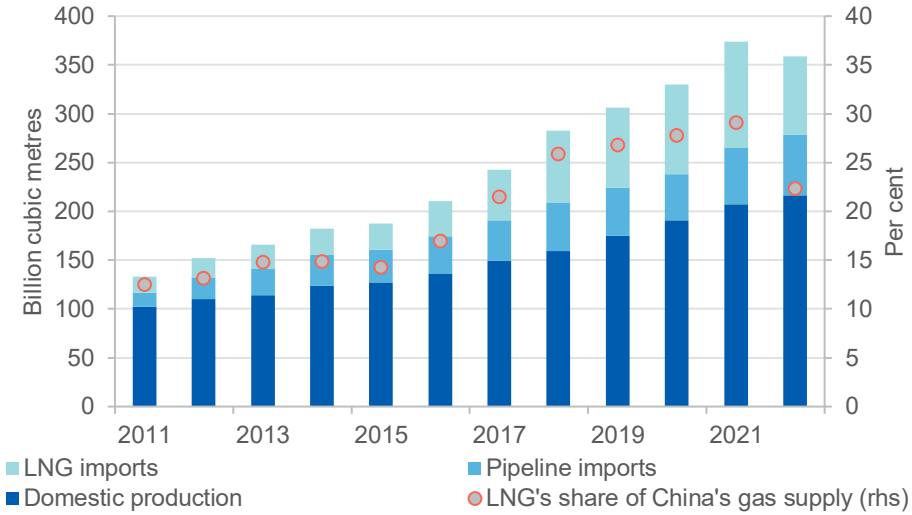
China's LNG imports remain subdued, but expected to recover

In 2022, Australia exported an estimated 22 Mt of LNG to China, worth approximately A$19 billion. China is the second largest destination for Australian LNG (by volume and value) and imported 5.2 Mt of LNG in the March 2023 quarter alone. Australia remains China's largest source of LNG, accounting for one-third of its LNG imports since 2020.

Since the start of 2022, China's total LNG imports have fallen significantly (26% year-on-year to 59 Mt), which has weighed on Australian imports, which have fallen by 10 Mt year-on-year (Figure 7.7). While Australia's total LNG exports to China have fallen, this has not impacted aggregate Australian exports, which were largely redirected to Japan, Korea, Taiwan and ASEAN.

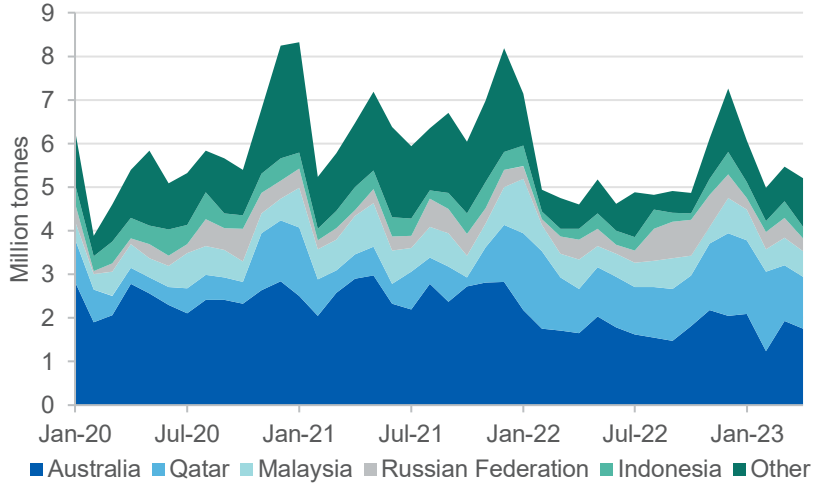
High prices, COVID-19 lockdowns and cheaper domestic thermal coal substitutes have driven China's lower gas consumption (see *Thermal Coal* chapter), with the largest declines concentrated in the electricity sector.

Figure 7.6: Chinese gas supply by source



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

Figure 7.7: Monthly Chinese LNG imports by volume and source



Source: Kpler (2023)

Meanwhile, China's gas supply from domestic production and pipeline imports all recorded steady growth in 2022 (Figure 7.6). China is not wholly reliant on LNG for its gas needs unlike other Asian economies. China has the world's seventh largest proven gas reserves, and the largest unconventional reserves after the US. China produces over 200 billion cubic meters of gas per annum (Figure 7.6), which is more than Australia's total gas production.

However, China's domestic gas output has struggled to keep pace with its gas demand, despite its abundant resources. Supply has been restricted due to the complexity of China's gas basins and the lack of technology and expertise in its largely state-owned sector. To cover the shortfall, China has had to import significant volumes of LNG.

China's imports are expected to gradually recover to pre-2022 levels (80Mt) by 2025 due to rising demand in the power generation sector.

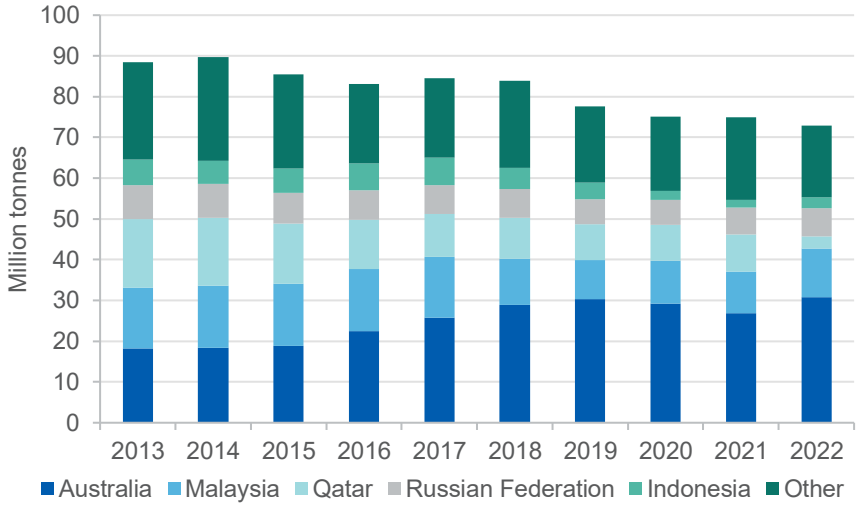
Japan's LNG imports to fall as Japan increases nuclear power generation

In 2022, Australia exported an estimated 31 Mt of LNG to Japan, worth approximately A$34 billion. Japan is the largest destination for Australian LNG (by volume and value) and imported 7.8 Mt in the March 2023 quarter alone. Australia is also Japan's largest source of LNG, accounting for two-fifths of its LNG imports since 2020 (Figure 7.8).

Japan is heavily reliant on LNG for its energy security. Japan obtains almost all its gas via LNG imports — approximately two-thirds of which is consumed in the power generation sector. Japan became increasingly reliant on LNG following the Fukushima accident in 2011, which lead to widespread closures of its nuclear generation fleet. In turn this saw an increase in LNG imports, and from Australia, as Japan embraced Gas-powered generation.

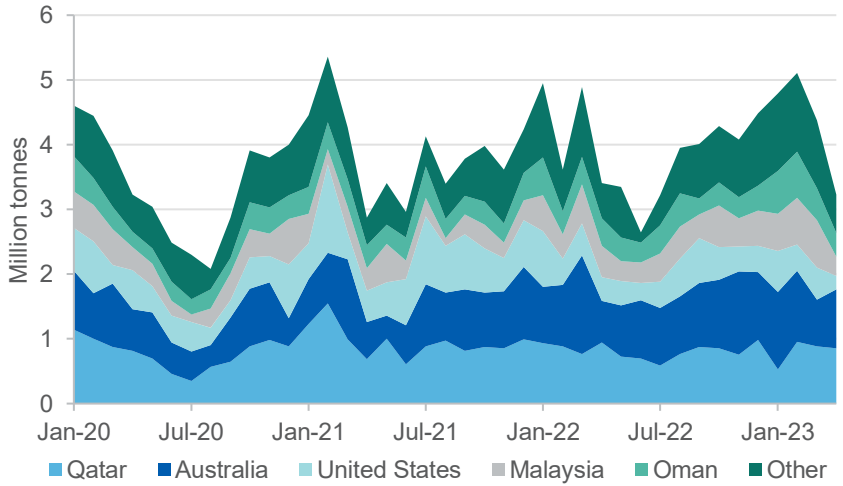
But high LNG prices have prompted Japan to reconsider its dependence on gas-powered generation. Meanwhile, public opinion is also becoming more supportive of nuclear technology. Some 58% of the Japanese public supports the restart of nuclear power, which could lay the foundation for further nuclear buildouts.

Figure 7.8: Annual Japanese LNG Imports by volume and source



Source: Kpler (2023)

Figure 7.9: Monthly South Korean LNG imports by volume and source



Source: Kpler (2023)

Japan's LNG imports are forecast to fall from 73 Mt in 2023 to 65 Mt in 2025, as its Ministry of Economy, Trade and Industry (METI) reduces the share of electricity generation from gas by reopening seven nuclear power plants. Under METI's proposal, the share of total generation from gas would fall from 38% in 2022 to 27% by 2030, while the share of nuclear power would lift from 6% to 22%.

South Korean imports likely to soften as nuclear power generation rises

In 2022, Australia exported 12 Mt of LNG to South Korea, worth an estimated A$19 billion. South Korea is the third largest destination for Australian LNG (by volume and value) and imported 3Mt in the March 2023 quarter. Australia is South Korea's largest source of LNG, accounting for roughly one-quarter of the nation's total LNG supply since 2020.

Australia's LNG revenues from sales to South Korea appear to have been bolstered by a large volume of spot sales in the second half 2022. According to customs data, the surge saw average Korean import prices from Australia rise to over US$25/MMBtu.

South Korean LNG demand is forecast to fall to 44 Mt by 2025 as new nuclear power plants ramp up electricity production. The South Korean government has plans to increase the share of nuclear generation in the energy sector to mitigate the impact of high energy prices on the country's trade deficit (see *Uranium* chapter). South Korea is currently highly dependent on LNG for its energy security. South Korea sources all of its gas from LNG imports, 55% of which is consumed to generate electricity. Of the remainder, 16% is used by the industrial sector (typically as a chemical feedstock or source of industrial heat), and 26% is used in the commercial and residential sectors.

ASEAN LNG demand rises fast over the outlook period

In 2022, Australia exported an estimated 8.2 Mt of LNG to ASEAN countries worth approximately A$6.6 billion. Thailand, Singapore, and Malaysia are the region's primary importers of LNG (Figure 7.10). Australia is a critical supplier of LNG to ASEAN, with half of the blocs LNG imports coming from Australia since 2020 (Figure 7.11).

ASEAN is forecast to be the fastest growing market for LNG after Europe out to 2025. LNG import demand is projected to rise by 47%, from 22 Mt in 2023 to 33 Mt in 2025.

Thailand and Singapore have historically relied on pipeline imports from Myanmar and Indonesia, respectively. However, the gas fields fuelling these pipelines are reaching the end of their economic life. Similarly, Malaysian pipeline imports from Indonesia are forecast to end after 2026 as Indonesia's upstream gas reserves in Sumatra also deplete.

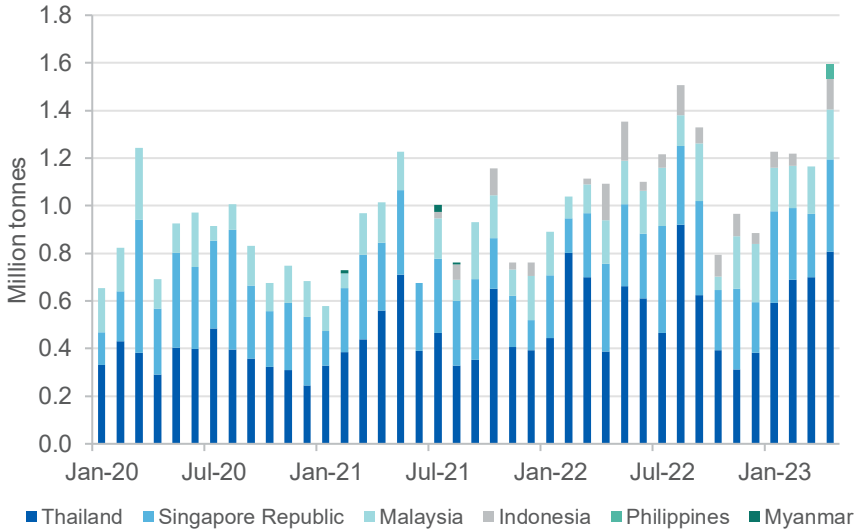
Indonesia, meanwhile, is now considering limiting LNG exports to ensure enough gas to satisfy the countries domestic needs. While nothing has been finalized at the time of writing, the move could create additional headaches for the region which is struggling secure new sources of contracted supply.

Demand for greater gas-powered generation sector will also support higher LNG imports, alongside the commissioning of new LNG import terminals in Vietnam and the Philippines.

Taiwan's imports slowly increasing

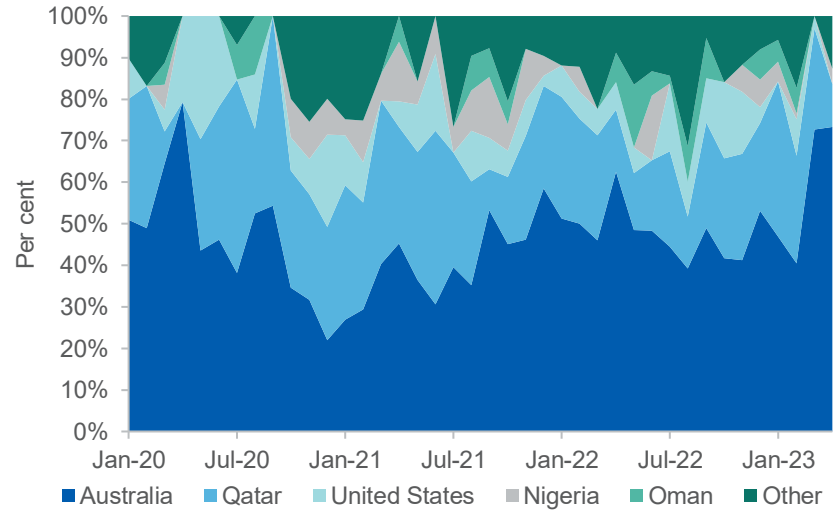
Australia is Taiwan's largest supplier of LNG and Taiwan is Australia's fourth largest LNG export market. Australia supplies one-third of Taiwan's entire LNG supply. In 2022, Australia exported an estimated 7.6 Mt of LNG to Taiwan, worth approximately A$12 billion. All of Taiwan's gas is imported via LNG facilities, and most of this gas is used to generate electricity in the power sector. Taiwan's LNG imports are expected to stabilize at 20 Mt in 2023 before rising to 23 Mt in 2025 as new gas-fired generators come online.

Figure 7.10: ASEAN LNG imports by destination, 2020–23



Source: Kpler (2023)

Figure 7.11: Monthly ASEAN LNG imports by source, 2020–23



Source: Kpler (2023)

Steady demand growth in South Asia

Australia exports only a marginal amount of LNG to South Asia (India, Pakistan, and Bangladesh), with the region sourcing most of its imports from the Persian Gulf. South Asian imports fell 16% to 31 Mt in 2022, amidst high and volatile spot prices. Over the outlook period, rising gas demand in the power sector is forecast to lift the region's LNG demand from 31 Mt to 40 Mt by 2025.

After ASEAN and Europe, South Asia is the only region forecast to experience growing LNG demand until 2025. Pakistan and Bangladesh will need to use LNG imports to offset falling domestic gas output and service growing demand in the power generation sector and industry. While Indian gas demand will be likely be met by higher coalbed methane production.

7.4 World exports

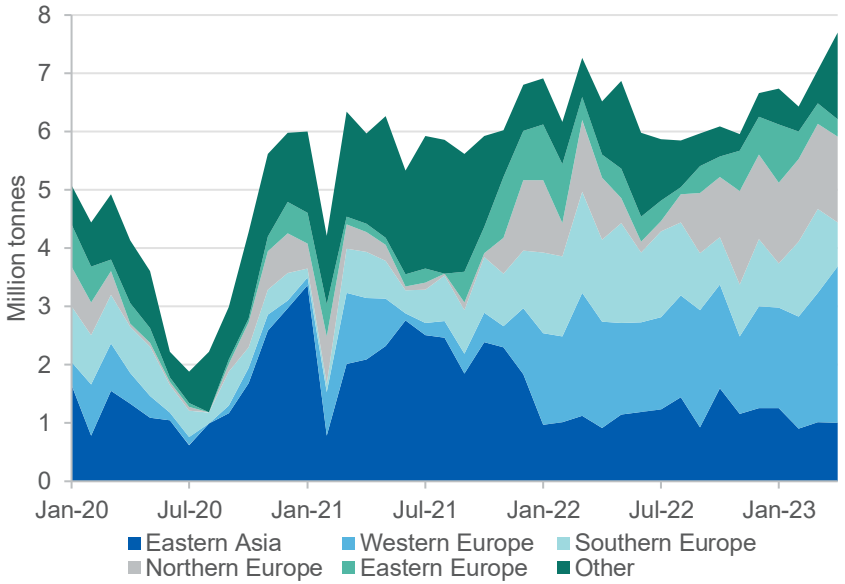
US to become largest LNG exporter as European imports rise

The United States is Australia's largest competitor in the global LNG market and is set to overtake Australia and Qatar as the world's largest LNG producer in 2023. The United States is undergoing an LNG investment boom which has seen its output rise by more than 50% per annum between 2018 and 2021, with exports reaching 74 Mt in 2022 (compared to exports from Australia of 82 Mt).

US LNG exports rose to 20 Mt in the March 2023 quarter after the Freeport LNG facility returned to full production. Production from this facility, the US's largest, had been halted since June 2022 after a fire occurred on a pipeline connecting its LNG storage tanks to its loading dock.

Despite the operational disruptions, US LNG has been critical to Europe's effort to replace lost Russian pipeline gas (Figure 7.12). US LNG exports to Europe increased by over 120% year on year in 2022, rising from 24 Mt to 53 Mt per annum.

Figure 7.12: Monthly US LNG exports by destination, 2020–23



Source: US Energy Information Agency (2023)

US exports will continue to grow over the outlook period. US LNG exports are forecast to reach 86 Mt in 2023 as Freeport LNG and a newly commissioned LNG facility at Calcasieu Pass come online. Additionally, three more LNG facilities are under construction and are expected to commence operation over the outlook period. These facilities include the 15 Mt per annum (Mtpa) Golden Pass facility in Texas, the 18 Mtpa Plaquemines' LNG facility in Louisiana and a 10 Mtpa Corpus Christi Liquefaction facility in Texas. These additional facilities are forecast to boost US LNG exports to 110 Mtpa by 2025.

The US's LNG capacity could double beyond 2025. Eight other proposed US facilities are targeting a final investment decision over the outlook period. The eight proposed facilities have completed front-end engineering design and have a combined nameplate capacity of over 100 Mt.

Russian gas stranded and unlikely to be redirected during outlook period

Russia has historically been the world's largest global supplier of natural gas, but a large portion of its gas is now stranded. After Russia invaded Ukraine in 2022, the country began to systematically repudiate its contractual obligations to supply Europe with pipeline natural gas (Figure 7.13).

In 2022, Russian pipeline gas exports to Europe more than halved, falling from 96 Mt of LNG equivalent gas in 2021 to 39 Mt LNG equivalent. In the March quarter 2023, Russian pipeline exports remained at their all-time low of 2 Mt of LNG equivalent gas per month. In June 2023, Ukrainian Energy Minister, German Galushchenko, warned that the remaining flows transiting Ukraine could be suspended by 2024, this would bring Russia's remaining Russian pipeline exports to Europe (ex-Turkiye) to zero.

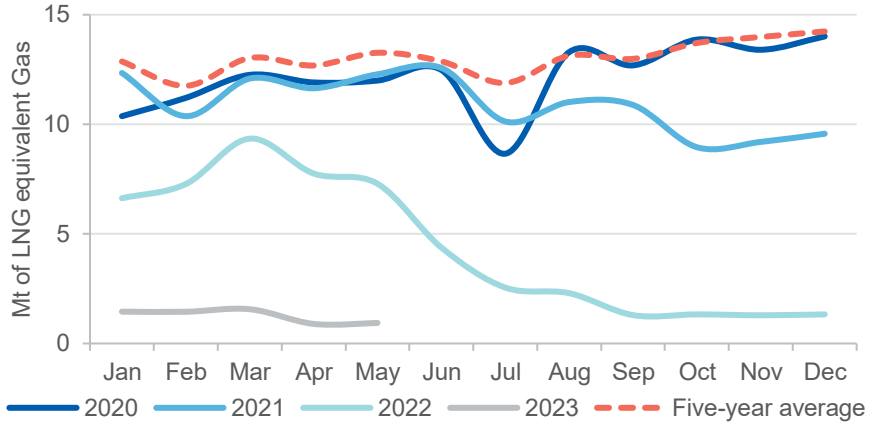
Russia is unable to redirect these volumes elsewhere, due to capacity constraints at its existing LNG facilities and the lack of pipeline connections to alternative markets. Russian LNG export volumes have remained stable at 3 Mt per month since the invasion; and there has been no material change in the destination of Russian exports (Figure 7.14).

Russia only has two LNG terminals, Yamal LNG, which supplies Europe from the Barents Sea, and Sakhalin LNG, which supplies Asia from Russia's far eastern coastline.

Russia's LNG exports are forecast to be flat over the outlook period. However, this forecast comes with a high degree of uncertainty. Sanctions on Russia may undermine the country's ability to continue operating its existing facilities, as a lack of parts/equipment raises the likelihood of unplanned outages.

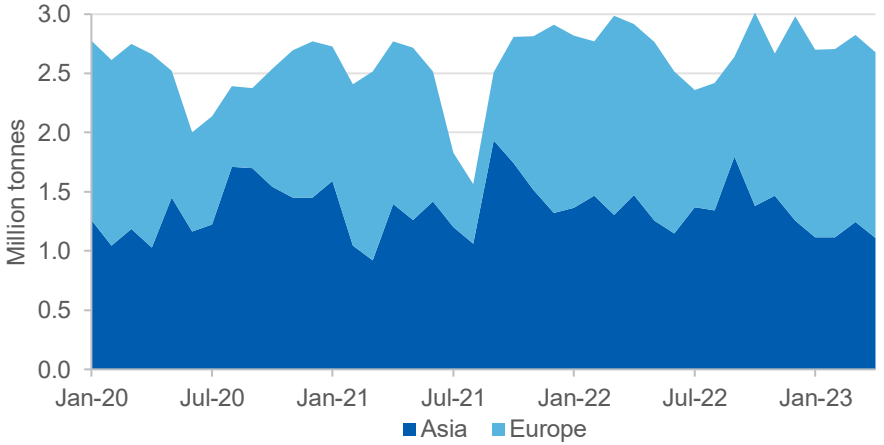
According to current projections Russia is expected to commence construction of the Power of Siberia 2 pipeline in 2024. When the pipeline is completed after 2029, it will connect Russia's Western Siberian gas fields with the Chinese market. But even if Russia can build the pipeline, it can only transport one-third of the volumes (around 50 bcm) previously exported to Europe.

Figure 7.13: Monthly Russian Pipeline Exports to Europe, 2021–23



Notes: Includes all Russian pipeline exports to Europe ex-Turkiye. 5-year intervals were estimated between 2016 and 2020. Assumes a conversion rate of 1 bcm to 1.6 Mt of LNG
Source: ENTSOG Transparency Platform (2022); Department of Industry, Science and Resources (2023)

Figure 7.14: Monthly 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)

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 to 108 Mt in 2026 and 127 Mt in 2028.

The demand for the new LNG 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.

7.5 Prices

Prices retreat after mild winter and high storage volumes

Global LNG prices fell sharply in the March and June quarter, due to record warm winter temperatures which reduced the drawdown of global gas storage inventories. Large storage inventories have eased buyer concerns of an immediate gas shortage, translating into lower buyer bids for uncontracted LNG cargoes on global spot markets.

Between December 2022 and May 2023, Asian LNG prices fell 66% from US$30/MMBtu to US$10/MMBtu, respectively (Figure 7.15). Importantly, the lower prices appear to have induced a demand response from Asian buyers previously priced out of the market. The demand response suggests that prices may have bottomed out, and that further offers below US$10 will be taken up.

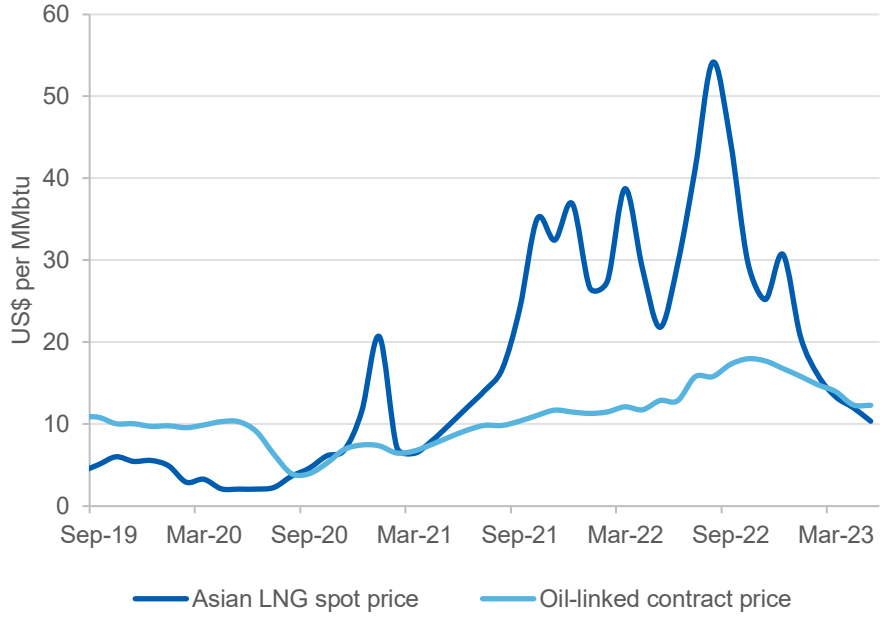
Asian LNG spot prices to remain volatile until 2025

Prices are forecast to rise to US$12/MMBtu in the September quarter 2023 as European refills its storage inventories to capacity (Figure 7.16). But once European storage inventories are full, the bloc will need to scale back its LNG imports until the start of the winter heating season in the December quarter, which could temporarily ease pressure on Asian prices.

The outlook for prices beyond the September quarter remains highly uncertain. Prices in the December quarter will be largely determined by the severity of the next Northern Hemisphere winter and its impact on gas demand for space heating. Higher gas demand over the Northern Hemisphere winter will influence the level of European LNG imports needed to refill its inventories over the 2024 calendar year, which could increase competition for spot LNG cargoes.

Our base case is for LNG prices to reach US$18/MMBtu over the December quarter 2023. Prices are expected to average US$15/MMBtu in 2024 (assuming normal Northern Hemisphere winter conditions) before easing in 2025 to US$13/MMBtu as new US facilities start coming online (see *US* section).

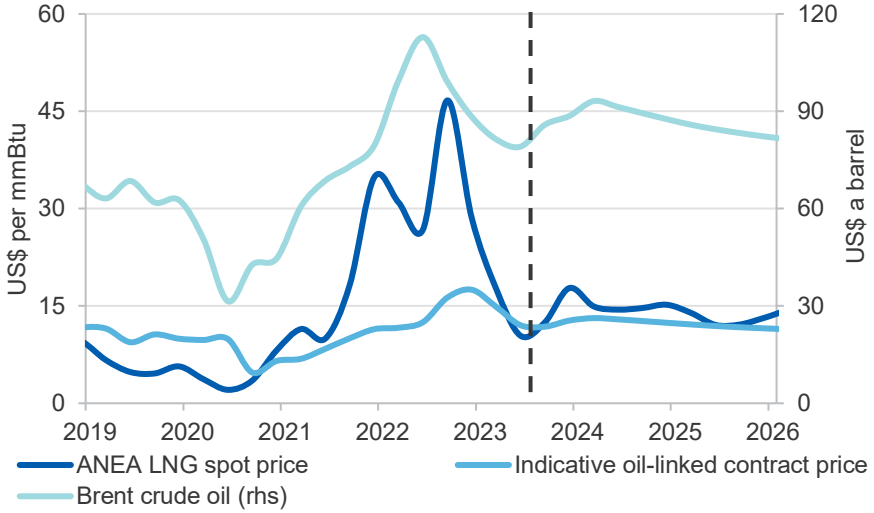
Figure 7.15: Global LNG and oil prices, 2013–23



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

Source: Argus (2023); Bloomberg (2023)

Figure 7.16: LNG spot and contract prices, 2020–25



Source: Argus (2023); 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 80–90% of Australian LNG exports are sold under long-term contracts that link the price of LNG to the Japanese Customs Crude (JCC) oil price (with a three to six-month lag, depending on contractual arrangements). As a result, oil-linked LNG contract prices are forecast to average US$13/MMBtu between 2023 and 2025 based on an oil price of US$86 per barrel.

Oil-linked contract prices have been selling at a discount to spot prices since 2021. However, as of May, this trend reversed, with the OCE's indicative oil-linked contract price achieving a premium 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. The current oil-price premium may undermine this incentive, which could drag output down over June and September quarters (See *Australia* section).

7.6 Australia

Australian LNG exports set record pace

Australia's LNG export volumes set a record in 2022, reaching 81 Mt (up 0.5% from 2021). Exports held steady at 21 Mt in the March 2023 quarter, up 4.6% year-on-year. The result was driven by Wheatstone, Pluto, APLNG and Gorgon LNG, which are estimated to have operated above nameplate capacity over the quarter. The result was enough to offset lower output from QCLNG, which experienced unplanned outages, and Darwin LNG, which is running out of feed gas from the Bayu-Undan field.

Export volumes are forecast to rise to 82 Mt in 2023, driven by higher output from Prelude FLNG. Prelude has experienced several unplanned outages that have weighed heavily on its output over the last two years. However, risks to this forecast are skewed to the downside, given recent falls in LNG spot prices relative to oil-linked prices.

Buyers have some flexibility in the volumes of LNG they purchase under long-term oil-linked contracts, so lower spot prices in the coming September quarter (relative to oil prices) may reduce the incentive for buyers to call on contracted volumes from Australian LNG facilities.

LNG export volumes to ease as facilities backfill operations

Australian LNG export volumes are forecast to fall from 82 Mt to 79 Mt in 2024–25 (Figure 7.20). Volumes are expected to drop off as several LNG facilities on the north and west coast face delays in backfilling their operations with gas from new fields.

The output from the North West Shelf (NWS) is forecast to decline in 2024 as current fields continue to decline. While the gas from the Browse joint venture will eventually backfill the project, the first gas is not expected until after 2030. Tolling arrangements will allow third parties' gas to be processed through the NWS facilities in the meantime (mainly from the Waitsia and Pluto JV), but these upstream fields will only arrest rather than offset the decline in the NWS' LNG output over the outlook period.

Lower output from Darwin LNG will also contribute to falling exports. Darwin LNGs upstream reserves in the Bayu-Undan field will deplete before gas from the Barossa field comes online, leading to a forecast drop in facilities' output over the outlook period.

However, several developments will help counterbalance these trends. Woodside is constructing a second train at its Pluto LNG facility in WA, which will process gas from the Scarborough field. This facility is the only new LNG train currently under construction in Australia, and is expected to increase Australia's nominal LNG capacity by ~4 Mt. At the time of writing, Pluto's second train was 30% complete and the Scarborough field is expected to come online in 2027.

INPEX will also be expanding the capacity of Ichthys LNG from 8.9 Mt to 9.3 Mt by end 2023. This will be achieved by upgrading liquefaction systems to 'debottleneck' the facility. INPEX has also announced the construction of the third train at their facility beyond the outlook period, which could boost Australia's LNG capacity by 4 Mt.

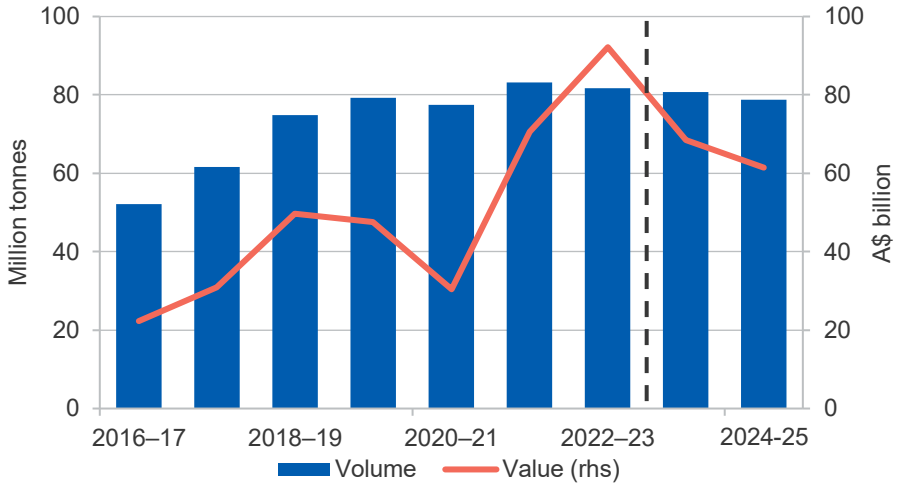
Australia's LNG earnings to fall from current record levels

Australian LNG export earnings in the March quarter 2023 hit A$23 billion, up 25% year-on-year, which marks the highest March quarterly earnings on record. Higher earnings have been supported by record-high oil and LNG spot price, which have now passed their peaks. Export earnings are still forecast to reach A$92 billion in 2022–23, driven by elevated spot LNG and oil price-linked contract prices in the second half of 2022.

But Australia's earnings from LNG are forecast to decline considerably after 2022–23, as global energy markets reorganise further in response to the fallout from Russia's invasion of Ukraine. Earnings are now forecast to fall to A$68 billion in 2023–24 and then ease to A$60 billion in 2024–25 due to lower commodity prices (Figure 7.17).

Key uncertainties for the forecast include seasonal fluctuations in demand that could cause spot sale earnings to rise in one financial year relative to another. As such, risks to the forecast are skewed to the upside if LNG markets tighten after the 2023–24 Northern Hemisphere winter.

Figure 7.17: 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)

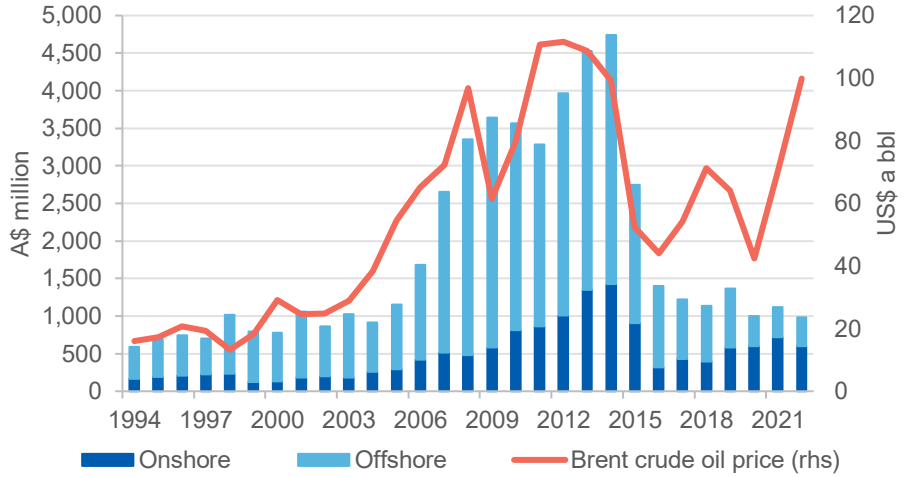
Exploration expenditure remains low despite high energy prices

Exploration expenditure has remained low in Australia despite record-high energy prices. Exploration expenditure has historically tracked oil prices since the 1990s. However, the relationship has begun to break down since 2016.

As LNG production and LNG prices reached record levels in 2022, expenditure on petroleum exploration reached its lowest level since 2004. Total onshore and offshore petroleum exploration expenditure reached only A$971 million in 2022 (Figure 7.18). The low spending primarily reflected lower offshore expenditure, which fell to only A$379 million in 2022.

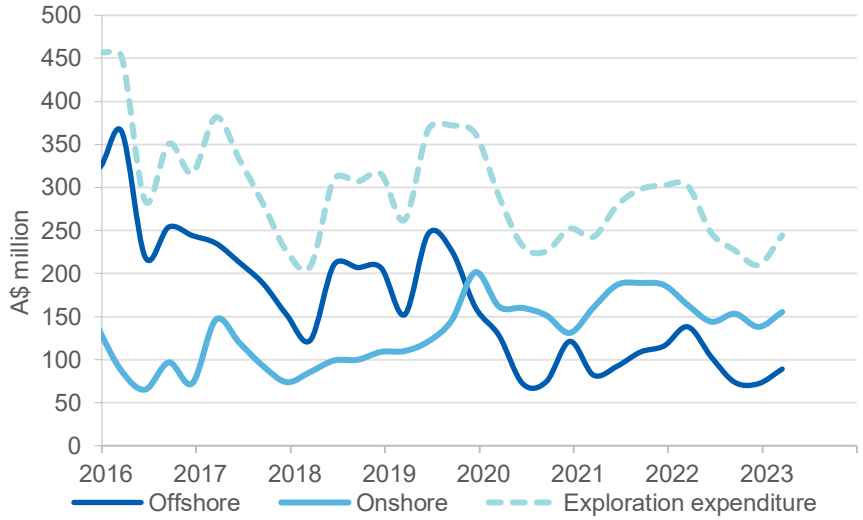
In the March 2023 quarter, exploration expenditure fell 19% year-on-year to $244 million in seasonally adjusted terms. The decline was similarly driven by falling offshore expenditure, which fell 35% year-on-year to A$89 million. Onshore exploration experienced a 5% year-on-year decline, but it remains relatively robust by historical standards (Figure 7.19).

Figure 7.18: Petroleum Exploration Expenditure and oil prices



Source: Australian Bureau of Statistics (2023) Mineral and Petroleum Exploration, 8412.0; Bloomberg (2023);

Figure 7.19: Quarterly Petroleum Exploration Expenditure



Note: Quarterly figures have been seasonally adjusted.
Source: Australian Bureau of Statistics (2023) Mineral and Petroleum Exploration, 8412.0;

Revisions to the outlook

Australian LNG export earnings for 2023–24 have been revised down by A$6 billion, on account of lower assumed prices for spot LNG and oil. LNG export earnings for 2024–25 have been revised down by A$2 billion.

Table 7.1: Gas outlook

World	Unit	2022	2023 f	2024 f	2025 f	Annual Percentage Change 2023 f	2024 f	2025 f
JCC oil price[a]								
– nominal	US$/bbl	102.7	87.9	86.2	79.3	-14	-2.0	-8
– real[h]	US$/bbl	107.3	87.9	84.2	75.9	-18	-4.2	-10
Asian LNG spot price								
– nominal	US$/MMbtu	33.2	14.4	14.8	12.8	-57	3	-13
– real[h]	US$/MMbtu	34.7	14.4	14.5	12.3	-59	1	-15
LNG trade	Mt c	393.8	414.6	430.3	445.2	5	3.8	3.5
Gas production	Bcm	4,093	4,108	4,185	4,266	0.4	1.9	1.9
Gas consumption	Bcm	4,078	4,123	4,187	4,276	1.1	1.6	2.1
Australia	**Unit**	**2021–22**	**2022–23 s**	**2023–24 f**	**2024–25 f**	**2021–22 s**	**2022–23 f**	**2023–24 f**
Production[d]	Bcm	159.8	159.8	159.0	160.0	0.0	-0.5	0.6
– Eastern market	Bcm	59.5	57.5	58.3	54.3	-3.3	1.3	-6.9
– Western market	Bcm	85.6	91.4	89.2	85.7	6.7	-2.5	-3.9
– Northern market [k]	Bcm	16.8	15.0	16.3	17.3	-10.8	8.8	6.1
LNG export volume	Mt c	83.2	81.7	80.8	78.7	-1.9	-1.1	-2.5
– nominal value	A$m	70,571	92,172	67,738	59,989	30.5	-26.5	-11.4
– real value[e]	A$m	75,580	92,172	64,917	55,723	21.9	-29.6	-14.2
LNG export unit value[g]								
– nominal value	A$/GJ	16.1	21.4	16.4	14.5	33.1	-25.7	-9.1
– real value[e]	A$/GJ	17.2	21.4	15.7	13.5	24.3	-28.8	-11.9
– nominal value	US$/MMBtu	12.3	15.2	12.2	11.4	23.8	-22.2	-4.1
– real value[h]	US$/MMBtu	13.2	15.2	11.7	10.6	15.6	-25.5	-7.0

Notes: **a** JCC stands for Japan Customs-cleared Crude; **b** Production includes both sales gas and gas used in the production process (i.e., plant use) and ethane. Historical gas production data was revised in the June quarter 2017 to align with Australian Petroleum Statistics; **c** Gas production from Bayu-Undan Joint Production Development Area is not included in Australian production. Browse basin production associated with the Ichthys project is classified as Northern market; **d** 1 Mt of LNG is equivalent to approximately 1.36 bcm of gas; **e** In 2021–22 Australian dollars; **f** Forecast; **g** 1 MMBtu is equivalent to 1.055 GJ; **h** In 2022 US dollars**; r** Average annual growth between 2021 and 2027 or 2020–21 and 2026–27; **s** Estimate; **z** Projection.
Source: ABS (2022) International Trade in Goods and Services, 5368.0; Department of Industry, Science, Energy and Resources (2022); Company reports; Nexant (2022) World Gas Model.

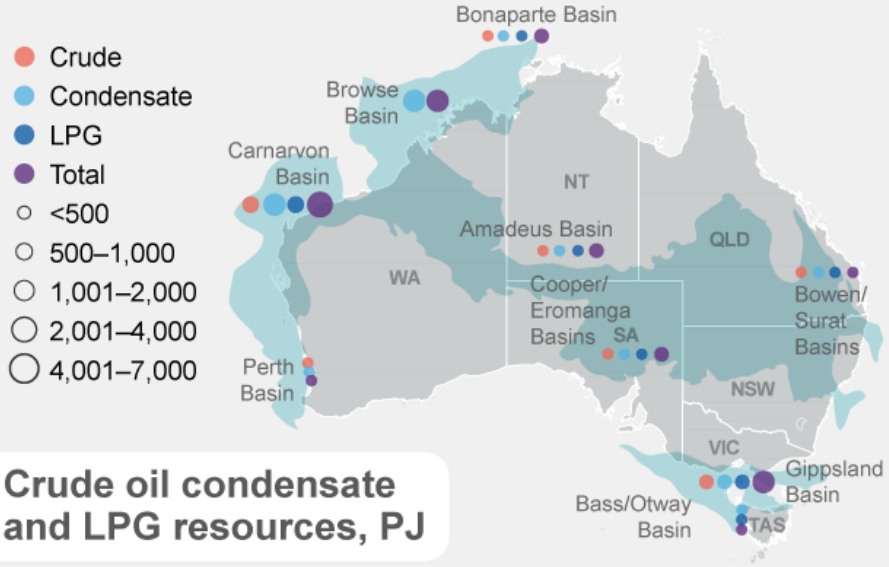
Oil

Australia's oil sector

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

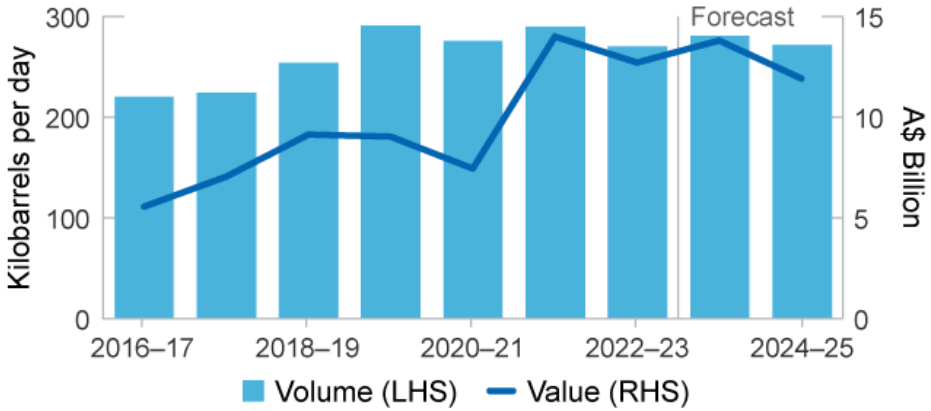
20%
crude & condensate **exported** to both Singapore and South Korea

Around 2/3
crude & condensate production from the **Carnavon basin,** offshore WA



Crude oil condensate and LPG resources, PJ

Australian oil exports



Outlook

Earnings **set a record** in 2021-22 Financial year due to high prices

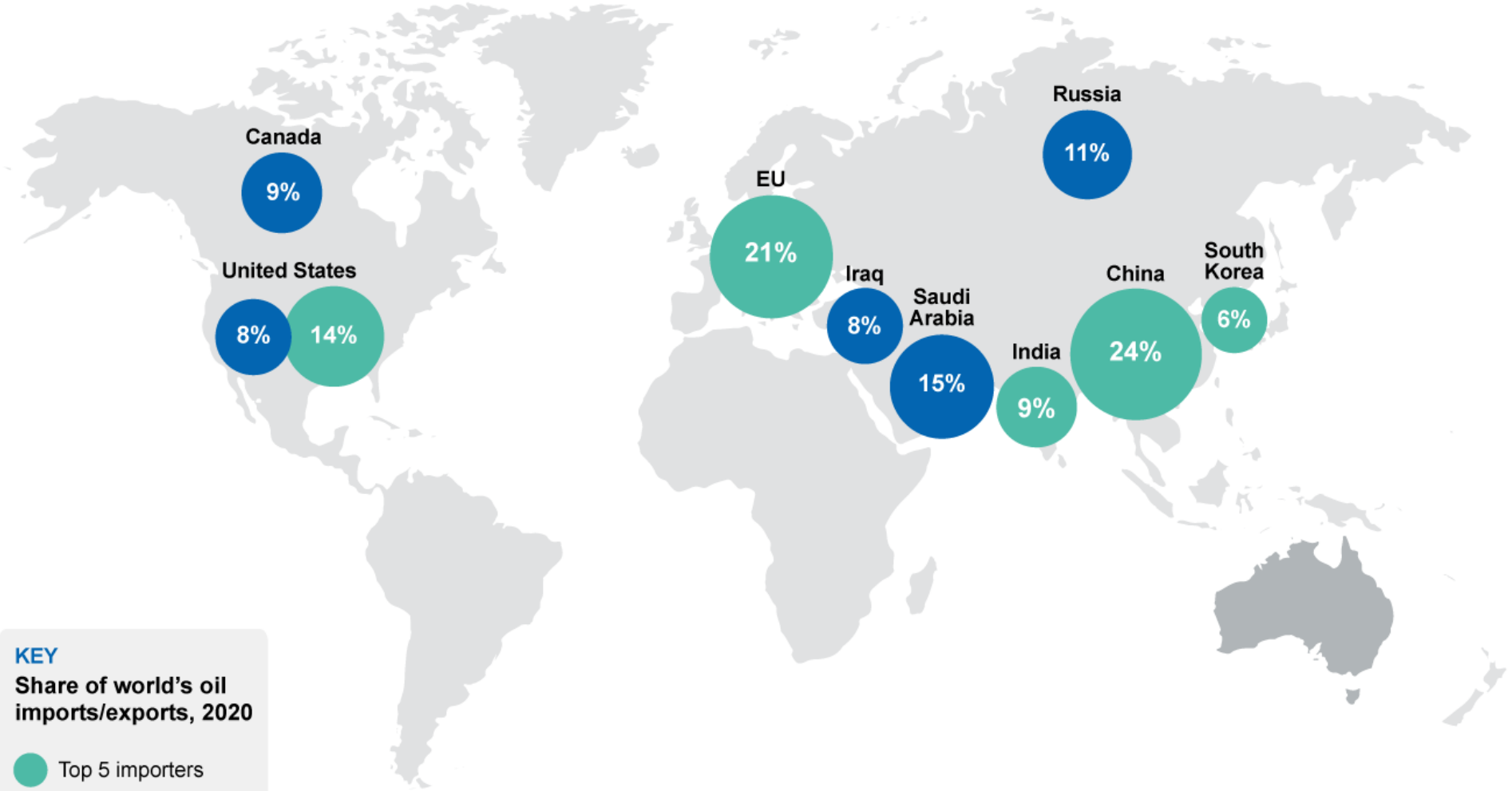
Future earnings to fall as global economic growth weakens

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

Exploration expenditure **remains subdued,** driven by weak offshore exploration activity

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 rise over H2 2023 to average US$84 a barrel over 2023, as a rebound in global transport demand drives higher oil usage. However, the price is expected to fall to around US$78 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$13.7 billion in 2023–24 as export volumes rise, before falling to A$11.7 billion in 2024–25 as output declines at the North-West Shelf.

8.2 World consumption

Recovery in consumption from the pandemic period continues

Global oil consumption is estimated to have risen by 1.1% year-on-year in the March quarter 2023 as the recovery from the pandemic period continues.

The end of COVID lockdowns saw Chinese demand rise by 3.2% year-on-year in the March quarter. China's post pandemic rebound has seen strong pent-up demand for services, resulting in stronger transport demand for oil. However, China exited from the pandemic period with a relatively low level of excess savings, due to more limited government support to households and businesses during the lockdowns. Weak domestic goods demand and a weak global macroeconomic environment have resulted in subdued industrial activity, and the recovery in oil demand for industrial use has been more modest.

Demand from OECD countries fell 0.7% year-on-year in the March quarter, where interest rate rises and concerns over bank failures saw a further tightening in monetary conditions. This follows a 1.9% year-on-year fall in the December quarter 2022.

The rapid adoption of EVs and weakening macroeconomic environment drove a fall in demand for petrol and diesel, down by 3.0% year-on-year.

With an energy crisis averted by one of the warmest European winters on record in the December quarter 2022, naphtha (typically used an as industrial solvent) demand rose by 8.2% quarter-on-quarter from very weak levels in the December quarter 2022 to be down 5.5% year-on-year.

Amongst OECD countries, air travel continued to recover from the pandemic. Jet fuel demand continued to grew strongly in the March quarter 2023, rising by 12% year-on-year, with increased demand across most countries (but particularly in Europe).

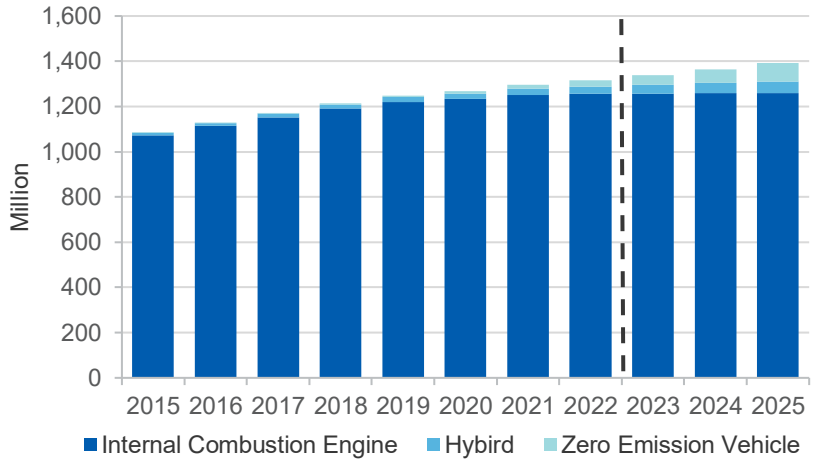
Jet fuel to support oil usage as electric vehicles displace some demand

Global oil consumption is forecast to rise by 2.2% to 102.0 million barrels per day in 2023, exceeding the pre-pandemic levels recorded in 2019. Consumption growth is expected to be underpinned by a continued demand recovery in China and the ongoing recovery of global air travel. World oil consumption growth is then expected to slow to an average of 0.9% per year in 2024 and 2025. The demand recovery from the pandemic period will taper off, and the gradual replacement of internal combustion engine vehicles (ICEs) with electric vehicles (EV) will cut oil demand.

EVs are rapidly gaining market share in the global passenger vehicle market (see *Lithium* chapter) as battery technologies improve, supported by policies such as the US Inflation Reduction Act. 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), compared to the average of 3.3% growth per year in the four years before the pandemic. Improved fuel efficiency of 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 International Energy Agency (IEA) estimating consumption

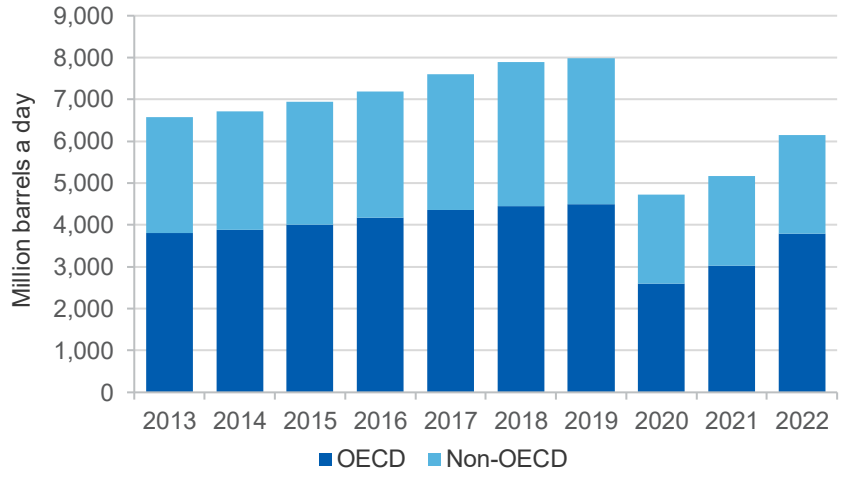
Figure 8.1: Global passenger vehicle stocks



Note: 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)

in 2022 to be 2.5% lower than in 2019 and forecast a further 1.2% fall in 2023.

The growing demand for jet fuel will support world oil consumption. The IEA estimates global jet fuel consumption in 2022 was around 30% lower than in 2019 (Figure 8.2). While the lockdowns in China during the year were a major factor, OECD jet fuel consumption in 2022 was also lower than in 2019 — by about 15%. The International Air Transport Association reported that, globally, kilometres travelled by paying passengers grew by 52% year-on-year in the March quarter 2023, reaching 88% of March 2019 levels. This suggests that there remains room for catch-up growth, and passenger volumes can be expected to further rebound over 2023. Global jet fuel demand growth is then expected to converge on the pre-pandemic trend over the outlook period, when (between 2009 and 2019) consumption grew an average of 3.6% per year.

In contrast to road transport, low-carbon substitutes such as 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. Instead, energy-dense fuels such as synthetic hydrocarbons remain the more likely alternative. Still, the IEA's net zero scenario in the *Energy Technology Perspectives 2023* found that synthetic fuels could only meet 25% of the sector's final energy consumption by 2050. Synthetic fuels could also displace naphtha, but the level of displacement is expected to be negligible over the outlook period.

8.3 World production

US and Latin American crude output to rise, offsetting OPEC+ cutbacks

World oil production is estimated to have risen 0.3% in the March quarter 2023 (up 2.7% year-on-year), driven mainly by North American producers. Production from OPEC members and Latin American producers was unchanged in the quarter but rose year-on-year.

World oil output is forecast to grow by 2.5% in 2023. Higher shale oil production in the US will be driving much of the output growth. Having kept production targets steady since November 2022, in early April OPEC+

announced that production targets would be reduced by 1.15 million barrels a day, and in early May Saudi Arabia announced further voluntary production cuts of 1 million barrels a day for July.

Forecasts from the US Energy Information Administration suggests US crude production could grow by about 3% per year over 2023 and 2024 — an increase of around 300 kilobarrels per day (kb/d) per year. This growth is much lower than in the peak years of the shale oil revolution, when US crude oil production grew by around 800 kb/d per year (2012-2019), as investors remain cautious about potential investment in new oil capacity.

Latin American countries are expected to add to global supply over the outlook period. The IEA is expecting Brazil to add around 300 kb/d to global crude supply in 2023, with Brazil's state-owned oil company Petrobras expected to deploy five new offshore platforms this year. New supply is also expected from Guyana in South America. 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.

Russian sanctions reorientate global oil trade

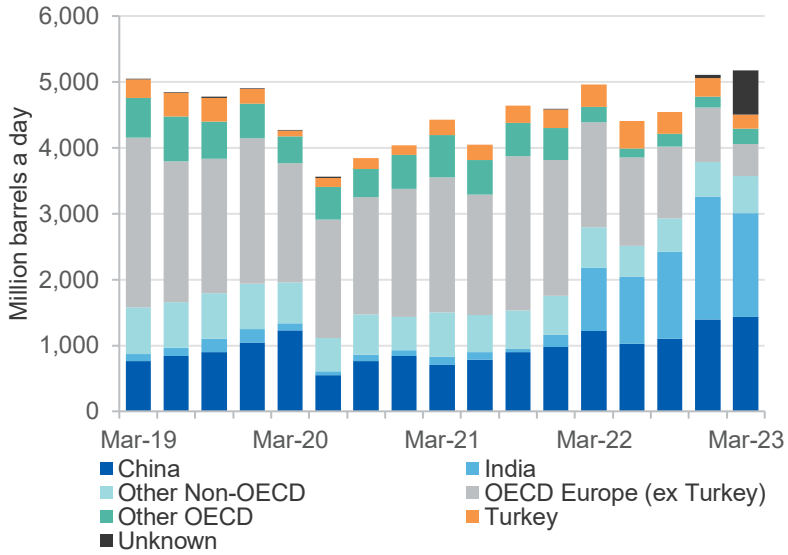
Concerns over the loss of Russian oil supply have loomed over global markets since the Russian invasion of Ukraine. The G7, the EU and Australia imposed price caps on Russian crude and refined products from 5 December 2022 and 5 February 2023, respectively, by preventing the sale of insurance for Russian oil cargoes if they are sold at a price above the cap. In response to the price caps, Russia announced in February 2023 that it would cut output by 500 kb/d, or around 5% of Russian production.

However, Russian seaborne oil exports have not yet shown substantial falls according to shipping data. Since the price caps took effect, Russian crude exports have been diverted away from OECD countries largely to India, but also to some extent China (Figure 8.3). Russia's refined exports were diverted to Turkey, the Middle East, Africa, and other countries; characterised either as geographically close to Europe or as large oil producers who can easily blend and resell Russian products to any customer.

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 – raising risks of environmental damage. 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.

If Russian production does fall, it would be partly due to the withdrawal of Western companies and bans on technology exports, which is expected to erode the productivity of Russian oil fields and delay new projects.

Figure 8.3: Russian seaborne crude and condensate exports



Note: Export volumes and destinations are estimated using vessel tracking data, and may deviate from customs data. Vessels on sea without a known destination is categorised as "Unknown".

Source: Kpler (2023)

8.4 Prices

Prices falling in the weakening macroeconomic environment

H2 2022 saw Brent crude spot falling from an average of US$109 a barrel in July to an average of US$81 a barrel in December (Figure 8.4). The fall reflects lower demand over the period, with pandemic restrictions causing sharp falls in Chinese demand, and high energy prices and interest rates hurting industrial output and consumer spending in Europe and the US.

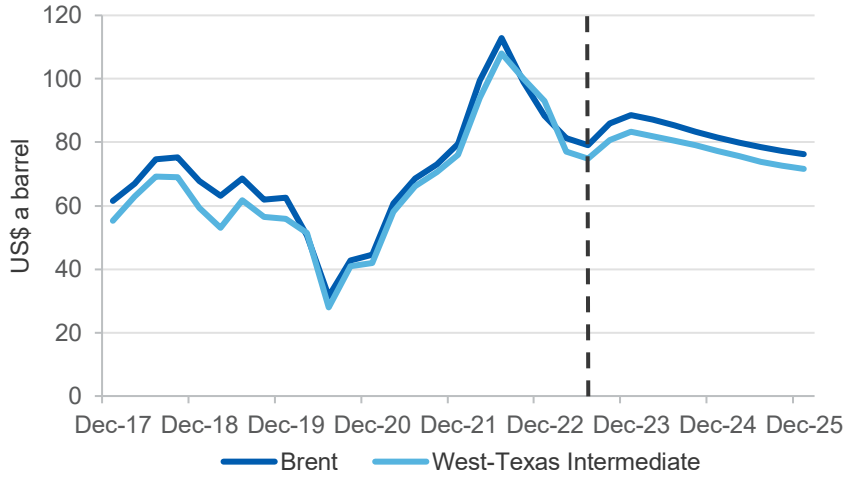
Oil prices came under pressure in H1 2023, largely due to slowing world growth. Several other factors contributed to the weaker environment, including the US debt ceiling debate, the failure of several US banks, the buyout of Credit Suisse, and rising interest rates. This was partly offset by hopes for higher demand from China re-opening, and a fall in OECD industry oil stocks in the March quarter (Figure 8.5) — following three quarters of gains. Brent crude averaged US$81 in the March quarter, unchanged from the December month average. Mid-April saw a rally to US$88 a barrel when OPEC surprised markets by cutting production targets. However, weaker than expected Chinese demand saw prices ease to a low of US$72 a barrel in early May.

Russian crude carried by ships insured by western companies has traded at deep discounts due to sanctions, with the IEA estimating that the Russian crude export price was about US$52 a barrel in the March quarter. However, as discussed, some portion of Russian crude is being sold above the price caps outside the western system.

Stronger transportation demand to push prices up in 2023

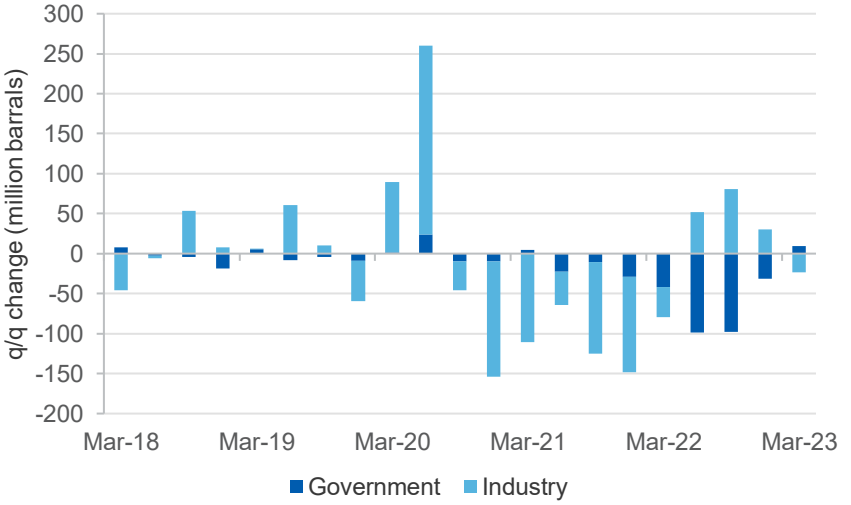
The Brent crude price is forecast to average US$84 a barrel over 2023, with prices rising marginally over the year from recovering transport demand following the pandemic period. The Brent crude is then projected to decline to US$78 a barrel by 2025 (Figure 8.4). The fall is expected to be driven by rising production outside of OPEC, particularly in North America and Latin America, combined with slowing demand growth — as the world transitions to low emission technologies.

Figure 8.4: Price outlook



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

Figure 8.5: Change in OECD Petroleum Stocks



Source: International Energy Agency (2023)

US efforts to replenish its Strategic Petroleum Reserve should lend support to oil prices. The US government has announced it will purchase 3 million barrels of crude oil for delivery in August, having previously announced a target price of about US$67-72 a barrel.

8.5 Australia

Export earnings to fall as prices decline

Australian crude oil and condensate export earnings fell 13% year-on-year to A$2.8 billion in the March quarter 2023, due to a combination of falls in condensate production and lower price. Most Australian exports over the quarter were shipped to Singapore, South Korea and China (Figure 8.6).

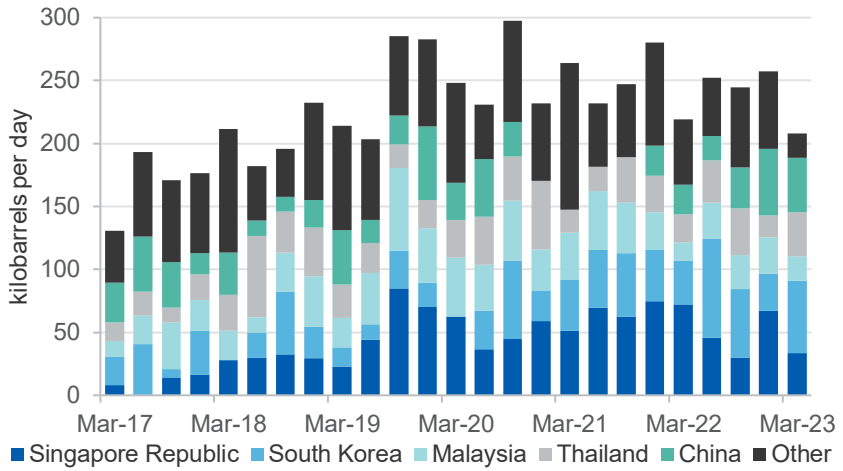
Export earnings are estimated to have fallen by 9.2% to A$12.7 billion in 2022–23 (Figure 8.7) as prices declined from very high levels seen in the wake of the Russian invasion of Ukraine. Production in H1 2023 was below expectations, impacted by disruptions such as a strike at the Prelude LNG facility. Export earnings are expected to lift to A$13.7 billion in 2023–24, as prices and production volumes recover. Exports are forecast to fall to then A$11.9 billion 2024–25, as prices fall and North-West Shelf output declines.

Delays over investment decision casts uncertainty over outlook

In the March quarter 2023, Australian crude oil and condensate output fell to 274 kb/d, down 10% year-on-year. The fall was due to temporary disruptions and is expected to recover to 301 kb/d over 2023–24, then fall to 292 kb/d in 2024–25, as North-West Shelf production declines.

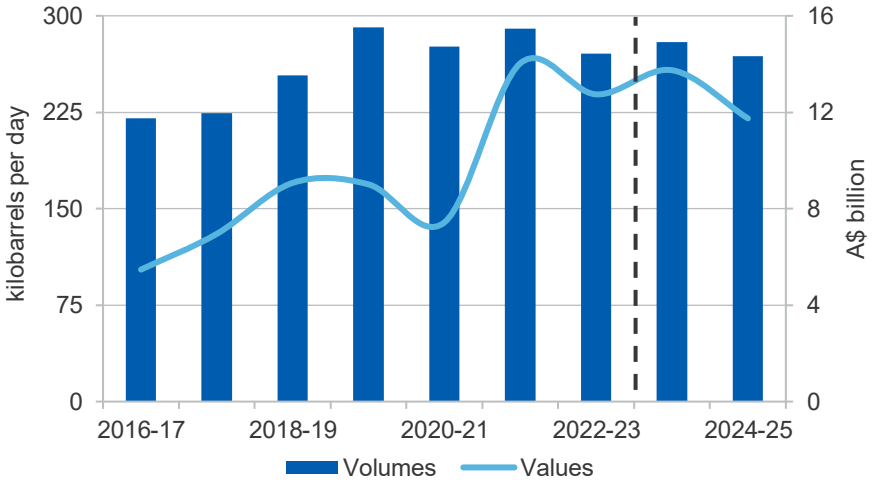
A final investment decision for the Dorado oil and gas field was expected in the second half of 2022, but the decision has been delayed to 2024, with Carnarvon Energy divesting a 10% stake in the project to Taiwan's CPC Corporation in February 2023. If the project proceeds, it could bring around 90 kb/d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

Figure 8.6: Australian oil and condensate export destination



Note: Export volumes and destinations are estimated using vessel tracking data, and may deviate from customs data.
Source: Kpler (2023)

Figure 8.7: 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 8.6% year-on-year in the March quarter 2023, driven by a 67% 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 3.1% year-on-year, and sales of diesel rising 3.5% year-on-year.

Exploration

Australia's petroleum exploration expenditure was $207 million in the March quarter 2023, down 19% year-on-year. Offshore exploration fell 33% year-on-year to $84 million, while onshore exploration spending fell by 4.4% year-on-year to $123 million.

Revisions to forecasts

Since the March 2023 *Resources and Energy Quarterly*, the forecast for Australia's crude and condensate export earnings has been revised up 13% (to $13.7 billion) in 2023–24 and 6.9% (to $11.7 billion) in 2024–25, due to higher export volume forecasts.

Table 8.1: Oil Outlook

						Percentage changes		
World	**Unit**	**2022**	**2023 [s]**	**2024[f]**	**2025[f]**	**2023[f]**	**2024[f]**	**2025[f]**
Production[a]	mb/d	100	102	103	104	2.5	0.5	1.1
Consumption[a]	mb/d	100	102	103	104	2.2	0.8	1.1
WTI crude oil price								
– nominal	US$/bbl	95	79	80	73	-16.8	1.3	-7.8
– real[b]	US$/	99	79	78	70	-20.4	-1.0	-9.7
Brent crude oil price								
– nominal	US$/bbl	100	84	84	78	-16.2	0.8	-7.6
– real[b]	US$/bbl	104	84	82	75	-19.9	-1.5	-9.5
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	289	300	289	-14.2	3.8	-3.5
Export volume[a]	kb/d	290	272	280	269	-6.3	3.0	-4.0
– Nominal value	A$m	14,031	12,831	13,744	11,745	-8.6	7.1	-14.5
– Real value[h]	A$m	15,027	12,831	13,171	10,910	-14.6	2.7	-17.2
Imports[a]	kb/d	180	180	186	184	0.0	3.1	-0.9
LPG production[acd]	kb/d	107	94	104	100	-12.4	10.2	-3.5
Refined products								
– Refinery production[a]	kb/d	266	254	251	249	-4.8	-1.1	-0.9
– Export volume[ae]	kb/d	8	7	6	6	-11.7	-15.6	-6.9
– Import volume[a]	kb/d	743	846	858	865	13.8	1.5	0.7
– Consumption[ag]	kb/d	934	1,012	1,020	1,024	8.4	0.8	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 2022-23 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).

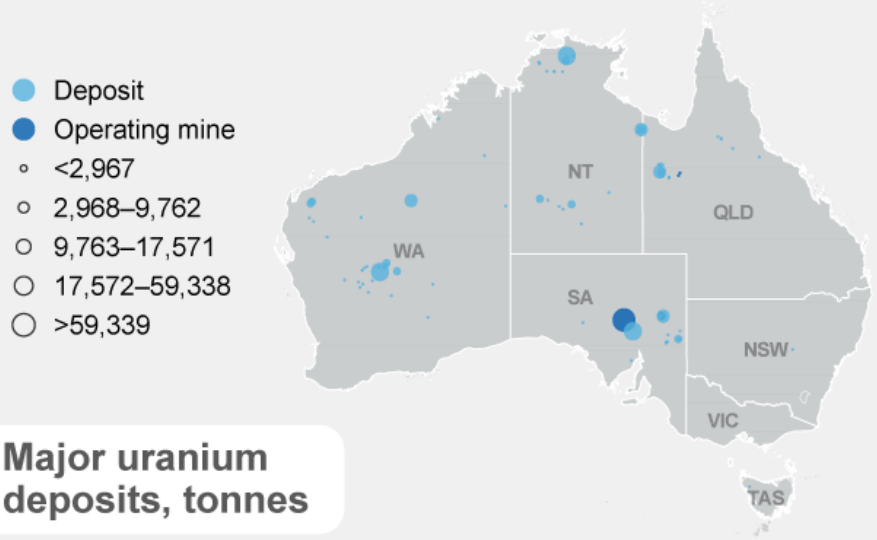
Uranium

Australia's uranium sector

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

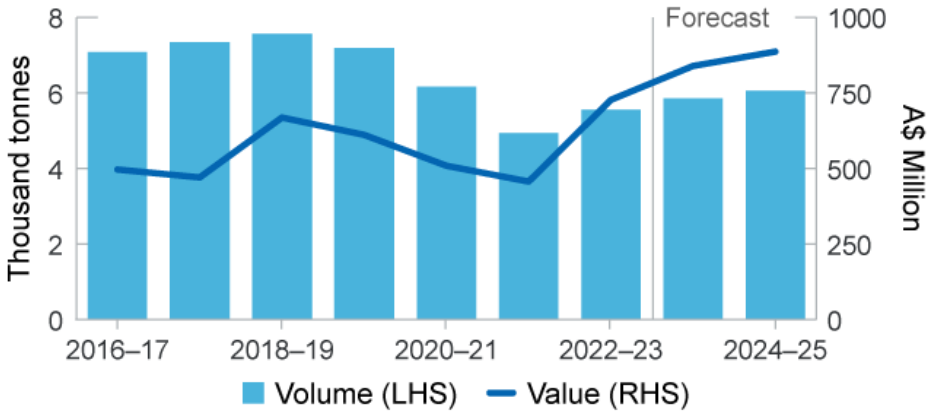
The bulk of uranium exports flow to the **USA, France, and China**

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 lift from US$50 a pound in 2022 to around US$62 a pound by 2025. Price growth reflects sustained low investment and potential structural shortfalls in uranium supply.
- Australian exports are forecast to increase from around 5,560 tonnes in 2022–23 to around 6,000 tonnes by 2024–25 (see Australia section). Growth reflects the expected opening and ramp-up of Boss Energy's Honeymoon mine in South Australia.
- Price and volume growth are expected to drive uranium export values from around $780 million in 2022–23 to $900 million by 2024–25.

9.2 World consumption

Power plant deployments are growing across a broad array of countries

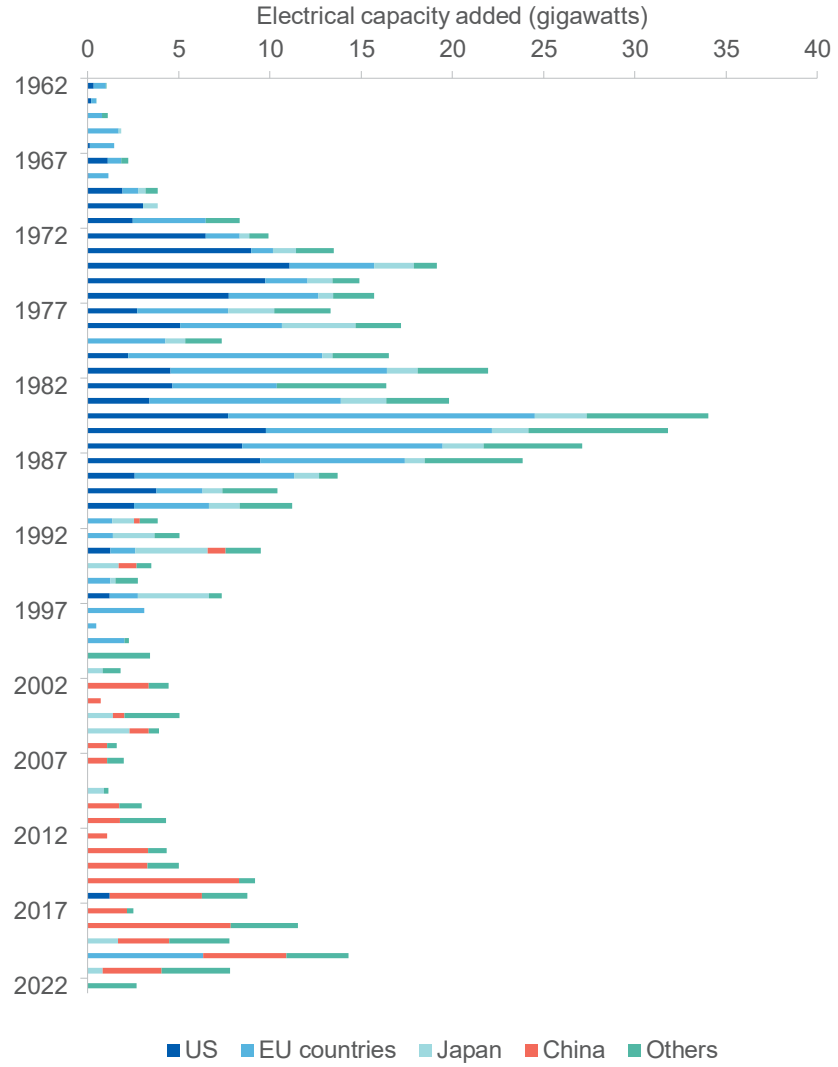
Nuclear deployments are expected to pick up in 2023 following a lull in 2022 (Figure 9.1). Uranium consumption will be supported by growing demand in China and other parts of Asia and Eastern Europe (Figure 9.2).

In the UK, environmental permits have been granted for the large Sizewell C nuclear plant, bringing its development a step closer. The UK Government has committed to development of a suite of nuclear plants to follow Sizewell C, with the intent to harness economies of scale, improve the climate for investment in nuclear power, and make the UK energy independent.

The Indian Government has signed a supplementary joint venture agreement with NTPC (an energy company) to undertake development work on a new set of six 700 MWe pressurised heavy water reactors. The Government has also announced a target to triple installed nuclear capacity in India by 2031.

South Korea has recommenced provisional work on units 3 and 4 of the Shin Hanul plant. Work had been suspended in 2017 under the previous government's nuclear phase-out policy, but this policy has now been dumped.

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)

In China, the Sanmen nuclear plant has progressed to a new phase of construction following the installation of a key module. Construction work has also begun on unit 4 of the Haiyang plant in Shandong, while unit 3 of the Fangchenggang nuclear power plant has now commenced commercial operation following the completion of primary construction in 2022.

In Egypt, construction has begun on unit 3 of the country's El Dabaa plant, with work on an additional unit expected to follow soon.

In contrast, Germany has ceased all use of nuclear power in its electricity grid, with the last three reactors closing in April following a brief extension which allowed operations to continue through the March quarter.

9.3 World production

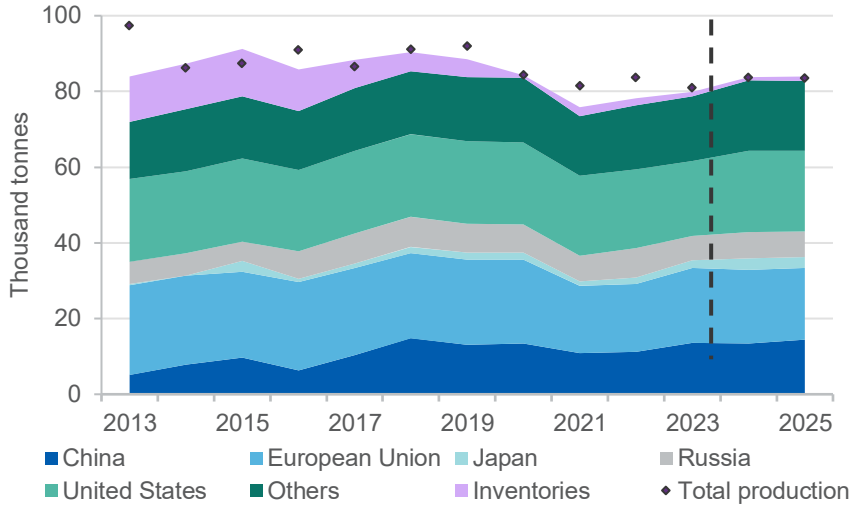
Production is building, with short-term and long-term growth expected

Production is expected to keep pace with usage over the outlook period (Figure 9.3). However, in subsequent years it is likely that some lift in the pace of development for new mine supply will be needed, given the rising pace of new reactor deployments. While uranium costs are only a small share of overall costs for nuclear power, the current price trajectory provides strong incentives to potential suppliers, potentially encouraging greater investment in uranium production over time.

In the short term, output needs will likely be met through ramp-ups from traditional suppliers. New output is expected from the re-opening of Australia's Honeymoon mine (from 2024), while Canada's large McArthur River mine is expected to resume full operation in the same year. Kazakhstan has tactically reduced output but could restore it again if prices continue to lift. In the longer term, it is likely that new mines in Africa and Asia will play an important role in meeting supply needs.

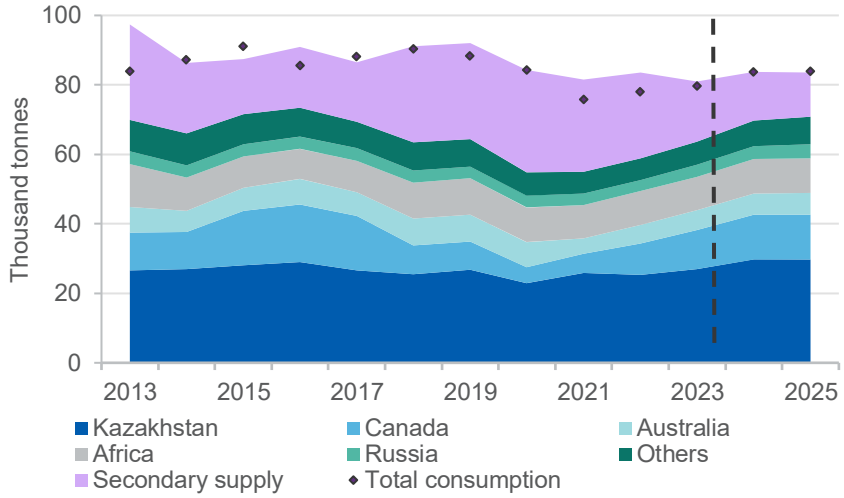
Stability may also be supported by a new agreement recently announced involving Canada, France, Japan, the UK and USA. Signatories have agreed to better cooperation to provide more stable and predictable supply to each country's nuclear power plants. The intent is to prevent any future price blowouts while supporting a faster attainment of net-zero targets.

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, and potentially rapidly

Following several years of weakness, uranium prices rose sharply in early 2022 and have since stabilised at around US$50 a pound. This growth reflects changing market fundamentals, with higher demand reflecting tightening emissions targets and a desire among some nations for greater energy independence. Supply has been constrained by years of low investment, with prices expected to lift to above US$60 a pound by 2025. Risks remain weighted to the upside, with the price outlook heavily influenced by the rate of development for new deposits (Figure 9.4).

9.5 Australia

Higher prices and volumes will boost export earnings

Australian output is currently limited to two mines, but more are in prospect. Boss Energy's Honeymoon mine, which is restarting from care and maintenance, is expected to produce around 1,100–1,200 tonnes of uranium per year for at least ten years. Boss Energy has announced it has made 'strong progress on all fronts' as it seeks to bring the mine online by the end of 2023.

Extra production and higher prices are expected to see export values and volumes rise through the outlook period, with export earnings forecast to surpass $900 million by 2024–25 (Figure 9.5, Table 1).

Uranium exploration has picked up following the lift in prices. Uranium miners spent $9.2 million on exploration in the March quarter 2023. This compares to $1.8 million spent in the March quarter 2021.

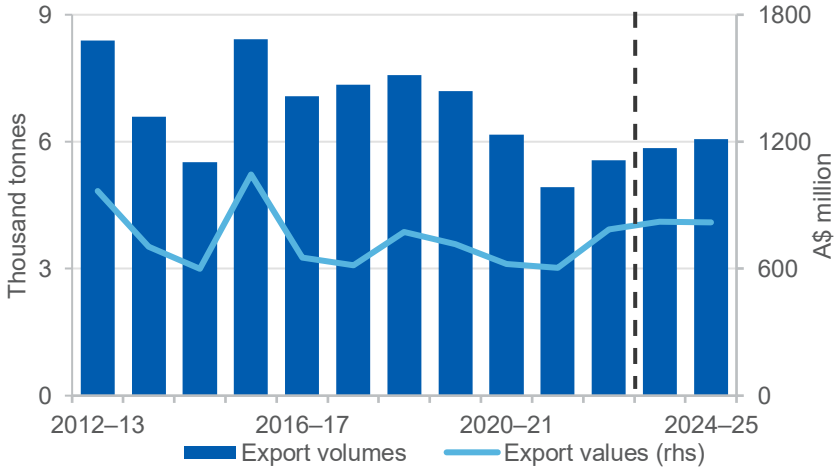
Revisions to the outlook

The export earnings forecasts for 2023–24 and 2024–25 are largely unchanged from those of the March 2023 edition of the *Resources and Energy Quarterly*.

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	63.6	69.7	70.8	8.3	9.5	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$/lb	49.8	54.8	60.1	61.8	10.0	9.8	2.7
– real[c]	US$/lb	52.1	54.8	58.8	59.1	5.2	7.3	0.6
Australia	**Unit**	**2021–22**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**
Mine production	t	4,485	5,553	5,855	6,060	23.8	5.4	3.5
Export volume	t	4,933	5,560	5,855	6,060	12.7	5.3	3.5
– nominal value	A$m	564	781	871	909	38.4	11.6	4.3
– real value[d]	A$m	604	781	835	844	29.2	6.9	1.1
Average price	A$/kg	114.4	140.4	148.8	150.0	22.8	5.9	0.8
– real[d]	A$/kg	122.5	140.4	142.6	139.3	14.6	1.5	-2.3

Notes: **b** Includes Niger, Namibia, South Africa, Malawi and Zambia; **c** In 2023 US dollars; **d** in 2022–23 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

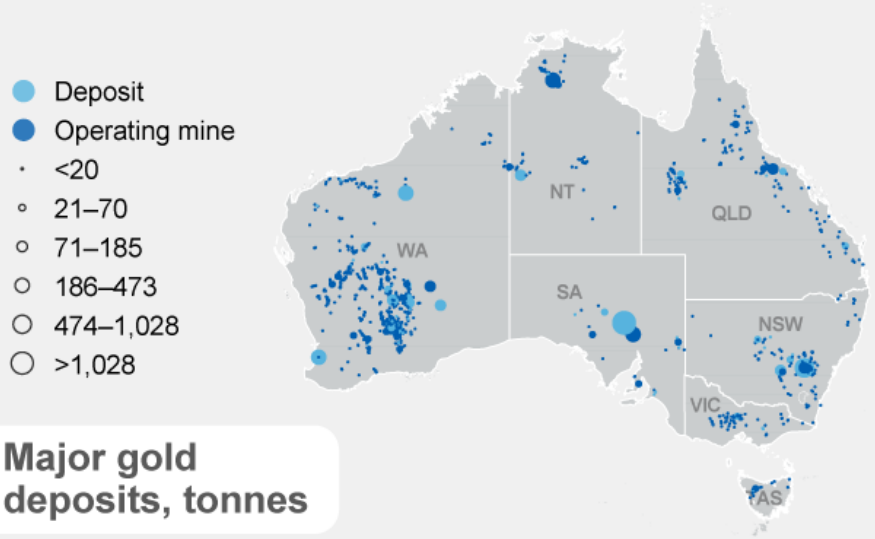
Gold

Australia's gold sector

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

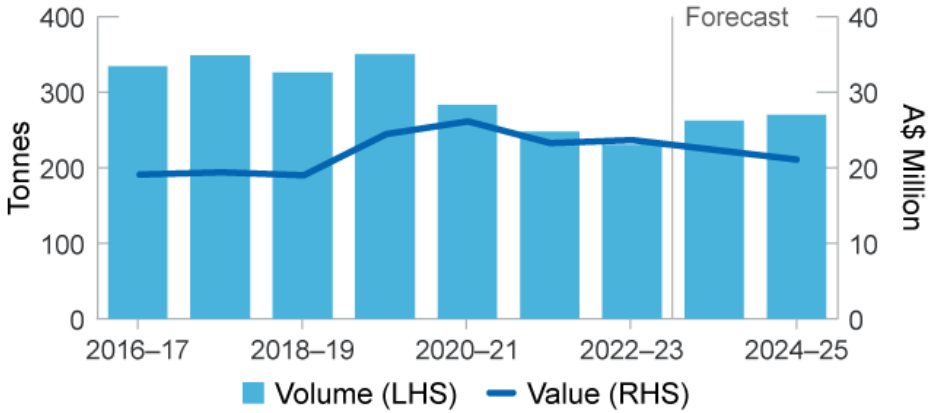
Largest
known share of globally known gold resources, at **22%**

237 tonnes
exported in 2022, valued at **$24 billion**



Major gold deposits, tonnes

Australian gold exports



Outlook

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

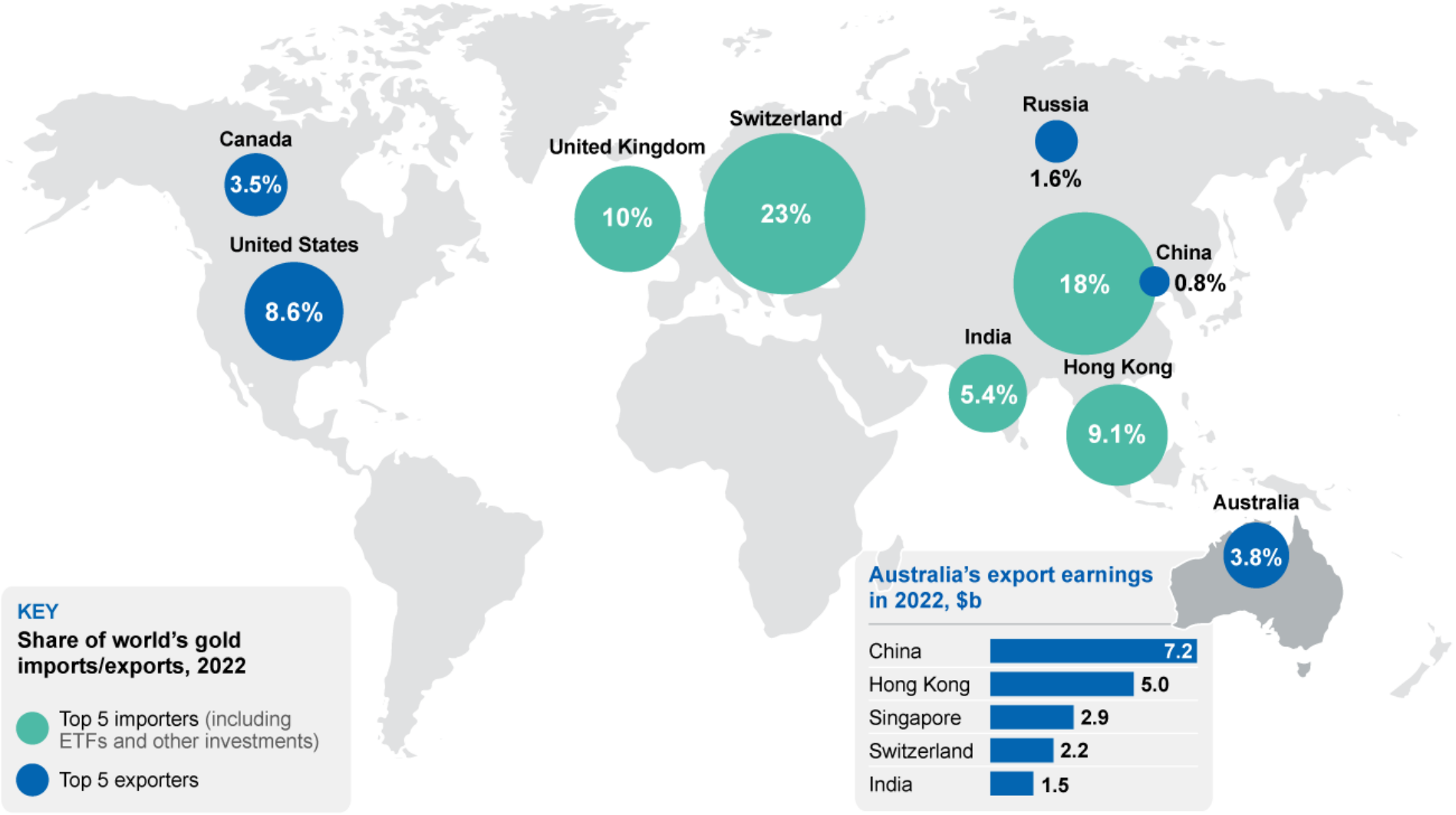
Export earnings forecast to fall as lower prices outweigh higher volumes

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 are estimated to have averaged US$1,920 an ounce in the first half of 2023, with support coming from strong safe-haven buying and a slightly weaker US dollar. Prices are forecast to remain elevated but decline gradually to average around US$1,770 an ounce in 2025.
- Australian gold production decreased to 71 tonnes in the March quarter 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 $23 billion in 2022–23 to around $21 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 13% year-on-year to 1,081 tonnes in the March quarter 2023. This was driven by a 51% decline year-on-year in investment demand, offset to some extent by continued strength in central bank net purchases.

Official sector buying (central banks and other government financial institutions) increased by 176% year-on-year to a record first-quarter high of 228 tonnes in the March quarter 2023. Most of these purchases were undeclared, meaning country details are unavailable. According to World Gold Council data for declared purchases, much of the buying was dominated by Singapore (69 tonnes) and China (58 tonnes). Türkiye also purchased 30 tonnes of gold in the quarter, a continuation of strong buying activity after reported purchases of 148 tonnes in 2022. Kazakhstan (20 tonnes), Uzbekistan (15 tonnes) and Cambodia (10 tonnes) were the largest reported sellers of gold in the quarter. Russia reported 6 tonnes of gold sales in the March quarter 2023, having previously paused reporting gold transactions from February 2022 onwards. Russia's updated data shows reported gold purchases of 31 tonnes in 2022.

Consumer demand for gold (jewellery, gold coins and bars) in the March quarter 2023 was higher year-on-year, however this growth was more than offset by outflows from gold-backed exchange-traded funds (ETFs).

ETF outflows reached 29 tonnes (US$1.5 billion) in the March quarter 2023, 111% lower year-on-year. Demand improved towards the end of the quarter, with strong inflows in the month of March — coinciding with sharp price increases — ending 11 months of outflows.

Retail investment in gold bars and coins rose year-on-year in the March quarter 2023, with investors buying 302 tonnes. Demand was supported by strong domestic gold prices in China during its Lunar New Year seasonal peak and a five-fold increase in Türkiye — where negative real interest rates and safe-haven demand are motivating gold buying.

Global jewellery demand tracked flat year-on-year in the March quarter 2023, driven by a strong resurgence in Chinese consumption, offsetting weaker Indian consumption.

Jewellery demand in China rose to an 8-year high of 198 tonnes in the March quarter 2023. Chinese consumption growth was strong year-on-year as the March quarter 2022 base was affected by COVID-related mobility restrictions. Wedding season, pent-up demand and real household income growth all supported jewellery demand, with *gold, silver and jewellery* the second-strongest growth category of Chinese retail sales growth over quarter.

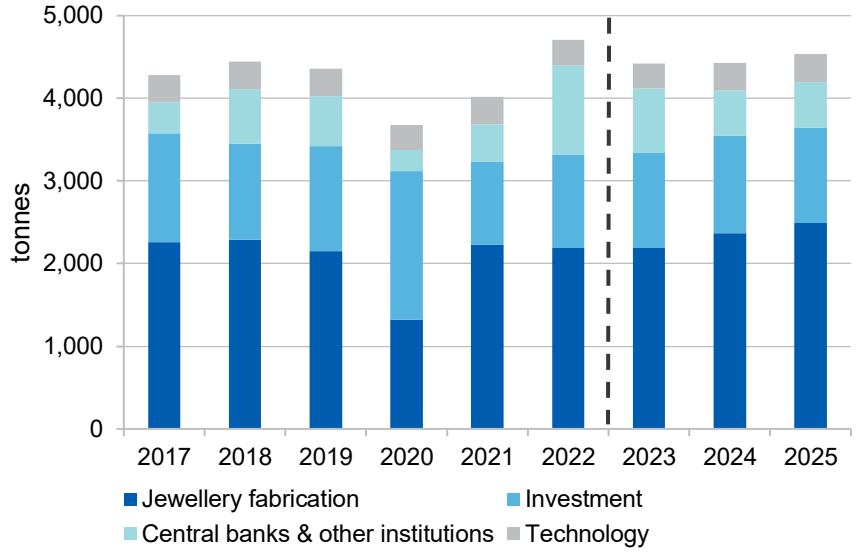
Jewellery consumption in India — along with many other markets — declined year-on-year in the March quarter 2023, due to high domestic prices.

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 6.7% to about 4,400 tonnes. The decline is expected to be mainly driven by lower official sector buying — which will nevertheless remain high in historical terms (Figure 10.1).

Official sector buying is forecast to remain elevated in 2023, at 780 tonnes. Investment demand (gold-backed ETFs or bar and coin holdings) is expected to increase in 2023, supported by ongoing geopolitical and economic uncertainty.

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 in 2023 is forecast to be in line with 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). China's strong jewellery consumption (despite high prices in the March quarter) has lifted the demand outlook, with year-on-year growth expected given COVID-related disruptions to retail consumption in 2022.

Gold consumption to grow over the medium-term

World gold consumption is forecast to increase gradually after 2023, to reach about 4,500 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). Jewellery consumption is forecast to grow strongly from 2023 onwards, to reach 2,500 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 strong demand growth in 2024, up almost 10% year-on-year.

Investment demand is forecast to remain relatively steady over the forecast period, at around 1,150 tonnes. As inflation eases down towards central bank targets, interest rates are assumed to decline over the medium-term. This will result in a decline in real interest rates, supporting institutional investment and retail demand. Physical (bar and coin) demand is expected to remain strong, as lower forecast prices and economic uncertainty support buying activity near recent elevated levels.

Official sector demand is projected to moderate to around 550 tonnes a year in 2024 and 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.

10.3 World production

World supply increased in March quarter 2023

World gold supply increased by 0.8% year-on-year to 1,174 tonnes in the March quarter 2023, driven by both higher mine production and recycling.

Global mine production rose by 1.5% year-on-year to a record high March quarter of 856 tonnes in 2023, driven by increased production from the major producers and ramp-up of new projects in Mongolia and Brazil.

Production in China — the world's largest gold producing country — rose by 1.9% year-on-year to 85 tonnes in the March quarter 2023, with the year-on-year improvement the result of fewer weather- and COVID-related disruptions.

In Australia — the third-largest gold producing country — output decreased by 2.6% year-on-year in the March quarter 2023, to 71 tonnes.

Australian mine production decreased due to disruptions from heavy rainfall over the quarter (see *Australia section*).

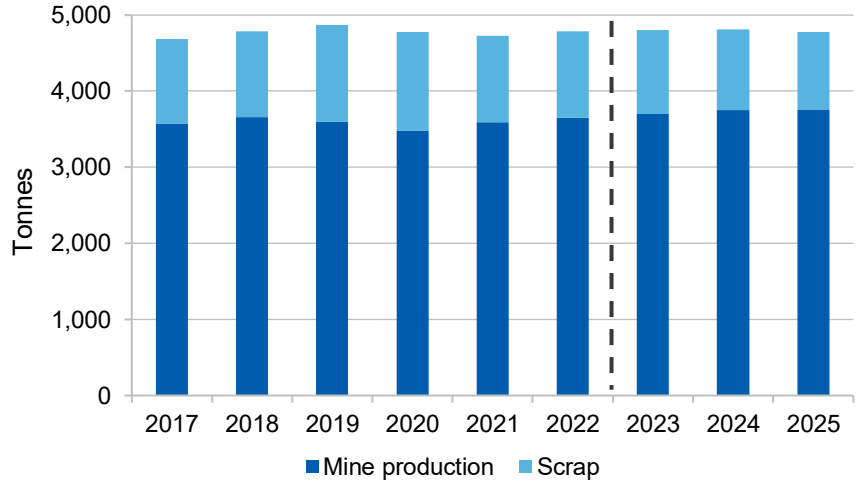
Production from Indonesia — the sixth-largest gold producing country — decreased by 19% year-on-year in the March quarter 2023, due to flooding and lower grades at its large Grasberg copper-gold mine.

Gold recycling in the March quarter rose to 310 tonnes — the highest March quarter in 7 years — in response to stronger gold prices. Recycling growth was strong in India (up by 25% year-on-year), a particularly price-sensitive market.

World supply to stabilise after peaking in 2024

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 1.0% a year on average by 2025 to 3,760 tonnes, led by increases in Canada, Chile and Brazil.

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).

Gold production increases will be particularly large in Canada, with the 11 tonnes per year Côté project and the 10 tonnes per year Blackwater project commencing operations in the next two years.

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

Partially offsetting increases in mine production, gold recycling activity is forecast to decline on average by 3.8% a year by 2025, due to lower forecast gold prices.

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 around US$1920 an ounce — 2.7% higher than in 2022.

Gold prices rallied strongly through March due to increased safe-haven buying, following problems with several tier 2 US banks. Prices have continued to be supported at relatively high levels, due to a range of factors including lower US Treasury yields, a weaker US dollar and strong central bank buying.

Coinciding with concerns for the banking sector, real US Treasury yields underwent a correction, as markets increasingly priced in interest rate cuts by the US Federal Reserve commencing in H2 2023. The US dollar has also weakened from its previous peak on 8 March 2023, due to lower Treasury bond yields compared with other major currency hubs — such as Europe and the United Kingdom.

Lower bond yields tend to increase gold's appeal to institutional and retail investors as a secure asset to hedge against inflation or other risks. This is because decreases in the yield of a US (or other credible government) Treasury bond lower the so-called market "risk-free rate", and hence the opportunity cost of holding gold.

The US inflation-indexed ("real") Treasury bond yield — which has historically held an inverse correlation with gold prices — has retreated

from 14-year highs (Figure 10.3). 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 — and led to the US dollar becoming a stronger driver of gold prices.

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

Gold prices are forecast to average about US$1,900 an ounce in 2023 — a 7.6% upward revision compared with the March 2023 *Resources and Energy Quarterly*.

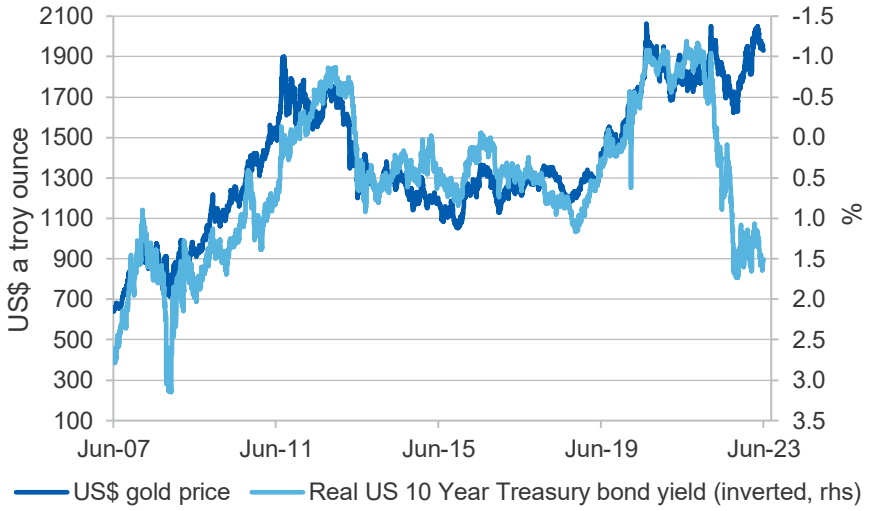
Price forecasts have been revised up sharply over the short-term, in recognition of additional upside risks, as well ongoing strength in safe-haven and central bank demand. Persistent price strength through the June quarter 2023 was achieved despite the presence of several price-pressuring factors. Real bond yields have remained relatively high, the US dollar has remained at relatively strong levels, and gold-backed ETF holdings remain lower than in previous price peaks (ETF holdings were 11% down year-on-year in April 2023).

If US economic activity declines substantially and interest rate cuts currently expected by markets come to fruition in H2 2023, this could create an even more supportive environment for gold through lower real interest rates, a weaker US dollar and demand for gold ETFs as equity markets decline.

If US economic activity merely slows down and core inflation continues to be persistent, it is likely expected US interest rate cuts will not eventuate over the second half of the year. In this case, real interest rates will be higher than current market expectations, leading to a notable decline in gold prices. The price forecast for the second half of 2023 is balanced between market expectations and this less bullish outcome.

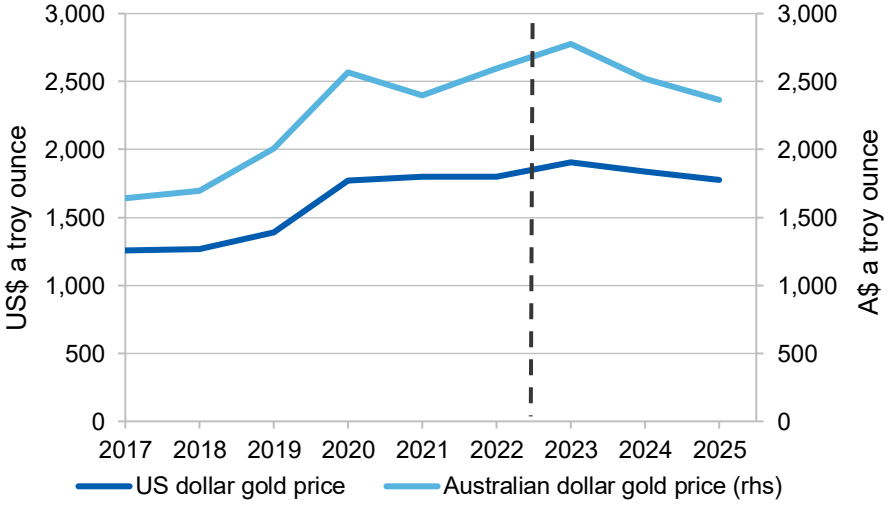
After 2023, gold prices are forecast to fall by 3.5% a year to an average of US$1,774 an ounce in 2025, due to pressure from high real interest rates (as global inflation eases) and a gradual easing of safe-haven demand.

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



Source: Bloomberg (2023)

Figure 10.4: US and Australian dollar gold prices



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

In combination with forecast appreciation in the Australian dollar, the lower US dollar gold price is expected to lower Australian dollar prices from A$2,800 an ounce in 2023 to A$2,400 an ounce in 2025 (Figure 10.4).

The risks to the medium-term price outlook are evenly balanced

Persistent global inflation (particularly core inflation) could result in official interest rates remaining higher for longer than currently expected, leading to a stronger than forecast decline in gold prices.

Should global inflation decline more quickly than expected (due to slowing economic activity), interest rates may begin to ease sooner than anticipated, leading to higher gold prices — particularly if the US dollar weakens more than forecast.

Financial stability concerns present an upside risk to forecast gold prices.

10.5 Australia's trade, production and exploration

Australian gold exports rose in the March quarter 2023

Australia's gold exports increased by 11% year-on-year to $6.0 billion in the March quarter 2023. The increase was driven by higher Australian dollar gold prices, which offset a 13% decline in export volumes. Export volumes fell despite an increase in mine production — a trend that has persisted since the June quarter 2021.

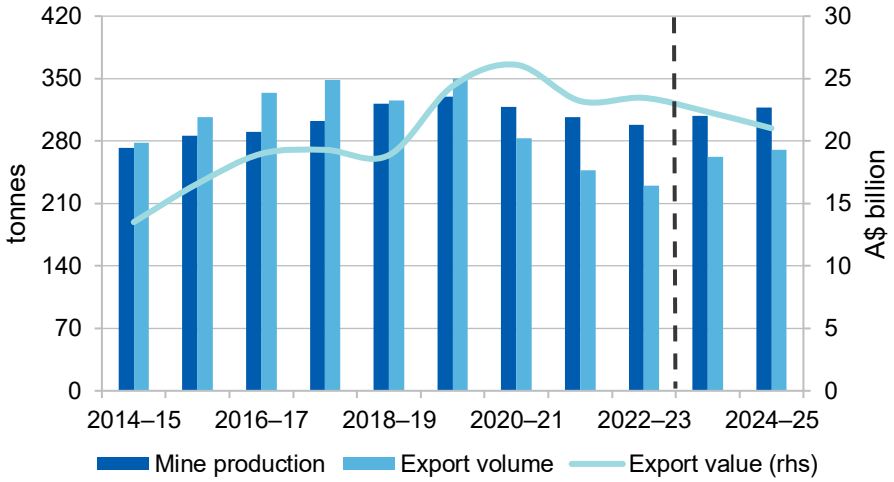
Australia exported $2.1 billion of gold to China in the March quarter 2023, down 18% year-on-year. Australian exports to the financial hubs (US, UK, Switzerland, Hong Kong and Singapore) were collectively worth $2.7 billion in the quarter — a 45% increase year-on-year. Within the financial hubs, exports to Singapore accounted for $1.2 billion.

Australian gold exports to decline over the medium-term

Australian gold export earnings are estimated to have increased marginally to $23 billion in 2022–23, as lower export volumes offset the impact of stronger Australian dollar gold prices.

Australian gold export earnings are forecast to decline over the next two years — to about $22 billion in 2023–24 and $21 billion in 2024–25 — as increasing export volumes are more than offset by the impact of lower prices (Figure 10.5). Considering recent production and export trends, Australian gold export volumes have been revised down to 85% of forecast mine production (see Box 10.1).

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 March quarter 2023

Australia's gold industry produced 71 tonnes of mined gold in the March quarter 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 36% year-on-year to 2.0 tonnes in the March quarter 2023. Newmont stated that record rainfall and associated flooding caused the closure of the main access route for supplies, leading to the cessation of milling operations for a few weeks in February. Tanami was also subject to heavy rainfall and winds, following the traversal of Cyclone Ilsa in April — although the company has not yet announced any production impacts.

Production at Evolution's 2.5 tonnes per year Ernest Henry project decreased by 26% year-on-year to 0.4 tonnes in the March quarter 2023. Operations were suspended at the mine on 8 March following heavy rainfall and floods across the North West Minerals Province of QLD. Operations resumed on 18 April and are expected to reach normal levels by the end of the June quarter 2023.

Production at Regis Resources' 10 tonnes per year Duketon project rose marginally year-on-year in the March quarter 2023. Production was lower than expected, due to a slower than planned ramp up of the new Garden Well South underground and unplanned maintenance at the Rosemont processing plant. In addition, Regis reported wet weather impacts at Duketon in late March.

Production at Newcrest's 20 tonnes per year Cadia mine in NSW decreased by 11% year-on-year to 4.2 tonnes in the March quarter 2023. Lower production was driven by lower mill throughput, following an unscheduled mechanical breakdown of the concentrate filter presses at the Blayney dewatering facility. Cadia delivered first ore from its new panel cave project PC2-3 during the quarter, with work now focused on establishing the cave towards project completion.

Bucking the trend, BHP's 4.5 tonnes per year Olympic Dam project has continued delivering record gold production, following the implementation of debottlenecking initiatives in 2022. Production in the March quarter 2023 increased by 67% year-on-year to 1.5 tonnes.

Australian gold mine production to increase over the next two years

Australian gold production is forecast to rise from 298 tonnes in 2022–23 to 317 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 is expected to come online in 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.

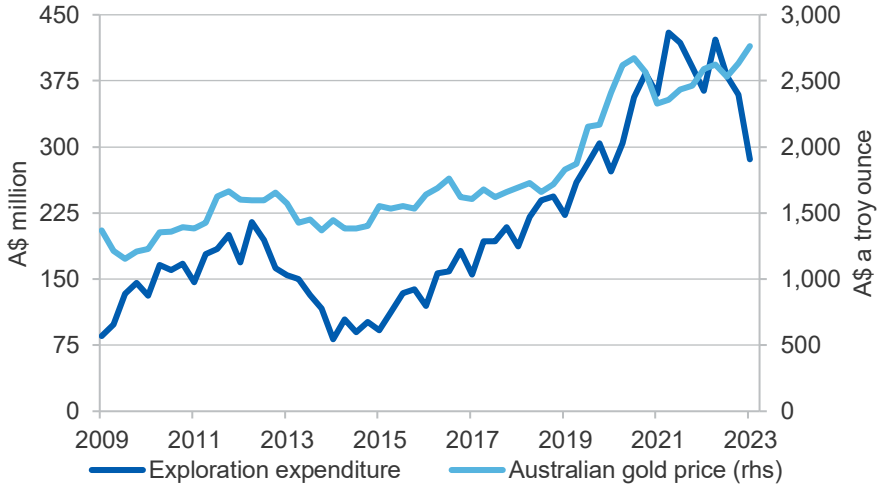
Northern Star Resources' Super Pit gold operation will begin long-term expansion in 2024, growing to 675,000 ounces by 2027–28.

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

Gold exploration expenditure declined in the March quarter 2023

Australia's gold exploration expenditure decreased by 21% year-on-year to $286 million in the March quarter 2023 (Figure 10.8). As a result, gold's share of Australian mineral exploration expenditure declined to an 8-year low of 32% in the quarter, down from 43% 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 70% of total gold exploration expenditure.

Figure 10.6: Australian gold exploration expenditure and prices



Source: ABS (2023)

Large gold facility decarbonisation plans

Northern Star Resources — one of Australia's largest gold producers — has been working towards decarbonisation, with a commitment to reduce Scope 1 and 2 emissions by 35% by 2030, en-route to net-zero by 2050. The majority of the company's 2021 emissions came from electricity (72%), so their project pipeline to 2030 includes 153.6-218.6 MW of solar and wind capacity across Carosue Dam, Jundee, Thunderbox and KCGM (the Super Pit).

Newcrest owns two large operations in Australia (Cadia and Telfer), with another project (Havieron) in the pipeline. Cadia accounts for 39% of Newcrest's emissions and draws electricity from the NSW grid, while Telfer accounts for 22% of emissions and generates electricity on-site using natural gas. Newcrest have committed to a 30% reduction of Scope 1 and 2 emissions intensity (per tonne of ore milled) by 2030, also en-route to net-zero by 2050. Newcrest have highlighted power purchase agreements (for operations utilising grid electricity), as well as building on-site solar, wind and battery storage where possible. For example, Newcrest signed a 15-year power purchase agreement with Tilt Renewables Limited to secure 55% of Rye Park Wind Farm's output once commercial operations commence in 2024 — accounting for 40% of Cadia's energy demand and 20% of Newcrest's emissions.

Newmont Corporation, the world's largest gold miner, operates the Boddington operation in WA and Tanami operation in NT. Newmont set targets of a 32% reduction in Scope 1 and 2 emissions and a 30% reduction in Scope 3 emissions by 2030, en-route to net-zero (including Scope 1, 2, 3) by 2050. Newmont have listed many methods to achieve their targets, such as renewables, battery storage and power purchase agreements, as well as electrification of their mining fleet. For example, Newmont have entered a strategic alliance with Caterpillar Inc. to create an automated, zero-emission mining fleet.

AngloGold Ashanti Limited operates two gold projects in WA: Sunrise Dam, and Tropicana — a joint venture with Regis Resources Ltd. AngloGold Ashanti has a 30% reduction target for Scope 1 and 2 emissions by 2030, as well as net-zero by 2050. The company intends to meet these targets through a combination of renewable energy projects, fleet electrification and lower-emission power sources. For example, 60% of the company's planned emissions reductions are expected to come from wind and solar projects at the company's Australian operations.

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. By extension, Australian dollar gold prices have been revised up across the profile.

Australia's forecast gold export earnings have been revised down by 8-10% over the forecast period compared with the March 2023 *Resources and Energy Quarterly*. This reflects downgrades made to export volumes (15-21%), a combination of lower forecast production and the reduction in exports relative to forecast production (see Box 10.1).

Downgrades to production forecasts are the result of project commencements being delayed, or unexpectedly entering care and maintenance.

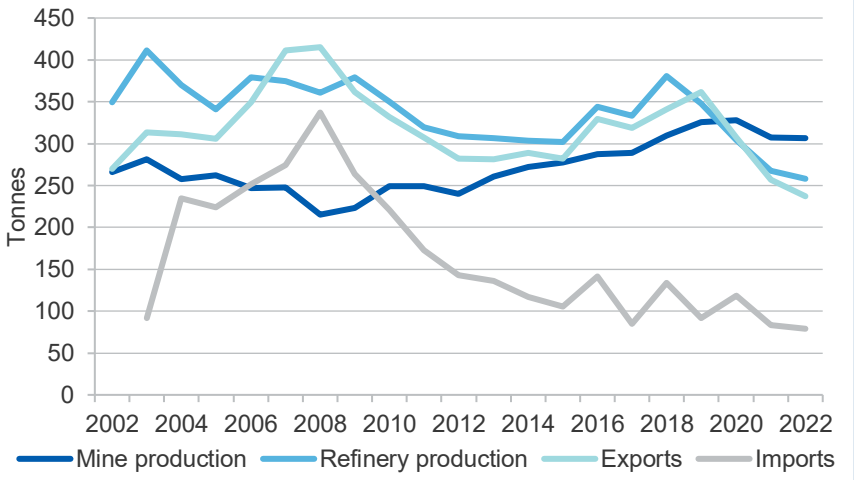
Box 10.1: Changes to forecast gold export volume calculations

Forecast Australian gold exports have been revised down by 16-22 tonnes a year compared to the March 2023 *Resources and Energy Quarterly*.

There has been a discrepancy between Australian mine production and non-monetary gold exports since late 2019. Exports averaged 85% of mine production from December quarter 2019 to March quarter 2023. Refinery production tends to dictate shifts in gold exports more than mine production (Figure 10.7).

A longer-term decline in refinery production has also coincided with a decline in gold imports. Some gold operations (such as Cadia) produce and export copper-gold concentrates as well as gold doré. These concentrates do not appear under the non-monetary gold exports category reported and forecast in this chapter.

Figure 10.7: Australian gold production and trade



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

Due to limitations in trade data resolution, gold ores and concentrates are incorporated under HS/AHECC code 261690: *precious metal (excl. silver) ores and concentrates* — of which, Australia exported $2.5 billion in 2022. Since Australian production of precious metals (excluding silver) is minimal compared to gold production, it is likely that most of the exports in this category are ores and concentrates containing gold (and other coexisting metals such as copper).

Australian non-monetary gold export volumes are now assumed to be 85% of forecast Australian mine production. This adjustment has been made with consideration of the gradual decrease in gold imports and refinery production, as well as the gradual increase in exports of precious metal ores and concentrates. Precious metal ores and concentrates is counted as a separate category in historical data.

If you have any comments or suggestions regarding this methodology change, please get in touch at REQ@industry.gov.au.

Table 10.1: Gold outlook

						Annual percentage change		
World	**Unit**	**2022**	**2023[f]**	**2024[f]**	**2025[f]**	**2023[f]**	**2024[f]**	**2025[f]**
Total demand	tonnes	4,706	4,421	4,424	4,539	-6.1	0.1	2.6
Fabrication consumption [b]	tonnes	2,501	2,491	2,701	2,830	-0.4	8.4	4.8
Mine production	tonnes	3,649	3,700	3,750	3,760	1.4	1.3	0.3
Price [c]								
– nominal	US$/oz	1,801	1,906	1,839	1,774	5.8	-3.5	-3.5
– real [d]	US$/oz	1,882	1,906	1,797	1,698	1.2	-5.7	-5.5
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	298	308	317	-2.8	3.5	2.9
Exports								
– volume	tonnes	248	230	262	270	-7.0	13.9	2.9
– nominal value	A$m	23,200	23,455	22,329	21,022	1.1	-4.8	-5.9
– real value [e]	A$m	24,874	23,455	21,351	19,483	-5.7	-9.0	-8.7
Price								
– nominal	A$/oz	2,529	2,707	2,651	2,423	7.1	-2.1	-8.6
– real [e]	A$/oz	2,711	2,707	2,534	2,050	-0.2	-6.4	-19.1

Notes: **b** includes jewellery consumption and industrial applications; **c** London Bullion Market Association PM price; **d** In 2023 US dollars; **e** In 2022–23 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

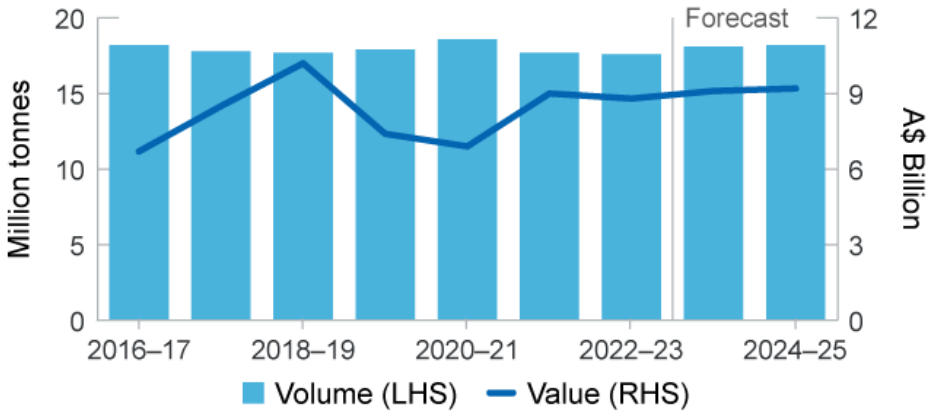
103m tonnes
of **annual bauxite output**, the world's largest producer

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

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

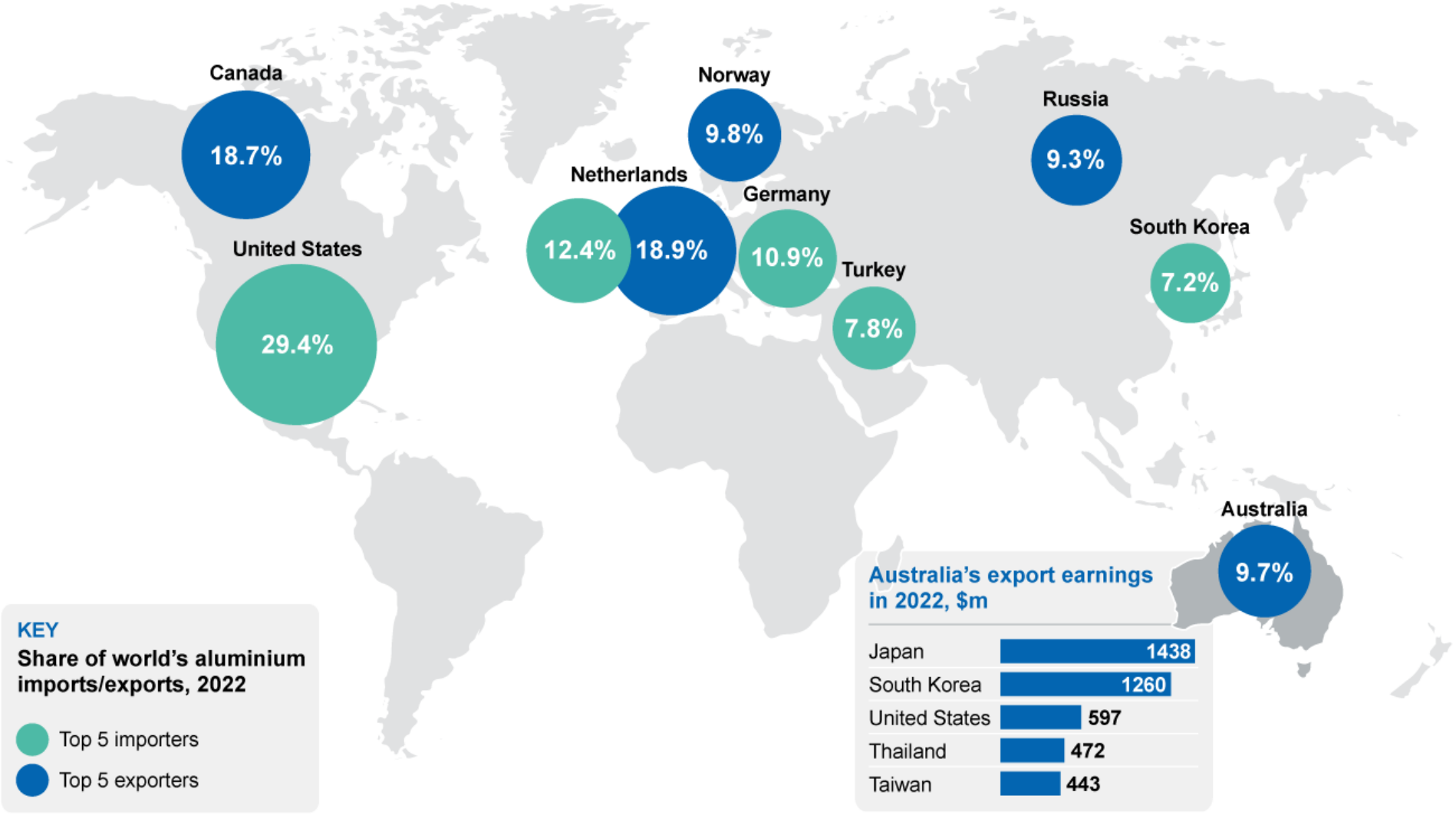
Future earnings for exports of aluminium, alumina and bauxite to **lift as prices rise**

Bauxite export volumes **set to increase** with Indonesia's Jun 2023 bauxite export ban

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

SOURCE: DISR; OCE

Aluminium TRADE MAP



SOURCE: WBMS; ABS

11.1 Summary

- Global demand for primary aluminium is sluggish, particularly in Europe. Tighter monetary conditions are likely to impact Western aluminium demand in 2023–24.
- Production outages in China's Yunnan Province have reduced supply. Declining energy prices are restoring the profitability of aluminium production.
- Earnings for Australian exports of aluminium, alumina and bauxite are expected to rise from $16 billion in 2022–23 to $17 billion in 2024–25, as prices rise.

11.2 World consumption

European led lower aluminium consumption in the March quarter 2023

Global primary aluminium consumption fell by 1.5% year-on-year in the March quarter 2023 to 16 million tonnes (Mt), due to a 28% year-on-year fall in European primary aluminium consumption. Weaker European demand was due to subdued activity in the housing and construction sectors — the sectors worst affected by rising inflation and interest rates. In Germany, the S&P Global Germany Construction Purchasing Managers' Index (PMI) has been in 'contraction' territory since March 2022, with a sharp fall to 42.9 in March 2023 from 48.6 in February 2023. Germany's primary aluminium demand fell by 44% year-on-year in the March quarter 2023 to 320,000 tonnes.

China's primary aluminium demand rose by 7.0% year-on-year in the March quarter 2023 to over 10 Mt. Helping demand was strong electric vehicle (EV) sales: in January and February 2023, there were 922,400 EVs sold in China, up 25% year-on-year.

World secondary aluminium consumption rose by 4.6% year-on-year in the March quarter 2023 to 6.3 Mt, as automotive makers in Asia, Europe, and the US sourced secondary — rather than primary — aluminium to cut costs. In Asia, secondary aluminium usage in Japan and South Korea increased by 5.9% and 5.5% year-on-year in the March quarter 2023, respectively, while in the US, secondary aluminium consumption increased by 2.4% year-on-year. Amongst major European purchasers, demand for secondary aluminium in Germany and Italy rose by 2.0% and 3.8% year-on-year in the March quarter 2023, respectively.

World alumina consumption rose by 5.1% year-on-year in the March quarter 2023 to 33 Mt, driven by higher global primary aluminium production. China remained the world's largest alumina consumer, accounting for 59% of global alumina usage, and drove most of the gain (up 7.3% year-on-year). Outside of China, alumina consumption in Canada and Russia rose by 7.1% and 1.3% year-on-year in the March quarter 2023, respectively.

World bauxite usage rose by 1.5% year-on-year in the March quarter 2023 to 88 Mt, driven by higher global alumina production. China remained the world's largest bauxite consumer, accounting for 54% of global usage.

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

Demand for primary aluminium in 2023 is expected to be mainly driven by China, as the gradual pick up in growth in the Chinese economy lifts usage in the construction and vehicle manufacturing sectors. On 21 June 2023, the Chinese Government's passenger electric vehicle (PEV) subsidy was extended to 2025, with half of this subsidy available until 2027. This announcement will support growth in aluminium demand from the Chinese automotive industry.

Outside of China, PEV sales in Europe and 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. As a result, global primary aluminium consumption is forecast to increase by 1.5% in 2023, to 69 Mt (Figure 11.1).

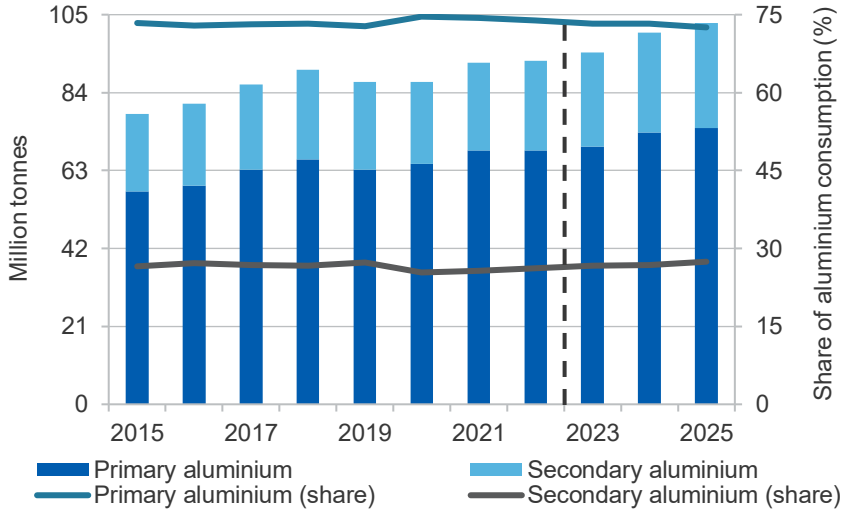
Beyond 2023, world primary aluminium consumption is forecast to grow at an annual average rate of 3.6% to 74 Mt by 2025. Demand will be boosted by the rising sales of energy-efficient vehicles, which are more aluminium intensive. Lower interest rates in 2024 and 2025 are likely to boost housing and commercial building activities, and thus aluminium demand.

World secondary aluminium demand is forecast to increase by 4.6% year-on-year in 2023 to 25 Mt. After 2023, world demand is forecast to increase at 5.5% a year over the outlook period (Figure 11.1). Rising primary aluminium prices and the use of low carbon aluminium are expected to be the drivers of higher secondary aluminium consumption.

In line with world primary aluminium production, world alumina consumption is forecast to grow by 3.0% year-on-year to 138 Mt in 2023 (Figure 11.2). After 2023, world alumina demand is forecast to rise at an average annual rate of 1.9% over the outlook period (Figure 11.2). Alumina demand is driven by primary aluminium production, which is forecast to lift by an average 1.9% a year between 2024 and 2025.

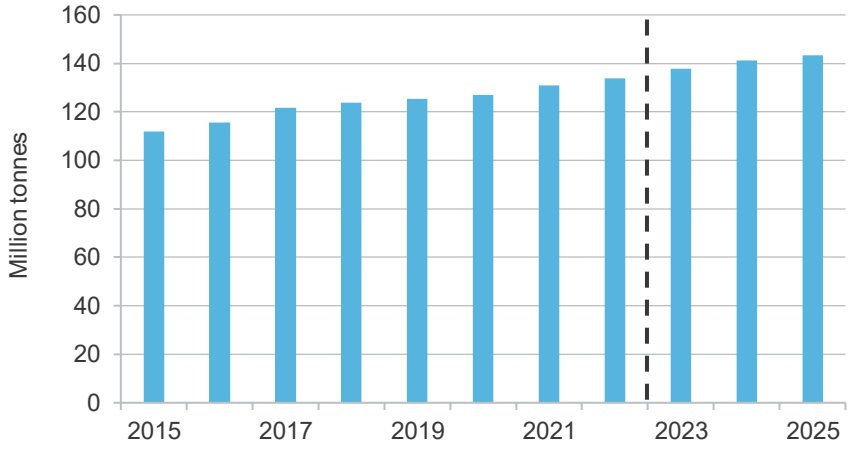
World bauxite usage is forecast to increase by 1.0% in 2023 to 367 Mt. After 2023, world bauxite demand is forecast to rise at an average annual rate of 1.0% over the outlook period (Figure 11.3). Bauxite demand is driven by alumina production, which is projected to lift by an average 1.4% a year between 2024 and 2025.

Figure 11.1: World primary/secondary aluminium consumption



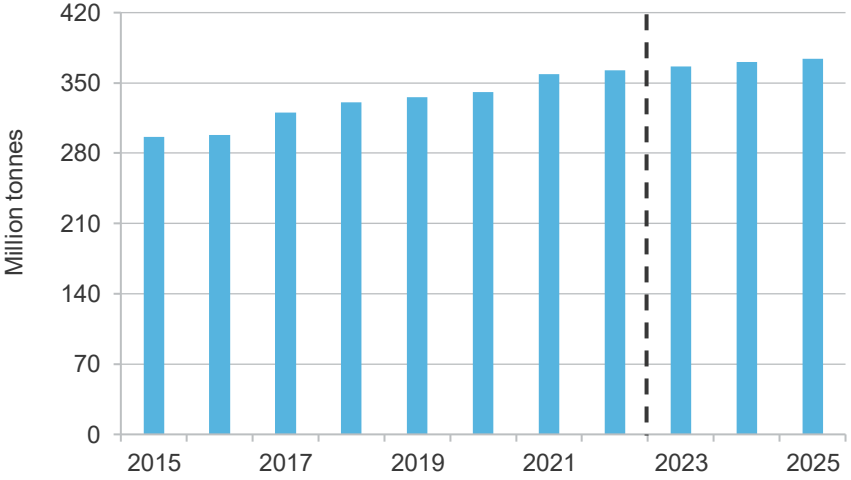
Source: Wood Mackenzie (2023); Department of Industry, Science and Resources (2023)

Figure 11.2: World alumina consumption



Source: World Bureau of Metals Statistics (2023); CRU (2023); Department of Industry, Science and Resources (2023)

Figure 11.3: World bauxite consumption



Source: World Bureau of Metals Statistics (2023); Department of Industry, Science and Resources (2023)

11.3 World production

Aluminium and alumina output grew in the March quarter 2023

World primary aluminium production increased by 2.1% year-on-year in the March quarter 2023 to 17 Mt, propelled by higher output in China — the world's largest aluminium producer. China produced 10 Mt of primary aluminium in the March quarter 2023, up by 4.9% year-on-year, driven by production restarts at some major aluminium producing cities. Bosai Group Aba Aluminium in Sichuan restarted 178 electrolytic tanks in March 2023. This is equivalent to 173,000 tonnes a year of capacity. Aluminium smelters in Guizhou restarted 70% of their operating capacity in the March quarter 2023. In Yunnan Province (the fourth largest producing province), low hydropower output — due to drought and low reservoir levels — prevented local aluminium smelters from restarting their curtailed capacity.

In Europe, the aluminium smelting capacity that was curtailed in 2022 — due to high energy costs — remained largely offline in the March quarter 2023.

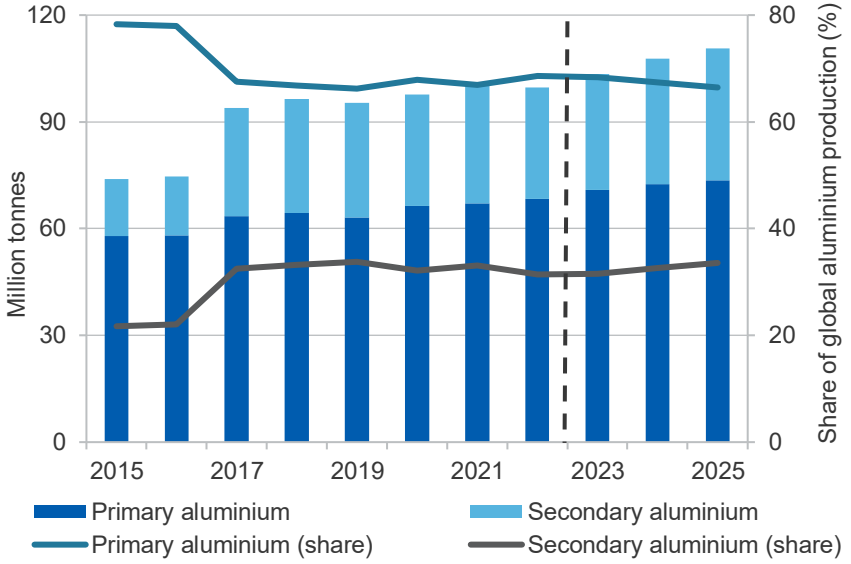
World secondary aluminium production decreased by 0.7% year-on-year in the March quarter 2023 to nearly 7.8 Mt, due to lower output from Germany and Japan. Over this period, Germany's secondary aluminium fell by 30% year-on-year, while the US secondary aluminium production fell by 5.6% year-on-year.

World alumina supply rose by 0.7% year-on-year in the March quarter 2023 to 34 Mt, driven by higher output in China and Indonesia. Production in China — the world's largest alumina producer — rose by 4.6% year-on-year, as Chinese refiners raised output to accommodate higher aluminium production.

Outside of China, Indonesia's alumina output rose by 31% year-on-year in the March quarter 2023, propelled by production ramp-up at the 300,000 tonnes a year Tayan alumina refinery.

Alumina production in Australia — the world's second largest alumina producer — fell by 0.7% year-on-year in the March quarter 2023 to 4.9 Mt, due to lower production at Rio Tinto's QAL and Yarwun refineries in Queensland. Over this period, alumina production in Brazil — the world's third largest alumina producer — fell by 6.1% year-on-year to 2.5 Mt, due to a belt system failure at Brazil's Alumar refinery.

Figure 11.4: World primary & secondary aluminium production



Source: World Bureau of Metals Statistics (2023); Department of Industry, Science and Resources (2023)

World bauxite production fell by 12% year-on-year in the March quarter 2023 to 86 Mt, due to lower output in Australia and Guinea — the world's two largest bauxite producers. Production in Australia fell by 6.7% year-on-year in the March quarter 2023 to 23 Mt (see *Australia's exports and production* section). Over this period, production in Guinea decreased by 18% year-on-year to 20 Mt.

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

World primary aluminium output is forecast to grow by 3.5% year-on-year to nearly 71 Mt in 2023 (Figure 11.4). The gain is expected to be driven by production ramp-ups in China and India, as well as the restart of idled capacity in Europe.

China's primary aluminium output is forecast to reach nearly 42 Mt in 2023, up 4.2% year-on-year. Outside of China, primary aluminium production in India is forecast to increase by 4.5% year-on-year to 4.2 Mt in 2023. Aluminium Dunkerque, which operates the Dunkerque aluminium smelter in France, restarted production capacity that was idled in 2022 due to high energy costs.

Montenegro's aluminium producer Uniprom announced in mid-May 2023 that its KAP aluminium smelter will close after over half a century of production. The timing of the closure is expected to be in the second half of 2023.

After 2023, world primary aluminium production is forecast to rise by 1.9% a year over the outlook period, reaching 73 Mt by 2025 (Figure 11.4). The gains will be driven by China, as more output is produced from greenfield aluminium smelters. China's primary aluminium production is projected to reach 43 Mt by 2025. This is edging closer to the capacity cap of 45 million tonnes per year, a policy introduced by the Chinese Government in 2017 in response to environmental and oversupply concerns. As China edges closer to its primary aluminium capacity cap, other primary aluminium producing nations — such as India, Canada, Brazil, and the UAE — will get the chance to fill any market gaps that develop.

According to Shanghai Metals Market, on 8 May 2023 China's Chongqing municipality authority issued a statement outlining that enterprises in highly polluting and energy intensive industries such as steel and aluminium will be subject to differential electricity prices and tiered electricity prices.

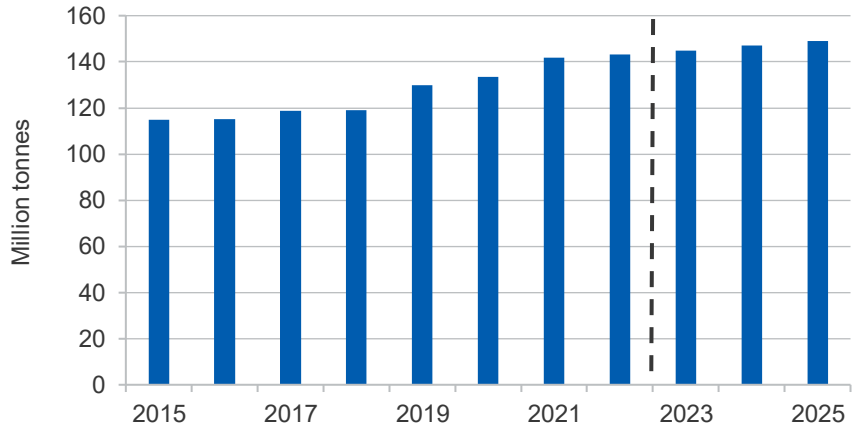
Outside of China, the Alba Aluminium smelter in Bahrain completed a pre-feasibility study for its Line 7 expansion project in the September quarter 2022. It is highly likely that the proposed Line 7 project will commence in 2023. Once completed, it will increase the smelter's output from 1.56 Mt in 2021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

Egyptian Company for Metal Constructions (Metalco) announced on 14 April that it is in talks with a partner to build a 600,000 tonnes per year aluminium smelter in the Golden Triangle area of Egypt. The project requires an investment of about US$2.7 billion and is expected to reach a final investment decision in 2023.

World secondary aluminium output is forecast to increase by 4.6% year-on-year in 2023 to nearly 33 Mt, driven by higher output from China (up by 7.3% year-on-year) and the US (up by 7.0% year-on-year). After 2023, world secondary aluminium is forecast to rise at 6.6% a year, reaching 37 Mt by 2025 (Figure 11.4). Rio Tinto's 30,000 tonnes a year Arvida recycling facility in Quebec, Canada, is expected to be commissioned in the March quarter 2025.

World alumina output is forecast to grow by 1.2% year-on-year to 145 Mt in 2023, driven by rising output from new/existing refineries in China and Australia (Figure 11.5). 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. Construction was completed at the second phase of 1.2 Mt a year Tiandong Jinxin alumina refinery, the third and fourth phases of 2.4 million tonnes a year Hebei Wenfeng alumina refinery, and the second phase of 1 Mt a year at Lubei

Figure 11.5: World alumina production



Source: World Bureau of Metals Statistics (2023); CRU (2023); Department of Industry, Science and Resources (2023)

Chemical Industry alumina refinery. These refineries were expected to commence production in the June quarter 2023. Australian output is forecast to rise by 1.9% year-on-year to nearly 20 Mt in 2023, driven by improved operating performance of alumina refineries.

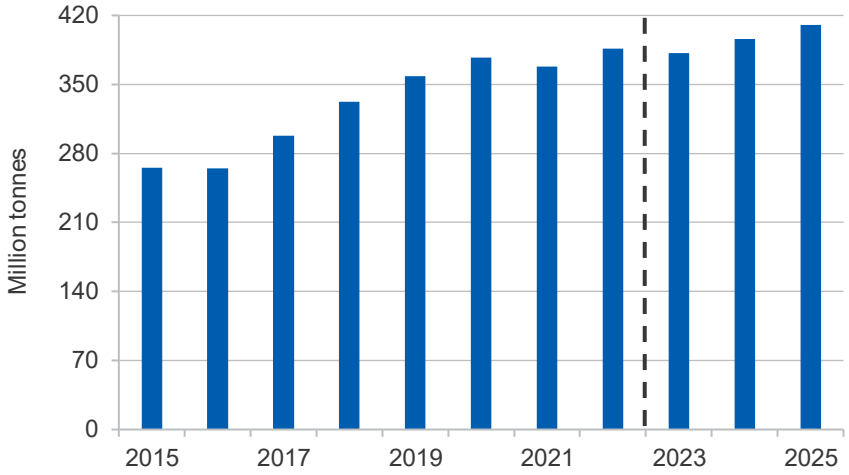
After 2023, world alumina output is forecast to rise by 1.4% a year over the outlook period, reaching 149 Mt by 2025 (Figure 11.5). The gains are forecast to be driven by China, India, and Indonesia. This will include China Aluminium Company and the Indonesian joint-venture partners' 2 million tonnes a year Mempawah alumina refinery in Indonesia, 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 August 2022, the east Indian state of Odisha approved Adani's 4 Mt a year alumina refinery project. The cost of the project is estimated to be US$5.2 billion; the start and completion dates for the project are unknown.

The Guinean Government has planned to develop its alumina refinery industry. With a vast bauxite resource, developing refinery capability would add more value to the Guinean economy. In early May 2023, a French-Guinean businessman asked the French Government to back his alumina refinery project in Guinea.

World bauxite output is forecast to fall by 1.1% year-on-year to 382 in 2023, due to lower production in Indonesia (Figure 11.6). Indonesian production is forecast to fall by 40% in 2023, as the bauxite export ban — commenced in June 2023 — will have an impact on the country's bauxite production. Production at the Tayan bauxite operation and the Ketapang bauxite operation are forecast to fall by 79% and 33% year-on-year in 2023 to 0.7 and 7.2 Mt, respectively.

After 2023, world bauxite production is forecast to increase by 3.6% a year, reaching 410 Mt by 2025 (Figure 11.6). 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

Figure 11.6: World bauxite production



Source: World Bureau of Metals Statistics (2023); Department of Industry, Science and Resources (2023)

the project is commercially viable and will require a capital investment of over US$1 billion.

Green aluminium, alumina and bauxite

The UAE's Emirates Global Aluminium (EGA) — the Middle East's biggest aluminium producer — joined Australia's Heavy Industry Low-carbon Transition Cooperative Research Centre (HILT CRC) in April 2023. Joining HILT CRC enables EGA to participate with the Australian alumina refining industry in finding technological solutions to the decarbonization challenges in alumina refining.

Bosnian aluminium firm Aluminij signed a deal with Glencore in May 2023 to build a 60 MW solar power project and aluminium recycling facility. The green aluminium plant is expected to be commissioned in 2025.

Norsk Hydro signed a contract to buy land in Spain in June 2023 for building a 120,000 tonnes per year aluminium recycling plant. The facility will strengthen Hydro's capabilities to produce low carbon aluminium.

11.4 World trade

Weak aluminium and alumina exports in the March quarter 2023

World primary aluminium exports fell by 44% year-on-year in the March quarter 2023 to 2.1 Mt, largely due to lower exports from Russia. The fallout from the Russian invasion of Ukraine reduced Russian primary aluminium exports by 85% year-on-year to 94,000 tonnes in the March quarter 2023. Despite no direct sanctions on Russian aluminium by the US and other Western nations, Russia's share of world primary aluminium exports fell from 16% in the March quarter 2022 to 4.4% in the March quarter 2023.

Offsetting the fall in aluminium exports from Russia was higher primary aluminium exports from Canada (up 25% year-on-year in the March quarter 2023) and Iceland (up 7.2% year-on-year in the March quarter 2023).

World secondary aluminium exports fell by 14% year-on-year to 517,000 tonnes in the March quarter 2023, driven by lower exports from Europe. Exports from Italy and Poland fell by 32% and 31% year-on-year in the March quarter 2023, respectively. The slower than expected restart of idled primary aluminium capacity forced European aluminium users to turn to secondary aluminium as a substitute.

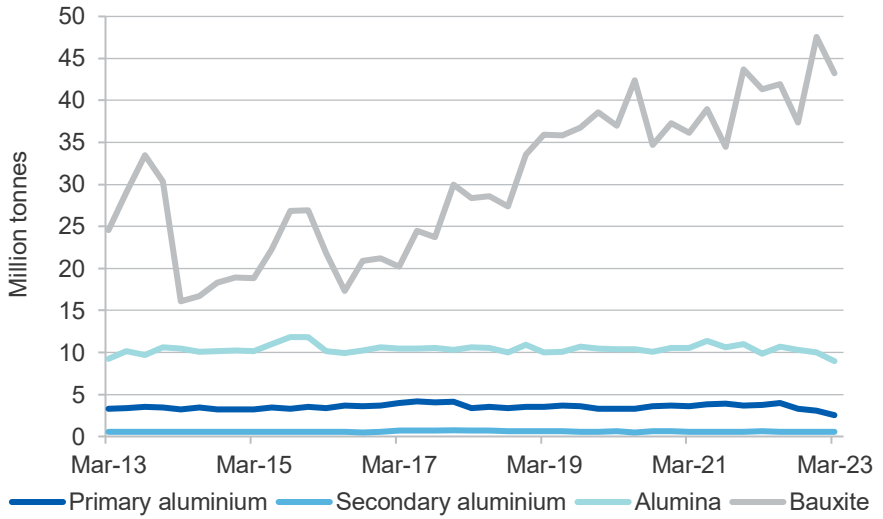
World alumina exports declined by 4.9% year-on-year in the March quarter 2023 to nearly 9.4 Mt. Over this period, exports from Australia — the world's largest alumina exporter — declined by 6.5% year-on-year. This followed a 0.7% fall in Australian alumina production over the same period (see *Australia's exports and production* section). Offsetting the decline in Australia's alumina exports was an increase in exports from China, rising 465% year-on-year in the March quarter 2023.

World bauxite exports increased by 4.7% year-on-year in the March quarter 2023 to 43 Mt. This was propelled by a 35% year-on-year rise in Guinea — the world's largest bauxite exporter. Over the same period, bauxite exports from Australia — the world's second largest bauxite exporter — decreased by 22% year-on-year. Bauxite exports from Indonesia decreased by 58% year-on-year in the March quarter 2023, as the Indonesian bauxite producers slowed down their production in preparation for the export ban commenced on 10 June 2023.

The bauxite export ban — reported to be part of the Indonesian Government's efforts to support domestic supply chains and increase the country's alumina production — is likely to benefit Australian bauxite exporters, with tighter global supply expected to push up bauxite prices. However, Indonesia's determination to raise its alumina refining capacity is unlikely to impact Australia's status as the world's largest alumina exporter in the near term at least.

The government of Ghana is expected to introduce a ban on bauxite exports in 2023. Ghana is a very small bauxite producer, accounting for only 0.13% and 0.09% of global bauxite production and exports, respectively.

Figure 11.7: World aluminium, alumina and bauxite exports



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

Lower aluminium demand led to lower aluminium imports in Europe

World primary aluminium imports fell by 32% year-on-year in the March quarter 2023 to 3.5 million tonnes, largely due to lower European imports. Many nations reduced their aluminium demand and imports. This included German primary aluminium imports, which decreased by 70% year-on-year in the March quarter.

World secondary aluminium imports fell by 9.9% year-on-year in the March quarter 2023 to 757,000 tonnes, largely due to lower European imports. Many European countries reduced secondary aluminium consumption to deal with slowing construction activities. In the Netherlands, secondary aluminium imports in the March quarter 2023 fell by 14% year-on-year to 90,000 tonnes. Over this period, secondary aluminium imports from Poland fell by 19% year-on-year to 79,000 tonnes.

World alumina imports fell by 12% year-on-year in the March quarter 2023 to 7.3 Mt, driven by a 2.9% year-on-year fall in Chinese alumina imports. Chinese imports fell due to higher Chinese domestic alumina production. Russia's alumina import data is not available and included in the assessment.

World bauxite imports decreased by 0.8% year-on-year to nearly 40 Mt in the March quarter 2023, due to lower imports from Spain (down 58% year-on-year) and the US (down 22% year-on-year). China — the world's largest bauxite importer — imported 35 Mt of bauxite in the March quarter 2023, up 8.3% year-on-year. Over this period, Guinea was the largest supplier of bauxite to China, accounting for 77% of China's total bauxite imports, followed by Australia (accounting for 18%) and Indonesia (accounting for 5.3%).

On 14 July 2021, the European Commission released its draft regulation on the Carbon Border Adjustment Mechanism (CBAM). The draft regulation sets out the policy for the European Union (EU) to tax imports based on the greenhouse gases emitted to make them. The CBAM — the world's first carbon tax on imports — applies to EU imports of iron ore, steel, aluminium, cement, fertiliser, electricity and hydrogen. After nearly two years of consultation, the EU's parliament approved the CBAM legislation on 18 April 2023. Starting in October 2023, European companies will have to report the emissions of their imported goods, including the indirect emissions released by the electricity generation that powers overseas factories. European importers will have to pay taxes on the emissions from 2026 and onwards.

The introduction of EU CBAM is unlikely to impact Australia's primary aluminium exports. The EU accounted for 0.1% ($2.9 million) of Australia's total primary aluminium exports in 2022. Over this period, Australia exported $5.6 billion of primary aluminium; 26% to Japan, 22% to South Korea, 8% to Thailand, and 8% to Taiwan.

11.5 Prices

Aluminium market deficit fails to boost aluminium prices

Sluggish primary aluminium demand in Europe and tight monetary conditions in major economies have slightly outweighed the impacts on aluminium prices of supply disruptions in China's Yunnan province. The London Metal Exchange (LME) spot price for primary aluminium has fallen by 8.0% so far in 2023, at US$2,152 a tonne on 27 June 2023 — compared to an average US$2,339 a tonne in the second half of 2022.

LME stock changes reflect the sluggish ex-China primary aluminium demand, rising from 407,325 tonnes in January 2023 to 572,775 tonnes in June 2023. Shanghai Future Exchanges aluminium stock changes reflect the supply issues in Yunnan, falling from 295,920 tonnes in February 2023 to 123,669 tonnes in June 2023. LME off-warrant stocks follow the same trend, falling from 435,869 tonnes in January 2023 to 276,587 tonnes in April 2023 (Figure 11.9).

The free on board (FOB) Australian alumina price has fallen by 5.6% so far in 2023, at US$334 a tonne on 27 June 2023 — compared to an average of US$329 a tonne in the second half of 2022.

The LME aluminium spot price is forecast to fall by 13% year-on-year in 2023, to average US$2,365 a tonne (Figure 11.8). Slowing world growth is

expected to be a significant driver of lower aluminium prices.

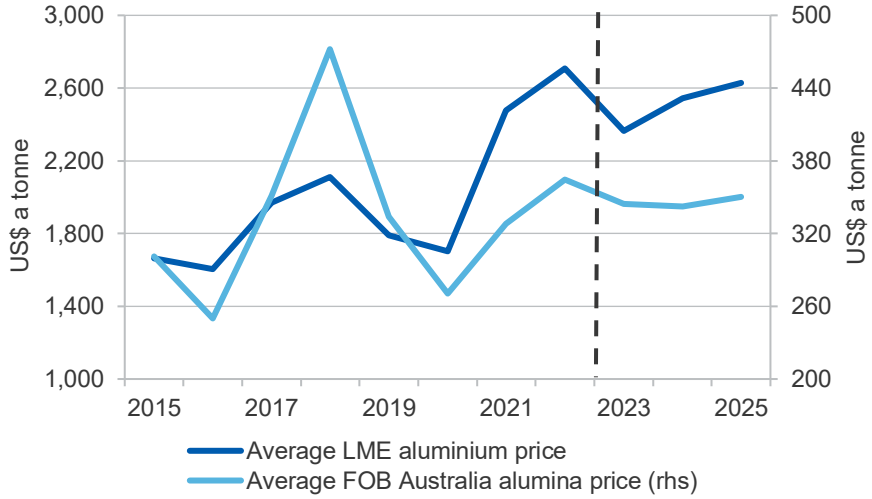
New alumina capacity additions in China — 3.4 Mt of new capacity in the first half of 2023 — are likely to put alumina prices under pressure. The free on board (FOB) Australian alumina price is forecast to decrease by 5.5% in 2023 to an average US$344 a tonne (Figure 11.8).

On 2 June 2023, China's Securities Regulatory Commission approved the registration of alumina futures on the Shanghai Futures Exchange (SHFE). The decision allows the SHFE to launch the world's first alumina contract with physical delivery. The contract started trading on 19 June 2023.

Higher aluminium prices in the short term

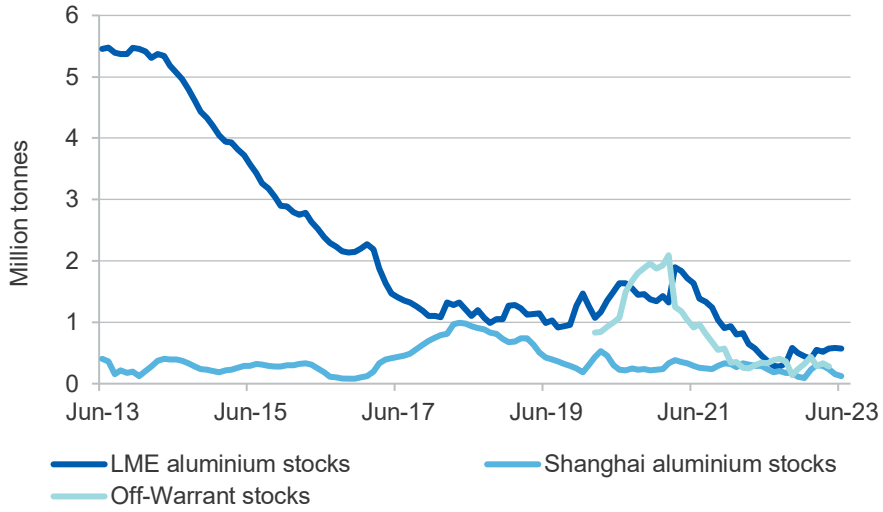
After 2023, the LME aluminium price is forecast to rise, averaging US$2,544 and US$2,629 a tonne in 2024 and 2025, respectively (Figure 11.8). Growing global demand for new, energy-efficient cars and technologies will support aluminium usage. The FOB Australian alumina price is forecast to fall in 2024, before resuming to grow in 2025, averaging US$350 a tonne in 2025 (Figure 11.8).

Figure 11.8: Primary aluminium and alumina prices



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

Figure 11.9: Exchange aluminium stocks



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

11.6 Australian exports and production

Lower aluminium and alumina prices reduced exports in the March quarter

Australia's aluminium, alumina and bauxite (AAB) exports decreased by 6.7% year-on-year in the March quarter 2023 to $3.8 billion, driven by lower aluminium and alumina prices. A 27% year-on-year fall in the LME aluminium price in the March quarter 2023 reduced Australian primary aluminium export values by 2.7% year-on-year to $1.4 billion in the March quarter 2023. Over this period, primary aluminium exports to Japan and Taiwan fell by 18% and 49% year-on-year to $332 million and $66 million, respectively. Largely offsetting the fall in exports to Japan and Taiwan was a 54% year-on-year rise in export to South Korea to $442 million, and a 39% year-on-year rise in export to the US to $235 million.

Australian alumina export values fell by 12% year-on-year to nearly $1.9 billion in the March quarter 2023, due to a 14% year-on-year fall in alumina prices in the March quarter 2023. Alumina export volumes were down by 7.5% year-on-year to 3.8 Mt in the March quarter 2023.

Australian bauxite export values increased by 9.1% year-on-year to $285 million in the March quarter 2023, despite a 19% year-on-year fall in bauxite export volumes.

A weak earnings year for Australia's AAB exports in 2022–23

An expected fall in average aluminium and alumina prices in 2023 is likely to reduce earnings for Australian aluminium smelters, alumina refiners and bauxite miners. Australia's AAB exports are estimated to have decreased by 5.5% in 2022–23 to nearly $16 billion (Figure 11.10).

Higher alumina, aluminium and bauxite export earnings after 2022–23

Over the outlook period, Australia's AAB exports are forecast to increase at an average annual rate of 3.7% a year, reaching $17 billion by 2024–25, with the price of primary aluminium forecast to rise in 2024 and 2025 (Figure 11.10).

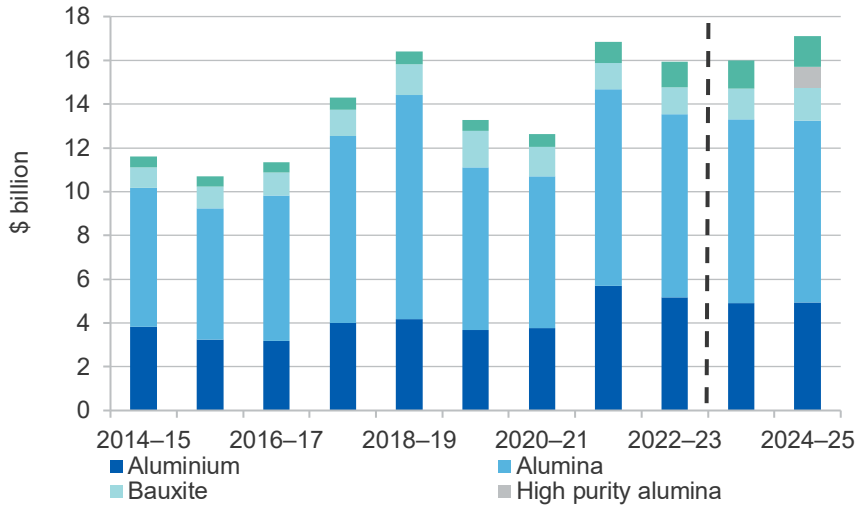
On 15 May 2023, Alcoa signed an 8-year supply agreement to supply 15.6 million tonnes of alumina from its alumina refineries in WA to Emirates Global Aluminium (EGA) in the UAE.

Australia's alumina/aluminium/bauxite production fell in the March quarter

Australia's primary aluminium output fell by 5.7% year-on-year in the March quarter 2023 to 360,000 tonnes. This was primarily due to a 4.9% year-on-year decline (to 117,000 tonnes) at Rio Tinto's Boyne Island smelter in Queensland, and a 2.2% year-on-year decline (to 45,000 tonnes) at Rio Tinto's Bell Bay aluminium smelter in Tasmania. As a result, Australia's primary aluminium output is estimated to fall by 2.3% year-on-year in 2022–23 to nearly 1.5 Mt.

Australia's alumina output fell by 4.1% year-on-year in the March quarter 2023 to nearly 4.7 Mt. Alumina output at Rio Tinto's QAL and Yarwun refineries in Queensland fell by 10% and 0.8% year-on-year in the March quarter 2023 to 790,000 and 739,000 tonnes, respectively, due to unplanned outages and plant reliability issues.

Figure 11.10: Australian aluminium/alumina/bauxite exports



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

Australia's alumina output in 2022–23 is estimated to have dropped by 4.0% year-on-year to 19.3 million tonnes. 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. As of 31 January 2023, about 20% (or 438,000 tonnes) of alumina refining capacity at the Kwinana plant was still curtailed. On 26 April 2023, Alcoa lifted the force majeure for its Kwinana operation.

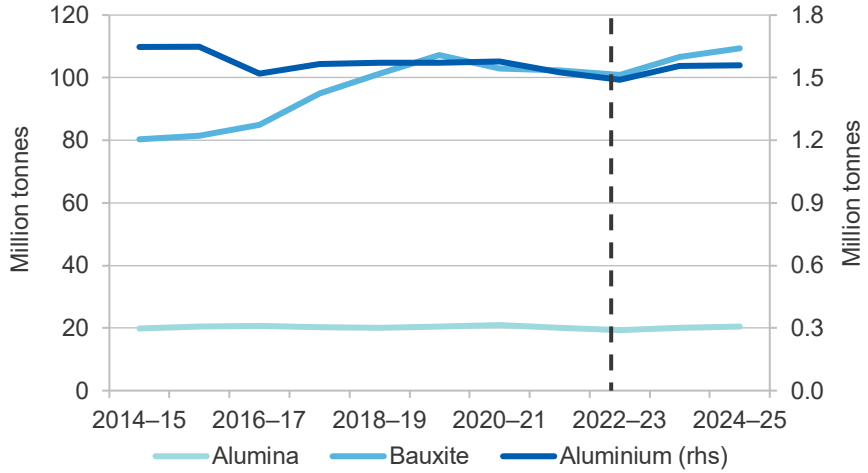
Australia's bauxite production fell by 6.7% year-on-year to 23 Mt in the March quarter 2023, due to lower production at Rio Tinto's Gove bauxite mine in the Northern Territory and the Weipa bauxite mine in Queensland. Higher than average annual rainfall reduced pit access and speed limits for mobile equipment. Metro Mining's Bauxite Hills mine in Queensland did not produce bauxite in the March quarter 2023, due to the annual wet season. As a result, Australia's bauxite output in 2022–23 is estimated to have decreased by 1.4% year-on-year to nearly 101 Mt.

Higher bauxite output over the outlook period

Over the outlook period, an expected improvement in Australian smelting and refining operations is likely to bring Australian primary aluminium and alumina output back to normality, at 1.6 Mt of primary aluminium a year and 20 Mt of alumina a year (Figure 11.11).

Australia's bauxite output is forecast to increase at 2.6% a year in 2023–24 and 2024–25, reaching 109 million tonnes in 2024–25 (Figure 11.11). The expansion of Metro Mining's Bauxite Hills mine in Queensland — from 3.5 million tonnes a year to 7 million tonnes a year — and higher production in other bauxite mines, are the main drivers of this increased output.

Figure 11.11: Australian aluminium/alumina/bauxite output



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

Australia's first high purity alumina (HPA) project to come online soon

In April 2023, Alpha HPA received a $21.7 million grant from the Queensland Government for its 10,000 tonnes a year HPA First project in Gladstone, Queensland. Commercial operation is expected to start by the end of 2023, with an initial output of 1,500 tonnes of HPA a year.

Following the termination of a joint-venture development with Alcoa in February 2023, FYI Resources has completed a 17-day production test run at its pilot plant in WA. The plant produced HPA for targeted product marketing to potential customers.

Impact Minerals recently 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 630,000 tonnes, most of which can be processed to HPA. Further drilling is occurring, and a pre-feasibility study is ongoing.

Pathways to emissions reduction

In Australia, around 215 production facilities (including four aluminium smelters and six alumina refineries) are covered by the Safeguard Mechanism scheme (see the *Safeguard Mechanism* box in the Overview chapter).

The Bell Bay aluminium smelter in Tasmania has access to low emissions electricity through its electricity contract with Hydro Tasmania. The Tomago aluminium smelter in NSW is seeking to switch to renewable power supply in 2029, following the expiration of its current electricity agreement with AGL. The options to switch the Boyne Island smelter in Queensland and the Tomago aluminium smelter in NSW to renewable energy are progressing.

A Rio Tinto and Alcoa joint-venture project developing the ELYSISTM technology (to eliminate carbon emissions from the smelting process) is also progressing, with commercial scale production on track for 2024.

Alcoa is aiming to trial a 4 megawatt mechanical vapour recompression module at its Wagerup refinery in late 2023.

In November 2022, the Australian Renewable Energy Agency (ARENA) released a roadmap for decarbonising Australian alumina refining. The roadmap considers the technical, commercial and market implications for emerging low emissions alumina refining, and identifies key pathways to emissions reduction for one of Australia's hard to abate industries.

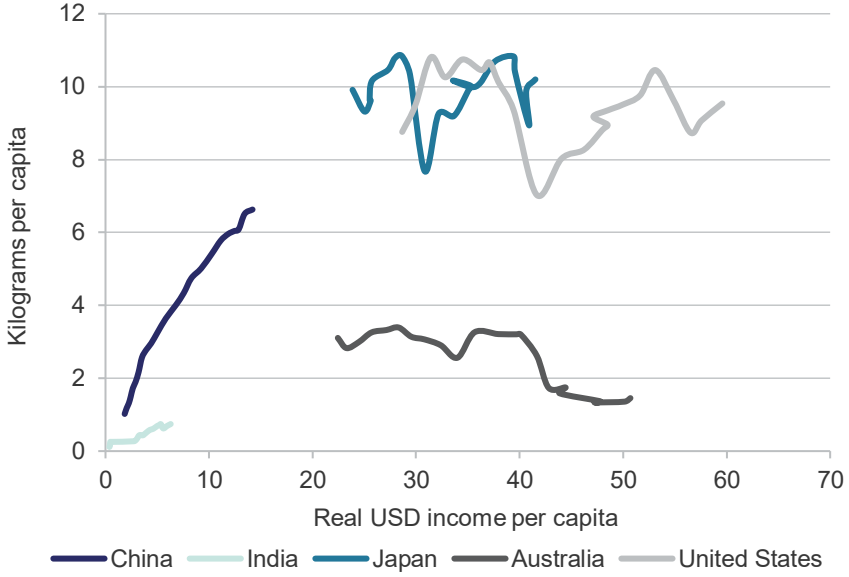
Australia's secondary aluminium consumption

Australia is far behind Japan, the US and China, with secondary aluminium consumption per capita of 1.4 kilograms (Figure 11.12). Australia consumed 38,000 tonnes of secondary/recycled aluminium in 2022, accounting for 0.2% of global secondary/recycled consumption. In the major economies, Japan has the highest secondary aluminium consumption per capita (10.2 kilograms), followed by the US (9.4 kilograms) and China (6.6 kilograms).

Revisions to the outlook

The forecasts for Australia's AAB export earnings in 2023–24 and 2024–25 have been revised down from the March 2023 *Resources and Energy Quarterly (REQ)* — by $598 million and $807 million, respectively. The revision reflects lower forecasts for Australia's alumina export volumes and values.

Figure 11.12: Secondary aluminium intensity use



Source: Organisation for Economic Cooperation and Development (2023); International Monetary Fund (2023); Department of Industry, Science and Resources (2023)

Table 11.1: Aluminium, alumina and bauxite outlook

World	Unit	2022	2023 [f]	2024[f]	2025[f]	Annual percentage change 2023[f]	2024[f]	2025[f]
Primary aluminium								
Production	kt	68,340	70,706	72,441	73,451	3.5	2.5	1.4
Consumption	kt	68,408	69,448	73,305	74,486	1.5	5.6	1.6
Prices aluminium[c]								
- nominal	US$/t	2,708	2,365	2,544	2,629	-12.7	7.6	3.3
- real[d]	US$/t	2,830	2,365	2,486	2,516	-16.4	5.1	1.2
Prices alumina spot								
- nominal	US$/t	365	344	343	350	-5.5	-0.6	2.3
- real[d]	US$/t	381	344	335	335	-9.6	-2.8	0.2
Australia	**Unit**	**2021–22**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**
Production								
Primary aluminium	kt	1,525	1,490	1,558	1,559	-2.3	4.5	0.1
Alumina	kt	20,138	19,326	20,108	20,446	-4.0	4.0	1.7
Bauxite	Mt	102.3	100.9	106.6	109.4	-1.4	5.7	2.6
Consumption								
Primary aluminium	kt	241	139	210	216	-42.4	51.2	3.0
Exports								
Primary aluminium	kt	1,368	1,422	1,418	1,419	4.0	-0.3	0.1
- nominal value	A$m	5,710	5,174	4,914	4,950	-9.4	-5.0	0.7
- real value[e]	A$m	6,115	5,174	4,709	4,598	-15.4	-9.0	-2.4
Alumina	kt	17,739	16,751	17,494	17,788	-5.6	4.4	1.7
- nominal value	A$m	8,977	8,354	8,383	8,292	-6.9	0.4	-1.1
- real value[e]	A$m	9,614	8,354	8,034	7,703	-13.1	-3.8	-4.1
Bauxite	kt	35,957	34,848	40,306	43,181	-3.1	15.7	7.1
- nominal value	A$m	1,177	1,239	1,414	1,538	5.3	14.1	8.8
- real value[e]	A$m	1,260	1,239	1,355	1,429	-1.7	9.3	5.4
Total value								
- nominal value	A$m	16,854	15,924	15,984	17,098	-5.5	0.4	7.0
- real value[e]	A$m	18,050	15,924	15,318	15,882	-11.8	-3.8	3.7

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 2022–23 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).

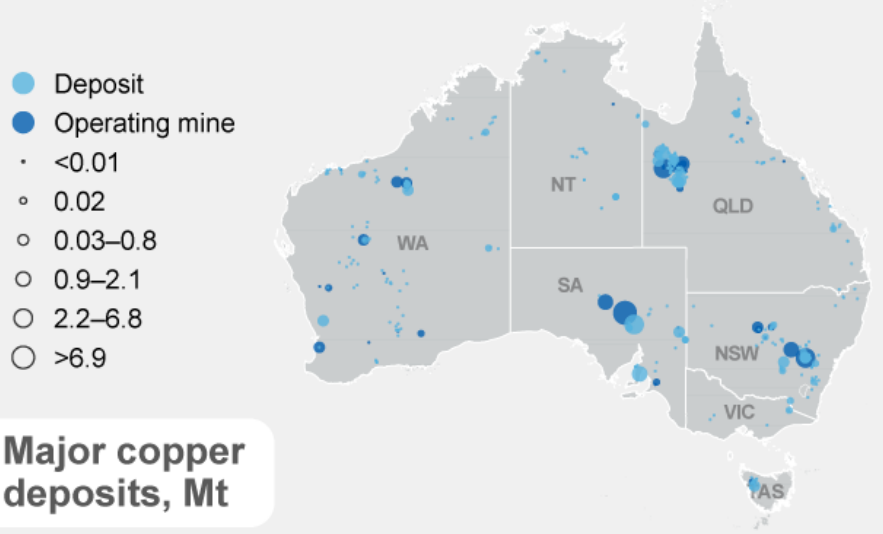
Copper

Australia's copper sector

Ranked 2nd
in the world for copper **resources**

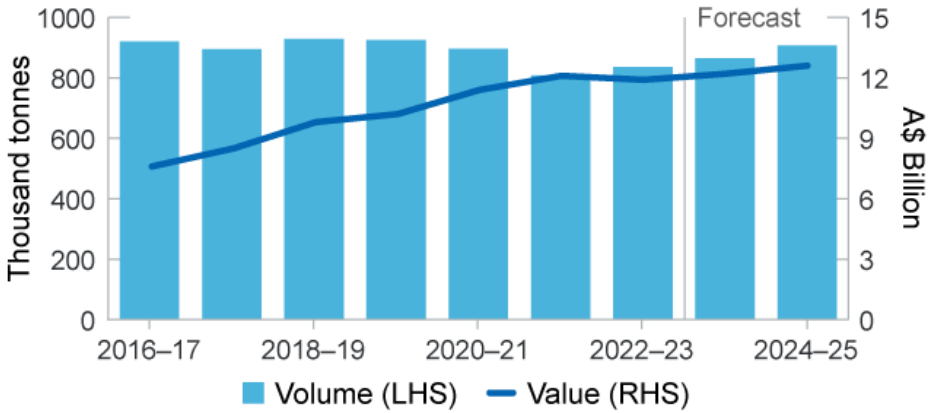
8th largest
producer and **4th largest exporter** globally, 2022

200k tonnes
produced per year at Olympic Mine, Australia's largest



Major copper deposits, Mt

Australian copper exports



Outlook

Slow recovery in Chinese economic activity weighing on copper prices

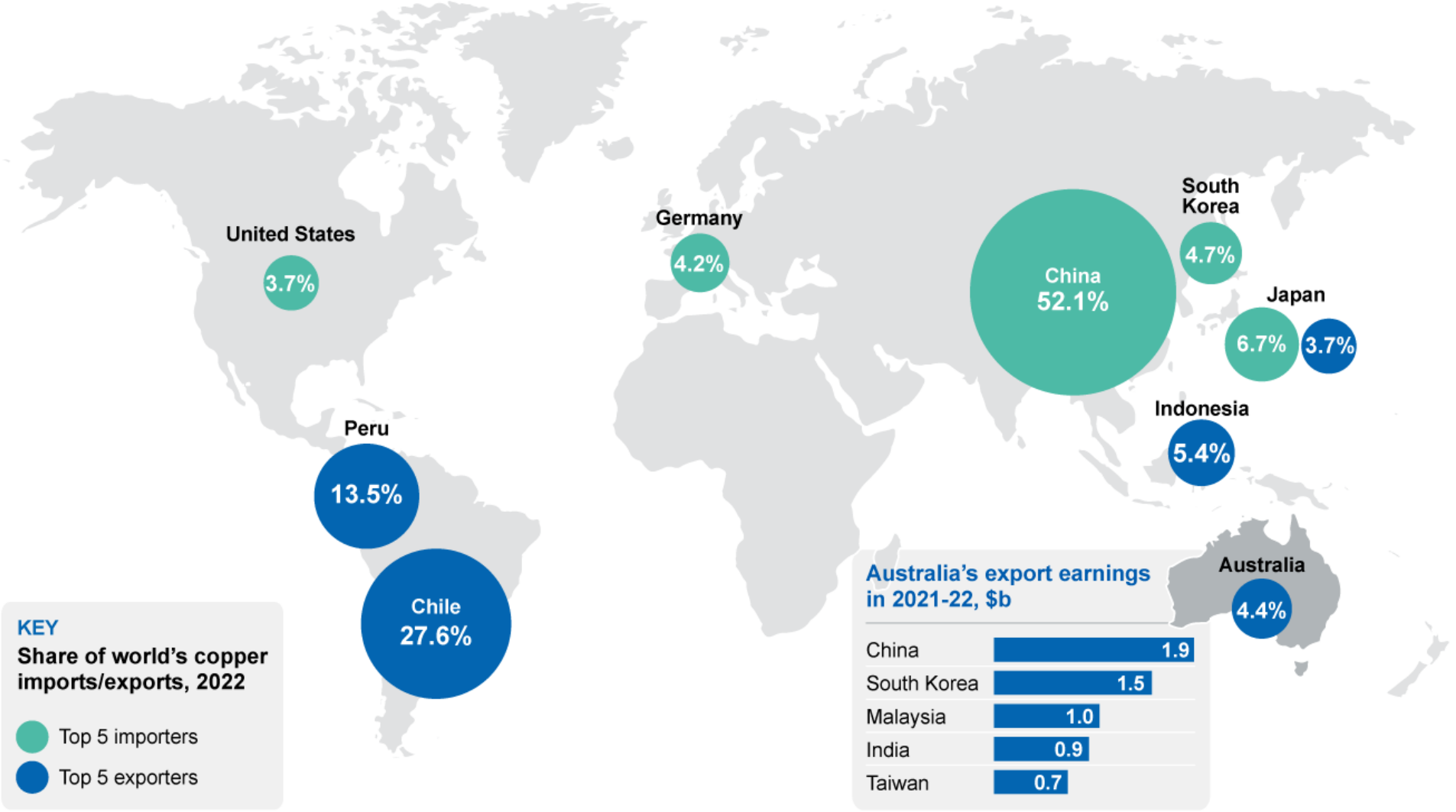
Export earnings stable at **$12 billion** as rising export volumes offset weaker prices

Exports to **increase** as supply disruptions ease, but growing South American competition

Exploration expenditure **declined** in the March quarter, but remains at elevated levels

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

- A slower than expected rebound in Chinese economic growth, combined with weak construction activity in Western countries, is putting downward pressure on copper prices.
- Growing demand from the power and EV sectors are key drivers of copper consumption over the outlook period. Indian consumption should be especially strong.
- Australian export earnings of copper are estimated to have declined slightly in 2022–23. Higher Australian production and exports will support export earnings, which are set to grow to $13 billion in 2024–25.

12.2 World consumption

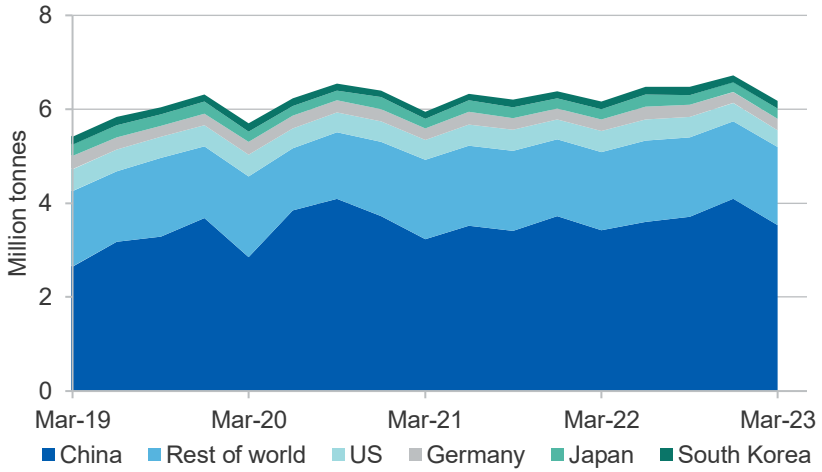
China to lead economic growth, copper consumption in the near term

Global refined copper consumption is forecast to grow to 26 million tonnes (Mt) in 2023 — an increase of 1.5% year-on-year. Consumption in the March quarter 2023 was flat compared to the March quarter 2022, with consumption growth in Asia (3.9%) offsetting falls in Europe (6.0%) and the United States (19%). Copper consumption is expected to increase throughout the year, though downside risks associated with softening global growth are apparent.

Despite China's GDP growth surpassing analyst expectations in March quarter 2023, the effects on copper demand are relatively small. Unlike previous periods of growth, this recovery was led by demand for services (over goods). Chinese copper consumption in the March quarter was 3.2% higher than a year ago.

While construction completions have improved from recent lows, it appears unlikely that the property sector will contribute to economic growth as much as previous recoveries. China's copper consumption over the outlook period will therefore be led by the energy sector, with substantial investment in the energy grid and renewable energy generation in the near term.

Figure 12.1: Refined copper consumption



Source: World Bureau of Metal Statistics (2023); Department of Industry, Science and Resources (2023)

Demographic factors to boost Indian copper consumption

India and the ASEAN nations are expected to make strong contributions to copper demand over the outlook period. Consumption in India is set to benefit from key demographic factors — population growth, as well as higher copper intensity per capita, driven by higher urbanisation and living standards. Indian copper consumption is expected to increase by 13% a year on average over the outlook period, and may overtake Japan as Asia's second largest copper market (after China) by 2025. In the March quarter 2023, Indian copper consumption was 27% higher than in the March quarter 2022.

Mixed conditions for European consumption

European manufacturing had a mixed start to 2023, initially buoyed by easing supply chain disruptions, falling input costs and a backlog of orders. However, manufacturers are exhausting this backlog of orders, and new orders have fallen month-on-month for 11 consecutive months. Construction activity has also weakened, due to high inflation and rising interest rates — with Germany (Europe's largest copper consumer)

particularly affected. US consumption activity largely mirrors that in Europe, with weakness in construction offsetting increasing demand from power and EV sectors.

EV uptake on the charge in Europe

An improvement in automotive production following COVID-19 supply disruptions is providing some support to copper consumption. There were an additional 400,000 passenger vehicle registrations in the EU in the March quarter 2023 compared to the corresponding quarter in 2022 — though registrations remain below 2019 levels.

EV penetration has increased at the same time, which will support copper demand (as EVs are more copper intensive than combustion vehicles). EV market share in the EU has increased by 2.5 percentage points (to 13.9%) in the March quarter 2023, compared to the March quarter 2022. The US has also seen stronger EV sales because of subsidy measures associated with the Inflation Reduction Act. Increasing total vehicle sales and the growing market shares of copper-intensive EVs will support copper consumption in the transport sector, though cost of living pressures remain a key risk for EV uptake.

Copper consumption is expected to grow by 2.8% in 2024 and by 3.5% in 2025, where it is forecast to reach 28 Mt, supported by growing demand from the power and EV sectors.

12.3 World production

Mined copper production to grow over 2023

Global mined copper production is forecast to grow to 22 Mt in 2023 — an increase of 5.1% year-on-year. Global mined production fell by 0.1% year-on-year in the March quarter 2023, but is expected to improve throughout the year.

Mined output in Asia improved by 3.9% year-on-year, supported by increases in output from Indonesia and Kazakhstan. Mined output in the Americas increased by 1.4% year-on-year; higher production from Peru has offset a decline in Chilean production.

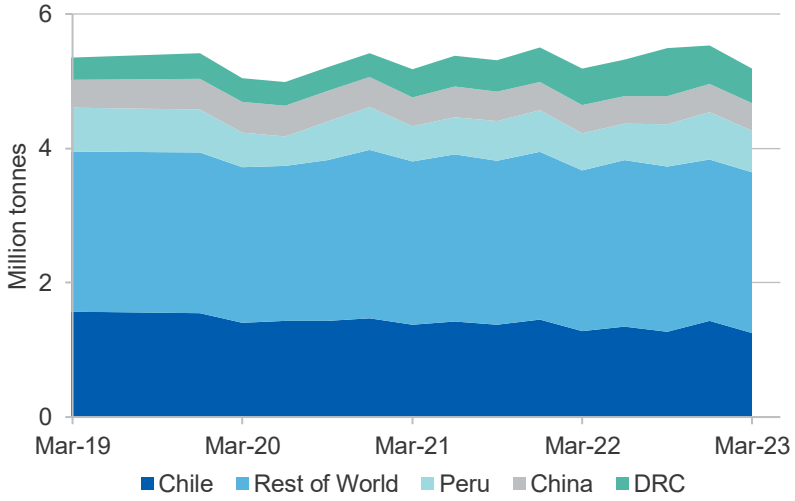
Teck Resources produced first copper concentrate at Quebrada Blanca Phase 2 in Chile in the March quarter 2023. The operation is targeting output of 300,000 tonnes from 2024. Copper production at the Quellaveco mine in Peru is continuing to ramp up towards its 300,000 tonne per annum capacity.

Before accelerating later in the outlook period

More significant growth in mined copper production is expected over the next two years. In addition to the further ramp up in production from the projects listed above, the Escondida expansion is expected to add 200,000 tonnes to Chile's copper production from 2024. Global mined copper production is expected to reach almost 24 Mt in 2025.

The forecast for higher mine production contains significant downside risks. Declining ore grades, higher production costs, aging facilities and increased environmental and social scrutiny increases challenges for producers.

Figure 12.2: Mined copper production



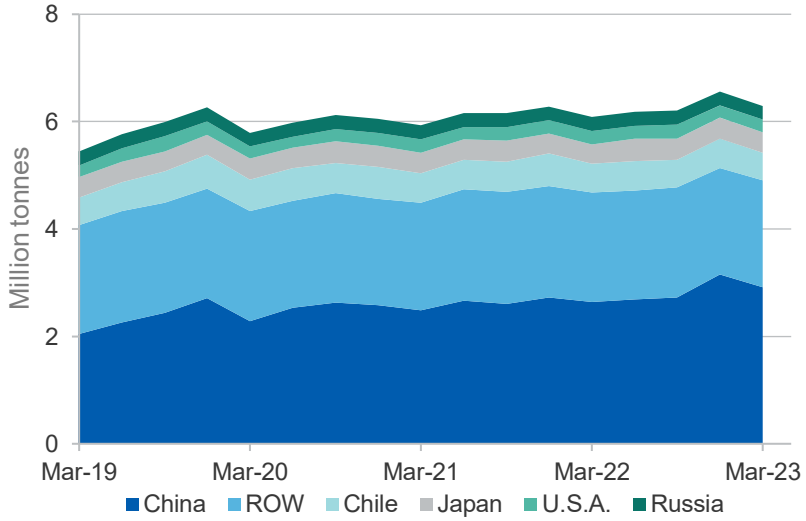
Source: World Bureau of Metal Statistics (2023); Department of Industry, Science and Resources (2023)

China leading refined copper production growth

Refined copper production is expected to grow by 3.0% to 26 Mt in 2023. Global refined output in the March quarter 2023 was 3.4% higher than the same period a year ago. Global refined copper production growth is being strongly driven by China, with March quarter 2023 production up 10% compared to the March quarter 2022. Refinery output in the Democratic Republic of Congo is also expected to grow strongly (at around 13%) in 2023.

Meanwhile, refined copper production in the United States has slumped 8.6% year-on-year in the March quarter 2023. European production is also weak at 5.1% lower year-on-year in the March quarter 2023. Refined copper production growth faces operational (electricity costs) and social (emission limits and approval processes) pressures over the outlook period, however this is partly offset by copper's importance to the energy transition.

Figure 12.3: Refined copper production



Source: World Bureau of Metal Statistics (2023); Department of Industry, Science and Resources (2023)

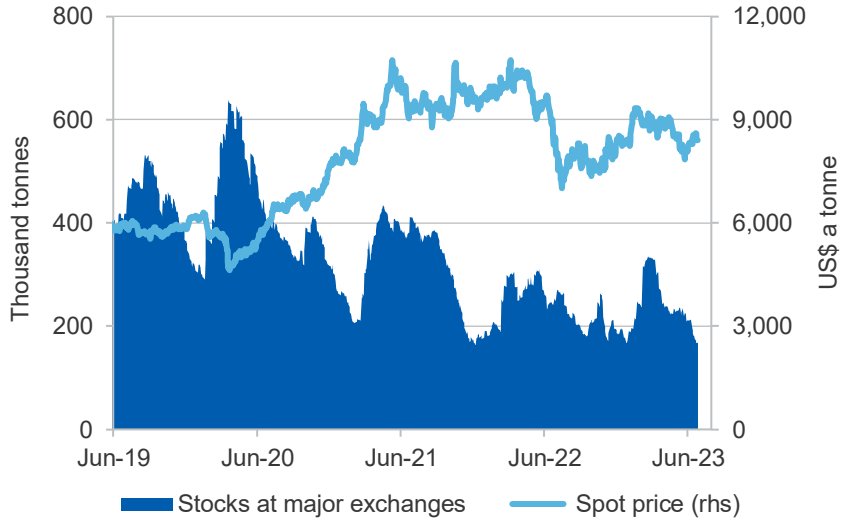
12.4 Prices

Softer Chinese manufacturing weighs on prices

Following an initial rebound in prices as China removed strict COVID-19 containment measures, copper prices have cooled over recent months. Slow world manufacturing activity has driven price down, as central banks tighten monetary conditions. Over the June quarter 2023, prices are estimated to have averaged US$8,300 a tonne, down from US$8,900 in the previous quarter.

Prices are likely to rebound in the second half of 2023. Chinese policymakers have signalled an intent to maintain growth targets and may stimulate activity to compensate for a weak start to the year. Further, the US dollar may face downward pressure if the US Federal Reserve pauses its monetary tightening agenda. Across the whole year, the LME spot price is forecast to average US$8,600 a tonne. Demand will be a stronger driver of price than supply over the year, with risks skewed to the downside if the Chinese recovery stalls, or major economies experience a hard landing.

Figure 12.4: Exchange inventories of copper vs spot price



Source: LME (2023) official cash price; Bloomberg (2023)

Inventory levels continue to drawdown

After the seasonal build-up of inventories in February 2023 (corresponding to Chinese New Year activities), inventories were subject to a steep draw down. Warehouse inventories have continued to decline, to around 168,000 tonnes in mid-June — the lowest level in 18 months.

Expected surplus to contain copper price gains

Despite higher global copper consumption over the forecast period, the uplift in production from Chile and Peru is set to tip the copper market into a surplus, constraining copper prices. Copper prices are expected to average US$8,500 a tonne in both 2024 and 2025. The macroeconomic outlook remains uncertain, and any recessions in major economies would impact copper consumption demand.

12.5 Australia

Falling copper price causes earnings to soften

Export earnings are estimated at $12 billion in 2022–23 — around the level seen in 2021–22.While higher production has lifted export volumes, this has been outweighed by falling prices (partly offset by a weakening exchange rate). In Australian dollar terms, the copper price for 2022–23 is estimated to be 7.7% lower compared to the previous financial year.

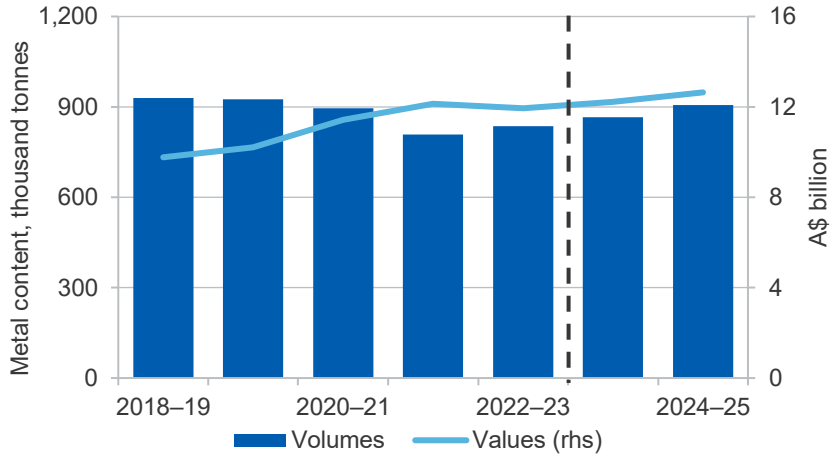
Over the outlook period, export volumes are set to rise further, to about 906,000 tonnes in 2024–25. The gains in export volumes should lift export earnings over the outlook period, with earnings forecast to reach around $13 billion in 2024–25 (Figure 12.5).

Production to continue to grow over the outlook period

Mined production in 2022–23 is estimated to have grown to 806,000 tonnes — up 4.0% year-on-year. This figure is lower than forecast in the March 2023 *Resources and Energy Quarterly* because of weather-related disruptions in early March 2023. For example, production guidance at Evolution Mining's Ernest Henry operations has been reduced by 10,000 tonnes for the year due to heavy rainfall and flooding. The Thalanga mine in Queensland was placed into care and maintenance in the March quarter 2023, as the mining operator was put into administration in December quarter 2022. Thalanga produced 3,200 tonnes of copper in the 2021–22 financial year.

Mined production is expected to grow over the outlook period, reaching 824,000 tonnes in 2023–24 and 865,000 tonnes in 2024–25. These gains are largely due to fewer weather and COVID-related disruptions, as well as new production from the West Musgrave copper-nickel project, which is expected to add to output from 2025.

Figure 12.5: 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)

Copper exploration falls, but still historically high

Copper exploration expenditure fell to $136 million in the March quarter 2023. Expenditure is still higher compared to the same period last year (up 11%) and higher than levels seen prior to the COVID pandemic.

Revisions to the outlook

Since the March *Resources and Energy Quarterly*, the forecast for Australia's copper export earnings in 2023–24 and 2024–25 have been revised down by $0.9 billion and $1.6 billion respectively, due to forecasts for lower prices and export volumes.

Table 12.1: Copper outlook

World	Unit	2022	2023[f]	2024[f]	2025[f]	Annual percentage change 2023[f]	2024[f]	2025[f]
Production								
– mine	kt	21,528	22,205	23,005	23,120	3.1	3.6	0.5
– refined	kt	25,270	26,064	26,611	27,011	3.1	2.1	1.5
Consumption	kt	25,967	25,790	27,182	28,159	-0.7	5.4	3.6
Closing stocks	kt	942	1 348	1 595	1 544	43.2	18.4	-3.2
– weeks of consumption		1.9	2.7	3.1	2.9	44.1	12.3	-6.6
Prices LME								
– nominal	US$/t	8,815	8,644	8,502	8,463	-1.9	-1.6	-0.5
	USc/lb	400	392	386	384	-1.9	-1.6	-0.5
– real[b]	US$/t	9,213	8,644	8,310	8,101	-6.2	-3.9	-2.5
	USc/lb	418	392	377	367	-6.2	-3.9	-2.5
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	775	808	824	865	4.2	2.0	5.0
Refined output	kt	362	420	435	404	16.1	3.6	-7.2
Exports								
– ores and concs[c]	kt	1,641	1,479	1,524	1,808	-9.8	3.0	18.6
– refined	kt	330	412	429	398	24.8	4.0	-7.2
– total metallic content	kt	808	836	865	906	3.5	3.5	4.8
Export value								
– nominal	A$m	12,128	12,073	12,529	12,782	-0.4	3.8	2.0
– real[d]	A$m	12,988	12,073	12,007	11,873	-7.0	-0.5	-1.1

Notes: **b** In 2023 calendar year US dollars; **c** Quantities refer to gross weight of all ores and concentrates; **d** In 2022–23 financial year Australian dollars; **f** Forecast.
Source: ABS (2023) International Trade, 5465.0; LME (2023) spot price; World Bureau of Metal Statistics (2023); Department of Industry, Science and Resources (2023).

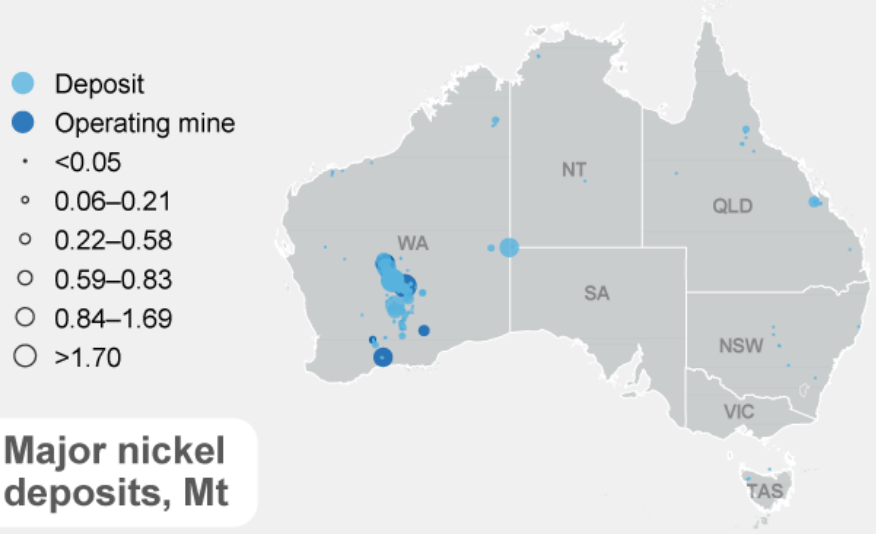
Nickel

Australia's nickel sector

22%
of the world's **resources, largest** global reserve

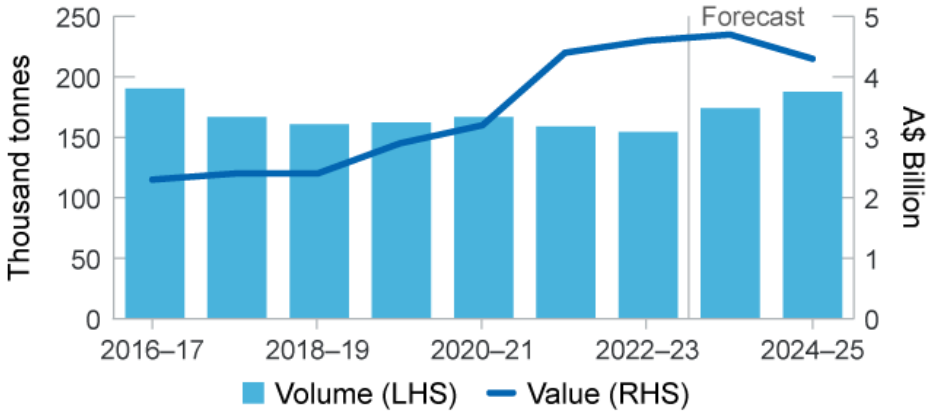
5th largest
nickel producer globally

$4.4 billion
contributed to the **economy** last year



Major nickel deposits, Mt

Australian nickel exports



Outlook

Prices still high, but **easing off** of strong Indonesian production

Export earnings to fall to **$4.2 billion** in 2024-25 as record prices ease

New projects, fewer supply disruptions to **improve production and export volumes**

Exploration expenditure over the past 12 months at **decade high** levels

SOURCE: GA; DISR; OCE

13.1 Summary

- A slow recovery in Chinese goods demand in H1 2023 has dampened global nickel demand. However, a stronger H2 2023, combined with EV demand in the West, is forecast to see nickel usage rise by 9.3% in 2023.
- Nickel supply is expected to exceed strong nickel demand, driven by Indonesian (and some Chinese) output growth. Surpluses are evident in Chinese markets, though Western markets remain tight.
- With prices coming off recent highs, Australian nickel export earnings are forecast to fall from $4.5 billion in 2022–23 to $4.2 billion in 2024–25.

13.2 World consumption

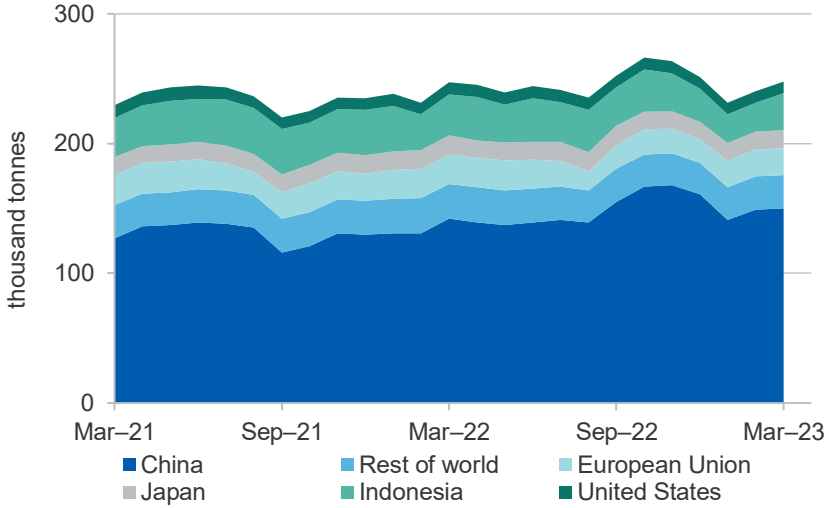
Nickel consumption started the year flat, but should pick up

Refined nickel consumption was just 0.4% higher in the March quarter 2023 compared to the same period last year (Figure 13.1). While declining in other markets, nickel usage in China rebounded 8.9% year-on-year. The rebound reflected the end of strict COVID-zero containment measures but was lower than consensus expectations, as the Chinese bounce-back has been led by demand for services rather than goods. While a pick-up in goods demand and nickel consumption is expected in H2 2023, there is a risk that activity remains subdued for longer.

In the stainless steel sector, a decline in scrap utilisation has driven rising primary refined nickel usage, rather than expanded production. High inventories and falling demand have seen Chinese stainless steel makers cut production guidance, while the decline in scrap utilisation has been caused by a glut of cheap nickel pig iron (NPI). China's electric vehicle (EV) sales have also been flat in recent months, following the cessation of generous government subsidies: EVs remain competitive in China compared to internal combustion engine vehicles (ICEV).

Global refined nickel consumption is forecast to grow to 3.2 million tonnes (Mt) in 2023 — an increase of 9.3% year-on-year. Growth in nickel demand is projected to remain robust in subsequent years, driven by both stainless steel and battery production. Nickel consumption is forecast to reach 3.6 Mt by 2025, representing average annual growth of 5.3%.

Figure 13.1: Composition of world nickel consumption



Source: International Nickel Study Group (INSG); Department of Industry, Science and Resources (2023)

Electric vehicle demand to boost nickel consumption

Despite weakening demand in China, EV sales have picked up in the United States and the European Union (EU), boosting global demand for EVs. Prices of battery packs are anticipated to fall from 2024, which should see the price gap between ICEVs and EVs narrow. This would increase demand for EVs, thereby supporting higher nickel consumption. Over the outlook period, EV sales are expected to grow from 11 million in 2022 to 23 million in 2025. EV batteries are forecast to account for 20% of total refined nickel usage by 2025.

However, high-nickel battery chemistries have lost some ground to lithium-iron phosphate (LFP) batteries (which do not contain nickel), which presents downside risk to nickel consumption. Market share for high-nickel chemistries fell from 76% in 2021 to 66% in 2022, led by Chinese EV manufacturers' preference for cheaper LFP batteries. Sodium-ion batteries — an alternative to lithium-ion batteries — are also becoming commercially viable, but these will likely be limited to urban vehicles or stationary storage applications due to inferior energy density properties.

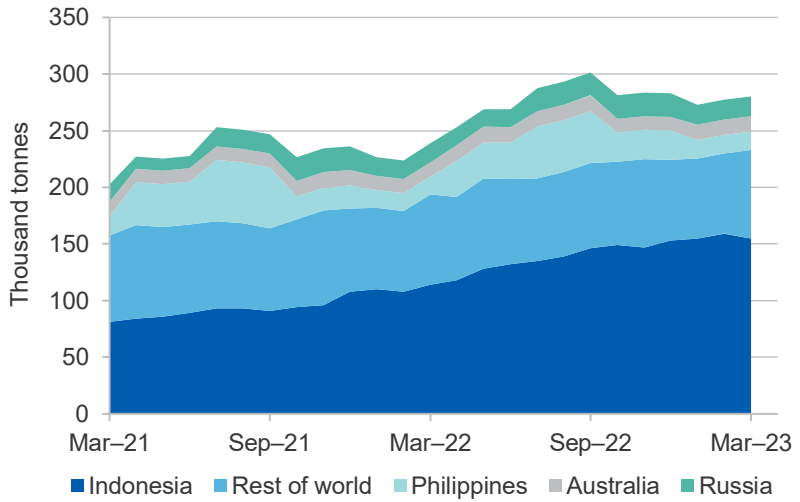
13.3 World production

Indonesia to lead mined nickel output growth over the outlook period

Mine production is expected to increase 7.2% in 2023, led by increases in Indonesia. March quarter mine production increased by a substantial 20% year-on-year, however the rate of growth is expected to slow over the year.

Mined nickel production is forecast to grow by 3.8% and 3.4% over 2024 and 2025 to reach 3.7 Mt, with Indonesian output expected to be responsible for four-fifths of this global uplift in production (Figure 13.2). A looming oversupply in refined nickel may provide some downside risks to mine production growth, as producers seek to avoid lower prices.

Figure 13.2: Composition of world mined nickel production



Source: International Nickel Study Group (2023); Department of Industry, Science and Resources (2023)

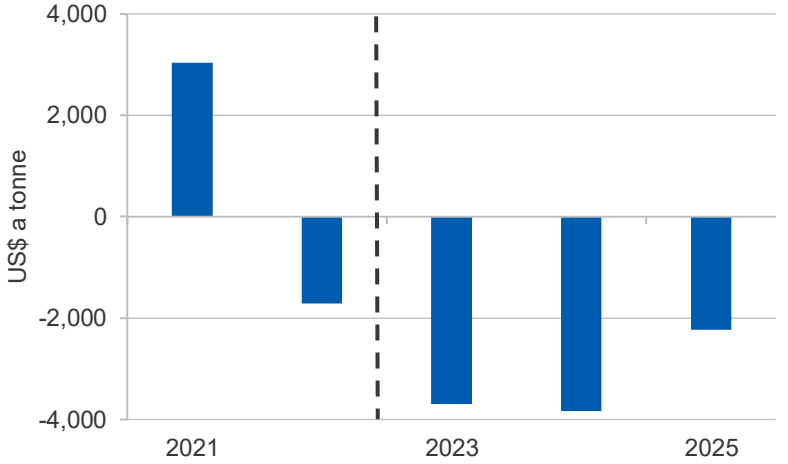
Indonesia announces no new NPI smelter licences

The Indonesian government has paused plans to introduce new taxation and export restrictions on nickel products further down the value chain (raw nickel exports are already banned). However, the government has stopped issuing new licences for NPI smelters, and is reviewing licences and tax incentives for matte producers. These changes have occurred due to concerns about the availability of nickel ore to sustain the industry's rapid growth. That said, there are many smelters already permitted but not yet producing, so there is further upside for Indonesian NPI output.

Nickel sulphate production for EVs to boost refined production

Global refined nickel output is forecast to be 3.3 Mt in 2023, a rise of 7.6% year-on-year. Higher nickel sulphate output is expected to support this growth; Chinese nickel sulphate output surged 30% last year, benefitting from a lift in imports of Indonesian nickel matte. Nickel sulphate is a key material in EV batteries.

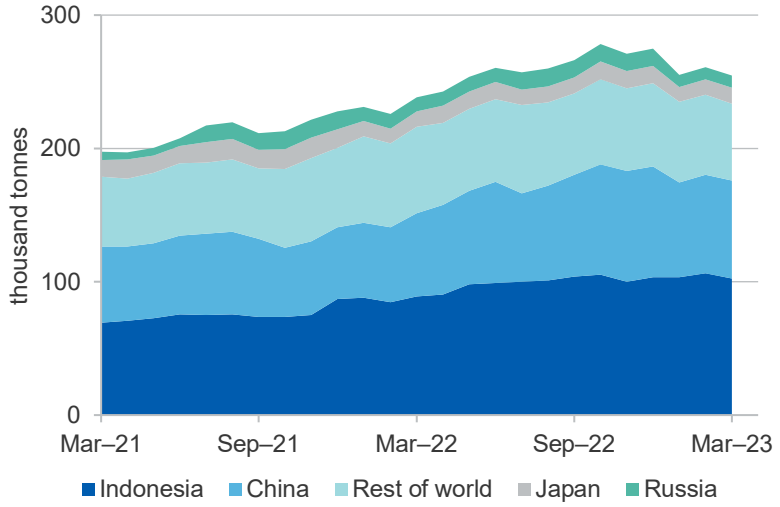
Figure 13.3: Nickel sulphate premium/discount over time



Source: Wood Mackenzie (2023); Department of Industry, Science and Resources (2023)
Note: Figures below 0 indicate that nickel sulphate is selling at a discount to metal.

Such is the glut of sulphate that it is trading at deep discounts to metal of about US$3,900 a tonne (Figure 13.3). With conversion costs of about US$1,000 a tonne, companies (including Tsingshan) are investigating producing metal from converting nickel sulphate. Refined production is forecast at 3.5 Mt in 2024 and 3.6 Mt in 2025 — annual gains of 5.8% and 3.9%, respectively.

Figure 13.4: Composition of world refined nickel production



Source: International Nickel Study Group (2023); Department of Industry, Science and Resources (2023)

13.4 Prices

LME price weakens on world slowdown fears

The LME nickel price has weakened in net terms since the March 2023 *Resources and Energy Quarterly*, as fears build of a hard landing in the world economy. The relatively anaemic recovery in the Chinese economy has been a factor in the price decline.

Nickel surplus grows, but LME price remains high in historical terms

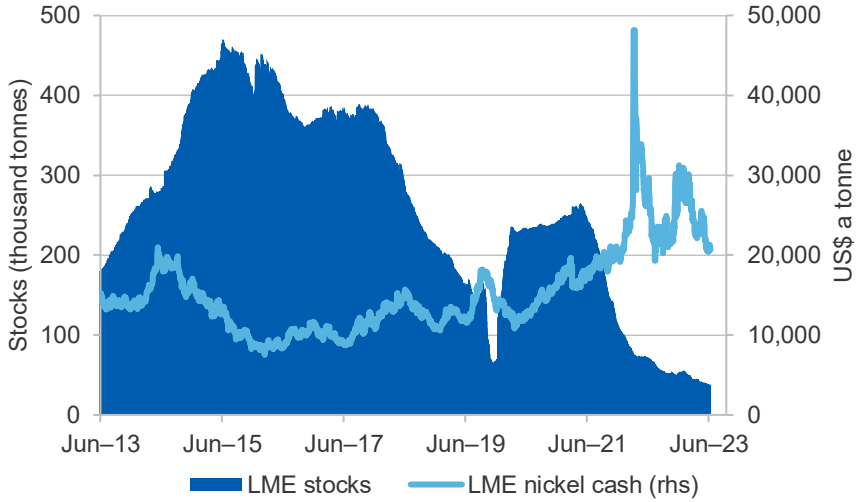
The International Nickel Study Group forecasts the surplus in the nickel market to be equal to 7.1% of primary supply in 2023. Normally, this would put considerable downward pressure on prices, however LME prices have remained above US$20,000 a tonne.

Underlying this anomaly is that the market surplus is almost wholly driven by Indonesian and Chinese Class II nickel products. Class I nickel markets remain tight, as indicated by further nickel outflows from LME warehouses.

Inventories as at the end of May stood at 39,000 tonnes — nearly half the level prior to Russia's invasion of Ukraine and the brief halt in LME trading in March 2022, and the lowest level recorded in the past decade (Figure 13.5).

The LME nickel price is forecast to average about US$23,000 a tonne in 2023. Surpluses across the next two years are forecast to see prices fall further — to around US$20,600 a tonne in 2024 and US$20,000 in 2025. That said, illiquidity in markets (following the Russian invasion of Ukraine) and historically low inventories will provide some support to nickel prices.

Figure 13.5 Nickel spot price and stock at exchanges



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

LME to expand trading platform to include more products

Following the short squeeze event that halted LME trading in March 2022, an independent review has recommended that the LME develop (in conjunction with the Qianhai Mercantile Exchange) platforms for Chinese nickel sulphate and nickel matte markets. These platforms are not expected to be functional until 2024.

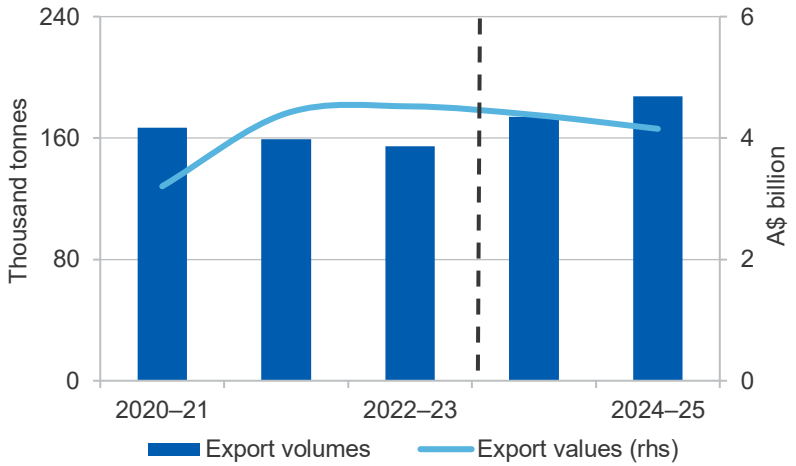
13.5 Australia

Stronger export volumes to boost nickel earnings

Strong nickel prices over the past year have lifted nickel export earnings, which are estimated to have grown by 3.9% to reach $4.5 billion in 2022–23 (Figure 13.6).

Stronger production and export volumes are expected over the outlook period, though this is expected to be outweighed by falling prices. Export earnings are expected to fall to $4.4 billion in 2023–24, and to $4.2 billion in 2024–25. Export volumes are forecast to increase from 154,000 tonnes in 2022–23 to 174,000 in 2023–24 (13% growth) and 188,000 in 2024–25 (13% growth).

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)

Mine production to grow strongly over the outlook period

After falling in 2021–22, due to the impacts of weather and labour shortages, Australian mined nickel production is forecast to remain flat at 155,000 tonnes in 2022–23. Mine production is expected to improve over the outlook period, reaching 214,000 tonnes in 2024–25. Contributing to this increase in mined production will be IGO's Cosmos project (first production expected September quarter 2023), further ramp ups at Kambalda (Mincor) and Avebury (Mallee Resources), as well as the West Musgrave copper-nickel project (first production from March quarter 2025).

BHP advised that the Mt Keith mine was affected by heavy rains in early April 2023, revising financial year production guidance lower as a result. Production at IGO's Nova mine recovered after a power station fire impacted December quarter 2022 production.

Meanwhile, Mincor has withdrawn financial year production guidance at its Kambalda operations. Mincor plans to stockpile ore for blending with better quality ore when the mine ramp up is complete.

Exploration expenditure hits record levels

Nickel and cobalt exploration expenditure for the March quarter 2023 was $78 million. While this is down from the previous quarter, it is 21% higher than in the March quarter 2022. Further, exploration in the 12 months to March 2023 is also higher than at any point since 2008, highlighting nickel's growing importance in the global energy transition.

Revisions to the outlook

Compared to the March 2023 *Resources and Energy Quarterly*, nickel export earnings have been revised down in each of the forecast years: by $0.5 billion in 2023–24; and $0.6 billion in 2024–25.

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	3,211	3,443	3,573	3,694	7.2	3.8	3.4
– refined	kt	3,059	3,292	3,484	3,620	7.6	5.8	3.9
Consumption	kt	2,957	3,233	3,476	3,584	9.3	7.5	3.1
Closing stocks	kt	443	502	510	546	16	3.9	9.0
– weeks of consumption		7.8	8.1	7.6	7.9	5.9	-3.4	5.7
Prices LME								
– nominal	US$/t	25,696	23,008	20,625	20,000	-6.1	-9.8	-7.5
	USc/lb	1 166	1 044	936	907	-6.1	-9.8	-7.5
– real [b]	US$/t	26,858	23,008	20,158	19,144	-10	-12	-9.4
	USc/lb	1 218	1 044	914	868	-10	-12	-9.4
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	157	187	204	0.8	20	15
– refined	kt	98	97	95	95	-1.0	-2.3	0.0
– intermediate		31	28	28	28	-10	-1.1	0.0
Export volume [dg]	kt	159	154	174	188	-3.5	13	13
Export value[g]								
– nominal value	A$m	4,405	4,521	4,381	4,151	3.9	1.9	-5.8
– real value [e]	A$m	4,718	4,521	4,198	3,856	-3.0	-2.3	-8.7

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 2022–23 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).

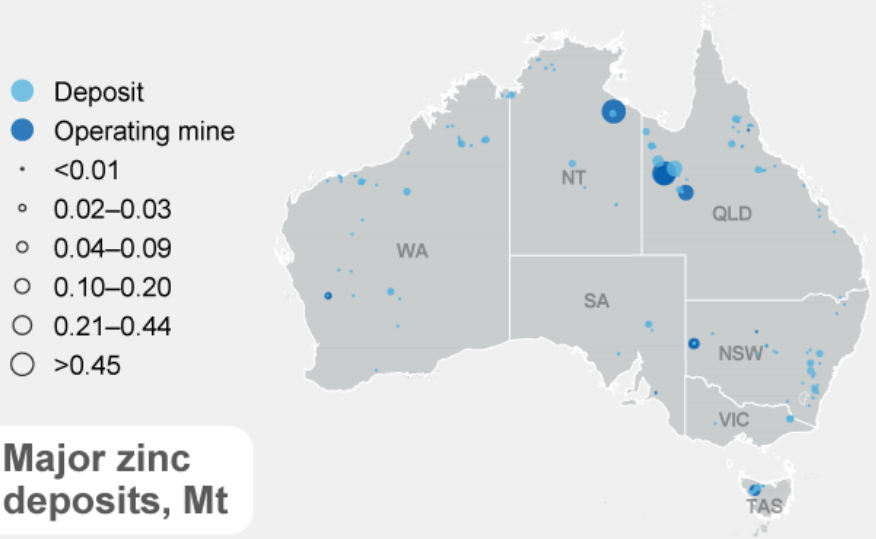
Zinc

Australia's Zinc sector

About 1/3
ores & concentrate production **refined domestically**

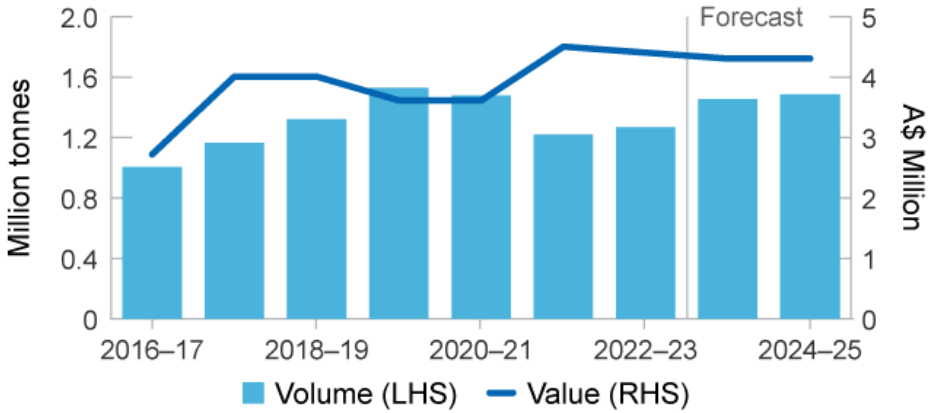
27%
of the world's known **zinc resources** and **10% of production**

$4.5 billion
record earnings in 2021-22, due to high prices



Major zinc deposits, Mt

Australian zinc exports



Outlook

Zinc prices fell as european smelters reopen

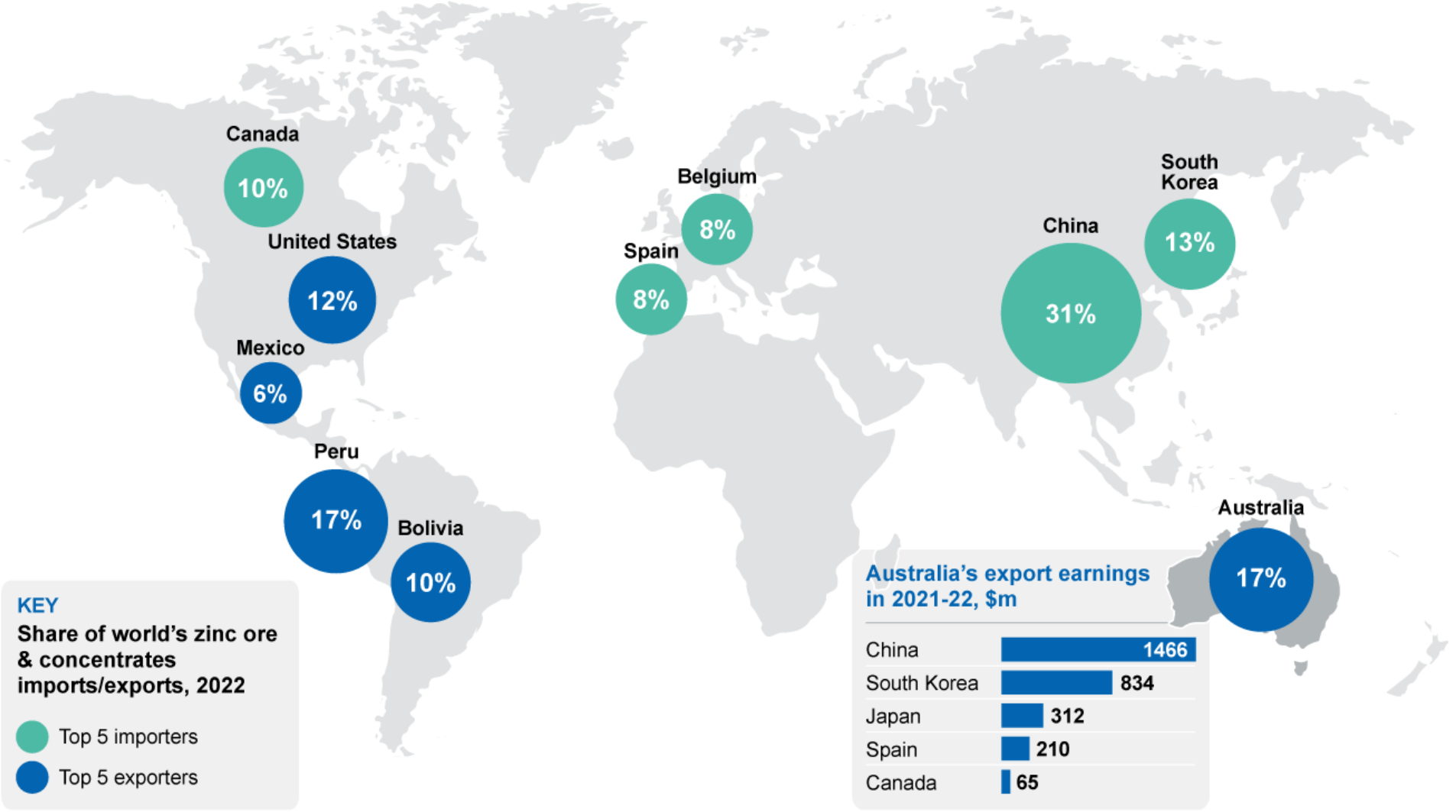
Future earnings to fall as global demand weakens

Australian **production volumes to recover** from COVID, weather and other disruptions

Zinc exploration expenditure **remains elevated**

SOURCE: GA; DISR; OCE

Zinc TRADE MAP



SOURCE: International Lead and Zinc Study Group; ABS

14.1 Summary

- The zinc price has declined noticeably in the June quarter, on worries over a global economic slowdown. Supply remains a concern however, and the zinc price is expected to rise gradually over the outlook period, averaging US$2,900 in 2025.
- Australia's zinc production is forecast to rise strongly over the outlook period, driven by expansion of the Century mine and a recovery in production at existing mines impacted by bad weather and COVID disruptions.
- Australia's zinc export earnings are forecast to remain steady at $4.3 billion between 2022–23 and 2024–25, with a forecast price decline balanced by higher production.

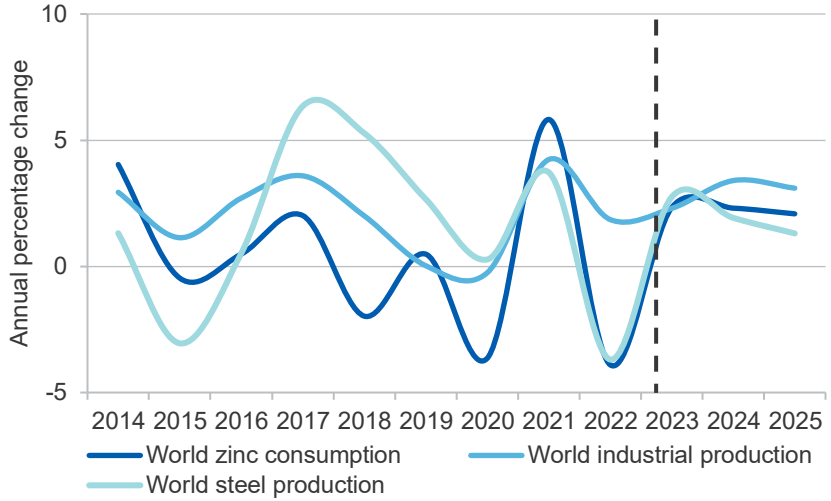
14.2 World consumption

China's post-pandemic growth disappoints, slowing zinc demand growth

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. World refined zinc consumption rose by 1.7% year-on-year in the March quarter 2023. Consumption rose in China (2.9%) and the US (18%), but fell in ex-China Asia (-1.8%) and the European Union (-2.4%). Rising demand from China reflects the country reopening from pandemic restrictions, while consumption in the US grew with a lift in construction spending.

China is the world's largest consumer of zinc, and demand in the March quarter 2023 rebounded as industrial activity recovered following the removal of pandemic restrictions in December. Zinc demand was helped by infrastructure spending over the quarter, as construction continued for projects funded by special purpose bonds issued over 2022. However, the recovery in industrial activity fell substantially below expectations. China's post-covid recovery saw pent-up demand for services, but goods demand remained subdued. A weak global macroeconomic environment also contributed to lower export demand.

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).

Weakness in the Chinese property market continues to weigh on zinc demand. The Chinese property market showed signs of stabilisation with upticks in property sales and price over the March quarter, following the Chinese government easing credit rules for the sector from late 2022. However, many construction projects remain stalled, and consumer confidence in the property market is weak (see Steel chapter).

Easing supply constraints to drive zinc consumption growth

The outlook for growth in world industrial production has deteriorated since the March 2023 *Resources and Energy Quarterly* (see Macroeconomic Outlook chapter). While inflation has begun to subside in Europe and the US, other macroeconomic concerns have arisen. These include bank failures, the US debt ceiling debate, rising interest rates and a weaker than expected recovery in China.

Nevertheless, zinc consumption should rebound in 2023 as consumers use recent weakness in price to replenish low inventories. World zinc

usage is forecast to grow on average 2.2% per year over the outlook period, supported by public infrastructure spending in China.

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. Spending on the deployment of these technologies is supported by policies such as the US Inflation Reduction Act and the EU Green Deal. Developments in zinc battery technology also have the potential to drive additional demand. However, zinc usage in auto manufacturing could decline, as electric vehicle adoption increases: automakers prefer lighter materials to offset the weight of battery packs.

Having grown an average of 4.0% per year between 2009-2019, Chinese zinc consumption is expected to slow as the lockdown-induced rebound tapers by 2025. The post-COVID recovery in China will likely not see growth in the construction sector return to its previous heights, with Chinese government policies on the residential property market focusing on preventing excessive increases in property values. Underlying housing demand is expected to slow, with China's population falling in 2022 for the first time since 1961, and urbanisation rates falling since 2010. China's economy is also expected to steadily transition towards services-driven growth, reducing investment in zinc-intensive infrastructure projects.

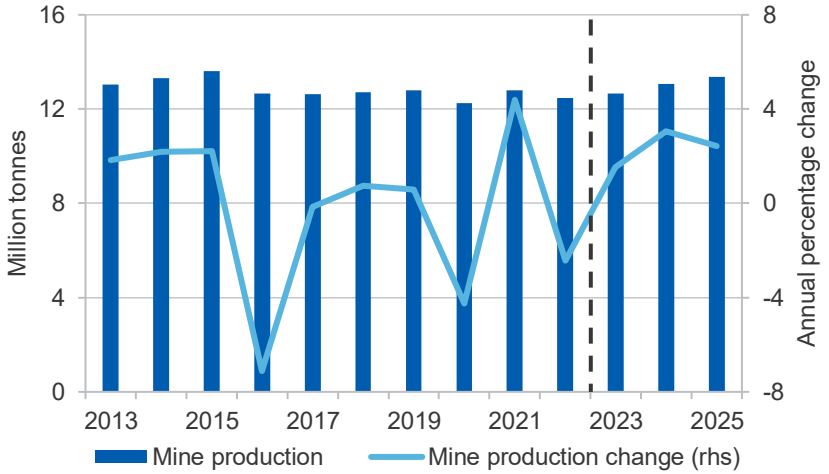
14.3 World production

Global mine production fell as rainfall disrupted mine production

World mined zinc production fell by 2.7% year-on-year in the March quarter 2023, with heavy rainfall disrupting operations in key mines, including Mt Isa and Century in Australia (-15%), and Antamina and Cerro Lindo in Peru (-12%). Canadian output (-44%) halved year-on-year, with several mines closed after reaching end of life. Civil unrest is affecting Peruvian mine output. So far, the focus of the impact of (often) violent anti-government protests by local communities has been on Peru's copper production. However, disruptions to zinc output in Peru — the world's 2nd largest miner of zinc — remain a significant risk.

World mine output is forecast to grow by 2.8% per year (on average) over the outlook period, as new mines and mine expansions come online and production recovers from pandemic disruptions (Figure 14.2). The largest new mines to commence production during the outlook period are located in Russia, the Democratic Republic of Congo, Eritrea and Mexico. Projects in Russia are being delayed: fallout from the Russian invasion of Ukraine has led to difficulty in sourcing equipment, and some businesses have withdrawn operations in the region. China, the world's largest producer of zinc ore, is also expected to expand production across several smaller mines.

Figure 14.2: World zinc mine production, metallic content



Source: International Lead Zinc Study Group (2023); Department of Industry, Science and Resources (2023).

Supply constraints from limited smelter capacity eases

World refining capacity is rising as European smelters reopen and China moves away from pandemic lockdowns, resulting in a 0.1% year-on-year rise in world refined zinc production in the March 2023 quarter. Zinc treatment costs are beginning to ease, as smelting capacity picks up. Spot

treatment costs of imported concentrates in China fell from an average of $263 per tonne in the March quarter 2023 to $225 per tonne in April 2023.

Refined zinc production in the European Union (EU) declined 10% year-on-year but rose 7.5% over the quarter, with the Auby smelter reopening in March. The closure of several European smelters over the second half of 2022 caused a crunch on zinc refining capacity. However, as energy prices ease, more European smelters can be expected to reopen in 2023.

Output in China — the largest zinc refiner globally — rose by 4.7% year-on-year in the March quarter 2023, as COVID pandemic lockdowns were abandoned. However, drought in south-west China affected production over the quarter. In Yunnan province, where about 20% of Chinese refining capacity is located, refineries closed in March 2023 due to power shortages from low hydroelectric power generation.

Over the outlook period, refined production from primary and secondary sources is expected to rise by 2.3% a year. The majority of new capacity is expected to be in China, while European smelters reopening will also contribute.

14.4 Prices

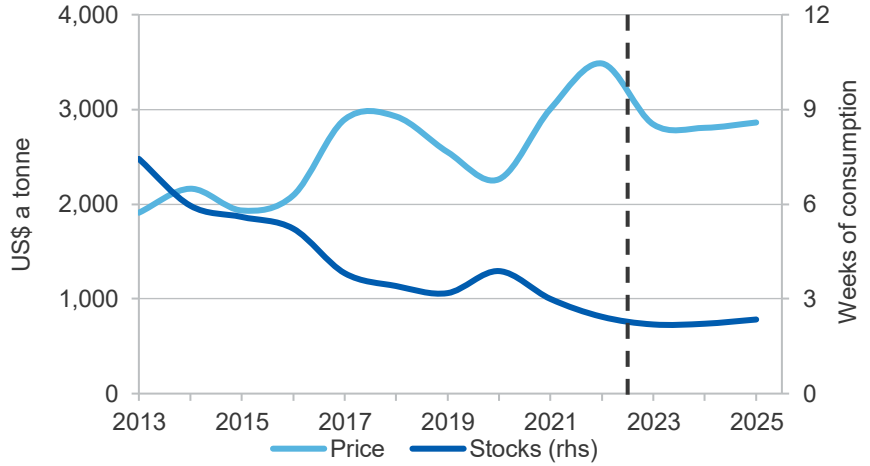
Prices weaken on growing concerns over the demand outlook

The London Metal Exchange (LME) zinc spot price declined sharply in the June quarter, after averaging about $3,100 a tonne over the previous three months. The LME zinc spot price slide over April and May to average around $2,600 a tonne. The price has declined on worries over a global economic slowdown, with the end of COVID lockdowns in China broadly balanced by the impact of European smelters reopening. A series of worrying developments — beginning with the failure of Silicon Valley Bank in March — led to increasing concerns about the weakening macroeconomic environment and its impact on zinc demand.

LME stocks fell to a low of around 15,000 tonnes in February, before rising to around 45,000 tonnes by the end of May, still a very low level historically.

The LME zinc spot price is forecast to average about US$2,800 a tonne in 2023. Following price falls over the June quarter 2023, the price is expected to gradually climb to around $2,900 a tonne by 2025, with the re-opening of China continuing to lift demand.

Figure 14.3: 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 $1.0 billion in the March quarter 2023. This was driven by a sharp fall in zinc ore and concentrates exports, down 39% year-on-year to around $500 million. Australian mine output fell sharply over the March quarter 2023, down 16% year-on-year. This was due to heavy rain at the Mt Isa and Century mines, amongst others. Additionally, a fatal incident saw the Dugald River mine suspended for more than a month.

Refined zinc exports rose 45% year-on-year to around $500 million in the March quarter 2023. Production of refined zinc rose 6.6% year-on-year

and 26% over the quarter, driven by higher production at the Townsville refinery. The refinery completed an expansion project and is now operating at a higher capacity; delays with commissioning the expansion project disrupted production in 2022.

Australian mine output is expected to grow an average of 7.9% per year over the outlook period. Output growth over the next two years will be driven by the expansion of the Century mine, and a production recovery at existing mines (previously impacted by labour shortages, weather and COVID disruptions).

Australia's export earnings for both concentrates and refined zinc (combined) are estimated at $4.3 billion in 2022–23, down 4.4%. A rise in export volumes was more than offset by the impact of prices falling from record highs recorded in H1 2022. (Figure 14.4) Australian export earnings are forecast to remain around $4.3 billion in the next two years, with higher production partially offsetting lower forecast prices.

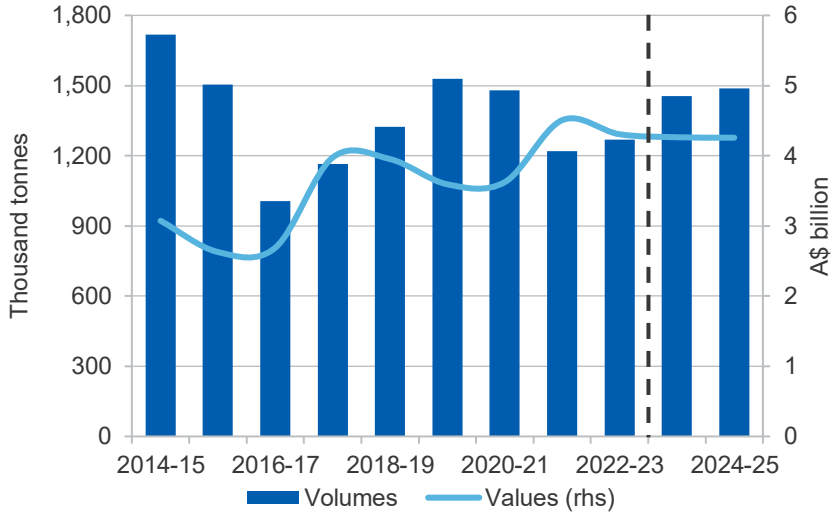
Exploration expenditure softens in the March quarter

Exploration expenditure for silver, lead and zinc fell 20% quarter on quarter to remain unchanged year-on-year in the March 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.

Revisions to the outlook

Compared to the March 2023 *Resources and Energy Quarterly*, 2023–24 and 2024–25 export values have been revised down by 6.5% and 0.8%, respectively, due to a downward revision to the zinc price forecast.

Figure 14.4: Australia's zinc exports, metallic content



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

Table 14.1: Zinc outlook

						Annual percentage change		
World	**Unit**	**2022**	**2023[f]**	**2024[f]**	**2025[f]**	**2023[f]**	**2024[f]**	**2025[f]**
Production								
– mine	kt	12,482	12,672	13,058	13,377	1.5	3.0	2.4
– refined [a]	kt	13,342	13,776	14,165	14,489	3.3	2.8	2.3
Consumption	kt	13,511	13,826	14,145	14,439	2.3	2.3	2.1
Closing stocks	kt	631	581	600	650	- 7.9	3.4	8.3
– weeks of consumption		2.4	2.2	2.2	2.3	-10.3	1.38	5.9
Price								
– nominal	US$/t	3,485	2,781	2,806	2,862	-18.5	-1.3	2.0
	USc/lb	158	126	127	130	-18.5	-1.3	2.0
– real [b]	US$/t	3,643	2,781	2,742	2,739	-22.0	-3.5	-0.1
	USc/lb	165	126	124	124	-22.0	-3.5	-0.1
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	1,257	1,205	1,370	1,401	-4.2	13.7	2.3
Refined output	kt	435	400	449	460	-8.1	12.2	2.6
Export volume								
– ore and concentrate [c]	kt	2,033	1,981	2,324	2,368	-2.5	17.3	1.9
– refined	kt	313	372	411	423	18.6	10.6	2.8
– total metallic content	kt	1,220	1,269	1,456	1,487	4.0	14.7	2.2
Export value								
– nominal	A$m	4,506	4,306	4,263	4,257	-4.4	-1.0	-0.1
– real [d]	A$m	4,826	4,306	4,086	3,954	-10.8	-5.1	-3.2

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 2022–23 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).

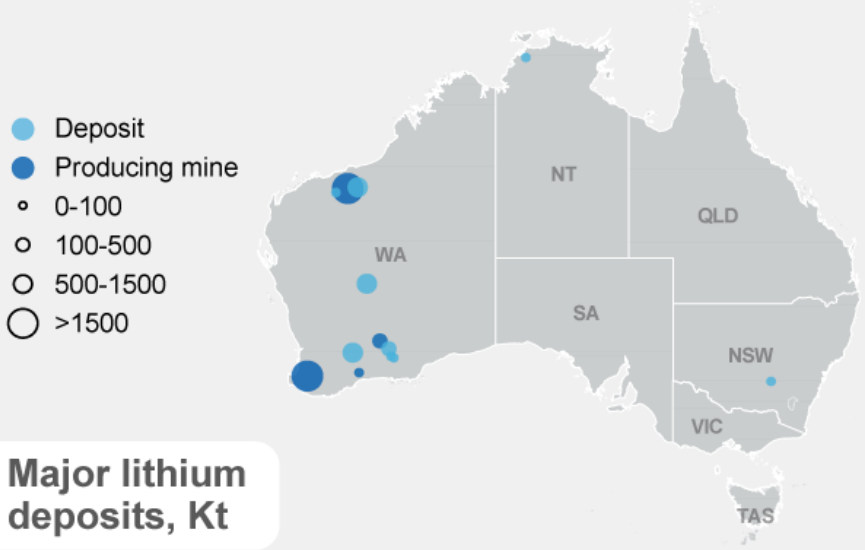
Lithium

Australia's lithium sector

96%
of spodumeme **exported to China**, 2021-22

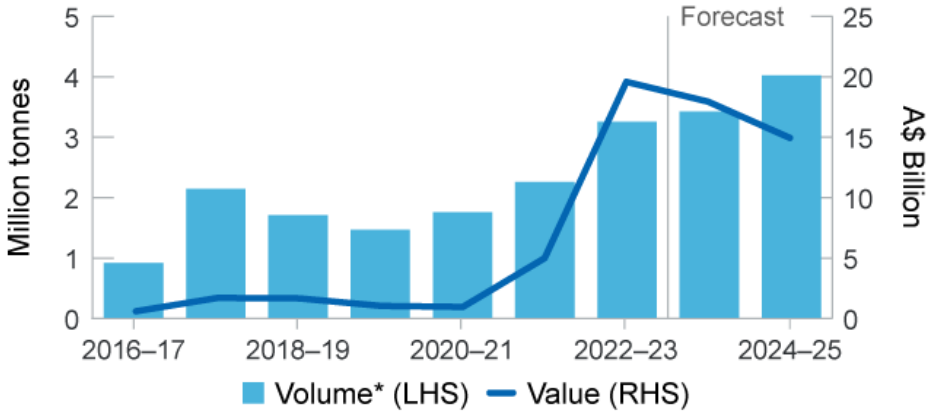
50%
of global lithium **extraction,** with **2nd** most resources

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

- The value of Australian lithium exports is set to decline from its 2022–23 record, with lower prices offsetting the impact of higher export volumes. Prices are falling as the global supply of lithium catches up to global demand.
- Project expansions and new mines will enable Australian lithium mine production to rise, with a growing share of mine output refined domestically to produce lithium hydroxide.
- Sources of global lithium supply continue to diversify amidst international efforts to strengthen critical minerals security. This provides further opportunities for investment in Australian lithium assets.

15.2 World demand

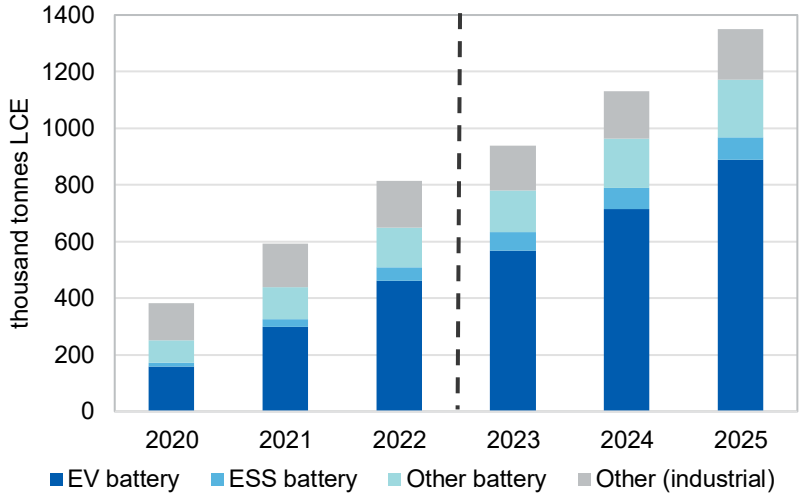
Rapidly growing lithium consumption, driven by electric vehicle demand

World lithium consumption is forecast to continue growing at a rapid rate, driven by high growth in the use of rechargeable batteries. In lithium carbonate equivalent (LCE) terms, global lithium consumption is forecast to increase from 814 thousand tonnes (kt) to 1,350 kt over the outlook period (from 2022 to 2025). Lithium demand for rechargeable batteries continues to grow at a much faster pace than other sources of industrial demand for lithium. Battery demand for lithium is expected to maintain high growth, increasing by 22% per year over the 3 years to 2025. Rapidly growing battery demand is driven by the use of lithium for electric vehicle (EV) batteries. EV demand is expected to take up an increasing share of total lithium demand, due to rising EV uptake (Figure 15.1).

Rising electric vehicle uptake, changing policy support across countries

The global uptake of EVs is expected to increase from 14% to 25% of vehicle sales over the outlook period (from 11 million to 23 million cars per annum) reflecting the high level of policy support across the world, despite declining battery cost reductions (Figure 15.2). Historically, the cost of lithium-ion batteries and the level of government support have been key factors contributing to reduce consumer prices for EVs. The cost of lithium-ion batteries has decreased significantly over the past decade (see *Selected Battery Minerals* chapter). In the short term, further decreases in the cost of lithium-ion batteries will be driven by the underlying mineral costs, especially as the underlying materials costs now make up a higher share of costs. In terms of government support, recent policy announcements are an important factor across major economies. Established markets will experience continued growth, while countries with relatively low levels of EV uptake — including the United States — will see the largest relative growth (see Box 15.1).

Figure 15.1: World lithium consumption, by demand source



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

Other battery demand contributes to rising lithium consumption

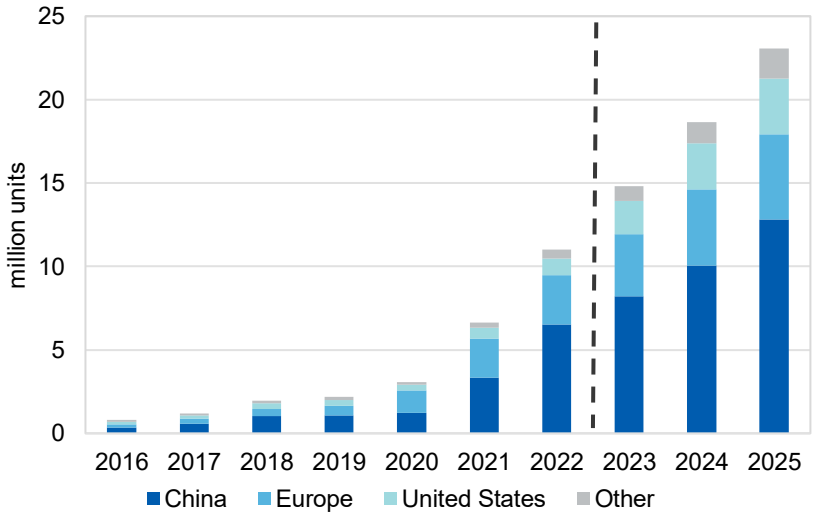
Overall, battery demand for lithium (excluding EVs) made up 23% of lithium demand in 2022 and is expected to grow by 15% per year over the 3 years to 2025. Other sources of battery demand include utility-scale energy storage systems (ESS), portable electronics, and other small electric devices. The largest share of growth comes from ESS demand (5.9% of lithium demand in 2022), which is forecast to grow by 18% per

year over the 3 years to 2025. Major ESS technologies (with the exception of hydropower) mainly use lithium-ion batteries, and the growth of renewable power has contributed to increasing demand for lithium. Growth in these sources of battery demand reflects ongoing trends towards electrification of tools and products, as well as stable growth in the portable electronics sector.

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 2.2% per year over the 3 years to 2025, in line with historical growth trends. Due to the rapid growth of battery demand for lithium, the share of industrial demand for lithium is expected to decrease from 20% in 2022 to 13% in 2025.

Figure 15.2: Global electric vehicle sales



Note: Electric vehicles are defined to be battery electric vehicles and plug-in hybrid electric vehicles.
Source: Wood Mackenzie (2023)

Box 15.1: Changing EV policy support across major economies

China leads global EV sales, with the highest EV share of domestic vehicle sales (28% in 2022). The high uptake of EVs in China was supported by domestic subsidies for EVs that commenced in 2009. On 21 June 2023, the vehicle purchase tax exemption (which makes up most of the support for EVs) was extended, providing up to US$4,170 for eligible vehicles in 2024 and 2025, and half that amount in 2026 and 2027.

Chinese EV uptake is expected to increase from 6.5 to 13 million over the outlook period. Several local governments, including Beijing, Shanghai and Zhengzhou, have also announced incentives to support the attainment of national EV targets. China has already surpassed the country's target of a 20% share for 'new energy vehicles' (includes electric and fuel cell vehicles) sales by 2025. The country's national action plan sets a target of 40% sales share for these vehicles by 2030.

Europe is the second largest EV market and increasing EV uptake is expected despite potentially lower government support in coming years. The EV share of vehicle sales is high (21% in 2022) and EV sales are expected to increase from 3.0 to 5.1 million over the outlook period. Policy support by European governments has been significant. The IEA reports per-unit support by European governments was steady at around US$6,000 from 2017 to 2022. The IEA notes average support could drop in 2023 and beyond — as subsidies decrease in countries such as Germany, the United Kingdom, and France — but other incentives will remain. In terms of targets, between 2025 and 2029, European Union (EU) car manufacturers that achieve a 25% share of 'zero and low emission cars' will benefit from an incentive mechanism. In March 2023, the 'Fit for 55' package was announced, requiring new car sales to have zero CO2 emissions from 2035 and 55% lower emissions from 2030.

In the **United States**, newly announced policy support is expected to drive increased EV uptake from current low levels. US EV sales are forecast to rise from 1.0 million in 2022 to 3.3 million in 2025. The EV share of US vehicles sales is currently relatively low (7.3% in 2022). Previously, the primary policy support for EVs in the US was a tax credit that is subject to

eligibility criteria. In particular, the vehicle tax credit ranged from US$2,500 to US$7,500 based on battery capacity, and credits for any single vehicle manufacturer were limited by a sales cap. Under the Inflation Reduction Act, the tax credit has been changed to be a credit of up to US$7,500. Eligibility is based on the sourcing of critical mineral components and the manufacture of battery components. In terms of targets, the US aims for 'clean energy vehicles' including EVs to make up a 50–52% share of vehicle sales by 2030.

Sources: International Energy Agency (2023), Wood Mackenzie (2023)

15.3 World production

Growing production of lithium required to meet rapidly increasing demand

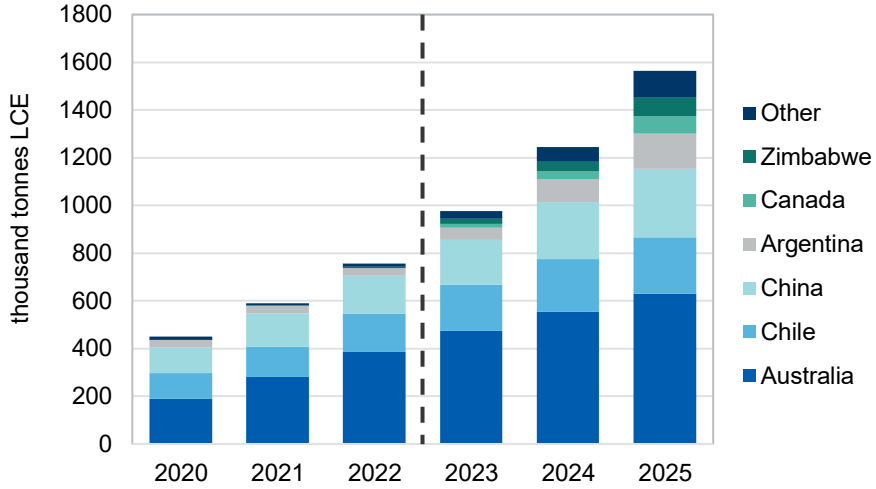
World lithium production is forecast to continue growing, spurred by rapidly increasing world demand induced by the global energy transition, and the high prices resulting from lithium market deficits in recent years. In LCE terms, world lithium production is forecast to increase from 737 kt to 1472 kt over the period 2022–25. This rise will result from increased investment in the extraction of brine and mining of hard rock, including spodumene and lepidolite. To meet rapidly growing demand for lithium, increased global investment in lithium refining is expected.

Increasing extraction of lithium, uncertain influence of governments

Increased extraction of lithium resources reflects higher production across all major producer nations alongside the ramp up of some smaller producers (Figure 15.3). The main uncertainty for this forecast relates to recent announcements by governments in Chile and China. Subsequent announcements by these governments may have a material impact on the growth of global lithium extraction.

Australia leads global lithium extraction (50% in 2022) and spodumene production is forecast to increase from 382 to 631 kt LCE in the 2022–25 period (see Australia section).

Figure 15.3: Global lithium extraction, by country



Note: 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)

Chile (the second largest source of lithium extraction) is expected to see further growth in lithium production over the outlook. Chile's lithium extraction is forecast to increase from 161 kt to 236 kt LCE over the 2022–25 period. While Chile announced plans to nationalise the lithium industry in April 2023, the government stated its intention to honour current lease arrangements that extend out to 2043 for Albemarle and 2030 for SQM. As a result, this announcement is assumed to not materially impact production by 2025.

The rate of growth in lithium extraction in China faces some uncertainty due to the prospect of further government regulation. China is forecast to increase lithium extraction from 157 kt LCE in 2022 to 288 kt LCE by 2025. A key uncertainty for this forecast relates to the policing of Chinese industry mining/processing standards, particularly for the extraction of lepidolite. In February 2023, government investigations led to closures of some producers (mainly lepidolite) in Yichun (Jiangxi province), due to

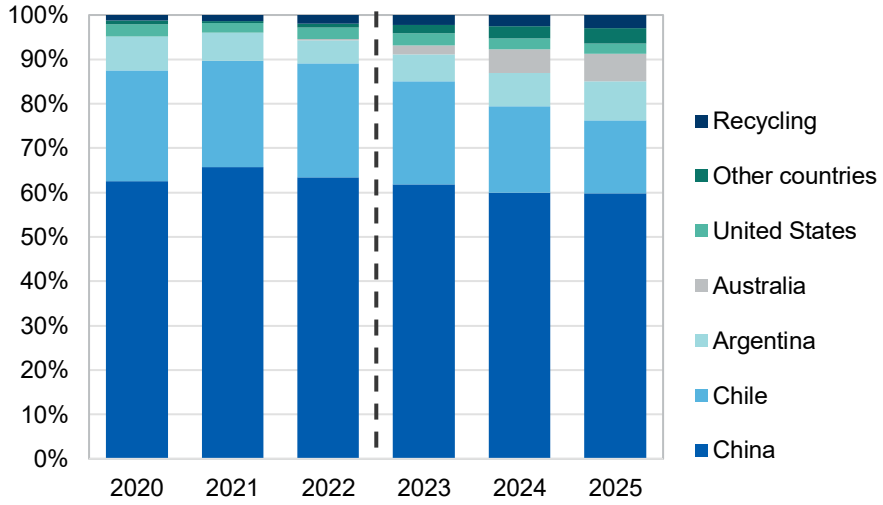
unlicensed mining and environmental infringements. BloombergNEF estimates the lithium mining capacity planned for Jiangxi is over 250 kt LCE, up from less than 50 kt LCE in 2022. Stricter regulations for Chinese lithium would decrease production in the short term, but could lead to an increase in the ESG credentials of Chinese lithium suppliers in the medium to long term.

In terms of 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).

Global lithium refining to increase and diversify, supported by policies

Global lithium supply is not only increasing, but also diversifying, reflecting efforts by governments to secure supplies of critical minerals including lithium (see Box 15.2). For lithium, global refining capacity is relatively more concentrated than extraction.

Figure 15.4: Share of global lithium refining, by country



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)

Higher global lithium refining is being driven by increases in refining capacity in China and Chile. However, further development is expected for countries such as Argentina, Australia, and the United States.

China is expected to maintain around 60% of global refining output, as a result of investments to build more refining capacity (Figure 15.4).

Chile's lithium refining is expected to increase in line with domestic production. Chile's share of global refining (26% in 2022) is expected to decrease, as growth in its domestic lithium extraction is outpaced by extraction elsewhere.

By 2025, investments to develop lithium refining in Argentina, Australia, and the US are expected to lead to market shares of 8.8%, 6.2% and 2.2% respectively. Recycling is expected to make up 2–3% of lithium supply from 2022 to 2025.

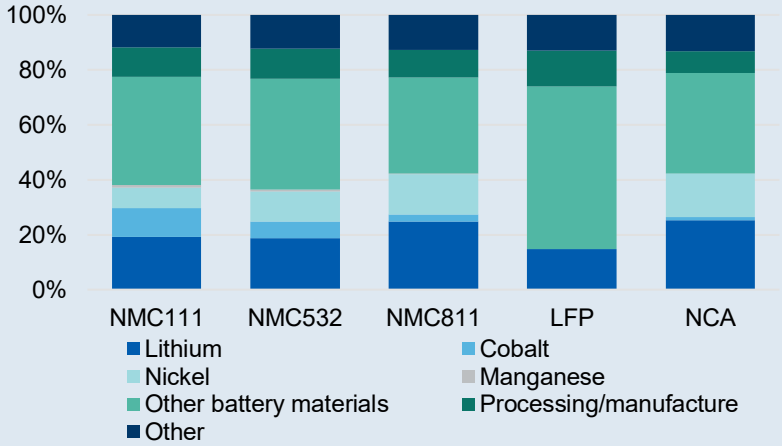
Box 15.2: Governments give more policy support for critical minerals

Major economies, including the United States and the EU, have announced policies aimed to support the development of the lithium supply chain both domestically and with select trading partners. This is expected to spur increased investment in the development of the lithium supply chain for countries with resources who satisfy the criteria.

On 31 March 2022, the US invoked the Defence Production Act, providing access to US$750 million to spur domestic investment in the extraction and processing of critical minerals. The US Department of Defence states this includes (but is not limited to) feasibility studies and modernisation projects for mining. In terms of processing, projects can increase productivity, sustainability, and workforce safety. Beneficiation projects that occur between the stage of mining and processing may also be eligible. In May 2023, it was also announced that President Biden will seek to gain congressional support for Australia to access the funding available under the US Defence Production Act. Access to this funding would support investment in the mining and refining of critical minerals, including lithium, in Australia.

The US Inflation Reduction Act also provides benefits to the domestic sector and select trade partners, providing incentives for the supply of critical minerals and battery manufacturing. Under the IRA, a US$7,500 tax credit is available for 'clean vehicles' including EVs. Half of the tax credit depends on criteria relating to critical minerals. Notably, a minimum threshold of the value of the battery's critical minerals must be extracted or processed in the US or by a US FTA partner, or recycled in North America. This threshold increases by 10% each year from 40% in 2023 to 80% in 2027. Furthermore, an eligible clean vehicle must not contain critical minerals that are extracted, processed, or recycled by a 'foreign entity of concern' (FEOC) from 2025. The US Treasury and IRS will provide subsequent guidance on the provision relating to FEOC. These incentives benefit eligible suppliers including Australia and Chile. Importantly, lithium makes up a high share of battery pack costs relative to other critical minerals (Figure 15.5). For analysis of the market shares of various battery types, see *Selected Battery Minerals* chapter.

Figure 15.5: Share of costs for various battery pack types, 2022



Note: Some critical minerals including graphite are not separately identified in this figure due to lack of data. Other battery materials include those contained in the cathode, anode, cell, module and pack materials.
Source: Wood Mackenzie (2023)

The EU proposed the Critical Raw Materials (CRM) Act in March 2023, setting targets aimed at increasing domestic production and limiting supply from third countries. The CRM sets targets for domestic extraction and processing of 10% and 40%, respectively, by 2030. Furthermore, no more than 65% of consumption at any stage of processing must come from any single third country. The benefits of the CRM include reduced procedural burdens for projects in the EU, and the provision of financial support and shortened timeframes for selected strategic projects. The EU has also highlighted the intention to form partnerships or "Critical Raw Materials Clubs" with countries including Canada and Australia.

In Australia, the recently released Critical Minerals Strategy will support investment in critical minerals including lithium (see *Selected Battery Minerals* special topic).

Sources: European Commission (2023), The White House (2023), US Department of Defense (2022)

15.4 Prices

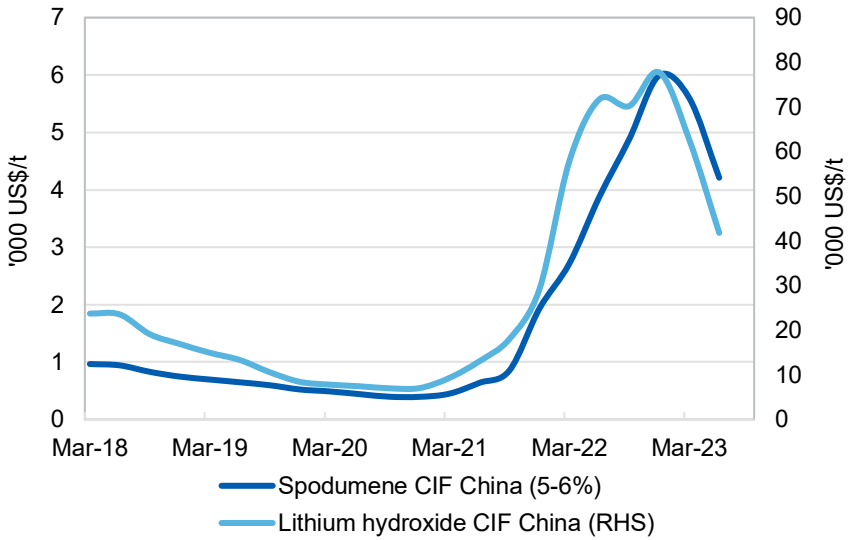
Lithium prices to moderate as supply catches up with demand

Lithium prices rose dramatically in 2022, as rapidly growing global demand outpaced growth in global supply. Demand was driven by the unprecedented pace of EV demand growth in 2021 and 2022. This was in direct contrast to the two preceding years. Insufficient growth in global EV sales during 2019 and 2020 contributed to lithium production outpacing demand, resulting in the build-up of lithium inventories and large decreases in lithium prices in those years. Unfavourable prices over that period led to several mine operations becoming insolvent or being placed under care and maintenance. Furthermore, downturn in 2019 and 2020 incentivised less investment in lithium supply, contributing to global demand outpacing global supply in recent years.

In 2022, spot prices for spodumene (concentrated ore) averaged US$4,368 per tonne, well above the average level of US$671 per tonne over the 3 years to 2021 (Figure 15.6). The spot price of lithium hydroxide (a lithium chemical that has undergone refinement and is generally battery

grade) averaged US$69,370 per tonne in 2022, dramatically higher than the average price of US$12,163 per tonne over the 3 years to 2021.

Figure 15.6: Lithium spot prices, quarterly average, 2018-2023



Source: Bloomberg (2023)

Prices are forecast to remain elevated in 2023, then decline significantly in 2024 and 2025, as the supply of lithium catches up to demand. Demand is expected to grow at recent high rates, driven by forecast growth in global EV sales — forecast at 3–4 million units over the forecast period. Forecasts of growing demand and high prices have driven an acceleration in growth of lithium supply. Producers are seeking to capitalise on current high prices, and there are increased instances of lower grade production. In particular, the average brine grade continues to be diluted by new entrants in marginal fields, and there are rising instances of direct shipped ore with lithium concentrations as low as 1–2% compared to typical spodumene concentrate of 6%.

Lithium prices are expected to decline, but not to the low levels observed in 2019 and 2020. The average spot price of spodumene is forecast to rise slightly in 2023 (to about US$4,357 per tonne), then decline to average US$2,740 per tonne in 2024 and US$2,149 per tonne in 2025. The spot price of lithium hydroxide is forecast to decline at a faster pace, falling to be about US$46,746 in 2023, then decline further to around US$35,416 per tonne in 2024 and US$30,357 per tonne in 2025.

15.5 Australia

Increasing lithium mine production, expansions for most mines

Australia leads global lithium extraction, and mine production is forecast to continue growing. Mine production of spodumene is forecast to rise from 3.1 million tonnes (Mt) in 2022–23, to 3.4 Mt in 2023–24, and to 4.0 Mt in 2024–25. In LCE terms, this equates to 452 kt in 2022–23, 507 kt in 2023–24, and 596 kt in 2024–25. Rising mine production is driven by expansion of existing mines, including Greenbushes, Wodgina, Pilgangoora, Mt Marion and Mt Cattlin. Furthermore, production has commenced at Finniss and is expected to commence at Mt Holland and Kathleen Valley. Other lithium deposits are under exploration and are assumed to not achieve production by 2025.

Greenbushes is the world's largest producing lithium mine and increasing production from this mine is due to expected project expansions. Ownership consists of 49% Albemarle and 51% TLEA (a joint venture consisting of 51% ownership Tianqi Lithium and 49% ownership IGO). IGO reports spodumene production in the March quarter 2023 was 356 kt, 6% lower than the previous quarter. Over the year to March quarter 2023, output was 1.4 Mt, 42% higher compared to the same period the year prior. Higher production is the result of mine expansions and additional processing plants. Annual production capacity was reported to be 1.5 Mt as of December quarter 2022. Greenbushes is undertaking further expansion projects to lift production capacity to 2.5 Mt over the next 4 years. Projects include the establishment of another processing plant (Chemical Grade Plant 3) and work on a mine services area.

Pilgangoora has become Australia's second highest production lithium operation, following investments that increased production capacity. Pilbara Minerals (100% ownership) reports spodumene production of 148 kt in the March quarter, 9% lower than the previous quarter. Production over the four quarters to March 2023 was 585 kt, 75% higher than the same period in the prior year. Higher production is due to improvements at the Pilgan Plant and the restart of production at the Ngungaju Plant. Production capacity was reported to a range of 540–580 kt as of the September quarter 2022. Multiple expansion projects are underway, including the P680 and P1000 expansion projects. The P1000 project has reached final investment decision (FID) and aims to lift capacity to 1 Mt.

Mt Marion is the Australia's third highest producing lithium mine and is undertaking expansion. Mineral Resources (50% ownership and 50% Jiangxi Ganfeng Lithium) reported spodumene output of 120 kt in the March quarter 2023, 1% below last quarter. Production over the four quarters to March 2023 was 478 kt, 15% higher than the same period in the prior year. The expansion of production capacity to 900 kt of mixed grade spodumene (equivalent to 570–600 kt of spodumene with 6% lithium oxide content) is expected to be complete by mid-2023.

Wodgina restarted operations in the June quarter 2022, and production is ramping up towards capacity. Mineral Resources (ownership 40% and 60% Albemarle) reported output of 110 kt in March quarter 2023, 19% higher than the previous quarter. Mining and environmental approvals have been granted to expand the mine and initial work has commenced.

Mt Cattlin is expected to increase production close to full capacity, following two quarters of lower production. Allkem (100% ownership) reported output of 39 kt in the March quarter 2023, significantly higher than in the December quarter (of 17 kt). Lower production during the December and September quarter of 2022 was due to unfavourable mineralogy and ore characteristics. As mining activities move into more central zones, this is expected to support production to remain close to capacity.

Core Lithium's Finniss is a new lithium operation, and the first to be based in the Northern Territory (NT). Core Lithium (100% ownership) reported the first cargo of 15 kt of direct shipped ore in January, and a subsequent shipment of 5.5 kt of spodumene. The NT government has also approved a second mine at Finniss with a current mineral resource of 10.1 Mt at 1.5% lithium oxide.

Lithium mine production is due to commence at Mt Holland, Kathleen Valley. Mt Holland (managed by Covalent Lithium, mine ownership is 50% SQM and 50% Wesfarmers) is under development and Wesfarmers report construction is well advanced, with the first ore mined in December 2022. The project is expected to begin earning from the first half of 2024. Feasibility to undertake expansion of the operation is also underway. The Kathleen Valley mine is under construction by Liontown (100% ownership) and expect first production by the middle of 2024. Resources were estimated to be 156 Mt at 1.4% lithium oxide content as of April 2021.

Growing share of Australian lithium to be refined domestically

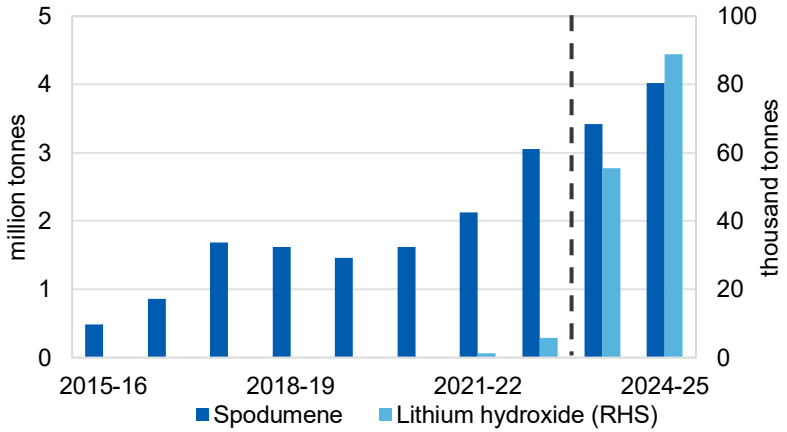
Australia is developing capacity to refine lithium domestically, producing lithium hydroxide to meet global demand for battery grade lithium. Production of lithium hydroxide is expected to be 5.8 kt in 2022–23, reflecting the commencement of commercial production at the Kwinana plant (Figure 15.7). Production is forecast to be 56 kt in 2023–24 and 89 kt in 2024–25. By 2024–25, this forecast implies 15% of Australian spodumene will be refined domestically. Higher forecast production is due to the ramp up of the first Kwinana refinery and Kemerton refinery, alongside the construction of a second Kwinana refinery.

The first Kwinana lithium hydroxide refinery is owned by Tianqi Lithium Corporation (51%) and IGO (49%), and production is increasing from a low base. Commercial production was declared in the December quarter 2022 with testing certifying the product meets battery industry standards. In the March quarter 2023, IGO reported output of 1.0 kt, 65% higher than the previous quarter. Early works have commenced on the development of a second train. However the FID on this investment is still pending.

The Kemerton lithium hydroxide refinery is owned by Albemarle (60%) and Mineral Resources (40%) and is undergoing qualification. In April 2023, the plant reported having a product that meets specification requirements. A second train is undergoing commissioning, with production expected in the September quarter 2023. FID has been reached to build a further third and fourth train.

The second Kwinana lithium hydroxide refinery (owned 50/50 by Wesfarmers and SQM) is under construction. First production is expected in 2024, and capacity is targeted to be 50 kt.

Figure 15.7: Australian lithium production



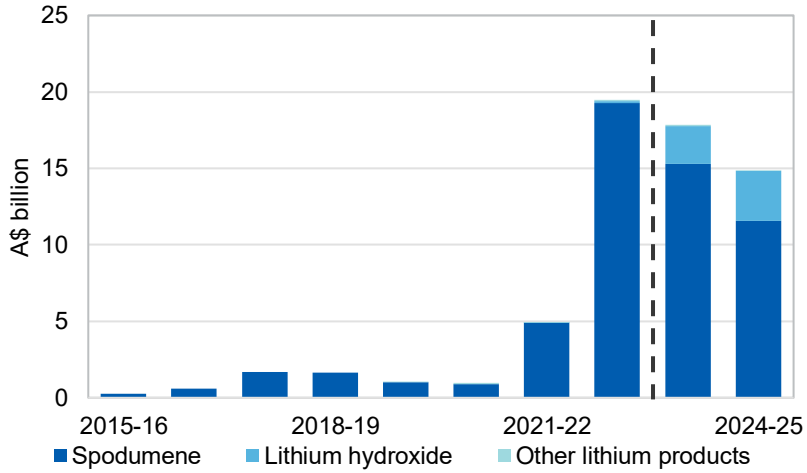
Sources: Department of Industry, Science and Resources (2023), Wood Mackenzie (2023)

Record lithium export earnings to decrease as prices decline

The value of lithium exports is expected to be $19.5 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 prices nearly tripling and the volume of spodumene exports increasing by 44%. The value of lithium exports is forecast to decline to $17.8 billion in 2023–24, then decrease further to $14.9 billion in 2024–25. The declines will be driven by falling prices in both 2023–24 and 2024–25. However, prices will remain high in historical terms. In terms of volumes, spodumene exports will grow at a slower pace (compared to historical growth), due to an increasing share of domestic refining to produce lithium hydroxide.

In 2021–22, 96% of spodumene by volume was exported to China. The remainder was exported to countries such as Belgium (2%), South Korea (1%), and the United States (1%).

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

The value of Australian lithium exports in 2022–23 is estimated at $19.5 billion, a quadrupling of 2021–22 export earnings. Since the March 2023 *Resources and Energy Quarterly,* the forecast for Australian lithium export earnings has been revised downward by 8% in 2023–24 and upward by 17% in 2024–25. In 2023–24, this is due to a downward revision in the export unit value price so that it tracks (lagged) spot prices more closely. In 2024–25, this reflects an upward revision in the forecast price.

Table 15.1: Lithium outlook

						Annual percentage change		
World	**Unit**	**2022**	**2023[f]**	**2024[f]**	**2025[f]**	**2023[f]**	**2024[f]**	**2025[f]**
Lithium production [a]	kt	737	950	1,199	1,472	28.9	26.2	22.7
Lithium demand [a]	kt	814	939	1,130	1,350	15.3	20.4	19.5
Spodumene price								
– nominal	US$/t	4,368	4,357	2,740	2,149	-0.3	-37.1	-21.6
– real [b]	US$/t	4,565	4,357	2,678	2,057	-4.6	-38.5	-23.2
Lithium hydroxide price								
– nominal	US$/t	69,370	46,746	35,416	30,357	-32.6	-24.2	-14.3
– real [b]	US$/t	72,505	46,746	34,614	29,057	-35.5	-26.0	-16.1
Australia	**Unit**	**2021–22**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**	**2022–23[s]**	**2023–24[f]**	**2024–25[f]**
Mine production [a]	kt	316	452	507	596	43.4	12.0	17.6
Spodumene export volume [d]	kt	2,248	3,252	3,420	4,021	44.7	5.2	17.6
Export value [e]								
– nominal	A$m	4,972	19,470	17,844	14,864	291.6	-8.3	-16.7
– real [c]	A$m	5,324	19,470	17,101	13,807	265.7	-12.2	-19.3

Notes: **a** Lithium Carbonate Equivalent (LCE) — a measure of the quantity of refined product; **b** In 2023 US dollars; **c** In 2022–23 Australian dollars; **d** Reflects the volume of spodumene concentrates exported (mostly 6% Li_2O concentrate), plus the volume of spodumene concentrate used to produce lithium hydroxide for export; **e** Revenue from spodumene concentrate, lithium hydroxide and other lithium products; **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).

Selected Battery Minerals

The global battery market

40%
yearly growth over past five years in global market

86%
drop in battery cell costs over 10 years to 2021

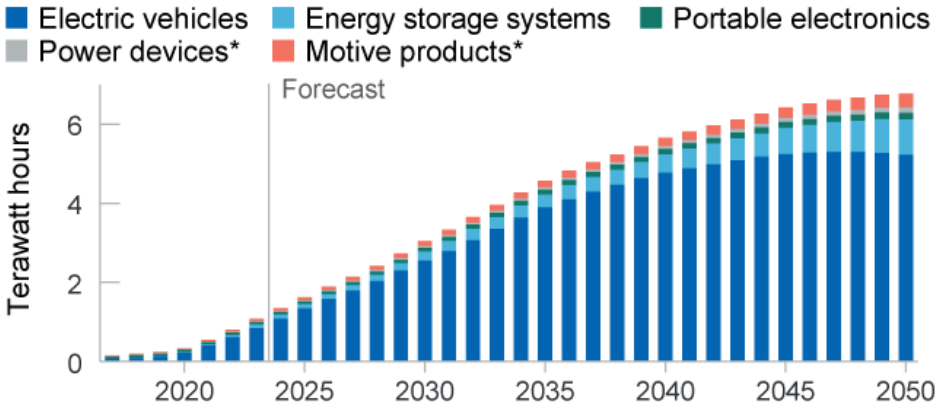
Key battery chemistries (% share of global market by tech)

Nickel manganese cobalt (NMC)	60
Lithium iron phosphate (LFP)	30
Nickel cobalt aluminium oxide (NCA)	8

Sources of battery demand

- Clean energy
- Electric vehicles
- Stationary storage
- Portable electronics
- Personal mobility

Global battery demand by end use



Outlook

Global battery demand is projected to increase exponentially to about **3,041 gigawatt hours** in 2030

Australia's share of global reserves 2023:

Cobalt	Manganese Ore	Graphite
20% global reserves **3%** global mined supply	**9%** global reserves **16%** global mined supply	**2%** global reserves

SOURCE: IEA; GA, Wood Mackenzie

*'Motive products' include smaller personal devices eg. scooters, wheelchairs. 'Power devices' are used for precisely controlling electrical energy

16.1 Summary

- The broad market outlook for battery minerals is promising. A rapidly transitioning electric vehicle and battery storage sector is expected to see consumption growth outpace production growth in the coming decades, lifting prices and production.
- Australia has significant reserves of battery commodities critical to the global energy transition — including lithium, cobalt, manganese and nickel — and is well placed to provide raw battery materials and refined product to the world.
- New and emerging battery chemistries, including lithium ferrous phosphate, sodium-ion and graphene aluminium-ion batteries, present both opportunities and the potential to further disrupt global markets.

16.2 Global battery demand

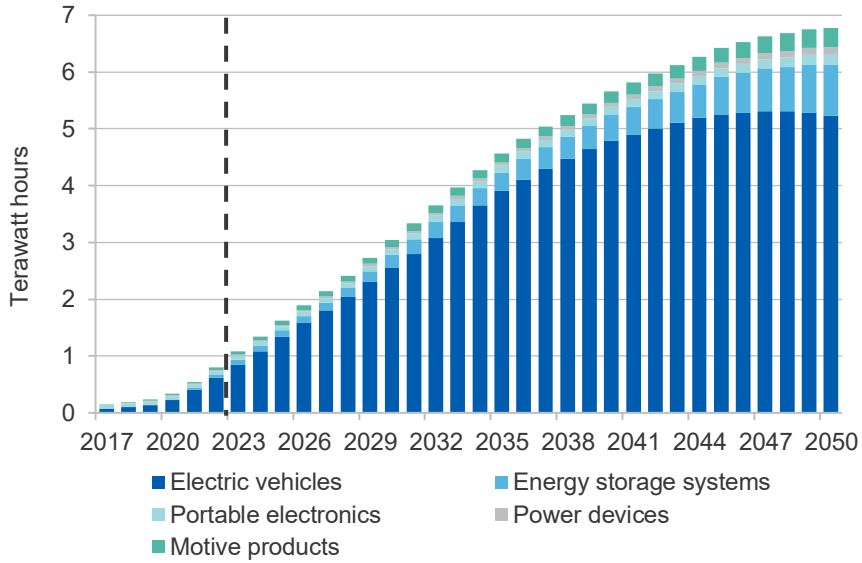
Global battery markets have entered a period of extremely rapid growth, and the implications for Australia are significant. This is due to the potential of battery technology itself, and its capacity to revolutionise clean energy, vehicles, and consumer products. Moreover, battery demand growth is also generating unique opportunities for producers of key commodities, including manganese, graphite, cobalt, lithium and nickel. Australia has significant deposits of a number of battery minerals, (discussed below) which, combined with a strong track record in resources technology and processing innovation, provides a unique opportunity for Australian industry.

Battery demand for electric vehicles continues to surge

Efforts to achieve net-zero by 2050 have resulted in the rapid growth of interest in battery technologies for electric vehicles (EVs), clean energy, and consumer products. Long-run forecasts indicate global lithium-ion battery demand will increase rapidly to 2050, driven mostly by increasing sales of EVs over the 2020s and 2030s, and increased demand for energy storage systems throughout the 2030s and 2040s (Figure 16.1). This interest has precipitated a surge in demand for battery commodities.

Australia's robust environmental, social and governance (ESG) credentials, and reputation as a reliable supplier of minerals and metals, means it is uniquely placed to capitalise on this trend. The economic security and supply chain reliability of battery materials and components are becoming increasingly important, as governments look to avoid the negative impacts of trade dependencies and market shocks — particularly in light of disruptions to global supply chains stemming from COVID-19 and the fallout from Russia's invasion of Ukraine. Increasing awareness of the need for responsible mineral sourcing, including related environmental and social impacts, is also driving interest in diversified battery metal supply chains — including European Union (EU) battery regulations and industry-led traceability measures.

Figure 16.1: Global lithium-ion battery demand by end use



Note: 'Motive products' include smaller personal devices such as scooters and wheelchairs.
Source: Wood Mackenzie (2023).

16.3 Developments in EV battery technology

Rapid advances in battery technology are shaping global demand for battery minerals. At the same time, new battery technologies and new applications are bringing about significant disruptions. While rapidly increasing prices for key battery minerals in recent years — notably lithium and nickel — saw battery prices increase by around 7% in 2022, battery prices are still dramatically cheaper than a decade ago (BNEF 2023). Total battery energy cell costs dropped by 86% over the 10 years to 2021, as a result of cheaper materials, better manufacturing processes, higher energy densities, better chemical formulations in battery cores, and increased economies of scale.

Lithium-ion batteries will continue to drive the global energy transition

While new battery products and chemistries continue to be developed, the lithium-ion battery remains one of the key technologies underpinning the global energy transition. Key lithium-ion battery technologies are discussed in Box 16.1. The rapid growth in global EV sales evident in recent years would not have been possible without the major improvements in lithium-ion battery technology achieved in prior decades. While disruptive market change in preferred battery technology may occur in the long-term, there is no evidence that lithium-ion batteries will be replaced in the foreseeable future. No alternative technology is currently being manufactured at the scale needed to meet projected global demand for EVs (Wood Mackenzie 2023).

Currently, the dominant lithium-ion (Li-ion) battery chemistry is lithium nickel manganese cobalt oxide (NMC) — with a market share of 60% in 2022, followed by lithium iron phosphate (LFP) with a share of just under 30%, and nickel cobalt aluminium oxide (NCA) with a share of about 8% (IEA 2023). However, the market share of different Li-ion technologies is a quickly evolving space.

The biggest change in global battery use over the past five years has been the rise in the LFP global share (up from 7% in 2017). Around 95% of the LFP batteries for EVs were used in China for locally produced vehicles.

The key advantage of LFP batteries is that they use iron and phosphorus rather than the currently more expensive nickel, manganese and cobalt found in NCA and NMC batteries, but the trade-off is that these batteries currently have lower energy density and EVs using this technology have a smaller range than some alternatives. However, China's compact city design contrasts with the sparsely populated cities of Australia and the US, and as such, energy density is much less of an issue.

Sodium-ion batteries are a cheaper alternative, for some applications

Alternatives to Li-ion batteries have been emerging in recent years, in particular sodium-ion. Sodium-ion batteries are one of the leading chemistries that do not contain lithium and are estimated to become at least 20% cheaper than an LFP battery (Wood Mackenzie 2023). However, the trade-off for the lower cost is a substantial penalty in energy density. The IEA notes that the sodium-ion battery chemistry is relevant for urban vehicles with low range, or for stationary storage, whereas challenges would arise in markets where consumers prioritise maximum range autonomy, or where charging is less accessible (IEA 2023).

Despite their lower energy density and (dis)charge cycle capacity, sodium–ion batteries are safer and perform better in a wider range of temperatures. These characteristics mean that, in the first instance, sodium-ion batteries will be well suited to the stationary storage sector, especially with requirements for daily or hourly charge/discharge cycles and a lower emphasis on lighter and smaller batteries. However, latest research suggests the technology also has potential for EV applications.

Other emerging alternatives include graphene aluminium-ion batteries, liquid metal batteries and redox flow batteries for stationary energy storage.

Box 16.1 Lithium ion battery types

First created in 1980, lithium-ion (Li-ion) batteries harnessed the movement of lithium ions between positive and negative electrodes in a way which created more power from a smaller quantity of material than any battery before it.

The Li-ion cell structure consists of 3 sections: an anode, cathode and a separator surrounded by electrolytes (Figure 16.2). The anode and cathode both store lithium ions whilst the electrolyte carries the ions from one end to another. During discharge, positively charged lithium ions are carried from the anode through the electrolyte and deposited at the cathode. This movement of electrons creates a charge that is collected at the positive current collector. During charging the opposite happens: lithium ions are released by the cathode and collected by the anode.

The key defining feature of a Li-ion battery is the composition of its cathode. There are currently 3 primary types of Li-ion batteries: Lithium Nickel Manganese Cobalt Oxide (NMC), Lithium Nickel-Cobalt-Aluminium Oxide (NCA) and Lithium Iron Phosphate (LFP).

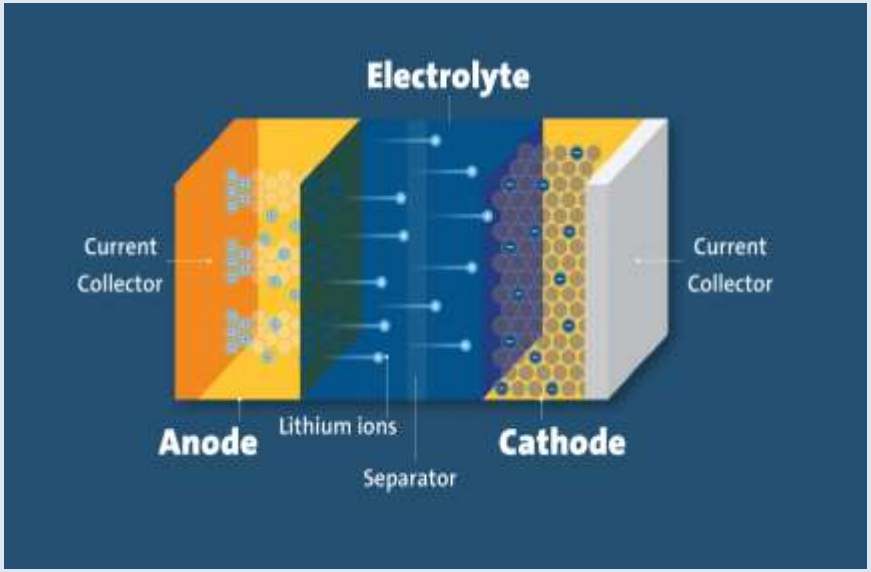
NMC and **NCA** are both nickel-based chemistries first discovered in the 1980s and becoming widely used in small electronics such as music players, power tools and phones. Nickel-based Li-ion cells are also powering the transition to net-zero, being the most common type of EV battery and having the unique potential to be recycled as stationary storage silos.

As of 2022, high nickel NMC batteries (NMC811), possess the majority of global EV market share, powering 63% of all EVs. Car makers including Tesla and Mercedes, employ NMC batteries with energy density at about 200Wh/kg compared to 160Wh/kg in a typical LFP cell. NMC batteries generally also have shorter lifetimes, with only around 1000 discharge cycles. This number assumes good quality products with appropriate battery management systems.

LFP batteries were first discovered in 1996. Whilst NMC batteries were already being widely used in Western markets, LFP technology was first used for Chinese electric buses. By 2018, 95% of China's electric buses used LFP cathode materials. While LFP batteries are cheaper and easier to produce, they cannot be recycled for raw materials as efficiently as their counterparts. Currently, LFP batteries also have a lower energy density compared to NMC chemistries.

The growing demand for these key Li-ion battery technologies has seen demand for battery metals surge in recent years. However, this has not been met with a similar rise in supply, thus increasing the prices of nickel and cobalt, which in turn has pushed up costs and reduced profit margins for producers of NMC and NCA batteries.

Figure 16.2: Components of a lithium-ion battery cell



Source: UL Research Institutes

16.4 Global supply of key battery minerals

Australia has favourable resource endowments and prospects for market growth in a number of battery minerals, including lithium, nickel, cobalt, graphite and manganese. These minerals are featured in the official US, EU and Canadian critical minerals lists, reflecting their importance in terms of future consumption and economic security requirements. Below is an overview of Australia's endowment and potential in three key battery minerals — cobalt, manganese, and graphite. For a discussion of the Australian and global outlook for other key battery metals see the *Nickel* chapter and the *Lithium* chapter of this publication.

Cobalt

Global consumption of cobalt has increased significantly in recent years and is estimated to have reached almost 187,000 tonnes (refined) in 2022 (Cobalt Institute 2023). Most of the growth in consumption has come from the use of cobalt chemicals in lithium-ion batteries, accounting for 40% of the total cobalt market. Australia has significant reserves of cobalt, with substantial potential for further development (Table 16.1).

Cobalt mine production is currently highly concentrated in the Democratic Republic of Congo (DRC), which accounts for around two-thirds of global mine production (Figure 16.3). Cobalt mine ownership in the DRC is dominated by Chinese and Swiss firms. China is the world's leading producer of refined cobalt, with more than 70% of global refinery capacity.

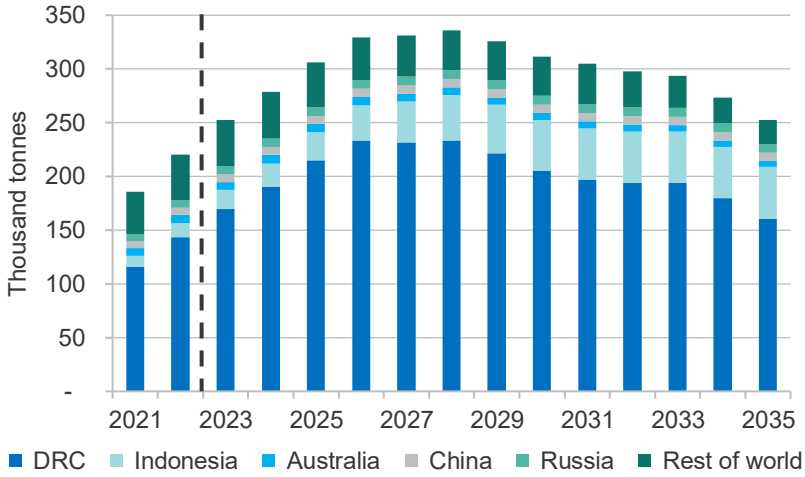
Primary production is also supplemented by increasing re-use of cobalt from scrap and secondary sources. In response to supply pressures, recycled cobalt from batteries is expected to rise steadily over the next decade. As the supply of end-of-life EV batteries rises, recycled cobalt could theoretically supply as much as one third of global cobalt demand by 2035, (Wood Mackenzie 2023).

Australia has strong cobalt prospects and a pipeline of cobalt projects

There is significant future potential for Australia's cobalt, with the rising demand for EV batteries — particularly with manufacturers seeking reliable and responsible alternatives sources of supply.

Wood Mackenzie's long-run projections suggest that global production of cobalt is expected to increase rapidly over the next 5 years, before plateauing and then declining in the 2030s. In addition to the high levels of concentration in global cobalt production, ongoing market concerns regarding stability of supply as well as ESG issues accentuate the supply chain risks (*Outlook for Selected Critical Minerals,* DISR 2021).

Figure 16.3: Projected cobalt production by country



Source: Wood Mackenzie (2023).

Australia has the second largest resources of cobalt in the world, estimated at around 20% of global resources, but only contributes 3% of global mined supply (Table 16.1). Australia has no dedicated cobalt mines in operation, with most cobalt mined as a by-product of copper, gold or nickel. Around 40 of Australia's gold and nickel operations are co-located with some form of cobalt deposit. These mines produce varying quantities

of cobalt as a secondary commodity. Most deposits are located in Western Australia, though there are small producers in Queensland, New South Wales and South Australia.

Australia's mined cobalt is typically a by-product of nickel laterite resources, and refined cobalt is currently exclusively in the form of cobalt metal. Australia currently produces no refined cobalt chemicals, after production ceased in 2016 with the closure of the Palmer Nickel and Cobalt Refinery (Queensland Nickel). There are currently four cobalt producing companies operational in Australia: Glencore Plc, BHP, First Quantum Minerals and IGO, with Glencore being the dominant producer in the Australian market and the only company producing refined material.

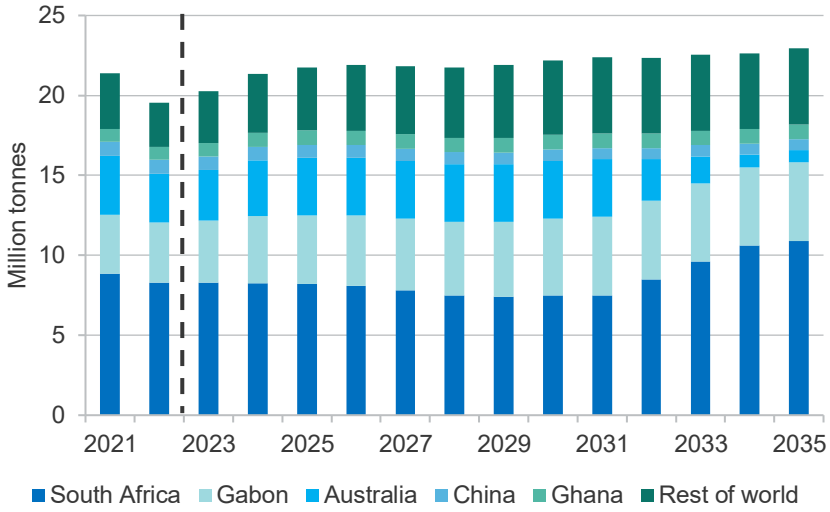
Manganese

Manganese is the fourth-most used metal in terms of tonnage after iron, aluminium and copper, and 90% of all manganese consumed annually goes into steel as an alloying agent (Geoscience Australia 2023). Additionally, it also acts as a stabiliser for NMC batteries, which improves their longevity. Australia has significant reserves of manganese with substantial potential for further development (see Table 16.1). The use of manganese in many essential modern technologies has resulted in it being designated a critical mineral by a number of countries, including Australia, the United States, Canada and Japan.

A key market for manganese is in the form of electrolytic manganese dioxide and electrolytic manganese metal, both of which are used in the production of EV batteries. The growth in production of EVs and battery storage technology is stimulating the interest of existing manganese miners in project expansion, and of explorers in re-evaluating historical mine deposits and prospects for potential development.

Global production of manganese in 2023 is expected to be dominated by South Africa (41%), Gabon (19%) and Australia (16%) (Figure 16.4). Projections by Wood Mackenzie (2023) suggest future production will be relatively flat overall over the next decade. An easing in the rate of growth of global steel production as China's economy shifts to less 'steel intensive' growth (see *Steel* chapter) is likely to be a key driver of this, given the dominant role the industry plays in global manganese demand.

Figure 16.4: Projected manganese production by country



Source: Wood Mackenzie (2023).

Estimates of Australian ore reserves of manganese were 120 million tonnes (Mt) in 2022, down 11% from 135 Mt the previous year. Deposits include the Woodie Woodie project in Western Australia, and the Groote Eylandt and Bootu Creek projects in the NT. In addition to existing manganese production facilities, a potential new source of manganese in Australia is the 300 kt Oakover manganese project in Western Australia.

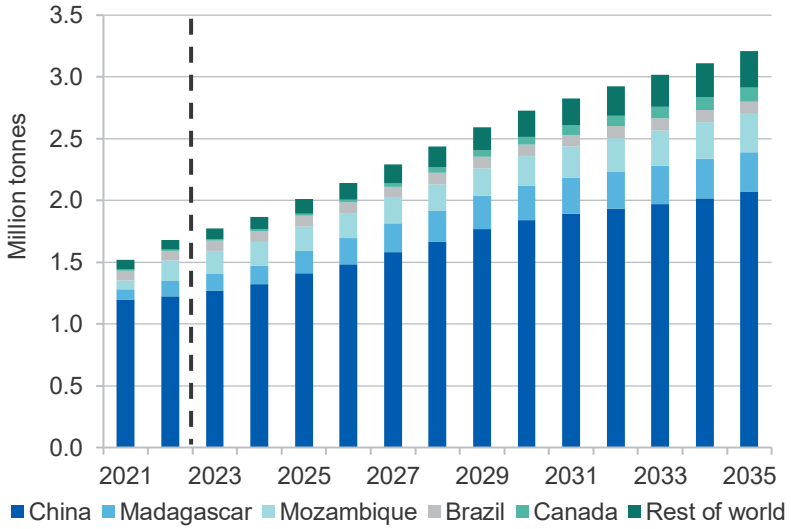
Graphite

Graphite is the largest mineral component in nickel and lithium batteries. It is also used for a range of products, including lubricants, foundry operations, brake linings, and aluminium production. Currently, battery applications account for one fourth of total graphite (11% in 2020). It is

used in a purified form (spherical graphite) in battery anodes, as a cost-effective and durable way to improve battery conductivity and charging. Increasingly, graphite is being supplemented with silicon to make the battery lighter and thus increase the energy density, with around 30% of anodes now containing silicon. High-purity graphite is also used in wind and solar technologies.

Advances in thermal technology and acid leaching techniques that enable the production of higher purity graphite powders, are likely to lead to the development of new applications for graphite in high-technology fields — such as improved carbon-graphite composites and electronics. Large-scale fuel-cell applications are also being developed, which could consume as much graphite as all other uses combined (United States Geological Survey).

Figure 16.5: Projected graphite mined production by country



Source: Wood Mackenzie (2023).

China dominates the world graphite market

Global graphite production is heavily concentrated, with China accounting for around 80% of world mined production (Figure 16.5). China is the largest producer of natural graphite in flake (60% of world production) and amorphous forms (20%) and is also the largest producer of synthetic graphite. Other major producers include Brazil (6% share of world production over last five years), Mozambique (5%) and Madagascar (3%).

New graphite deposits are being developed at various sites around the world, and mines will soon begin production in Madagascar, Mozambique, Namibia and Tanzania. The global graphite market is forecast to expand by over 50% over the next decade. As battery manufacturing capacity and scale rises, demand growth could lead to an undersupplied market around the middle of the decade, before new production comes online. Because of the dependence on China, as well as the importance of graphite to the economy, the EU and the US have declared graphite a critical mineral.

Australia's reserves of graphite are comparatively modest, and there are no operating graphite mines. South Australia hosts 65% of Australia's economically demonstrated graphite resources, followed by Western Australia (18%) and Queensland (17%). A range of projects are being progressed (see *Resources and Energy Major Projects 2022*). Graphite is rated by Geoscience Australia as having medium geological potential in Australia (Table 16.1).

16.5 The outlook for battery minerals

The broad market outlook for battery minerals is promising; a rapidly transitioning EV and battery storage sector is driving consumption growth and driving up input prices. However, sharp price rises are usually not sustained, as shown by the volatile history of cobalt and more recently nickel and lithium prices. Instead, actual consumption growth will pivot on availability and reliability of supply, as well as competition between different battery technologies. The reliability of supply will be affected by many factors including production uncertainties relating to ore body

quality, processing technology, operating costs and environmental and waste management issues.

Another factor that will shape future investment and trade patterns is the policies that Governments are implementing to secure supply chains and incentivise production in critical minerals. Governments around the world are increasingly targeting efforts to secure the supply of refined battery chemicals and metals (see Box 15.2 of the *Lithium* chapter).

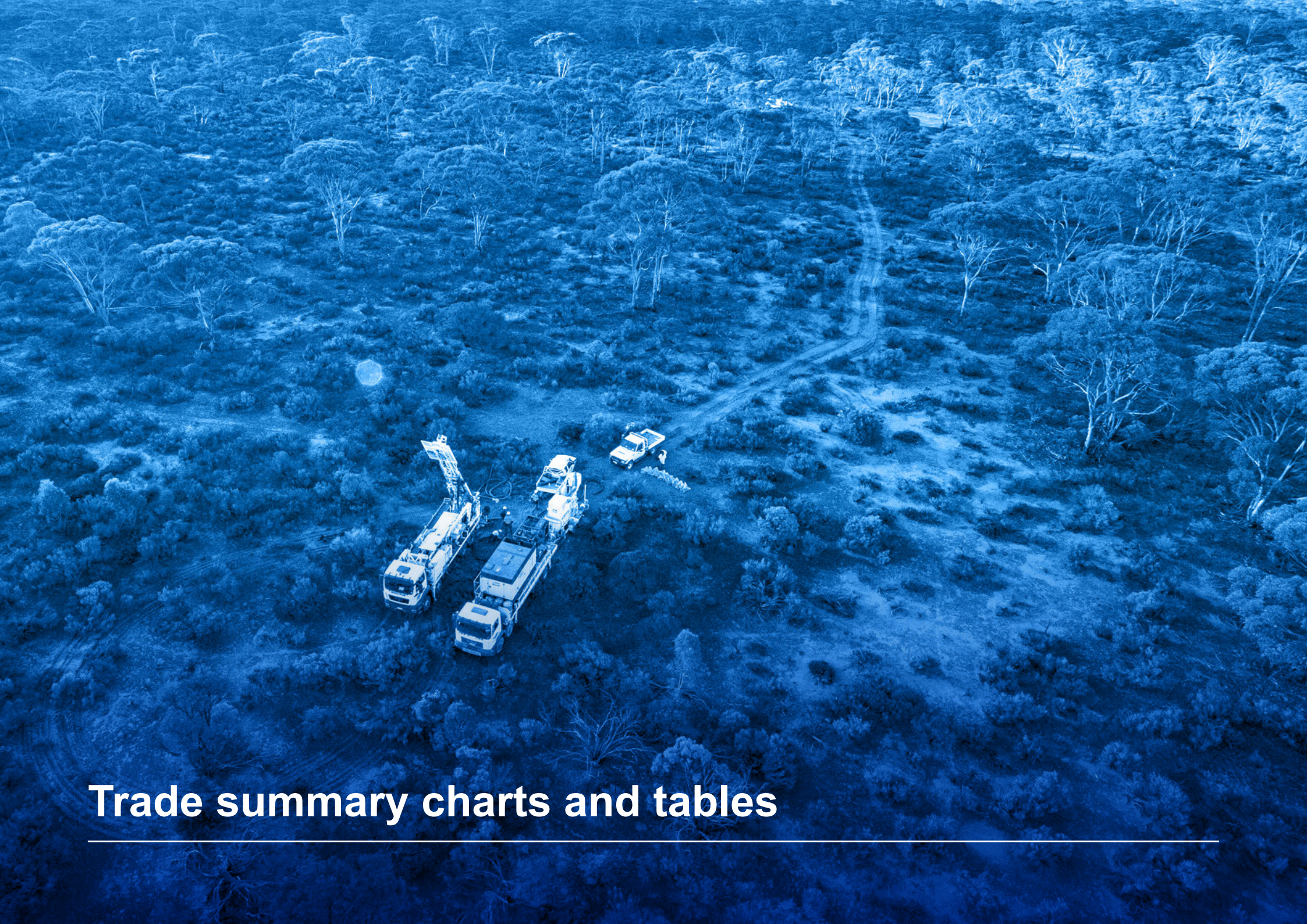
In June 2023 the Australian Government released its Critical Minerals Strategy, outlining the Government's plan to grow the critical minerals industry to maximise the national benefits from Australia's critical minerals endowments. Key focus areas include: developing strategically important projects; attracting investment and building international partnerships; First Nations engagement and benefit sharing; promoting Australia as a world leader in ESG performance; unlocking investment in enabling infrastructure and services; and growing a skilled workforce.

The Strategy outlines the Government's commitment to ask the Northern Australia Infrastructure Facility (NAIF) to earmark $500 million for projects that align with the Strategy. This will support the growth of the critical minerals sector, particularly downstream processing. This is in addition to the funding for critical minerals under the National Reconstruction Fund, including $1 billion for value-add in resources and $3 billion for renewables and low emissions technologies.

Table 16.1: Australia's battery metals resources and production

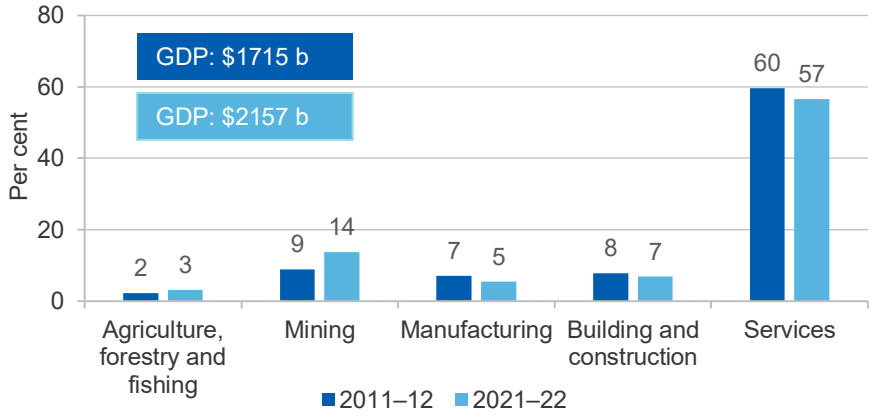
	Australia's Resources			Australia's Production			
	Economic Demonstrated Resources (EDR)	Share of global EDR	World ranking resources	Production (2022)	Share of world production	World ranking production	Australian Geological Potential
Lithium	6,700 kt Li	29%	2	55 kt Li	53%	1	High
Cobalt	1,582 kt Co	20%	2	5.3 kt Co	3%	3	High
Graphite	7.97 Mt	2%	8	0 Mt	0%	0	Moderate
Manganese	277 Mt	9%	4	4.9 Mt	11%	3	High
Nickel	21.7 Mt Ni	23%	1	0.15 Mt Ni	6%	5	na*

Notes: *Nickel is not included in Australia's critical minerals list.
Source: Geoscience Australia, Australia's Identified Mineral Resources 2022



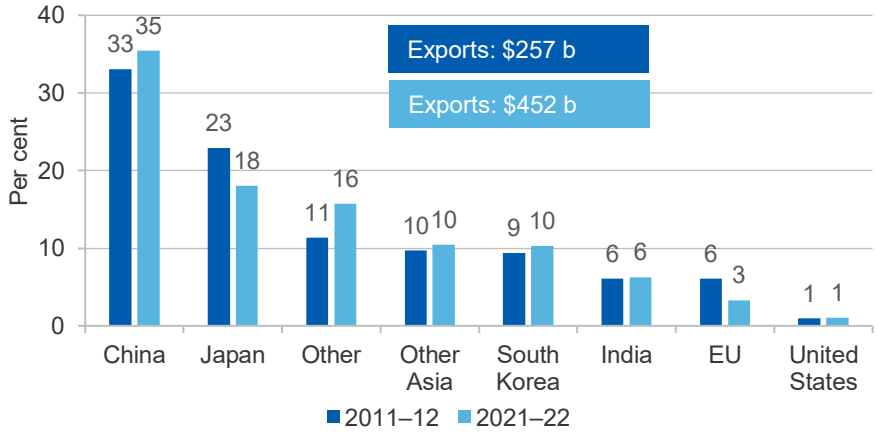
Trade summary charts and tables

Figure 17.1: Industry shares of GDP



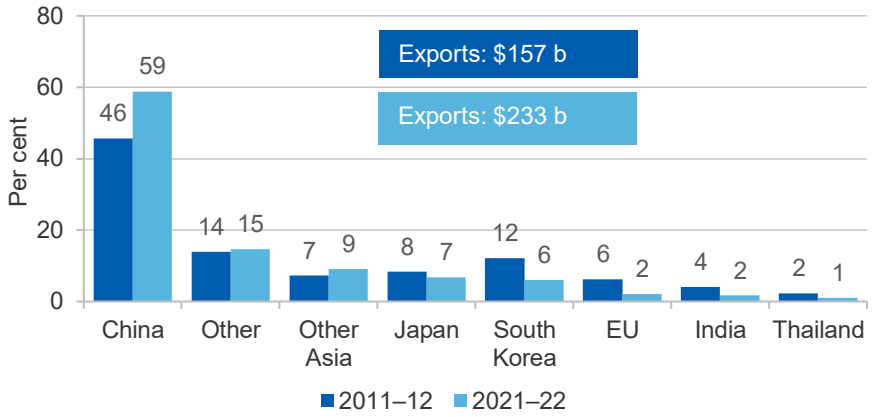
Source: ABS (2023) Australian National Accounts, National Income, Expenditure & Production, 5204.0

Figure 17.2: Principal markets for Australia's resources and energy exports, 2022–23 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, 2022–23 dollars

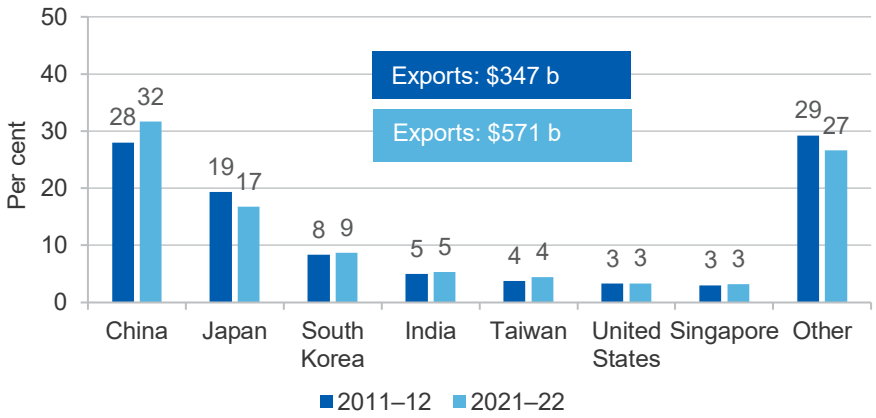


Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2023) International Trade in Goods and Services, 5368.0

Figure 17.4: Principal markets for Australia's energy exports, 2022–23 dollars

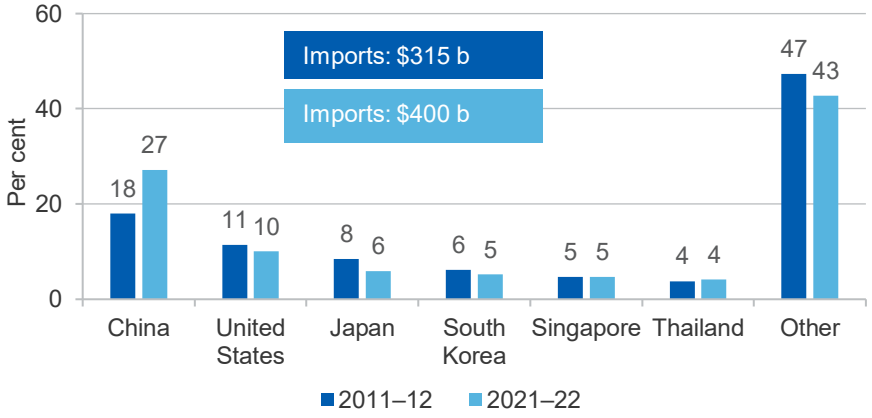
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2023) International Trade in Goods and Services, 5368.0

Figure 17.5: Principal markets for Australia's total exports, 2022–23 dollars



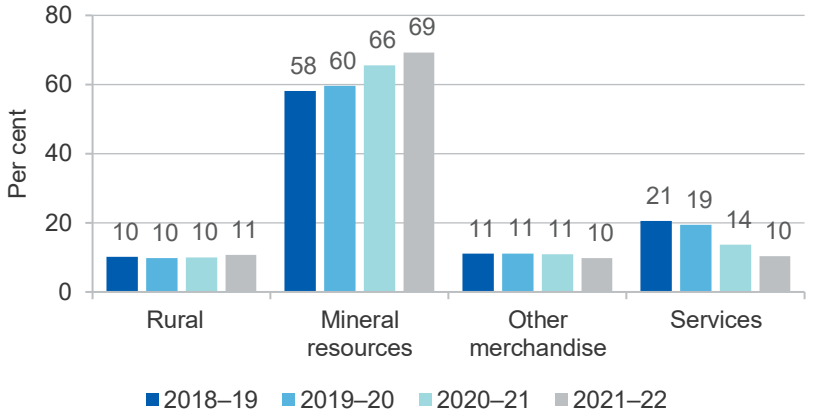
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2023) International Trade in Goods and Services, 5368.0

Figure 17.6: Australia's total imports by country of origin, 2022–23 dollars



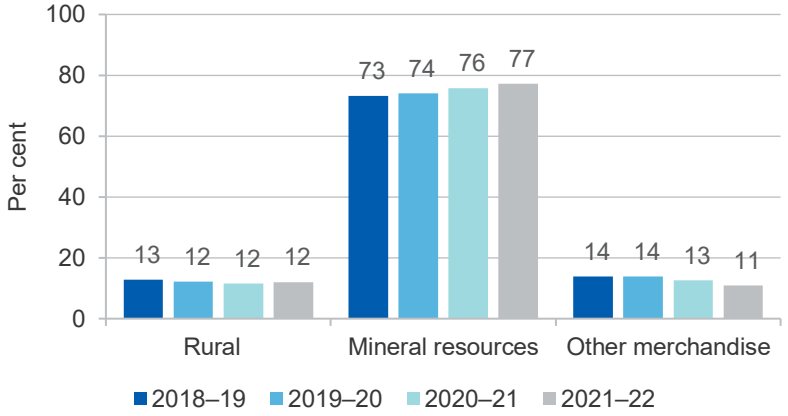
Note: Some country details have been confidentialised by the Australian Bureau of Statistics.
Source: ABS (2023) International Trade in Goods and Services, 5368.0

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, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
Japan	$m	11,518	13,397	9,488	7,840	25,509
South Korea	$m	3,479	4,391	3,231	2,873	7,303
Taiwan	$m	3,010	3,643	2,712	2,305	7,107
Vietnam	$m	150	765	1,183	796	1,808
Malaysia	$m	875	1,042	608	626	1,534
Thailand	$m	434	461	491	580	865
Total	**$m**	**26,446**	**29,902**	**23,161**	**17,907**	**49,540**

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

Table 17.2: Principal markets for Australia's metallurgical coal exports, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
India	$m	11,103	12,950	8,513	8,479	22,371
Japan	$m	8,505	8,821	6,916	5,306	15,134
South Korea	$m	4,294	4,635	3,448	3,056	10,099
Netherlands	$m	2,097	2,064	1,411	990	4,393
Taiwan	$m	2,263	2,992	2,266	1,490	4,248
China	$m	9,808	11,392	11,114	1,866	0
Total	**$m**	**44,251**	**50,266**	**38,927**	**25,936**	**72,385**

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, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
Singapore	$m	1,374	2,242	1,546	1,858	1,620
South Korea	$m	810	799	384	100	695
Japan	$m	421	346	155	102	234
Indonesia	$m	1,532	747	865	689	197
China	$m	738	1,161	1,174	180	169
Malaysia	$m	686	1,889	1,152	736	50
Total	**$m**	**8,147**	**10,449**	**10,240**	**8,316**	**15,027**

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, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
Japan	$m	16,991	24,432	22,652	13,030	26,560
China	$m	11,194	20,138	18,502	12,726	22,940
South Korea	$m	4,318	6,113	5,867	3,739	12,288
Taiwan	$m	875	2,699	2,948	2,503	8,055
Singapore	$m	1,330	1,424	1,181	971	2,399
Malaysia	$m	426	1,005	1,655	558	599
Total	**$m**	**36,188**	**57,281**	**54,022**	**34,091**	**75,580**

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, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
China	$m	58,683	73,108	96,378	139,621	115,993
Japan	$m	6,242	6,632	8,000	10,157	10,985
South Korea	$m	4,223	5,376	7,072	10,104	8,882
Taiwan	$m	1,446	2,036	2,132	3,434	2,991
Indonesia	$m	52	50	31	45	41
India	$m	351	273	23	11	37
Total	**$m**	**71,883**	**89,334**	**116,924**	**171,115**	**141,891**

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

Table 17.6: Principal markets for Australia's aluminium exports, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
Japan	$m	1,608	1,520	1,155	1,069	1,612
South Korea	$m	988	884	1,294	1,013	1,102
Chinese Taipei	$m	383	338	409	466	661
United States	$m	217	969	280	287	638
Thailand	$m	438	451	329	390	558
Indonesia	$m	214	138	108	124	175
Total	**$m**	**4,699**	**4,798**	**4,197**	**4,209**	**6,115**

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

Table 17.7: Principal markets for Australia's copper exports, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
China	$m	4,411	4,154	4,305	3,073	2,097
South Korea	$m	340	787	740	1,471	1,473
Malaysia	$m	1,019	1,430	937	951	1,029
India	$m	981	512	526	700	1,008
Japan	$m	1,786	2,112	2,417	19	19
Philippines	$m	196	705	410	0	0
Total	**$m**	**9,895**	**11,254**	**11,604**	**12,797**	**12,988**

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, 2022–23 dollars

	Unit	2017–18	2018–19	2019–20	2020–21	2021–22
China	$m	3,440	5,842	936	2,269	8,760
Hong Kong	$m	9,419	5,034	3,797	1,577	5,240
India	$m	857	666	75	1,649	2,065
Switzerland	$m	1,282	1,337	2,159	2,113	2,011
Singapore	$m	1,355	1,831	1,617	3,281	1,721
United States	$m	86	147	3,500	4,404	1,480
Total	**$m**	**22,589**	**21,733**	**27,729**	**29,200**	**24,846**

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 June 2023.

Resources and Energy Quarterly publication schedule

Publication	Expected release date	Outlook period final year
September 2023	3 October 2023	Australian data: 2024–25 World data: 2025
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

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