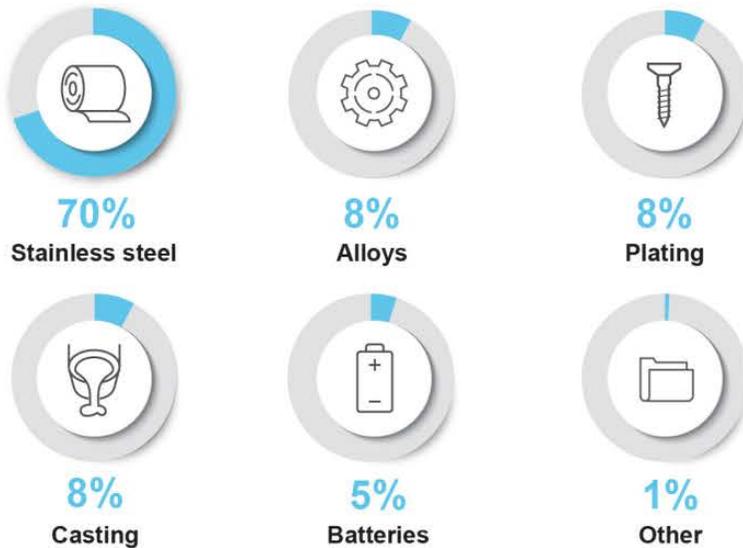


Nickel

Major Australia nickel deposits (Mt)



World consumption

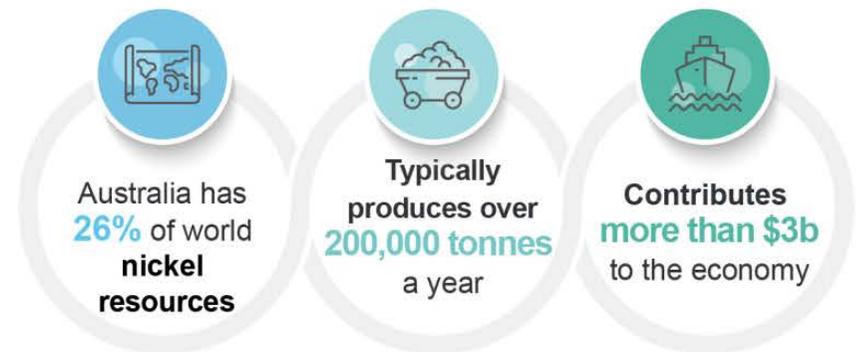


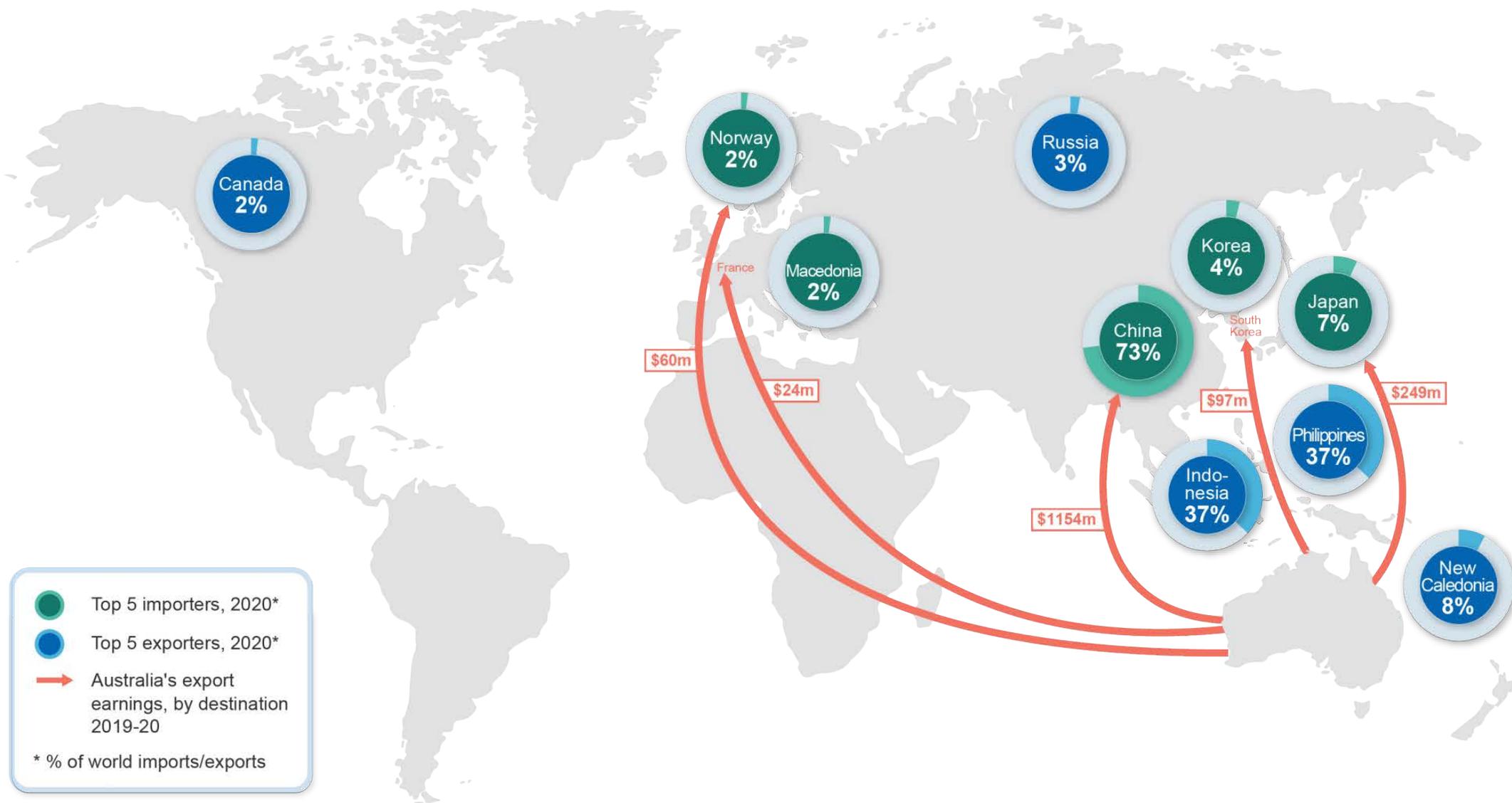
Nickel facts



- Nickel is used in the **US, UK and Euro coins**
- Nickel has a growing role in **electric vehicle batteries**
- Nickel is **magnetic** at room temperature and is **fully recyclable**
- Nickel is the **second most abundant element** in the Earth's core after iron

Australia's nickel





13.1 Summary

- The nickel price is estimated to average US\$18,388 a tonne in 2021, 34% higher than in 2020. Strong demand in stainless steel usage and electric vehicle batteries drove early gains, and supply-side shocks propelled subsequent gains.
- New projects and expansions are expected to lift Australia's export volumes from an estimated 181,000 tonnes in 2020–21 to about 272,000 tonnes in 2022–23 (see [Australia section](#)).
- Australia's nickel export earnings are forecast to rise on the back of growing export volumes and higher prices, reaching \$5.2 billion in 2021–22 and \$4.8 billion in 2022–23, up from \$3.8 billion in 2020–21.

13.2 World consumption

Nickel consumption growth stumbles

Global nickel consumption grew by 14% year-on-year in the September quarter 2021 as the industry continues to rebound following the COVID-19 pandemic. However, episodes of power rationing in China have contributed to a 3.3% quarter-on-quarter decline in nickel consumption in the September quarter — with consumption likely to be subdued into the December quarter as well. Despite this, global finished nickel demand is still estimated to reach 2.8 million tonnes in 2021, up 16% from 2020. Demand is expected to continue to grow, hitting 2.9 million tonnes in 2022, and 3.1 million tonnes in 2023.

Nickel will be of growing importance to the global supply chain. The United States Geological Survey (USGS) has added nickel to its critical minerals list for 2021. Nickel's addition to this list offers miners access to US government subsidies, encouraging greater supply. It is expected that these effects will be felt beyond the forecast period.

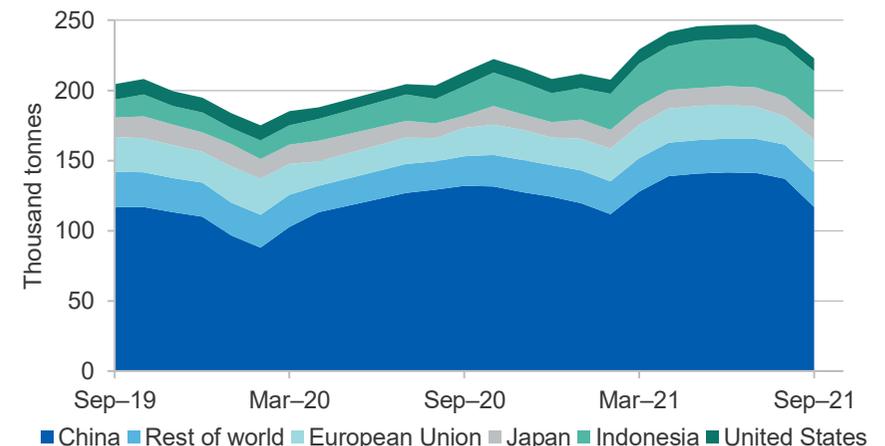
Power rationing a hurdle to stainless steel's rebound

Stainless steel still constitutes the majority of global nickel demand, despite the burgeoning electric vehicle (EV) sector. China thus remains crucial to nickel markets, since it produces close to 60% of the world's

stainless steel output. However, power rationing has significantly decreased Chinese stainless steel output, with monthly output being approximately 330,000 tonnes — or 24% — lower than expected in September. This decreased output implies a drop in demand of around 26,000 tonnes of nickel for the month of September alone (Figure 13.1). Data for October suggests demand will be equally subdued through the December quarter. With energy demand set to remain high as the Northern Hemisphere winter begins, it is plausible that power rationing may continue to be a feature of the Chinese economy as 2022 begins, constraining stainless steel output in the first half of 2022 at least.

In spite of China's production problems, global stainless steel production in 2021 is still forecast to be 14% higher than in 2020, largely supported by government stimulus spending and strong Chinese production in the first half of 2021. Global growth in stainless steel production is expected to moderate to 6% in 2022 and 4% in 2023 (Figure 13.2). This growth is expected to be driven by expansions from Delong (Indonesia) and Tsingshan (China), while stainless steel production is set to remain relatively stable in the US, Europe, Japan and Taiwan.

Figure 13.1: Refined nickel consumption by major country



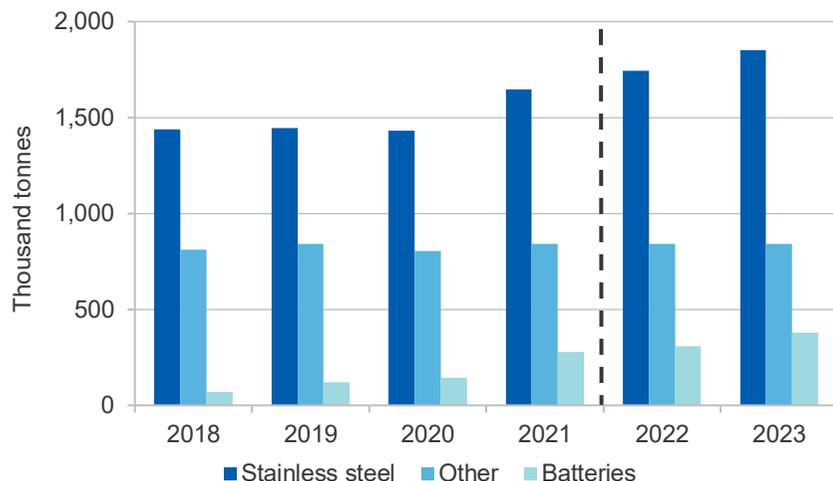
Source: International Nickel Study Group (2021), Department of Industry, Science, Energy and Resources (2021)

Expectations of future consumption growth driven by the battery sector

Accelerating demand for EVs — as part of global moves towards decarbonisation — is driving rising demand for nickel. Nickel use in battery precursors is forecast to increase by 60% to 280,000 tonnes globally in 2021, with China accounting for 75% of this demand.

Use in battery precursors accounted for about 6% of primary nickel consumption in 2020. However, rising EV penetration rates, combined with increased use of nickel in batteries, is projected to see this contribution reach 12% by 2023. This will likely be driven by demand in the EU, China and the US in the short term, while local EV value chains in populous nations such as India and Indonesia are likely to drive consumption beyond the forecast period. Also pointing to the growing importance of nickel in the EV supply chain, several supply deals were struck between refined nickel producers and automotive and battery manufacturers, including BHP's Nickel West deal with Prime Planet Energy & Solutions' (PPES) to supply Nickel Sulphate (see *Australia section*).

Figure 13.2: Forecast nickel consumption by use



Source: International Nickel Study Group (2021), Department of Industry, Science, Energy and Resources (2021), BloombergNEF (2021)

13.3 World Production

Global nickel production set to increase in 2021

Global mined nickel production is estimated to rise by 10% year-on-year to 2.7 million tonnes in 2021, as production ramps up in Indonesia and returns to pre-COVID-19 levels in other regions. Mine production increased by 12% year-on-year in the September quarter 2021, while refined production increased 4.5% year-on-year. In 2021, refined nickel production is expected to increase by 10% to 2.6 million tonnes.

Indonesian nickel mining has largely returned to pre-COVID-19 pandemic levels, and continues to grow. In the September quarter 2021, Indonesian mine production was up 3.9% quarter-on-quarter and 29% year-on-year.

Mining has been halted at Vale's Onça Puma operations in Brazil, after an injunction was brought against them by the state's environmental agency in October. This will affect December quarter 2021 production.

Canadian refined output fell 18% quarter-on-quarter, mainly owing to protest action at Vale's Sudbury operations. The protests occurred for a total of 70 days, of which 40 were in the September quarter, and reduced finished nickel output by 11,000 tonnes in the September quarter 2021.

Production in the Philippines continues its significant rise. Mine production increased 26% quarter-on-quarter in September quarter 2021, after more than doubling quarter-on-quarter in the June quarter 2021. This rise is despite the continuation of the ban on new open cut mines.

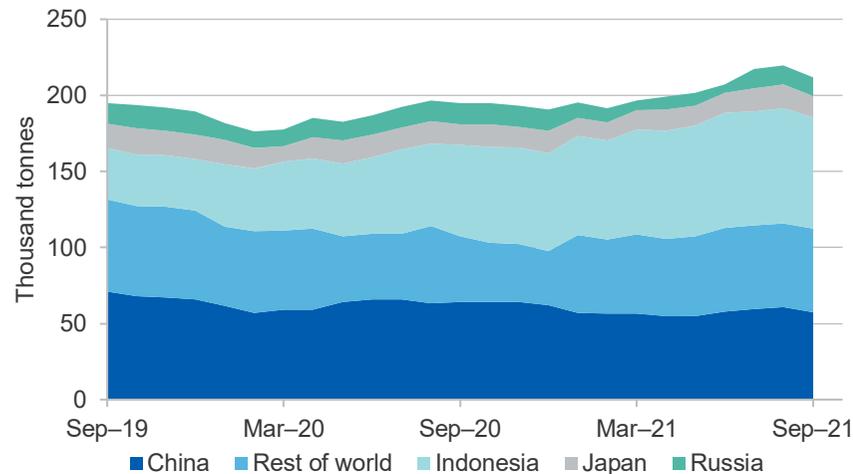
Russian mine production rebounded to pre-COVID-19 levels in the September quarter 2021, after a slow start in the first half of 2021. Norilsk Nickel completed the recommencement of its Russian operations, with production expected to return to full capacity in December. Consolidated nickel output (refined and intermediate products) was 43,000 tonnes for the quarter — an increase of 80% from the June quarter.

World mine production is expected to increase by 7.7% in 2022 and 9.3% in 2023, largely driven by increased mine production in Indonesia.

Rising cost affecting refined nickel production

Rising costs have significantly curtailed refined nickel production in China. Refined nickel production is energy intensive, and as rising energy costs cut profitability, finished nickel production in 2021 is expected to be 6.6% lower than in 2020 (which was already lower than the preceding year due to the COVID-19 pandemic). Costs pressures have also come from rising ore costs, as lower shipments from the Philippines (disrupted by seasonal monsoons) force higher competition for cargoes. Scrap usage has risen by about 5% in China, in an effort to reduce the need for primary nickel.

Figure 13.3: Refined nickel production by major country



Source: International Nickel Study Group (2021), Department of Industry, Science, Energy and Resources (2021)

Indonesian nickel pig iron (NPI) costs have also risen sharply in line with input costs, with the price of energy having risen 50% over the last year. However, Indonesian producers have access to local nickel ore supply at a government-regulated price. Despite global cost pressures, Indonesia's refined nickel production rose by 33% year-on-year in the September quarter 2021. Production is coming from NPI and high pressure acid leach (HPAL) operations (Figure 13.3). Lygend, a Chinese company, is adding

to NPI production, with 20 production lines planned and first production expected in early 2022.

HPAL producers are also seeing significant cost pressures, due to higher sulphur costs. Quantum's Ravensthorpe HPAL plant saw its pre-cobalt credit cash costs rise to \$22,751 per tonne — an annual rise of two thirds.

13.4 Prices

Prices have been volatile in the September quarter

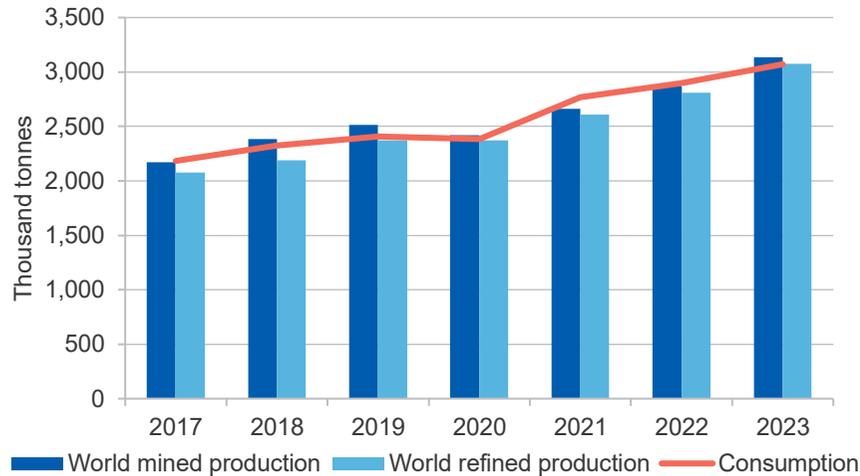
Nickel prices were volatile in 2021, with prices peaking at almost US\$20,000 a tonne in mid-February 2021, falling to \$17,320 a tonne in the June quarter 2021 and then rebounding to average \$19,125 a tonne in the September quarter 2021 (Figure 13.5). Prices averaged around US\$19,500 a tonne in the December quarter — a figure which hides significant price fluctuations within the quarter. Prices were significantly affected by power rationing in China — on both the demand and supply side — in the December quarter 2021. Initially, weaker demand from stainless steel makers saw prices fall to US\$18,000 a tonne. However, the decline in refined nickel supply has now far outweighed the decrease in nickel demand, creating upward pressure on the nickel price. As a result, the nickel price reached a 7-year high of US\$21,046 a tonne in October. Rumours about a potential export ban on various nickel products by the Indonesian government have also created uncertainty, and pushed prices up.

Elevated prices are expected to be supported through the continued proliferation of EVs into the global market. Non-stainless steel demand (primarily batteries, including those used in EVs) is expected to grow by 7.3% annually. Nickel supply — especially for EVs in the form of nickel chemicals — remains tight, with some market participants finding supplies difficult to source in the second half of 2021. That said, there remains some downside risks if the semiconductor chip shortage continues and forces temporary shutdowns in automotive manufacturing plants. Volkswagen has announced it has shut two EV plants for a week in

November, affecting 5,000 vehicles, while Tesla has pushed delivery for new Model S and Model X orders out to the March quarter 2023.

Nickel prices are expected to ease to about US\$18,600 a tonne in 2022 and US\$17,200 a tonne in 2023, as power rationing eases, which will lift supply to around the same level as demand (Figure 13.4).

Figure 13.4: World nickel production and consumption



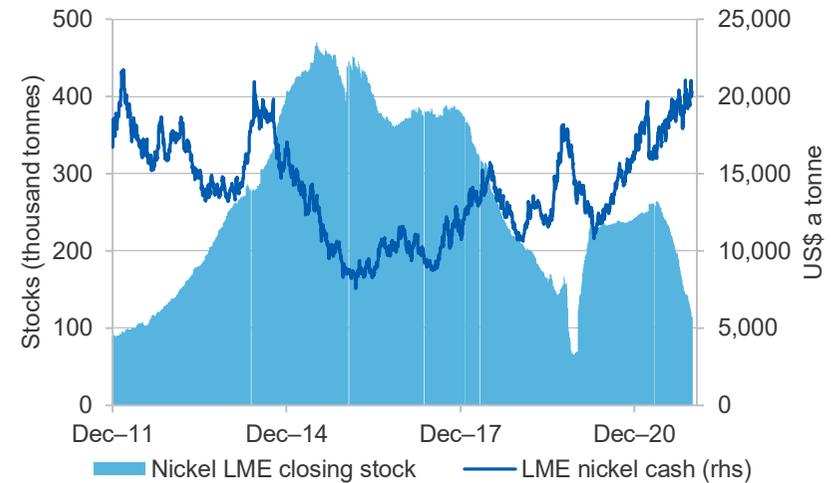
Source: International Nickel Study Group (2021), Department of Industry, Science, Energy and Resources (2021)

13.5 Australia

Export earnings to grow

In 2020–21, nickel export earnings were \$3.8 billion, roughly the same as in the previous year (Figure 13.6). Over the outlook period, export earnings are forecast to reach \$5.2 billion in 2021–22 and \$4.8 billion in 2022–23. Export earnings growth is based on rising output — as operations restart and new capacity comes online — spurred by strong nickel prices, as the battery sector expands. Export volumes are forecast to total 257,000 tonnes in 2021–22 — up 42% year-on-year — and to climb to 272,000 tonnes in 2022–23.

Figure 13.5: Nickel price and stock levels



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

Expectations of market growth support openings and restarts

The battery sector continues to grow, with global EV sales expected to rise to over 5 million vehicles in 2021 (see *lithium* chapter). This is expected to keep nickel price growth strong in the short term.

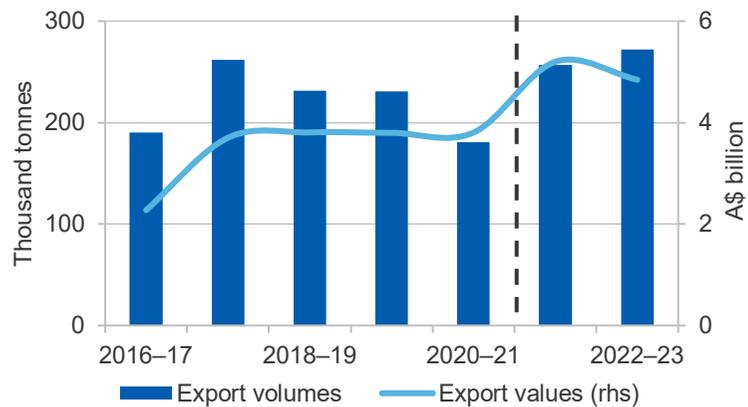
Panoramic Resources has begun mining and developing the Savannah nickel project in Western Australia (WA). The mine has produced its first concentrate, with the first shipments expected in December 2021. Average annual output of 9,100 tonnes of nickel is planned.

Poseidon Nickel has stated it may make a FID on Golden Swan by the end of 2021, with production possible by the December quarter 2022. This follows upgrades to its contained resources. Mincor have issued a start notice for an offtake and processing agreement with BHP for its Kambalda Nickel Operations (KNO), with first concentrate sales expected in June quarter 2022 — a quarter later than planned, due to labour shortages in WA. Production at Nova decreased by 13% quarter-on-quarter — to 6,889 tonnes — due to an expected decrease in feed grades and recoveries. Output at Forrestania in WA was 3,741 tonnes, down 24%

quarter-on-quarter, due to the mining of lower ore grades. Western Areas' Odysseus produced its first ore in October, and is undertaking an offtake tender process for the sale of its concentrate, which is expected for the December quarter 2022.

Australia's mine production is forecast to lift from 162,000 tonnes in 2020–21 to 219,000 tonnes in 2022–23. Output during the 2019–20 to 2021–22 period has been impacted by Ravensthorpe's entry, closure and re-entry.

Figure 13.6: Australia's nickel export volumes and values



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

Significant potential exists in battery chemicals capacity

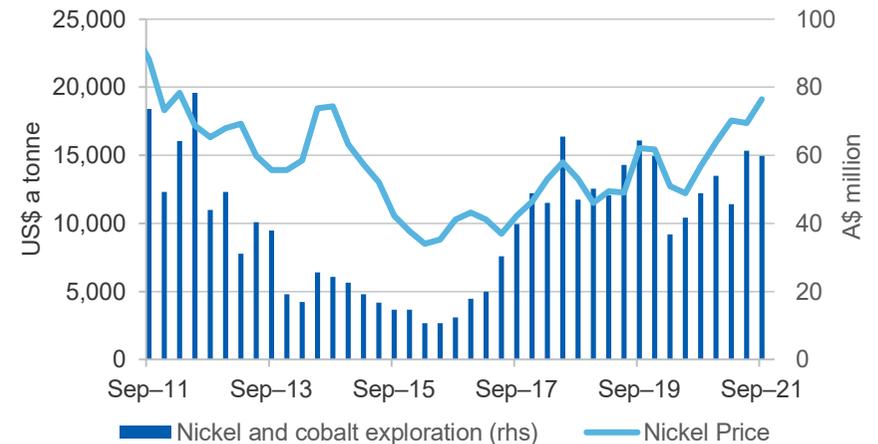
Australia's refinery output is forecast to rise from 105,000 tonnes in 2020–21 to 129,000 tonnes in 2022–23. First Quantum has lowered its guidance for 2021 to 17,000–20,000 tonnes of nickel, due to both equipment delays for its Ravensthorpe operation in WA, as well as the impacts of COVID-19 travel restrictions and higher (sulphur) production costs. Production for the September quarter 2021 was 4,248 tonnes of nickel. First Quantum have completed an agreement for POSCO to secure 7,500 tonnes of nickel in a mixed nickel-cobalt hydroxide precipitate from 2024; enough for 180,000 electric cars a year.

Quarterly output at BHP's Nickel West operations in WA was steady at about 14,400 tonnes of nickel in the September quarter 2021. Nickel West produced its first nickel sulphate crystals in the September quarter 2021, with saleable production expected in December quarter 2021. Production capacity of 100,000 tonnes of nickel sulphate per annum is expected when fully operational. BHP has signed a Memorandum of Understanding (MoU) with Prime Planet Energy & Solutions (PPES) and Toyota Tsusho Corporation (TTC) to deliver nickel sulphate from its Nickel West facility.

Exploration expenditure

In the September quarter 2021, nickel and cobalt exploration fell slightly to \$60 million — down 2.4% on the previous quarter but up 22% year-on-year (Figure 13.7).

Figure 13.7: Australia's nickel and cobalt exploration expenditure



Source: ABS (2021) Mineral and Petroleum Exploration, Australia, 8412.0

Revisions to the outlook

Australia's nickel export earnings forecasts have been revised up from the September 2021 *Resources and Energy Quarterly*, due to minor upward revisions to the nickel price.

Table 13.1: Nickel outlook

World	Unit	2020	2021 ^f	2022 ^f	2023 ^f	Annual percentage change		
						2021 ^f	2022 ^f	2023 ^f
Production								
– mine	kt	2,419	2,663	2,868	3,134	10.1	7.7	9.3
– refined	kt	2,372	2,611	2,812	3,074	10.1	7.7	9.3
Consumption	kt	2,385	2,767	2,896	3,072	16	4.7	6.1
Closing stocks	kt	647	491	408	410	-24.0	-17.0	0.6
– weeks of consumption		14.1	9.2	7.3	6.9	-34	-20.7	-5.2
Prices LME								
– nominal	US\$/t	13,769	18,388	18,596	17,184	33.5	1.1	-7.6
	USc/lb	625	834	843	779	33.5	1.1	-7.6
– real ^b	US\$/t	14,276	18,388	17,975	16,179	28.8	-2.3	-10.0
	USc/lb	648	834	815	734	28.8	-2.3	-10.0
Australia	Unit	2019–20	2020–21	2021–22 ^f	2022–23 ^f	2020–21	2021–22 ^f	2022–23 ^f
Production								
– mine ^c	kt	161	162	195	219	0.6	20.3	12.7
– refined	kt	108	105	121	129	-2.5	15.0	7.1
– intermediate		15	29	29	30	89.1	-2.6	6.4
Export volume ^d	kt	231	181	257	272	-22	42.0	5.8
Export value								
– nominal value	A\$m	3,798	3,804	5,201	4,846	0.1	36.7	-6.8
– real value ^e	A\$m	3,953	3,896	5,201	4,744	-1.5	33.5	-8.8

Notes: ^b In 2021 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 2021–22 financial year Australian dollars; ^f Forecast .

Source: ABS (2021) International Trade in Goods and Services, Australia, Cat. No. 5368.0; Company reports; Department of Industry, Science, Resources and Energy (2021); International Nickel Study Group (2021); LME (2021); World Bureau of Metal Statistics (2021)