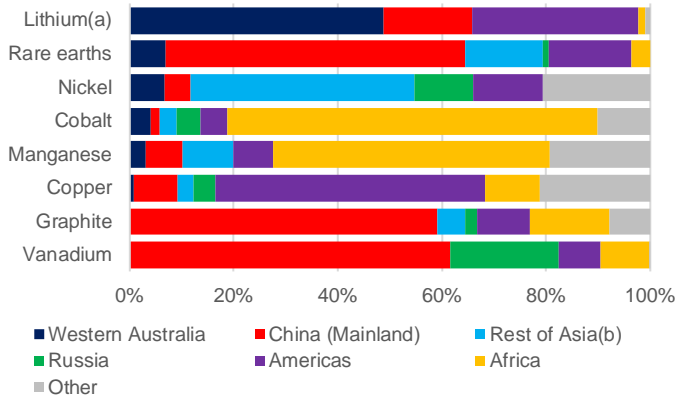




WESTERN AUSTRALIA BATTERY MINERALS PROFILE – December 2021

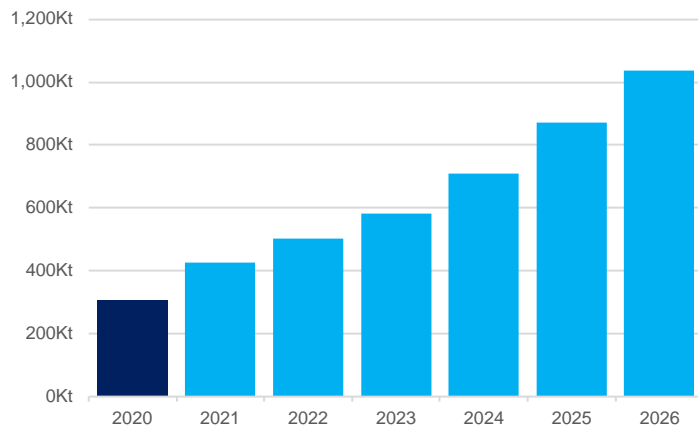
Major global battery minerals production¹: 2020 calendar year



¹ Mine production rather than processed products. (a) Lithium content of brine, spodumene, other hard rock or clay mine production. (b) Excludes China.
Source: US Geological Survey, Mineral Commodity Summaries (Annual); Office of the Chief Economist, Resources and Energy Quarterly; and WA Department of Mines, Industry Regulation and Safety, Resource Data Files (Bi-Annual).

- Western Australia is the world's largest producer of mined lithium and produces most other battery minerals.
- Western Australia accounted for 49% of global lithium production in 2020, followed by Chile (22%), China (17%) and Argentina (8%).
- Western Australia also ranked among the top 5 global producers for cobalt (4% global share), rare earths (7%) and nickel (7%) in 2020.
- China was the world's largest producer of vanadium (62%), graphite (59%) and rare earths (58%) in 2020, and a significant producer of other battery minerals.
- In 2020, the world's largest producer of:
 - Nickel was Indonesia (30%).
 - Cobalt was Congo (68%).
 - Manganese was South Africa (28%).
 - Copper was Chile (29%).

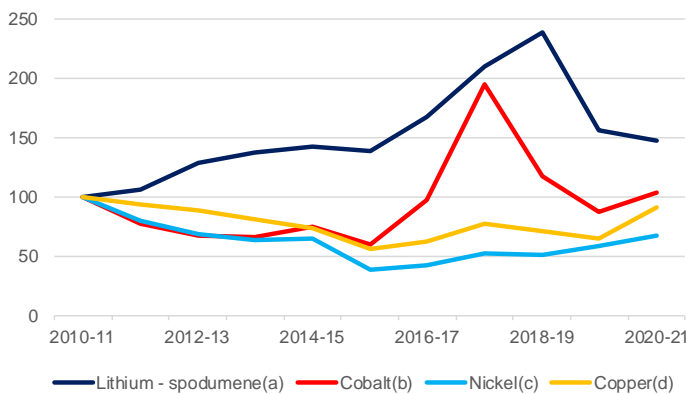
World lithium demand outlook: Calendar years



Kt = Thousand tonnes.
Source: Office of the Chief Economist, Resources and Energy Quarterly, Medium Term (5 years) Outlook (March quarter 2021).

- Lithium-ion batteries are made from mostly lithium, graphite, nickel, cobalt and manganese.
- World lithium demand was 305 thousand tonnes in 2020. The Office of the Chief Economist forecasts world lithium demand will rise to 1,038 thousand tonnes by 2026.
- The world consumed 2,377 thousand tonnes of nickel in 2020. The Office of the Chief Economist forecasts world nickel consumption will rise to 3,326 thousand tonnes by 2026.
- Electric vehicles and associated batteries and charging infrastructure will require significant amounts of copper.
- The world consumed 24,885 thousand tonnes of copper in 2020. The Office of the Chief Economist forecasts world copper consumption will rise to 28,031 thousand tonnes by 2026.

Battery minerals prices indexes¹: Financial years²



¹ Index prices in nominal US dollars a tonne (2010-11 = 100.0). ² Annual average. (a) Unit prices of WA spodumene concentrate sales converted to US dollars. (b) Minimum 99.80% purity. (c) Minimum 99.80% purity, cathodes. (d) Minimum 99.9935% purity, cathodes and wire bar.
Source: World Bank, Commodity Markets (Monthly); and WA Department of Mines, Industry Regulation and Safety, Resource Data Files (Bi-Annual).

- Prices for lithium spodumene have fallen over the past two years because of an oversupply of lithium spodumene, slowing demand for electric vehicles and delays in the construction of battery manufacturing facilities. In contrast, average annual prices for nickel, cobalt and copper all increased in 2020-21.
- In 2020-21, the annual average price of:
 - Spodumene fell 6% to US\$432 a tonne.
 - Lithium hydroxide rose 8% to US\$8,368 a tonne.
 - Nickel rose 17% to US\$16,300 a tonne.
 - Cobalt rose 18% to US\$40,421 a tonne.
 - Copper rose 41% to US\$7,973 a tonne.
- The Office of the Chief Economist forecasts an increase in lithium prices in the 2022 calendar year, with the:
 - Spodumene price forecast to rise from US\$719 a tonne in 2021 to US\$1,185 a tonne in 2022.
 - Lithium hydroxide price forecast to rise from US\$17,137 a tonne in 2021 to US\$23,804 a tonne in 2022.



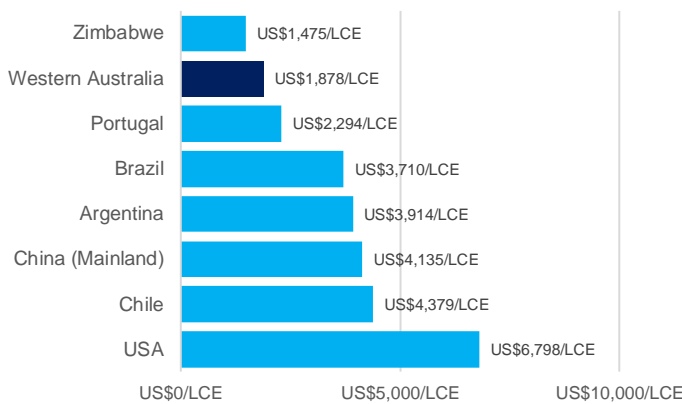
Western Australia's battery minerals reserves¹: 2020 calendar year

| Commodity | Unit | Western Australia | Australia | World | Western Australia share of world |
|-------------|------|-------------------|-----------|-------|----------------------------------|
| Lithium | Mt | 4.5 | 4.7 | 21 | 21% |
| Nickel | Mt | 18.2 | 20.0 | 94 | 19% |
| Cobalt | Mt | 1.0 | 1.4 | 7 | 14% |
| Vanadium | Kt | 2.8 | 4.0 | 22 | 13% |
| Manganese | Mt | 78.2 | 230.0 | 810 | 6% |
| Rare earths | Mt | 2.9 | 4.1 | 120 | 2% |
| Copper | Mt | 5.3 | 88.0 | 870 | 1% |

Mt = Million tonnes Kt = Thousand tonnes ¹ Estimated from Australia's battery minerals reserves.
Source: US Geological Survey, Mineral Commodity Summaries (Annual); and Geoscience Australia (Annual).

- Western Australia has globally significant battery minerals reserves of a quality suitable for battery manufacturing.
- Western Australia accounted for 21% of the world's lithium reserves in 2020 and has the world's 2nd largest lithium reserves behind Chile (44%).
- Western Australia accounted for 19% of the world's nickel reserves in 2020 and has the world's 2nd largest nickel reserves behind Indonesia (22%).
- Western Australia accounted for over 10% of the world's cobalt and vanadium reserves in 2020.

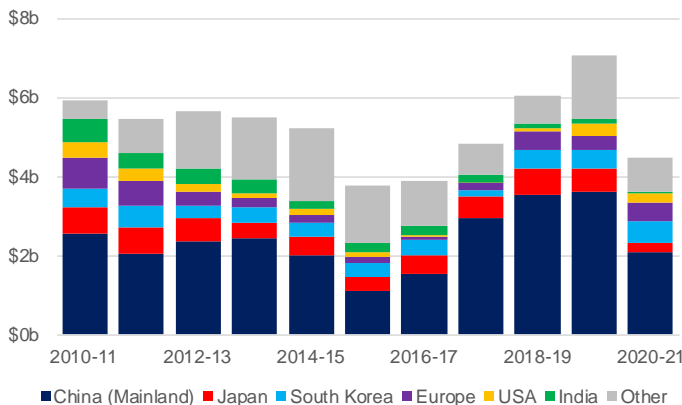
Total cash cost¹ of global seaborne lithium exports: 2021 calendar year



¹ Production costs for different lithium products and grades are adjusted to a benchmark product (lithium carbonate equivalent).
Source: S&P Global Market Intelligence, Mine Economics Model (Annual).

- Western Australia's lithium producers are among the world's lowest cost seaborne lithium exporters.
- The average total cash cost of Western Australia's lithium exports was US\$1,878 a lithium carbonate equivalent in 2021, below the world average of US\$2,866 a lithium carbonate equivalent.
- In 2021, the average total cash cost of Western Australia's exports of:
 - Nickel was US\$11,478 a tonne (world average was US\$8,685 a tonne).
 - Copper was US\$3,149 a tonne (world average was US\$3,273 a tonne).
 - Cobalt was US\$25,978 a tonne (world average was US\$17,258 a tonne).

Western Australia's markets for battery minerals¹ exports: Financial years

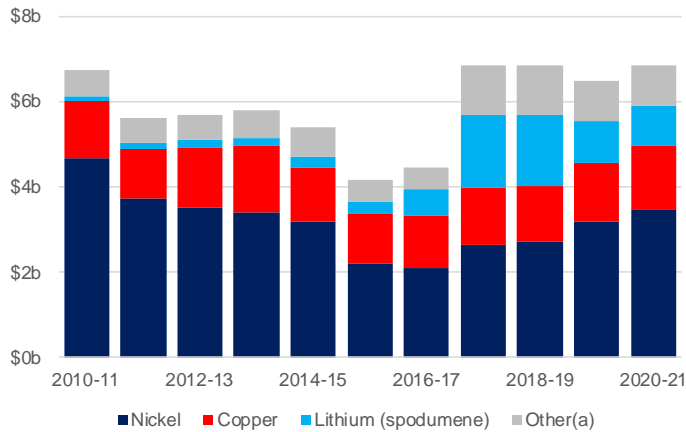


Note – The value of copper exports was understated in 2020-21 due to confidentiality restrictions limiting the release of data between June 2020 and April 2021. ¹ Includes copper, lithium, nickel, graphite and manganese (until 2014-15). Excludes rare earths, cobalt, vanadium and manganese (since 2015-16).
Source: ABS 5368.0 International Trade in Goods and Services, Australia (Monthly), and WA Department of Mines, Industry Regulation and Safety, Resource Data Files (Annual).

- China accounted for 47% of Western Australia's battery minerals exports in 2020-21.
- The value of Western Australia's battery minerals exports to China fell 42% to \$2.1 billion in 2020-21.
- In 2020-21, Western Australia's battery minerals exports to:
 - Japan fell 63% to \$218 million.
 - South Korea rose 29% to \$570 million.
 - Europe rose 21% to \$466 million.
 - United States fell 27% to \$206 million.
 - India fell 67% to \$43 million.
- Western Australia's lithium, cobalt and nickel exports are mostly used in battery manufacturing. New investment in battery minerals processing will result in more battery minerals exported specifically for battery manufacturing.



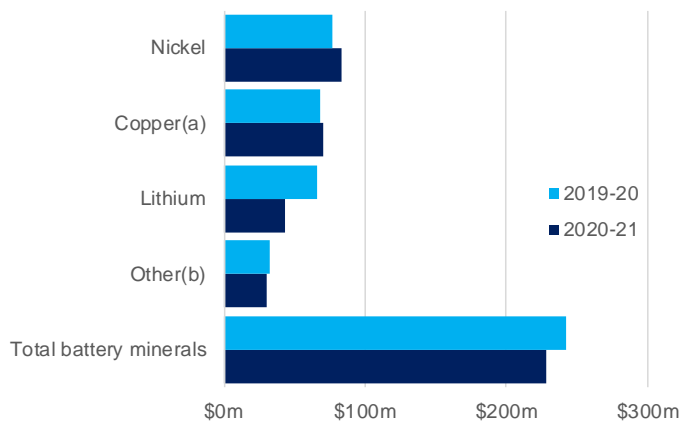
Western Australia's battery minerals sales: Financial years



(a) Includes cobalt, manganese, vanadium and rare earths (and some other minerals).
Source: WA Department of Mines, Industry Regulation and Safety, Resource Data Files (Annual).

- Battery minerals accounted for 3% of the value of Western Australia's minerals and petroleum sales in 2020-21.
- The value of Western Australia's battery minerals sales rose 6% to \$6.9 billion in 2020-21
- In 2020-21, the value of Western Australia's sales of:
 - Nickel rose 10% to \$3.5 billion.
 - Copper rose 7% to \$1.5 billion.
 - Lithium (spodumene) fell 6% to \$938 million.
 - Other battery minerals rose 2% to \$951 million.

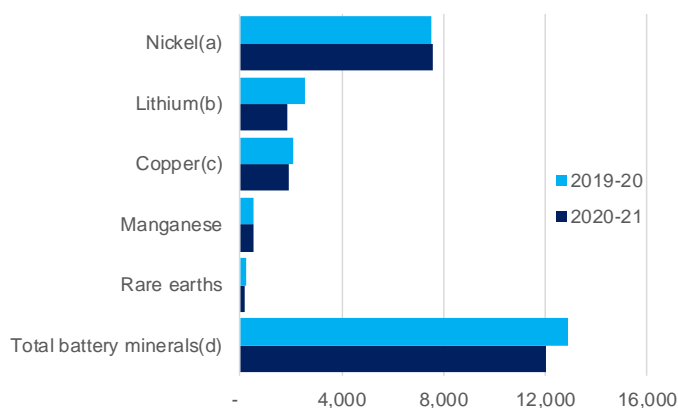
Western Australia's battery minerals royalty revenue: Financial years



¹ Includes North West Shelf Grants. (a) Includes lead and zinc. (b) Includes rare earths, manganese, cobalt, vanadium and graphite.
Source: WA Department of Mines, Industry Regulation and Safety, Resource Data Files (Annual).

- Battery minerals accounted for 2% of Western Australia's royalty revenue¹ in 2020-21
- Western Australia's battery minerals royalty revenue fell 6% to \$228 million in 2020-21.
- In 2020-21, Western Australia's royalty revenue from:
 - Nickel rose 10% to \$84 million.
 - Copper (lead and zinc) rose 4% to \$71 million.
 - Lithium fell 35% to \$43 million.
 - Other battery minerals fell 5% to \$31 million.

Western Australia's battery minerals industry employment¹: Financial years



¹ Direct employment. Full-time equivalent (average on site). (a) Includes cobalt. (b) Includes tin and tantalum. (c) Includes zinc and lead. (d) Excludes graphite.
Source: WA Department of Mines, Industry Regulation and Safety, Resource Data Files (Annual).

- Battery minerals accounted for 11% of direct full-time equivalent employment in Western Australia's minerals mining industry in 2020-21 (excluding exploration).
- Direct full-time equivalent employment in Western Australia's battery minerals industry fell 7% to 12,009 in 2020-21.
- In 2020-21, direct employment in Western Australia's industry of:
 - Nickel rose 0.4% to 7,553.
 - Lithium fell 28% to 1,846.
 - Copper fell 9% to 1,894.
 - Manganese rose 4% to 542.
 - Rare earths fell 25% to 170.



Western Australia's battery minerals industry development

- The Greenbushes lithium mine in Western Australia has operated since 1983, initially producing lithium for glass and ceramics. The Greenbushes mine was expanded in recent years and other lithium mines were developed to meet the growing demand from lithium-ion battery manufacturers and material suppliers. Lithium-ion batteries are used in electronics, clean energy storage and electric vehicles.
- Western Australia exports lithium as spodumene concentrate for further processing and has three lithium hydroxide processing plants under construction. Tianqi Lithium's Kwinana plant and Albemarle's Kemerton plant are expected to start exporting lithium hydroxide in 2022, followed by Covalent Lithium's Mt Holland plant in 2024. Mineral Resources will restart its Wodgina lithium mine in the September quarter 2022, after it was put into care and maintenance in November 2019.
- Western Australia is the only producer of nickel in Australia. The first major nickel deposit was discovered at Kambalda in 1966, followed by other major deposits at Mount Keith, Perseverance, Yakabindie, Murrin Murrin and Ravensthorpe. BHP's Nickel West is Western Australia's largest nickel operation consisting of the Mount Keith, Cliffs, Leinster and Rocky's Reward mines, the Kambalda Concentrator, Kalgoorlie Smelter (matte) and Kwinana Refinery (powder and briquettes). Until recently, Western Australia's nickel production was mainly used for stainless steel, but is now mostly sold to global battery material suppliers. BHP started operations at Australia's first nickel sulphate plant at its Kwinana Nickel Refinery in September 2021, which produces nickel sulphate for lithium-ion batteries.
- Western Australia is the world's largest rare earths producer outside of China, with production mainly coming from Lynas' Mount Weld mine. Lynas is also constructing a rare earths processing plant at Kalgoorlie and there are other rare earths pilot plants and potential projects in the pipeline.

Major battery minerals projects¹ in Western Australia

| Operator | Mine/plant | Primary commodity | Region | Capex ³ (\$m) | Capacity (Ktpa) | Start of operations |
|--|---|---------------------------------------|------------------------------|--------------------------|-----------------|---------------------|
| OPERATING² | | | | | | |
| Lithium | | | | | | |
| Talison Lithium [^] | Greenbushes mine (includes CGP1-2) | Lithium concentrate | South West | n.a. | 1,340 | 1983 |
| Galaxy Resources | Mt Cattlin mine | Lithium concentrate | Goldfields-Esperance | 250 | 180 | 2016 |
| Mineral Resources | Mt Marion mine | Lithium concentrate | Goldfields-Esperance | 300 | 450 | 2016 |
| Pilbara Minerals | Pilgangoora mine (stage 1) ⁴ | Lithium concentrate | Pilbara | 414 | 540 | 2018 |
| Nickel, cobalt | | | | | | |
| BHP | Nickel West mines and plants | Nickel concentrate and other* | Goldfields-Esperance | n.a. | 100 | 1967 |
| Glencore | Murrin Murrin mine and plant | Nickel briquettes, powder* | Goldfields-Esperance | 2,500 | 45 | 1999 |
| Western Areas | Forrestania mines and plant | Nickel concentrate | Goldfields-Esperance | 387 | 24 | 2006 |
| IGO | Nova-Bollinger mine and plant | Nickel concentrate | Goldfields-Esperance | 443 | 30 | 2016 |
| First Quantum | Ravensthorpe mine and plant (restart) | Nickel concentrate* | Goldfields-Esperance | 480 | 30 | 2020 |
| BHP | Nickel West/Kwinana plant (stage 1) | Nickel Sulphate* | Perth | 60 | 100 | 2021 |
| Other | | | | | | |
| Sandfire Resources | DeGrussa mine | Copper concentrate | Mid West | 409 | 77 | 2012 |
| Lynas | Mt Weld mine and plant | Rare earth oxide | Goldfields-Esperance | 170 | 27 | 2013 |
| Consolidated Minerals | Woodie Woodie mine (restart) | Manganese ore | Pilbara | 30 | 1,500 | 2017 |
| Northern Minerals | Browns Range pilot plant | Rare earths | Kimberley | 89 | 0.05 | 2018 |
| UNDER CONSTRUCTION OR COMMITTED | | | | | | |
| Lithium | | | | | | |
| Austroid | Bald Hill (restart) | Lithium concentrate | Goldfields-Esperance | 60 | 155 | 2022 |
| Tianqi Lithium | Kwinana plant (train 1) | Lithium hydroxide | Perth | 400 | 24 | 2022 |
| Albemarle | Kemerton plant (trains 1-2) | Lithium hydroxide | South West | 500 | 50 | 2022 |
| Mineral Resources | Wodgina mine (restart) | Lithium concentrate | Pilbara | 610 | 750 | 2022 |
| Tianqi Lithium | Kwinana plant (train 2) [on hold] | Lithium hydroxide | Perth | 300 | 24 | 2024 |
| Covalent Lithium | Mt Holland mine and plant | Lithium hydroxide | Goldfields-Esperance / Perth | 1,900 | 50 | 2024 |
| Talison Lithium [^] | Greenbushes mine expansion - CGP3 | Lithium concentrate | South West | 580 | 608 | 2025 |
| Talison Lithium [^] | Greenbushes mine expansion - CGP4 [on hold] | Lithium concentrate | South West | 438 | 520 | 2027 |
| Nickel, cobalt | | | | | | |
| Mincor Resources | Cassini/Kambalda mine | Nickel concentrate | Goldfields-Esperance | 179 | 16 | 2022 |
| Other | | | | | | |
| Lynas | Kalgoorlie Processing Plant | Rare earths (Neodymium, Praseodymium) | Goldfields-Esperance | 500 | 11 | 2023 |

Note – Spodumene concentrate produced from the Greenbushes mine contains around 5% to 7.5% lithium. Ktpa = thousand tonnes per annum. CGP = Chemical Grade Plant. n.a. – not available or not applicable. [^] Tianqi Lithium and Albemarle Joint Venture. * Produces cobalt. * Produces copper. ¹ Major projects that produce battery minerals as a primary commodity (excludes projects that produce battery minerals as a by-product only, such as copper produced at the Boddington, Telfer and Deflector gold mines). ² Includes the largest producing projects and projects recently placed under care and maintenance. ³ Capital expenditure. ⁴ Includes Altura Mining's Pilgangoora operations acquired by Pilbara Minerals.

Source: S&P Global Market Intelligence; and company investor information (announcements, reports and presentations).