



Department of Energy, Mines,  
Industry Regulation and Safety

Western Australian Mineral and Petroleum

# Statistics Digest 2022-23





### Acknowledgement of Country

The Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) respectfully acknowledges Aboriginal peoples as being the traditional custodians of Western Australia. We acknowledge the enduring connection Aboriginal people continue to share with the land, sea and sky through both their ancestral ties and custodianship to Country. We pay our respect to Elders both past and present, and acknowledge the value brought to our department through the collective contribution of Aboriginal and Torres Strait Islander peoples across Western Australia.

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Cover photo: Stockpile at Pilbara Minerals' Pilgangoora lithium operation in the Pilbara.  
Photo provided by Pilbara Minerals



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# FOREWORD



I am pleased to present the Mineral and Petroleum Statistics Digest for 2022–23.

The Western Australian (WA) resources sector remained resilient and had another impressive year, solidifying its position as the backbone of the State's economy.

From exploration to development to production, strong levels of activity across the entire mining life cycle contributed to high employment levels.

Globally, economic activity slowed due to rising inflation – a consequence of a range of factors – as well as tighter monetary policies in many countries around the world. China's economy was still feeling the effects of COVID-19 lockdowns and an ailing property sector.

While commodity prices remained high, these economic conditions broadly translated into lower prices than previous years, with the notable exceptions of gas and lithium reaching record levels.

Locally, the sector was affected by capacity constraints amid a tight labour market and supply issues, as well as slower and higher cost development.

A weaker Australian dollar meant the impact of lower prices was muted for local minerals and petroleum producers.

Significant production highlights include:

- The iron ore sector achieved record levels of production.
- Record levels of production and prices for lithium were achieved.
- The liquefied natural gas (LNG) industry was stronger than ever achieving all-time high production volumes at previously unseen prices.

Iron ore projects, new and expanding lithium projects, and the Scarborough gas field development also dominated resource sector investment, which was at its highest level in some years.

The future looks even brighter with exploration expenditure at record levels, driven by spending on gold, iron ore, and critical minerals, which are essential to a net-zero emissions future.

This investment in the mines of tomorrow will not only help sustain the WA resources sector but position our State to capitalise on the decarbonisation ambitions of economies worldwide.

## **Richard Sellers**

Director General  
Department of Energy, Mines,  
Industry Regulation and Safety

# OVERVIEW

WA's resources sector delivered yet another sales record of \$254 billion in 2022–23.

This outperformed previous records of \$251 billion in 2022 and \$234 billion in 2021–22.

While down on recent levels due to lower prices, the iron ore industry still achieved a historically high sales value of \$125 billion supported by record production of 861 million tonnes (Mt).

The fall in the value of iron ore sales was offset by growth in the value of LNG and lithium sales.

Record high prices, particularly during the second half of 2022, and production translated into an all-time high LNG production value of \$56 billion (almost \$18 billion more than in 2021–22 and more than \$2 billion greater than the previous high in 2022).

Supported by record high prices and expanding production, the value of lithium (spodumene concentrate) sales increased to a record \$21 billion, making it the State's second most valuable mineral after iron ore.

The result was also supported by strength in several other commodities:

- Gold sales were valued at a record \$18.6 billion on the back of the highest Australian dollar prices in history.
- The value of nickel sales was \$5.7 billion, which is among the highest levels in the last 15 years and was achieved largely due to historically high prices, particularly in late 2022 and early 2023, as well as a rebound in production.
- Domestic gas sales were at an all-time high of \$2.5 billion as higher demand and a shortfall in production resulted in increasing higher prices.
- Salt sales reached a record \$714 million due to increased prices.

The value of some other major commodities including condensate (\$8.6 billion), alumina (\$6.7 billion), and mineral sands (\$1.4 billion) remained around the same level as in recent years.

The sector was also assisted by an overall weaker Australian dollar (as most commodities are priced in United States (US) dollars). It averaged 67 US cents for the financial year, down seven per cent on 2021–22, due to strength in the US dollar and financial market volatility.

## Minerals

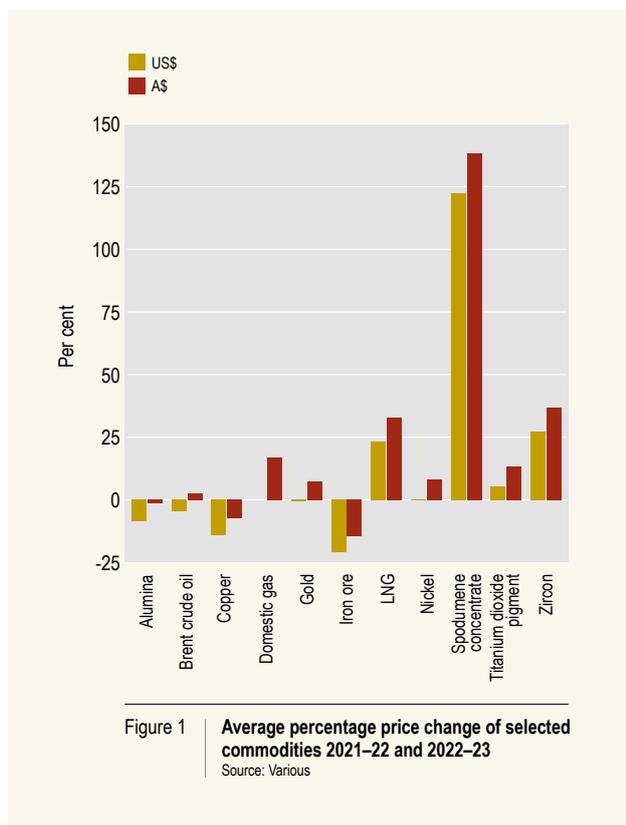
Minerals production was once again the dominant economic activity in the State's resources sector with \$183 billion in sales, despite this figure being down on recent years.

Minerals accounted for 72 per cent of all resources sector sales, below the long-term historical average.

Iron ore sales were valued at \$125 billion, down from record levels in recent years, and the major reason for the overall decline in the value of minerals production.

This result was still high in a historical context and the industry remained the backbone of the resources sector in WA.

Across most of the second half of 2022, iron ore prices were in decline. They fell below US\$100 per tonne as China's government remained committed to its COVID-zero policy. They subsequently improved following an easing of China's COVID-19 related restrictions, economic stimulus including to support an ailing property sector, as well as restocking by Chinese steel mills. However, this was not enough to offset the earlier losses.

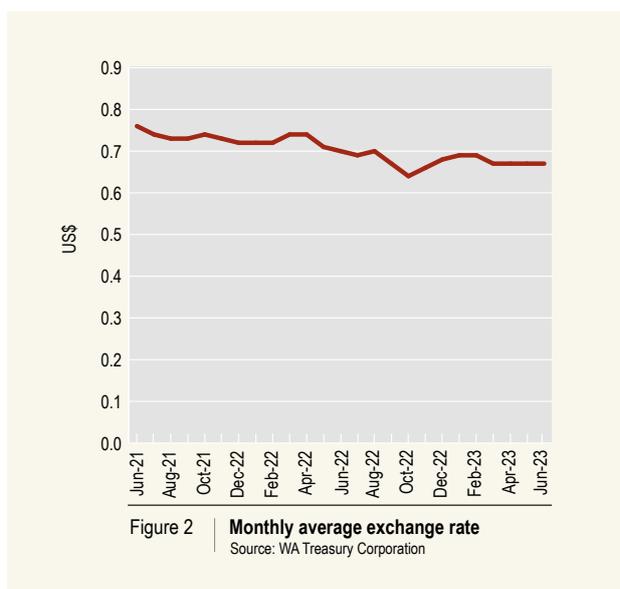


There was 861 Mt of iron ore sold from WA, the highest quantity on record for a single calendar or financial year. This was supported by a recovery in sales from Rio Tinto's operations due to operational improvements and the ramp-up of Gudai-Darri, which achieved nameplate capacity in the June quarter 2023, as well as another year of record sales and shipments from Fortescue.

The iron ore industry's share of sales was down on previous years, but it still accounted for 68 per cent of all mineral sales and 49 per cent of total resources sales.

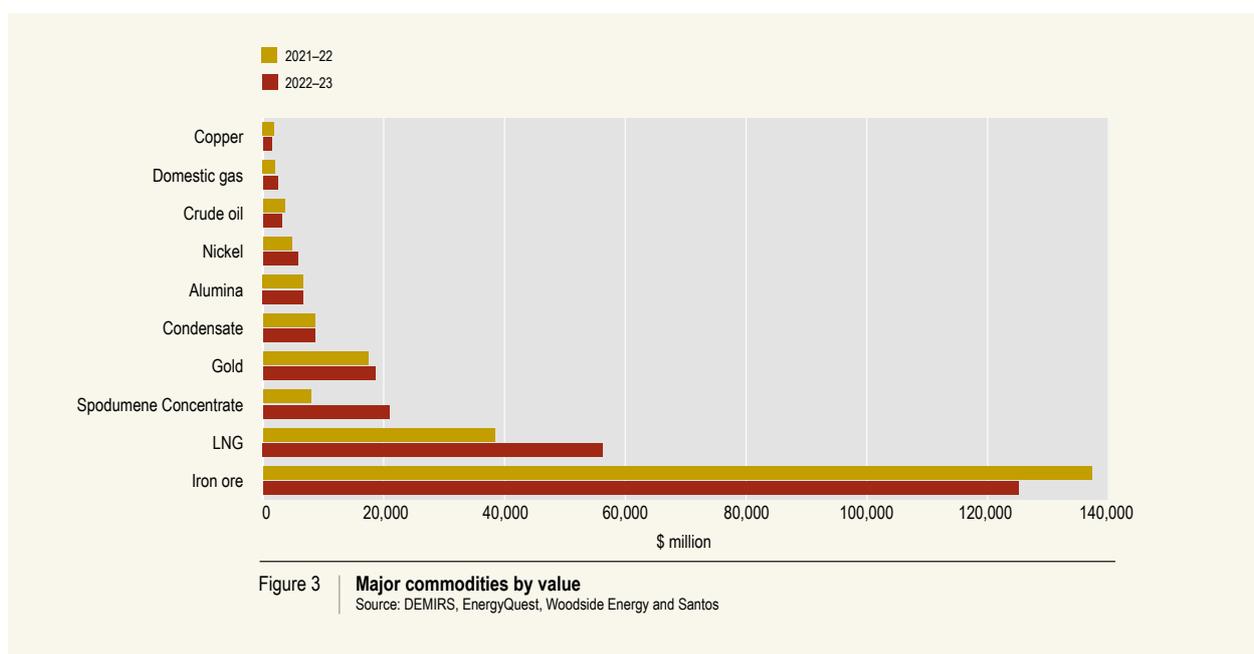
Lithium (spodumene concentrate) sales increased to a record \$21 billion supported by higher prices and tonnages, which elevated it into the position of WA's second most valuable mineral by sales after iron ore. Spodumene concentrate spot prices increased to almost \$10,000 per tonne in the second half of 2022 as lithium demand continued to outstrip supply, supported by government policies to encourage the sale of electric vehicles (EVs), particularly in China. Prices eased across the first half of 2023 with the removal of EV tax concessions in China, though still remained higher than any other time prior to 2022.

Lithium (spodumene concentrate) sales volumes were the highest on record at 3.19 Mt with the ongoing optimisation of processing facilities and the completion of ramp-up of the tailings retreatment plant at Talison Lithium's Greenbushes project, the ramp-up to nameplate capacity of Pilbara Minerals' Ngungaju plant at Pilgangoora, as well as the ramp-up of Wodgina and the expansion of production capacity at Mount Marion (both Mineral Resources operated projects).



Gold sales increased to a record \$18.6 billion. The average price of gold was stable year-on-year in US dollar terms but increased in Australian dollar terms. Prices trended higher over the year on concerns about the global economy and fears of a recession, peaking at more than US\$2,000 per ounce in April (and almost \$3,000 per ounce in May), before easing on signals of further interest rate rises in the US. In volume terms, 6.8 million ounces (212 tonnes) of gold was sold in the State, around the same level as recent years.

Alumina's sales value remained steady at \$6.7 billion despite lower production. Prices declined through the second half of 2022 on excess supply in the Asia Pacific market following the ban of alumina exports to Russia,



| <b>Commodity</b>      | <b>Western Australia</b> | <b>Rest of Australia</b> | <b>Rest of World</b> | <b>Global Ranking</b> |
|-----------------------|--------------------------|--------------------------|----------------------|-----------------------|
| Alumina               | 9.9%                     | 4.5%                     | 85.6%                | 2                     |
| Cobalt                | 3.1%                     | 0.0%                     | 96.9%                | 4                     |
| Copper                | 0.7%                     | 3.1%                     | 96.2%                | >13                   |
| Crude oil             | 0.1%                     | 0.04%                    | 99.9%                | 42                    |
| Diamonds              | 0.0%                     | 0.0%                     | 100.0%               | n/a                   |
| Garnet                | 38.8%                    | 0.0%                     | 61.2%                | 1                     |
| Gold                  | 7.0%                     | 2.9%                     | 90.1%                | 4                     |
| Ilmenite              | 2.3%                     | 5.1%                     | 92.6%                | 9                     |
| Iron ore              | 32.9%                    | 0.4%                     | 66.7%                | 1                     |
| Lead                  | 0.0%                     | 9.6%                     | 90.4%                | n/a                   |
| Lithium               | 52.9%                    | 0.0%                     | 47.1%                | 1                     |
| Liquefied natural gas | 12.4%                    | 8.4%                     | 79.2%                | 3                     |
| Manganese             | 2.5%                     | 12.5%                    | 85.0%                | 6                     |
| Nickel                | 4.7%                     | 0.1%                     | 95.2%                | 5                     |
| Rare earth oxides     | 9.6%                     | 0.0%                     | 90.4%                | 3                     |
| Rutile                | 11.7%                    | 20.8%                    | 67.5%                | 5                     |
| Salt                  | 4.0%                     | 0.5%                     | 95.6%                | 5                     |
| Zinc                  | 0.6%                     | 9.1%                     | 90.3%                | >11                   |
| Zircon                | 16.0%                    | 17.1%                    | 67.0%                | 3                     |

as well as an increase in China's domestic alumina production, while downstream demand remained suppressed by China's ongoing COVID-zero policy. Local production was at the lowest level in 10 years (13.1 Mt) with Alcoa affected by lower bauxite grades, maintenance, as well as a gas supply interruption, while South32 was affected by energy supply challenges and planned calciner maintenance.

The value of nickel sales was \$5.7 billion, amongst the highest levels in the last 15 years. Nickel prices ended the financial year around the same level as where they started, although this masked considerable volatility. Prices rose sharply in late 2022/early 2023 on supply issues, particularly in Indonesia, as well as the easing of COVID-related restrictions in China. Prices declined following concerns about a supply surplus after Tsingshan Holding Group's announcement that it will add Class 1 nickel to its production mix, the failure of Chinese demand to rebound following the cessation of its COVID-zero policies, and a strengthening US dollar.

Local sales tonnages increased from:

- BHP Nickel West's increased production of concentrate and matte products, and inventory drawdowns offset a slower than planned ramp-up of the Kwinana refinery following maintenance in late 2022 and heavy rainfall at Mt Keith operations in early April 2023.
- Scheduled major maintenance at Minara Resources' Murrin Murrin project in 2021.
- Improved ore handling and processing from the new Shoemaker-Levy deposit as well as improved beneficiation plant availability and stability at First Quantum Minerals' (FQM) Ravensthorpe project.
- Panoramic Resources' Savannah mine in the Kimberley, supported by record production in the second half of 2022 and despite several issues in the first half of 2023, including damage to its logistics route to site via the Fitzroy River Bridge, and technical challenges.

Conversely, IGO's production was down from Nova (due to an 18-day suspension following a fire at the diesel power station in December) and Forrestania due to several seismic events that restricted access to higher grade areas.

Copper sales were valued at \$1.4 billion, down one quarter. This was mostly due to lower sales volumes as Sandfire Resources' DeGrussa operations approached end-of-life, with processing transitioning to low-grade surface ores and stockpiles until no longer viable. The yearly average price declined on US interest rate rises and concerns about global economic growth amid bank failures, as well as a weak demand from the construction sector in China initially due to its COVID-zero policy and then a slower than expected recovery in demand following the relaxation of the restrictions.

The remaining significant other mineral sales included:

- Mineral sands – \$1.4 billion (the highest on record).
- Salt – \$714 million (the highest on record).
- Coal – \$376 million (the highest on record).
- Cobalt – \$368 million.
- Manganese – \$298 million.
- Zinc – \$265 million.

## Petroleum

The petroleum sector, comprising LNG, condensate, crude oil, domestic gas and liquefied petroleum gas (LPG) production, achieved sales valued at a record \$71 billion.

The sector's share of total mineral and petroleum sales was 28 per cent.

LNG was the most valuable petroleum product with production valued at a record \$56 billion, followed by condensate at \$8.6 billion (the second highest level of all-time), crude oil at \$3.1 billion (down on 2022, but still high in the context of the last decade), domestic gas at a record \$2.5 billion, and LPG at \$720 million (around the same level as recent years).

After increasing through the first half of 2022 to peak at around US\$120 per barrel in mid-2022, oil prices trended down on increasing supplies from major producers including the Organisation of Petroleum Exporting Countries (OPEC), as well as concerns about global economic growth which stifled demand. They were, fairly stable year-on-year.

A record peak for LNG prices of nearly \$28 per million British thermal units (Mmbtu) was not reached until September 2022 as gas supply concerns, particularly in Europe, saw previous importers of now-sanctioned Russian gas seek alternative sources of supply in the Asia Pacific market (the main market for LNG from WA), and Japan, China and South Korea secured supplies ahead of winter. Prices moderated through the first half of 2023 on muted demand and solid inventories in major importing nations. The result was higher average LNG prices compared to 2021–22 and a similar average to 2022.

LNG production was at its highest level on record (49.7 Mt) with all WA facilities reporting a year-on-year increase in output. The result largely reflected the ongoing outperformance of Chevron's Wheatstone and Woodside Energy's Pluto, with the North West Shelf also performing better via the start-up of the Pluto-Karratha Gas Plant Interconnector. Chevron's Gorgon was impacted in the June quarter 2023 by the tie-in of new wells to maintain supply volumes.

Condensate production was 11.7 gigalitres (GL), a decrease from 12.1 GL in 2021–22 but still at a historically high level. This decline largely reflected a fall in output from the Inpex Corporation's Ichthys Floating, Production, Storage and Offloading (FPSO) facility and the North West Shelf as legacy gas fields decline.

Oil production was 3.4 GL, the first time it has dropped below 4 GL in five years and continuing a slow decline from the record levels of 15 to 20 years ago. This was due largely to the shutdown of Woodside Energy's Enfield/Vincent with the Ngujima-Yin FPSO departing for planned maintenance in the first half of 2023.

# AVAILABLE RESOURCE DATA

The Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) publishes detailed resource data on its website. Three separate Excel files are available:

- 1. Major commodities** – this file contains information about the scale and scope of WA's mineral and petroleum industries, as well as detailed information about the State's major commodities. It includes data relating to sales values and quantities, prices, exports, as well as production compared with the rest of Australia and the rest of the world.
- 2. Economic indicators** – this file contains information about how the State's mineral and petroleum industry contributes to the economy through exploration, investment, employment and royalties.
- 3. Spatial and regional** – this file contains information about mining and petroleum tenements, the distribution of the value of mineral and petroleum sales and royalties, and mining employment across the State.



This digest provides references on where to find more detailed information.

Some key announcements after the financial year to December 2023 have been included for broader context.

# 1 INDUSTRY ACTIVITY

## 1.1 Principal resource projects

WA's mining industry consisted of 134 predominantly higher value and export-oriented mining projects in 2022–23, up from 129 in 2021–22 and the highest number since DEMIRS began tracking projects on this basis in 2014–15.

The most notable change in the mining industry during 2022–23 was the entry of two new mineral sands projects into the production phase: Strandline Resources' Coburn project and Australian Garnet's Lucky Bay garnet project. With these new projects, the total number of mineral sands projects increased to 10, up from eight the previous financial year.

WA also had its first potash sales, from the Beyondie project in July 2022 before the owner and operator of the project, Kalium Lakes, had receivers and managers appointed in August 2023.

There were 33 iron ore projects in 2022–23, one less than the 34 projects in 2021–22 as a result of the suspension of both the Ridges and Mid West projects in late 2021 and the start-up (and subsequent suspension) of the Paulsens East project in September 2022.

While the number of gold projects was stable at 52, the gold industry had the greatest degree of turnover and activity:

- There were six re-started gold projects in 2022–23:
  - Four were short-term campaign mining operations – Aurrenne Group's Parker Range, Focus Minerals' Coolgardie, Greenstone Resources' Burbanks, and Lukah Mining's The Mount.
  - Two were continuous, longer-term, operations – Northern Star Resources' Bronzewing and Pantoro's Norseman.
- Six principal gold projects from 2021–22 were either under the threshold (i.e. they did not produce more than 2,500 ounces of gold) or did not operate in 2022–23.
- Considerable merger and acquisition activity meant that several gold projects changed hands in 2022–23, including:
  - Catalyst Metals acquired Superior Gold, the owner of the Plutonic project.
  - Genesis Minerals acquired Dacian Gold, the owner of Mt Morgans.
  - Newmont Corporation acquired Newcrest Mining, the owner of Telfer.
- Gascoyne Resources, the owner of Dalgaranga, changed its name to Spartan Resources.
- Several gold projects were suspended or entered care and maintenance during the financial year including Spartan Resources' Dalgaranga project, Pandoro's Halls Creek project, Genesis Minerals' Mt Morgans, and Ramelius Resources' Tampia, and Vivien projects.

An additional copper-lead-zinc project was added following the start-up of Abra Mining's Abra project. This brought the total number of copper-lead-zinc principal projects to four, before Sandfire Resources' DeGrussa project reached the end of its life during the financial year and the Jaguar project was suspended in September 2023.

The number of nickel projects in WA increased to nine this year, up from eight in 2021–22, due to the addition of BHP Nickel West's Cliff project as a standalone project (it had previously been considered part of Mt Keith).

There was also an additional silica sand project (bringing the total to three) with Simcoa's operations achieving more than \$5 million in sales (up from less than that threshold in 2021–22) for the financial year.

The state's mining industry also comprised hundreds of quarries and small mines in 2022–23 that largely produced the basic raw materials required for the local construction or agricultural industry. Such materials include clays, construction materials (aggregate, gravel, rock and sand), dimension stone, gypsum, limestone, limesand and spongolite. There were nine principal producers of these materials in 2022–23.

In 2022–23 there were 15 major mineral processing operations that transformed bauxite into alumina; gold doré into gold bars; nickel ore into nickel concentrate (through toll treatment) and nickel concentrate into nickel matte, nickel powder, nickel briquettes, and nickel sulphate; rutile and synthetic rutile into titanium dioxide pigment; zircon into fused zirconia; silica sand into silicon metal; and spodumene concentrate into lithium hydroxide.

This was one higher than the 14 in 2021–22 with Albemarle Corporation's Kemerton lithium hydroxide plant progressing through commissioning and achieving on-specification and customer qualified product in April 2023.

WA's petroleum industry consisted of 19 projects that produced oil, gas and condensates from 49 fields in onshore and offshore areas of the State in 2022–23.

Many of these petroleum projects had associated processing plants for LNG exports and domestic gas sales.

This was down from 20 projects and 51 fields in 2021–22.

RCMA's Jingemia oil project was removed as it has been shut-in since July 2020.

The number of fields declined in 2022–23 due to the removal of Jingemia, as well as the conclusion of production from the Persephone and Wanaea fields at the North West Shelf. The Redback and Redback South fields at Beach Energy's Beharra Springs project also concluded.

The offshore Lambert Deep field (part of the Greater Western Flank Phase 3 project for the North West Shelf), and the Spartan field (part of Santos' Varanus Island project) entered production during the financial year.

#### **A note about principal resource projects**

A principal mining project is defined as a project that produced minerals valued at more than \$5 million (or more than 2,500 ounces of gold) in a given financial year. Also included are mining projects on private land, for which production values are not required to be reported, where full-time equivalents (FTEs) are greater than 50.

Mining projects are grouped according to the main commodity produced and sold from them.

For basic raw materials (i.e. sand, aggregate, rock, limestone, and limesand), only those producers with sales valued at more than \$5 million are captured. Basic raw materials projects are not specifically captured.

All major producing downstream mineral processing operations are captured.

A principal petroleum project is any project that produced LNG, condensate, oil, domestic gas or LPG in onshore and offshore areas of the State.



A list of the principal resource projects, including project details and notable events, is available on the DEMIRS website and at Table 9.

## 1.2 Employment

WA's mining industry employed 126,481 operational employees in full-time equivalent terms during 2022–23. This was another record for a calendar or financial year, marking six consecutive financial years of growth, the last five of which have all been new record highs.

The major contributors to mining employment continued to be the iron ore (61,203 FTEs), gold (29,257 FTEs), nickel (9,839 FTEs), lithium (8,092 FTEs), and alumina and bauxite (6,995 FTEs) industries.

The number of people on mining operations was up year-on-year for most minerals, with the notable exception of gold (down 1,507 FTEs).

Employment on minerals exploration operations was 4,195 FTEs. While this was a drop from the previous year's record high, it still represents the second highest employment in minerals exploration in a financial year.

These overall results reflected ongoing strong levels of mining, construction, and exploration activity in the State.

The rate of growth of mining employment in 2022–23 of 6.3 per cent is an improvement on 2021–22, which only saw growth of 4.5 per cent.

Employment in the State's petroleum operations dropped slightly in 2022–23 to an average of 12,478 persons, down from 12,960 in 2021–22.

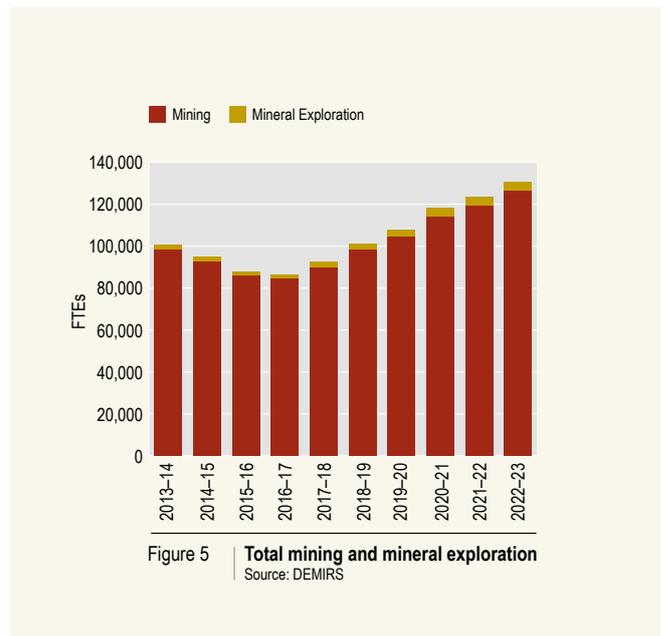
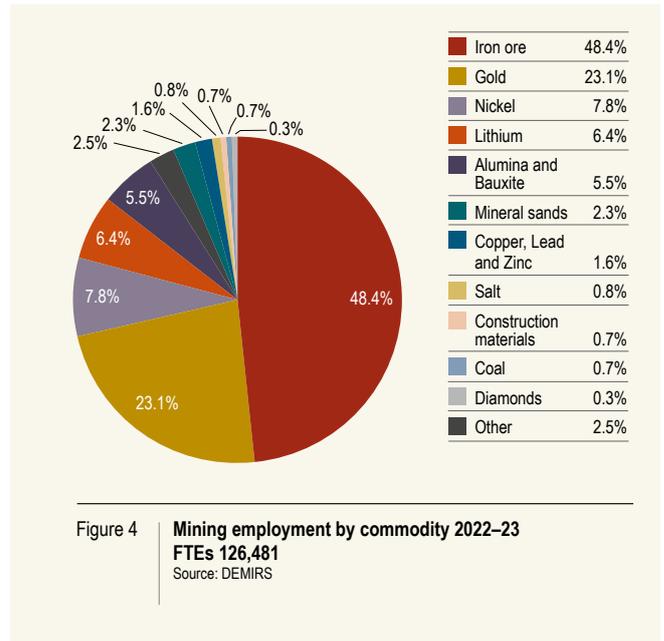


The economic indicators file provides detailed employment data, including:

- Employment data for the mining industry by commodity, as well as the minerals exploration and petroleum industries.
- Mining employment data by site.



The spatial and regional file provides detailed employment data by Local Government Area (LGA) and region.



### A note about employment data

Mining and mineral exploration employment data is based on reporting under the *Work Health and Safety Act 2020* and, prior to April 2022, the *Mines Safety and Inspection Act 1994*.

Data is submitted monthly (before March 2022) or quarterly (from April 2022).

The reporting provides the number of hours worked on operating sites in the State by those people on site, and from March 2008, exploration personnel working on greenfield sites. It does not include personnel in administrative locations located outside of operating sites. Port authorities were previously included under the *Mines Safety and Inspection Act 1994* and are now excluded under the *Work Health and Safety Act 2020*. No attempt has been made to adjust for this change.

Data is adjusted to full-time equivalents based on the number of hours workers with an FTE considered to be 2,000 hours worked in a year, 500 hours worked in a quarter, and 166.7 hours worked in a month.

By contrast, petroleum employment data is from the Australian Bureau of Statistics (ABS) and represents the numbers of persons employed in 'Oil and Gas Extraction' class of the Australian and New Zealand Standard Industrial Classification WA.

This data includes onshore, coastal waters, and offshore areas and includes persons mainly engaged in producing crude oil, natural gas or condensate through the extraction of oil and gas deposits, including LNG facilities.

It does not include employees engaged in natural gas and petroleum exploration.

Importantly, the mining and mineral exploration and petroleum employment data is not directly comparable and should not be combined.

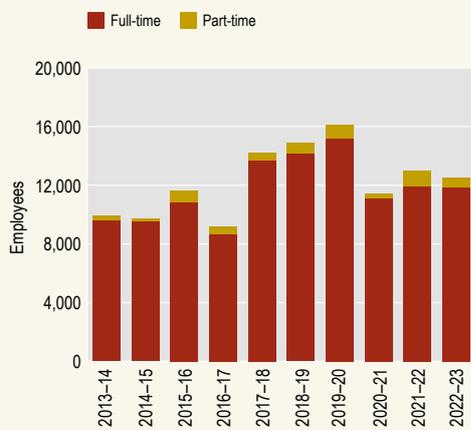


Figure 6 **Petroleum employment last 10 financial years**  
Source: Australian Bureau of Statistics

## 1.3 Investment



The economic indicators file contains historic and current mining investment data, including:

- Mining investment in WA.
- Mining share of new capital investment in WA.

### 1.3.1 Mining investment

More than \$27 billion was invested in WA's mining and petroleum sector (excluding the smelting or refining of ores and LNG production) in 2022–23.

This was an increase on last year and represented the highest level of investment for a single calendar or financial year since 2015–16.

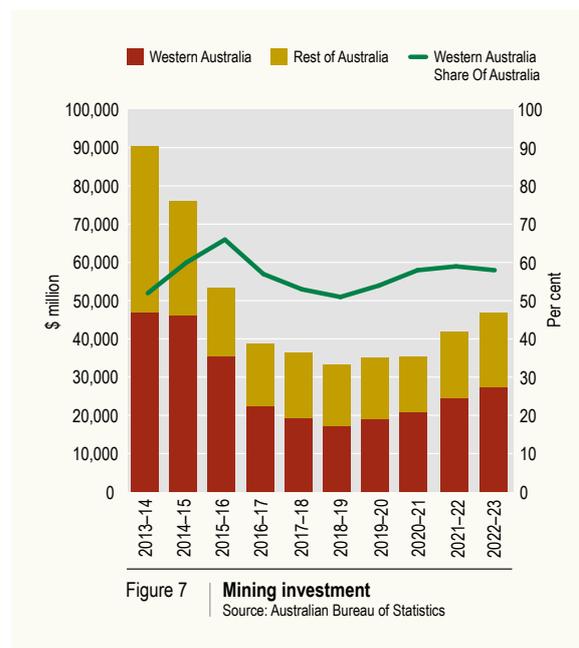
Mining investment has increased for 16 consecutive quarters after adjusting for seasonal variability, although the level of investment was still less than a third of the highs it reached during the investment boom between 2011 and 2015.

This result was largely driven by new and expanding lithium projects such as Covalent Lithium's Mount Holland and Albemarle Corporation's Kemerton, iron ore projects such as Fortescue's Iron Bridge (now in production), Mineral Resources' Onslow and Rio Tinto's Western Range, as well as the Scarborough project. This result also likely reflected the impact of cost inflation.

WA's share of national mining and petroleum investment was fairly stable at 58 per cent, around its 10-year average.

The resources sector was again a key contributor (71 per cent) to growth in total new capital expenditure in WA.

This figure is below the greater than 80 per cent share during the investment boom.



### 1.3.2 Investment pipeline

DEMIRS monitors and collects information on mineral, petroleum, and associated infrastructure projects in the investment pipeline and the estimated capital value of these projects.

Analysis of this information shows that as of September 2023, there was around \$55 billion in projects committed and under construction, a decrease of around \$5 billion from the March 2023 estimate.

This was due to the completion of two major projects valued at more than \$10 billion:

- Iron Bridge magnetite, which achieved first production in May and a first shipment in July.
- Chevron operated Gorgon Stage Two, which announced the production of first gas in June.

These completions were partially offset by final investment decisions on Northern Star Resources' Kalgoorlie Consolidated Gold Mines (KCGM) Mill expansion, expansion of Albemarle Corporation's Kemerton lithium hydroxide plant, Pilbara Minerals' Pilgangoora 1000 project, the start of construction on Hastings Technology Metals' Yangibana rare earths, and upward revisions in expected capital costs for a host of projects including BCI Minerals' Mardie salt, Mount Holland lithium, and Lynas Corporation's Kalgoorlie cracking and leaching plant.

The major projects under development and that continued to support investment spending in WA as of September 2023 included:

- Woodside Energy's Pluto LNG expansion and Scarborough gas;
- Chevron's Jansz-Lo compression project;
- Shell's Crux gas;
- Mineral Resources' Onslow iron ore;
- Rio Tinto's Western Range iron ore;
- Covalent Lithium's Mt Holland lithium;
- Albermarle Corporation's Kemerton lithium hydroxide plant Trains 3 and 4;
- BHP's West Musgrave nickel and copper;
- Iluka Resources' Eneabba rare earths refinery;
- BCI Minerals' Mardie salt; and
- Lynas Corporation's Mt Weld rare earths mine expansion and Kalgoorlie cracking and leaching plant.

The estimated capital cost of medium to longer-term projects (i.e. feasibility and pre-feasibility stage) was \$93 billion, up by \$4 billion from the March 2023 estimate.

New major projects announced included BHP's plans to install 500 Megawatts (MW) of renewable energy generation and storage capacity by 2030 for its Pilbara

iron ore mines, Chalice Mining's Julimar nickel, and the MARBL joint venture's Wodgina Lithium Trains 4 and 5, while the cost estimate for Ardea Resources' Kalgoorlie nickel project was increased.

These more than offset the transition of projects that moved into the construction phase (such as the expansion of the KCGM Mill and the Kemerton lithium hydroxide plant), projects with revised development plans and reduced costs (such as Red Hawk Mining's Blacksmith iron ore), and projects that were cancelled (such as Metallicity's Admiral Bay zinc).

#### A note about investment pipeline data

Information on investment projects is obtained from various sources including Australian Securities Exchange announcements, the Office of the Chief Economist's major projects data, resources sector market analysts and consultants, as well as media reports.

Projects are categorised based on the following criteria:

- Under construction – those actually under construction.
- Committed – company has reached a positive Final Investment Decision (FID).
- Planned – those that have completed advanced feasibility studies including Definitive and Bankable Feasibility Studies and Front End Engineering and Design (FEED).
- Possible – those at an early stage of development including initial Scoping and Pre-Feasibility Studies.

| Sector                           | Commodity                    | Capital expenditures (\$ million) |                  |
|----------------------------------|------------------------------|-----------------------------------|------------------|
|                                  |                              | Under construction/committed      | Planned/possible |
| Minerals                         | Gold                         | 3,198                             | 4,443            |
|                                  | Iron ore                     | 6,005                             | 9,335            |
|                                  | Nickel                       | 810                               | 9,945            |
|                                  | Copper, lead and zinc        | 1,700                             | 2,609            |
|                                  | Lithium                      | 7,436                             | 3,596            |
|                                  | Infrastructure               | 1,639                             | 11,170           |
|                                  | Rare earths                  | 3,106                             | 1,345            |
|                                  | Other minerals               | 2,534                             | 7,807            |
|                                  | <b>Sub-total Minerals</b>    | <b>26,428</b>                     | <b>50,249</b>    |
| Petroleum                        | Crude oil                    | 450                               | 3,000            |
|                                  | Domestic gas                 | 0                                 | 853              |
|                                  | Liquefied natural gas        | 28,502                            | 38,637           |
|                                  | Pipelines and infrastructure | 0                                 | 0                |
|                                  | <b>Sub-total Petroleum</b>   | <b>28,952</b>                     | <b>42,490</b>    |
| <b>Total Forecast Investment</b> |                              | <b>55,380</b>                     | <b>92,739</b>    |

## 1.4 Exploration



The economic indicators file contains detailed exploration expenditure data, including:

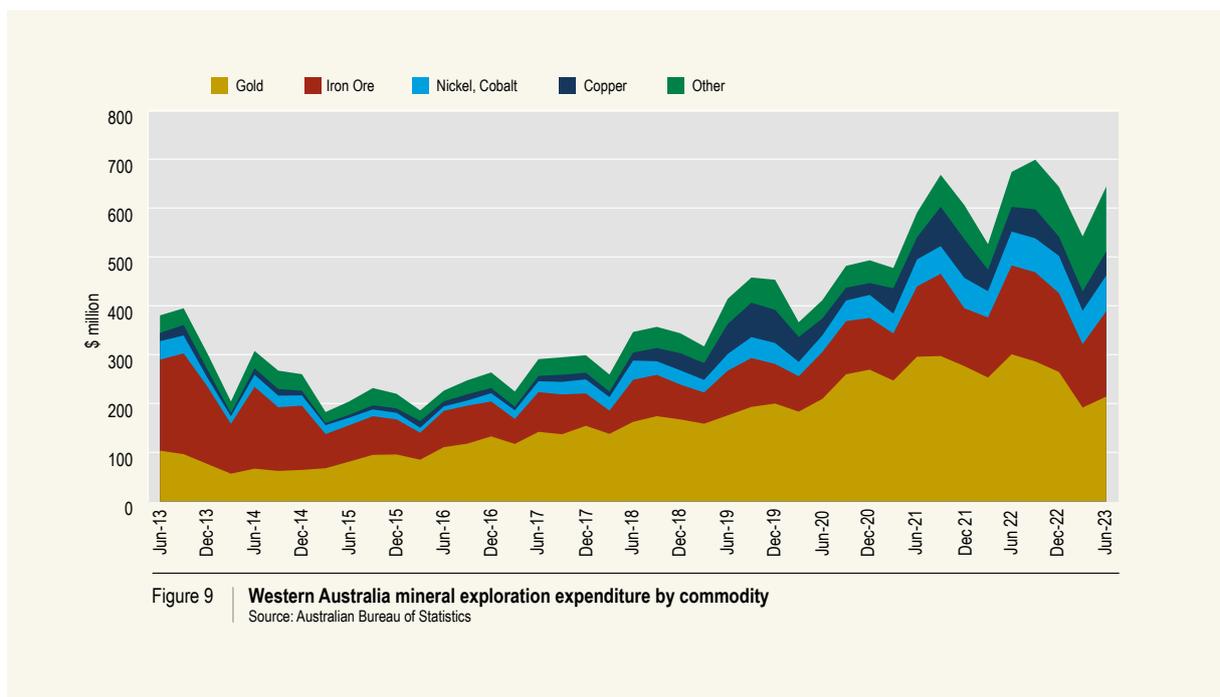
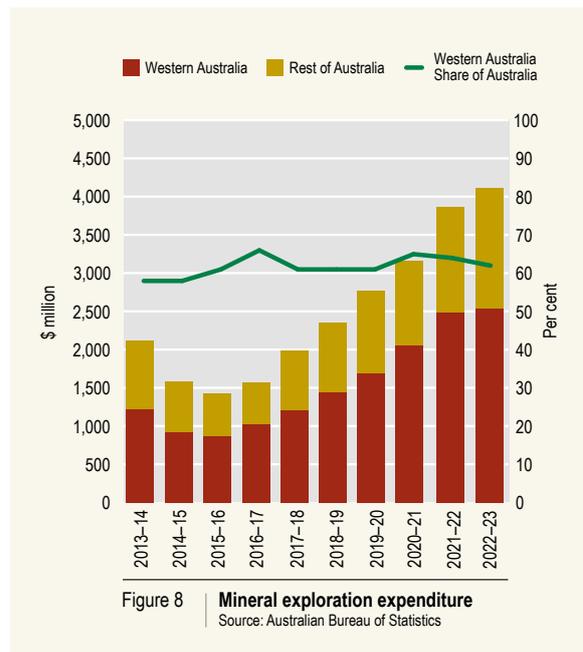
- Mineral exploration expenditure in WA and the rest of Australia.
- Mineral exploration expenditure by commodity in WA compared with the rest of Australia.
- Mineral exploration expenditure and drilling metres on new and existing mineral deposits.
- Petroleum exploration expenditure in WA and the rest of Australia.

### 1.4.1 Minerals

Minerals exploration expenditure in the State was valued at \$2.5 billion, a new financial year high but just short of the record \$2.55 billion in the 2022 calendar year.

The overall strength in spending targeting minerals reflected:

- Historically high expenditure on gold exploration of \$956 million (though it did decline from record levels).
- Iron ore exploration expenditure of \$648 million, near to the highest levels in a decade.
- Another single-year record spend on exploration for other minerals, which includes lithium and rare earths, of \$419 million (a \$123 million increase over the previous high set in 2022).
- A 15 year high in nickel-cobalt expenditure of \$287 million and the second highest level for a single calendar or financial year on record.
- Copper exploration expenditure of \$188 million, which is high in a historical context.



Spending remained largely focused on brownfield areas or existing deposits. These areas attracted \$1.7 billion in expenditure, down marginally from a record \$1.8 billion in the 2022 calendar year. In comparison, spending in greenfield locations or on new deposits increased to a record of \$814 million.

The share of expenditure in greenfields locations, compared to brownfields areas, has not recovered to its pre-COVID levels of around 40 per cent. Its share was around the same level as recent prior years at 32 per cent.

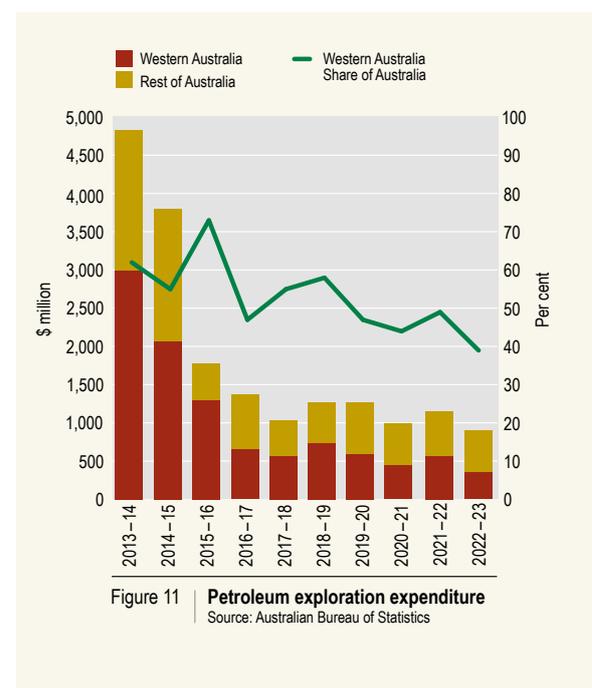
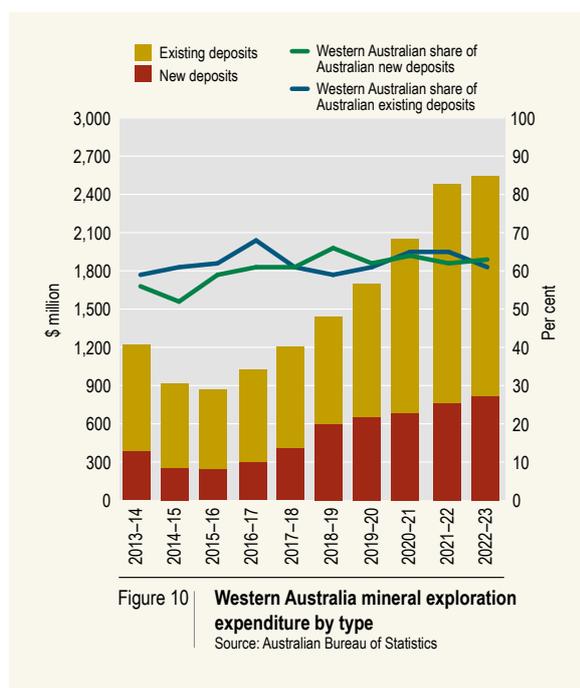
This may reflect a recent interest in exploration on mature ground for commodities which had not previously been targeted such as lithium and rare earths. Brownfields exploration is also lower cost, which is likely to be a key consideration in an inflationary environment.

WA remained the leading destination for exploration investment in Australia. It accounted for 63 per cent of the national spend, which is around the level it has been for several years.

## 1.4.2 Petroleum

Petroleum exploration expenditure in WA was valued at \$352 million in 2022–23. This represented the lowest calendar or financial year spend in the last 25 years.

This result, combined with a smaller decrease in petroleum exploration spending in the rest of the country (expenditure in Victoria and South Australia increased while expenditure in Queensland and the Northern Territory decreased by less than WA), meant that WA's share of the national spend fell to 39 per cent. This is the lowest level for a single calendar or financial year on record.



## 1.5 Royalties

The WA Government received \$12.76 billion in royalties and related grants from minerals and petroleum producers in 2022–23.

This was slightly lower than the record of \$12.83 billion received in 2021–22.

Lower royalty receipts from the iron ore industry, driven by lower prices, were largely offset by higher royalties from the lithium industry due to higher spodumene prices and North West Shelf grants due to higher petroleum prices.

Royalty receipts from the iron ore industry were \$9.4 billion in 2022–23, down 13.4 per cent or \$1.5 billion compared to 2021–22. The lower receipts resulted in the sector’s share of total receipts dropping from 85 per cent in 2021–22 to 74 per cent in 2022–23.

The continued high prices in the petroleum industry have seen receipts from North West Shelf grants increase from just \$386 million in 2020–21, to \$960 million in 2021–22, and to \$1.5 billion in 2022–23.

Lithium had an exceptional year of record prices, such that royalty receipts from the industry rose more than six-fold to \$930 million in 2022–23.

Market conditions remained strong for gold, alumina, nickel and mineral sands, with each resulting in increased royalty receipts in 2022–23.

### A note about royalties

The WA Government received royalties for all minerals and petroleum produced on State land and in State waters.

The figure reported in this publication is the actual cash the State Government received for the relevant period, i.e. 2022–23. This means the royalty receipts are offset from sales figures by one quarter.

Included in the royalty receipts for petroleum is both the State’s and Commonwealth’s share of royalties collected under the WA *Petroleum (Submerged Lands) Act 1967*. The State’s share of the Resource Rent Royalty for the Barrow Island project is included, but the Commonwealth’s share is not included.

Included in the State’s royalty receipts for iron ore is an additional lease rental amount, which is currently applied under Iron Ore State Agreement Acts and the *Mining Act 1978*. The additional lease rental applies to iron ore obtained from a mining lease following 15 years from the date the iron ore was first obtained from the mining tenement by the lessee.

The State Government also receives about 65 per cent of the royalties from the petroleum produced by the North West Shelf project, in the form of Commonwealth grant, in accordance with an agreement between the WA and Australian governments.



The economic indicators file contains royalty receipts by commodity and North West Shelf grants.

The spatial and regional file contains royalty receipts by region.

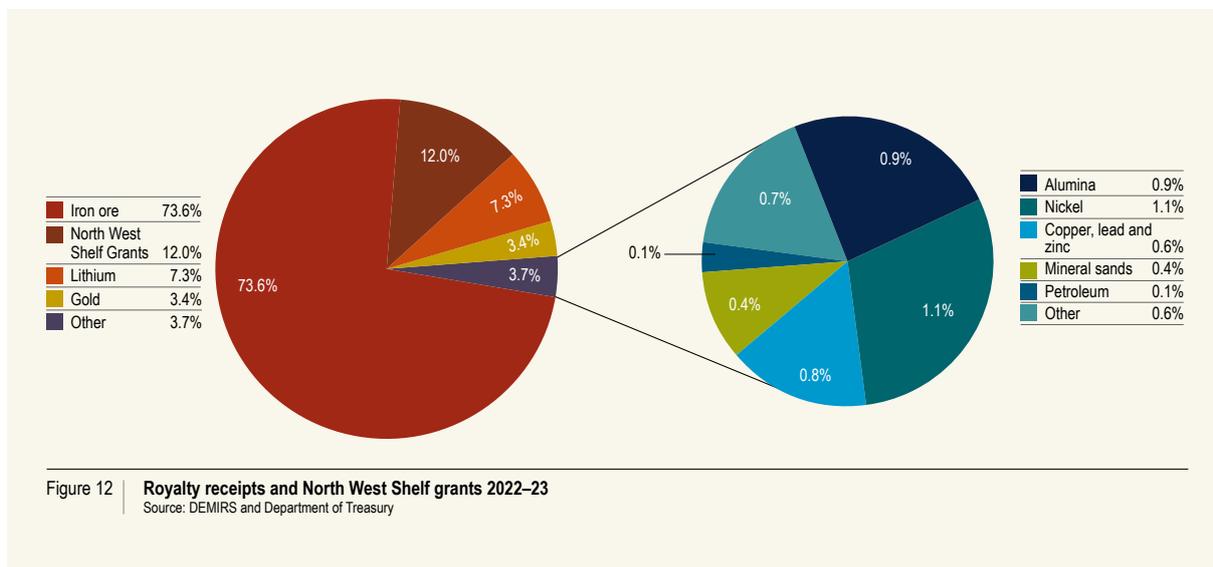


Figure 12 | Royalty receipts and North West Shelf grants 2022–23  
Source: DEMIRS and Department of Treasury

| <b>Table 3. Royalty receipts and North West Shelf grants</b> |                   |                   |                       |              |
|--|-------------------|-------------------|-----------------------|--------------|
| <b>Commodity</b>   | <b>2021–22</b>    | <b>2022–23</b>    | <b>2022–23 Growth</b> |              |
|  | <b>\$ million</b> | <b>\$ million</b> | <b>\$ million</b>     | <b>%</b>     |
| Alumina  | 101.1             | 113.6             | 12.6                  | 12.4%        |
| Copper, lead and zinc  | 104.6             | 74.8              | -29.8                 | -28.5%       |
| Diamonds   | 0.5               | 0.0               | -0.5                  | -100.0%      |
| Gold   | 412.3             | 436.0             | 23.7                  | 5.8%         |
| Iron ore   | 10,848.0          | 9,393.1           | -1,454.8              | -13.4%       |
| Lithium  | 150.4             | 929.9             | 779.4                 | 518.1%       |
| Mineral sands  | 44.2              | 46.6              | 2.4                   | 5.4%         |
| Nickel   | 107.6             | 139.7             | 32.1                  | 29.8%        |
| Petroleum  | 8.5               | 15.3              | 6.8                   | 79.4%        |
| Other minerals   | 91.6              | 78.7              | -12.9                 | -14.1%       |
| <b>Total royalty receipts</b>                                | <b>11,868.7</b>   | <b>11,227.7</b>   | <b>-641.0</b>         | <b>-5.4%</b> |
| <b>North West Shelf grants</b>                               | <b>959.5</b>      | <b>1,528.4</b>    | <b>568.9</b>          | <b>59.3%</b> |
| <b>Total revenue</b>   | <b>12,828.2</b>   | <b>12,756.1</b>   | <b>-72.1</b>          | <b>-0.6%</b> |

## 1.6 Exports

WA's minerals and petroleum exports were valued at an estimated \$251 billion in 2022–23, accounting for 93 per cent of the State's record merchandise exports of almost \$270 billion.

This was the highest total ever recorded for mineral and petroleum exports from WA in a single year.

The WA resources sector was responsible for 54 per cent of the nation's \$467 billion in resource sector exports.

While this was down from recent highs, it was consistent with earlier levels.

The decline in WA's share of the value of exports was due to the combination of lower iron ore exports from WA and an increase in the value of coal exports from other Australian States and Territories.

Despite this, WA and its resources sector remained unrivalled as the nation's major export earner.

The value of WA's resources exports has increased by two-thirds over the past five years. This has been driven, at least in part, by a period of high commodity prices and a strong prior period of investment to increase production.

WA exported its mineral and petroleum resources to a wide range of countries in 2022–23, but the value of these exports remained highly concentrated.

China, the top destination country, was responsible for more than half of all minerals and petroleum exports. The next largest export destinations, Japan and South Korea, were responsible for approximately 15 and eight per cent of all shipments respectively.

### A note about exports

Mineral and petroleum exports include gold, mineral sands and nickel refined or processed in WA but mined in other States and Territories of Australia and overseas.



The major commodities and economic indicators files contain information about mineral and petroleum exports including export destinations of key commodities produced in WA including iron ore, petroleum, lithium, gold, alumina, nickel, copper, lead, and zinc, and mineral sands.

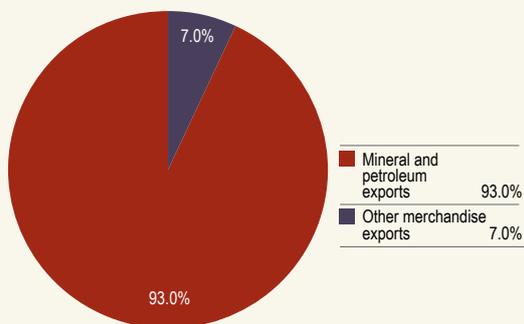


Figure 13 **Merchandise exports 2022–23**  
**\$270.4 billion**  
 Source: DEMIRS and Australian Bureau of Statistics

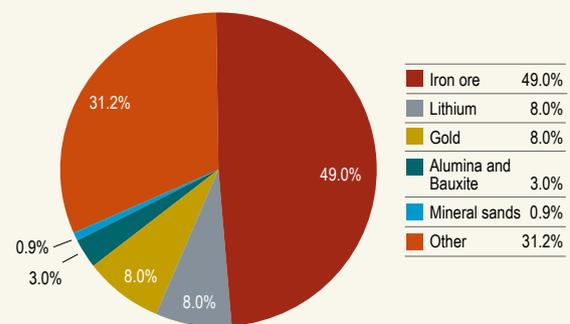


Figure 14 **Mineral and petroleum exports 2022–23**  
**\$251.5 billion**  
 Source: DEMIRS and Australian Bureau of Statistics

## 1.7 Tenements and titles

At the end of 2022–23, more than 74 million hectares (MH) of land within WA (an area almost as large as Chile) was overlaid by mining tenure (i.e. prospecting and exploration licences, mining leases, miscellaneous licenses, general purpose leases, retention leases, special prospecting licences for gold, and mineral claims and *Mining Act 1904* tenure).

This was up from a total of 71 MH the previous financial year, but lower than the record 76 MH in the 2022 calendar year, due predominantly to changes in the land area of exploration licences from 61 MH in 2021–22 and 66 MH in 2022 to 64 MH in 2022–23.

Mining leases, on which mining operations occur, covered 3.32 MH of land, up from 3.28 MH the previous financial year.

To put these figures into perspective, all mining tenure covered approximately 29 per cent of WA's total land area of almost 253 MH, with exploration licences covering 26 per cent and mining leases covering 1.3 per cent of the State's land area.

Actual exploration and mining activities, however, would have been over a much smaller area.

The total number of mining tenements in force was at a record number of 24,830.

The increase was predominantly due to a rise in exploration licences and other leases (including general purpose leases, retention licences and miscellaneous licences) supporting increased exploration and mining activities.

The number petroleum titles in force in WA's jurisdiction remained steady overall, although the area and number of blocks under the *Petroleum and Geothermal Energy Resources Act 1967* increased significantly primarily due to the issuing of new Exploration Permits between April and the end of July 2023.

Under the *Petroleum (Submerged Lands) Act 1982*, the area and number of blocks declined on account of one less active Exploration Permit and one less active Retention Lease.

### A note about tenements and titles

Mining tenements are administered under the *Mining Act 1978*.

State petroleum titles are administered under three Acts:

1. The *Petroleum (Submerged Lands) Act 1982* generally applies to the State's territorial sea up to the three-nautical mile mark, including the territorial sea around State islands.
2. The *Petroleum and Geothermal Energy Resources Act 1967* generally covers all onshore areas of the State, including its islands. Most areas under petroleum titles are covered under this Act.
3. The *Petroleum Pipelines Act 1969* applies to petroleum pipelines on land within the State.

Reported mining tenements in force represent live tenements only. Tenements granted post a given year and invalid and dead tenements are not included in the totals.

In the reported petroleum titles in force, the total area for the *Petroleum (Submerged Lands) Act 1982* excludes Pipeline Licences due to different units (i.e. km<sup>2</sup> vs km). The total area is the sum of the total area for the *Petroleum (Submerged Lands) Act 1982* and *Petroleum and Geothermal Energy Resources Act 1967*, and does not include the Total Area of the *Petroleum Pipelines Act 1969* due to different units (i.e. square kilometres (km<sup>2</sup>) vs kilometres (km)).



The spatial and regional file contains information about the number, area and types of mineral and petroleum tenements.

|                                 | 2018-19       |               | 2019-20       |               | 2020-21       |               | 2021-22       |               | 2022-23       |               |
|---------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                                 | Number        | '000 ha       |
| Prospecting licences            | 3,786         | 471           | 5,147         | 634           | 5,362         | 658           | 5,633         | 692           | 5,788         | 711           |
| Exploration licences            | 4,516         | 28,145        | 5,791         | 41,937        | 6,581         | 48,854        | 7,659         | 61,074        | 8,137         | 64,417        |
| Mining leases                   | 5,806         | 3,123         | 5,890         | 3,171         | 5,954         | 3,226         | 5,983         | 3,275         | 5,998         | 3,318         |
| Other                           | 3,776         | 3,010         | 4,160         | 3,320         | 4,187         | 3,475         | 4,357         | 3,874         | 4,528         | 3,776         |
| Mineral Claims & Other 1904 Act | 379           | 2,098         | 379           | 2,098         | 379           | 2,098         | 379           | 2,098         | 379           | 2,114         |
| <b>Total mining tenements</b>   | <b>18,263</b> | <b>36,847</b> | <b>21,367</b> | <b>51,160</b> | <b>22,463</b> | <b>58,312</b> | <b>24,011</b> | <b>71,013</b> | <b>24,830</b> | <b>74,335</b> |

| <b>Title type</b>  | <b>Area</b>                        | <b>Blocks</b> | <b>Number of titles</b> |
|--|------------------------------------|---------------|-------------------------|
| <b><i>Petroleum (Submerged Lands) Act 1982</i></b>               | <b>2,211.7382 km<sup>2</sup></b>   | <b>74</b>     | <b>45</b>               |
| Access authority   | -                                  | 2             | 1                       |
| Exploration permit   | 335.4 km <sup>2</sup>              | 34            | 3                       |
| Pipeline licence   | 627.3 km                           | 0             | 26                      |
| Production licence   | 1,668.8 km <sup>2</sup>            | 31            | 10                      |
| Retention lease  | 207.5 km <sup>2</sup>              | 7             | 5                       |
| <b><i>Petroleum and Geothermal Energy Resources Act 1967</i></b> | <b>107,548.7231 km<sup>2</sup></b> | <b>1,405</b>  | <b>82</b>               |
| Access authority   | -                                  | 8             | 4                       |
| Exploration permit   | 102,659.2 km <sup>2</sup>          | 1,321         | 53                      |
| Petroleum lease  | 260.1 km <sup>2</sup>              | 9             | 1                       |
| Production licence   | 3,774.5 km <sup>2</sup>            | 55            | 20                      |
| Retention lease  | 854.8 km <sup>2</sup>              | 12            | 4                       |
| Special prospecting authority                                    | -                                  | -             | -                       |
| <b><i>Petroleum Pipelines Act 1969</i></b>                       | <b>7,946.8 km</b>                  | <b>9</b>      | <b>111</b>              |
| Pipeline licence   | 7,946.8 km                         | 9             | 111                     |
| <b>Total</b>   | <b>109,760.4613 km<sup>2</sup></b> | <b>1488</b>   | <b>238</b>              |

## 2 COMMODITY REVIEW

### 2.1 Minerals

#### 2.1.1 Iron ore

##### Prices

Despite trending down, iron ore prices remained resilient compared to historical levels.

The benchmark grade (62 per cent iron ore fines spot Cost and Freight (CFR) China price) declined for most of the second half of 2022 driven by lowered investor sentiment arising from the war in Ukraine and rising interest rates. In addition, the ongoing “dynamic zero” COVID-19 lockdown policy in China resulted in lower economic growth.

The policy was dropped in December 2022, which, combined with restocking of iron ore stockpiles by steel mills drawn down during COVID-19 lockdowns, coincided with the turnaround in iron ore prices.

The rise in prices prompted the Chinese government to intervene in the iron ore markets to scrutinise spot iron ore futures due to perceived unreasonable prices.

Iron ore prices declined in April and May 2023, but ended the financial year trending upwards, albeit in a volatile fashion, firming to be over US\$112 per tonne in June 2023 as China embarked on a new stimulus package to shore up the country’s economic recovery.

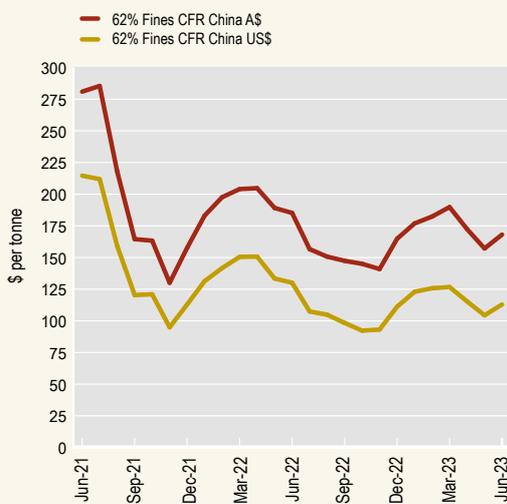


Figure 15 | Iron ore monthly prices  
Source: Argus Media

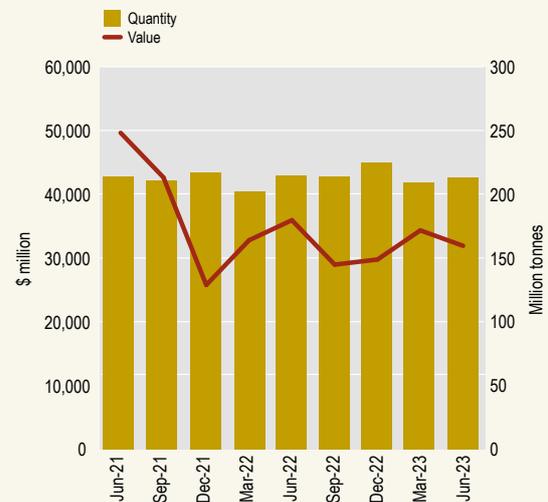


Figure 16 | Iron ore quantity and value by quarter  
Source: DEMIRS

##### Quantity and value

Iron ore accounted for 68 per cent of all mineral sales and 49 per cent of total mineral and petroleum sales in 2022–23. It was the first financial year since 2009–10 that iron ore dropped below 50 per cent of mineral and petroleum sales.

Iron ore remained the most valuable commodity mined in WA, and the dominant industry in the State’s resource sector, with \$125 billion in iron ore sales in 2022–23, down from \$137 billion in 2021–22 and the record of \$158 billion in 2021, because of lower iron ore prices.

This was despite the industry achieving record sales tonnages on either a financial or calendar year basis of 861 Mt in 2022–23.

The three largest producers, Rio Tinto, BHP and Fortescue, continued to dominate WA sales volumes, accounting for 87 per cent of the total in 2022–23. This is a similar percentage to previous years.

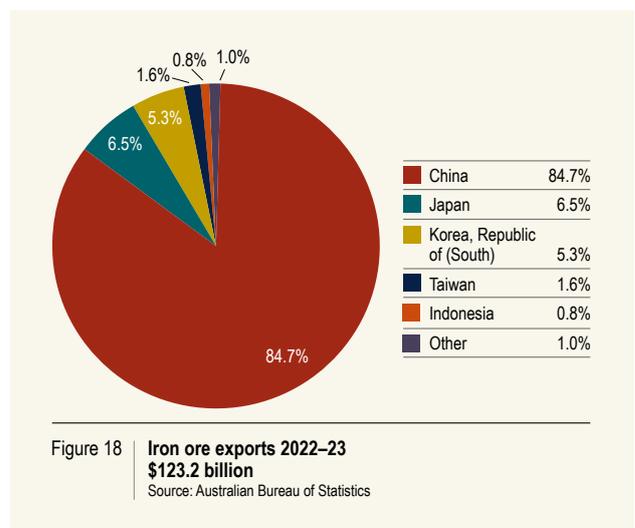
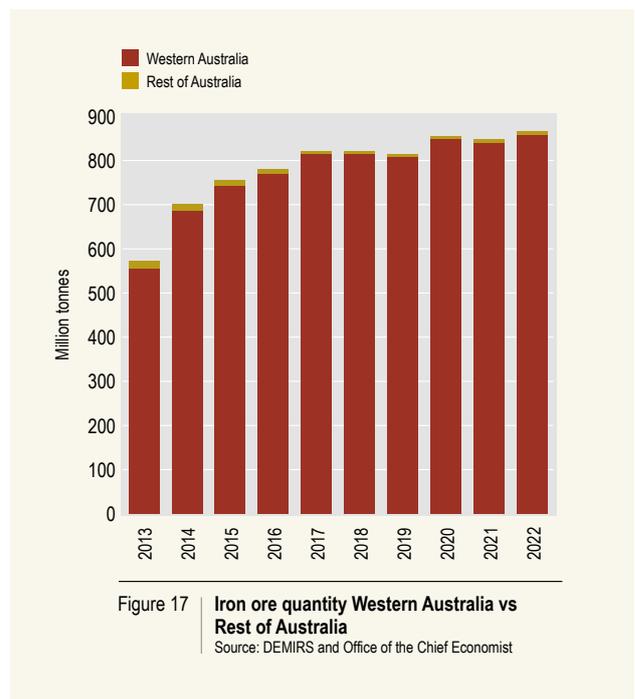
Rio Tinto’s iron ore shipments increased in 2022–23 on the back of production ramp-up at Gudai-Darri, which achieved nameplate capacity in the June quarter 2023, and productivity increases resulting from the company’s Safe Production System, which involves lifting operational performance.

BHP announced record WA iron ore production for 2022–23 driven by productivity gains in its supply chain, rail network and car dumpers. South Flank completed deployment of autonomous trucks in May 2023, and continued to ramp up towards full capacity as a replacement for the aging Yandi mine.

Fortescue achieved record annual iron ore shipments in 2022–23, based on strong performance.

WA continued to be the world’s largest iron ore producer, accounting for 33 per cent of global output. The State was also responsible for 99 per cent of Australian iron ore production.

WA iron ore export destinations were dominated by China (85 per cent), followed by Japan (seven per cent), South Korea (five per cent), Taiwan (two per cent) and Indonesia (one per cent).



## Notable events

- Fortescue produced the first concentrate from its Iron Bridge magnetite project in April 2023, with the first shipment achieved in July 2023.
- Construction commenced on the Western Range mine (a joint venture of Rio Tinto 54 per cent, China Baowu Steel Group 46 per cent) in the March quarter 2023.
- Rio Tinto announced in November 2022 that it planned to build two new solar farms and battery energy storage systems in the Pilbara as part of efforts to decarbonise its iron ore operations, while also announcing plans in June 2023 to build a desalination plant to increase water supply for its Pilbara operations with construction to commence in 2024.
- The 34MW solar plant at Gudai-Darri began commissioning in August 2022, which, when combined with battery storage, is expected to provide one third of project energy needs.
- BHP announced in June 2023 a company-wide decarbonisation initiative, which is to include up to 500MW of renewable power generation and storage capacity in the Pilbara.
- Mineral Resources announced FID in August 2022 on the Onslow iron ore project with Red Hill iron ore joint venture partners (China Baowu Steel Group, American Metals and Coal Industries, and Pohang Iron and Steel Co).
- Fortescue announced FID in November 2023 for several green initiatives, including the Christmas Creek Green Iron Trial Commercial Plant. The trial plant is planned to produce iron utilising green hydrogen and solar power electricity with first production targeted for 2025. In February 2023, the company also announced it had commenced construction on the 100MW North Star Junction solar farm to support Iron Bridge's energy needs.
- In July 2023 Fenix Resources completed the acquisition of Mount Gibson's Mid West iron ore, rail and port assets, including the Shine and Extension Hill iron ore mines.
- Strike Resources completed its first shipment of iron ore from the Paulsens East Project in September 2022, before suspending mining citing higher operating costs and lower realised iron ore prices.
- CuFe resumed mining at the JWD mine in January 2023 as iron ore prices improved, having suspended operations in November 2022.



The major commodities file contains detailed information about iron ore, including:

- Iron ore prices.
- Quantity and value of iron ore sales.
- Value of iron ore exports by destination.
- Iron ore production in WA compared with the rest of Australia.

## 2.1.2 Lithium

### Prices

Lithium prices rose in the second half of 2022 to reach all-time highs on tight raw material supply and strong demand for EVs across all major markets including China, Europe and North America, supported by tax exemptions for new EVs.

Spodumene concentrate spot prices increased to more than \$9,000 per tonne (45 per cent higher than the previous record set in 2021–22), while the price of battery-grade lithium hydroxide in China was more than US\$76,000 per tonne.

Prices tumbled over the first half of 2023 with the removal of EV subsidies in many European countries and China affecting sales, which were 10 per cent lower than a year earlier in China, as well as upstream demand leading to high stockpiles of raw materials.

There was some relief in June 2023 as downstream demand recovered following the announcement that China would continue to exempt new energy vehicles from purchase tax until the end of 2025.

### Quantity and value

WA's spodumene concentrate sales in 2022–23 increased to a record 3.19 Mt, up 44 per cent on 2021–22.

Record prices saw the value of these sales increase a remarkable 162 per cent from 2021–22 to \$20.9 billion.

The increase in volumes was largely due to the ongoing optimisation of processing facilities and the completion of ramp-up of the tailings retreatment plant at Talison Lithium's Greenbushes project, the ramp-up to nameplate capacity of Pilbara Minerals' Ngungaju plant at Pilgangoora, as well as the ramp-up of Wodgina and the expansion of production capacity at Mount Marion (Mineral Resources operated projects).

Record prices and higher volumes meant the lithium industry displaced the gold industry as the State's second most valuable mineral by sales value.

Exports of spodumene concentrate from WA were overwhelmingly to China (98.6 per cent), with Belgium (0.8 per cent) and South Korea (0.4 per cent) the next two largest markets.

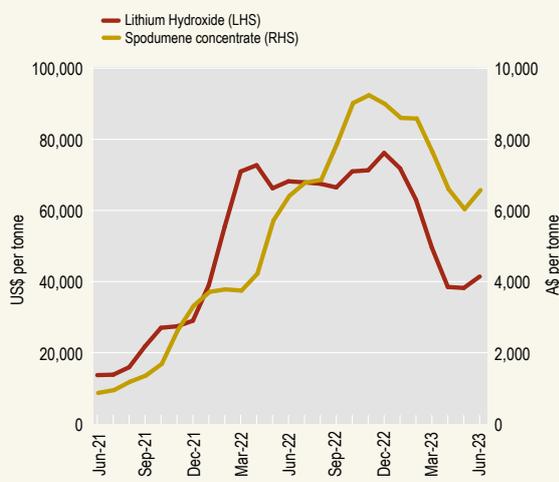
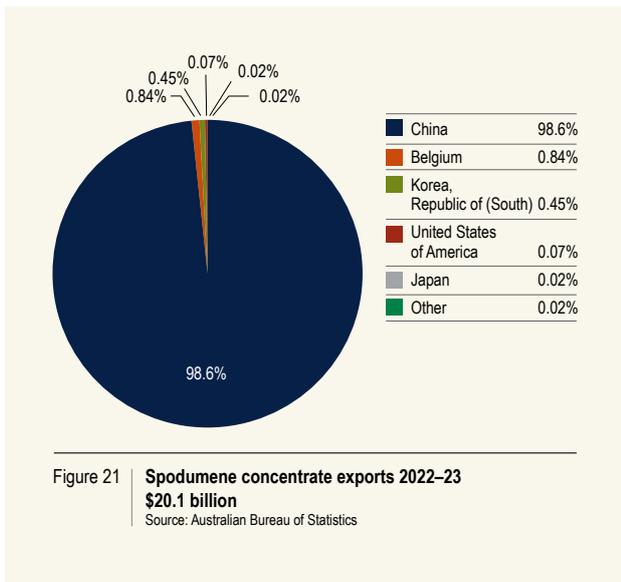


Figure 19 | Lithium monthly average prices  
Source: Asian Metal



Figure 20 | Spodumene concentrate quantity and value by quarter  
Source: DEMIRS



### Notable events

- First product from the Albemarle Corporation's Kemerton lithium hydroxide plant was delivered in July 2022. It subsequently progressed through commissioning and achieved on-specification and customer qualified product in April 2023.
- First spodumene concentrate from Train 2 at the MARBL joint venture's Wodgina was achieved in July 2022, while Train 3 met practical completion in the September quarter 2022 and is planned to restart in 2024.
- An expansion to the processing facilities at Mineral Resource's Mount Marion project was delivered in the June quarter 2023 with commissioning of both the crushing and beneficiation plants late in the quarter. This increased the production capacity from 600 thousand tonnes per annum (ktpa) to 900 ktpa of mixed-grade product.
- An expansion of Talison Lithium's Greenbushes project, adding a third chemical grade plant as part of its plans to increase production capacity to 2.5 million tonnes per annum (Mtpa), was completed in September 2022.
- Pilbara Minerals greenlit its P1000 project to increase its nameplate production capacity to 1 Mtpa in March 2023.
- Calix and Pilbara Minerals announced FID in August 2023 for the development of a demonstration plant at the Pilgangoora project, with the aim of producing lithium salts utilising Calix's patented calcination technology.

- There was also considerable mergers and acquisitions activity both for operating assets as well as projects under development and assessment:
  - Mineral Resources completed the acquisition of the assets of Alita Resources, including Tawana Resources, Lithco No. 2 and Bald Hill, on 1 November 2023.
  - An updated MARBL joint venture between Mineral Resources and Albemarle Corporation was announced in July 2023 and completed in October 2023. The joint venture now involves Mineral Resources and Albemarle Corporation each having a 50 per cent share of the Wodgina lithium mine, with Albemarle Corporation taking full ownership of the Kemerton lithium hydroxide plant.
  - Allkem, owner of the Mt Cattlin lithium project, struck a merger deal in May 2023 with US firm Livent to create a globally significant lithium chemicals producer.
  - Mineral Resources increased its interests in Delta Lithium, owner of the Mt Ida and Yinnetharra projects, to 19.1 per cent, and in Develop Global, owner of the Pioneer Dome project to 14 per cent.
  - Liontown Resources, owner of the Kathleen Valley project, was subject to a takeover by Albemarle Corporation in September 2023 but the offer was withdrawn in October 2023 due to growing complexities with the proposed transaction. Around the same time, Hancock Prospecting increased its stake in Liontown Resources to 19.9 per cent.



The major commodities file contains detailed information about lithium, including:

- Spodumene concentrate and lithium hydroxide prices.
- Quantity and value of spodumene concentrate sales.
- Value of spodumene concentrate exports by destination.

# LITHIUM: THE NEW (WHITE) GOLD?

Lithium was first mined in WA in 1983 at Greenbushes in the south west of the State with the first lithium processing plant commissioned in 1985.

Greenbushes was expanded several times over the subsequent decades with production growing steadily to reach around 100 kt valued at \$21 million in 2003–04 (20 years ago) and 342 kt valued at \$151 million in 2013–14, just 10 years ago.

Greenbushes remained the State's only lithium site until the Mt Cattlin project near Ravensthorpe commenced production in 2011 only to be put on care and maintenance in July 2012 amid excess supplies.

Mt Cattlin eventually recommenced in late 2016 with a host of new producers and projects following suit with first sales from Wodgina (direct shipping ore) and Mount Marion in 2017, as well as Bald Hill and two operations at Pilgangoora in 2018, as the local industry sought to keep pace with rapidly growing demand.

This was at a time when battery-grade lithium hydroxide spot prices had risen to more than US\$20,000 per tonne with lithium viewed as a globally significant critical mineral in a world shifting to decarbonisation and net zero emissions and demand rising for lithium containing cathodes used in EV batteries.

This translated into sales of more than 2 Mt of spodumene concentrate valued at nearly \$1.7 billion in 2017–18; the fifth most valuable mineral in WA.

Significantly, around this time the first commitments were undertaken to develop downstream lithium hydroxide facilities at Kwinana and Kemerton.

A host of new lithium mining projects and expansions were also progressing and planned. They included the CGP2 and CGP3 expansions at Greenbushes, the Mount Holland project, and stage two developments at the two Pilgangoora projects.

Just as an expanded local lithium industry had begun to emerge, the lithium market bottomed out with prices for lithium hydroxide falling more than one-third to US\$6,000 per tonne and spodumene concentrate prices at around \$500 per tonne by late-2020 amid upstream oversupply.

These tough market conditions had a significant impact on the local industry:

- Alita Resources, owner of the Bald Hill project, was put into administration at the end of August 2019.
- Wodgina was put on care and maintenance in November 2019 following the completion of construction on the concentrate plant.
- Altura Mining, owner of one of the Pilgangoora projects, was put into administration in October 2020, with its project subsequently acquired by neighbouring Pilbara Minerals in January 2021.

Two companies – Galaxy Resources, then owner of the Mt Cattlin project, and Pilbara Minerals, then owner of one of the Pilgangoora projects – received financial assistance from the State Government to support ongoing operations and jobs.

The previously announced investments and expansions were also scaled-back, deferred, paused, or cancelled.

As a result, in 2019–20 the local industry faltered with production moderated to meet customer demand and lower costs with 1.5 Mt of spodumene concentrate produced (down around one-third from 2017–18) valued at \$999 million (down 40 per cent from 2017–18).

The industry gradually recovered in subsequent years as prices trended up from late-2020 eventually hitting astonishing peaks in late-2022 when the spot price of lithium hydroxide in was in excess of US\$76,000 per tonne and spodumene concentrate exceeded \$9,000 per tonne.

This recovery was driven by a supply deficit as strong demand for lithium-ion batteries for EVs outpaced supply and efforts to increase output throughout the value chain.

As prices recovered, production was increased and plans for new projects and expansions were underway, while restarts were considered and initiated for previously suspended projects including:

- Altura Mining's former Pilgangoora project was integrated into a single Pilgangoora project, owned and operated by Pilbara Minerals and comprising the Pilgan (existing Pilbara Minerals' plant) and Ngungaju (former Altura plant) plants with first spodumene concentrate from the restart of the Ngungaju plant delivered in October 2021.
- Construction of a tailings retreatment plant at Talison Lithium's Greenbushes was completed and production commenced in March 2022.
- Restarts of Trains 1 and 2 of the MARBL joint venture's Wodgina project, which were completed in May 2022 and early July 2022 respectively.

- Operations recommenced at Bald Hill in February 2022 for first sales in the June quarter 2022 under new owner Lithco No. 2.
- Mineral Resources' Mt Marion project was expanded in two stages to spodumene concentrate production capacity of 900 ktpa of mixed-grade product.

In 2022–23, the lithium industry in WA reached new heights with record local spodumene concentrate sales of three Mt, valued at more than \$20 million which saw lithium dethrone gold as the State's second most valuable mineral commodity and sit third overall, behind only iron ore and LNG.

This equates to a 30-fold increase in the quantity of sales over the past 20 years, and an almost 1,000-fold increase in the value of sales.

Employment in the lithium industry has grown, with over 8,000 FTEs employed in 2022–23, almost 20 times the FTEs in 2013–14. The industry was the fourth biggest employer in the mining sector in 2022–23 up from twelfth 10 years earlier.

This increase in production has seen WA solidify its position as the biggest producer of lithium globally, a rank it has held since passing Chile in 2012. It accounted for more than half of world production on a contained basis.

The future is also bright with additional spodumene concentrate capacity committed to come online in the coming years through:

- Construction of Covalent Lithium's Mt Holland project.
- Expansion of Pilbara Minerals' Pilgangoora project in two stages known as Pilgangoora 680 and Pilgangoora 1000.
- Construction of the CGP 3 expansion at Talison Lithium's Greenbushes project.
- Train 3 at Wodgina, which met practical construction completion in the September quarter 2022 and is planned to restart in 2024.
- Liantown Resources' Kathleen Valley project, currently under construction.

Combined with the existing operations, these projects will increase WA's spodumene concentrate nameplate production capacity to around 6 Mtpa up from around 4 Mtpa in November 2023.

There have also been positive developments in downstream processing with both Kwinana and Kemerton achieving on-specification and customer qualified products. Output is also committed to increase in the coming years through:

- Tianqi Lithium Energy Australia's Train 2 at Kwinana, currently under construction.
- Construction on Trains 3 and 4 at Albemarle Corporation's Kemerton lithium hydroxide plant.
- Construction of another lithium hydroxide plant at Kwinana by Covalent Lithium, which will be fed with spodumene concentrate from Mt Holland.

Once completed, these projects will bring WA's lithium hydroxide production capacity to 198 ktpa. This will mean that around 20 per cent of WA's spodumene concentrate will be converted locally into battery-grade lithium hydroxide.

Pilbara Minerals and Calix have also committed to developing a mid-stream lithium sulphate demonstration plant.

There are also a host of projects subject to economic assessment that have the potential to grow the local industry further including another expansion of Greenbushes by Talison Lithium through the CGP 4 project, the development of Trains 4, 5 and 6 by the MARBL joint venture at Wodgina, expansion and extension of the life of Alkem's Mt Cattlin, Global Lithium's Manna project and Essential Metals' Pioneer Dome project, as well as the development of a lithium sulphate plant in Port Hedland by Alkemy Capital Investments.

Exploration for lithium is also strong with a single-year record of \$419 million (17 per cent of total exploration) spent on exploration for other minerals in WA, which includes lithium and rare earths. This is up from \$146 million, or an eight per cent share, in 2013–14. This activity is producing significant results across several lithium prospects.

While the downturn in lithium prices may result in lower sales values in the short-term, the medium to long-term outlook for lithium remained positive and WA is poised to benefit.

### 2.1.3 Gold

#### Prices

The average price of gold was stable year-on-year in US dollar terms but increased in Australian dollar terms.

Prices trended higher over the course of the 2022–23 financial year, up more than five per cent in US dollars and 10 per cent in Australian dollars from June 2022 to June 2023.

This minor increase mostly occurred in the second half of the year, with prices peaking in April 2023 at above US\$2,000 per ounce (and almost \$3,000 per ounce in May), before easing at the end of the financial year.

Prices were supported by concerns about the global economy and fears of a recession, continued high inflation in several major currencies, and a relative weakening of the US dollar against other major currencies.

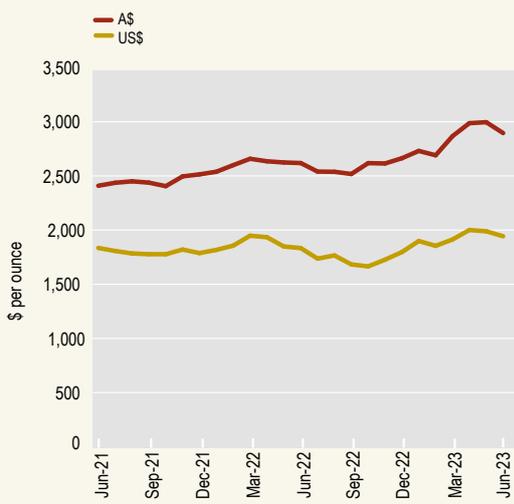


Figure 22 Gold monthly average prices  
Source: Perth Mint and Kitco

#### Quantity and value

The quantity of gold sold dropped slightly from its 20-year high in 2021–22 to 212 tonnes or 6.8 million troy ounces but was still around the same level as recent years.

Newmont Corporation reported increased output from Boddington, Red 5's King of the Hills ramped-up following the completion of an expansion in June 2022, while Calidus Resources' Warrawoona and Ramelius Resources' Penny projects achieved first gold during the year.

On the downside, Genesis Minerals' Gwalia had reduced performance, while Spartan Resources' Dalgaranga and Genesis Minerals' Mt Morgans were placed on care and maintenance in November 2022 and June 2022. Sales from Northern Star Resources' Super Pit/Mt Charlotte were lower due to greater mill downtime than the prior year.

High quantities and record prices resulted in WA recording the highest value of gold production in the state's history for a financial or calendar year.

Despite this, gold dropped to be WA's third most valuable mineral commodity after iron ore and lithium.

Gold accounted for 10 per cent of the value of minerals sold and seven per cent of the value total mineral and petroleum sales in 2022–23.

Exports of gold from WA increased to \$20 billion from \$19 billion in the previous year.

China (40 per cent) was the largest destination for gold exports from WA, followed by Hong Kong (17 per cent), Singapore (16 per cent) and India (7 per cent).



Figure 23 Gold quantity and value by quarter  
Source: DEMIRS

### A note about gold exports

The ABS releases WA exports data that shows exports of gold that are higher than the value of gold produced in WA.

This is because Gold Corporation, or as it is more commonly known, The Perth Mint, refines gold produced in other States and Territories, gold from surrounding countries and also secondary gold, mainly from Asia.

Overseas imported gold also includes scrap, which is refined in WA and exported.

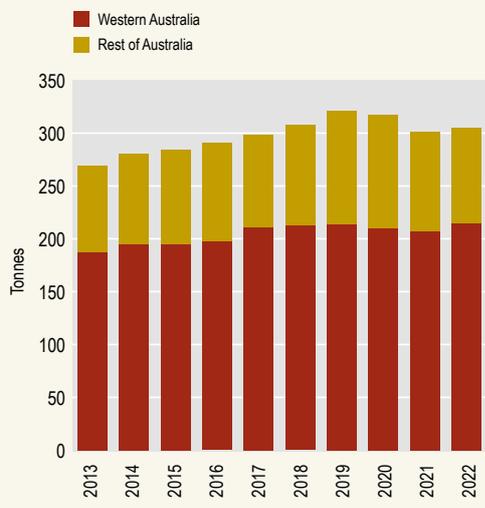


Figure 24 **Gold quantity Western Australia vs Rest of Australia**  
Source: DEMIRS and Office of the Chief Economist

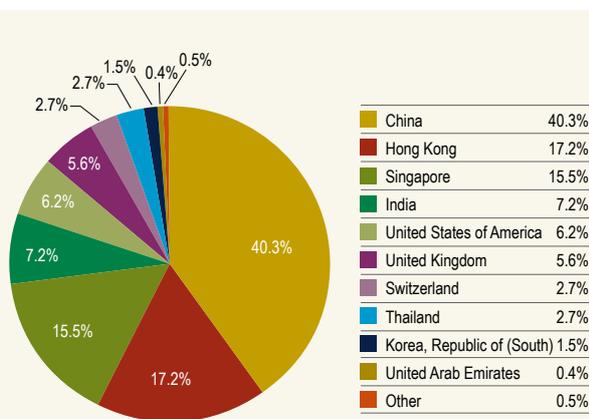


Figure 25 **Gold exports 2022-23**  
**\$20.0 billion**  
Source: Australian Bureau of Statistics

### Notable events

Mergers and acquisitions were a key theme for the year with several key announcements including:

- Newmont Corporation acquiring Newcrest Mining, owner of the Telfer project and Haviron development, in November 2023.
- Genesis Minerals acquiring the Leonora assets of St Barbara, including Gwalia, in June 2023. This followed a failed merger and consolidation of assets under a new entity to be called Hoover House. Genesis Minerals also subsequently acquired Dacian Gold, the previous owner of the Mt Morgans project, in November 2023.
- Catalyst Metals acquiring Superior Gold Inc., the owner of the Plutonic project, in June 2023.
- Ramelius Resources acquiring gold explorers Musgrave Minerals in October 2023 and Breaker Resources in June 2023.

Several mines were opened and achieved first gold:

- Norton Gold Fields commenced operations at Binduli North, part of the broader Paddington operations, in July 2022.
- Pantoro's Norseman operations poured first gold in October 2022.
- Focus Minerals re-commenced gold production and sales from the Coolgardie project through the toll treating of historically stockpiled low-grade materials and the Big Blow small-scale operations that were completed during the December quarter 2022. Further sales of low-grade stockpiles from toll treating were undertaken in the June quarter 2023.
- Northern Star Resources achieved the processing of first ores from Bronzewing in the June quarter 2023.
- Auric Mining commenced production at its Jeffreys Find project in July 2023, with first gold in August 2023.
- Bellevue Gold achieved first gold from its namesake project in October 2023.
- Brightstar Resources mined first ore at the Selkirk deposit, part of the Menzies project, in November 2023.

There were also positive FIDs on project developments including Evolution Mining's expansion of the Mungari Mill in June 2023, Northern Star Resources' expansion of the KCGM Mill in August 2023, and West Gold Resources' Big Bell expansion and Great Fingall project in August 2023 and November 2023 respectively.

At the same time, several mines were closed or mothballed:

- Wiluna Mining entered voluntary administration in July 2022 with mining operations at the Wiluna project ceasing in December 2022, with the processing of low-grade stockpiles to February 2023 and the reprocessing of tailings from March 2023.
- Mining at Mt Morgans was discontinued in June 2022 with the processing of stockpiles and historical materials continuing until the suspension of operations in April 2023.
- Novo Resources' Beatons Creek project was placed on care and maintenance by the end of October 2022 following a phased wind down of operational activities. Novo Resources also announced in September 2023 it was seeking expressions of interest for the sale of the asset.
- Northern Star Resources idled the Jubilee mill at its South Kalgoorlie operations in the September quarter 2022 in response to inflationary pressures and COVID-19 absenteeism.
- Mining and processing operations at Dalgaranga were suspended in November 2022.
- Ramelius Resources placed the Vivien mine on care and maintenance in January 2023 and completed mining operations at Tampia in May 2023.
- Pantoro's Halls Creek operations were placed on care and maintenance in June 2023 due to escalating diesel costs, impacts from COVID-19, and border closures.

In other notable events:

- The State Government initiated a process in April 2023 to explore strategic options for Gold Corporation, owner and operator of the Perth Mint.



The major commodities file contains detailed information about gold, including:

- Gold prices.
- Quantity and value of gold sales.
- Value of gold exports by destination.
- Gold production in WA compared with the rest of Australia.

## 2.1.4 Alumina

### Prices

The monthly average unit price of Australia alumina remained relatively steady across 2022–23 financial year, ranging between \$460 per tonne and \$544 per tonne, ending the year where they began.

Prices declined through the second half of 2022 on excess supply in the Asia Pacific market following the ban of alumina exports to Russia, as well as an increase in China's domestic alumina production, while downstream demand remained suppressed by China's ongoing COVID-zero policy.

They rebounded in early 2023 on supply disruptions, including in WA, before easing on a boost to regional supplies from new domestic projects in China.

### Quantity and value

Local alumina production was at the lowest level in 10 years at 13.1 Mt.

Alcoa's operations were affected by lower bauxite grades and maintenance, but most particularly by the declaration of force majeure in January 2023, resulting from a disruption to natural gas supplies cutting about 30 per cent of its output at the Kwinana refinery. Approximately 20 per cent of the alumina refining capacity at Kwinana was still curtailed at the end of March 2023, but subsequently recovered.

Worsley Alumina's saleable production was impacted by planned calciner maintenance in the September 2022 and March 2023 quarters and managed short-term coal supply issues, although by the end of the year, improved calciner availability supported above nameplate production rates.

Despite lower production, the value of alumina sales remained steady at \$6.7 billion due to higher realised prices for local producers.

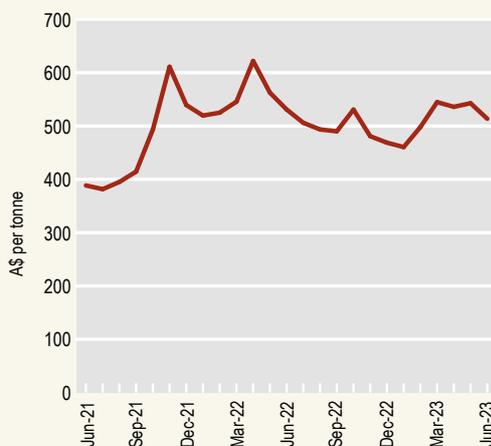


Figure 26 Alumina monthly average price  
Source: Australian Bureau of Statistics

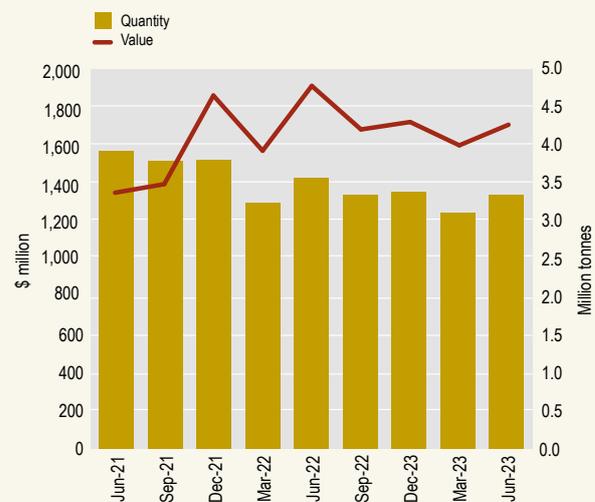


Figure 27 Alumina and bauxite quantity and value by quarter  
Source: DEMIRS



Figure 28 **Alumina quantity Western Australia vs Rest of Australia**  
Source: DEMIRS and Office of the Chief Economist

### Notable events

- At Alcoa:
  - Job cuts were announced for the Kwinana refinery, reported to be around 90 positions by early 2024, as part of a cost-cutting exercise across its WA operations.
  - Construction on a Mechanical Vapour Recompression module, powered by renewable energy, commenced at Alcoa’s Wagerup alumina refinery. The project recycles the waste steam produced during alumina refining, rather than releasing it into the atmosphere and is slated to be operational in 2024.
  - Commitments were made to not seek to mine within three kilometres—and in some instances more than six kilometres—of the Dwellingup town centre as well as within five kilometres of Jarrahdale.
  - Renewed plans to export bauxite were withdrawn.
  - A development project with FYI Resources to produce high purity alumina was terminated in February 2023 with FYI Resources resuming control of advancement of the project.
  - Former OZ Minerals executive Matt Reed was announced in May 2023 to lead the Australian operations.
- At Worsley Alumina, decarbonisation and energy security initiatives were executed, including commencement of the conversion of the first coal-fired boiler to natural gas, as well as studies into mud washing, waste to heat digestion and coal-alternative steam supply.

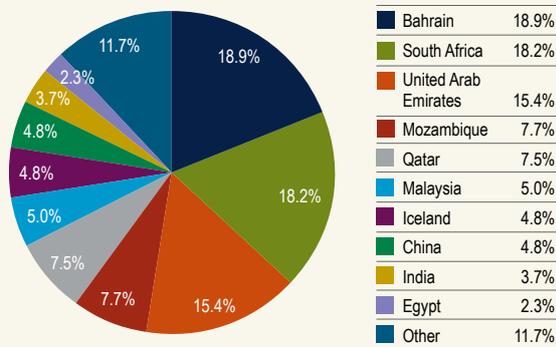


Figure 29 **Alumina exports 2022-23 \$7.6 billion**  
Source: DEMIRS



The major commodities file contains detailed information about alumina, including:

- Alumina prices.
- Quantity and value of alumina sales.
- Value of alumina exports by destination.
- Alumina production in WA compared with the rest of Australia.

## 2.1.5 Nickel

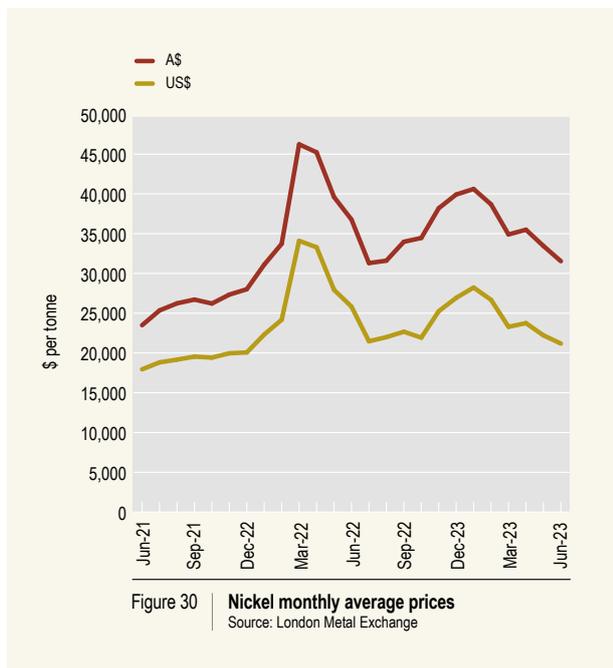
### Prices

Following nickel prices exceeding US\$100,000 per tonne in March 2022 amid a short squeeze triggered by concerns over Russian nickel exports, nickel returned to a level more in-line with market fundamentals by mid-2023.

Prices were elevated from November 2022 to February 2023 on the back of strong demand (particularly in China following the ease of COVID-19 restrictions) and supply concerns, most notably in Indonesia. By June 2023, prices had returned to around the same level as prior to the short squeeze of early 2022. The drop can be explained by several factors including:

- Tsingshan Holding Group's announcements that it will add Class 1 nickel to its production mix from Indonesia.
- The failure of Chinese demand, particularly stainless demand, to rebound following the cessation of its COVID-zero policies.
- A strengthening US dollar.

Despite this, average prices over 2022–23 were at the highest levels since before the Global Financial Crisis.



### Quantity and value

Sales quantities rebounded in 2022–23 to 160 kt, up from a 20-year low of 147 kt in 2021–22.

To put this into context, quantities in 2022–23 were at about average levels for the preceding eight years.

The year-on-year increase was due to:

- An increase in production of concentrate and matte products and inventory drawdowns at BHP Nickel West, which offset a slower than planned ramp-up of the Kwinana refinery following maintenance in late 2022 and heavy rainfall at Mt Keith operations in early April 2023.
- More consistent production from Minara Resources' Murrin Murrin project following scheduled major maintenance in 2021.
- Improved ore handling and processing from the new Shoemaker-Levy deposit as well as improved beneficiation plant availability and stability at FQM's Ravensthorpe project.
- Record production in the second half of 2022 at Panoramic Resources' Savannah, despite several issues in the first half of 2023, including damage to its logistics route to site via the Fitzroy River Bridge, and technical challenges.

IGO's production was down from Nova, due to an 18 day suspension following a fire at the diesel power station in December 2022, and at Forrestania due to several seismic events that restricted access to higher grade areas.

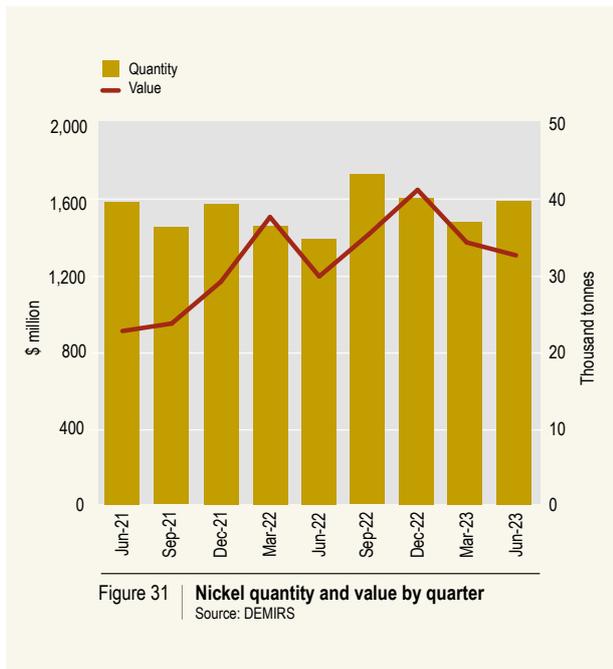
The combination of higher average prices and production resulted in \$5.7 billion in sales – the highest nickel sales value in 15 years, up 19 per cent from 2021–22, and double from five years ago.

China remained the main recipient of exported nickel (47 per cent down from 63 per cent the previous financial year), with Japan (13 per cent), South Korea (12 per cent) and the Netherlands (nine per cent) being other major importers from WA.

Nickel remained WA's fifth most valuable mineral commodity, representing three per cent of mineral sales up slightly from 2021–22.

With the Avebury nickel project in Tasmania restarting nickel concentrate production in October 2022, WA is no longer the only producer of nickel in Australia yet remained – by far – the largest producer.

WA remained the fifth largest producer, accounting for five per cent of global production.



### Notable events

- Wyloo Metals (a subsidiary of Tattarang, a private investment group owned by Andrew and Nicola Forrest) secured control of Mincor Resources, owner of the Cassini mine at Kambalda, in April 2023 through a takeover.
- Mincor Resources delivered some ore from its Cassini mine at Kambalda to BHP Nickel West that did not meet the required specifications under an offtake agreement. Mincor Resources continued to deliver on-specification ore to BHP Nickel West, with the off-specification ore being stockpiled for possible blending at a future date.
- Panoramic Resources initiated a strategic review of its Savannah project in November 2023 and subsequently was placed into administration in December 2023.
- BHP completed the acquisition of OZ Minerals in May 2023. OZ Minerals had, in September 2022, made FID on the West Musgrave project.
- BHP Nickel West and TransAlta achieved commercial operation of the Northern Goldfields solar and battery storage facility for its Mt Keith and Leinster operations.
- IGO continued to make progress on construction of the Cosmos project, but it faced several challenges including capital and operating cost escalation, delays in development, and challenges to the mine production schedule. As a result, IGO initiated a comprehensive review of the project.



The major commodities file contains detailed information about nickel, including:

- Nickel prices.
- Quantity and value of nickel sales.
- Nickel exports by destination.
- Nickel production in WA compared with the rest of Australia.

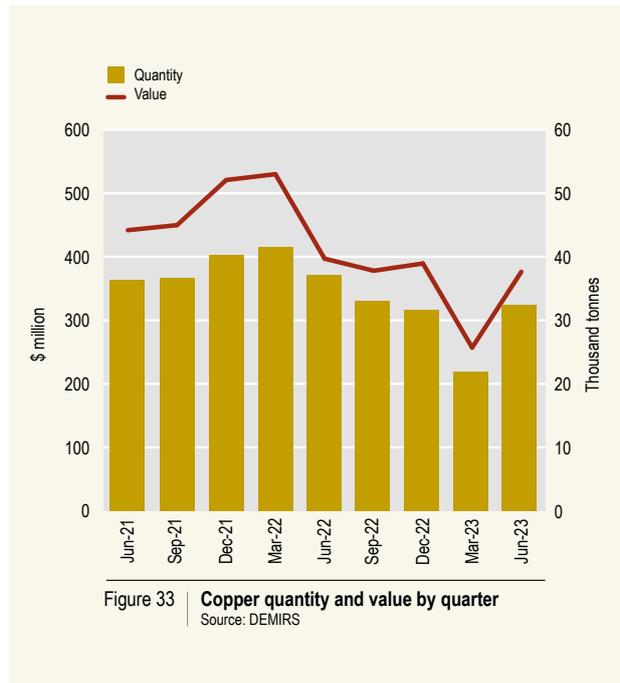
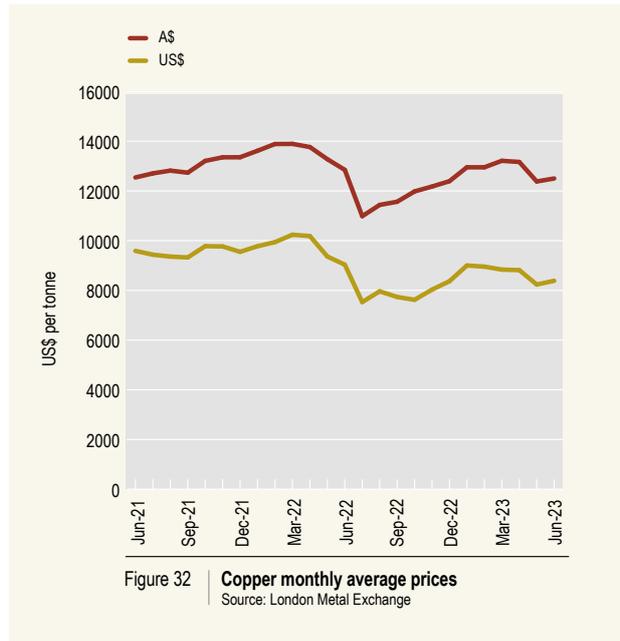
## 2.1.6 Copper

### Prices

Copper prices declined from a yearly average of more than US\$9,600 per tonne in 2021–22 to US\$8,360 per tonne in 2022–23.

The average price declined on US interest rate rises and concerns about global economic growth amid bank failures, as well as a weak demand from the construction sector in China initially due to its COVID-zero policy and then a slower than expected recovery in demand following the relaxation of the restrictions.

Copper prices trended higher across the year largely due to optimism around China's relaxation of its COVID-19 rules and related improved expectations for demand (that ultimately proved unfounded) as well as slowing inflation in the US in the period from November 2022 to January 2023.



## Quantity and value

Copper sales were valued at \$1.4 billion in 2022–23, down one quarter from \$1.9 billion the previous financial year.

This was in part due to lower prices but mostly from sales volumes falling to the lowest level in 15 years.

WA's largest copper project, Sandfire Resources' DeGrussa operations, significantly reduced production as it approached its end-of-life, with underground mining completed in October 2022 and processing transitioning to low-grade surface ores and stockpiles until its transition to care and maintenance in late June 2023. This is expected to result in WA's overall copper production settling at a lower level in the coming years.

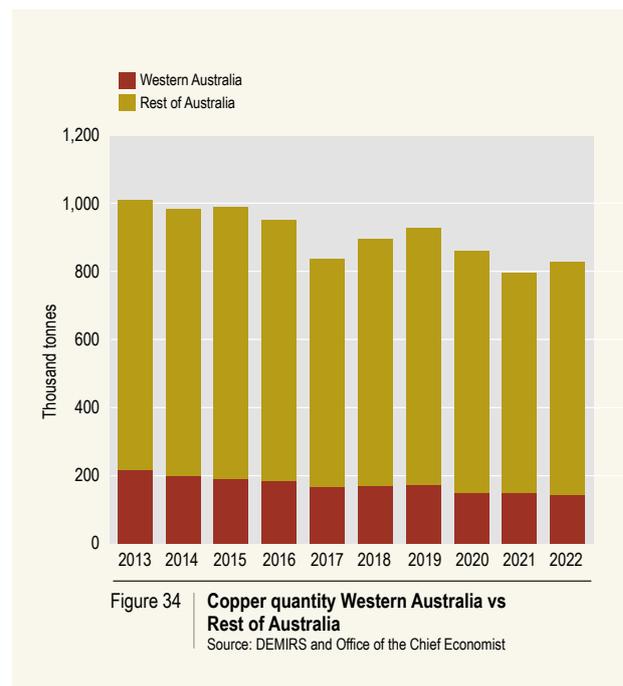
Production from IGO's Nova was also down, impacted by an 18 day production outage due to an onsite fire in December 2022 as well as related power supply issues, while 29Metals' Golden Grove's copper output was lower consistent with its production profile which was weighted toward zinc in the second half of 2022, in addition to constraints on processing rates associated with tailings management and a power outage in March 2023.

Aeris Resources' Jaguar had lower production on account of three separate mining induced seismic events during the first half of 2023 that required the suspension of operations in some mining areas.

Most other by-product copper projects, including Newmont Corporation's Boddington and Telfer projects, had higher sales due to higher grades, while Panoramic Resources' output from Savannah nearly doubled as it ramped-up production and exports.

Copper remained WA's sixth most valuable mineral, but in an Australian and global context, WA was a minor producer.

Philippines (22 per cent), South Korea (22 per cent) and Japan (14 per cent), remained the largest export destinations for copper, lead, and zinc produced in WA, but Finland (12 per cent) and Germany (11 per cent) captured an increased share.



## Notable events

- Sandfire Resources, in December 2022, initiated a formal sale process to divest the DeGrussa project, inclusive of underground mines and associated near-mine tenements, oxide stockpiles and tailings dam mineral inventory and other property, plant and equipment.
- Aeris Resources announced in September 2023 it was to suspend production and place the Jaguar project on care and maintenance.

## The future of copper and the role for WA

Copper, with its excellent properties as an electrical conductor, is considered essential to the world achieving the goal of net-zero emissions by 2050 on account of its applications in the electrification of transport (EVs), and the electrification of power and transmission infrastructure in the clean energy transition.

In recognition of its importance, copper is on the list of critical minerals in Canada and is considered by the US Department of Energy as a mineral near critical to its energy needs, as well as a strategic raw material by the European Union.

The International Energy Agency has noted that expected supply from existing copper mines and projects under construction is expected to meet only 80 per cent of forecast demand by 2030, while S&P Global has estimated that copper demand will double by 2035 and create the potential for a chronic supply deficit with potentially significant consequences for the global economy and decarbonisation unless new supply is developed and brought online.

While this represents a global challenge it is also an opportunity, however the extent to which WA can capitalise on this opportunity is limited.

Australia has globally significant copper mines at Olympic Dam in South Australia and Mt Isa in Queensland.

WA has never been a major copper producer in a national or global context, with output peaking at more than 210,000 tonnes or around 20 per cent of national and one per cent of global supply in the early 2010s.

Much local copper production has been a by-product of gold mining, such as at Boddington and Telfer, or as a secondary product of other base metals, such as nickel at Nova and Savannah, and zinc at Golden Grove and Jaguar.

Sandfire Resources' DeGrussa, the State's largest copper project and generally responsible for around 40 per cent of production in recent years, has reached the end of its current economic life and will result in a significant downturn in local production in the short-term.

WA has many known copper deposits, but most are relatively small with the State's total known economic resources comparatively insignificant at just eight per cent of the Australian total and less than one per cent of global reserves.

The largest of WA's known copper deposits include Caravel (Caravel Minerals), Winu (Rio Tinto), West Musgrave (BHP), and Nifty (Cyprium Metals).

The most advanced development is at West Musgrave, with a project currently under construction that is expected to produce 41 ktpa of copper from late 2025. This will only partially offset the loss of DeGrussa volumes.

Caravel (65 ktpa) and Nifty (25 ktpa) are currently at the feasibility stage, while other projects are under assessment at Sulphur Springs (10.1 ktpa) Whim Creek (8.194 ktpa) and Havieron (6.9 ktpa).

The potential, therefore, exists to boost local copper production over the next 5 to 10 years by upwards of 150 ktpa or around double the level in recent years.

This would still put WA well below BHP's South Australian copper operations (Olympic Dam, Prominent Hill and Carrapateena) alone at current levels of production (more than 300,000 tonnes). There are also large-scale projects in development (such as an expansion of Prominent Hill) and under assessment (such as the Carrapateena Block Cave 1 Expansion, the Ernest Henry expansion, Eva, Hillside, and Jervois) in other parts of the country.

While WA's copper production may increase, it will perhaps, at best, be in proportion with expanded Australian and global output and WA is unlikely to significantly grow its share of the market in the short-to medium-term.



The major commodities file contains detailed information about copper, including:

- Copper prices.
- Quantity and value of copper sales.
- Copper, lead, and zinc exports by destination.
- Copper production in WA compared with the rest of Australia.

## 2.1.7 Mineral sands

### Prices

Mineral sands prices continued their strong run from 2021–22, reaching new highs late in the 2022–23 financial year.

Prices for titanium products and related feedstocks increased, with titanium dioxide reaching an all-time high monthly average price of \$5,249 per tonne in June 2023.

These prices were driven upwards due to several factors, such as strong demand in North America due to a backlog of construction and remodelling projects, several pigment plants bringing forward planned maintenance in late 2022, and an improved economic outlook in a post COVID-19 lockdown China.

Zircon prices also continued to rise, hitting an all-time monthly high of \$3,448 per tonne in May 2023.

Zircon prices were supported on the demand side by improved ceramics production in Europe, as well as strong tile and foundry product manufacturing in India. In China, demand was initially hampered by COVID-19 related restrictions and a soft real estate market. Signs of recovery in housing demand and improved economic outlook in China towards the end of the financial year pushed prices higher.

### Quantity and value

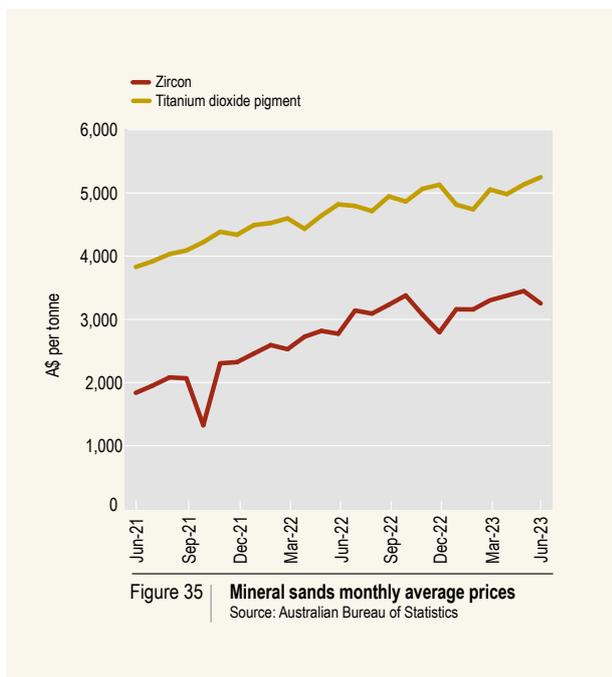
Higher prices drove total mineral sands sales to reach a record high of \$1.4 billion in 2022–23.

Volumes declined year-on-year due to lower garnet sands and zircon sales, though they were partially offset by increased volumes of the remaining mineral sands products, most notably rutile:

- Zircon sales declined around one-third due to reduced volumes from Tronox's and Iluka Resources' operations, as well as Image Resources' Boonanarring project, reflecting declining heavy mineral grades in ore, despite the start-up and ramp-up of Strandline Resources' Coburn project.
- Rutile sales increased to a 13 year high, largely due to higher volumes from Doral's and Iluka Resources' operations, the latter due to improvements in ore grades and heavy mineral recoveries, as well as the start-up of the Coburn project.
- Ilmenite sales remained stable, with increases in volumes from Iluka Resources' and Doral's operations, as well as the Coburn project, ostensibly offset by reduced production from the Boonanarring project and Tronox's operations.
- Synthetic rutile sales were also similar to previous levels.
- Garnet sales fell despite the start-up of the Lucky Bay project due to decreased volumes from the Port Gregory operations.

WA continues to be a globally significant producer of mineral sands products. The State was the world's largest producer of garnet (39 per cent), and a top ten producer of zircon, rutile and ilmenite.

China remained WA's biggest consumer of mineral sands products (41 per cent). WA's next largest customers for mineral sands were Malaysia (10 per cent), Spain (nine per cent), USA (six per cent), followed by a slightly less than five per cent share each to Mexico, Saudi Arabia and the United Kingdom.



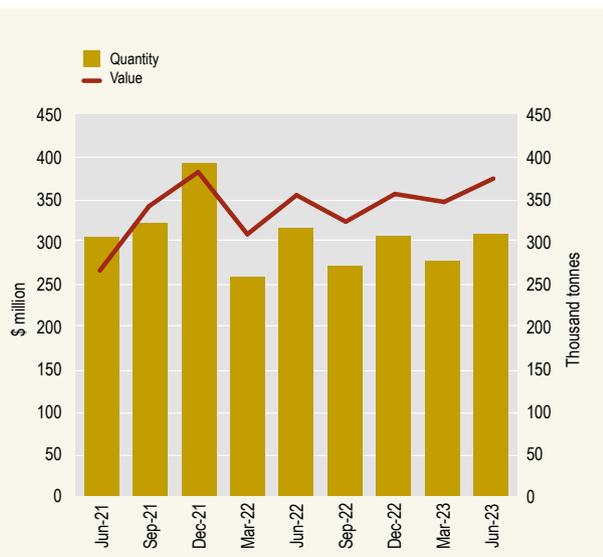


Figure 36 Mineral sands quantity and value by quarter  
Source: DEMIRS

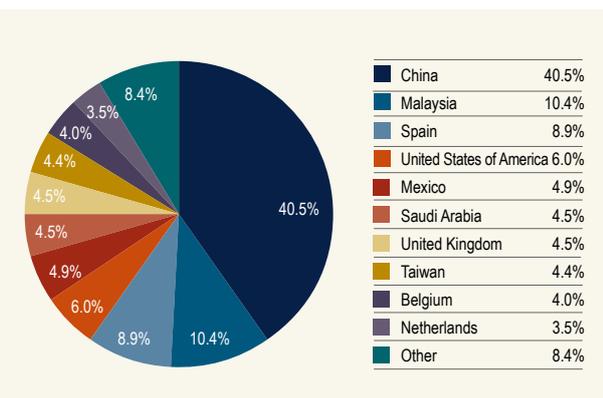


Figure 37 Mineral sands exports 2022-23  
\$2.2 billion  
Source: DEMIRS

### A note about mineral sands exports from WA

WA export data shows exports of mineral sands are significantly higher than mineral sands produced. This is largely attributable to the use of WA mineral sands refining and export capacity for products from other states. It is also the result of the export of mineral sand products from projects on Minerals to Owner land (i.e. land granted before 1899), which are not required to report sales or production to DEMIRS.

### Notable events

- Strandline Resources achieved first commercial production in November 2022 and a first shipment in December 2022 from its Coburn project.
- WA's second garnet sand producer, Australian Garnet, achieved first production at its Lucky Bay project in December 2022.
- Doral commenced production from its Yalyalup mine in mid-2022, located approximately 6km north-east of the previously mined Yoongarillup site. The new mine produces a heavy mineral concentrate comprising ilmenite, leucoxene, rutile, and zircon.
- Image Resources processed its last heavy mineral concentrate from the Boonanarring project during the September quarter 2023, with the final sales expected to be in the following quarter. It is expected to transition operations to the Atlas project, subject to approvals.
- Iluka Resources re-started SR1, the second of two synthetic rutile kilns, at North Capel in December 2022. It subsequently announced a production pause at SR1 concurrent with a planned major maintenance outage at the SR2 kiln from the December quarter 2023.
- Sheffield Resources achieved FID to proceed with Stage 1 of its Thunderbird project, with first production expected in the December quarter 2023.
- Iluka Resources progressed its rutile-rich Balranald project in NSW through FID in February 2023. This is relevant to WA as the intent is to transport heavy mineral concentrates from the project to WA for further processing.
- Iluka Resources completed the demerger of its Sierra Leone interests into a separate business entity (Sierra Rutile), such that all its remaining assets are in Australia.



The major commodities file contains detailed information about iron ore, including:

- Zircon and titanium dioxide prices.
- Quantity and value of mineral sands sales.
- Value of mineral sands exports by destination.
- Value of mineral sands production in WA compared with the rest of Australia.

## 2.1.8 Other minerals

### Salt

#### Quantity and value

There was 11.592 Mt of salt sold in WA during the 2022–23 financial year, a slight decrease from 11.646 Mt in 2021–22. This was the second consecutive financial year in which a fall in salt production had been observed (the sales quantity was 12.5 Mt in 2020–21)

Despite lower production, the value of the sector for the 2022–23 financial year was a record \$714 million, a substantial increase from \$558 million in 2021–22, due to higher salt prices.

Dampier Salt (with its operations at Dampier, Port Hedland and Lake MacLeod) remained the State's biggest producer of salt. Mitsui & Co was also a prominent producer through its operations at Onslow and Shark Bay. WA's remaining salt production was from Lake Deborah and Bulagin.

WA accounts for the majority of Australia's salt production and is a globally significant producer ranking fifth in the world in 2022, a position it has held for several years.

#### Notable events

- Construction of BCI Minerals' Mardie salt and potash project progressed with completion of construction on a primary seawater intake station, a 400-person accommodation village, and civil works for five evaporation ponds, with road and jetty infrastructure under construction. The project was also affected by increased costs and construction delays resulting in a revised timeframe for first production and the development of the potash component.
- Dampier Salt was reported to be in negotiations for the sale of its long-running Lake MacLeod operations with Leichhardt Industrials emerging as a potential buyer.

#### A note about salt

Salt is not a standard product and its composition differs based on factors such as purity and production processes. There are also differences in contracts between customers and suppliers as well as shipping costs. These factors mean that sales values vary across the world.

The reported sales value able to be derived from the quantities and values reported in the Digest is the Free-on-Board (FOB) sales value received by WA salt producers. Comparisons between FOB sales and CFR sales paid in the destination country may suggest a discrepancy if full shipping costs are not taken into account.

Highly detailed audits are carried out and include assessment of invoices associated with getting the salt to market. This includes shipping and handling, as well as the price ultimately paid by the customer in the destination country.

The confidential details of the audits confirm that DEMIRS' reported sales value is an accurate representation of the value of the salt produced.

### Coal

#### Quantity and value

Collie coal sales decreased to another record low of 4.8 Mt in 2022–23, down from the previous low of 5.2 Mt tonnes in 2021–22.

Coal production from the Griffin and Premier Coal operations has declined in recent years with stockpiles drawdown to sales meet demand and obligations.

Premier Coal had been affected by wet weather and an outage following a safety incident in October 2022.

The value of the coal produced increased to a record high of \$376 million, up from \$325 million in 2021–22, due to higher prices paid by customers.

#### Notable events

- Receivers and Managers were appointed to the Griffin Coal Mining Company in September 2022. The State Government subsequently provided funding of \$39.3 million over the 12 months to December 2023 to support operations and committed \$220 million to June 2026 to ensure ongoing mining at the Griffin project.
- The State Government announced that State-owned coal-fired power stations are set to be retired by 2030.

## Cobalt

### Prices

Cobalt prices trended down over 2022–23, losing the gains made over the previous 18 months.

The price fell from an average of US\$71,828 per tonne in June 2022 to US\$28,924 per tonne in June 2023.

Ongoing COVID-19 restrictions in China during the middle of the year as well as semiconductor shortages, inflation, and supply chain constraints undermined demand from the EV, industrial and consumer electronics sectors.

The global output of cobalt also surged during the year, with a supply glut from rising production out of the two largest producers, the Democratic Republic of the Congo and Indonesia.

### Quantity and value

In WA, cobalt is produced as a by or co-product by the State's nickel producers.

In 2022–23, 5,612 tonnes of cobalt was sold, valued at \$368 million.

The quantity sold remained relatively similar to 2021–22, however, there was a one-quarter drop in the value of those as a result of the price slump.

WA was Australia's only cobalt producer and was the fourth largest producer of cobalt in the world, down from third the previous year due to increased production from Indonesia.

## Manganese

### Quantity and value

In volume terms, manganese production continued to increase in 2022–23 – 567 kt of contained manganese were sold, up from the 537 kt in 2021–22.

Higher sales volumes were driven by increased output from both Woodie Woodie and Element 25's Butcherbird projects, with the latter improving operational performance through debottlenecking the processing plant.

The value of manganese sales fell to \$298 million, down from \$322 million in 2021–22 due to lower realised prices from weak steel demand in China.

WA accounted for four per cent of global manganese production and was the sixth largest supplier in the world, up from eighth due to lower output from Ukraine and Brazil.

## Zinc

### Prices

The price of zinc declined across the 2022–23 financial year, falling from US\$3,643 per tonne in June 2022 to US\$2,368 per tonne in June 2023.

This was primarily due to slowdown in the Chinese economy and cash flow issues for many Chinese property developers, resulting in the suspension of many construction projects, as well as weak inventory stocks.

Simultaneously, the fall in demand for zinc was softened by strong infrastructure spending in China.

### Quantity and value

The total quantity of zinc sold in 2022–23 was 62,223 tonnes, a reduction from the 73,971 tonnes in 2021–22.

This was due to reduced output from Aeris Resources' Jaguar project, which experienced three separate mining induced seismic events that delayed production and required the suspension of operations in high grade mining areas.

The combination of lower prices and reduced sales quantities meant the value of zinc sales for 2022–23 was also down to \$265 million from \$350 million the previous financial year, which was the highest level in 15 years.

WA remained an insignificant zinc producer on a global scale.

### Notable events

- Aeris Resources acquired Round Oak Minerals, the former owner of Jaguar, in July 2022. It subsequently announced in September 2023 it was to suspend production and place the Jaguar project on care and maintenance.

## Rare earth elements

### Quantity and value

A new record high of 30.6 million kilograms of rare earth oxides (based on rare earth oxides sold in concentrate) was sold in WA in 2022–23.

All of the sales were from Mt Weld due to improved processing efficiency and despite water supply disruptions related to its Malaysian downstream operations. As Mt Weld was the only producing project, the sales value cannot be reported due to commercial sensitivities.

Rare earths prices in China decreased during the year, down from record levels in 2021–22. For example, the price of neodymium declined on weaker demand from magnet manufacturers and greater supply.

WA accounted for 10 per cent of global rare earths production and was the world's third largest producer of rare earths, up from fourth the previous year due to lower production from Burma.

### Notable events

- Construction of Lynas Corporation's Kalgoorlie rare earths processing facility was largely completed and commissioning was underway with first feed of material introduced to the plant in December 2023.
- Lynas Corporation also committed to expanding the capacity and extending the life of its Mt Weld mine and concentration plant in August 2022 with design, procurement, and approvals undertaken during the year. Lynas Corporation also undertook a mining campaign and released a tender for a gas-renewable hybrid power station at Mt Weld.
- Iluka Resources progressed construction on its Eneabba rare earths refinery with bulk earths works, ground improvement, and construction of the accommodation village underway and expected to be completed by the end of 2023. FEED is also expected to be completed by the end of 2023.

- Northern Minerals announced a strategic partnership with Iluka Resources in October 2022 encompassing rare earths concentrate supply agreement (feedstock from Browns Range for Iluka Resources' Eneabba rare earths refinery), equity investment and funding support.
- Hastings Technology Metals introduced a staged development strategy for its Yangibana project comprising an initial mine and beneficiation plant to produce a rare earth concentrate, followed by a hydrometallurgy plant at Onslow to produce a mixed-rare earth carbonate. During the year, the company moved towards the commencement of main construction of the mine and beneficiation plant through the completion of early works including site access roads, water infrastructure, an airstrip, communications, and an accommodation village.

### Potash industry challenges

The local potash industry experienced a host of challenges in the last year that included:

- Receivers and Managers being appointed to Kalium Lakes (Kalium), owner and operator of the Beyondie project, in August 2023. After achieving first sales (and revenues) in July 2022.

Beyondie had experienced several technical challenges during its commissioning and ramp up phases (it achieved first sales in July 2022), resulting in production delays and the need for further funding. It was unable to secure additional funding from its lenders.

Administrators for Kalium announced in September 2023 they had entered into an agreement with Agrimin for the sale of Kalium's subsidiaries, which includes Beyondie, only for it to be terminated as Agrimin was unable to satisfy its conditions, including a capital raising.

As of December 2023, Reward Minerals had reached an agreement with Receivers and Managers for acquiring Kalium and its assets.

- Australian Potash announcing on 15 August 2023 a decision to surrender some of its Lake Wells mining leases following a strategic review process as it was unable to secure the funding required for project construction. The holding costs of the mining leases were deemed to be high. The company was subsequently placed into administration in December 2023.

- BCI Minerals reporting increased costs and construction delays relate to the salt component of its Mardie project, resulting in a revised timeframe for the development of and first production from the potash component.

These developments followed the appointment in October 2021 of receivers and managers to Salt Lake Potash after it experienced technical issues during commissioning of its Lake Way project resulting in a revised ramp-up timeframe and a funding shortfall.

Such decisions and challenges are a normal part of operating in the resources sector and have been made based on the financial circumstances of the companies involved.

Despite its recent challenges, WA still has a medium to long-term opportunity to develop a globally significant potash industry focused on specialty and higher-value Sulphate of Potash (SOP) for the Australian and global fertiliser market.

WA has a competitive advantage due to an abundance of potassium sulphate-rich brine lakes from which SOP can be produced via extraction, evaporation, concentration, and purification (by flotation), at lower cost compared with production from Muriate of Potash feedstock.

Compared to most SOP production around the world, the WA industry also has the potential to employ more sustainable practices incorporating renewable energy technologies and less carbon intensive methods of production.

The WA Government has provided, and continues to provide, significant and extensive support to facilitate the development of a local potash sector that has included the Potash Industry Royalty Rebate Scheme, mining lease rent concessions and payment extensions, specific Mining Rehabilitation Fund levy rates, and investments in infrastructure.

## 2.2 Petroleum

The petroleum sector, comprising LNG, condensate, crude oil, domestic gas and LPG production, achieved sales valued at a record \$71 billion in 2022–23.

The sector's share of total mineral and petroleum sales increased to 28 per cent, the highest level in 15 years.

Most of these sales were again from fields in Commonwealth offshore areas of WA with a relatively minor share in onshore areas and coastal waters.

Once again, Japan (36 per cent) was the major buyer of petroleum products from WA, followed by South Korea (14 per cent) and Singapore (13 per cent). China and Taiwan (both 13 per cent) were the other major export destinations.

### A note about petroleum quantity and value

Prior to 2016, DEMIRS received from the Australian Government, for statistical purposes, sales quantity and value data related to offshore fields in WA. This included data on oil and gas projects such as Pyrenees, Varanus Island, Van Gogh, Macedon, Reindeer/Devil Creek, Enfield, and Cliff Head.

Beginning with the March quarter 2016, DEMIRS has used data from EnergyQuest, Woodside Energy and Santos for petroleum quantities for WA, with estimates made of the value of production based on prevailing market prices.

The data for the different periods is not directly comparable.



The major commodities file contains more detailed information, including the:

- Crude oil, LNG, and domestic gas prices.
- Quantity and value of crude oil, condensate, LNG, domestic gas and LPG.
- Petroleum exports by destination.
- Crude oil and condensate production and LNG production in WA compared with the rest of Australia.

## 2.2.1 LNG

### Prices

Gas prices and gas pricing mechanisms vary from region to region around the world.

Almost all of LNG produced in WA is sold into the Asia Pacific region via long-term contracts tied to the price of oil. Local producers are also exposed to LNG spot prices and increasingly so through production at above nameplate capacity.

Australian LNG prices were an average of \$22 per Mmbtu in 2022–23, up 33 per cent compared to 2021–22 and a similar average to 2022.

LNG prices reached a record peak of more than \$28 per Mmbtu in September 2022 as gas supply concerns, particularly in Europe, saw previous importers of now-sanctioned Russian gas seek alternative sources of supply in the Asia Pacific market, while Japan, China and South Korea secured supplies ahead of winter.

Prices subsequently moderated through the first half of 2023 on muted demand and solid inventories in major importing nations.

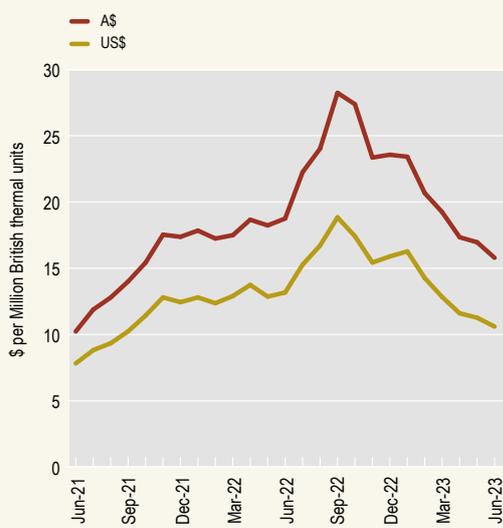


Figure 38 | **LNG monthly average prices**  
Source: Australian Bureau of Statistics

### Quantity and value

LNG was the most valuable petroleum product and second most valuable resource overall with production valued at a record \$56 billion on a combination of record prices and production.

It accounted for 79 per cent of petroleum sales and 22 per cent of the value of all minerals and petroleum production and sales – both record levels.

LNG production was at its highest level on record at 49.7 Mt (2,423 Petajoules (PJ) or 2.39 Trillion cubic feet (Tcf)) in 2022–23 with all WA facilities reporting a year-on-year increase in output.

The result largely reflected the ongoing outperformance of Wheatstone as well as Pluto.

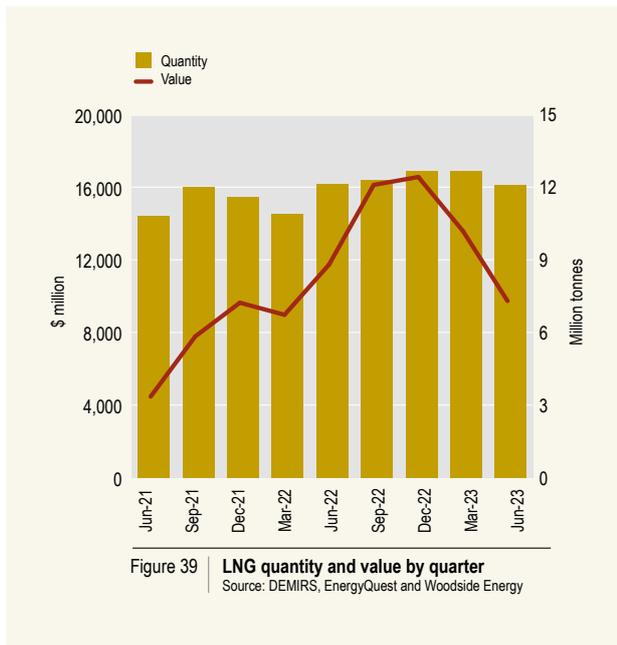
The North West Shelf also performed better via the start-up of the Pluto-Karratha Gas Plant Interconnector and the completion of the Greater Western Flank Phase-3 project.

Gorgon, WA's largest LNG producer, had marginally higher output, but was impacted in the June quarter 2023 by the tie-in of new wells to maintain supply volumes as part of the project extension.

Prelude's output increased with the project enjoying some of its highest levels of production since commissioning during the first half of 2023. This was despite industrial action, which meant the project was shut for most of the September quarter 2022, as well as technical and safety interruptions in the December quarter 2022.

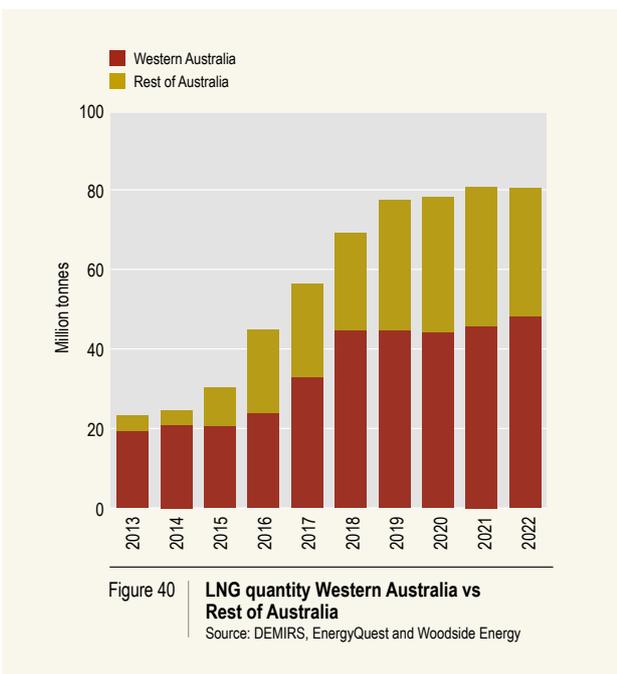
Australia slipped to second place among the world's LNG producers behind Qatar and ahead of the United States. WA accounted for 60 per cent of national production and, taken alone, remained the third largest LNG producers globally.

LPG, which is produced as a by-product of LNG production, was valued at \$720 million (around the same level as recent years) on the highest levels of production in 10 years of 756 kt.



### Notable events

- Woodside Energy reported it is assessing one of the five LNG trains at the North West Shelf project for closure in 2024 as legacy gas fields decline and with limited demand for third-party tolling.
- Chevron produced first gas from the Gorgon Stage Two development in June 2023 to sustain production.
- Woodside Energy made FID in April 2023 on Julimar-Brunello Phase Three, which will tie-back additional production wells to the Wheatstone LNG facility.
- Shell announced in April 2023 the sale of its 27 per cent stake in the Browse JV, lifting BP's stake in the project to 44.33 per cent with the balance held by Woodside Energy, MIMI and PetroChina.
- Woodside Energy completed Phase 2 of the Pyxis Hub in November 2022, tying back the Pyxis, Pluto North and Xena fields to the Pluto offshore platform.
- In December 2022, Western Gas announced it had signed non-binding term sheets with the partners in the North West Shelf and Pluto projects for toll processing of 2 to 3 Mtpa of Equus gas from 2027.
- Waitsia Stage 2 was delayed due to the collapse of its major contractor and labour shortages, with first gas for processing through the North West Shelf revised to mid-2024 (from mid-2023).



## 2.2.2 Crude oil and condensate

### Prices

Average oil prices were fairly stable year-on-year with Brent crude at US\$85 per barrel in 2022–23 and US\$91 per barrel in 2021–22.

After increasing through the first half of 2022 to peak at around US\$120 per barrel in mid-2022, oil prices trended down across the second half of 2022 and first half of 2023 on increasing supplies from major producers including OPEC and stifled demand as a result of concerns about global economic growth amid interest rate rises in the US and China’s property market problems.

By June 2023, oil prices had receded to US\$77 per barrel, around the same level as December 2021 and wiping out the price gains made during the first half of 2022.

Condensate price trends were like those of oil.

### Quantity and value

The value of condensate in 2022–23 was \$8.6 billion – the second highest level of all-time and making it WA’s second most valuable petroleum product and fifth most valuable resource commodity overall (down from fourth the previous financial year due to the rise of lithium).

Condensate production was 11.7 GL or 73.5 million barrels (Mbb), a decrease from 12.1 GL or 76 Mbb) in 2021–22 but still at a historically high level.

This decline largely reflected a fall in output from Inpex Corporation’s Ichthys Floating, Production, Storage and Offloading Facility and the North West Shelf as legacy fields declined.

Prelude’s output increased with the project enjoying some of its highest levels of production since commissioning during the first half of 2023.

Wheatstone and Pluto also had higher condensate production due to outperformance of nameplate capacity.

Crude oil production was valued at \$3.1 billion (down on 2022 and 2021–22), but still high in the context of the last decade.

Oil production was 3.4 GL (31.4 Mbb), the first time it has dropped below 4 GL (25.2 Mbb) in five years and continuing a slow decline from the record levels of 15 to 20 years ago.

This was due largely to the shutdown of Woodside Energy’s Enfield/Vincent with the Ngujima-Yin FPSO departing for planned maintenance in the first half of 2023.

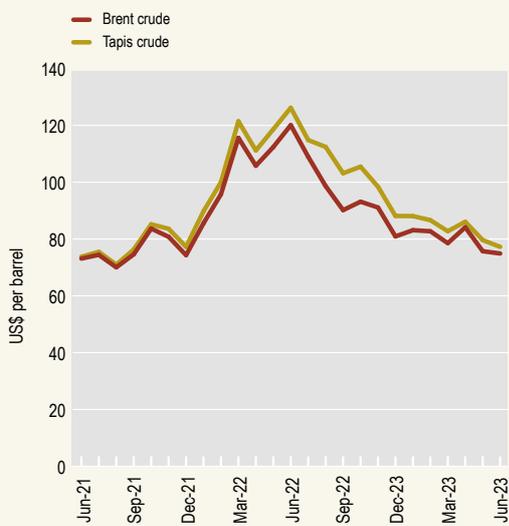


Figure 41 Crude oil monthly average prices  
Source: WA Treasury Corporation

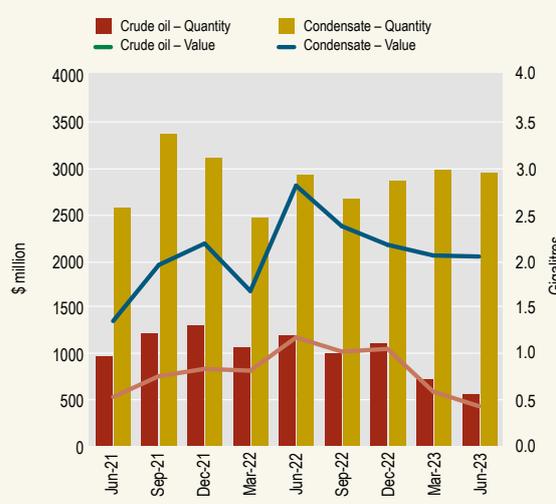
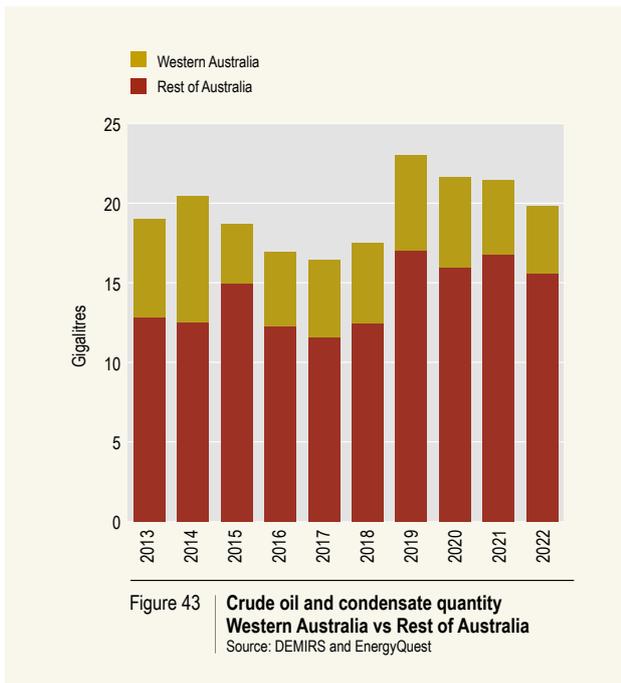


Figure 42 Crude oil and condensate quantity and value by quarter  
Source: DEMIRS and EnergyQuest



Condensate production was more than three times the quantity of oil production in 2022–23, continuing a trend that started around 10 to 15 years ago. Prior to that, oil production had consistently been more than twice the quantity of condensate production.

WA's share of national combined condensate and crude oil production was 78 per cent, around the same level as previous years.

The State remained a relatively minor producer of oil on a world scale, while data was not available to enable a global comparison of condensate production.

#### Notable events

- Buru Energy assumed full ownership of the Ungani project following agreement with Roc Oil for its 50 per cent interest in the September quarter 2023.
- Triangle Energy reached an agreement with Pilot Energy in July 2023 for the sale of the Cliff Head oil field and its associated assets for conversion of the facilities to a Carbon Capture and Sequestration project.
- Jadestone Energy acquired BP's stake in the oil-producing fields of the North West Shelf project in November 2023.

Oil production from most other assets was also lower:

- Santos' Van Gogh was down due to a three-week planned shutdown of the Ningaloo Vision FSPO from mid-September to early-October.
- The North West Shelf project continued to trend down as fields were depleted.
- Woodside Energy's Pyrenees was down, but its output improved considerably following the completion of the Phase 4 infill campaign to increase recoveries from the Crosby and Stickle fields.
- Buru Energy's Ungani was down following the suspension of production and transport operations in January due to the impact of Tropical Cyclone Ellie on its logistics route. Operations resumed in May, only to be suspended again (for just over a week) in July due to rising water levels at the temporary crossing at Fitzroy River.
- Vermillion Energy's Wandoo was offline through the first half of 2023 due to unplanned maintenance.

### 2.2.3 Domestic gas

#### Prices

The average price of WA domestic gas was \$6.23 per gigajoule (GJ) (\$6.57 per Mmbtu) in 2021–22. This is the highest level of record.

The price peaked at an average of \$7.35 per GJ (\$7.75 per Mmbtu) in the March quarter 2023 before easing to \$6.65 per GJ (\$7.02 per Mmbtu) in the June quarter 2023.

Spot prices reportedly exceeded \$10 per GJ during the first half of 2023.

The price increase was reportedly driven by the impending closure of the State’s coal-fired power plants and increased demand from gas-fired generation, supply outages at Varanus Island and Wheatstone, as well as a decline in output from Santos’ Reindeer/ Devil Creek project.

These prices were still considerably lower than on the east coast of Australia, and WA continued to have one of the lowest gas prices in the developed world.

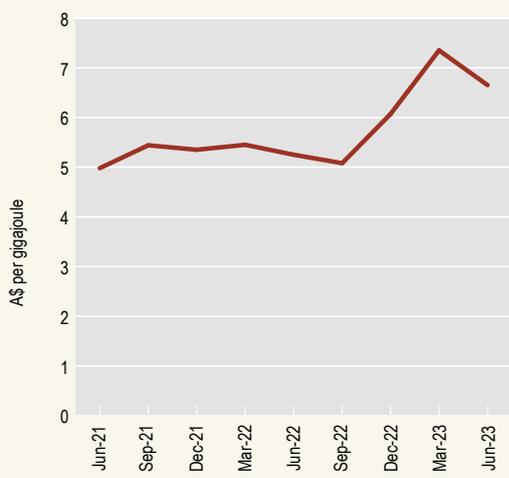


Figure 44 Domestic gas quarterly average price  
Source: DEMIRS, Woodside Energy and Santos

#### A note about domestic gas prices

Prior to 2016, the average domestic gas price was derived from all domestic gas sales into WA.

Beginning with the March quarter 2016, the average domestic gas price was estimated only from domestic gas sales reported to the State Government in relation to the administration of royalties from projects such as the North West Shelf, Waitsia and Beharra Springs.

Over time, the share of domestic gas sales captured through this methodology had diminished considerably.

DEMIRS, therefore, undertook a review of its methodology for deriving a domestic gas price for WA in 2022.

The outcome of the review has been the development of a new domestic gas price and production value series backdated to 2016.

This new data series is reflected in this data publication.

It is based on a broader set of available pricing data including Woodside Energy and Santos published prices, in combination with prices derived from domestic gas sales data reported to the State Government.

Under the new data series, a domestic gas price is applied to a project based on a determination of the best available price, combination of prices, or average prices at any one time.

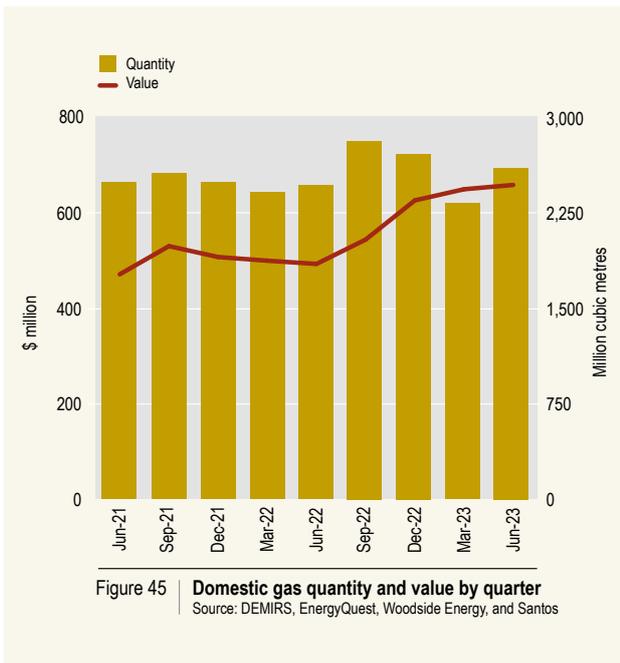
The result is a domestic gas price and production value data series that captures a larger subset of the value of domestic gas sales at any one time.

The data for 2016 and earlier is not directly comparable to the data for the post-2016 period.

This series is also not comparable to the previous domestic gas series published by DEMIRS. The previous price series is available from DEMIRS upon request.

Note that the prices quoted here represent average estimated producer prices, i.e. the sales price at the point of entry of domestic gas into the Dampier to Bunbury Natural Gas Pipeline, or where applicable, the Goldfields Gas Transmission Pipeline or the Parmelia pipeline.

They do not include transport costs, other downstream costs, nor any mark-up paid by customers to wholesalers. They are distinct from other published prices achieved on the spot market or that represent the price paid by gas users.



### Quantity and value

Domestic gas was valued at a record \$2.5 billion on higher prices and production.

The quantity of production was up five per cent to 10.5 billion cubic metres (398 PJ or 0.38 Tcf).

The increase was on account of increased domestic gas volumes from Gorgon and Wheatstone (despite a short-term technical outage), as well as the North West Shelf.

Gorgon became the largest domestic gas project in the State, followed by Wheatstone, Macedon, Varanus Island and Reindeer.

Production from the Perth Basin also grew, reflecting greater demand and uptime at Beach Energy's Beharra Springs.

This offset a major outage at Santos' Varanus Island from mid-November to February (and that resulted in a significant fall in production for the March quarter 2023) due to a leak in the John Brookes pipeline and related repairs as well as water issues at the Spar field.

Production from Santos' Reindeer/Devil Creek also declined with intermittent operations (to manage water levels at the Devil Creek processing facility) as it approaches the end of its life, which is expected in late 2023 or early 2024.

### Notable events

- The WA Government announced in August 2023 that it will not consider exemptions from the WA Domestic Gas Policy for onshore gas developments on the existing pipeline network to export LNG, including those in the Perth Basin, while, for the Canning Basin, a normal application of the WA Domestic Gas Policy applies, which requires developers to make available 15 per cent of exports for the domestic market.
- Santos' Spartan development – a tie-back to Varanus Island – achieved first gas in the June quarter 2023.
- First gas was reported from Strike Energy's Walyering project in September 2023.
- APA Group commissioned and officially opened its Northern Goldfields Interconnector pipeline in July 2023.
- Waitsia Stage 2 was delayed due to the collapse of its major contractor and labour shortages, with first gas for processing through the North West Shelf revised to mid-2024 (from mid-2023) and flow-on effects to domestic gas supply.
- There was notable merger and acquisition activity related to Perth Basin domestic gas assets that included:
  - Hancock Prospecting acquiring Warrego Energy, a 50 per cent owner of West Erregulla (the remaining 50 per cent is owned by Strike Energy), in March 2023.
  - Mineral Resources acquiring Norwest Energy, its minority partner in the Lockyer Deep project, in June 2023.
  - Strike Energy reaching an agreement in August 2023 to acquire Talon Energy, a 45 per cent owner in the Walyering project.

## **Domestic gas developments and forecast supply challenges**

Touted by owner and operator Strike Energy as the first greenfield domestic gas development in WA in 10 years, the Walyering project achieved first gas on 25 September 2023.

The project is based approximately 150km north of Perth, near Cataby in the Mid West, and has the capacity to produce up to 33 terajoules (TJ) of gas per day, of which 20 TJ per day is contracted to Santos in a five-year 36.5 Petajoules supply agreement.

The field is also expected to produce between 150 and 300 barrels per day of condensate.

Walyering represents around three per cent of the WA market as additional supply capacity.

In a further development, Santos announced in the June quarter 2023 it had successfully produced first gas from the Spartan field, which is processed through the Varanus Island facility.

Spartan is expected to add approximately 30 TJ of gas to domestic supply, this largely represents replacement capacity and not additional incremental domestic gas supply.

Inclusive of these and other developments (including West Erregulla from 2025, Scarborough from 2027 and Waitsia Stage 2 from 2029), in broad terms the Australian Energy Market Operator in its annual Western Australian Gas Statement of Opportunities report in December 2022, forecast the WA gas market to experience:

- A small supply deficit until 2026.
- A slight surplus from 2027 through 2029.
- A large deficit (over 200 TJ per day) in 2030 corresponding with the retirement of coal-fired power and the requirement for additional gas generation.

There are potential projects that could help fill the forecast supply gaps after 2026 such as Corvus (from 2028), Lockyer Deep (from 2027) and South Erregulla (from 2026).

A large volume of undeveloped, more speculative gas could also supply the WA domestic market into the future including Chandon, Geryon, Orthrus, Maenad, Spar Deep and Clio-Acme.

## 3 SUPPLEMENTARY INFORMATION

**Table 6. Quantity and value of minerals and petroleum**

| COMMODITY                             | UNIT | 2021-22     |                      | 2022-23     |                       |
|---------------------------------------|------|-------------|----------------------|-------------|-----------------------|
|                                       |      | QUANTITY    | VALUE \$             | QUANTITY    | VALUE \$              |
| <b>ALUMINA AND BAUXITE</b>            |      |             |                      |             |                       |
| Alumina                               | t    | 13,928,030  | 6,695,295,399        | 13,128,592  | 6,681,682,673         |
| Bauxite                               | t    | 397,970     | 13,530,239           | 0           | 0                     |
| <b>TOTAL ALUMINA AND BAUXITE</b>      |      |             | <b>6,708,825,638</b> |             | <b>6,681,682,673</b>  |
| <b>COPPER-LEAD-ZINC</b>               |      |             |                      |             |                       |
| Copper metal                          | t    | 155,526     | 1,897,980,660        | 119,128     | 1,401,042,034         |
| Lead metal                            | t    | 1,266       | 3,968,739            | 12,776      | 39,771,335            |
| Zinc metal                            | t    | 73,971      | 349,507,226          | 62,223      | 265,193,795           |
| <b>TOTAL COPPER-LEAD-ZINC</b>         |      |             | <b>2,251,456,625</b> |             | <b>1,706,007,164</b>  |
| <b>CHROMITE</b>                       | t    | 0           | 0                    | 0           | 0                     |
| <b>CLAYS</b>                          | t    | 29,774      | 2,514,551            | 20,218      | 2,675,589             |
| <b>COAL</b>                           | t    | 5,194,393   | 324,648,262          | 4,772,894   | 375,827,701           |
| <b>COBALT</b>                         | t    | 5,311       | 513,865,812          | 5,863       | 367,597,583           |
| <b>CONSTRUCTION MATERIALS</b>         |      |             |                      |             |                       |
| Aggregate                             | t    | 2,480,214   | 71,513,897           | 2,583,809   | 85,617,476            |
| Gravel                                | t    | 208,677     | 3,223,394            | 381,285     | 3,541,904             |
| Rock                                  | t    | 673,121     | 12,408,414           | 893,575     | 20,843,347            |
| Sand                                  | t    | 4,048,416   | 40,665,536           | 3,685,932   | 39,608,267            |
| <b>TOTAL CONSTRUCTION MATERIALS</b>   |      |             | <b>127,811,241</b>   |             | <b>149,610,993</b>    |
| <b>DIAMONDS</b>                       | ct   | 43,073      | 1,195,627            | 0           | 0                     |
| <b>DIMENSION STONE</b>                | t    | 4,928       | 2,188,481            | 5,612       | 2,697,031             |
| <b>GEM &amp; SEMI-PRECIOUS STONES</b> | kg   | 582,309     | 796,389              | 349,114     | 786,530               |
| <b>GOLD</b>                           | kg   | 214,368     | 17,416,742,801       | 212,465     | 18,591,868,174        |
| <b>GYPSUM</b>                         | t    | 1,303,483   | 30,349,597           | 1,316,774   | 34,828,810            |
| <b>IRON ORE</b>                       | t    | 844,875,395 | 137,215,536,194      | 861,316,804 | 125,052,300,378       |
| <b>LIMESAND-LIMESTONE-DOLOMITE</b>    | t    | 4,819,227   | 50,457,613           | 5,131,467   | 54,277,867            |
| <b>LITHIUM</b>                        |      |             |                      |             |                       |
| Spodumene                             | t    | 2,209,339   | 7,974,201,105        | 3,191,946   | 20,900,021,265        |
| Lithium hydroxide                     | t    | 0           | 0                    | 0           | 0                     |
| <b>TOTAL LITHIUM</b>                  |      |             | <b>7,974,201,105</b> |             | <b>20,900,021,265</b> |
| <b>MANGANESE</b>                      | t    | 537,019     | 321,735,752          | 567,670     | 297,523,476           |

**Table 6. Quantity and value of minerals and petroleum (continued)**

| COMMODITY   | UNIT               | 2021-22    |                        | 2022-23    |                        |
|---|--------------------|------------|------------------------|------------|------------------------|
|   |                    | QUANTITY   | VALUE \$               | QUANTITY   | VALUE \$               |
| <b>MINERAL SANDS</b>  |                    |            |                        |            |                        |
| Garnet  | t                  | 374,476    | nfp                    | 343,580    | 113,695,319            |
| Ilmenite  | t                  | 233,085    | 81,218,391             | 236,400    | 92,551,540             |
| Leucoxene   | t                  | 16,845     | 18,989,519             | 19,848     | 29,411,241             |
| Rutile  | t                  | 67,778     | 97,076,235             | 87,805     | 134,324,833            |
| Zircon  | t                  | 285,677    | 610,022,457            | 192,930    | 513,700,409            |
| Synthetic rutile  | t                  | 281,991    | 454,785,752            | 282,240    | 517,025,576            |
| Other (may include garnet, staurolite and monazite)   | t                  |            | 125,658,335            |            | 598,023                |
| <b>TOTAL MINERAL SANDS</b>  |                    |            | <b>1,387,750,689</b>   |            | <b>1,401,306,941</b>   |
| <b>NICKEL</b>   | t                  | 147,184    | 4,817,217,347          | 160,371    | 5,743,187,936          |
| <b>PETROLEUM</b>  |                    |            |                        |            |                        |
| Condensate  | kl                 | 12,077,963 | 8,617,402,787          | 11,683,595 | 8,641,078,360          |
| Crude oil   | kl                 | 4,838,370  | 3,581,099,378          | 3,446,220  | 3,095,107,798          |
| LNG   | t                  | 46,604,533 | 38,396,791,289         | 49,679,278 | 56,266,631,142         |
| LPG – butane and propane  | t                  | 687,493    | 717,264,839            | 756,334    | 720,519,013            |
| Domestic gas  | '000m <sup>3</sup> | 9,952,573  | 2,033,544,818          | 10,476,376 | 2,481,976,961          |
| <b>TOTAL PETROLEUM</b>  |                    |            | <b>53,346,103,111</b>  |            | <b>71,205,313,275</b>  |
| <b>PLATINUM GROUP ELEMENTS</b>  | kg                 | 459        | 38,985,835             | 568        | 41,321,184             |
| <b>POTASH</b>   |                    | 0          | 0                      | 5,954      | nfp                    |
| <b>RARE EARTHS</b>  | kg                 | 29,977,164 | 778,672,985            | 30,591,770 | nfp                    |
| <b>SALT</b>   | t                  | 11,646,755 | 557,530,879            | 11,592,184 | 714,153,622            |
| <b>SILICA SANDS</b>   | t                  | 952,776    | 17,760,841             | 1,224,713  | 23,945,891             |
| <b>SILVER</b>   | kg                 | 158,367    | 158,039,541            | 115,205    | 119,546,844            |
| <b>TIN AND TANTALUM</b>   |                    |            |                        |            |                        |
| Tantalite   | t                  | 216        | nfp                    | 36         | nfp                    |
| Tin Metal   | t                  | 68         | nfp                    | 68         | nfp                    |
| <b>TOTAL TIN AND TANTALUM</b>   |                    |            | <b>43,501,503</b>      |            | <b>10,572,617</b>      |
| <b>OTHER<br/>(May include Rare Earths, Manganese,<br/>Potash, Spongolite, Talc, and Cesium)</b> |                    |            | 15,266,677             |            | 631,945,571            |
| <b>TOTAL MINERALS</b>   |                    |            | <b>180,757,051,984</b> |            | <b>182,903,685,840</b> |
| <b>TOTAL MINERALS AND PETROLEUM</b>   |                    |            | <b>234,103,155,096</b> |            | <b>254,108,999,115</b> |

**Table 7. Value of minerals and petroleum by region by commodity 2022–23**

| REGION                                     | Value \$              |
|--|-----------------------|
| <b>Gascoyne</b>                            |                       |
| Salt                                       | 135,396,496           |
| Gypsum, mineral sands and spongolite       | 76,849,481            |
| Construction materials                     | 2,198,951             |
| Gem and semi precious stones               | 632,737               |
| Limesand limestone                         | 444,482               |
| <b>Gascoyne Total</b>                      | <b>215,522,147</b>    |
| <b>Goldfields-Esperance</b>                |                       |
| Gold                                       | 12,583,296,993        |
| Nickel                                     | 5,174,541,319         |
| Spodumene and tantalum pentoxide           | 3,512,461,553         |
| Potash and rare earth oxide                | 617,311,772           |
| Cobalt                                     | 338,557,676           |
| Copper, lead and zinc                      | 274,342,614           |
| Iron ore, palladium and platinum           | 194,351,646           |
| Silver                                     | 50,836,930            |
| Construction materials and dimension stone | 30,891,273            |
| Limesand limestone                         | 12,749,980            |
| Gypsum                                     | 2,731,243             |
| <b>Goldfields-Esperance Total</b>          | <b>22,792,072,999</b> |
| <b>Great Southern</b>                      |                       |
| Limesand limestone, spongolite and silica  | 9,682,463             |
| <b>Great Southern Total</b>                | <b>9,682,463</b>      |
| <b>Kimberley</b>                           |                       |
| Iron ore, cobalt and nickel                | 689,647,357           |
| Copper, gold and silver                    | 106,002,788           |
| Construction materials                     | 17,292,909            |
| Crude oil and dimension stone              | 15,447,701            |
| <b>Kimberley Total</b>                     | <b>828,390,755</b>    |

| REGION                                     | Value \$               |
|--|------------------------|
| <b>Mid West</b>                            |                        |
| Gold                                       | 1,973,055,193          |
| Iron ore                                   | 1,255,439,413          |
| Copper                                     | 515,072,959            |
| Mineral sands                              | 251,631,722            |
| Lead and zinc                              | 220,512,662            |
| Natural gas and crude oil                  | 123,179,031            |
| Manganese ore and talc                     | 48,957,193             |
| Silver                                     | 39,493,560             |
| Limesand limestone                         | 2,647,711              |
| Clays                                      | 1,183,260              |
| Gypsum                                     | 716,213                |
| Construction materials                     | 408,341                |
| Gem and semi precious stones               | 30,138                 |
| <b>Mid West Total</b>                      | <b>4,432,327,396</b>   |
| <b>Peel</b>                                |                        |
| Alumina                                    | 6,681,682,673          |
| Copper, gold and silver                    | 2,779,172,384          |
| <b>Peel Total</b>                          | <b>9,460,855,057</b>   |
| <b>Perth Metropolitan</b>                  |                        |
| Limesand limestone                         | 30,053,457             |
| Construction materials and silica          | 26,955,509             |
| <b>Perth Metropolitan Total</b>            | <b>57,008,966</b>      |
| <b>Pilbara</b>                             |                        |
| Iron ore                                   | 122,151,082,656        |
| Spodumene                                  | 5,413,466,036          |
| Gold                                       | 1,200,568,081          |
| Salt                                       | 567,593,173            |
| Copper and manganese ore                   | 438,806,256            |
| Crude oil and gem and semi precious Stones | 174,190,935            |
| Construction materials                     | 81,517,809             |
| Silver                                     | 6,585,571              |
| Tantalum pentoxide                         | 3,039,695              |
| Dimension stone                            | 1,409,867              |
| <b>Pilbara Total</b>                       | <b>130,038,260,079</b> |

**Table 7. Value of minerals and petroleum by region by commodity 2022–23 (continued)**

| <b>REGION</b>                     | <b>Value \$</b>        |
|-----------------------------------|------------------------|
| <b>South West</b>                 |                        |
| Tin tantalum lithium              | 11,981,626,598         |
| Coal                              | 375,827,701            |
| Mineral sands                     | 111,902,980            |
| Limesand limestone                | 3,058,066              |
| Construction materials            | 335,747                |
| Dimension stone                   | 198,562                |
| <b>South West Total</b>           | <b>12,472,949,654</b>  |
| <b>Wheatbelt</b>                  |                        |
| Iron ore, cobalt and nickel       | 1,400,787,014          |
| Mineral sands                     | 980,517,552            |
| Gold                              | 491,947,451            |
| Gypsum                            | 11,861,649             |
| Salt                              | 11,163,953             |
| Construction materials and silica | 5,752,412              |
| Limesand limestone                | 5,091,396              |
| Clays                             | 1,492,329              |
| Silver                            | 675,499                |
| <b>Wheatbelt Total</b>            | <b>2,909,289,255</b>   |
| <b>Offshore</b>                   |                        |
| Liquefied natural gas             | 56,266,631,142         |
| Condensate                        | 8,641,078,360          |
| Crude oil                         | 2,874,591,452          |
| Natural gas                       | 2,389,820,375          |
| LPG Butane and propane            | 720,519,013            |
| <b>Offshore Total</b>             | <b>70,892,640,343</b>  |
| <b>Grand Total</b>                | <b>254,108,999,116</b> |

**Table 8. Value of minerals and petroleum by region by local government area 2022–23**

| REGION                             | Value \$              |
|------------------------------------|-----------------------|
| <b>Gascoyne Region</b>             |                       |
| Carnarvon                          | 113,263,726           |
| Shark Bay                          | 99,938,259            |
| Exmouth                            | 2,319,482             |
| Upper Gascoyne                     | 680                   |
| <b>Gascoyne Total</b>              | <b>215,522,147</b>    |
| <b>Goldfields-Esperance Region</b> |                       |
| Laverton                           | 5,464,011,369         |
| Coolgardie                         | 5,248,543,906         |
| Leonora                            | 4,179,746,465         |
| Kalgoorlie-Boulder                 | 2,224,534,077         |
| Ravensthorpe                       | 1,854,112,597         |
| Menzies                            | 1,608,262,034         |
| Wiluna                             | 1,163,689,894         |
| Dundas                             | 1,047,045,842         |
| Esperance                          | 2,126,815             |
| <b>Goldfields-Esperance Total</b>  | <b>22,792,072,999</b> |
| <b>Great Southern Region</b>       |                       |
| Albany, Denmark and Plantagenet    | 9,682,463             |
| <b>Great Southern Total</b>        | <b>9,682,463</b>      |
| <b>Kimberley Region</b>            |                       |
| Derby-West Kimberley               | 468,695,581           |
| Halls Creek                        | 343,226,810           |
| Broome                             | 12,718,699            |
| Wyndham-East Kimberley             | 3,749,665             |
| <b>Kimberley Total</b>             | <b>828,390,755</b>    |
| <b>Mid West Region</b>             |                       |
| Meekatharra                        | 1,100,277,684         |
| Perenjori                          | 1,061,504,692         |
| Yalgoo                             | 766,095,816           |
| Cue                                | 745,276,618           |
| Mt Magnet                          | 274,207,831           |
| Carnamah                           | 129,156,241           |
| Irwin                              | 124,766,249           |
| Northampton                        | 122,817,902           |
| Sandstone and Three Springs        | 105,150,138           |
| Coorow                             | 1,840,016             |
| Murchison                          | 1,234,209             |
| <b>Mid West Total</b>              | <b>4,432,327,396</b>  |
| <b>Peel Region</b>                 |                       |
| Boddington and Murray              | 9,460,855,057         |
| <b>Peel Total</b>                  | <b>9,460,855,057</b>  |

| REGION                              | Value \$               |
|-------------------------------------|------------------------|
| <b>Perth Metropolitan Region</b>    |                        |
| Swan                                | 19,241,057             |
| Wanneroo                            | 19,062,844             |
| Cockburn                            | 17,743,859             |
| Kwinana                             | 961,206                |
| <b>Perth Metropolitan Total</b>     | <b>57,008,966</b>      |
| <b>Pilbara Region</b>               |                        |
| Ashburton                           | 62,808,944,053         |
| East Pilbara                        | 61,747,394,067         |
| Karratha                            | 3,987,566,193          |
| Port Hedland                        | 1,494,355,766          |
| <b>Pilbara Total</b>                | <b>130,038,260,079</b> |
| <b>South West Region</b>            |                        |
| Bridgetown-Greenbushes              | 11,981,626,598         |
| Collie                              | 375,827,701            |
| Busselton                           | 111,902,980            |
| Augusta-Margaret River and Manjimup | 3,058,066              |
| Harvey                              | 314,847                |
| Donnybrook-Balingup                 | 219,462                |
| <b>South West Total</b>             | <b>12,472,949,654</b>  |
| <b>Wheatbelt Region</b>             |                        |
| Yilgarn                             | 1,289,768,066          |
| Dandaragan                          | 822,997,924            |
| Kondinin                            | 361,386,925            |
| Narabreen and Wickepin              | 184,170,527            |
| Gingin                              | 165,586,261            |
| Westonia                            | 71,717,347             |
| Dowerin and Moora                   | 5,102,448              |
| Lake Grace                          | 3,838,817              |
| Dalwallinu                          | 2,324,388              |
| Koorda                              | 1,183,973              |
| Wyalkatchem                         | 677,820                |
| Kellerberrin and Northam            | 534,759                |
| <b>Wheatbelt Total</b>              | <b>2,909,289,255</b>   |
| <b>Offshore Region</b>              |                        |
| <b>Offshore Total</b>               | <b>70,892,640,343</b>  |
| <b>Grand Total</b>                  | <b>254,108,999,116</b> |

**Table 9. FTE employment in mining by commodity and mineral exploration**

| <b>Commodity</b>                            | <b>2018-19</b> | <b>2019-20</b> | <b>2020-21</b> | <b>2021-22</b> | <b>2022-23</b> |
|---|----------------|----------------|----------------|----------------|----------------|
| Alumina and bauxite                         | 6,924          | 6,765          | 6,840          | 6,733          | 6,995          |
| Coal  | 711            | 700            | 642            | 675            | 824            |
| Construction materials                      | 766            | 706            | 675            | 767            | 884            |
| Copper-lead-zinc                            | 2,256          | 2,075          | 1,894          | 2,072          | 1,994          |
| Diamond                                     | 836            | 618            | 276            | 256            | 357            |
| Gold  | 25,660         | 26,287         | 28,419         | 30,764         | 29,257         |
| Iron ore                                    | 45,116         | 52,321         | 60,488         | 59,724         | 61,203         |
| Lithium                                     | 4,855          | 2,563          | 1,846          | 3,801          | 8,092          |
| Mineral sands                               | 2,053          | 1,957          | 1,870          | 2,419          | 2,896          |
| Nickel                                      | 6,232          | 7,500          | 7,553          | 8,301          | 9,839          |
| Salt  | 614            | 645            | 622            | 824            | 999            |
| Other                                       | 2,253          | 2,278          | 2,793          | 2,701          | 3,141          |
| <b>Total Mining</b>                         | <b>98,278</b>  | <b>104,416</b> | <b>113,919</b> | <b>119,039</b> | <b>126,481</b> |
| <b>Mineral Exploration</b>                  | <b>2,859</b>   | <b>3,355</b>   | <b>4,170</b>   | <b>4,680</b>   | <b>4,195</b>   |
| <b>Total Mining and Mineral Exploration</b> | <b>101,137</b> | <b>107,771</b> | <b>118,089</b> | <b>123,719</b> | <b>130,676</b> |

**Table 10. FTE employment in mining by LGA**

| Region and Local Government Area  | 2021-22       | 2022-23       |
|-----------------------------------|---------------|---------------|
| <b>Pilbara</b>                    |               |               |
| Ashburton                         | 18,561        | 16,309        |
| East Pilbara                      | 33,017        | 36,118        |
| Karratha                          | 5,797         | 6,282         |
| Port Hedland                      | 4,106         | 5,330         |
| <b>Pilbara Total</b>              | <b>61,480</b> | <b>64,039</b> |
| <b>Goldfields-Esperance</b>       |               |               |
| Coolgardie                        | 3,323         | 4,434         |
| Dundas                            | 1,075         | 1,229         |
| Esperance                         | 148           | 28            |
| Kalgoorlie-Boulder                | 5,686         | 6,306         |
| Laverton                          | 6,921         | 6,552         |
| Leonora                           | 5,466         | 6,803         |
| Menzies                           | 3,074         | 2,916         |
| Ngaanyatjarraku                   | 0             | 175           |
| Ravensthorpe                      | 1,313         | 1,361         |
| Wiluna                            | 3,158         | 3,292         |
| <b>Goldfields-Esperance Total</b> | <b>30,164</b> | <b>33,097</b> |
| <b>Peel</b>                       |               |               |
| Boddington                        | 1,880         | 1,891         |
| Mandurah                          | 1             | 1             |
| Murray                            | 2,158         | 2,294         |
| Serpentine-Jarrahdale             | 114           | 108           |
| Waroona                           | 1,135         | 1,264         |
| <b>Peel Total</b>                 | <b>5,287</b>  | <b>5,557</b>  |
| <b>Mid West</b>                   |               |               |
| Carnamah                          | 136           | 144           |
| Chapman Valley                    | 0             | 0             |
| Coorow                            | 3             | 4             |
| Cue                               | 918           | 672           |
| Greater Geraldton                 | 349           | 319           |
| Irwin                             | 35            | 32            |
| Meekatharra                       | 2,422         | 2,343         |
| Morawa                            | 0             | 0             |
| Mount Magnet                      | 766           | 309           |
| Murchison                         | 2             | 2             |
| Northampton                       | 160           | 211           |
| Perenjori                         | 1,550         | 1,764         |
| Sandstone                         | 97            | 118           |
| Three Springs                     | 18            | 18            |
| Yalgoo                            | 1,684         | 1,705         |
| <b>Mid West Total</b>             | <b>8,140</b>  | <b>7,639</b>  |

| Region and Local Government Area | 2021-22      | 2022-23      |
|----------------------------------|--------------|--------------|
| <b>South West</b>                |              |              |
| Augusta-Margaret River           | 8            | 5            |
| Bridgetown-Greenbushes           | 299          | 381          |
| Bunbury                          | 869          | 1,505        |
| Busselton                        | 55           | 66           |
| Capel                            | 356          | 379          |
| Collie                           | 2,303        | 2,423        |
| Dardanup                         | 0            | 0            |
| Donnybrook-Balingup              | 3            | 1            |
| Harvey                           | 728          | 761          |
| <b>South West Total</b>          | <b>4,623</b> | <b>5,520</b> |
| <b>Perth</b>                     |              |              |
| Armadale                         | 95           | 99           |
| Belmont                          | 96           | 115          |
| Canning                          | 0            | 0            |
| Cockburn                         | 18           | 11           |
| Fremantle                        | 3            | 2            |
| Gosnells                         | 126          | 106          |
| Kwinana                          | 1,561        | 2,010        |
| Mundaring                        | 8            | 8            |
| Rockingham                       | 607          | 641          |
| Stirling                         | 0            | 0            |
| Swan                             | 98           | 111          |
| Wanneroo                         | 106          | 86           |
| <b>Perth Total</b>               | <b>2,716</b> | <b>3,190</b> |

**Table 10. FTE employment in mining by LGA (continued)**

| Region and Local Government Area | 2021-22      | 2022-23      |
|----------------------------------|--------------|--------------|
| <b>Wheatbelt</b>                 |              |              |
| Brookton                         | 0            | 0            |
| Chittering                       | 192          | 189          |
| Cunderdin                        | 0            | 0            |
| Dalwallinu                       | 2            | 2            |
| Dandaragan                       | 596          | 647          |
| Dowerin                          | 0            | 0            |
| Gingin                           | 222          | 196          |
| Goomalling                       | 0            | 0            |
| Kellerberrin                     | 10           | 12           |
| Kondinin                         | 282          | 291          |
| Koorda                           | 1            | 1            |
| Lake Grace                       | 193          | 206          |
| Moora                            | 13           | 15           |
| Mount Marshall                   | 3            | 4            |
| Narembeen                        | 173          | 135          |
| Narrogin                         | 2            | 1            |
| Northam                          | 78           | 82           |
| Toodyay                          | 20           | 15           |
| Wagin                            | 0            | 0            |
| West Arthur                      | 0            | 0            |
| Westonia                         | 295          | 267          |
| Wickepin                         | 21           | 21           |
| Wyalkatchem                      | 0            | 0            |
| Yilgarn                          | 2,240        | 2,549        |
| <b>Wheatbelt Total</b>           | <b>4,344</b> | <b>4,634</b> |
| <b>Kimberley</b>                 |              |              |
| Broome                           | 83           | 319          |
| Derby-West Kimberley             | 678          | 652          |
| Halls Creek                      | 545          | 527          |
| Wyndham-East Kimberley           | 294          | 357          |
| <b>Kimberley Total</b>           | <b>1,600</b> | <b>1,854</b> |

| Region and Local Government Area | 2021-22        | 2022-23        |
|----------------------------------|----------------|----------------|
| <b>Gascoyne</b>                  |                |                |
| Carnarvon                        | 138            | 174            |
| Exmouth                          | 3              | 3              |
| Shark Bay                        | 359            | 478            |
| Upper Gascoyne                   | 1              | 143            |
| <b>Gascoyne Total</b>            | <b>501</b>     | <b>799</b>     |
| <b>Great Southern</b>            |                |                |
| Albany                           | 23             | 24             |
| Cranbrook                        | 0              | 0              |
| Denmark                          | 1              | 0              |
| Jerramungup                      | 0              | 1              |
| Plantagenet                      | 11             | 9              |
| Woodanilling                     | 0              | 0              |
| <b>Great Southern Total</b>      | <b>34</b>      | <b>34</b>      |
| <b>Grand Total</b>               | <b>118,890</b> | <b>126,364</b> |

**Table 11. Royalties by region 2021–23**

|                                 | <b>2021-22</b>    | <b>2022-23</b>    |
|---------------------------------|-------------------|-------------------|
| <b>REGION</b>                   | <b>\$ million</b> | <b>\$ million</b> |
| Pilbara                         | 10,747.40         | 9,513.68          |
| Goldfields–Esperance            | 479.87            | 648.83            |
| Peel                            | 168.05            | 183.32            |
| Mid West                        | 206.69            | 168.99            |
| Great Southern                  | 0.23              | 0.31              |
| Wheatbelt                       | 143.30            | 130.84            |
| Kimberley                       | 14.72             | 35.50             |
| South West                      | 101.70            | 537.16            |
| Gascoyne                        | 1.18              | 2.92              |
| Perth Metropolitan and offshore | 5.57              | 6.18              |
| <b>Total Royalty Receipts</b>   | <b>11,868.69</b>  | <b>11,227.74</b>  |

**Table 12. Principal mining projects 2022–23**

| Principal mining projects                |                 |  |
|--|-----------------|--|
| Company                                  | Projects        | Comments   |
| <b>Bauxite</b>                           |                 |  |
| <b>Alcoa World Alumina and Chemicals</b> | Huntly          | Alcoa World Alumina and Chemicals is a joint venture of Alcoa Corporation (60 per cent) and Alumina (40 per cent).   |
|  | Willowdale      |  |
| <b>South32</b>                           | Boddington      |  |
| <b>Coal</b>                              |                 |  |
| <b>Griffin Coal Mining Company</b>       | Griffin         | Receivers and managers were appointed to the Griffin Coal Mining Company in September 2022.  |
| <b>Yancoal</b>                           | Premier         |  |
| <b>Copper-Lead-Zinc</b>                  |                 |  |
| <b>29Metals</b>                          | Golden Grove    |  |
| <b>Aeris Resources</b>                   | Jaguar          | Aeris Resources acquired Round Oak Minerals, the former owner of Jaguar, in July 2022. It announced in September 2023 that it was to suspend production and place the project into care and maintenance.   |
| <b>Abra Mining</b>                       | Abra            | A new project with first production and shipment in March 2023. Abra Mining is owned by Galena Mining (60 per cent) and Toho Zinc Co. (40 per cent).   |
| <b>Sandfire Resources</b>                | DeGrussa        | Mining at DeGrussa was completed in October 2022 with processing operations continuing until the project transitioned into care and maintenance in late June 2023.   |
| <b>Gold</b>                              |                 |  |
| <b>AngloGold Ashanti</b>                 | Sunrise Dam     |  |
|  | Tropicana       | Tropicana is owned by a joint venture of AngloGold Ashanti (70 per cent) and Regis Resources (30 per cent).  |
| <b>Aurene Group Mining</b>               | Parker Range    | A re-started project with sales commencing in October 2022 and completed in June 2023.   |
| <b>Barto Gold Mining</b>                 | Southern Cross  | Minjar Gold manages the Southern Cross project on behalf of Barton Gold.   |
| <b>Beacon Minerals</b>                   | Jaurdi          |  |
| <b>Catalyst Metals</b>                   | Plutonic        | Catalyst Metals acquired Superior Gold Inc., the previous owner of the Plutonic project, in June 2023.   |
| <b>Calidus Resources</b>                 | Warawoona       |  |
| <b>Capricorn Metals</b>                  | Karlawinda      |  |
| <b>Evolution Mining</b>                  | Mungari         | Includes Mungari and Kundana.  |
| <b>FMR Investments</b>                   | Gordon - Sirdar |  |
|  | Hawkins Find    |  |
| <b>Focus Minerals</b>                    | Coolgardie      | A re-started project. Recent production and sales were from the toll treating of historically stockpiled low-grade materials and the Big Blow small-scale operations which were completed during the December quarter 2022. Further sales of low-grade stockpiles from toll treating were undertaken in the June quarter 2023. |

**Table 12. Principal mining projects 2022–23 cont.**

| <b>Principal mining projects</b> |                          |  |
|----------------------------------|--------------------------|--|
| <b>Company</b>                   | <b>Projects</b>          | <b>Comments</b>  |
| <b>Genesis Minerals</b>          | Mt Morgans               | Mining at Mt Morgans was discontinued in June 2022 with the processing of stockpiles and historical materials continuing until the complete suspension of operations in April 2023. Genesis Minerals acquired the previous owner of Mt Morgans, Dacian Gold, in November 2023. |
|                                  | Gwalia                   | Genesis Minerals acquired Gwalia from St Barbara in June 2023.   |
| <b>Gold Fields</b>               | Agnew                    |  |
|                                  | Granny Smith             |  |
|                                  | Gruyere                  | Gruyere is a joint venture of Gold Fields (50 per cent) and Gold Road Resources (50 per cent).   |
|                                  | St Ives                  |  |
| <b>Greenstone Resources</b>      | Burbanks                 | A re-started project with short-term trial mining undertaken under a joint venture between Greenstone Resources and FMR Investments.   |
| <b>Karora Resources</b>          | Beta Hunt                |  |
|                                  | Higginsville             | Includes Higginsville, Spargos Reward, and Polar Bear.   |
| <b>Linden Gold Alliance</b>      | Second Fortune           | This project was renamed from Linden.  |
| <b>Lukah Mining</b>              | The Mount                | A re-started project.  |
| <b>Newmont Corporation</b>       | Boddington               |  |
|                                  | Telfer                   | Newmont Corporation acquired Newcrest Mining, the previous owner of the Telfer project, in November 2023.  |
| <b>Northern Star Resources</b>   | Carosue Dam              | Part of the Kalgoorlie production centre. Includes Carosue Dam, Porphyry and Deep South.   |
|                                  | Jundee                   | Part of the Yandal production centre.  |
|                                  | Kanowna Belle            | Part of the Kalgoorlie production centre. Includes Golden Valley and Golden Feather.   |
|                                  | South Kalgoorlie         | Part of the Kalgoorlie production centre.  |
|                                  | Super Pit / Mt Charlotte | Part of the Kalgoorlie production centre.  |
|                                  | Thunderbox               | Part of the Yandal production centre.  |
|                                  | Bronzewing               | Part of the Yandal production centre. The first ores from Bronzewing were processed in the June quarter 2023.  |
| <b>Norton Gold Fields</b>        | Paddington               | Norton Gold Fields is a subsidiary of Zijin Mining. Includes Paddington, Binduli, and Rose Dam.  |
| <b>Novo Resources</b>            | Beatons Creek            | Includes Nullagine. Mining was completed in August 2022 followed by a phased wind-down of operational activities completed by the end of October 2022.   |
| <b>Ora Banda Mining</b>          | Davyhurst                |  |
| <b>Pantoro</b>                   | Halls Creek              | The Halls Creek project was wound down and eventually placed on care and maintenance in June 2023.   |
|                                  | Norseman                 | Re-started project. A first gold pour was achieved in October 2022.  |

**Table 12. Principal mining projects 2022–23 cont.**

| <b>Principal mining projects</b>       |                   |  |
|--|-------------------|--|
| <b>Company</b>                         | <b>Projects</b>   | <b>Comments</b>  |
| <b>Ramelius Resources</b>              | Edna May          | Part of the Edna May production centre.  |
|  | Marda             | Part of the Edna May production centre.  |
|  | Mt Magnet         | Part of the Mt Magnet production centre.   |
|  | Penny             | Part of the Mt Magnet production centre.   |
|  | Tampia            | Part of the Edna May production centre. Mining operations at Tampie were completed in May 2023.  |
|  | Vivien            | Part of the Mt Magnet production centre. The mine was placed into care and maintenance in January 2023.  |
| <b>Red 5</b>                           | Darlot            | Includes Darlot and Great Western.   |
|  | King of the Hills |  |
| <b>Regis Resources</b>                 | Duketon           | Includes Duketon and Garden Well.  |
| <b>Silver Lake Resources</b>           | Deflector         |  |
|  | Mt Monger         | Includes Mt Monger and Aldiss.   |
| <b>Spartan Resources</b>               | Dalgaranga        | Mining and processing operations at the Dalgaranga project were suspended in November 2022. The owner of Dalgaranga changed its name from Gascoyne Resources to Spartan Resources in August 2023.  |
| <b>Westgold Resources</b>              | Murchison         | Includes Cue and Meekatharra.  |
|  | Bryah             | Includes Fortnum.  |
| <b>Wiluna Mining</b>                   | Wiluna            | Wiluna Mining entered voluntary administration in July 2022 and was subsequently under the control of FTI Consulting. Mining operations at Wiluna ceased in December 2022 with the processing of low-grade stockpiles continuing to February 2023 and the reprocessing of tailings commencing from March 2023. |
| <b>Iron ore</b>                        |                   |  |
| <b>Atlas Iron</b>                      | Miralga Creek     | Atlas Iron is a subsidiary of Hancock Prospecting.   |
|  | Mt Webber         |  |
|  | Sanjiv Ridge      |  |
| <b>BCI Minerals</b>                    | Iron Valley       | Iron Valley is 100 per cent owned by BCI Minerals and operated by Mineral Resources. It is part of Mineral Resources' Pilbara Hub.   |
| <b>BHP</b>                             | Jimblebar         |  |
|  | Mining Area C     | Includes the South Flank mine.   |
|  | Newman            | Includes the Newman East and Newman West mines.  |
|  | Yandi             |  |
| <b>CITIC Pacific Mining Management</b> | Sino Iron         |  |
| <b>Fenix Resources</b>                 | Iron Ridge        |  |

**Table 12. Principal mining projects 2022–23 cont.**

| <b>Principal mining projects</b>     |                                     |  |
|--------------------------------------|-------------------------------------|--|
| <b>Company</b>                       | <b>Projects</b>                     | <b>Comments</b>  |
| <b>Fortescue</b>                     | Chichester                          | Includes the Cloudbreak and Christmas Creek mines.   |
|                                      | Solomon                             | Includes the Firetail, Kings Valley and Queens Valley mines.   |
|                                      | Western                             | Includes the Eliwana mine.   |
| <b>GWR Group</b>                     | Wiluna West                         | Wiluna West is wholly owned by GWR Group. It includes the C4 (operated by Gold Valley Group) and JWD (operated by CuFe) mines. The JWD mine was temporarily suspended between October and December 2022. |
| <b>Hancock Prospecting</b>           | Roy Hill                            |  |
| <b>Karara Mining</b>                 | Karara                              | Karara Mining is a subsidiary of Ansteel Group Corporation.  |
| <b>Mineral Resources</b>             | Carina                              | The Carina, Koolyanobbing, and Parker Range projects are part of Mineral Resources' Yilgarn Hub.   |
|                                      | Koolyanobbing                       |  |
|                                      | Parker Range                        |  |
|                                      | Wonmunna                            | The Wonmunna project is part of Mineral Resources' Pilbara Hub.  |
| <b>Mount Gibson Iron</b>             | Koolan Island                       |  |
| <b>Rio Tinto</b>                     | Brockman 2 – Nammuldi – Silvergrass |  |
|                                      | Brockman 4                          |  |
|                                      | Greater Paraburdoo                  | Includes the Channar, Paraburdoo and Eastern Ranges mines.   |
|                                      | Gudai-Darri                         |  |
|                                      | Hope Downs                          | Includes the Hope Downs 1 and 4 mines.   |
|                                      | Marandoo                            |  |
|                                      | Mount Tom Price                     |  |
|                                      | Robe Valley                         | Includes the Mesa A and Mesa J mines.  |
|                                      | West Angelas                        |  |
| Yandicoogina                         |                                     |  |
| <b>Sinosteel Midwest Corporation</b> | Blue Hills                          | Operated by Kimberley Metals Group.  |
| <b>Strike Resources</b>              | Paulsens East                       | A new project. The Paulsens East project was suspended in September 2022 after the completion of a maiden shipment.  |

**Table 12. Principal mining projects 2022–23 cont.**

| <b>Principal mining projects</b> |  |   |
|----------------------------------|--|---|
| <b>Company</b>                   | <b>Projects</b>  | <b>Comments</b>   |
| <b>Lithium</b>                   |  |   |
| <b>Allkem</b>                    | Mt Cattlin   |   |
| <b>Mineral Resources</b>         | Bald Hill  | Mineral Resources acquired the Bald Hill project and its related companies in November 2023.  |
|                                  | Mount Marion   | Mount Marion is owned under a Joint Venture between Mineral Resources (50 per cent) and Jiangxi Ganfeng Lithium Co., (50 per cent). The project is operated by Mineral Resources.   |
|                                  | Wodgina  | Wodgina is owned by the MARBL joint venture, with Mineral Resources holding a 50 per cent interest and Albemarle Corporation holding a 50 per cent interest. The project is operated by Mineral Resources.  |
| <b>Pilbara Minerals</b>          | Pilgangoora  |   |
| <b>Talison Lithium</b>           | Greenbushes Lithium  | Talison Lithium Australia is a joint venture of Tianqi Lithium and IGO (51 per cent) and Albemarle Corporation (49 per cent).   |
| <b>Manganese</b>                 |  |   |
| <b>Consolidated Minerals</b>     | Woodie Woodie  |   |
| <b>Element 25</b>                | Butcherbird  |   |
| <b>Mineral sands</b>             |  |   |
| <b>Doral</b>                     | Yalyalup mine and Picton dry separation plant                | Mining at Yalyalup commenced in the June quarter 2022. The previous Yoongarillup mine ceased operations in November 2020. Doral is owned by Iwatani Corporation.  |
|                                  | Keysbrook  |   |
| <b>GMA Garnet</b>                | Port Gregory mine and Geraldton dry plant                    |   |
| <b>Iuka Resources</b>            | Mid West   | The active operations at Mid West comprised the Cataby mine and the Narngulu mineral separation plant. The Eneabba screening (since December 2021) and concentrator plants (since September quarter 2022) are in care and maintenance pending the completion of the Eneabba rare earths refinery. |
|                                  | South West   | The active operations at South West comprised the two synthetic rutile kilns at North Capel (SR1 and SR2). Operations at SR1 re-started in December 2022.   |
| <b>Image Resources</b>           | Boonanarring   | Final ore processing and production at Boonanarring was completed in the September quarter 2023 with final sales planned for the December quarter 2023.   |
| <b>Tronox</b>                    | Cooljarloo mine and Chandala mineral separation plant        |   |
|                                  | Wonnerup North mine and North Shore mineral separation plant |   |
| <b>Australian Garnet</b>         | Lucky Bay  | A new project with operations commencing in December 2022.  |
| <b>Strandline Resources</b>      | Coburn   | A new project with first production achieved in November 2022 and a first shipment completed in December 2022.  |

**Table 12. Principal mining projects 2022–23 cont.**

| <b>Principal mining projects</b> |                         |  |
|----------------------------------|-------------------------|--|
| <b>Company</b>                   | <b>Projects</b>         | <b>Comments</b>  |
| <b>Nickel</b>                    |                         |  |
| <b>BHP</b>                       | Cliffs                  |  |
|                                  | Leinster                |  |
|                                  | Mt Keith                | Includes Mt Keith and the Yakabindie satellite mine.   |
| <b>First Quantum Minerals</b>    | Ravensthorpe            |  |
| <b>IGO</b>                       | Forrestania             |  |
|                                  | Nova                    |  |
| <b>Minara Resources</b>          | Murrin Murrin           | Minara Resources is a subsidiary of Glencore Plc.  |
| <b>Mincor Resources</b>          | Kambalda                | Includes the Cassini mine. Mincor Resources is a wholly owned subsidiary of Wyloo Metals.  |
| <b>Panoramic Resources</b>       | Savannah                |  |
| <b>Potash</b>                    |                         |  |
| <b>Kalium Lakes</b>              | Beyondie                | A new project that achieved first sales in July 2022 after first production in October 2021. Kalium Lakes subsequently had administrators and receivers and managers appointed in August 2023. |
| <b>Rare earths</b>               |                         |  |
| <b>Lynas Corporation</b>         | Mt Weld                 |  |
| <b>Salt</b>                      |                         |  |
| <b>Dampier Salt</b>              | Dampier                 | Dampier Salt is a joint venture between Rio Tinto (68 per cent), Marubeni Corporation (22 per cent) and Sojitz Corporation (10 per cent).  |
|                                  | Lake MacLeod            |  |
|                                  | Port Hedland            |  |
| <b>Onslow Salt</b>               | Onslow                  | Onslow Salt is a subsidiary of Mitsui & Co.  |
| <b>Shark Bay Salt</b>            | Shark Bay               | Shark Bay Salt is a subsidiary of Mitsui & Co.   |
| <b>WA Salt Koolyanobbing</b>     | Lake Deborah            |  |
| <b>Silica sand</b>               |                         |  |
| <b>Hanson</b>                    | Gnangara                |  |
| <b>TT Sand</b>                   | Mindijup                |  |
| <b>Simcoa Operations</b>         | Moorá                   |  |
| <b>Talc</b>                      |                         |  |
| <b>Imerys Talc Australia</b>     | Three Springs           |  |
| <b>Tantalum</b>                  |                         |  |
| <b>Global Advanced Metals</b>    | Greenbushes<br>Tantalum |  |

**Table 12. Principal mining projects 2022–23 cont.**

|  |
|--|
| <b>Principal mining projects</b>                                     |
| <b>Company</b>   |
| <b>Basic raw materials</b>   |
| <b>Adelaide Brighton</b>   |
| <b>Archipelago Nominees/Spinifex Crushing and Screening Services</b> |
| <b>BGC</b>   |
| <b>Boral</b>   |
| <b>Hanson</b>  |
| <b>Holcim</b>  |
| <b>MLG Oz</b>  |
| <b>Mobile Concreting Solutions</b>                                   |
| <b>Supajet/Kimberley Quarry</b>                                      |

**Table 13. Principal mineral processing operations 2022–23**

| <b>Principal mineral processing operations</b> |                                  |   |
|--|----------------------------------|---|
| <b>Company</b>                                 | <b>Projects</b>                  | <b>Comments</b>   |
| <b>Alumina</b>                                 |                                  |   |
| <b>Alcoa World Alumina and Chemicals</b>       | Kwinana alumina refinery         | Alcoa World Alumina and Chemicals is a joint venture of Alcoa Corporation (60 per cent) and Alumina (40 per cent).  |
|  | Pinjarra alumina refinery        |   |
|  | Wagerup alumina refinery         |   |
| <b>South32</b>                                 | Worsley alumina refinery         |   |
| <b>Gold</b>                                    |                                  |   |
| <b>Gold Corporation</b>                        | Perth Mint                       |   |
| <b>Lithium</b>                                 |                                  |   |
| <b>Tianqi Lithium Energy Australia</b>         | Kwinana lithium hydroxide plant  | Tianqi Lithium Energy Australia is a joint venture of Tianqi Lithium (51 per cent) and IGO (49 per cent). Production continued on a trial basis and then moved into ramp-up.                              |
| <b>Albemarle Corporation</b>                   | Kemerton lithium hydroxide plant | The Kemerton lithium hydroxide plant progressed through commissioning, achieving on-specification and customer qualified product in April 2023.   |
| <b>Nickel</b>                                  |                                  |   |
| <b>BHP</b>                                     | Kalgoorlie nickel smelter        |   |
|  | Kambalda nickel concentrator     | The Kambalda nickel concentrator was successfully recommissioned and processed first ores from Mincor Resources' Kambalda project in May 2022. It had previously been in care and maintenance since 2018. |
|  | Kwinana nickel refinery          | The Kwinana nickel refinery includes the Kwinana nickel sulphate circuit.   |
| <b>Minara Resources</b>                        | Murrin Murrin nickel refinery    |   |
| <b>Mineral sands</b>                           |                                  |   |
| <b>Tronox</b>                                  | Bunbury pigment plant            | The Bunbury pigment plant comprises facilities at Kemerton and Australind.  |
|  | Kwinana pigment plant            |   |
| <b>Doral</b>                                   | Rockingham fused zirconia plant  | Doral is owned by Iwatani Corporation.  |
| <b>Silica sand</b>                             |                                  |   |
| <b>Simcoa</b>                                  | Kemerton silicon smelter         |   |

**Table 14. Principal petroleum projects 2022–23**

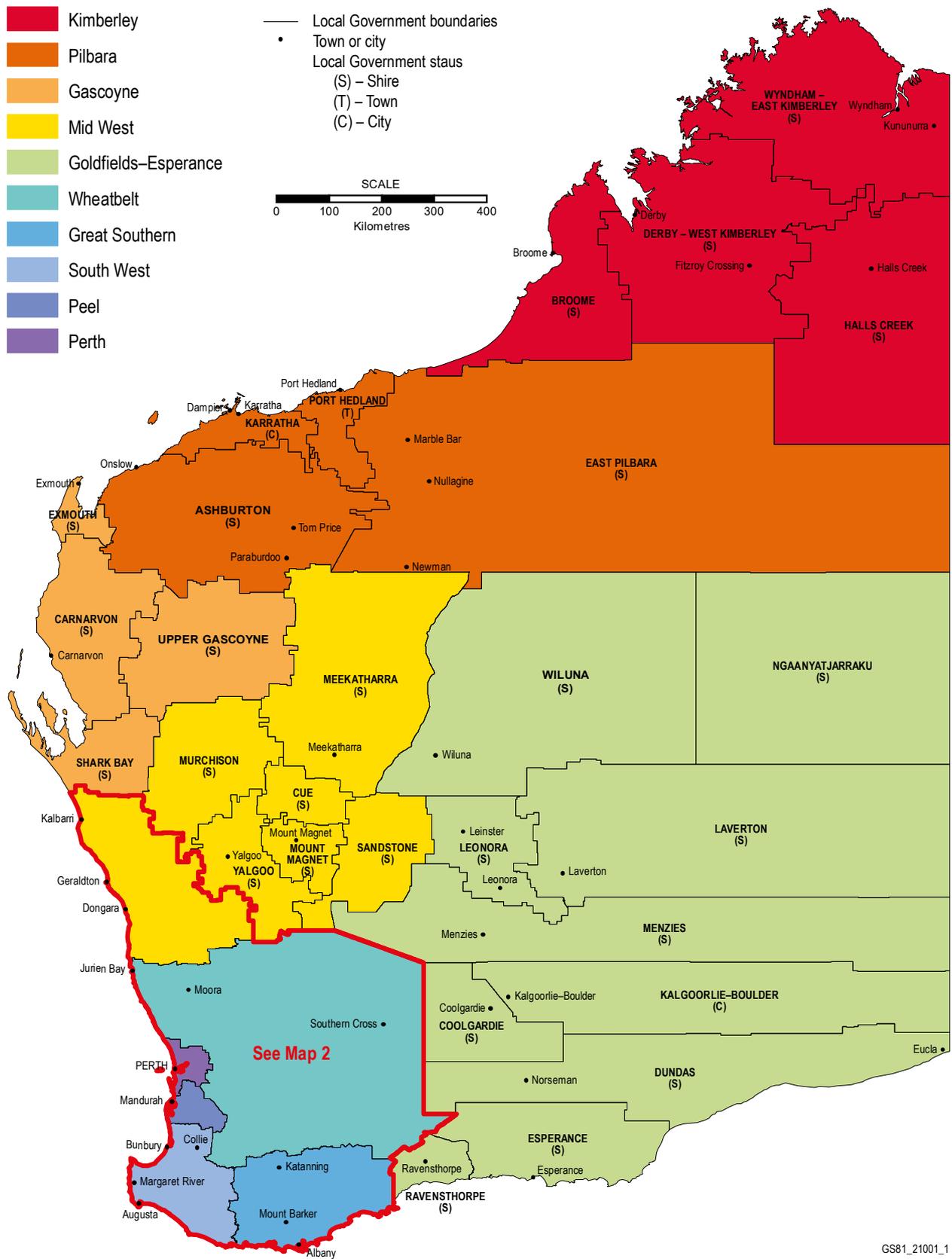
| <b>Principal petroleum projects</b> |                 |                                     |                                   |             |  |
|-------------------------------------|-----------------|-------------------------------------|-----------------------------------|-------------|--|
| <b>Operator</b>                     | <b>Projects</b> | <b>Field</b>                        | <b>Type</b>                       | <b>Area</b> | <b>Comments</b>  |
| <b>Beach Energy</b>                 | Beharra Springs | Beharra Springs Deep                | Domestic gas                      | Onshore     | Beharra Springs is owned by Beach Energy (50 per cent) and Mitsui & Co (50 per cent).<br><br>The Redback and Redback South fields ceased production in 2021.   |
| <b>Buru Energy</b>                  | Ungani          | Ungani                              | Oil                               | Onshore     | Production from Ungani was suspended in January 2023 due to the impact of Tropical Cyclone Ellie on its logistics route. Operations resumed in May, only to be suspended again (for just over a week) in July 2023.<br><br>Buru will assume full ownership of the Ungani project following agreement with Roc Oil for its 50 per cent interest in the project in the September quarter 2023.   |
| <b>Chevron Corporation</b>          | Barrow Island   | Barrow Island                       | Oil                               | Onshore     | Barrow Island is owned by Chevron (57.14 per cent), Santos (28.57 per cent) and ExxonMobil (14.29 per cent).   |
|                                     | Gorgon          | Jansz-Io, Gorgon                    | LNG, condensate, and domestic gas | Offshore    | Gorgon is a joint venture of Chevron (47.3 per cent), ExxonMobil (25 per cent), Shell (25 per cent), Osaka Gas (1.25 per cent), Tokyo Gas (1 per cent) and JERA (a joint venture of Tokyo Electric Power Company, and Chubu Electric Power, 0.417 per cent).   |
|                                     | Wheatstone      | Brunello, Iago, Julimar, Wheatstone | LNG, condensate, and domestic gas | Offshore    | Wheatstone is a joint venture of Chevron (64.14 per cent), Kuwait Foreign Petroleum Exploration Company (13.4 per cent), Woodside Energy (13 per cent), and Kyushu Electric Power Company (1.46 per cent), together with PE Wheatstone (involving Tokyo Electric Power Company, Chubu Electric Power Company, Mitsubishi Corporation and Nippon Yusen, 8 per cent).<br><br>The Julimar and Brunello fields are owned by Woodside Energy (65 per cent) and Kuwait Foreign Petroleum Exploration Company (35 per cent). Woodside Energy also operates the Brunello field.    |
| <b>INPEX Corporation</b>            | Ichthys         | Ichthys                             | Condensate                        | Offshore    | Ichthys is a joint venture of INPEX Corporation (66.245 per cent), Total (26 per cent), CPC Corporation (2.625 per cent), Tokyo Gas (1.575 per cent), Osaka Gas (1.2 per cent), Kansai Electric Power (1.2 per cent), JERA (0.735 per cent) and Toho Gas (0.420 per cent).<br><br>Only the condensate produced via a floating, production, storage and offloading installation is considered as a project for Western Australia. The gas fields are located off the coast of Western Australia, but natural gas is transported to Darwin for processing and export as LNG. |
| <b>Jadestone Energy</b>             | Stag            | Stag                                | Oil                               | Offshore    |  |

**Table 14. Principal petroleum projects 2022–23 cont.**

| <b>Principal petroleum projects</b> |                          |  |  |             |   |
|-------------------------------------|--------------------------|--|--|-------------|---|
| <b>Operator</b>                     | <b>Projects</b>          | <b>Field</b>   | <b>Type</b>  | <b>Area</b> | <b>Comments</b>   |
| <b>Mitsui &amp; Co</b>              | Waitsia                  | Waitsia  | Domestic gas   | Onshore     | Waitsia is a joint venture of Mitsui & Co (50 per cent) and Beach Energy (50 per cent).   |
| <b>Santos</b>                       | Reindeer/<br>Devil Creek | Reindeer   | Domestic gas<br>and condensate                       | Offshore    |   |
|                                     | Van Gogh                 | Coniston,<br>Novara, Van<br>Gogh   | Oil  | Offshore    | Van Gogh is owned by Santos (52.5 per cent) and INPEX Corporation (47.5 per cent).  |
|                                     | Varanus<br>Island        | Greater East<br>Spar (Spar,<br>Halyard and<br>East Spar),<br>John Brookes,<br>Spartan  | Domestic gas<br>and condensate                       | Onshore     | First production from the Spartan field was achieved in the June quarter 2023.  |
| <b>Shell</b>                        | Prelude<br>FLNG          | Prelude  | LNG,<br>condensate, and<br>LPG                       | Offshore    | Prelude is owned by Shell (67.5 per cent), INPEX (17.5 per cent), Korea Gas Corporation (10 per cent), and CPC Corporation (5 per cent).  |
| <b>Triangle<br/>Energy</b>          | Cliff Head               | Cliff Head   | Oil  | Offshore    | Triangle Energy reached an agreement with Pilot Energy in July 2023 for the sale of its 78.75 per cent interest in the Cliff Head oil field and its associated assets for conversion of the facilities to a Carbon Capture and Sequestration project. Royal Energy holds a 21.25 per cent interest in the project.  |
| <b>Vermilion<br/>Energy</b>         | Wandoo                   | Wandoo   | Oil  | Offshore    | Wandoo was offline through the first half of 2023 due to unplanned maintenance.   |
| <b>Woodside<br/>Energy</b>          | Enfield/<br>Vincent      | Cimatti,<br>Laverda<br>Canyon, Norton<br>over Laverda,<br>Vincent  | Oil  | Offshore    | Enfield/Vincent is owned by Woodside Energy (60 per cent) and Mitsui & Co (40 per cent).  |
|                                     | Macedon                  | Macedon  | Domestic gas   | Offshore    | Macedon is owned by Woodside Energy (71.4 per cent) and Santos (28.6 per cent).   |
|                                     | North West<br>Shelf      | Cossack,<br>Goodwyn,<br>Hermes, Keast<br>/Dockrell,<br>Lady Nora/<br>Pemerton,<br>Lambert Deep,<br>Perseus,<br>Sculptor,<br>Tidepole | LNG,<br>condensate, oil,<br>domestic gas,<br>and LPG | Offshore    | Production from Lambert Deep (part of the Greater Western Flank Phase-3 project) commenced in July 2022. Production from the Persephone and Wanaea fields was completed in 2021–22. The North West Shelf project is owned by a range of joint ventures. Jadestone Energy acquired BP's 16.67 per cent stake in the oil-producing fields in November 2022. |
|                                     | Pluto                    | Pluto, Pyxis,<br>and Xena  | LNG,<br>condensate,<br>domestic gas,<br>and LPG      | Offshore    | Pluto is owned by Woodside Energy (90 per cent), Kansai Electric (5 per cent) and Tokyo Gas (5 per cent). Pyrenees is owned by Woodside Energy, Santos and INPEX.   |
|                                     | Pyrenees                 | Crosby,<br>Moondyne,<br>Ravensworth,<br>Stickle,<br>Tanglehead,<br>Wild Bull   | Oil  | Offshore    |   |

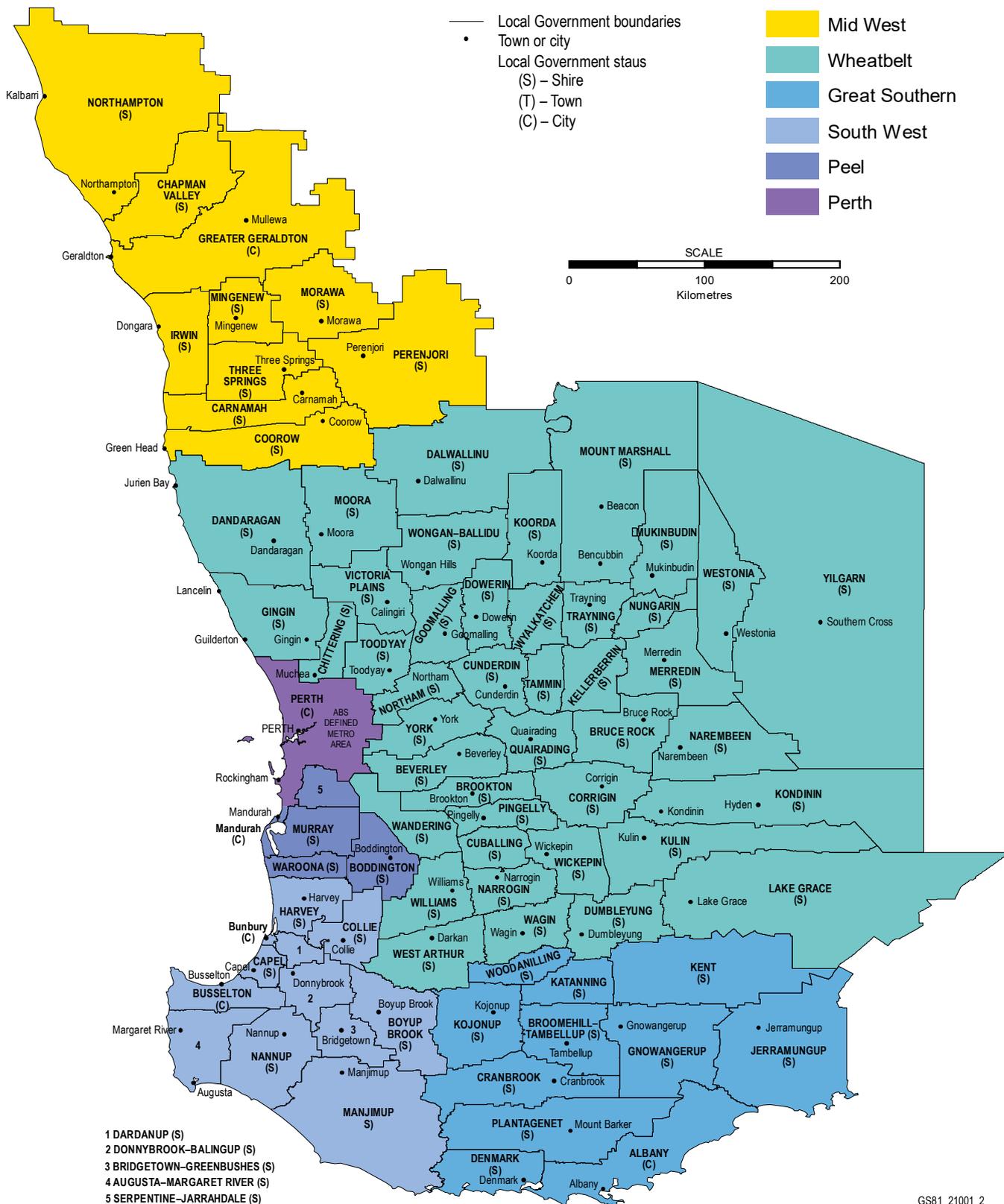
## ABBREVIATIONS

|                 |   |
|-----------------|---|
| 000             | Thousand  |
| A\$             | Australian dollar   |
| ABS             | Australian Bureau of Statistics                             |
| CFR             | Cost, insurance and freight                                 |
| ct              | Carat   |
| DEMIRS          | Department of Energy, Mines, Industry Regulation and Safety |
| EV              | Electric vehicle  |
| FEED            | Front End Engineering and Design                            |
| FID             | Final Investment Decision                                   |
| FOB             | Free-on-Board   |
| FPSO            | Floating, Production, Storage and Offloading Facility       |
| FTE             | Full-time Equivalent  |
| FQM             | First Quantum Minerals                                      |
| GJ              | Gigajoule   |
| GL              | Gigalitre   |
| ha              | Hectares  |
| KCGM            | Kalgoorlie Consolidated Gold Mines                          |
| ktpa            | Thousand tonnes per annum                                   |
| kg              | Kilograms   |
| kl              | Kilolitre   |
| km              | Kilometres  |
| km <sup>2</sup> | Kilometres square   |
| kt              | Thousand tonnes   |
| LGA             | Local Government Area                                       |
| LNG             | Liquefied natural gas                                       |
| LPG             | Liquefied petroleum gas                                     |
| m <sup>3</sup>  | cubic metres  |
| Mbbl            | Million Barrels   |
| MH              | Million Hectares  |
| Mmbtu           | Million British thermal units                               |
| Mt              | Million tonnes  |
| Mtpa            | Million tonnes per annum                                    |
| MW              | Megawatt  |
| nfp             | Not for publication   |
| OPEC            | Organization of Petroleum Exporting Countries               |
| PJ              | Petajoules  |
| SOP             | Sulphate of Potash  |
| t               | tonnes  |
| Tcf             | Trillion cubic feet   |
| US              | United States of America                                    |
| US\$            | United States dollar  |
| WA              | Western Australia   |



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Map 1. Local Government and Regional boundaries



Map 2. Local Government and Regional boundaries – enlargement

Government of Western Australia

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