



Government of Western Australia
Department of Mines, Industry Regulation and Safety

WESTERN AUSTRALIAN MINERAL AND PETROLEUM

STATISTICS DIGEST

2020–21



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Cover photo: Kwinana lithium hydroxide plant, Kwinana, Western Australia.
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FOREWORD

It is an honour to introduce the Mineral and Petroleum Statistics Digest, or 'the Digest' as it is colloquially known, for 2020-21.

The year was again dominated by COVID-19, which continued to impact the world's health and wellbeing and have implications for the global economy.

Commodity markets felt the force of the pandemic as global movement and manufacturing ground to a halt and uncertainty about the future took hold.

Prices for materials used in transportation such as oil and lithium, and energy generation such as LNG, were initially the hardest hit, as too were nickel and copper due to the shutdown of industrial activity particularly in China. Conversely, iron ore remained strong while gold benefitted from its safe haven status.

As vaccines rolled out and virus-related restrictions eased across 2020, the world's economic recovery gathered pace and activity rebounded supported by government-led stimulus infrastructure and 'green recovery' spending as well as lower interest rates.

This drove demand for most commodities at a time of constrained supply due to ongoing pandemic-related restrictions.

In response, commodity prices rallied, with iron ore, copper, and nickel leading the way, while oil, LNG and lithium prices rebounded across the financial year.

Many of these commodities represent an important part of Western Australia's resources sector and the State's economy.

Western Australia and its resources sector successfully navigated the challenges of COVID-19 and continued to operate and supply the world with raw materials when other jurisdictions could not.

This success enabled the State's resources sector to benefit from high prices and deliver a year like none before it, with the community benefitting in the form of record employment and royalty returns.



Richard Sellers
Director General

Department of Mines, Industry Regulation and Safety

OVERVIEW

Western Australia and its resources sector continued to successfully navigate the global COVID-19 pandemic to deliver mineral and petroleum sales valued at a record \$210 billion in 2020-21.

This eclipses the previous single highest calendar year or financial year sales value of \$177 billion set in 2020.

The result was driven almost entirely by the iron ore industry, which recorded sales valued at a massive \$155 billion. It was achieved on the back of all-time high iron ore prices that exceeded US\$200 per tonne (t) for the first time.

To put this into perspective, iron ore industry sales in 2020-21 were valued at more than all mineral and petroleum sales from Western Australia just two years ago.

This astounding result was countered by a downturn in the petroleum industry with the value of LNG (down \$11 billion or 41 per cent on 2019-20), condensate (down \$1 billion or 21 per cent), and crude oil (down \$965 million or 36 per cent) all declining. This was due to a combination of lower sales quantities and overall weak prices.

The majority of Western Australia's commodities are sold through international markets, priced in US dollars and then converted back to Australian dollars. As such,

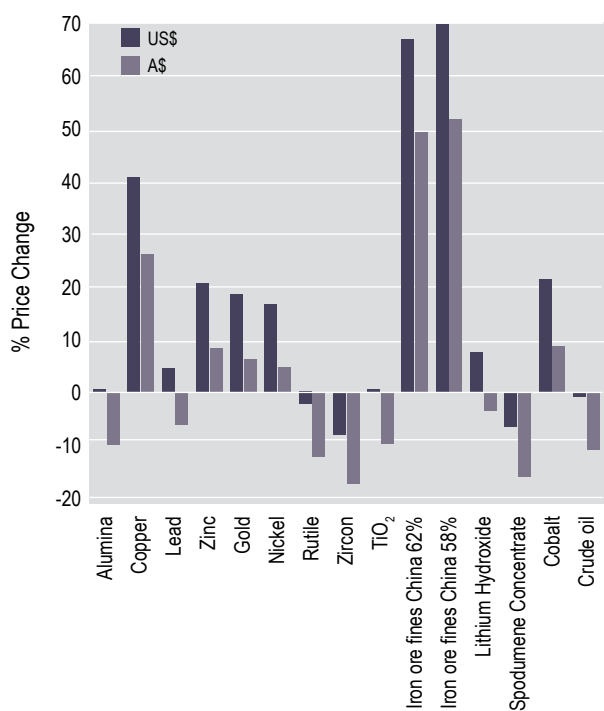


Figure 1 | **Percentage price change between 2019-20 and 2020-21**
Source: ABS, LME, Kitco, Asian Metal, WATC and Perth Mint

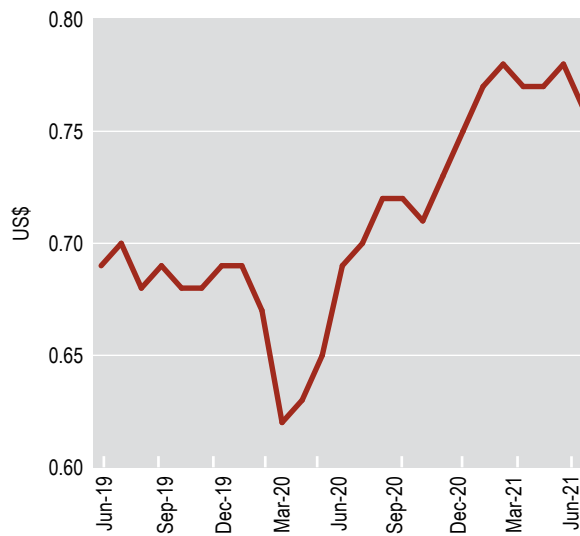


Figure 2 | **Monthly average exchange rate**
Source: WATC

a stronger Australian dollar, which was an average of 75 US cents up from 67 US cents the previous year, had a negative impact on the sector's performance. The strengthened Australian dollar was due to high commodity prices, particularly iron ore, and a weak US dollar.

Minerals highlights

The mining of minerals increased its position as the dominant activity in the State's resources sector with \$186 billion in sales, accounting for 89 per cent of all sales.

Iron ore was by far the most valuable mined commodity in Western Australia and its overall contribution to the value of the State's resources sector continued to grow. It accounted for 83 per cent of the value of all mineral sales and 74 per cent of all mineral and petroleum sales in 2020-21 (up from previous highs of 79 per cent and 67 per cent respectively in 2020).

The iron ore sector achieved record sales valued at \$155 billion in 2020-21, up by almost 50 per cent on the previous financial year. With relatively stable sales quantities of 839 million tonnes (Mt) (compared to 837 Mt in 2019-20), this result was principally due to all-time high iron ore prices, which exceeded US\$200 per tonne for the first time. Prices were higher on the back of ongoing tight supply and stronger demand in China's steel industry stemming from increased construction sector activity in the recovery effort from COVID-19.

Gold sales were valued at \$16.6 billion. The sales were up by four per cent from 2019-20, but down from the record \$17.3 billion in sales in 2020. During the year, nearly 6.7 million ounces (oz) of gold were sold, down from a recent high of 6.8 million oz in 2019-20. The price of gold was at record levels in US dollar terms amid ongoing economic uncertainty created by the COVID-19 pandemic, weak global economic growth, as

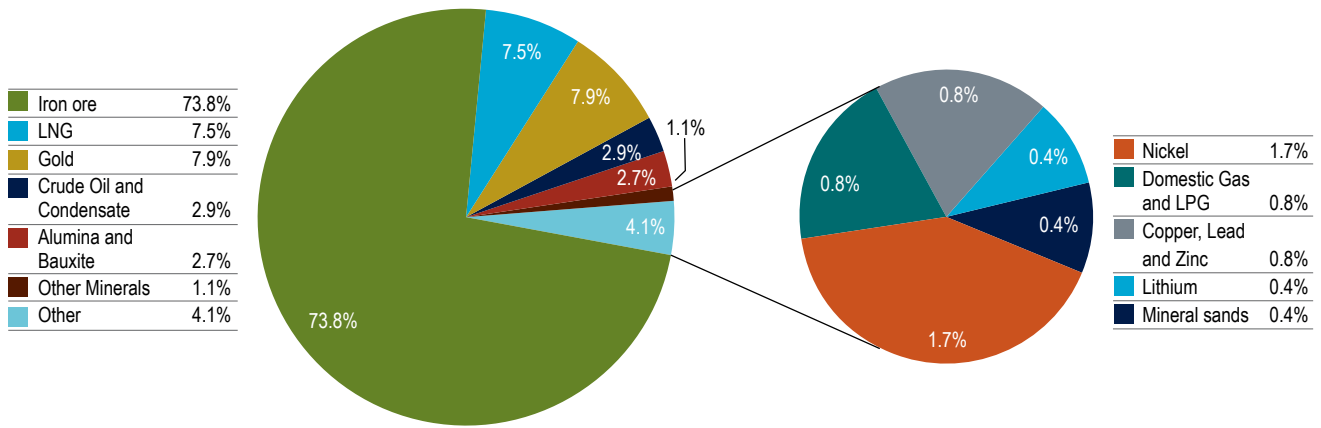


Figure 3 | **Financial year 2020-21 mineral and petroleum summary**
\$210 Billion
 Source: DMIRS

well as trade and geopolitical tensions. However, for local producers, price gains were partially offset by the stronger Australian dollar.

Softer prices from a regional market oversupply and related demand weakness meant the value of alumina and bauxite sales declined to \$5.6 billion in 2020-21. This was despite the quantity of alumina and bauxite sales increasing to a record 14.4Mt and 1.8Mt respectively.

The value of nickel sales was \$3.5 billion – the industry’s highest sales value in seven years. This was largely the result of the price of nickel increasing to a level last reached eight years ago. Sales quantities also increased three per cent year-on-year from rising output from the Nickel West operations following start-up of new mines and improved operational stability, as well as the ramp-up of the Ravensthorpe project, which restarted in the first half of 2020.

Copper-lead-zinc sales were up to \$1.7 billion (up six per cent from \$1.6 billion in 2019-20), the highest level since 2014. This was primarily due to a spike in copper prices during the year to record levels of more than \$10,000 per tonne due to supply constraints, improved demand from COVID-19 economic stimulus measures, and a weak US dollar. Higher prices offset a fall in sales quantities to a decade low as many of the State’s producers reported lower volumes and the Nifty copper operations were suspended in November 2019.

Market conditions in the lithium sector reached bottom at the end of 2020 amid excess spodumene concentrate supplies and issues further down the supply chain. The turning point came in the new year with strong electric vehicle (EV) sales and concern over future supply. These factors saw average monthly prices grow 65 per cent from \$526 per tonne in December 2020 to \$870 per tonne in June 2021. In a sign of improving market conditions, sales quantities were up for the first time in three years as projects including Mt Cattlin and Pilgangoora moved back

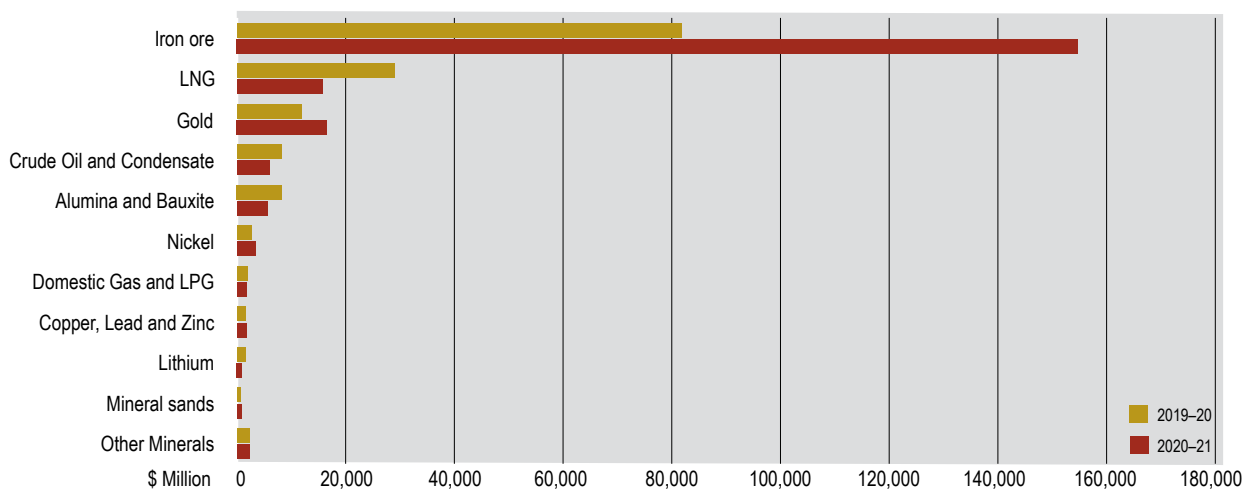


Figure 4 | **Major commodities by value**
\$210 Billion
 Source: DMIRS, EnergyQuest and Woodside

towards capacity, offsetting the suspension of Altura Mining's operations in October 2020. Despite the recovery in the industry, the State's spodumene concentrate sales were valued at \$938 million – more than 2020, but still less than 2019-20 and less than half of the single year sales record of \$1.9 billion set in 2018.

The remaining major minerals sales include the following:

- Mineral sands sales of \$824 million (up six per cent on 2019-20).
- Other mineral sales including rare earths and manganese of \$657 million (up three per cent).
- Salt sales of \$553 million (up 47 per cent).
- Coal sales of \$306 million (down six per cent).
- Cobalt sales of \$294 million (down less than one per cent).
- Silver sales of \$153 million (up 40 per cent).
- Diamond sales of \$112 million (down 60 per cent).

Petroleum highlights

The petroleum sector, which comprises crude oil, condensate, LNG, and LPG dropped to a five-year low sales value of \$23 billion in 2020-21, a decrease of 37 per cent from \$37 billion in 2019-20.

With the decline in the value of petroleum sales and the rise in the value of mineral sales, the petroleum sector's share of total mineral and petroleum sales dropped to 11 per cent in 2020-21, its lowest level since prior to the development of the North West Shelf project in the late 1980s.

LNG remained the most valuable petroleum product produced in Western Australia at \$16 billion or 67 per cent of petroleum sales, followed by condensate at \$4.3 billion (18 per cent) and crude oil at \$1.7 billion (seven per cent).

The value of LNG and condensate sales (down 42 per cent and 21 per cent respectively) were affected by a combination of:

- The aftermath of oil prices falling to their lowest level in 20 years on a combination of excess supply amid a price war between Russia and Saudi Arabia and subdued global demand due to the COVID-19 pandemic and related economic shutdowns.
- Operational issues at Gorgon, Prelude remaining offline until January 2021, as well as maintenance shutdowns at the North West Shelf and Wheatstone.

Oil sales values were similarly affected (down 36 per cent) by overall weaker realised oil prices and production being hampered by:

- lower reliability at some Floating, Production, Storage and Offloading Facilities (FPSO);
- a prolonged period of nil production from the Van Gogh project fields after the Ningaloo Vision FPSO went in for planned maintenance and was caught up in COVID-19 vessel restrictions; and
- cyclone activity.

Notably, the performance of the petroleum sector improved as the financial year went on with a recovery in prices to pre-COVID-19 levels and the resolution of issues at LNG production facilities.

AVAILABLE RESOURCES DATA

The department 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. The file includes data relating to sales values and volumes, prices, exports, as well as production compared with the rest of Australia.
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 mining employment across the State.

Throughout this digest, you will find references on where to find more detailed information.



1 INDUSTRY ACTIVITY

1.1 Principal resource projects

WA's mining industry consisted of 125 predominantly higher value and export-oriented mining projects in 2020-21, up from 124 in 2019-20.

The State's mining industry also comprised hundreds of quarries and small mines producing clays, construction materials, dimension stone, gypsum, limestone, limesand, and spongolite for the local construction industry.

There were also 13 major mineral processing operations which transform bauxite into alumina; gold dorè into gold bars; nickel concentrate into nickel matte, nickel powder and nickel briquettes; rutile and synthetic rutile into titanium dioxide pigment; zircon into fused zirconia; and silica sand into silicon metal.

On the back of record prices, the number of iron ore projects rose from 25 to 32 with the emergence of a set of new small-scale producers such as Fenix Resources (Iron Ridge), GWR Group (Wiluna West) and Young Australian Mines (Spinifex Ridge).

The number of gold projects was 53, the same number as 2019-20. There were five new projects for 2020-21, as high prices provided an incentive for the restart of small-scale operations. However, five other projects reached the end of their current life.

The increase in iron ore projects was largely offset by the suspension of other projects in recent years, including Metals X's Nifty copper project, Panoramic Resources' Savannah nickel project, the MARBL Joint Venture's Wodgina lithium project, as well as the suspension and subsequent acquisition of the former Altura Mining lithium project by Pilbara Minerals.

The total number of petroleum projects was unchanged from 2019-20.

There were 22 principal petroleum projects producing oil, gas and condensates from 55 fields onshore and in Commonwealth waters around WA. These projects had 13 processing plants, predominantly for LNG exports and domestic gas sales.



A list of the principal resource projects is available on the department's website.

1.2 Employment

Western Australia's mining, mineral exploration and petroleum industries employed an average of 149,469 people (based on number of individual (NoI) terms) or 119,502 (based on full-time equivalent (FTE) terms) during 2020-21, representing another record for a single calendar or financial year.

The mining and mineral exploration industries were responsible for the lion's share of employment, with an average of 148,395 people (139,790 FTEs) working in the industries during the year (also a record) compared to just 1,073 persons (1,097 FTEs) in the onshore petroleum industry.

The largest number of people were employed in the mining of iron ore (76,150 persons or 60,810 FTEs), while gold was the next highest with average employment of 34,153 people (28,420 FTEs).

Most of the growth in mining employment was due to:

- the iron ore industry amid production-sustaining construction projects and the emergence of new small-scale producers in a high price environment (up 9,149 persons or 8,843 FTEs); and
- the gold industry amid high prices (up 2,645 persons or 2,081 FTEs).

For its part, employment in minerals exploration was up 846 persons (901 FTEs).

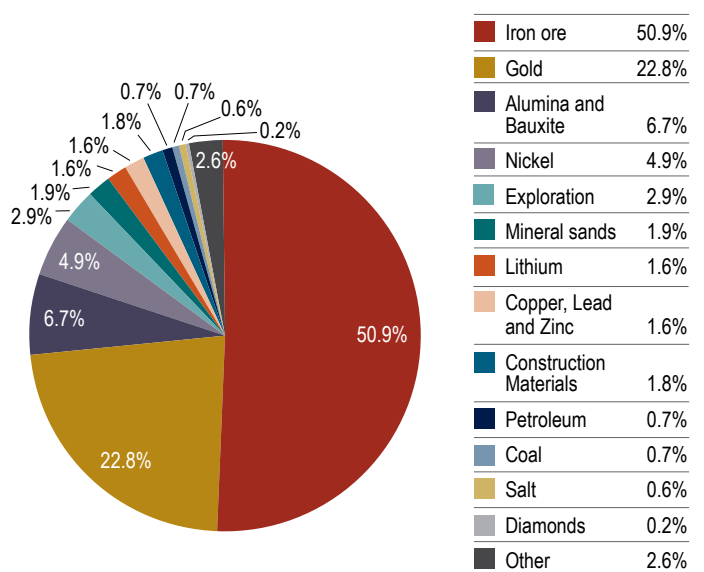


Figure 5 **WA mining and petroleum employment by commodity 2020-21**
149,469 individuals
 Source: DMIRS

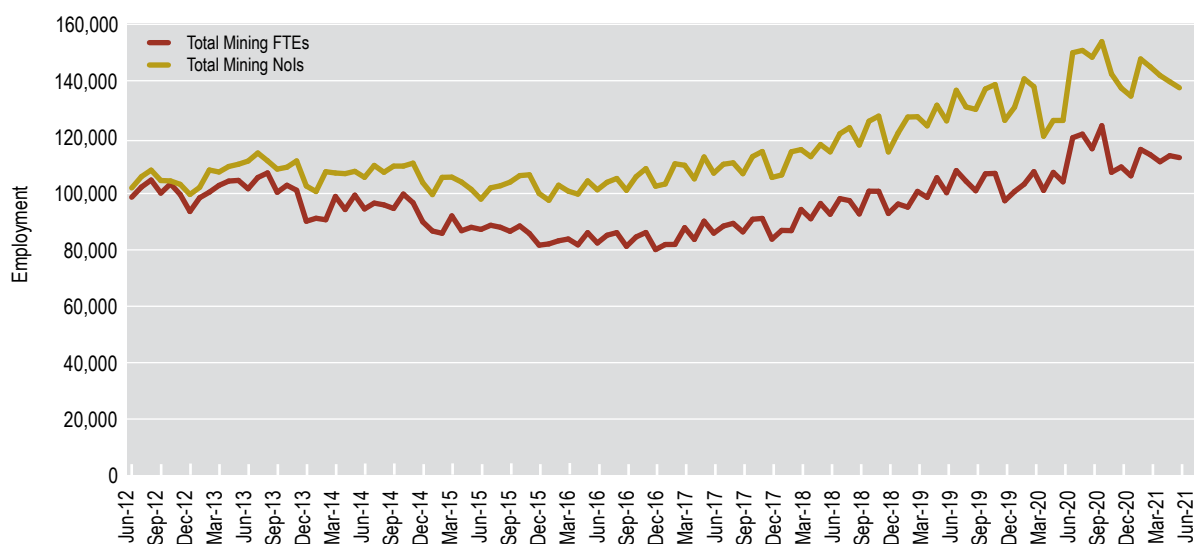


Figure 6 | **FTE and Nol employment in WA's mining industry**
Source: DMIRS

Conversely, employment was down in the following parts of the mining sector:

- Diamond sector was down 346 persons (360 FTEs) following the end of production at the Argyle diamond mine in November 2020.
- Copper, lead and zinc sector was down 317 persons (181 FTEs), largely due to the suspension of the Nifty copper operations.
- Coal sector was down 278 persons (58 FTEs) as the Griffin coal operations experienced ongoing operation issues.
- Lithium sector was down 243 persons (717 FTEs) due to the worsening market conditions in the second half of 2020.

Employment in the onshore petroleum industry was down 204 persons (52 FTEs) in an environment of weak prices.

During the height of Western Australia's COVID-19 restrictions and measures in April 2020, average employment in the mining and exploration sector had decreased. The difference between average employment numbers and FTEs in the mining industry also declined, as people were staying on-site for longer.

However, the impact of these restrictions and measures has proven to be short-lived.

Average employment numbers and FTE numbers in the mining industry had surpassed pre-COVID 19 levels by July 2020 and strengthened across the remainder of the 2020 21 financial year.

By the end of 2020, the disparity between average employment numbers and FTEs in the mining industry had returned to pre-COVID-19 levels and this was maintained through the first half of 2021.

In the exploration sector, average employment numbers and FTEs largely exceeded pre-COVID-19 levels throughout 2020-21.

Overall, the figures suggest that employment numbers in Western Australia's mining and exploration sectors have continued to strengthen from the early months of the COVID-19 pandemic. This likely reflects Western Australia being sheltered from the pandemic's most severe global and national economic impacts.

While overall employment numbers may not have been impacted by COVID-19, many companies across the mining sector reported rising labour costs and ongoing difficulties in sourcing skilled labour during the year due to a combination of continuing pandemic related border restrictions and high levels of industry activity.

The recovery in Western Australia's onshore petroleum sector is likely taking longer due to the oil price crash immediately preceding and exacerbated by COVID-19. Average employment numbers have recovered but still remain below March 2020 levels, while average FTEs only reached pre-COVID-19 levels in the June quarter 2021 suggesting many of the employees in the onshore petroleum sector are working longer.



The economic indicators file provides detailed employment data including the following:

- Calendar year employment data for the mining, exploration and petroleum industries.
- Financial year employment data for the mining, exploration and petroleum industries.
- Monthly employment data for the mining and exploration industries by commodity since 2001.
- Monthly employment data for the petroleum industry since 2010.
- Mining and petroleum employment data by site for the current and previous years.
- Historic calendar-year mining employment data (by commodity) for 1987–2000.

A note about employment data

The department reports employment data in two different ways:

- Nol: The number of individual people who have performed at least one hour of work on a mine site.
- FTE: The number of people employed according to standardised full-time equivalent hours.

These figures include people employed in mine site infrastructure construction, mineral processing, mine site surveying, transport, and catering – essentially those people operating on site.

Mining employment data is collected from monthly accident reports, which all operating mines, as well as companies undertaking exploration activities on exploration and mining leases, are required to submit. The data identifies the number of direct employees and contractors and includes sites under State Agreement Acts. It does not include personnel in administrative locations not at operating sites.

Petroleum employment data includes people employed at operating sites, including contractor employees. It comprises only operations subject to State petroleum legislation, and includes petroleum facilities and pipelines both onshore and in coastal waters. It excludes LNG operations and land-based service operations.

This data is not directly comparable to employment data collected and published by the Australian Bureau of Statistics (ABS), which is classified using Australian and New Zealand Standard Industrial Classification (ANZSIC).

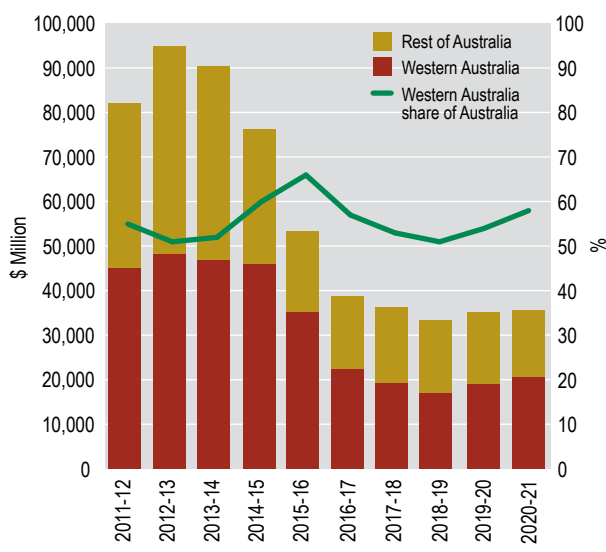


Figure 7 Mining investment
Source: ABS

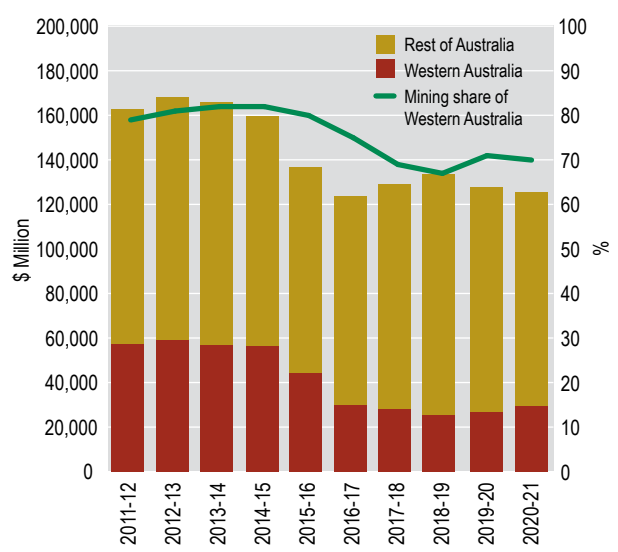


Figure 8 New capital expenditure
Source: ABS

1.3 Investment



The economic indicators file contains historic and current ABS investment data. This data includes:

- Mining investment in WA.
- New capital expenditure in WA.

1.3.1 Mining investment

Almost \$21 billion was invested into Western Australia's mining and petroleum sector, up from \$19 billion in 2019-20. This was a five-year high.

This was largely achieved on the back of ongoing investments by Rio Tinto, BHP and FMG in large-scale iron ore production sustaining projects, as well as FMG's Iron Bridge magnetite project.

Western Australia's share of national mining and petroleum investment increased to 58 per cent due to higher levels of investment growth in Western Australia compared to the rest of the country. The State's share is now slightly above its 10-year average share of 56 per cent.

The resources sector was a key contributor (68 per cent) to growth in total new capital expenditure in Western Australia, which at \$29 billion was up from \$27 billion in 2019-20.

The increase in resources sector investment spending also helped Western Australia increase its total share of Australia's new capital expenditure to 23 per cent in 2020-21, compared to 21 per cent in 2019-20.

COVID-19 has not had much immediate or residual impact on levels of mining and petroleum investment in Western Australia. In fact, resources sector investment in Western Australia has increased for the last eight quarters after adjusting for seasonal variability.

1.3.2 Investment pipeline

DMIRS also monitors and collects information on mineral and petroleum projects under development in Western Australia to estimate the capital cost of projects.

As of September 2021, the total estimated value of resources projects under development in Western Australia was \$127 billion. This was down from the March 2021 estimate of \$140 billion and the September 2020 estimate of \$129 billion.

Over the past year, several significant new projects were announced including:

- Northern Star Resources' Fimiston South cutback at the Super Pit;
- BHP's Western Ridge iron ore project;
- Newcrest Mining's Telfer West Dome Stage 5 gold project;
- King River Resources Limited's Kwinana high-purity alumina plant; and
- Talison Lithium's Greenbushes tailings retreatment plant.

There were also a significant number of projects that progressed to a final investment decision or construction including:

- APA Group's Northern Goldfields Interconnector pipeline;
- Bellevue Gold's namesake gold project;
- Chevron's Jansz-10 compression project;
- Covalent Lithium's Mount Holland lithium project;
- Galena Mining's Abra lead project;
- Mitsui and Co's Waitsia Stage 2 gas expansion;
- Newcrest Mining's early works program at Haverton;

A note about investment pipeline data

Information is obtained from various sources including the Office of the Chief Economist's (OoCE) major projects data, Australian Securities Exchange (ASX) announcements, resources sector analysts and consultants, and media reports. Projects are categorised as follows:

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

Sector	Commodity	CAPEX (\$ million)	
		Committed/ under construction	Planned/ possible
Minerals	Gold	2,303	1,479
	Iron ore	11,840	4,815
	Nickel, copper and zinc	416	5,859
	Lithium	2,840	1,835
	Infrastructure	1,407	5,600
	Other minerals	1,661	11,731
	Sub-total Minerals	20,468	31,319
Petroleum	Crude oil and condensate	0	2,200
	Gas	0	200
	LNG	15,146	56,889
	Pipelines and infrastructure	460	0
	Sub-total Petroleum	15,606	59,289
Total		36,074	90,609

Source: DMIRS

- Nickel West's expansion plans at Mt Keith and Northern Goldfields solar project;
- Northern Star Resources' Thunderbox mill expansion;
- Red 5's King of the Hills expansion;
- Strandline Resources' Coburn mineral sands project;
- Wiluna Mining's Stage 1 growth project at Wiluna; and
- Woodside's Pluto – North West Shelf Interconnector and Greater Western Flank Phase-3 projects.

The value of projects under construction or in the committed stage of development was an estimated \$36 billion, down by approximately \$500 million from March 2021, but up from an estimated \$28 billion in September 2020.

This was the result of a balance of factors that included:

- the start of production at BHP's South Flank iron ore project, FMG's Eliwana project; Mineral Resources' expansion projects, and Capricorn Metals' Karlawinda gold project;
- several projects moving into the committed and construction phase (as detailed above); and
- revisions to capital expenditure estimates on several projects, most notably FMG's Iron Bridge magnetite project and the expansion of Talison Lithium's Greenbushes lithium project.

The value of medium to longer-term planned or possible projects decreased to \$91 billion, from \$100 billion in September 2020 and \$103 billion in March 2021.

This decrease was largely the result of changes in development plans for longer-term investment projects including West Pilbara iron ore, the Equus gas project off the North West Shelf, Southdown magnetite, and expansion plans for the former Altura Mining lithium project. Several more-advanced projects also progressed through development stages into a final investment decision or construction.

Outside of these changes, there were a host of new diamonds, gold, iron ore, silica sand projects, as well as upward revisions in capital expenditure estimates across a range of commodities following the release of new or updated development studies.

1.4 Exploration



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

- historic and current expenditure on mineral exploration in WA and the rest of Australia;
- a breakdown of the State's exploration spend by commodity compared with the rest of Australia;
- historic and current exploration drilling and expenditure on new and existing mineral deposits; and
- historic and current expenditure on petroleum exploration in WA compared with the rest of Australia.

1.4.1 Minerals

Mineral exploration expenditure in Western Australia was \$2.1 billion in 2020-21, an increase of 21 per cent from \$1.7 billion in 2019-20 and its highest level since 2012.

Growth in mineral exploration expenditure was mainly due to increased spending on gold (up \$286 million), supported by record high prices. The other notable increases in spending were for iron ore (up \$106 million) and nickel-cobalt (up \$36 million), again reflecting higher prices for these commodities.

These commodities also represented the main targets of mineral exploration in Western Australia: gold (52 per cent), iron ore (22 per cent), and nickel-cobalt (9 per cent).

Spending on gold exploration in Western Australia surpassed \$1 billion for the first time in history, while iron ore exploration (\$455 million) was at its highest level since 2013-14 and nickel-cobalt exploration (\$185 million) recorded a nine-year high.

The State's share of national mineral exploration expenditure increased to 65 per cent, highlighting that overall growth in exploration expenditure for the country as a whole was overwhelmingly due to Western Australia.

The impact of COVID-19 on overall exploration activity in Western Australia appears to have been relatively muted and largely restricted to the June quarter 2020, which recorded a \$3 million fall in exploration expenditure compared to the same period a year earlier.

This was at the height of COVID-19 restrictions in Western Australia including regional travel restrictions, plus the cancellation and scaling back of exploration programs across the State.

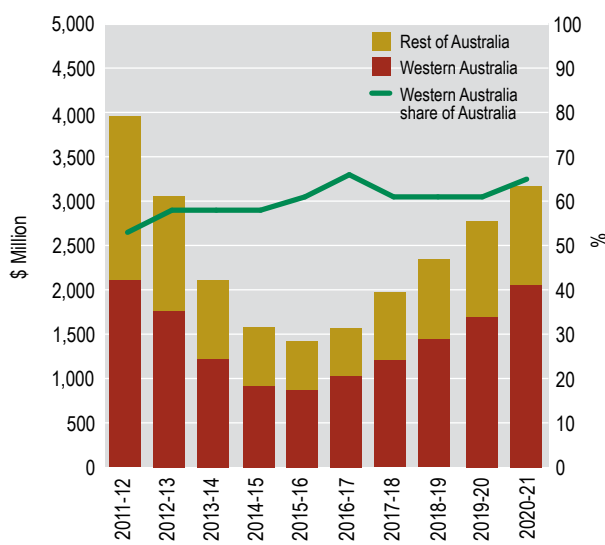


Figure 9 | Mineral exploration expenditure
Source: ABS

Any overall negative effect of COVID-19 on mineral exploration expenditure in Western Australia was short-lived with the September and December 2020 quarters returning to growth. This growth continued into the March and June 2021 quarters, with year-on-year increases in exploration spending of 31 per cent and 44 per cent respectively.

The effect of COVID-19 on the location of expenditure was perhaps more pronounced and lasting. Spending in greenfields areas declined year-on-year by 28 per cent in the June 2020 quarter, 21 per cent in the September 2020 quarter, and 17 per cent in the December 2020 quarter. However, spending began to recover through the first half of 2021 and even surpassed pre-COVID-19 levels.

This resulted in an overall increase in spending of five per cent on new deposits in 2020-21. However, by comparison, for the same period, spending on existing deposits rose by 31 per cent.

As a result, the share of expenditure in greenfields areas compared to brownfields areas was 33 per cent in 2020-21, down from 38 per cent in 2019-20.

Mineral exploration activities during the year targeted a range of geological areas and prospects across the State.

The Goldfields and Mid West regions remain a hotspot of mineral exploration activity with significant discoveries, upgraded resources and drilling activities announced during the year.

- **Mid-West**

Cobalt mineralisation was discovered at the Mt Labouchere prospect, an area traditionally prospective for manganese, with results from shallow drilling including 5m at 0.24 per cent copper, 0.20 per cent cobalt and 0.12 per cent nickel.

High-grade gold intersections were found at the Trident prospect within the Marymia project including 9m at 26.2 grams per tonne (g/t) gold from 137m.

Drilling results were announced for Eelya South that included 3m at 3.78 per cent copper, 6.68g/t gold and 81g/t silver.

The Bellevue mineral resource estimate increased to 3 million oz gold following inclusion of the Marceline and Deacon North lodes.

High-grade drilling was announced for the White Heat prospect at the Break of Day deposit with results of 3.4m at 107.6g/t gold from 74.6m, including 1.2m at 303.2g/t gold from 74.6m.

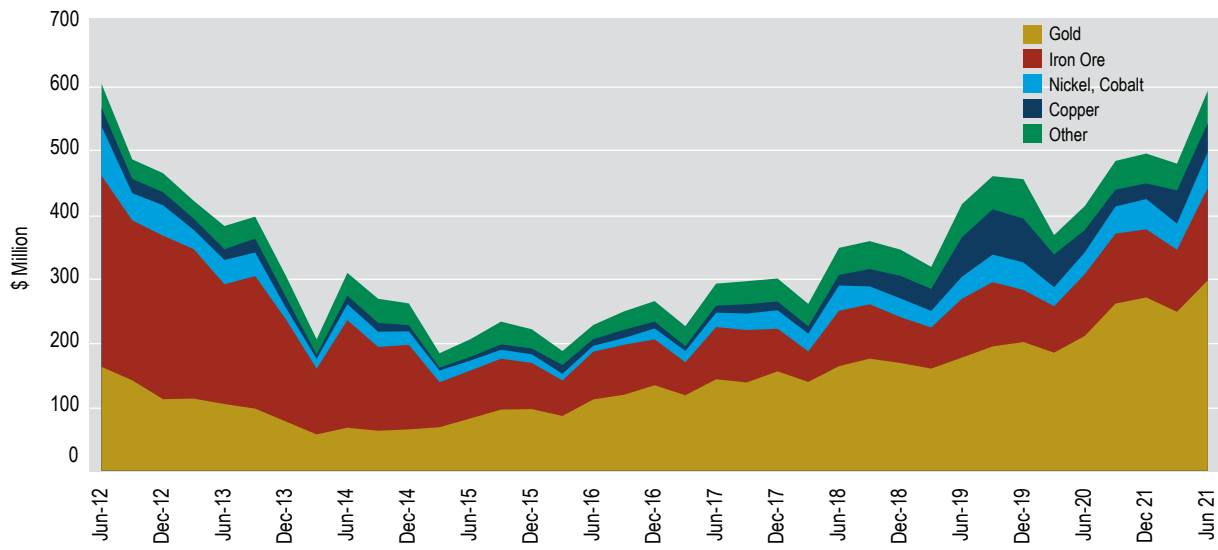


Figure 10 | **WA mineral exploration expenditure by commodity**
Source: ABS

The mineral resource estimate for the Menari and Menari North deposits (part of the Lucky Bay project) increased significantly to 438.8Mt at 4.3 per cent heavy minerals and 86.2 per cent garnet for 18.8Mt of heavy minerals and 16.2Mt of garnet.

• **Goldfields**

A new zone of gold mineralisation was discovered at the Ida Valley project.

A new zone of gold mineralisation was discovered at the Mulgabbie North project, with drilling results including 4m at 5.02g/t gold and 10m at 2.8g/t gold (including 1m at 21.6g/t gold) from 17m.

A new nickel zone referred to as Gamma 50C has been announced at Beta Hunt. This hole was drilled under the Exploration Incentive Scheme (EIS) and encountered significant nickel intersections of 4.6 m at 11.6 per cent nickel from 135.1m including 2.2m at 18.4 per cent nickel, 0.3m at 1.2 per cent nickel from 193.6m, and 1.8m at 2.4 per cent nickel from 161.95m. This followed another significant nickel discovery called 30C Nickel Trough with results that include 1.2m at 7.2 per cent nickel and 2.2m at 4.1 per cent nickel.

High-grade gold mineralisation was discovered at the Scotia prospect in the Central Norseman project, representing the first drilling program into the Noganyer Formation.

A single shallow infill hole drilled for advanced metallurgical and research and development studies returned the highest ever recorded gold intercept at Kat Gap of 10m at 40.5g/t gold from 26.5m including 0.5 m at 592.0g/t from 28.5m.

Drilling results at the Dusty prospect confirmed 4.5m of cumulative massive nickel sulfides were intersected with an average grade of 3.91 per cent nickel, 0.34 per cent copper, 0.13 per cent cobalt and 0.45g/t platinum and palladium.

Bonanza grades were intersected at the Cox's Find main lode with results including 5.65m at 80.0g/t gold (as well as 1.1m at 404g/t gold).

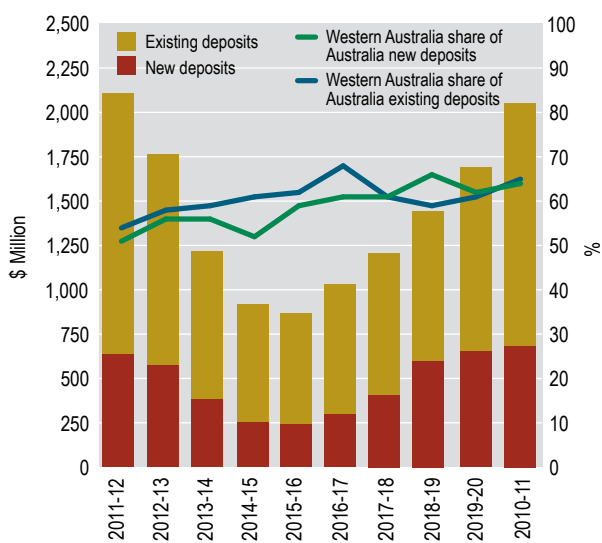


Figure 11 | **WA mineral exploration expenditure by type**
Source: ABS

Drilling results from the Investigators prospect within the Mt Alexander project, confirmed a thick interval of high-grade nickel–copper sulfides with results of 11.07m at 1.58 per cent nickel, 0.71 per cent copper, 1.23g/t total platinum group elements from 333.5m including 3.9m at 3.98 per cent nickel, 1.8 per cent copper, 3.1g/t total platinum group elements.

A maiden underground inferred mineral resource of 18.47Mt at 1.47g/t gold for 0.87 million ounces (Moz) of gold was announced for Gruyere.

Increased interest and activity across the remainder of the State have also led to several other significant exploration announcements in the past year:

- **Wheatbelt**

Further high-grade drilling results from the Julimar Gonneville intrusion eastern footwall contact included 14m at 4.2g/t palladium, 1.1g/t platinum, 0.2g/t gold, 0.5 per cent nickel, 0.8 per cent copper and 0.03 per cent cobalt from 85m.

A maiden inferred mineral resource estimate was announced for the Cloud Nine Halloysite–Kaolin deposit following the completion of a maiden drilling program in 2020.

- **Albany–Fraser**

Drilling continued at the Mawson prospect, part of the Rockford project with recent results reported of 14.45m at 2.63 per cent nickel, 2.09 per cent copper, and 0.14 per cent cobalt from 162.05m.

Nickel–copper mineralisation was intersected at the Lantern South prospect, with 41m at 0.19 per cent nickel and 0.14 per cent copper from 55m.

- **Pilbara**

Several zones of massive nickel–copper sulfides were intersected at Andover, including the VC-07 East target with drilling results of 7.15m at 2.28 per cent nickel and 0.57 per cent copper from 135.4m including 4.25m at 3.59 per cent nickel and 0.78 per cent copper from 137.1m.

A maiden indicated and inferred mineral resource estimate of 192Mt at 1.1g/t gold for 6.8 million oz of gold was announced for Hemi.

A new lithium–tantalum discovery in spodumene-hosted pegmatite dykes was announced for the Marble Bar project, followed by a maiden inferred resource estimate of 10.5Mt at one per cent lithium oxide and 44 parts per million (ppm) tantalum pentoxide.

1.4.2 Petroleum

Petroleum exploration expenditure in Western Australia was down to \$442 million, its lowest level since 1996-97, reflecting cuts to exploration budgets amid ongoing overall weak oil prices.

Lower petroleum exploration spending in Western Australia, combined with increased expenditure in Queensland, resulted in Western Australia’s share of the national spend declining to a new single year average low of 44 per cent.

Petroleum exploration activity was led by drilling at the Lockyer Deep-1 well to a depth of 4,000m, which identified a significant gas discovery in the Kingia sandstone.

1.5 Royalties

The Western Australian Government received royalty revenue from the State’s minerals and petroleum producers totalling \$11 billion in 2020-21. This was a record total, surpassing the previous record of \$9.3 billion received in 2019-20 by \$1.7 billion.

This result was due to increased royalty receipts from the iron ore industry amid higher iron ore prices. Royalty receipts from the iron ore industry alone were \$9.8 billion, half a billion dollars more than the previous record single year State Government royalty paid for all commodities. The industry’s share of total royalty revenue also increased to 89 per cent from 84 per cent the previous financial year.

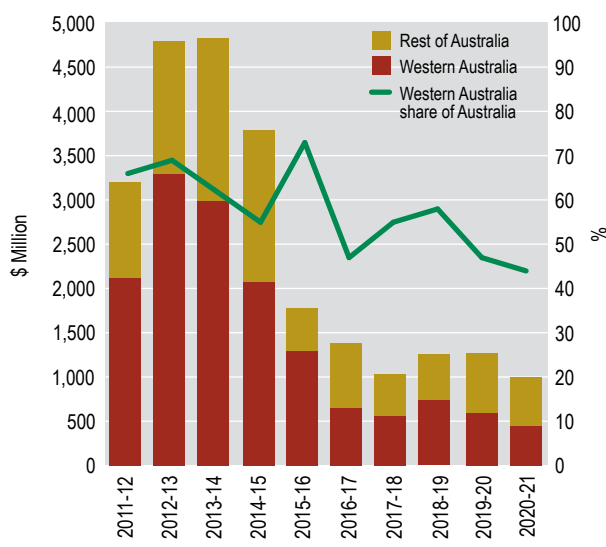


Figure 12 | **Petroleum exploration expenditure**
Source: ABS

Consistent with the strong market conditions seen in the gold industry, its royalty payments rose by 15 per cent to a record \$416 million. Likewise, royalties collected from the nickel and copper-lead-zinc rose 10 per cent (to \$84 million) and four per cent (to \$71 million) respectively.

Challenging market conditions for the alumina and bauxite, lithium, and petroleum industries also resulted in royalty payments falling by 19 per cent, 35 per cent, and 65 per cent respectively.

These increases were offset by Western Australia's grants from the North West Shelf project falling by \$304 million or 44 per cent amid lower oil prices.

A note about royalties

Royalties for all minerals and petroleum produced on State land and in State waters are paid into the State Government's Consolidated Revenue Fund.

The figure reported in this publication is the 'royalty receipt' for the relevant period (i.e. the actual funds the State Government received during 2020-21). This means the royalty receipts are offset from sales figures by one quarter, and comprise the royalties accrued in the June, September, December quarters 2020 and the March quarter 2021.

For commodities subject to an ad-valorem royalty rate (e.g. iron ore), the royalty payable is calculated from the gross sales less any allowable deductions. For commodities on a specific rate (e.g. construction materials), the royalty payable is calculated on a per-tonne basis.

Included in the royalty receipts for petroleum is the State and Commonwealth share of royalties collected under the Western Australian *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 rate is 25 cents per tonne. In the case of some older Agreement Acts, the rate is 25 cents per imperial ton. 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 grants, in accordance with an agreement between the WA and Australian Governments.

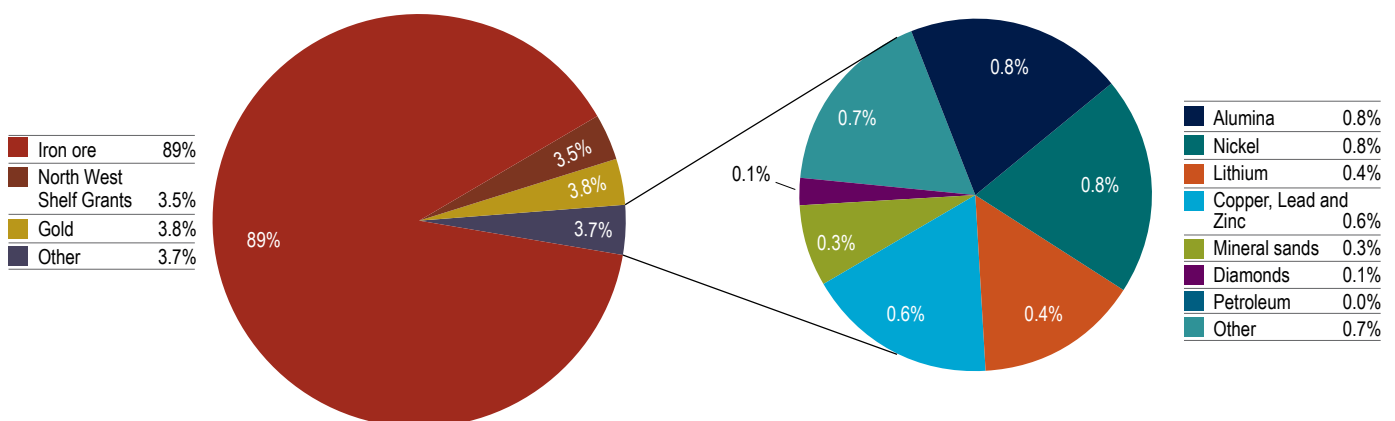


Figure 13 **Royalty receipts and North West Shelf grants 2020-21**
\$11 Billion
 Source: DMIRS and Department of Treasury

Commodity	2019–20	2020–21	2020–21 growth	
	Total \$	Total \$	\$	%
Alumina	113,602,584	92,446,233	-21,156,351	-19%
Copper, Lead and Zinc	67,643,885	70,545,597	2,901,713	4%
Diamonds	11,335,632	9,432,109	-1,903,523	-17%
Gold	361,428,949	415,650,664	54,221,714	15%
Mineral sands	23,004,163	31,042,374	8,038,211	35%
Iron ore	7,802,720,539	9,796,786,334	1,994,065,795	26%
Lithium	66,311,831	43,324,947	-22,986,884	-35%
Nickel	76,155,817	83,530,749	7,374,932	10%
Petroleum	6,922,254	2,426,256	-4,495,999	-65%
Other	78,304,997	73,271,480	-5,033,517	-6%
Total royalty receipts	8,607,430,650	10,618,456,742	2,011,026,092	23%
North West Shelf Grants	690,202,284	386,231,535	-303,970,749	-44%
Total revenue	9,297,632,934	11,004,688,277	1,707,055,342	18%



The economic indicators file contains:

- royalty receipts by commodity for the past two calendar and financial years; and
- historic royalty receipts and North West Shelf grants by commodity from 1984–present.

1.6 Exports

Minerals and petroleum exports were valued at an estimated \$208 billion, accounting for 94 per cent of WA's total merchandise exports of almost \$223 billion in 2020-21.

The Western Australian resources sector was also responsible for 67 per cent of the nation's \$310 billion in resource sector exports, up from 60 per cent the previous year and highlighting the importance of the State's mineral and petroleum industries to the nation's fortunes.

On each measure, this was the highest value and share for any 12-month period since records began.

Record exports were driven, at least in part, by a strong prior period of project investment that has also seen Western Australia's resources exports double over the past 10 years.

WA exported its mineral and petroleum resources to a wide range of countries in 2020-21, but the value of these exports remained highly concentrated with the top 10 destination countries responsible for more than 90 per cent of all shipments.

China, in particular, continued to play a massive role in the State's trade accounting for \$134 billion in exports or more 60 per cent of total shipments.

Japan was once again the State's second largest export market, though the value of merchandise exports fell from \$22.5 billion to \$19.3 billion. South Korea was ranked third with exports increasing to \$13.3 billion, up by \$2.8 billion from 2019-20. It displaced the United Kingdom (\$9 billion), which was the fourth most valuable export destination, with Singapore (\$8.7 billion) rounding out the top five.



The major commodities and economic indicators files contains current and historic information about mineral and petroleum exports including data on export destinations of key commodities including iron ore, petroleum, gold, alumina and bauxite, nickel, and mineral sands.

1.7 Tenements and titles

Tenements and titles are another indicator of the health and the scale of the mining and petroleum industries.

As of June 2021, more than 58 million hectares (ha) of land within WA (an area larger than the total area of California, the third largest state in the United States) 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 51 million ha the previous year, due to 6.9 million ha increase in the area covered by exploration licences.

Mining leases, on which mining operations occur, overlaid 3.22 million ha of land, up from 3.17 million ha the previous financial year

To put these figures into perspective, all mining tenure overlaid approximately 23 per cent of WA's total land area of almost 253 million ha, with mining leases covering 1.3 per cent of the State's land area.

The total number of mining tenements in force was up 14 per cent at 22,400 compared to 21,304 in the last financial year.

The increase was predominantly due to a rise in exploration licences and mining leases, supporting increased exploration and mining activities.

The number (237) and area (93,755 square kilometres (sq km)) of petroleum titles in force in WA's jurisdiction were both up largely due to an increase in the number and area of exploration permits and the grant of special prospecting authorities related to geothermal energy resource exploration.

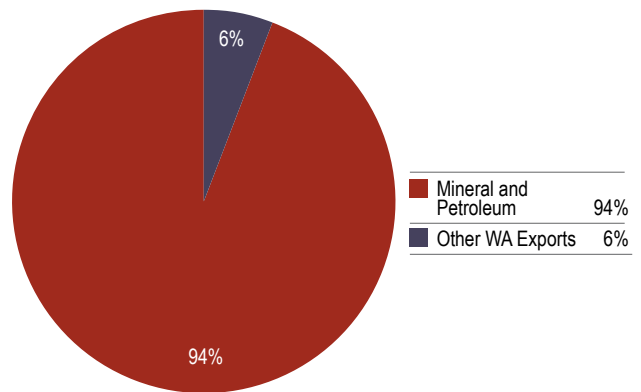


Figure 14 WA merchandise exports 2020-21

\$223 Billion

Source: DMIRS and ABS

Note: Mineral and petroleum exports include gold, mineral sands, and nickel refined or processed in WA but produced in other State and Territories or overseas.

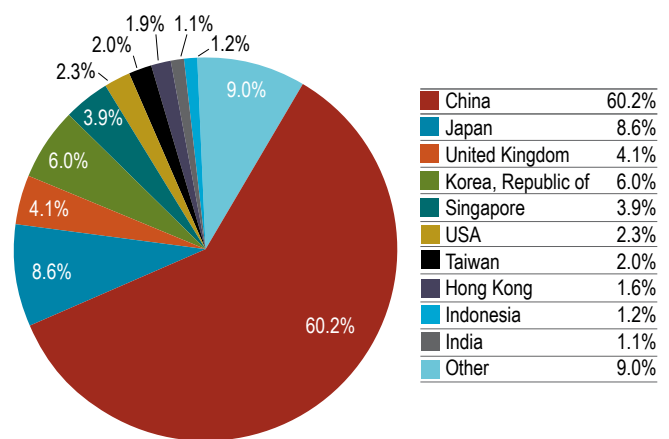


Figure 15 WA merchandise exports by country 2020-21

\$223 Billion

Source: ABS

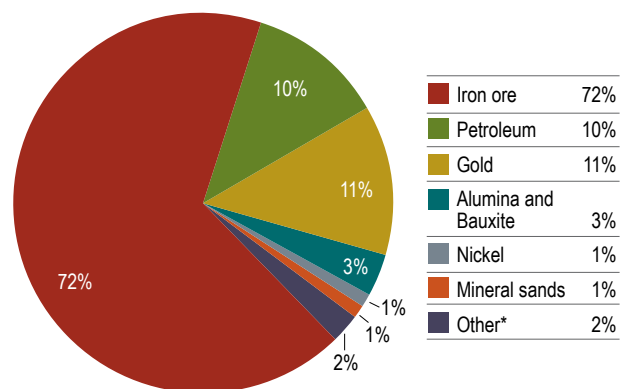


Figure 16 WA mineral and petroleum exports 2020-21

\$208 Billion

Source: DMIRS and ABS * Excludes manufactured products

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.

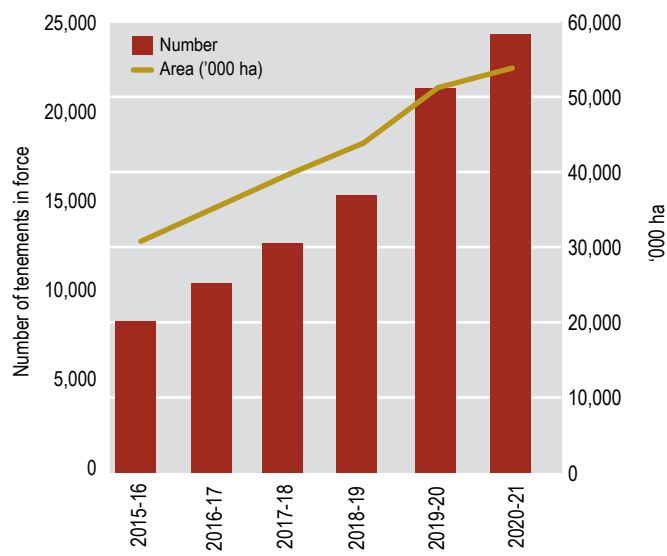


Figure 17 | Mining tenements in force
Source: DMIRS



The spatial and regional file contains historic information about the number and type of mining tenements and petroleum titles.

TABLE 3. Petroleum titles in force (as at 10/08/2021)				
Legislation	Title Type	Area	Blocks	Number of Titles
Petroleum (Submerged Lands) Act 1982		3,890.1588km²	111	47
	Exploration Permit	1,290.7111km ²	55	5
	Pipeline Licence	627.3461km	0	25
	Production Licence	1,668.8048km ²	31	10
	Retention Lease	930.6429km ²	23	6
Petroleum and Geothermal Energy Resources Act 1967		82,513.7965km²	1,095	82
	Access Authority	-	5	3
	Exploration Permit	73,880.6103km ²	957	49
	Petroleum Lease	260.1000km ²	9	1
	Production Licence	3,707.0407km ²	56	21
	Retention Lease	654.2943km ²	10	5
	Special Prospecting Authority	4,011.7512km ²	58	3
Petroleum Pipelines Act 1969		7,350.6053km²	9	108
	Pipeline Licence	7,350.6053km	9	108
Total		93,754.5606km²	1,215	237

2 COMMODITY REVIEW

2.1 Minerals

The mining of minerals was once again the dominant activity in the State's resources sector with \$186 billion in sales, accounting for 89 per cent of all sales.

This was up by \$50 billion from \$136 billion in mineral sales and 79 per cent of mineral and petroleum sales in 2019-20.

2.1.1 Iron ore

Prices

Iron ore prices continued to defy expectations, strengthening to an average of US\$155 per tonne (\$206 per tonne) for the benchmark (62 per cent iron spot fines cost, insurance and freight (CFR) China) and US\$139 per tonne (\$185 per tonne) for lower grades (58 per cent spot fines CFR China).

The benchmark reached more than US\$235 per tonne (\$364 per tonne) in May 2021, its highest ever level.

Prices were driven higher by a combination of supply and demand factors. These are:

- a slow recovery in production from operations in Brazil in the aftermath of the failure of the Brumadinho tailings dam; and
- strong crude steel production from stimulus measures for the construction industry as part of the recovery effort from COVID-19 in China.

The difference between the benchmark and low-grade ore prices increased to an annual average of around US\$16 per tonne and ended the financial year at a record discount of more than US\$30 per tonne. This was due to rising coking coal prices (lower grade ores require more coke in the steel-making process) and efforts in China to reduce carbon emissions from the steel industry.

Quantity and value

Iron ore was by far the most valuable mined commodity in Western Australia and its overall contribution to the value of the State's resources sector continued to grow.

It accounted for 83 per cent of the value of all mineral sales and 74 per cent of all commodity sales in 2020-21 (up from previous highs of 79 per cent and 67 per cent respectively in 2020).

All-time high prices saw the value of iron ore sales reach a new record of \$155 billion in 2020-21, up by almost 50 per cent on the previous financial year.

Iron ore became the first single commodity produced in WA with sales valued at more than \$100 billion in 2019-20. It broke another threshold in 2020-21, becoming the first single commodity produced in WA with sales valued at more than \$150 billion.

To put this into perspective, iron ore sales in 2020-21 were valued at more than all mineral and petroleum sales from Western Australia just two years ago.

The State had 839 Mt in iron ore sales in 2020-21, the second highest level for a financial year after 2017-18.

The three major producers – Rio Tinto, BHP, and FMG – once again dominated sales with 87 per cent of total sales volumes.

BHP and FMG both achieved record levels of production during the financial year from strong operational performance across the supply chain, while output was negatively affected at Rio Tinto's operations by above average rainfall, shutdowns related to new replacement mines, processing plant availability, and cultural heritage management.

Sales quantities were also boosted by the entry into the market of smaller (higher cost) producers (described below).

WA was still the world's largest seaborne producer in 2020, accounting for 36 per cent of global iron ore production, a larger share than in 2019. WA was also responsible for 99 per cent of Australia's iron ore production.

Sales from WA were overwhelmingly exported to China (82 per cent), with Japan (six per cent) and South Korea (six per cent) the next two largest markets. Singapore (three per cent) and Hong Kong (two per cent) have also emerged as more significant markets for WA iron ore over the past 18 months, likely due to ship bunkering and related to the impact of COVID-19 on logistics and supply chains

Notable events

- BHP commenced iron ore production at its South Flank project in May 2021. South Flank will produce 80 million tonnes per annum (Mtpa), replacing production from the Yandi mine.
- FMG opened the new Eliwana mine (part of its new Western Hub) in December 2020, which will produce 30 Mtpa replacing tonnes from its near end-of-life Firetail mine. It also completed the conversion of haulage trucks to autonomous systems and deployed a fleet of autonomous light vehicles at its Chichester Hub.

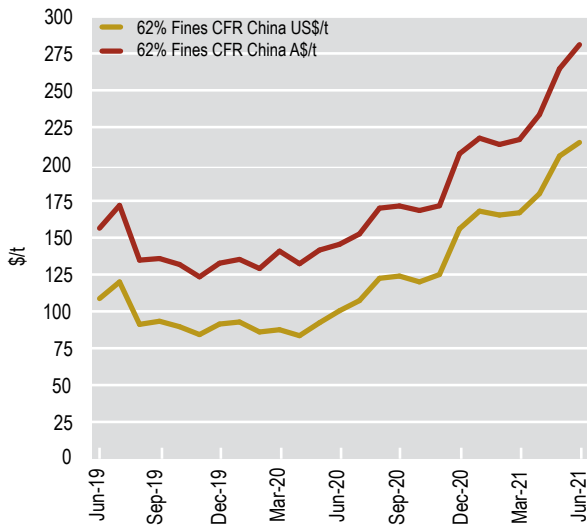


Figure 18 | **62% Fe iron ore price**
Source: Argus Metals

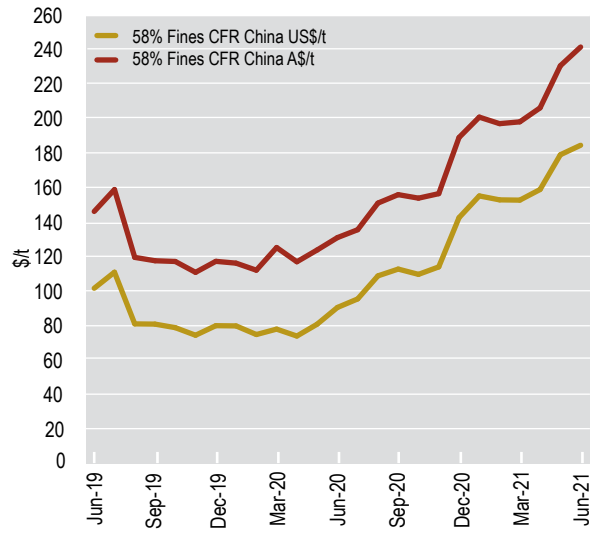


Figure 19 | **58% Fe iron ore price**
Source: Argus Metals and TSI

- Mineral Resources commenced iron ore production at its Wonmunna project in March 2021. It has a nameplate production capacity of 5Mtpa.
- Atlas Iron achieved first production from the Sanjiv Ridge (formerly Corunna Downs) mine in February 2021. The project will boost Atlas Iron's annual output, providing four to five Mtpa of iron ore lump and fines.
- GWR Group shipped maiden lump iron ore from its Wiluna West C4 iron ore mine in February 2021.
- Fenix Resources achieved a maiden shipment of iron ore from its Iron Ridge project in February 2021.
- Mineral Resources completed the purchase of Red Hill Iron's 40 per cent interest in the Red Hill Iron Ore joint venture in September 2021.
- Rio Tinto implemented management changes following the destruction of rock shelters at Juukan Gorge within the company's Pilbara iron ore operations.
- Following the end of the 2020-21 financial year, several projects announced the suspension of operations due to a fall in the price of iron ore.
 - The Ridges operations in the East Kimberley were suspended in September 2021.
 - GWR Group announced a 30-day suspension of mining operations at the Wiluna West C4 mine in September 2021, and a 14-day extension to this suspension in October 2021.
 - Mount Gibson Mining suspended its Shine project in October 2021, just months after first production and sales.

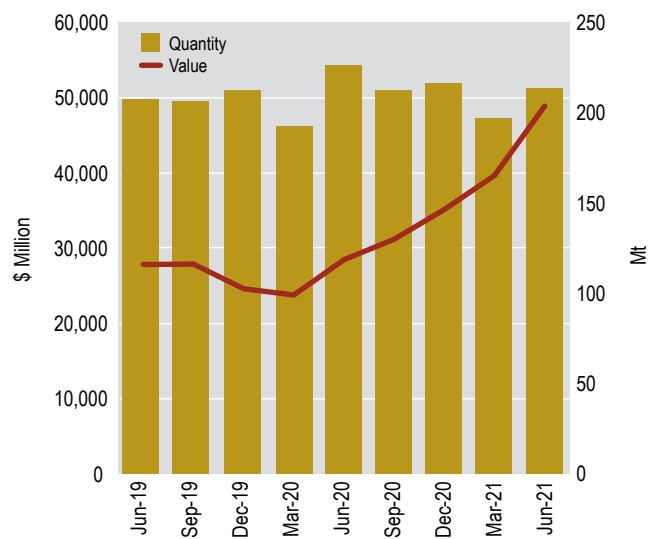


Figure 20 | **Iron ore quantity and value by quarter**
Source: DMIRS

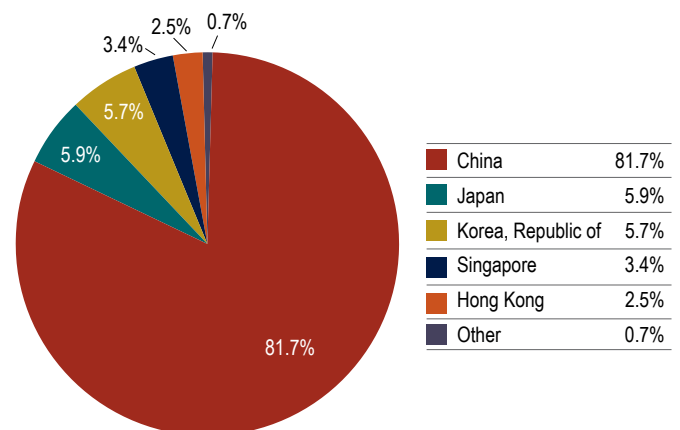


Figure 21 | **Iron ore exports 2020-21**
\$150 Billion
Source: ABS

WA's place in the global iron ore market

Global iron ore markets have seen dramatic changes over the last two decades.

The dominant change has been the massive increase in steelmaking, driven primarily by the rapid industrialisation and urbanisation of China. Global crude steelmaking increased from 850Mt in 2000 to 1,878Mt in 2020. Over that period, China's crude steel production rose from 129Mt to 1,05Mt.

The rapid growth in steelmaking has driven strong demand for iron ore. As China is not self-sufficient in iron ore, it has relied on seaborne imports to satisfy its steel manufacturing sector.

Western Australian iron ore producers took advantage of China's demand and undertook new projects and project expansions to address the market's supply shortage. As a result, Western Australia's iron ore production more than doubled from under 400Mt in 2010 to more than 800Mt by 2017, a level the State's producers have since maintained.

In recent years, major new Western Australian iron ore projects have largely represented replacement capacity for aging and depleted mines, such that there is limited capacity for higher exports in the near future.

Western Australia is currently the largest producer and largest seaborne supplier of iron ore, representing 55 per cent of the seaborne market by tonnage in 2020.

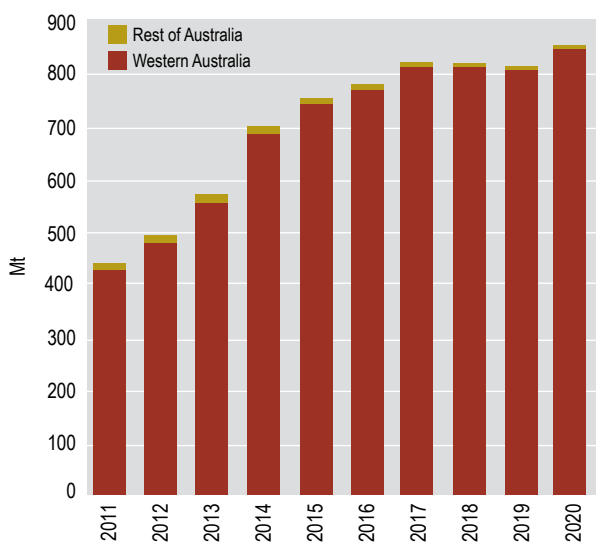


Figure 22 | **WA iron ore production v rest of Australia**
Source: DMIRS and OoCE

Brazil, which was comparable in size to Australian production two decades ago, now accounts for 21 per cent of the market.

The remaining global exporters such as South Africa, Canada, India, Ukraine and Russia are each responsible for four per cent or less of global seaborne supply.

Western Australia has benefitted from competitive advantages to meet demand from China that include its:

- world class iron ore resources amenable to large scale mining and logistics, and that are of a grade suitable for use in steelmaking without additional concentration (so called 'direct shipping ore').
- proximity to the main growth markets relative to the main competition in Brazil, which significantly reduces shipping costs to Chinese ports relative to Brazil.

The Chinese Government has indicated an interest in diversifying its iron ore supply sources, which has prompted moves to develop mines in other countries such as Algeria, Congo and Guinea. The massive Simandou project in Guinea, for example, had its port and rail project agreement signed off at the end of 2020. Simandou is projected to be completed by 2025, however there are significant challenges to bringing the 100Mtpa project into production.

Longer term, China is expected to see decreased reliance on iron ore feedstock as the country begins to recover steel scrap from retired vehicles and older infrastructure projects. In the long run, China is also likely to have diminished reliance on Western Australian iron ore supply. In the short term, the country's alternative supply options are limited.



Figure 23 | **Iron ore exploration expenditure 2020–21**
Total WA spend \$455 Million
Source: ABS



The major commodities file contains the following:

- Quarterly production and sales value figures for iron ore in WA.
- Historic annual average iron ore price and recent monthly prices.
- Value of iron ore exports from WA by destination.
- Historic annual iron ore production in WA compared with the rest of Australia.
- Historic annual calendar-year iron ore imports and crude steel production in China since 1980 and a detailed breakdown of iron ore imports to China, including Australia's contribution.
- Annual historic financial-year iron ore imports and crude steel production in China since 1990–91 and a detailed breakdown of iron ore imports to China, including Australia's contribution.

2.1.2 Gold

Prices

The price of gold rose to its highest ever value at more than US\$2,000 per oz (\$2,800 per oz) in August 2020.

While the price of gold trended lower across the rest of the financial year, it was still at a historically high level and rose by 18 per cent for the year compared to 2019-20.

For local producers, the average annual price rose just six per cent due to the impact of a stronger Australian dollar.

Prices were overall linked to factors associated with the COVID-19 pandemic. They were:

- supported by ongoing economic uncertainty and weak growth related to COVID-19; and
- weakened by positive sentiment related to COVID-19 vaccine rollouts, as well as concerns about inflation and rising interest rates related to stimulus spending measures.

Quantity and value

Higher prices saw the value of gold sales reach \$16.6 billion, up by four per cent from 2019-20 but down from the record \$17.3 billion in sales in 2020.

This result meant the gold sector became WA's second most valuable commodity overall after iron ore, surpassing the LNG sector for the first time in a decade, and accounting for eight per cent of sector-wide sales.

During the year, nearly 208t (6.7Moz) of gold were sold, down marginally from a recent high of 212t (6.8Moz) in 2019-20 and still less than the production boom in the mid-1990s. This fall was not due to any single operation but rather represented a general decrease in production across the industry.

The top 10 gold projects in WA accounted for more than half of the State's total gold production, largely the same as in previous years.

WA was still Australia's most significant gold producer with 66 per cent of the nation's estimated 318t (10.2Moz) of production. The State was also the third largest gold producer in the world when compared to other countries, accounting for six per cent of global output.

Exports of gold from WA also increased to a record \$22 billion. The United Kingdom (40 per cent) was the largest destination for gold exports from WA, followed by the United States of America (16 per cent), Singapore (10 per cent), China (nine per cent), and India (six per cent).

A note about gold exports from WA

The ABS releases Western Australian export data that shows exports of gold that are significantly higher than gold produced in this State.

This is because Gold Corporation, or as it is more commonly known, The Perth Mint, which is Australia's only London Bullion Market Association (LBMA) accredited gold refinery, refines gold produced in other states and territories, gold from surrounding countries and also secondary gold, mainly from Asia.

The ABS estimates that gold exports from Western Australia in 2020-21 amounted to approximately \$22 billion. Approximately 75 per cent or \$16.6 billion was gold produced in Western Australia.

The remaining 25 per cent (approximately \$5.4 billion) can be attributed to gold refined and exported from Western Australia but produced from mining operations in other states, territories and overseas.

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

Recent trends in Western Australia's gold exports

Until recently, Western Australia's gold exports had been predominantly to China, the United Kingdom, Hong Kong, Singapore, Thailand and India.

However, over the last 18 months, the United States emerged as the second largest importer of gold from WA. At the same time, the value of gold exports to China decreased.

This shift was against a backdrop of increased demand for gold as a secure and dependable investment during a period of economic crisis and uncertainty.

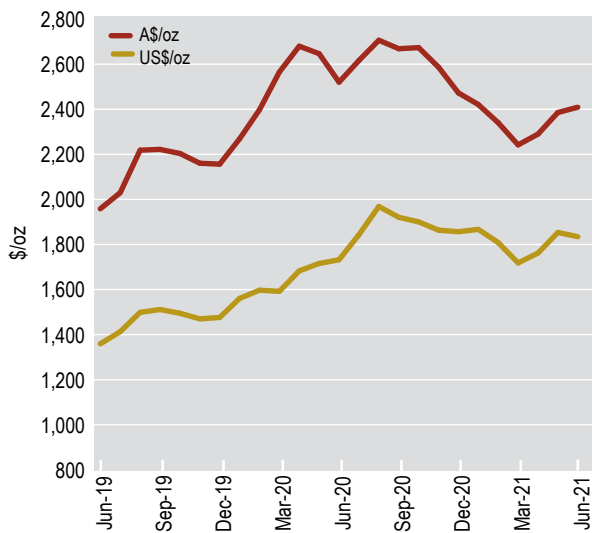


Figure 24 **Gold price**
Source: Perth Mint and Kitco

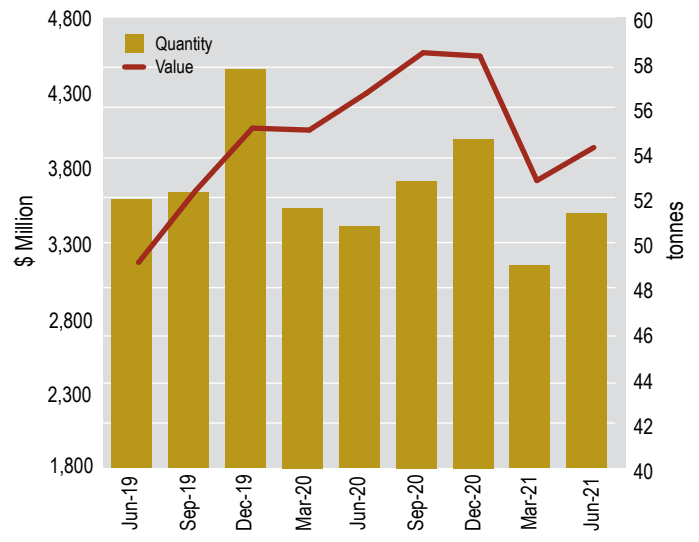


Figure 25 **Gold quantity and value by quarter**
Source: DMIRS

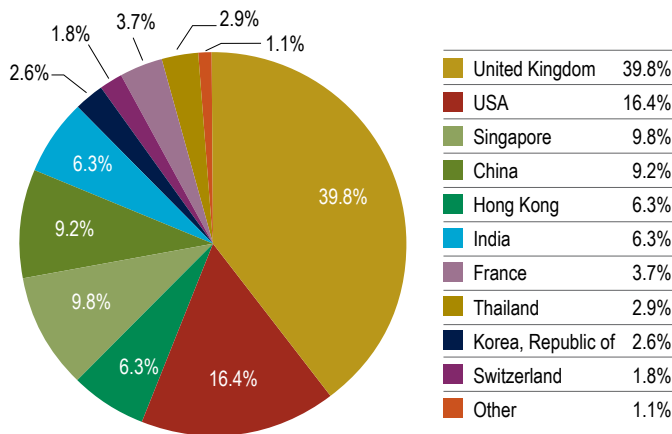


Figure 26 **Gold exports 2020-21**
\$22 Billion
Source: ABS
Note: Includes gold refined/processed and exported from WA that is produced from mining operations in other states, territories and overseas.

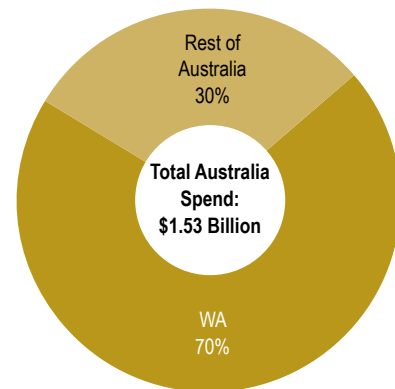


Figure 27 **Gold exploration expenditure 2020-21**
Total WA spend \$1.07 Billion
Source: ABS

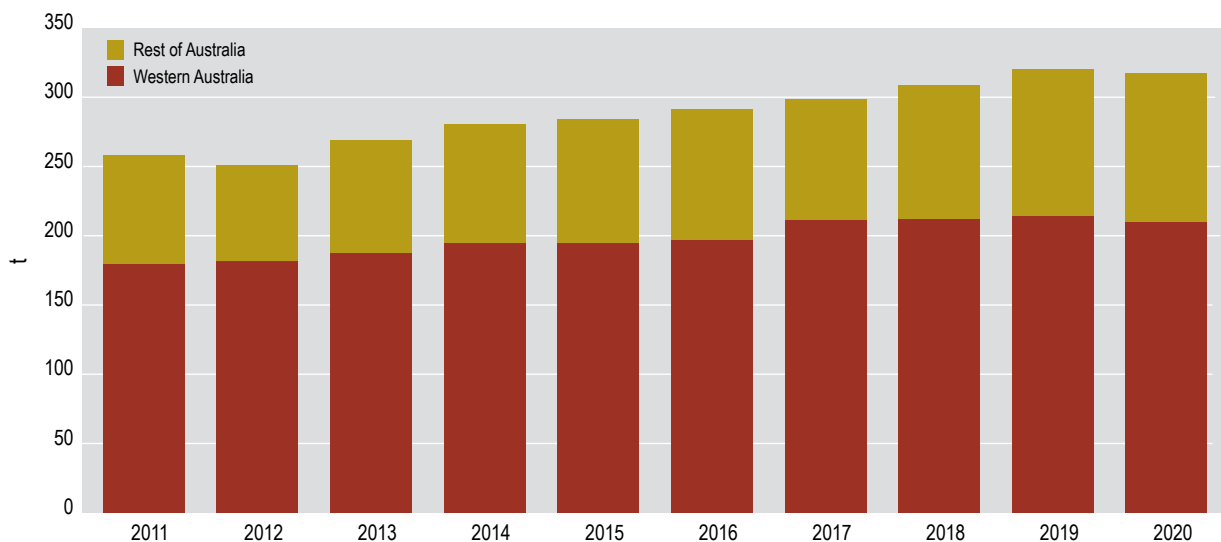


Figure 28 **WA gold production v rest of Australia**
Source: DMIRS and OoCE

The COVID-19 pandemic, in particular, elevated investor uncertainty that led many, including central banks, to seek assets to diversify and protect the value of investment portfolios in a time of crisis.

Notably, many global banks started buying and increasing their reserves of gold, and even transferred offshore gold holdings back to their vaults. This not only led to a surge in demand for gold but also created a shortage in the physical supply of gold and a rise in prices.

Against this backdrop, a number of factors explain recent trends in gold exports, including the rise in the value of gold exports to the USA and drop in the value of exports to China.

The outbreak of the global COVID-19 pandemic in early 2020 caused logistic constraints due to lockdowns and the suspension of mining and processing operations around the world, including major gold refineries in Switzerland and other parts of the world. However, gold miners in Western Australia and the Perth Mint refinery were able to continue operating, even after, and perhaps because, the State Government imposed a 'hard border'.

There was reduced demand for physical gold from Asia. China, previously among the largest importers of gold from WA, had virtually no demand for gold after it went into lockdown in early 2020. Chinese demand stayed very low until February 2021. Lower levels of demand were also present in other Asian countries due to social restrictions and economic slowdowns.

An arbitrage opportunity developed across two of the world's largest gold trading hubs – COMEX in New York and LBMA – in April and May 2020 with the COMEX futures contract price trading above the LBMA spot price.

With the higher COMEX gold futures contract pricing, traders took advantage of the opportunity to generate a profit by selling COMEX gold futures contracts at a relatively higher price and purchasing physical gold from the COMEX exchange at a relatively lower price.

The Perth Mint, being one of the very few refineries still operating during early-mid 2020, was able to meet this demand and supply banks that wanted to deliver gold into COMEX.

Notably, even though WA exported a significant value of gold to the USA at the start of the pandemic, it ranked fifth overall among jurisdictions from which the USA imported gold in 2020 behind Switzerland, Canada, Mexico, and Singapore.

Notable events

- Northern Star Resources and Saracen Mineral Holdings completed a 'merger of equals' in February 2021 with the merged company trading as Northern Star Resources.
- Regis Resources acquired a 30 per cent stake in the Tropicana gold mine joint venture from IGO in May 2021.
- Evolution Mining acquired the Kundana operations from Northern Star Resources in August 2021.
- Novo Resources Corp became the owner of the Nullagine project through its acquisition of Millennium Minerals. Novo Resources Corp absorbed the Nullagine project into its Beatons Beatons Creek operations operations and subsequently poured first gold from Beatons Creek in February 2021.
- Ora Banda Mining poured first gold at its recommissioned Davyhurst project in February 2021. It is targeting annual gold production of 81koz over an initial five year mine life.
- Capricorn Metals achieved first gold from its Karlawinda project in July 2021. It is targeting production of 110 to 125 thousand ounces (koz) of gold per annum over a 12-year mine life.
- The Boston Shaker mine at Tropicana achieved first production in September 2020. It will contribute approximately 100koz per annum to gold production at Tropicana over a seven-year mine life.
- Red 5 commenced construction on an expansion of the King of the Hills project in December 2020. Once complete, King of the Hills is expected to produce an average of 146koz of gold per annum over a 16-year mine life.
- Newcrest Mining committed in August 2021 to construction of an extension of its Telfer project through the Telfer West Dome Stage 5 cutback. The development will ensure Telfer is able to continue to operate for at least the next two years.
- Wiluna Mining commenced construction on the Stage 1 growth project in December 2020. The project will increase production to approximately 100 to 120koz of gold in concentrate per annum at the Wiluna / Matilda project.
- Pantoro made a FID on the restart of the Norseman project in February 2021, commencing construction in October 2021.
- Northern Star Resources committed to expansion of its Yandal production centre through doubling the capacity of the Thunderbox mill and infrastructure and mine development.

2.1.3 Alumina and Bauxite

Prices

The price of Australian alumina remained depressed overall at an average of \$378 per tonne in 2020-21, down from \$419 per tonne in 2019-20.

This was largely due to ongoing overcapacity and a supply surplus in the seaborne market.

The price did trend higher across the financial year, increasing nine per cent from \$350 per tonne in June 2020 to \$383 per tonne in June 2021, but remained below pre-pandemic levels.

While a more significant price rise remained constrained by a market surplus, the upward shift across the year was supported by:

- improving downstream demand (i.e. aluminium) from increased infrastructure spending driving construction and manufacturing activity, particularly in China but also other parts of the world, as part of the recovery effort from the COVID-19 pandemic; and
- a period of price arbitrage (i.e. the differential between China's domestic prices and import prices favoured imports) also supported seaborne prices.

Quantity and value

Weaker alumina prices overall meant that despite WA selling a record quantity of alumina and bauxite in 2020-21 (14.4Mt), the value of those sales declined by 13 per cent to \$5.6 billion.

All-time high alumina sales were due to record production for Alcoa's refineries as well as South32's Worsley operations, which operated above nameplate capacity enabled by improvement initiatives.

Alcoa had bauxite exports of 1.8Mt, which was similar to 2019-20.

Alumina remained the State's third most valuable mineral commodity and fifth most valuable commodity overall, accounting for three per cent of the value of mineral sales and all mineral and petroleum sales.

WA accounted for more than 11 per cent of global alumina production in 2020, making it the world's second largest producer after China. WA was also responsible for almost 68 per cent of Australia's alumina production.

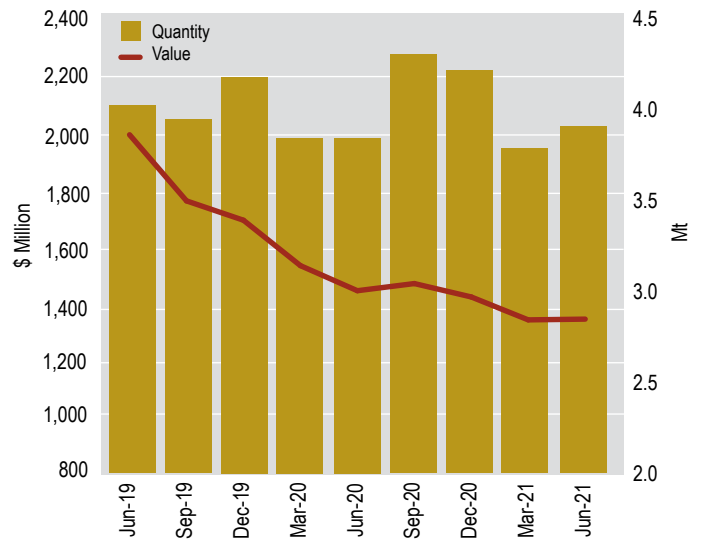


Figure 30 Alumina and bauxite quantity and value by quarter
Source: DMIRS

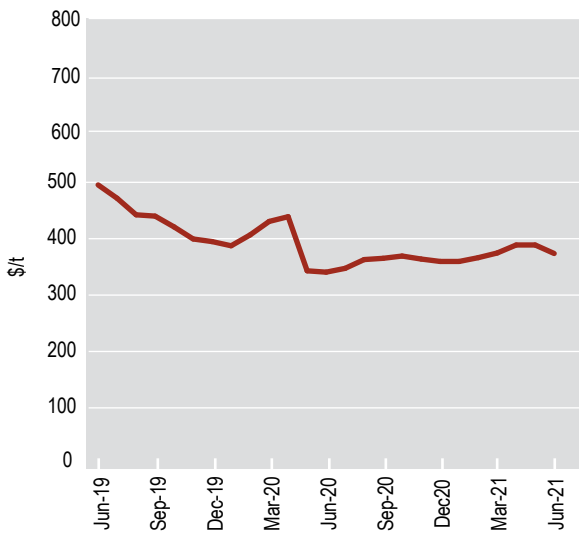


Figure 29 Alumina price
Source: ABS

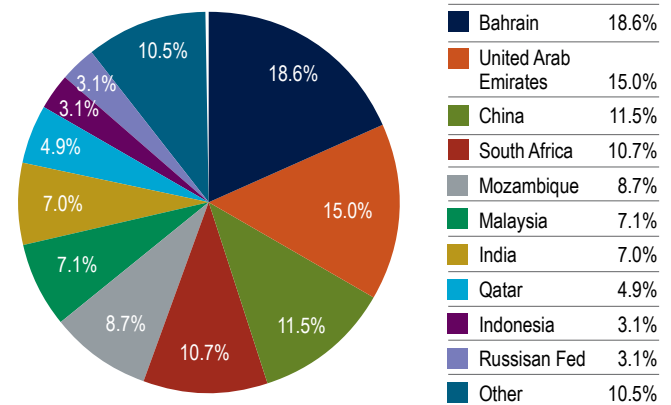


Figure 31 Alumina and bauxite exports 2020-21
\$5.7 Billion
Source: DMIRS

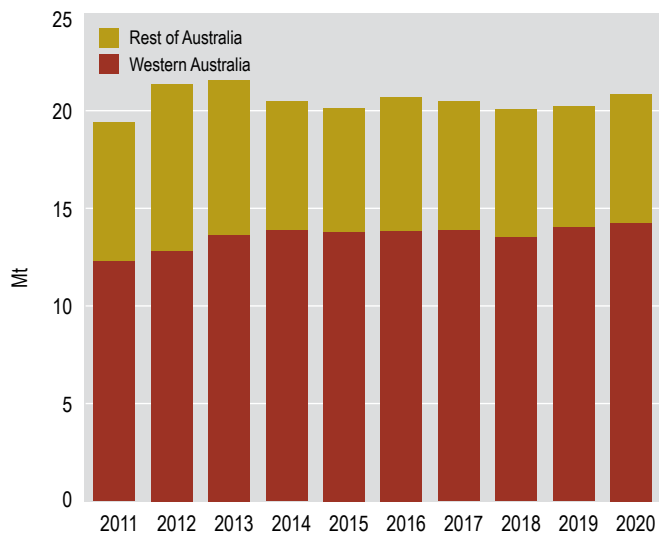


Figure 32 | **WA alumina production v rest of Australia**
Source: DMIRS and OoCE

Sales were predominantly to Bahrain (19 per cent), the United Arab Emirates (15 per cent), China (12 per cent), South Africa (11 per cent), and Mozambique (nine per cent).

Notable events

- Alcoa signed three new gas agreements with Warrego Energy, ExxonMobil and Chevron to supply 198 petajoules (PJ) of gas to its local alumina refineries from 2024.
- FYI Resources and Alcoa signed a Memorandum of Understanding (MoU), and subsequently a binding agreement for the joint development of a high-purity alumina project in WA.
- Alcoa is undertaking a project to trial using renewable energy in the alumina refining process at its Wagerup refinery.



The major commodities file contains detailed information about alumina including the following:

- Quarterly quantity and value figures.
- Historic annual average prices and recent monthly prices.
- Value of alumina exports from WA by destination.
- Annual historic production in WA compared with the rest of Australia.

2.1.4 Nickel

Prices

The price of nickel increased to an average of US\$16,285 per tonne, up from US\$13,974 per tonne and a level last reached eight years ago.

The nickel price has risen strongly since April 2020 on strong fundamentals including:

- heightened demand from a recovery in stainless steel production in China, as well as nickel use in batteries as the number of EVs being built and sold continues to grow; and
- supply disruptions from flooding at Nornickel's operations in Russia, the suspension of operations in Myanmar following a coup d'état, COVID-19 related restrictions in New Caledonia, and a strike at Vale's Sudbury operations in Canada.

A brief price blip occurred in March 2021 after China's Tsingshan Holding Group Co. Ltd (the world's largest nickel producer) announced plans to process nickel pig iron into high-grade nickel matte that can be converted into nickel sulfate for use in the EV battery sector, and to significantly ramp up its nickel production in Indonesia.

Quantity and value

Higher prices, combined with rising sales quantities, saw the value of nickel sales reach \$3.5 billion – the industry's highest sales value in seven years.

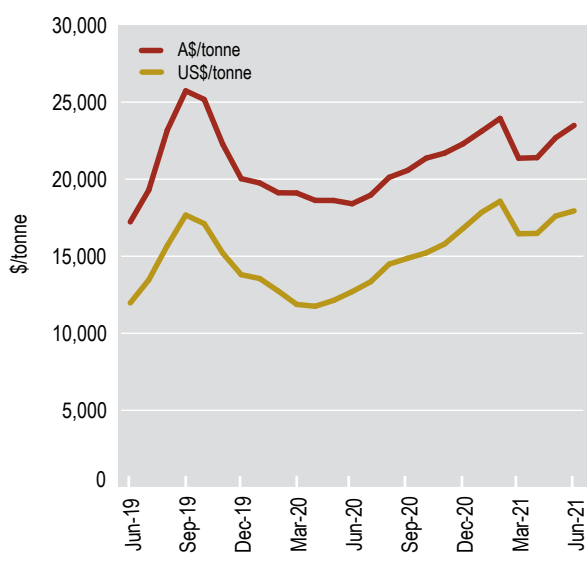


Figure 33 | **Nickel price**
Source: LME

Nickel sales quantities increased three per cent year-on-year to 158,710t, up from 153,420t.

Sales were supported by increased production from the BHP Nickel West operations (the State's largest nickel producer) the start-up of new mines and improved operational stability due to maintenance shutdowns in 2019-20, as well as the ramp up of the restarted Ravensthorpe project and outperformance at the Nova operations.

On the downside, production was impacted by planned maintenance at Minara Resources' Murrin project, and lower grades at Western Areas' Forrestania project.

China (44 per cent), South Korea (16 per cent), Japan (eight per cent), the Netherlands (seven per cent), and the United States (seven per cent) were the State's top nickel customers.

Nickel was WA's fourth most valuable mineral commodity and sixth most valuable resources commodity overall. It accounted for two per cent of the value of all resource sales.

WA remained Australia's only nickel producer, a status it has held since 1997. WA was also a significant global producer, accounting for seven per cent of world production, ranking fifth in the world.

Notable events

- BHP Nickel West had:
 - delivered first crystals from its Kwinana nickel sulphate plant in October 2021. It will produce 100,000t of nickel sulphate per year when fully operational;
 - entered a deal with TransAlta for the construction of two solar farms and a battery storage system (known at the Northern Goldfields Solar Project) for its Mt Keith and Leinster mines; and
 - signed nickel supply agreements with Tesla Inc., the world's largest manufacturer of EVs and battery storage systems, and a battery-making joint venture between Toyota and Panasonic.
- First Quantum Minerals sold a 30 per cent interest in the Ravensthorpe nickel operation to South Korean steel producer POSCO. It also mined first ore from its Shoemaker-Levy mine, with first concentrates expected in the December quarter 2021. The mine will extend the life of the Ravensthorpe operations by 20 years.

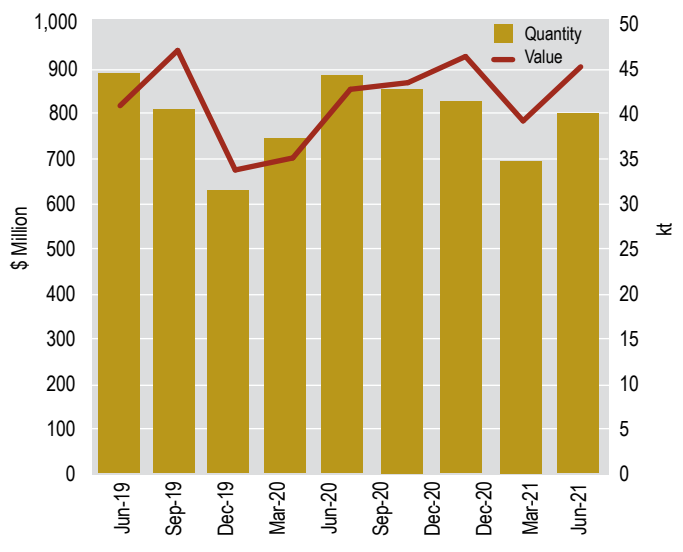


Figure 34 | Nickel quantity and value by quarter
Source: DMIRS

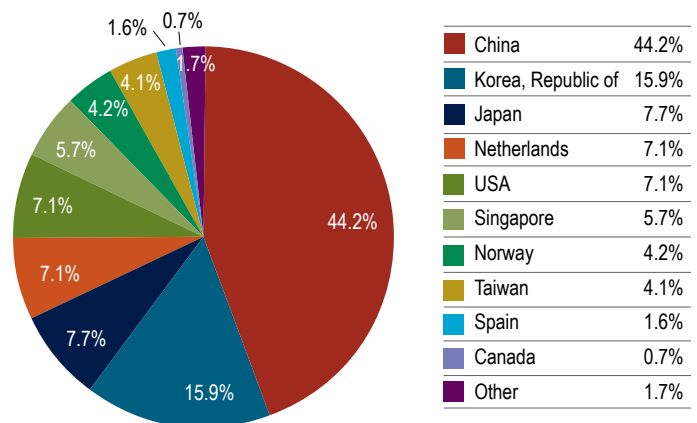


Figure 35 | Nickel exports 2020-21
\$2.8 Billion
Source: DMIRS

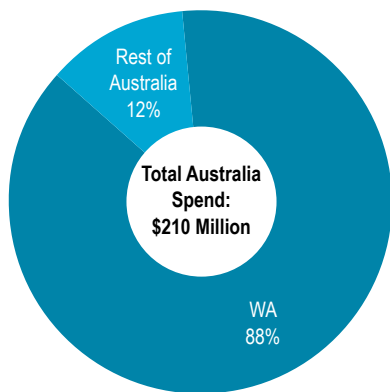


Figure 36 | **Nickel cobalt exploration expenditure 2020-21**
Total WA spend \$185 Million
 Source: ABS

- Panoramic Resources announced the restart of the Savannah nickel project and achieved first concentrate in October 2021. The operation has a 12-year mine life with an average annual production target of 9,072t of nickel, 4,683t of copper and 676t cobalt.
- Mincor Resources opened its Cassini nickel mine, part of its broader Kambalda nickel operation, with first nickel concentrate to be delivered in mid-2022.



The major commodities file contains information about nickel including the following:

- Quarterly quantity and value figures.
- Historic annual average prices and recent monthly prices.
- Value of nickel exports from WA by destination.
- Annual historic nickel production in WA compared with the rest of Australia.

2.1.5 Copper, Lead and Zinc

Prices

The price of copper spiked to record levels of more than US\$10,000 per tonne in May for a financial year average of almost US\$8,000 per tonne up from less than US\$6,000 per tonne the previous year.

Copper was boosted by improved demand from COVID-19 recovery measures, economic stimulus, and infrastructure plans boosting construction activity in China, the United States and many other parts of the world.

In addition, supporting prices were concerns over supply following the closure of the Chilean border – Chile is the world's largest copper supplier – due to a surge in COVID-19 cases, as well as disruptions to operations in Canada, the United States and Peru.

Zinc trended higher, approaching US\$3,000 per tonne by the end of the financial year, to average of US\$2,656 per tonne up from US\$2,204 per tonne the previous financial year.

Stronger prices were primarily due to concerns over supply amid mine curtailments and indefinite mine closures, especially in Peru and China. Infrastructure stimulus spending and manufacturing output (such as home appliances), has also been supportive.

While the prices of copper and zinc strengthened significantly, lead prices remained subdued, rising just five per cent to an average of US\$1,982 per tonne from US\$1,896 per tonne. This was due predominantly from reduced demand for lead-acid batteries – the main end use of lead – and a limited ability to curtail mined supply as it is produced primarily as a by-product.

There were signs of life at the end of the financial year with lead fetching upwards of US\$2,100 per tonne – a three-year monthly average high point. The rebound was on improved demand for lead-acid batteries from higher battery failures rates in the aftermath of many cars going unused for an extended period during COVID-19 lockdowns.

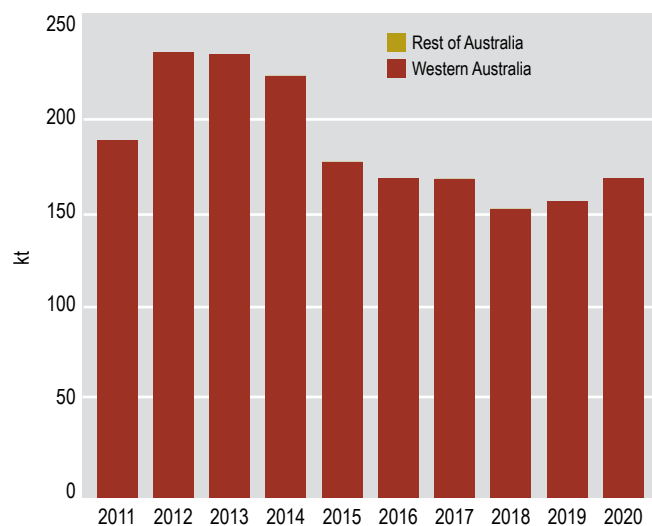


Figure 37 | **WA nickel production v rest of Australia**
 Source: DMIRS and OoCE

Quantity and value

Overall copper, lead and zinc sales increased to \$1.7 billion (up six per cent from \$1.6 billion in 2019-20) – the highest level since 2014.

Copper was the major commodity produced from this group, achieving an all-time high sales value of \$1.5 billion equal to 87 per cent of all group sales, while there was \$229 million of zinc (13 per cent) and \$2 million of lead (less than one per cent) sold.

As a result, copper was again WA's fifth most valuable mined commodity, remaining in the top five for a second consecutive year after it was displaced by the lithium industry in 2017-18 and 2018-19.

Record copper prices helped offset a fall in sales quantities to a decade low as many of the State's copper producers reported lower sales volumes and following the suspension of the Nifty operations in November 2019.

Zinc sales declined to 64 thousand tonnes (kt) while there was just 851t of lead sales with 29 Metals' Golden Grove project only reporting one quarter of lead sales.

WA remained a relatively minor producer of copper, lead and zinc in both an Australian and global context.

Copper, lead and zinc exports were not available due to ABS confidentiality restrictions.

Notable events

- Cyprium Metals acquired a portfolio of assets from Metals X including the Nifty copper operation and exploration assets in March 2021. It is progressing a restart plan for Nifty.

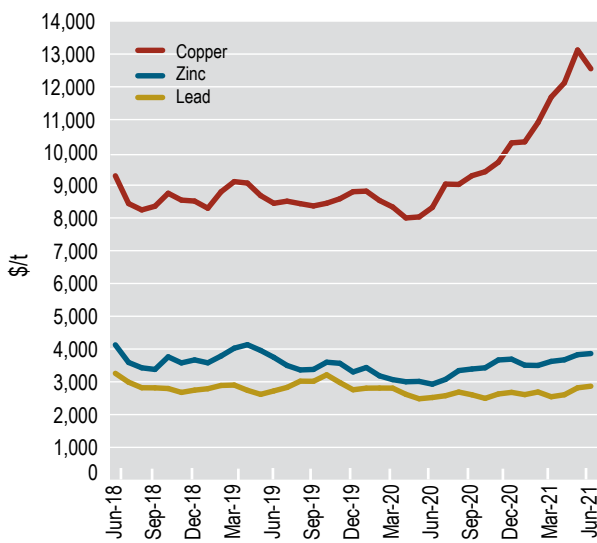


Figure 38 | **Copper, lead and zinc price**
Source: LME

- Galena Mining made a FID in June 2021 and commenced substantive development works in September 2021 at its Abra lead project. First production is expected in early 2023.
- 29Metals, a subsidiary of EMR Capital, owner of the Golden Grove project, was listed on the ASX on 2 July 2021.

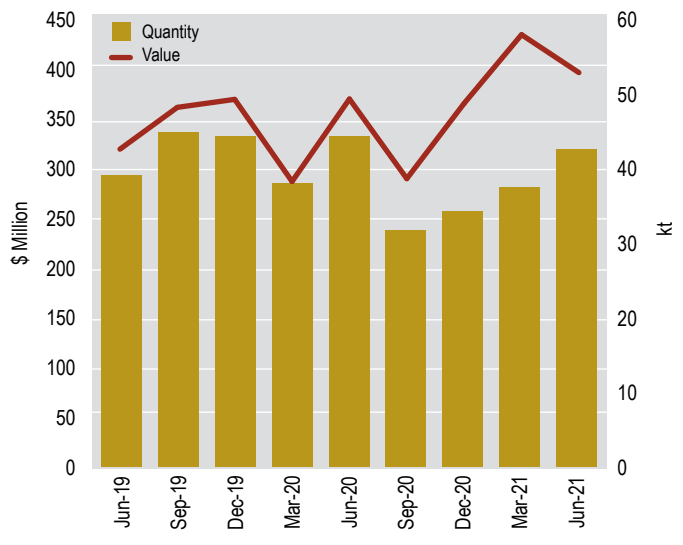


Figure 39 | **Copper quantity and value by quarter**
Source: DMIRS



The major commodities file contains the following:

- Quarterly quantity and value figures for copper, lead and zinc.
- Historic annual average prices for copper, lead and zinc and recent monthly prices.
- Value of copper, lead and zinc exports from WA by destination.
- Annual historic copper, lead and zinc production in WA compared with the rest of Australia.

2.1.6 Lithium

Prices

While lithium prices were down year-on-year, this conceals a significant reversal of fortunes for the industry.

The overall fall in lithium prices occurred in the second half of 2020.

- Spodumene concentrate recorded a low of US\$390 per tonne in October 2020 as the ramp-up at lithium mines outpaced construction on new and expanded lithium hydroxide conversion capacity, particularly in China, leaving some spodumene concentrate without a home.
- The price for battery-grade lithium hydroxide in China recorded a low of US\$6,046 per tonne in August due mainly to delays in the introduction of nickel-rich cathodes (those that rely on lithium hydroxide) in batteries across Asia and in the construction of new battery megafactories.

However, prices rebounded and continued to climb thereafter from rising lithium-ion battery demand amid surging EV sales in the European Union and China, as well as mining supply curtailments and suspensions.

- Spodumene concentrate was selling at US\$664 per tonne (Cost including freight (CIF)) by June 2021, a 70 per cent increase from the October 2020 low.
- The price for a tonne of battery-grade lithium hydroxide in China was US\$13,708 per tonne, more than double its value from just nine months earlier.

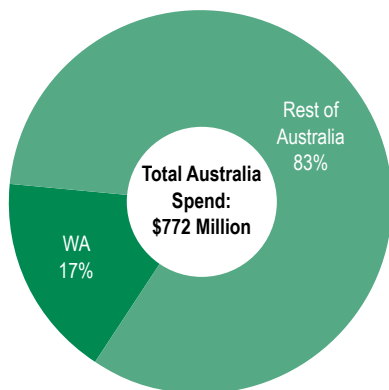


Figure 40 | **Copper exploration expenditure 2020–21**
Total WA spend \$148 Million
Source: ABS

Quantity and value

Despite the recent recovery in lithium prices, the State's spodumene concentrate sales were valued at \$938 million – more than 2020, but still less than 2019-20 and less than half of the single year sales record of \$1.9 billion set in 2018.

However, in a signal of improving market conditions, sales quantities were up for the first time in three years increasing by 12 per cent to 1.6Mt.

This was due to Mt Marion achieving record production as well as the Mt Cattlin and Pilgangoora projects moving back towards capacity after a period of supply curtailments. These developments offset Altura Mining's operations at Pilgangoora being put into care and maintenance in October 2020, and earlier suspensions at Bald Hill and Wodgina.

Notable events

- First lithium hydroxide was produced from Western Australia in August 2021 at the Kwinana lithium hydroxide plant (a joint venture of Tianqi Lithium and IGO). The plant is expected to ramp up to full production by the December quarter 2022.
- IGO acquired minority stakes in the Greenbushes lithium mine (24.99 per cent) and the Kwinana lithium hydroxide facility (49 per cent) from Tianqi Lithium in June 2021.
- MARBL, a joint venture between Mineral Resources and Albemarle, committed in October 2021 to restart the Wodgina lithium project at one third of its capacity, with first spodumene concentrate expected in the September quarter 2022.

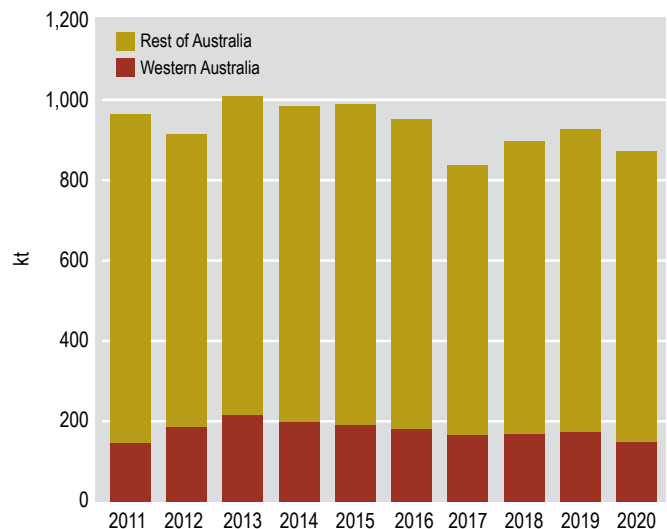


Figure 41 | **WA copper production v rest of Australia**
Source: DMIRS and OoCE

- Covalent Lithium (a joint venture of Wesfarmers and Sociedad Quimica y Minera de Chile) approved and commenced construction on the Mt Holland lithium project. The project is expected to produce 50,000 tonnes per annum (tpa) of battery-grade lithium hydroxide starting in the second half of 2024.
- Galaxy Resources, owner and operator of the Mt Cattlin project, merged with Orocobre Limited in August 2021, creating the fifth largest lithium producer in the world. The merged entity is trading as Orocobre Limited. It subsequently changed its name to Allkem.
- Altura Mining entered administration in late October 2020 and its Pilgangoora operation was put into care and maintenance.
- In an active year, Pilbara Minerals:
 - acquired Altura’s project at Pilgangoora in January 2021 resulting in the consolidation of Pilbara Minerals’ existing operations and the former Altura project into a single Pilgangoora project comprising the Pilgan (existing Pilbara Minerals’ plant) and Ngungaju (former Altura plant) plants;
 - completed improvements at the Pilgan plant in October 2021 to increase its spodumene production capacity to up to 380,000 tpa from 330,000 tpa, with first spodumene concentrate from the restart of the Ngungaju plant also delivered in October 2021;
 - entered into a MoU with Calix Limited in May 2021 on the possible development of a plant to produce a concentrated lithium salt (a midstream lithium product) from lower grade spodumene concentrate; and

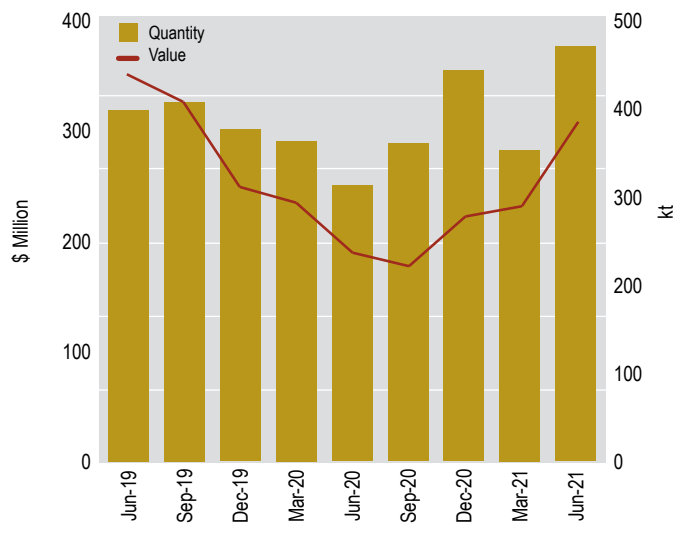


Figure 43 | Spodumene concentrate quantity and value by quarter
Source: DMIRS

- launched a digital trading and sales platform known as Battery Material Exchange in March 2021 for spot-spodumene concentrate sales from its Pilgangoora project, making sales of 10,000t at US\$1,250 per tonne in July 2021 and 8,000t at US\$2,240 per tonne in September.
- Neometals sold its option on 30 per cent of the spodumene offtake from the Mt Marion project to the project owners Mineral Resources and Jiangxi Ganfeng Lithium Co. Ltd in June 2021.

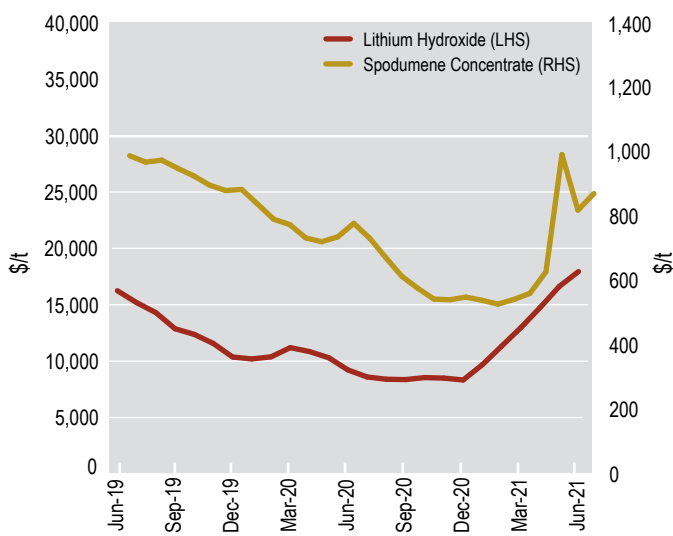


Figure 42 | Lithium prices
Source: Asian Metal

2.1.7 Mineral sands

Prices

Mineral sands prices trended down in 2020-21.

The market price of titanium products was lower, with rutile prices decreasing 12 percent to an average of \$1,688 per tonne and titanium dioxide prices falling 10 per cent to an average of \$3,659 per tonne.

Zircon prices also moved lower, falling 17 per cent to an average of \$1,728 per tonne.

With construction, renovation and manufacturing largely driving demand for titanium dioxide (a white pigment predominantly used in paints and manufacturing of consumer goods) and zircon (predominantly used in ceramics and tiles), prices were subdued by reduced activity in these areas associated with the COVID-19 pandemic.

This overall downward trend, however, obscured some positives with zircon on an upward trajectory through the first half of 2021 and titanium dioxide shifting higher at the end of the financial year.

This rally was due to a range of factors, including:

- Supply concerns stemming from issues at operations in South Africa and Sierra Leone.
- Increased demand for zircon as ceramics production in China and other locations such as Spain, Italy, Brazil and Turkey returned to pre-pandemic levels, while the global shift to renewable energy is increasing demand for use in refractories.
- Robust demand for titanium dioxide, particularly from the paints market, as the global economy recovers from the pandemic.

Quantity and value

Despite overall lower prices, total mineral sands sales were valued at \$824 million in 2020-21, up six per cent from the previous year.

About half of the State's mineral sands sales were from the mining and processing of titanium products (i.e. ilmenite, rutile, leucosene, and synthetic rutile), with the other half from zircon, garnet, and staurolite.

This increase in the value of these sales was largely due to higher volumes of ilmenite, rutile and zircon sales through the ramp-up of Image Resources' Boonanarring project and Iluka Resources' Cataby and Eneabba monazite and zircon recovery projects.

- Ilmenite sales increased 18 per cent to a nine-year high of 322,114t.
- Rutile sales increased 48 per cent to a five-year high of 48,548t.
- Zircon sales volumes increased 29 per cent to a 10-year high of 221,079t.

Synthetic rutile production was impacted by a planned production suspension by Iluka in February and March 2021 in order to manage stocks. This decision was related to an ongoing contractual dispute with its customer Chemours Co.

Mineral sands were the State's seventh most valuable mineral commodity in 2020-21, a position the industry has held since the emergence of the lithium industry in recent years.

WA was once again a significant producer of mineral sands products with an increasing share of global zircon and rutile production. It was the world's second largest producer of garnet and third largest producer of zircon, and was in the top 10 for ilmenite and rutile production.

China remained the State's biggest customer for mineral sand products, accounting for 51 per cent of the value of all exports. The next largest mineral sands export destinations were the Netherlands (eight per cent), the United States (six per cent), Saudi Arabia (five per cent), and Spain (five per cent).

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 our local 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 the department.

Notable events

- It was another active year for Iluka Resources. The company:
 - settled its contractual dispute with its customer Chemours in the June quarter 2021 with the terms including Chemours taking all of the synthetic rutile production not taken in 2020;
 - demerged its royalty on BHP Group's Area C iron ore operation into Deterra Royalties Ltd; and
 - made a FID to restart its Synthetic Rutile Kiln 1 at Capel in August 2021.
- Strandline Resources made a FID and commenced construction on its Coburn mineral sands project in April 2021. The project has a development cost of \$260 million, with forecast annual production and sales of 34kt of premium zircon, 54kt of zircon concentrate, 110kt of chloride-grade ilmenite, and 24kt of rutile. It has an estimated peak construction workforce of more than 300 people, and a production workforce of approximately 150 people.
- Resource Development Group made a FID on its Lucky Bay garnet project in June 2021.

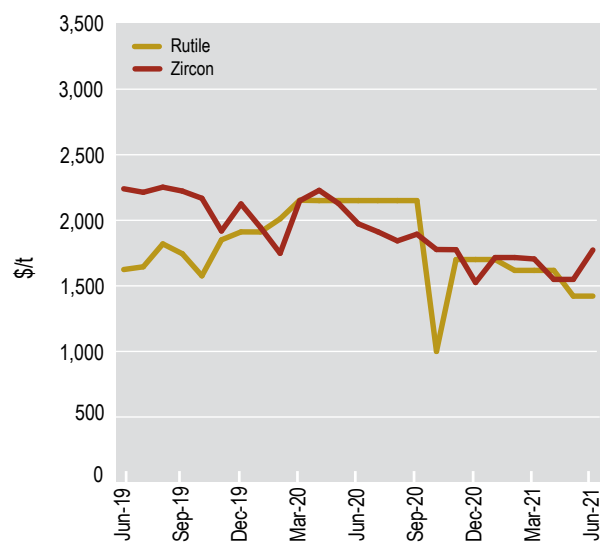


Figure 44 | Mineral sands prices
Source: ABS

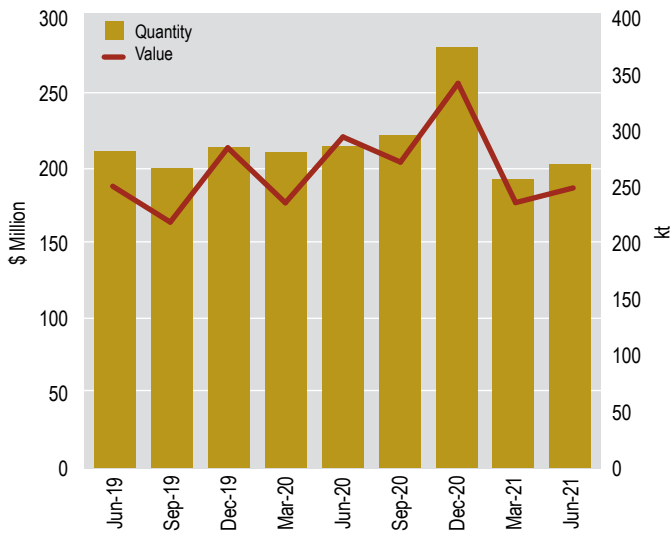


Figure 44 | **Mineral sands quantity and value by quarter**
Source: DMIRS

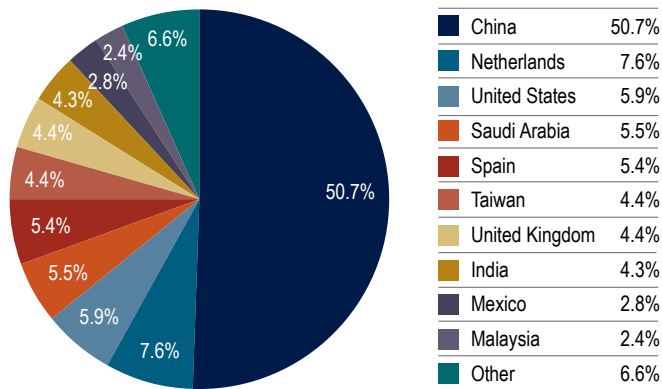


Figure 46 | **Mineral sands exports 2020-21**
\$1.5 Billion
Source: DMIRS

A changing world – critical minerals

In the future, commodity demand is expected to be driven by:

1. The world's transition to a low carbon future reliant on battery technologies for electric vehicles and energy storage systems and renewable energy generation technologies such as solar panels and wind turbines.
2. Emerging high-end technologies in the defence, communications, and medical industries, as well as in consumer electronics such as mobile phones, computers, and flat screen monitors.

These advancements are largely dependent on the supply of a range of minerals.

These 'critical minerals' include lithium, rare-earth elements, cobalt, titanium, zirconium, manganese, platinum-group elements, tantalum, graphite, vanadium and tungsten.

While not generally considered to be 'critical minerals' due to a diversity in sources of supply, nickel, copper, and aluminium will also be important to a clean energy future and emerging technologies.

Western Australia had sales of these minerals (and related feedstocks) valued at \$13 billion in 2020-21, equal to six per cent of total mineral and petroleum sales.

WA was also a globally significant producer of many of these minerals ranking as the world's largest supplier of lithium, second largest exporter of alumina, and among the top five jurisdictions for the production of cobalt, nickel, rare earth elements, and zircon. The State is also in the top 10 for manganese, ilmenite, and rutile output.

Western Australia has a host of significant project developments across these minerals that recently commenced or are under construction, positioning the State to grow its share of production in a net zero emissions future.

- The Kwinana lithium hydroxide plant achieved first lithium hydroxide in August 2021 and is expected to ramp up to full production by the December quarter 2022. Further investment is planned to complete construction on Stage 2 of the refinery that will see its capacity double in 2024.
- BHP Nickel West delivered first crystals from its Kwinana nickel sulphate plant in October 2021. It will produce 100,000t of nickel sulphate per year when fully operational.
- Panoramic Resources achieved first concentrate from the restart of the Savannah project in October 2021. The operation has a 12-year mine life with an average annual production target of 9,072t of nickel, 4,683t of copper and 676t cobalt.
- Element 25 commenced production from its Butcherbird manganese project in May 2021 with a first shipment in July 2021. It is targeting annual production of 312 kilotonnes per annum (ktpa) over a 42-year mine life.
- Albemarle is developing a 50,000tpa lithium hydroxide plant at Kemerton, on track for completion by the end of 2021.
- Covalent Lithium approved construction on the Mt Holland lithium project in February 2021. The project is expected to produce 50,000 tpa of battery-grade lithium hydroxide starting in the second half of 2024.
- The Greenbushes spodumene project is being expanded through a tailings retreatment facility that will have a capacity of 280,000tpa. It is expected to be operating by 2022.

- Pilbara Minerals is undertaking improvements at the Pilgan plant and plant modifications and other works on the Ngungaju plant that will increase the annual spodumene production capacity of its Pilgangoora operations to 600 ktpa by mid-2022.
- Western Areas' Odysseus nickel project is under construction and is expected to produce first concentrate in 2023, delivering 130,000t over a 10-year mine life.
- Mincor Resources' is targeting first nickel production from its recently opened Cassini mine in mid-2022. The project involves a five-year operation producing a total 71kt of nickel and 5kt of copper.
- First Quantum Minerals mined first ore from its Shoemaker-Levy mine, with first concentrates expected in the December quarter 2021. The mine will extend the life of the Ravensthorpe operations by more than 20 years.
- Lynas Corporation is progressing construction on its Kalgoorlie rare earths processing plant, targeting production by mid-2023. The project will upgrade rare earth concentrates by removing impurities to deliver a rare earth carbonate precipitate.
- Iluka Resources is constructing a new plant at Eneabba for the processing of mineral sands to produce a 90 per cent monazite concentrate. It also made a FID on a restart of its Synthetic Rutile Kiln 1 at Capel in August 2021.
- Strandline Resources made a FID on and commenced construction on its Coburn mineral sands project in April 2021. It has forecast annual production and sales of 34kt of premium zircon, 54kt of zircon concentrate, 110kt of chloride-grade ilmenite, and 24kt of rutile.

There are also many other projects targeting vanadium, rare earths and copper at an earlier stage of development.

2.1.8 Other mineral commodities

Salt

Quantity and value

There were 12.5 Mt in salt sales from WA in 2020-21, up 25 per cent from 11.3Mt in 2019-20.

Higher volumes combined with overall realised prices meant the value of the sector increased by 47 per cent to \$553 million.

Rio Tinto subsidiary Dampier Salt, with operations at Dampier, Port Hedland and Lake MacLeod, was the State's biggest producer for another year, accounting for two-thirds of total sales volumes.

Mitsui & Co was responsible for the bulk of the remaining sales through its operations at Onslow and Shark Bay.

WA accounts for the majority of Australia's salt production and is a globally significant producer. It was the fifth largest salt producer in the world in 2020, an improvement on sixth in 2019.

A note about salt

Salt is not a standard product and its composition differs significantly for reasons such as purity and method of manufacture. There are also variations in individual contracts between specific customers and suppliers and variations in shipping costs. These factors mean that sales values vary across the world.

The reported sales value here is the free-on-board (FOB) sales value received by WA salt producers. Comparisons between FOB sales and CIF or 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 invoice examinations for the various services 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 nation.

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

Coal

Quantity and value

Collie coal-sales volumes decreased to a record low of 5.3 Mt in 2020-21, and, as a result, the value of these sales decreased to a five-year low of \$306 million.

Sales volumes were impacted, in part, by Griffin Coal declaring force majeure with a wet winter season affecting open-pit mining operations in May, June and into the next financial year.

Rare earth elements

Quantity and value

More than 27,103,719 kilograms (kg) of rare earth elements were sold in WA in 2020-21, up by 22 per cent from sales of 22,149,362kg in 2019-20.

The value of these sales was not reported due to commercial sensitivities, as Mt Weld was the only producing project for the year.

Sales volumes rebounded following a downturn in 2019-20 on the temporary shutdown of Lynas Corporation's Mt Weld project as inventory levels reached maximum levels, as well as its Advanced Materials Plant in Malaysia to comply with COVID 19 movement restrictions. However, output was moderated at around 75 per cent of production rates.

The Browns Range operations of Northern Minerals were also temporarily suspended in March 2020 due to COVID-19 restrictions in WA.

WA was the world's fourth largest producer of rare earth elements.

Notable events

- Lynas Corporation raised funds for its growth projects including construction of the Kalgoorlie rare earths processing plant. It is also planning a new mining campaign at Mt Weld in 2021-22.
- Northern Minerals partially restarted operations at the Browns Range pilot project. Operations had been placed on care and maintenance in March 2020 due to the impact of the COVID-19 pandemic and travel and biosecurity restrictions applied across the Kimberley region. The company also commissioned a new enhanced ore sorting system in October 2021 that will enhance grades, increase production and lower costs.
- Hastings Technology Metals continued to advanced its Yangibana project by:
 - commencing early works at the mine site;
 - selecting Onslow as the preferred site for its hydrometallurgical plant;
 - signing a new 10-year offtake agreement with tyssenkrupp;
 - reducing the capital cost of the project by \$68 million; and
 - increasing the ore reserve by 37 per cent.
- Iluka Resources is constructing a new plant at Eneabba for the processing of mineral sands to produce a 90 per cent monazite concentrate. The company is also considering the development of a rare earths refinery at Eneabba.

Cobalt

Prices

Cobalt prices rallied in late 2020 through early 2021, rising 21 per cent from an average of US\$32,059 per tonne in 2019-20 to US\$38,926 per tonne in 2020-21.

Driving this shift was a recovery in demand from the battery sector as the manufacturing and consumption of EVs is on the rise.

Quantity and value

Some of the State's nickel producers produce by-product cobalt.

In 2020-21, they made 5,446t of cobalt sales valued at \$294 million.

Despite higher prices, the value of sales was broadly similar to 2019-20 due to a six per cent fall in sales volumes.

Diamonds

Quantity and value

Diamond sales volumes decreased to 8.1 million carats (Mct). While the value of sales decreased to \$112 million.

This followed the Argyle mine reaching the end of its life and closing on 3 November 2020, having exhausted its economic reserves. Final processing and sales were in early 2021 and its final pink diamonds were put up for sale in August 2021.

Decommissioning and rehabilitation of the site is ongoing.

Manganese

Quantity and value

In volume terms, manganese sales declined year-on-year to 468kt from 554kt.

As Woodie Woodie was the State's only manganese producer, the value of these manganese sales cannot be disclosed.

WA was the world's ninth largest producer of manganese in the most recent period

Notable events

- Element 25 commenced production from its Butcherbird manganese project in May 2021 with a first shipment in July 2021. It is targeting annual production of 312ktpa over a 42-year mine life. This project will contribute to sales volumes and values in future years. The company also announced plans for an expansion, as well as electrolytic manganese metal and manganese sulphate production.

2.2 Petroleum

The value of petroleum products produced in WA (including crude oil, condensate, LNG, domestic gas and LPG produced in State onshore and offshore areas as well as adjacent Commonwealth offshore areas) totalled \$23 billion in 2020-21 down 37 per cent from \$37 billion in 2019-20 and a five-year low.

The overwhelming majority of these sales were sourced from fields in adjacent Commonwealth offshore areas.

Petroleum production accounted for just 11 per cent of the value of all mineral and petroleum sales for Western Australia, its lowest level since prior to the development of the North West Shelf project in the late 1980s .

Japan (37 per cent) was the major destination for petroleum exports from WA, followed by Singapore (19 per cent), China (17 per cent), South Korea (eight per cent) and Taiwan (four per cent).

A note about petroleum quantities and values

Prior to 2016, DMIRS received from the Commonwealth 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, Enfield, and Cliff Head.

Beginning with the March quarter 2016, DMIRS has used data from EnergyQuest and Woodside 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 following:

- Quarterly quantity and value figures for crude oil and condensate.
- Quarterly quantity and value figures for natural gas, LNG and LPG (butane and propane).
- Historic annual average Tapis crude oil prices and recent monthly prices.
- Value of exports of petroleum products from WA by destination.
- Annual historic crude oil and condensate production in WA compared with the rest of Australia.
- Production and domestic consumption of natural gas in WA compared with the east coast of Australia.

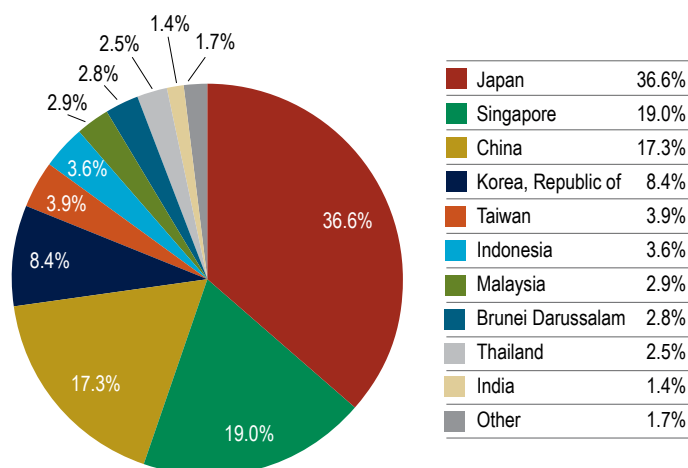


Figure 47 | **Petroleum exports 2020-21**
\$22 Billion
Source: DMIRS

- Global trade in LNG, including WA and Australia's position within the global market.
- Proven global oil reserves, by country and OPEC affiliation.

2.2.1 LNG

Prices

Gas prices and gas pricing mechanisms vary from region to region.

Most LNG produced in Western Australia is sold into the Asia Pacific region, most particularly Japan, China, and South Korea, via long-term contracts. Under these contracts, the price of LNG is tied to the price of oil and generally lags oil price movements by around three months. Local producers are also exposed to LNG spot prices and increasingly so through production at above nameplate capacity.

Prices received for LNG exported from Australia into key markets declined across the board in 2020-21 compared to 2019-20.

- Japan's Australian imports price declined to US\$7.47 per million metric British thermal units (Mmbtu) (US\$7.08 per gigajoule (GJ)) from US\$9.77 per Mmbtu (US\$9.26 per GJ)
- China's Australian imports price declined to US\$6.65 per Mmbtu (US\$6.30 per GJ) from US\$8.30 per Mmbtu (US\$7.87 per GJ)
- South Korea's Australian imports price declined to US\$7.48 per Mmbtu (US\$7.09 per GJ) from US\$8.75 per Mmbtu (US\$8.30 per GJ).

These falls were due to a period in the second half of 2020 during which the full impact of the earlier decline in oil prices to 20-year lows flowed through to LNG prices. They were also impacted by reduced energy requirements from unseasonably warm weather during the northern winter, COVID-19 related restrictions on travel and manufacturing, as well as rising LNG supplies. This saw LNG prices decline to their lowest levels since 2005.

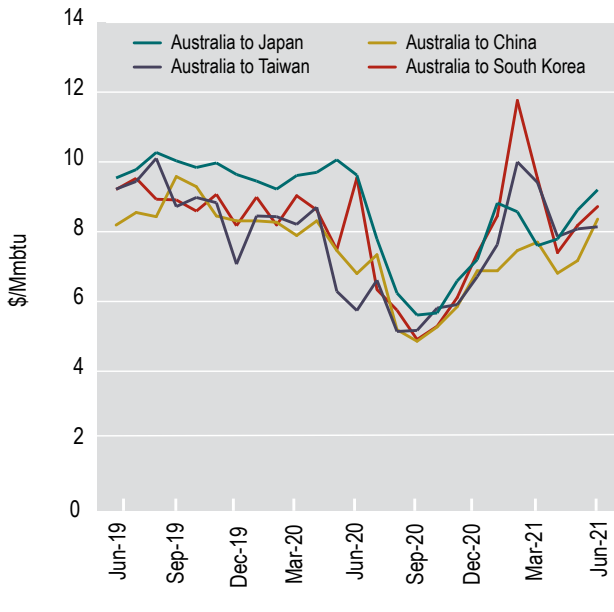


Figure 48 | **LNG import prices**
Source: EnergyQuest

LNG prices recovered through the first half of 2021 to levels prior to the pandemic on higher oil prices and strong demand in Asia. Warmer than usual weather in Japan and China heightened demand for power generation reducing stocks. Supply was also tight amid maintenance shutdowns and other LNG plant outages. This combination of factors has created the potential for a supply shortfall heading into the northern winter.

Quantity and value

Overall weaker prices and falling production resulted in a near halving of the value of LNG produced in Western Australia to \$16 billion in 2020-21 from \$27 billion in 2019-20.

As a result, LNG was displaced by gold as the second most valuable resource commodity produced or sold in Western Australia. LNG accounted for 67 per cent of the value of petroleum production and just eight per cent of total mineral and petroleum sales.

LNG production was from five projects in fields off the northern coast of the State – the North West Shelf (NWS) and Pluto, Gorgon, Wheatstone and Prelude.

The quantity of LNG from these projects decreased albeit from record levels with approximately 42Mt of LNG produced, down from 47Mt in 2019-20.

This result was due to operational issues at Gorgon, Prelude remaining offline until January 2021, as well as maintenance shutdowns at the NWS and Wheatstone.

Australia displaced Qatar as the world's largest exporter of LNG in 2020. More than half of the Australia's LNG production emanates from Western Australia. Taken alone, Western Australia was the world's third-largest exporter, down from second in 2019, due to dramatic growth in exports from the United States over the the past five years.

Notable events

- Woodside and BHP Petroleum entered into a merger to combine their respective oil and gas portfolios. The merger is expected to be completed in the June quarter 2022.
- Production resumed at Shell's Prelude FLNG platform in early January 2021 after it was held offline since February 2020 following power generation and other issues.
- The six NWS project partners agreed in December 2020 to process third-party gas through NWS project facilities in respect of gas from the Pluto fields and Stage 2 of the Waitsia project, beginning in 2022.
- Chevron completed staged repairs on propane heat exchangers at its Gorgon LNG facility:

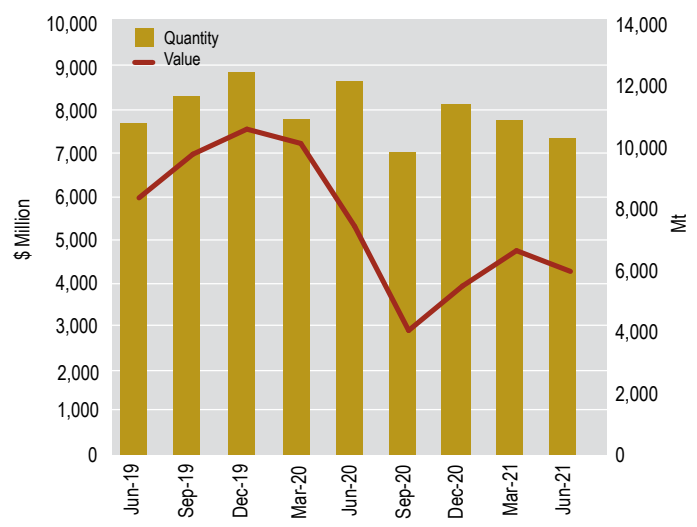


Figure 49 | **LNG quantity and value by quarter**
Source: DMIRS, EnergyQuest and Woodside

- Train 2 was restarted in November 2020, six months after being taken offline and two months behind schedule.
- Train 1 was shutdown in December 2020 and restarted in March 2021.
- Train 3 was shutdown in April 2021 and restarted in June 2021.
- Chevron will proceed with the Jansz-Lo Compression project in order to maintain gas supply to its Gorgon LNG plant. Construction and installation activities are expected to take approximately five years, with work to begin in the second half of 2022.
- Meg O'Neill was appointed Chief Executive Officer and Managing Director of Woodside in August 2021 following the departure of Peter Coleman.

2.2.2 Crude oil and condensate

Prices

Oil prices were stable overall with the Tapis oil price recording an average of US\$55 per barrel of oil (bbl) in 2020-21, the same as the previous year.

However, this picture of stability obscures tremendous volatility over the past two years.

After oil prices declined dramatically in early 2020 to 20-year lows, they began to stage a recovery by the middle of the year supported by production cuts by OPEC and its allies and the relaxation of COVID-19 related restrictions around the world.

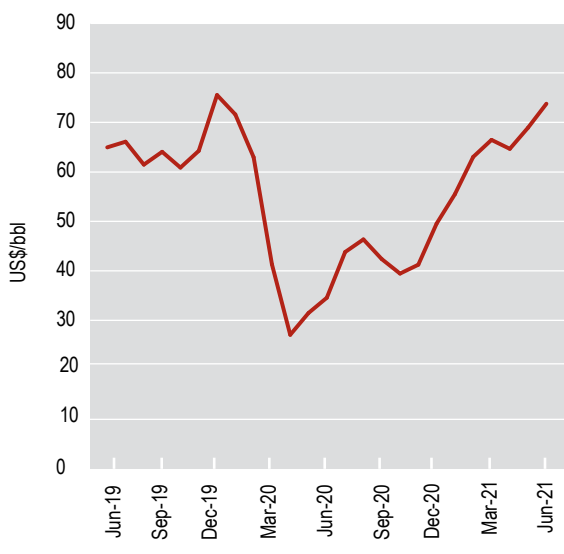


Figure 50 | **Tapis Crude**
Source: WA Treasury Corporation

This recovery continued into the new financial year and continued largely uninterrupted as the mass rollout of COVID-19 vaccines in many high-income countries led to the increased movement of people, and a lid remained on supply due to the ongoing production cuts. By June 2021, oil prices had exceeded levels prior to the pandemic.

Prices suffered a temporary blip in September and October 2020 after renewed lockdown measures and travel restrictions to contain COVID-19 dampened the outlook for a recovery in demand.

Quantity and value

The value of oil production decreased by 36 per cent to \$1.7 billion (a 20-year low) due to a combination of lower realised oil prices and lower oil production.

Oil production was down by 13 per cent to 27.4 million barrels (Mbbbl) or 4.4 million kilolitres (Mkl) on account of:

- lower reliability at some FPSOs including Enfield and Okha;
- downtime at some onshore operations for maintenance; and
- a prolonged period of nil production from the Van Gogh project after the Ningaloo Vision FPSO went in for planned maintenance and was caught up in COVID-19 vessel restrictions.

Operations off the coast of the Pilbara and in Kimberley were also affected by adverse weather conditions including cyclone activity through the first half of 2021.

Lower prices and lower production also meant that the value of condensate produced in WA decreased by 21 per cent.

The volume of condensate decreased by 7.7Mbbbl or 1.2Mkl to 69.9Mbbbl or 11.1Mkl, ending a period of growth in its output from WA.

Produced predominantly as a by-product of LNG production, decreased condensate production reflected operational issues at Gorgon, with Prelude remaining offline until January 2021, as well as a maintenance shutdown at the NWS. Output from Wheatstone and the Ichthys FPSO was up.

In volume terms, historically, condensate production had been almost three times the volume of crude oil. However, it was closer to twice its level in 2020-21.

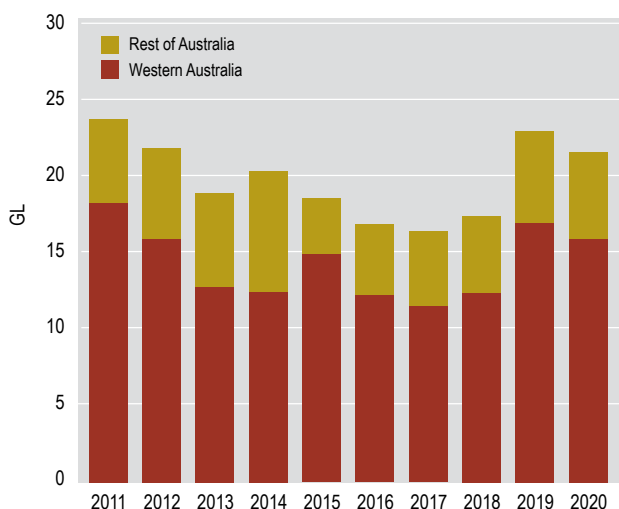


Figure 51 **Crude oil and condensate production WA v rest of Australia**
Source: DMIRS and EnergyQuest

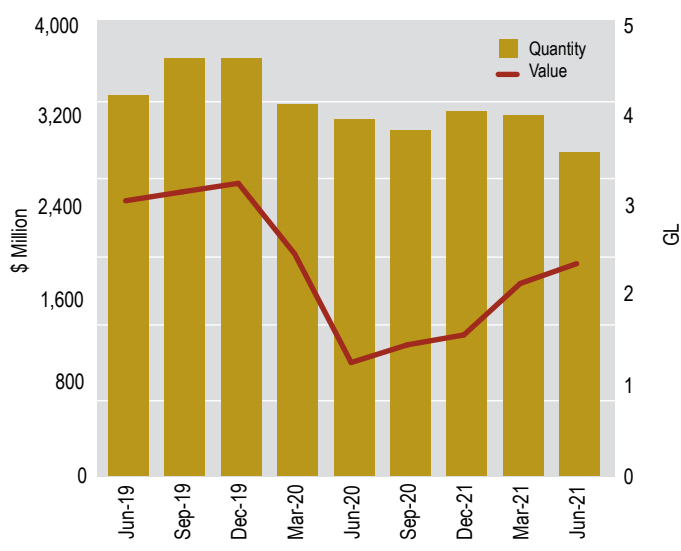


Figure 52 **Crude oil and condensate quantity and value by quarter**
Source: DMIRS and EnergyQuest

Crude oil and condensate combined were the second most valuable petroleum products produced in WA, and the fourth most valuable resource commodity overall.

WA's share of national condensate and crude oil production combined decreased to 74 per cent down from 79 per cent the previous year. The State remains a minor oil producer globally.

Notable events

- BP closed its Kwinana oil refinery in March 2021 and commenced fuel imports. Triangle Energy, a former supplier to the refinery, entered into an agreement with BP in April 2021 to store the crude oil from its Cliff Head project in the Perth Basin at the Kwinana facility for a period of one-year. The two companies signed an offtake agreement in October 2021 for all crude oil produced from Cliff Head, initially for the term of the storage agreement.

2.2.3 Domestic gas

Prices

The derived average price of domestic gas sold into the Dampier to Bunbury Natural Gas Pipeline, Parmelia pipeline and Goldfields pipeline in WA decreased by nine per cent to an average of \$3.80 per GJ (\$4.01 per Mmbtu), from \$4.18 per GJ (\$4.41 per Mmbtu) the previous year.

This was largely due to a 16 per cent decline in the September quarter that reflected lower consumption and demand amid COVID-19 restrictions. However, the price recovered across the remainder of the financial year on rising consumption and it had returned to earlier levels by the June quarter 2021.

A note about domestic gas prices

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

However, beginning with the March quarter 2016, the average domestic gas price is derived only from domestic gas sales reported to the State Government in relation to the administration of royalties.

This means that recent average domestic gas prices reflect domestic gas sales from projects such as the NWS Waitsia and Beharra Springs, and do not reflect domestic gas sales from other Western Australian offshore petroleum projects such as Varanus Island, Macedon, Wheatstone, Gorgon, Reindeer, and Pluto. Therefore, the domestic gas price represents only a subset of all domestic gas sales.

The prices quoted do not include transport costs, other downstream costs, nor any mark-up paid by customers to wholesalers.

The data for the different periods is not directly comparable.

Quantity and value

The quantity of natural gas sold into the domestic market decreased to 10.2 billion cubic metres (Bcm) (387 PJ) in 2020-21 from a record of 11.1Bcm (424 PJ) in 2019-20.

This was due to a decline in production to almost zero from the NWS project following the completion of long-term historic domestic gas agreements.

The Varanus Island facility is now the State's largest contributor to domestic gas supply. This project, as well as other domestic gas suppliers including Wheatstone, Macedon, Gorgon, Reindeer and Pluto, all increased production.

Lower sales volumes and lower prices combined to decrease the value of sales by to \$1.5 billion, its lowest total since 2013-14.

Notable events

- In August 2020, the State Government announced that the WA domestic gas policy had been amended to prevent the export of local gas. Under the updated policy, local gas cannot be exported to the Eastern States or overseas. Exemptions to the policy were granted to the Waitsia joint venture in August 2020 and Black Mountain Energy in relation to its Valhalla project in October 2021.
- Woodside and NWS project participants reached agreement, and finalised arrangements with the WA Government, enabling the processing of Pluto feed gas at the NWS's Karratha gas plant including the processing of domestic gas and sale into the domestic market.
- APA Group announced in November it had committed to construct a 580 km pipeline connecting new domestic gas projects in the onshore Perth Basin with its Goldfields Gas Pipeline.
- Santos entered into a host of new agreements to supply gas from its Varanus Island facility that included:
 - Kleenheat for more than 16PJ of gas over three years from 2021.
 - Rio Tinto's iron ore business for up to 15PJ of natural gas from late 2021.
- Warrego Energy (from its 50 per cent owned West Erregulla development project, subject to a FID), ExxonMobil and Chevron (from Wheatstone, Gorgon, and NWS) all reached gas supply agreements with Alcoa for 198PJ of gas over 10 years, commencing in 2024.
- Strike Energy (operator and owner of the remaining 50 per cent of West Erregulla development project, signed an agreement with Wesfarmers' CSBP (a fertilisers and chemicals company) in August for the supply of 100PJ over 11 years.
- The Waitsia joint venture signed a five-year gas supply agreement with Mid West LNG in June, which will supply gas to mining projects. The deal will begin in the December quarter 2021 and is for 2TJ per day or 700TJ per annum.

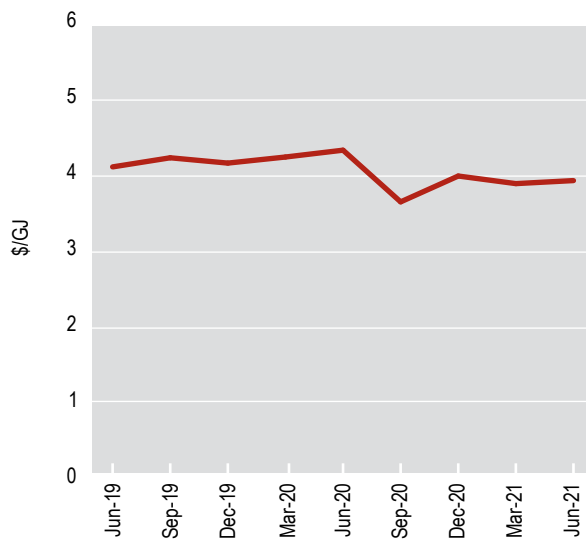


Figure 53 | **Average quarterly WA domestic gas prices**
Source: EnergyQuest and DMIRS

3 SUPPLEMENTARY INFORMATION

TABLE 4. Quantity and value of minerals and petroleum last two years

COMMODITY	UNIT	FINANCIAL YEAR 2019–20		FINANCIAL YEAR 2020–21	
		QUANTITY	VALUE \$	QUANTITY	VALUE \$
ALUMINA AND BAUXITE	t	15,804,008	6,416,570,525	16,205,112	5,565,020,545
COPPER-LEAD-ZINC					
Copper Metal	t	171,383	1,386,762,286	145,853	1,485,144,140
Lead Metal	t	2,775	7,470,740	851	2,186,697
Zinc Metal	t	71,771	223,321,577	64,219	229,189,908
TOTAL COPPER-LEAD-ZINC			1,617,554,603		1,716,520,744
CLAYS	t	18,920	1,985,156	23,773	2,866,699
COAL	t	6,195,614	326,981,226	5,272,434	306,063,405
CONSTRUCTION MATERIALS					
Aggregate	t	3,286,049	87,003,096	2,740,476	75,774,221
Gravel	t	171,850	2,246,538	100,342	1,368,124
Rock	t	330,067	7,277,602	491,248	10,367,435
Sand	t	2,459,329	30,404,255	2,992,342	33,834,424
TOTAL CONSTRUCTION MATERIALS			126,931,490		121,344,204
DIAMONDS	ct	17,489,920	281,266,033	8,083,056	112,100,235
DIMENSION STONE	t	10,849	1,739,353	7,236	867,678
GEM & SEMI-PRECIOUS STONES	kg	268,036	423,429	295,776	464,759
GOLD	kg	212,142	15,872,150,556	207,567	16,573,760,712
GYPSUM	t	515,194	11,798,021	781,179	17,748,366
MINERAL SANDS					
Garnet	t	323,842	nfp	277,047	nfp
Ilmenite	t	264,846	60,671,202	322,114	71,880,419
Leucoxene	t	27,129	27,918,452	19,893	23,729,975
Rutile	t	32,845	36,694,067	48,548	43,494,131
Zircon	t	171,592	275,620,890	221,079	323,860,272
Synthetic Rutile	t	255,891	268,419,815	150,631	261,436,769
Other (includes Garnet and Staurolite)	t		105,973,282		100,045,074
TOTAL MINERAL SANDS			775,297,708		824,446,640
IRON ORE	t	836,757,810	104,616,533,849	838,687,123	154,732,940,789

TABLE 4. Quantity and value of minerals and petroleum last two years (continued)

COMMODITY	UNIT	FINANCIAL YEAR 2019–20		FINANCIAL YEAR 2020–21	
		QUANTITY	VALUE \$	QUANTITY	VALUE \$
LIMESAND–LIMESTONE–DOLOMITE	t	4,009,523	39,531,244	4,732,727	48,067,033
LITHIUM INDUSTRY					
Spodumene		1,459,797	998,656,158	1,627,771	938,305,026
Tantalite		191	nfp	108	nfp
Tin Metal		150	nfp	55	nfp
TOTAL LITHIUM INDUSTRY			1,029,879,825		953,754,802
MANGANESE ORE	t	554,483	359,186,308	467,660	nfp
NICKEL INDUSTRY					
Cobalt	t	5,796	295,164,292	5,446	293,803,177
Nickel	t	153,420	3,167,492,780	158,710	3,480,602,339
Palladium and Platinum By-Product	kg	482	39,618,802	470	40,285,878
TOTAL NICKEL INDUSTRY			3,502,275,874		3,814,691,394
PETROLEUM					
Condensate	kl	12,340,926	5,401,864,390	11,116,898	4,277,981,027
Crude Oil	kl	5,006,074	2,680,648,960	4,361,028	1,716,421,257
LNG	t	47,113,045	27,047,964,512	42,392,687	15,780,495,070
LPG – Butane and Propane	t	431,562	217,253,672	379,651	227,504,065
Domestic Gas	'000m ³	11,158,952	1,773,054,730	10,178,575	1,471,361,565
TOTAL PETROLEUM			37,120,786,264		23,473,762,984
RARE EARTHS	kg	22,149,362	258,918,330	27,103,719	nfp
SALT	t	11,266,385	375,124,667	12,498,613	553,347,570
SILICA-SILICA SAND	t	991,398	19,661,802	849,162	16,825,292
SILVER	kg	131,665	109,720,500	139,814	153,185,940
OTHER (May include Rare Earths, Manganese, Spongolite, Talc, and Cesium)			19,804,008		656,976,626
TOTAL MINERALS			135,763,163,618		186,170,993,433
TOTAL MINERALS AND PETROLEUM			172,883,949,882		209,644,756,417

Quantities used in this table only apply to Minerals and Petroleum covered by the *Mining Act 1978*, the *Petroleum and Geothermal Energy Resources Act 1967*, the *Petroleum (Submerged Lands) Act 1982*, the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and relevant State Agreement Acts.

Some values for staurolite, garnet, monazite, manganese, talc, tantalite, tin, and cesium not available due to confidentiality.

TABLE 5. Quantity and value of minerals and petroleum historic

		2013-14		2014-15		2015-16	
COMMODITY	UNIT	Quantity	Value \$	Quantity	Value \$	Quantity	Value \$
ALUMINA AND BAUXITE							
Alumina	t	13,717,952	4,295,348,699	13,771,412	5,022,721,218	13,893,540	4,937,279,870
Bauxite	t	0	0	0	0	47,703	1,952,600
TOTAL ALUMINA & BAUXITE	t	13,717,952	4,295,348,699	13,771,412	5,022,721,218	13,941,243	4,939,232,470
COPPER, LEAD AND ZINC							
Copper Metal	t	211,186	1,559,565,610	184,495	1,283,046,797	190,275	1,181,262,087
Lead Metal	t	78,651	178,764,058	59,248	136,949,662	5,988	14,810,595
Zinc Metal	t	54,060	118,261,576	77,831	197,040,406	82,676	195,494,453
TOTAL COPPER, LEAD AND ZINC			1,856,591,245		1,617,036,865		1,391,567,135
CHROMITE	t	66,540	nfp	0	0	0	0
CLAYS	t	5,139	345,148	17,670	1,043,438	21,969	1,104,708
COAL	t	6,275,422	263,701,680	6,553,064	306,733,911	6,890,951	336,466,825
CONSTRUCTION MATERIALS							
Aggregate	t	2,154,534	47,255,402	1,963,871	69,239,676	1,313,696	42,256,613
Gravel	t	51,853	338,431	172,556	993,903	177,243	1,055,083
Rock	t	402,652	10,070,061	1,746,693	46,504,731	220,402	1,828,018
Sand	t	3,796,749	28,420,888	5,658,758	46,314,767	3,434,992	34,591,599
Other		0	0	0	0	0	0
TOTAL CONSTRUCTION MATERIALS			86,084,782		163,053,077		79,731,313
DIAMONDS	ct	11,610,631	398,210,926	10,387,926	342,313,664	13,869,547	354,047,664
DIMENSION STONE	t	5,021	1,365,020	21,250	2,892,731	4,113	2,205,326
GEM & SEMI-PRECIOUS STONES	kg	309,575	401,960	720,552	1,402,333	243,376	627,546
GOLD	kg	196,074	8,890,995,046	193,162	9,107,167,942	195,968	10,104,514,299
GYPSUM	t	532,919	9,496,857	576,880	12,240,632	551,910	13,830,966
MINERAL SANDS							
Garnet	t	357,266	68,896,504	299,022	nfp	251,162	nfp
Ilmenite	t	78,900	19,515,066	99,674	21,000,789	174,687	39,692,103
Leucoxene	t	29,268	26,205,650	16,965	14,636,208	18,137	16,452,584
Rutile	t	65,084	65,938,306	30,206	29,582,184	45,888	44,260,114
Zircon	t	212,068	114,307,405	182,859	136,321,656	191,551	151,297,003
Synthetic Rutile	t	n/a	n/a	198,232	215,809,868	271,220	254,260,587
Other (may include Garnet, Monazite, Rutile, Synthetic Rutile, Staurolite)	t		176,168,377		53,279,846		65,585,669
TOTAL MINERAL SANDS			471,031,306		470,630,551		571,548,060

2016-17		2017-18		2018-19		2019-20		2020-21	
Quantity	Value \$	Quantity	Value \$	Quantity	Value \$	Quantity	Value \$	Quantity	Value \$
13,855,382	5,073,995,897	13,669,467	6,596,818,325	13,643,445	8,211,863,758	14,015,165	6,349,569,377	14,361,022	5,506,217,460
310,341	14,563,469	1,117,323	46,704,951	1,784,088	67,576,671	1,788,843	66,830,260	1,844,090	58,803,085
14,165,722	5,088,559,366	14,786,790	6,643,523,276	15,427,533	8,279,440,429	15,804,008	6,416,399,637	16,205,112	5,565,020,545
170,730	1,240,528,049	174,074	1,347,798,371	162,483	1,321,630,656	171,383	1,386,762,286	145,853	1,485,144,140
3,507	10,146,717	7,397	22,799,223	4,852	13,344,177	2,775	7,470,740	851	2,186,697
82,943	204,161,259	93,373	323,504,398	71,405	263,162,703	71,771	223,321,577	64,219	229,189,908
	1,454,836,025		1,694,101,992		1,598,137,536		1,617,554,603		1,716,520,744
0	0	0	0	0	0	0	0	0	0
20,865	1,390,448	18,278	1,274,478	19,259	1,662,231	18,920	1,985,156	23,773	2,866,699
6,806,389	338,435,045	6,679,935	331,959,622	6,275,190	319,370,156	6,195,614	326,981,226	5,272,434	306,063,405
1,053,311	29,764,624	1,236,605	37,736,095	1,608,274	54,031,240	3,286,049	87,003,096	2,740,476	75,774,221
261,219	1,652,110	155,130	1,067,114	168,084	2,247,986	171,850	2,246,538	100,342	1,368,124
412,876	6,376,681	267,388	4,417,888	381,791	11,071,975	330,067	7,277,602	491,248	10,367,435
2,578,804	25,273,008	4,120,161	28,667,596	2,017,218	27,732,365	2,459,329	30,404,255	2,992,342	33,834,424
0	0	0	0	0	0	0	0	0	0
	63,066,424		71,888,692		95,083,566		126,931,490		121,344,204
12,607,032	268,383,094	15,281,303	249,759,751	11,149,895	219,221,184	17,489,920	281,266,033	8,083,056	112,100,235
4,795	1,823,218	6,397	2,372,892	8,910	2,238,062	10,849	1,739,353	7,236	867,678
334,786	725,557	204,227	443,041	129,385	343,859	268,036	423,429	295,776	464,759
203,003	10,859,574,221	212,060	11,420,664,493	211,534	11,958,926,074	212,142	15,872,150,556	207,567	16,573,760,712
531,399	12,980,853	895,502	20,462,106	770,904	14,496,800	515,194	11,798,021	781,179	17,748,366
565,618	nfp	379,724	nfp	388,470	nfp	323,842	nfp	277,047	nfp
178,528	42,912,243	120,227	25,279,255	234,452	48,772,986	264,846	60,671,202	322,114	71,880,419
7,144	6,492,778	14,287	13,031,604	15,176	18,209,118	27,129	27,918,452	19,893	23,729,975
21,562	21,953,547	20,596	22,170,174	23,906	29,470,430	32,845	36,694,067	48,548	43,494,131
184,700	101,083,491	72,567	100,649,559	140,681	257,581,580	171,592	275,620,890	221,079	323,860,272
298,482	252,213,036	264,427	279,071,093	254,478	244,256,417	255,891	268,419,815	150,631	261,436,769
	158,791,842		110,190,573		116,708,350		4,778,738		16,877,607
	583,446,937		550,392,258		714,998,881		775,297,708		824,446,640

TABLE 5. Quantity and value of minerals and petroleum historic (continued)

COMMODITY	UNIT	2013-14		2014-15		2015-16	
		Quantity	Value \$	Quantity	Value \$	Quantity	Value \$
IRON ORE	t	623,507,315	75,165,715,685	718,806,408	54,375,667,290	748,100,421	48,767,746,598
LIMESAND-LIMESTONE-DOLOMITE	t	3,116,623	23,378,197	4,903,039	33,175,834	4,446,486	28,826,046
LITHIUM INDUSTRY							
Spodumene		342,065	150,564,378	489,074	245,874,387	465,817	260,721,540
Tantalite		58	4,074,774	70	nfp	183	nfp
Tin Metal		0	0	14	nfp	22	nfp
TOTAL LITHIUM INDUSTRY			154,639,152		251,051,748		269,771,196
MANGANESE ORE	t	711,536	nfp	800,985	nfp	425,303	146,188,090
NICKEL INDUSTRY							
Cobalt	t	6,236	175,117,788	6,036	210,567,512	5,479	174,846,826
Nickel	t	232,673	3,419,023,120	183,320	3,169,605,001	175,752	2,202,734,451
Palladium and Platinum By-Product	kg	1,015	18,855,882	464	13,380,730	687	16,656,441
TOTAL NICKEL INDUSTRY			3,612,996,790		3,393,553,243		2,394,237,718
PETROLEUM							
Condensate	kl	4,399,263	3,199,879,402	6,753,213	3,528,826,231	6,775,142	2,214,239,599
Crude Oil	kl	6,867,302	5,385,519,964	7,952,478	4,567,638,161	7,685,922	3,044,532,696
LNG	t	19,826,065	14,651,522,774	20,447,845	13,817,042,487	20,955,641	10,764,545,353
LPG – Butane and Propane	t	389,533	353,541,334	553,055	405,565,516	531,595	249,059,073
Domestic Gas	'000m ³	8,217,579	1,446,935,711	9,875,339	1,820,197,055	10,223,641	1,908,487,074
TOTAL PETROLEUM			25,037,399,184		24,139,269,449		18,180,863,795
RARE EARTHS	kg	7,653,061	nfp	13,762,327	nfp	18,773,690	nfp
SALT	t	12,992,042	410,097,849	11,726,606	374,622,315	10,974,721	336,253,755
SILICA-SILICA SAND	t	449,587	15,847,051	483,809	17,927,564	581,966	18,072,793
SILVER	kg	137,179	93,414,212	150,578	95,972,009	155,292	104,786,546
OTHER (May include Manganese, Rare Earths, Spongolite, Talc, Vanadium, Chromite, Cesium and Feldspar)	t		494,402,726		507,533,600		199,236,525
TOTAL MINERALS			96,243,719,184		76,096,739,965		70,059,995,579
TOTAL MINERALS AND PETROLEUM			121,281,118,367		100,236,009,414		88,240,859,375

TABLE 6. Value of minerals and petroleum by region by commodity

REGION	2020–21 Value \$
Pilbara	
Iron Ore	151,022,112,039
Gold and Silver	1,033,797,994
Salt	409,423,460
Copper and Manganese Ore	380,844,165
Spodumene, Other lithium not specified crushed and screened and Tantalum pentoxide specified crushed and screened and Tantalum pentoxide	211,309,619
Construction Materials, Dimension Stone and Limesand Limestone Dolomite	82,522,788
Gem and Semi Precious Stones	99,600
Pilbara Total	153,140,109,665

Offshore Petroleum	
Liquefied Natural Gas and LPG Butane and Propane	16,007,999,135
Condensate	4,277,981,027
Crude Oil	1,683,616,388
Domestic Gas	1,434,297,319
Offshore Total	23,403,893,870

Goldfields-Esperance	
Gold and Silver	11,518,688,451
Nickel and Cobalt	3,433,352,340
Rare Earth Oxide and Iron Ore	471,558,339
Spodumene and Tantalum pentoxide	348,701,554
Copper and Zinc	272,803,953
Platinum and Palladium	40,285,878
Construction Materials and Dimension Stone	17,792,472
Gypsum and Limesand Limestone Dolomite	13,611,946
Goldfields-Esperance Total	16,116,794,933

Peel	
Gold, Silver and Copper	2,056,546,051
Peel Total	2,056,546,051

Wheatbelt	
Iron Ore and Gypsum	1,809,793,299
Mineral Sands	623,169,821
Gold	391,118,035
Nickel and Silver	341,930,856
Salt and Silica and Silica Sand	14,375,086
Limesand Limestone Dolomite, Construction Materials and Clays	6,720,092
Wheatbelt Total	3,187,107,189

REGION	2020–21 Value \$
Mid West	
Gold	1,842,332,794
Iron Ore	1,469,732,860
Copper, Lead and Zinc	1,054,518,765
Mineral Sands	132,650,907
Silver	59,766,399
Petroleum	52,498,817
Talc, Attapulgitite and Saponite	11,533,375
Limesand Limestone Dolomite and Gypsum	2,126,732
Construction Materials	1,485,403
Gem and Semi Precious Stones	203,404
Mid West Total	4,626,849,456

Kimberley	
Petroleum and Iron Ore	375,345,351
Diamonds, Gold and Silver	199,681,336
Construction Materials, Dimension Stone and Limesand Limestone Dolomite	6,799,491
Kimberley Total	581,826,178

South West Total	
Alumina and Construction Materials	1,835,043,497
Spodumene, Tantalum Pentoxide and Tin Metal	393,743,629
Coal	306,063,405
Mineral Sands	68,625,912
Limesand Limestone Dolomite and Dimension Stone	2,325,678
Gold and Silver	975,434
Gold and Silver	2,606,777,555

Gascoyne	
Salt	134,380,442
Gypsum and Spongolite	8,335,876
Construction Materials	1,354,410
Gem and Semi Precious Stones	161,755
Limesand Limestone Dolomite	242,972
Gascoyne Total	144,475,455

Perth Metropolitan	
Alumina, Bauxite and Kaolin	3,731,678,408
Silica and Silica Sand and Limesand Limestone Dolomite	32,794,074
Construction Materials	10,902,863
Perth Metropolitan Total	3,775,375,345

Great Southern	
Spongolite, Silica and Limesand Limestone	5,000,720
Great Southern Total	5,000,720

TABLE 7. Value of minerals and petroleum by region local government area

REGION	2020–21 Value \$
Pilbara	
East Pilbara	68,337,663,034
Ashburton	76,994,738,057
Karratha and Marble Bar	7,666,098,773
Port Hedland	141,609,801
Pilbara Total	153,140,109,665

Offshore Petroleum	23,403,893,870
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Goldfields-Esperance	
Laverton	3,692,278,459
Coolgardie	3,871,983,158
Kalgoorlie-Boulder	2,808,698,178
Leonora	2,379,917,993
Wiluna	921,296,253
Menzies	896,664,794
Dundas	872,571,038
Ravensthorpe	567,196,971
Esperance	106,188,089
Goldfields-Esperance Total	16,116,794,933

Peel	
Boddington	2,056,546,051
Peel Total	2,056,546,051

Mid West Total	
Meekatharra	1,386,982,755
Perenjori	1,222,663,466
Yalgoo and Morawa	871,092,842
Mt Magnet	630,096,480
Cue	317,257,779
Geraldton	88,333,075
Carnamah and Three Springs	54,479,207
Irwin	53,664,822
Coorow	2,279,030
Mid West Total	4,626,849,456

Great Southern	
Albany, Plantagenet and Denmark	5,000,720
Great Southern Total	5,000,720

REGION	2020–21 Value \$
Wheatbelt	
Yilgarn	2,009,442,430
Dandaragan	446,443,953
Kondinin	341,582,922
Westonia	194,314,765
Gingin	182,552,127
Northam and Moora	5,599,140
Lake Grace	3,990,002
Dalwallinu	1,388,677
Wyalkatchem and Dowerin	913,871
Koorda	879,302
Wheatbelt Total	3,187,107,189

Kimberley	
Derby-West Kimberley	254,765,392
Wyndham-East Kimberley	234,636,996
Halls Creek	87,581,101
Broome	4,842,689
Kimberley Total	581,826,178

South West	
Collie	2,140,606,318
Bridgetown-Greenbushes	393,743,629
Bunbury, Busselton and Augusta-Margaret River	72,166,386
Donnybrook-Balingup	235,763
Manjimup	25,459
South West Total	3,154,339,333

Gascoyne	
Carnarvon	93,353,735
Shark Bay	49,870,621
Exmouth	1,250,447
Upper Gascoyne	652
Gascoyne Total	144,475,455

Perth Metropolitan	
Kwinana and Rockingham	3,731,872,738
Cockburn	21,010,724
Swan	17,235,357
Wanneroo	5,256,526
Perth Metropolitan Total	3,775,375,345

TABLE 8. Average annual employment in the WA mineral sector

Primary Commodity	2019–20 Nol	2020–21 Nol	2019–20 FTE	2020–21 FTE
Alumina – Bauxite	8,434	10,079	6,765	6,840
Base Metals	2,636	2,319	2,075	1,894
Chemicals	129	101	49	42
Clays	148	178	124	111
Coal	1,280	1,002	700	642
Construction Materials	2,653	2,660	706	674
Diamond	665	320	618	258
Diatomite – Spongolite	2	2	1	1
Dimension Stone	179	174	51	68
Gem & Semi-Precious Stones	3	3	0	1
Gold	31,561	34,153	26,290	28,420
Gypsum	52	57	18	16
Iron Ore	67,427	76,150	52,321	60,810
Lithium	2,673	2,419	2,563	1,846
Limestone – Limesand	584	633	124	146
Manganese	0	1	0	0
Manganese Ore	530	576	522	542
Mineral Sands	3,086	2,847	1,957	1,876
Nickel	7,285	7,345	7,500	7,553
Other	68	71	21	19
Pigments	0	7	0	7
Phosphate	137	144	114	124
Potash	122	391	183	688
Rare Earths	262	235	228	170
Salt	965	878	645	622
Silica – Silica Sand	553	475	275	257
Silver	6	9	1	2
Talc	65	62	29	20
Unassigned	631	762	528	574
Uranium	0	1	0	0
Vanadium – Titanium	13	8	5	4
Grand Total	132,151	144,058	104,419	114,227

TABLE 9. Principal mining projects 2020–21

Company	Project(s)	Comments
Copper-lead-zinc		
29Metals Ltd Level 2, 150 Collins St, Melbourne VIC 3000 (03) 7037 5300 www.29metals.com	Golden Grove	29Metals Ltd was divested from EMR Capital Pty Ltd, the former owner of Golden Grove, in June 2021.
Round Oak Minerals Pty Ltd Level 10, 120 Edward St , Brisbane QLD 4000 (07) 3835 6200 www.roundoak.com.au	Jaguar	
Sandfire Resources NL Level 2, 10 Kings Park Road , West Perth WA 6005 (08) 6430 3800 www.sandfire.com.au	DeGrussa	
Bauxite		
Alcoa Corporation 181–205 Davy Street, Booragoon WA 6154 (08) 9316 5111 www.alcoa.com/australia	Huntly Willowdale	Huntly and Willowdale are owned by a joint venture of Alcoa Corporation (60%) and Alumina Limited (40%)
South32 Limited Level 35, 108 St Georges Tce, Perth WA 6000 (08) 9324 9000 www.south32.net	Boddington	Boddington is a joint venture of South32 Limited (86%) Sojitz Corporation (9%), and Press Metal Bintulu (5%).
Coal		
Griffin Coal Mining Company Pty Ltd Suite A, 20 Kings Park Rd West Perth WA 6005 (08) 6188 2200	Griffin	
Yancoal Australia Limited Level 18, Darling Park Tower 2, 201 Sussex Street Sydney NSW 2000 (02) 8583 5300 www.yancoal.com.au	Premier	
Diamonds		
Rio Tinto Ltd Level 16, Central Park 152-158 St Georges Terrace Perth WA 6000 (08) 9168 4900 www.riotinto.com	Argyle	Production at Argyle ended in November 2020 with final sales in the March quarter 2021.
Gold		
Adaman Resources Pty Ltd Level 3, 140 St Georges Terrace, Perth WA 6000 (08) 6216 9900	Kirkalocka	Adaman Resource Pty Ltd is a subsidiary of Remagen Lend ADA Pty Ltd.
AngloGold Ashanti Limited Level 10, 140 St Georges Terrace, Perth WA 6000 (08) 9425 4600 www.anglogoldashanti.com	Sunrise Dam Tropicana	Tropicana is owned by a joint venture of AngloGold Ashanti Limited (70%) and Regis Resources Limited (Regis, 30%). Regis acquired its 30 per cent interest in Tropicana in May 2021 from IGO Ltd.

TABLE 9. Principal mining projects 2020–21 (continued)

Company	Project(s)	Comments
Beacon Minerals Limited 144 Vivian Street Boulder 6432 WA (08) 9093 2477 www.beaconminerals.com.au	Jaurdi	
Billabong Gold Pty Ltd Level 1, 30 Richardson Street, West Perth WA 6005 (08) 6324 0000 www.superior-gold.com	Plutonic	Billabong Gold Pty Ltd is a subsidiary of Superior Gold Inc.
Dacian Gold Limited Level 19, 58 Mounts Bay Road Perth WA 6152 (08) 6323 9000 www.daciangold.com.au	Mt Morgans	Dacian Gold Limited merged with NTM Gold Ltd in March 2021 with the merged company trading as Dacian Gold Limited.
Evolution Mining Limited Level 15, 37 St Georges Terrace, Perth WA 6000 (08) 6216 9700 www.evolutionmining.com.au	Kundana Mungari	Evolution Mining Limited acquired Kundana from Northern Star Resources Ltd in August 2021.
FMR Investments Pty Ltd Level 2, 2 Hardy Street, South Perth WA 6151 (08) 6216 5400 www.fmrinvestments.com.au	Gordon-Sirdar	
Gascoyne Resources Limited Office Level 1, 41-47 Colin Street, West Perth WA 6005 (08) 9481 3434 www.gascoyneresources.com.au	Dalgaranga	
Gold Fields Limited Level 4, 235 St Georges Terrace Perth WA 6005 (08) 9211 9200 www.goldfields.com.au	Agnew Granny Smith St Ives Gruyere	Gruyere is a joint venture of Gold Fields Limited (50%) and Gold Road Resources (50%).
Habrok Pty Ltd 63 Dowd Street, Welshpool WA 6106 (02) 8920 0700 www.habrokmining.com	Battler Bullabulling North	Bullabulling North is a joint venture of Habrok Pty Ltd (70%) and Bulletin Resources Limited (30%).
Horizon Minerals Ltd 163-167 Stirling Highway, Nedlands WA 6009 (08) 9386 9534 www.horizonminerals.com.au	Boorara	New project. Trial mining conducted between April and August 2020 with sales between July 2020 and April 2021.
Karora Resources Inc. Karora Resources Inc Ground Floor, 15 Altona Street West Perth WA 6005 www.karoraresources.com	Beta Hunt Higginsville	RNC Minerals Corporation changed its name to Karora Resources on 17 June 2020.
Linden Gold Alliance Pty Ltd 152 Great Eastern Hwy, Ascot WA 6104 (08) 6146 6268 www.lindengold.com.au	Linden	Re-opened project. Linden Gold Alliance Pty Ltd acquired the project in September 2020, with gold production re-commencing in April 2021.
Lord Byron Mining Pty Ltd 312 Victoria Road, Malaga WA 6090 (08) 6465 8000	Jasper Hills	Sales occurred between July and September 2020.

TABLE 9. Principal mining projects 2020–21 (continued)

Company	Project(s)	Comments
Lukah Mining Pty Ltd 42 Vivian St, South Boulder WA 6432 (08) 9093 3001	The Mount	
Matsa Resources Limited Suite 11, 139 Newcastle Street, Perth WA 6000 (08) 9230 3555 www.matsa.com.au	Lake Carey	Production at the Red October mine within the Lake Carey project was completed in the June quarter 2021, with further exploration underway.
Minjar Gold Pty Ltd Level 3, 66 Kings Park Road, West Perth WA 6005 (08) 9212 8900 www.minjargold.com.au	Southern Cross	Minjar Gold Pty Ltd is a subsidiary of Shandong Tianye Real Estate Development Group Co., Ltd
Newcrest Mining Limited Level 1, 1 Centro Ave, Subiaco WA 6008 (08) 9270 7070 www.newcrest.com.au	Telfer	
Newmont Corporation Level 2, 388 Hay Street, Subiaco WA 6008 (08) 9423 6100 www.newmont.com	Boddington	
Northern Star Resources Ltd Level 1, 388 Hay Street, Subiaco WA 6008 (08) 6188 2100 www.nsrld.com	Jundee Carosue Dam Kanowna Belle South Kalgoorlie Super Pit / Mt Charlotte Thunderbox	Northern Star Resources Ltd merged with Saracen Mineral Holdings Ltd in February 2021, with the merged company trading as Northern Star Resources Ltd.
Norton Gold Fields Ltd Paddington Site, Goldfields Highway Kalgoorlie WA 6430 (08) 9080 6800 www.nortongoldfields.com.au	Paddington	Norton Gold Fields Pty Ltd is a subsidiary of Zijin Mining Group Company Limited.
Novo Resources Corp. Level 1, 46 Ventnor Avenue, West Perth WA 6005 (08) 6400 6100 www.novoresources.com	Beatons Creek	Novo Resources Corp. acquired the Nullagine gold project through its acquisition of Millennium Minerals Limited in September 2020. Nullagine is now part of the Beatons Creek project. Sales from Beatons Creek commenced in February 2021.
Ora Banda Mining Ltd Level 1, 2 Kings Park Road West Perth WA 6005 (08) 6365 4548 www.orabandamining.com.au	Davyhurst	Re-opened project. Sales recommenced in February 2021.
Orminex Limited Suite 5, Level 1, 460 Roberts Road, Subiaco WA 6008 (08) 6149 1550	Comet Vale	Mining activities were suspended at Comet Vale in September 2020, with final sales in July 2021.
Pantoro Limited Level 2, 46 Ventnor Ave West Perth WA 6000 (08) 6263 1110 www.pantoro.com.au	Halls Creek	The Halls Creek project includes the Nicolsons mine.

TABLE 9. Principal mining projects 2020–21 (continued)

Company	Project(s)	Comments
Ramelius Resources Ltd Level 1, 130 Royal Street, East Perth WA 6004 (08) 9202 1127 www.rameliusresources.com.au	Edna May Marda Mt Magnet Vivien	Marda is a new project. Ramelius Resources Ltd acquired the Marda Gold Project from Black Oak Minerals Ltd in 2018. Mining activities commenced in November 2019 with first sales in February 2020.
Red 5 Limited 35 Ventnor Avenue, West Perth WA 6005 (08) 9322 4455 www.red5limited.com	Darlot King of the Hills	Sales from King of the Hills occurred between July 2020 and April 2021 and were suspended as an expansion project is undertaken.
Regis Resources Ltd Level 2, 516 Hay Street, Subiaco WA 6008 (08) 9442 2200 www.regisresources.com.au	Duketon	
Rose Dam Resources NL Level 8, 350 Collins St, Melbourne VIC 3000	Rose Dam	
Shine Resources Pty Ltd 21, 22 Railway Road Subiaco WA 6008	Scotia	New project. Achieved first sales in January 2021.
Silver Lake Resources Ltd Suite 4, Level 3, 85 South Perth Esplanade South Perth WA 6151 (08) 6313 3800 www.silverlakeresources.com.au	Deflector Mt Monger	
St Barbara Mines Ltd Level 7, 40 The Esplanade Perth WA 6005 (08) 9476 5555 www.stbarbara.com.au	Gwalia	
Westgold Resources Limited Level 6, 197 St Georges Tce, Perth WA 6000 (08) 9462 3400 www.westgold.com.au	Meekatharra Cue Fortnum	
Wiluna Mining Corporation Limited Level 3, 1 Altona Street, West Perth WA 6005 (08) 9322 6418 www.wilunamining.com.au	Matilda / Wiluna	Blackham Resources Limited changed its name to Wiluna Mining Corporation Limited on 18 June 2020.
Iron ore		
Atlas Iron Limited Level 18, Raine Square 300 Murray Street Perth WA 6000 (08) 6228 8000 www.atlasiron.com.au	Mt Webber Sanjiv Ridge	Atlas Iron Limited is a subsidiary of Hancock Prospecting Pty Ltd. Sanjiv Ridge is a new project with first sales in the March quarter 2021.
BCI Minerals Limited Level 1, 1 Altona Street West Perth WA 6005 (08) 6311 3400 www.bciron.com.au	Iron Valley	Operated by a subsidiary of Mineral Resources Limited.
BHP 125 St Georges Terrace, Perth WA 6000 1300 55 47 57 www.bhpbilliton.com	Jimblebar / Wheelara Mining Area C Newman Yandi	Newman comprised the Mt Whaleback, Orebody 24 / 25 (Eastern Ridge), Orebody 29 / 30 / 35, and Orebody 18 mines. The South Flank mine, part of the Mining Area C project, achieved first production in May 2021.

TABLE 9. Principal mining projects 2020–21 (continued)

Company	Project(s)	Comments
CITIC Pacific Mining Management Pty Ltd 45 St Georges Terrace, Perth WA 6000 (08) 9226 8888 www.citicpacificmining.com	Sino Iron	
Fenix Resources Ltd Office 10, Emerald House, 1202 Hay Street West Perth WA 6005 (08) 9226 2011 www.fenixresources.com.au	Iron Ridge	New project. First sales achieved in the March quarter 2021.
Fortescue Metals Group Ltd Level 2, 87 Adelaide Terrace, East Perth WA 6004 (08) 6218 8888 www.fmgj.com.au	Chichester Solomon Western	Chichester comprised the Christmas Creek and Cloudbreak mines, while Solomon comprised the Firetail and Kings Valley mines. Western is a new project that includes the Eliwana mine. First sales occurred in the March quarter 2021
GWR Group Ltd 97 Outram Street West Perth, WA 6005 (08) 9322 6666 www.gwrgroup.com.au	Wiluna West	New project. First sales from the C4 deposit were achieved in the March quarter 2021. Operations were subsequently suspended in September 2021.
Hancock Prospecting Pty Ltd 28-42 Ventnor Avenue, West Perth WA 6005 (08) 9429 8222 www.hancockprospecting.com.au	Roy Hill	
Karara Mining Limited London House, 2/216 St Georges Terrace Perth WA 6000 (08) 6298 1888 www.kararamining.com.au	Karara	Karara Mining Limited is wholly owned by Anshan Iron and Steel Group.
Kimberley Metals Group Pty Ltd Level 1, 10 Ord Street West Perth WA 6005 (08) 9225 3100 www.kmetgroup.com	Ridges	Operated by a Joint Venture of Ridges Iron Ore Pty Ltd and Habrok (Ridges) Pty Ltd. Ridges was placed into care and maintenance in September 2021.
Mineral Resources Limited 1 Sleaford Road, Applecross WA 6153 (08) 9329 3600 www.mineralresources.com.au	Carina Koolyanobbing Wonmunna	Wonmunna is a new project. First sales achieved in the March quarter 2021.
Mount Gibson Iron Limited Level 1, 2 Kings Park Road, West Perth WA 6005 (08) 9426 7500 www.mtgibsoniron.com.au	Koolan Island Mid West	Mid West includes the Extension Hill and Shine mines. Sales concluded from Extension Hill in the December quarter 2020. Production from the Shine mine commenced in the June quarter 2021 with first sales in August 2021. It was subsequently announced in October 2021 that operation

TABLE 9. Principal mining projects 2020–21 (continued)

Company	Project(s)	Comments
Rio Tinto Ltd Level 16, Central Park 152-158 St Georges Terrace Perth WA 6000 (08) 9327 2000 www.riotinto.com	Brockman 2 – Nammuldi – Silvergrass Brockman 4 Greater Paraburdoo Hope Downs Marandoo Mt Tom Price Robe Valley (Mesa A & Mesa J) West Angelas Yandicoogina	Greater Paraburdoo comprised the Paraburdoo, Channar and Eastern Ranges mines, Hope Downs comprised the Hopes Downs 1 and 4 mines, and Mt Tom Price included the Western Turner Syncline mine.
Sinosteel Midwest Corporation Limited Level 8, 251 St Georges Terrace Perth WA 6000 (08) 9429 4888 www.smcl.com.au	Blue Hills	Re-started project. Sales recommenced in the March quarter 2021.
Young Australian Mines Ltd Level 11, 100 Edward Street Brisbane QLD 4000 (07) 3210 0113 www.yamines.com.au	Spinifex Ridge	Re-started project.
Lithium		
Alita Resources Limited Level 3, 20 Parkland Road, Osborne Park WA 6017 (08) 9489 2600 www.allianceminerals.com.au	Bald Hill	Alita Resources Limited went into receivership in August 2019 and as a result suspended operations at Bald Hill. Bald Hill has been on care and maintenance since August 2020. Sales of stockpiles occurred in the September and December quarters 2020.
Mineral Resources Limited 1 Sleaf Road, Applecross WA 6153 (08) 9329 3600 www.mineralresources.com.au	Mount Marion	Mount Marion is a joint venture of Mineral Resources Limited (50%) and Ganfeng Lithium Company (50%).
Orocobre Limited Riparian Plaza, Level 35, 71 Eagle Street Brisbane QLD 4000 (07) 3871 3985 www.orocobre.com	Mt Cattlin	Orocobre Limited merged with Galaxy Resources Limited in August 2021, with the merged company trading as Orocobre Limited.
Pilbara Minerals Limited Level 2, 88 Colin Street, West Perth WA 6005 (08) 6266 6266 www.pilbaraminerals.com.au	Pilgangoora	Pilbara Minerals Limited acquired Altura Mining Limited's (Altura) Pilgangoora lithium project in January 2021 after Altura went into receivership in October 2020. The former Altura operations are now part of the Pilgangoora project, which includes the Pilgan (original Pilbara Minerals) and Ngungaju (former Altura) plants.
Talison Lithium Australia Pty Ltd Level 15, 216 St Georges Terrace, Perth WA 6000 (08) 9263 5555 www.talisonlithium.com	Greenbushes Lithium	Talison Lithium Australia Pty Ltd is a joint venture of Tianqi Lithium Pty Ltd and IGO Ltd (51%) and Albemarle Corporation (49%).

TABLE 9. Principal mining projects 2020–21 (continued)

Company	Project(s)	Comments
Manganese		
Consolidated Minerals Pty Ltd Level 2, 7 Ventnor Avenue, West Perth WA 6005 (08) 9460 7000 www.consmin.com	Woodie Woodie	
Mineral sands		
Doral Pty Ltd 1 Alumina Road, East Rockingham WA 6168 (08) 9439 2236 www.doral.com.au	Yoongarillup mine and Picton dry separation plant Keysbrook	
GMA Garnet Pty Ltd Level 4, 108 St Georges Terrace Perth WA 6000 (08) 9287 3200 www.gmagarnet.com/en-au/	Port Gregory	
Iluka Resources Limited Level 17, 240 St Georges Terrace Perth WA 6000 (08) 9360 4700 www.iluka.com	South West Mid West	Active operations at South West comprised the Capel dry plant, the North Capel mineral separation plant, and one of two synthetic rutile kilns at North Capel. Active operations at Mid West comprised the Cataby mine, Narngulu mineral separation plant and the Eneabba screening plant.
Image Resources Level 2, 23 Ventnor Avenue West Perth WA 6005 (08) 9485 2410 www.imageres.com.au	Boonanarring	
Tronox Limited Lot 22 Mason Road, Kwinana Beach WA 6167 (08) 9411 1444 www.tronox.com	Cooljarloo mine and Chandala mineral separation plant Wonnerup mine and North Shore mineral separation plant	
Nickel		
BHP 125 St Georges Terrace, Perth WA 6000 1300 55 47 57 www.bhpbilliton.com	Leinster Mt Keith	The Leinster and Mt Keith operations comprised mining and concentrator operations.
First Quantum Minerals Ltd 1/24 Outram St, West Perth WA 6005 (08) 9346 0100 www.first-quantum.com	Ravensthorpe	
IGO Limited Suite 4, Level 5, 85 South Perth Esplanade South Perth WA 6151 08 9238 8300 www.igo.com.au	Nova	

TABLE 9 Principal mining projects 2020–21 (continued)

Company	Project(s)	Comments
Minara Resources Ltd Level 4, 30 The Esplanade Perth WA 6000 (08) 9212 8400 www.minara.com.au	Murrin Murrin	Minara Resources Ltd is a subsidiary of Glencore Plc.
Western Areas Ltd 2 Kings Park Rd, West Perth WA 6005 (08) 9334 7777 www.westernareas.com.au	Forrestania	
Rare earths		
Lynas Corporation Ltd Level 1, 45 Royal Street East Perth WA 6004 (08) 6241 3800 www.lynascorp.com	Mt Weld	
Salt		
Dampier Salt Ltd Level 16, Central Park 152-158 St Georges Terrace Perth WA 6000 (08) 9327 2000 www.riotinto.com	Dampier Lake MacLeod Port Hedland	Dampier Salt Ltd is a joint venture of Rio Tinto (68%), Marubeni Corporation (22%) and Sojitz Corporation (10%).
Onslow Salt Pty Ltd Level 16 Exchange Tower, 2 The Esplanade Perth WA 6000 (08) 9265 8000 www.salt.com.au	Onslow	
Shark Bay Salt Pty Ltd Level 16 Exchange Tower, 2 The Esplanade Perth WA 6000 (08) 9265 8000 www.salt.com.au	Shark Bay	
WA Salt Koolyanobbing Pty Ltd 185-187 Cockburn Road North Coogee WA 6163 (08) 9431 9431 www.wasalt.com.au	Lake Deborah	
Silica sand		
Hanson Australia Pty Ltd Level 1, 35 Great Eastern Hwy Rivervale WA 6103 (08) 9311 8811 www.hanson.com.au	Gnangara	
Simcoa Operations Pty Ltd 973 Marriott Road, Wellesley WA 6232 (08) 9780 6666 www.simcoa.com.au	Moora	
Talc		
Imerys Talc Australia Pty Ltd 21 Glyde Street, Three Springs WA 6519 (08) 9954 1427 www.imerystalc.com	Three Springs	

TABLE 9. Principal mining projects 2020–21 (continued)

Company	Project(s)	Comments
Tantalum		
Global Advanced Metals Pty Ltd Level 3, 123B Colin Street, West Perth WA 6005 (08) 6217 2500 www.globaladvancedmetals.com	Greenbushes Tantalum	
Basic Raw Materials		Location
Adelaide Brighton Ltd Level 9, 88 Phillip Street Sydney NSW 2000 (02) 8248 9999 www.adbri.com.au	Dongara, Lake Hillman, Lancelin, Nowergup, Parkeston, Woodman Point	
BGC Pty Ltd 5th Floor, 22 Mount St Perth WA 6000 (08) 6220 4800 www.bgc.com.au	Chidlow, Perth Metro, Port Hedland	
Boral Limited 130 Fauntleroy Ave, Perth Airport WA 6105 (08) 9333 3400 www.boral.com.au	Ashburton, Kalgoorlie, Kununurra, Mt Regal, Orange Grove, Perth North, Pilbara (Tabba Tabba), Port Hedland	
Hanson Australia Pty Ltd 35 Great Eastern Hwy Rivervale WA 6103 (08) 9311 8811 www.hanson.com.au	Ashburton, Bunbury, Byford, Learmonth, Mt Barker, Mt Regal, North of Perth, Port Hedland, Red Hill, South of Perth	
Holcim (Australia) Pty Ltd Level 3, 200 Adelaide Terrace, East Perth WA 6004 (08) 9212 2000 www.holcim.com.au	Albany, Bunbury, Esperance, Geraldton, Gosnells, Jandabup, Kalgoorlie-Boulder, Karratha, Newman, Port Hedland	
MLG Oz Pty Ltd 10 Yindi Way, Kalgoorlie WA 6433 (08) 9022 7746 www.mlgoz.com.au	Coolgardie (Canegrass, Eight Mile, Jonah Bore), Tarmoola	
Mobile Concreting Solutions Pty Ltd Level 1, 985 Wellington Street, West Perth 6005 (08) 9200 1840 www.mobileconcrete.com.au/	Indee, Tom Price, Onslow	
Spinifex Crushing & Screening Services Pty Ltd 16 Anthony Rd, Albany WA 6330 (08) 9845 7688 www.spinifexcrushing.com.au	Mt Regal, Port Hedland	
Urban Resources Pty Ltd 33 Cocos Dr, Bibra Lake WA 6163 (08) 9368 1299 www.urbanresources.com.au	Baldivis-Nambeelup, Jarrahdale-West Coolup, Perth North, Perth South	
WA Limestone Pty Ltd 401 Spearwood Avenue, Bibra Lake WA 6163 (08) 9434 7777 www.walimestone.com/	Byford, North Metro, Onslow, Port Hedland, Perth Metro, South Metro	

TABLE 10. Principal mining processing operations 2020-21

Company	Project
Alumina	
Alcoa Corporation 181–205 Davy Street, Booragoon WA 6154 (08) 9316 5111 www.alcoa.com/australia	Kwinana alumina refinery Pinjarra alumina refinery Wagerup alumina refinery
South32 Limited Level 36, 108 St Georges Tce, Perth WA 6000 (08) 9324 9000 www.south32.net	Worsley alumina refinery
Gold	
Gold Corporation 310 Hay Street, East Perth WA 6004 (08) 9451 7222 http://www.perthmint.com	Perth Mint
Nickel	
BHP 125 St Georges Terrace, Perth WA 6000 1300 55 47 57 www.bhpbilliton.com	Kalgoorlie nickel smelter Kambalda nickel concentrator Kwinana nickel refinery
Minara Resources Ltd Level 4, 30 The Esplanade, Perth WA 6000 (08) 9212 8400 www.minara.com.au	Murrin Murrin nickel refinery
Mineral sands	
Tronox Limited Lot 22 Mason Road, Kwinana Beach WA 6167 (08) 9411 1444 www.tronox.com	Bunbury pigment plant Kwinana pigment plant
Doral Pty Ltd 1 Alumina Road, East Rockingham WA 6168 (08) 9439 2236 www.doral.com.au	Rockingham fused zirconia plant
Silica sand	
Simcoa Operations Pty Ltd 973 Marriott Road, Wellesley WA 6232 (08) 9780 6666 www.simcoa.com.au	Kemerton silicon smelter

TABLE 11. Principal petroleum projects 2020-21

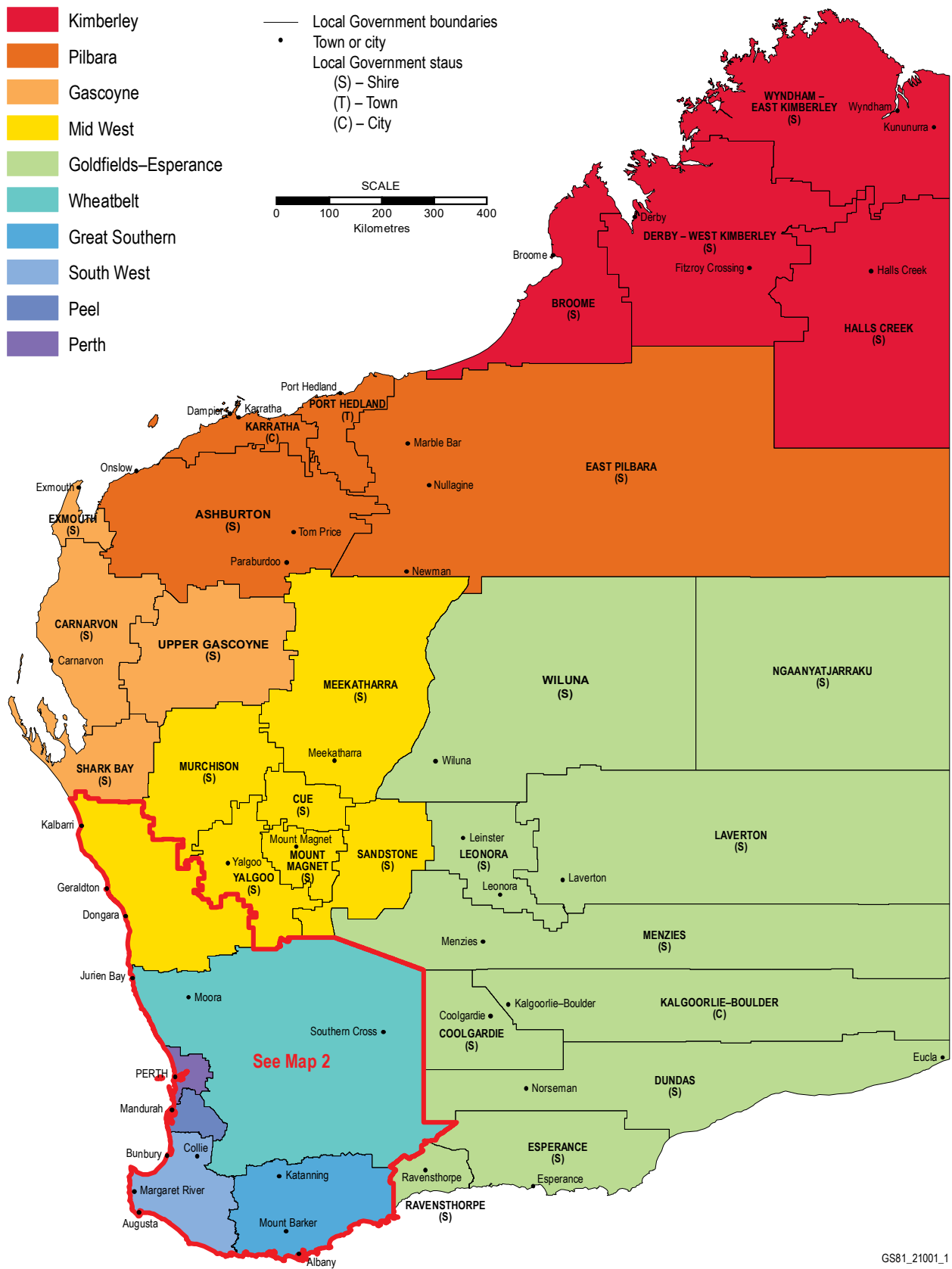
Operator	Project(s)	Processing plant(s)	Operating field(s)	Type	Area	Comments
Beach Energy Level 6, 160 St Georges Terrace Perth WA 6000 (08) 8338 2833 www.beachenergy.com.au	Beharra Springs	Beharra Springs Gas Facility	Redback, Redback South	Gas	Onshore	
BHP 125 St Georges Terrace Perth WA 6000 1300 55 47 57 www.bhpbilliton.com	Macedon Pyrenees	Macedon Domestic Gas Plant	Macedon Crosby, Moondyne, Ravensworth, Stickle, Tanglehead, Wild Bull	Gas and condensate Oil	Offshore Offshore	
Buru Energy Level 2, 16 Ord Street West Perth WA 6005 1800 337 330 www.buruenergy.com	Ungani	Ungani Production Facility	Ungani	Oil	Onshore	
Chevron Corporation 250 St. Georges Terrace Perth WA 6000 (08) 9216 4000 www.australia.chevron.com	Barrow Island Gorgon Wheatstone	Gorgon LNG Wheatstone LNG	Barrow Island Jansz-lo, Gorgon Iago, Wheatstone, Brunello	Oil Gas and condensate Gas and condensate	Onshore Offshore Offshore	Woodside Petroleum operates the Brunello field within the Wheatstone LNG project
ENI 226 Adelaide Terrace Perth WA 6000 (08) 9 320 1111 www.eni.com	Blacktip		Blacktip	Gas and condensate	Offshore	
Exxon Mobil Level 9, 664 Collins Street Docklands Vic 3008 (03) 9261 0000 www.exxonmobil.com.au	Athena		Athena	Gas and condensate	Offshore	Athena ceased production in October 2020
INPEX Corporation Level 22, 100 St Georges Terrace Perth WA 6000 (08) 6213 6000 www.inpex.com.au	Ichthys		Ichthys	Condensate	Offshore	

TABLE 11. Principal petroleum projects 2020-21 (continued)

Operator	Project(s)	Processing plant(s)	Operating field(s)	Type	Area	Comments
Jadestone Energy Level 2, 168 St Georges Terrace Perth, WA 6000 (08) 9486 6600 www.jadestone-energy.com	Stag		Stag	Oil	Offshore	
Mitsui & Co Level 16, 2 The Esplanade Perth WA 6000 (08) 9476-2333 www.mitsui.com/au	Waitsia	Xyris Production Facility	Waitsia	Gas	Onshore	
RMCA Group 120 Robinson Road Singapore 068913 +65 6332 2282 www.rcma.com	Jingemia	Jingemia Production Facility		Oil	Onshore	
Santos Level 7, 100 St Georges Terrace Perth WA 6000 (08) 6218 7100 www.santos.com	Reindeer	Devil Creek Processing Plant	Reindeer	Gas	Offshore	Van Gogh was renamed from Ningaloo Vision
	Van Gogh		Coniston, Novara, Van Gogh	Oil	Offshore	
	Varanus Island	Varanus Island Processing Facility	Bambra, Halyard, John Brookes, Lee, Spar	Oil, gas and condensate	Offshore	
Shell 562 Wellington Street Perth WA 6000 (08) 9338 6600 www.shell.com.au	Prelude	Prelude FLNG	Prelude	Gas	Offshore	
Triangle Energy (Global) Limited Suite 2, Ground Floor 100 Havelock Street West Perth WA 6005 (08) 9219 7111 www.triangleenergy.com.au	Cliff Head	Arrowsmith Stabilisation Plant	Cliff Head	Oil	Offshore	
Vermillion Level 5, 30 The Esplanade Perth WA 6000 (08) 9215 0300 www.vermillionenergy.com	Wandoo		Wandoo	Oil	Offshore	

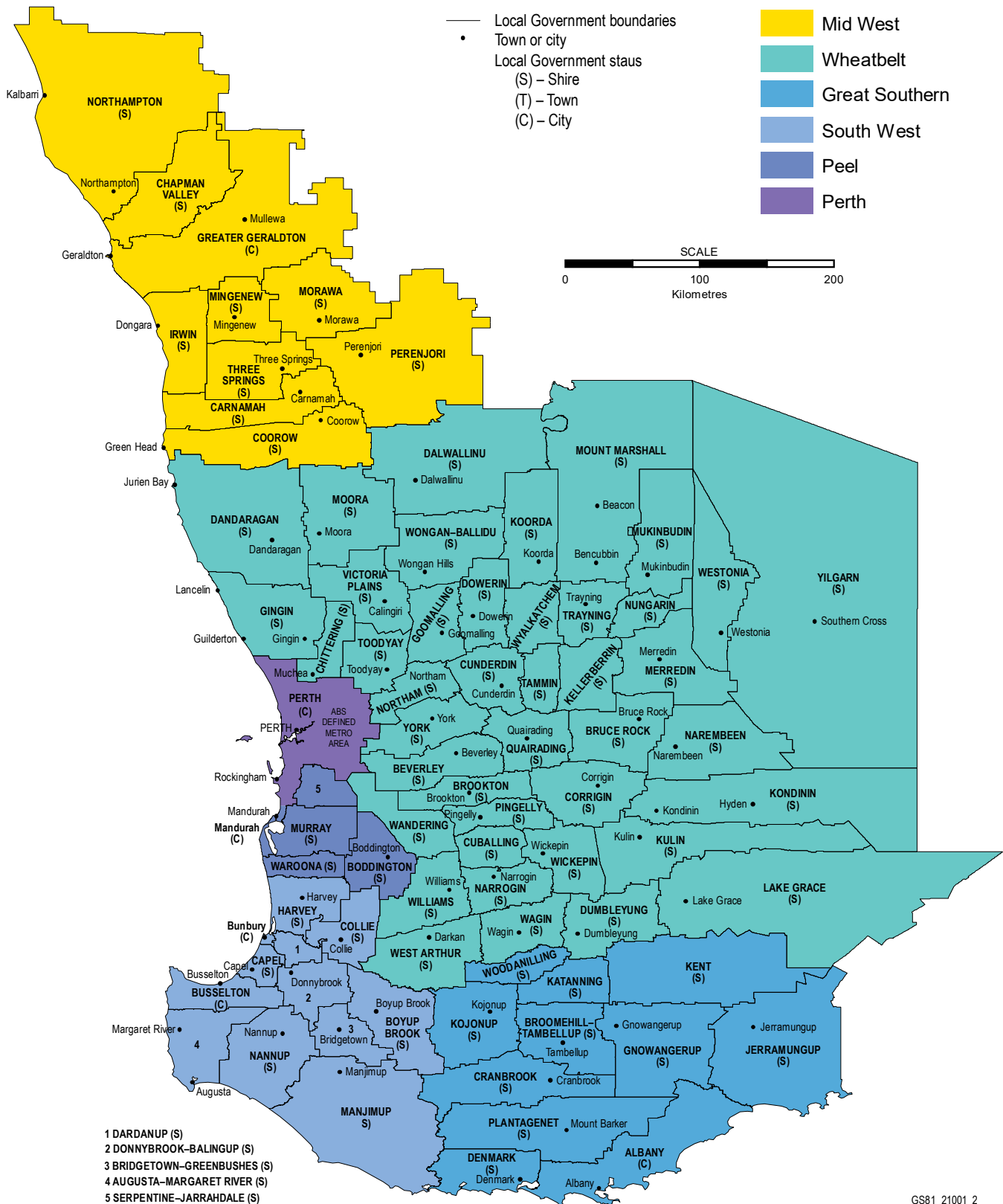
TABLE 11. Principal petroleum projects 2020-21(continued)

Operator	Project(s)	Processing plant(s)	Operating field(s)	Type	Area	Comments
Woodside Petroleum 11 Mount Street Perth WA 6000 (08) 9348 4000 www.woodside.com.au	Enfield		Vincent, Cimatti and Laverda	Oil and gas	Offshore	
	North West Shelf	Karratha Gas Plant	Angel, Cossack, Dockrell, Goodwyn, Hermes, Keast, Lady Nora, Lambert, North Rankin, Pemberton, Persephone, Perseus, Rankin, Sculptor, Searipple, Tidepole, Wanaea	Oil, gas, and condensate	Offshore	
	Pluto	Pluto LNG	Pluto, Xena	Gas	Offshore	

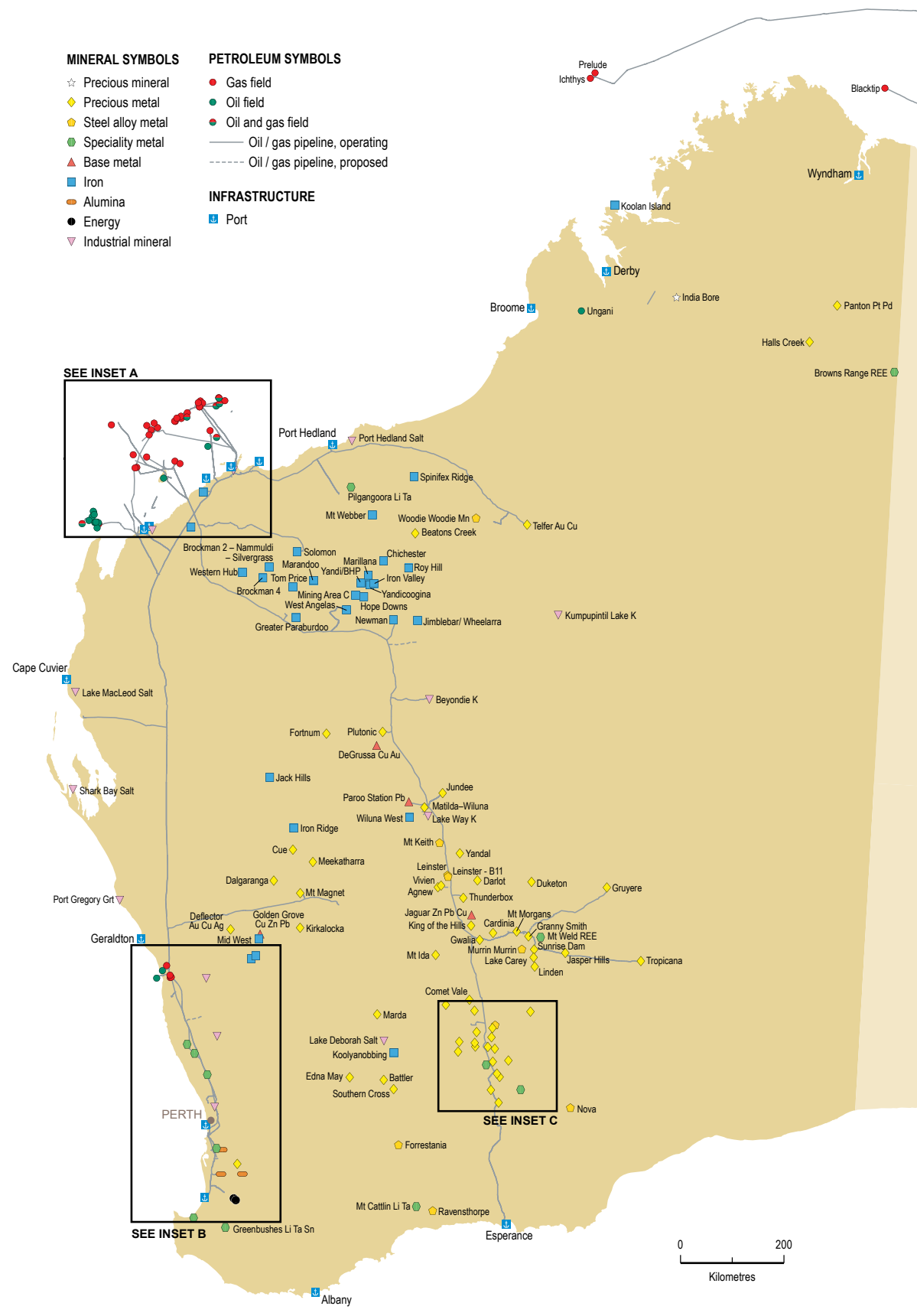


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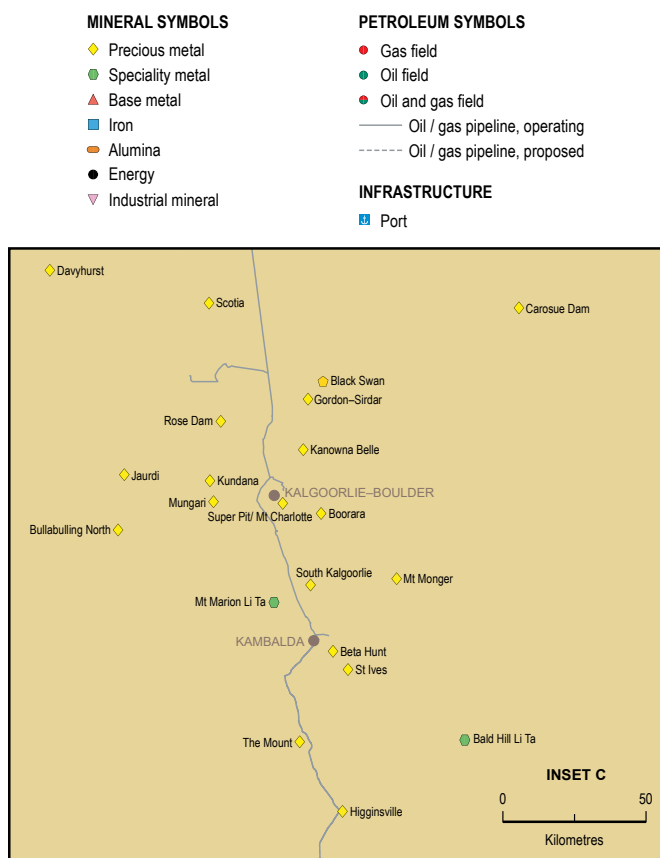
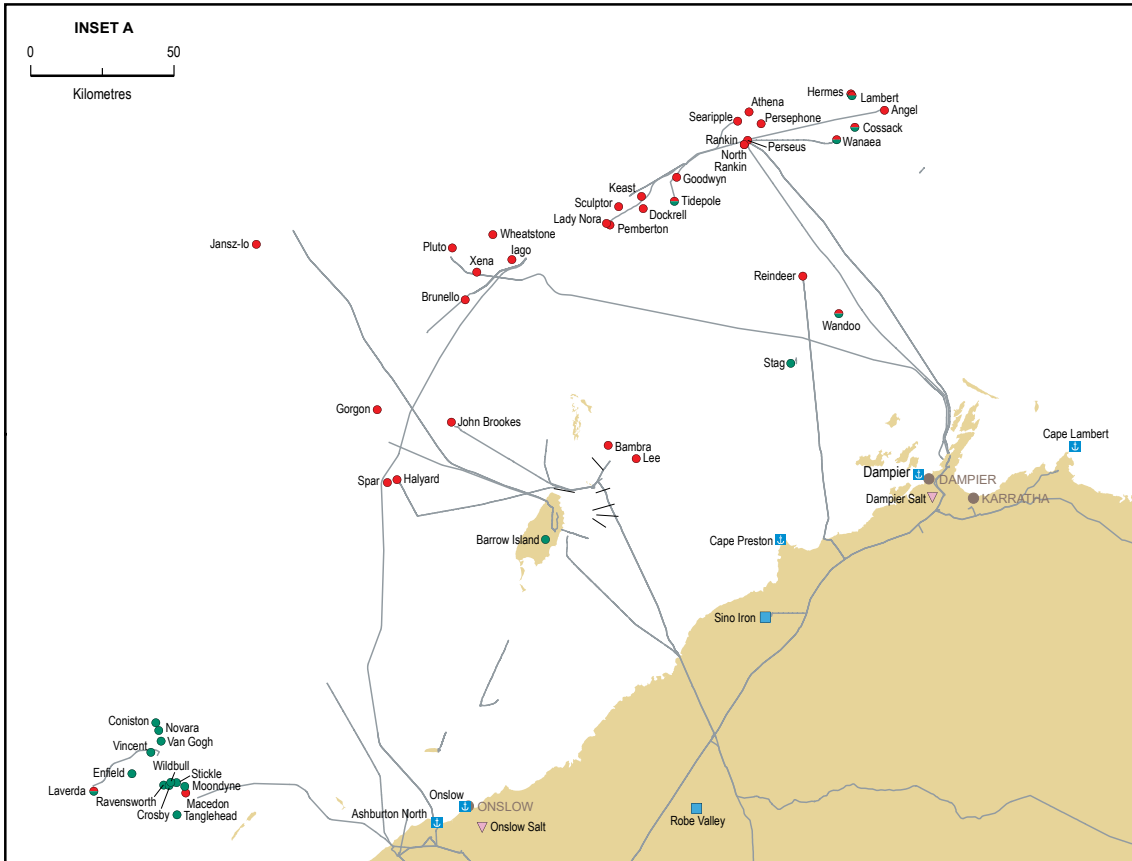
Map 1. Local Government and Regional boundaries



Map 2. Local Government and Regional boundaries- enlargement



Map 3. Principal mining and petroleum projects 2020-21



MINERAL SYMBOLS

- ◆ Precious metal
- Speciality metal
- ▲ Base metal
- Iron
- Alumina
- Energy
- ▽ Industrial mineral

PETROLEUM SYMBOLS

- Gas field
- Oil field
- Oil and gas field
- Oil / gas pipeline, operating
- - - Oil / gas pipeline, proposed

INFRASTRUCTURE

- Port

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Map 4. Principal mining and petroleum projects 2020-21 insets

ABBREVIATIONS

A\$	Australian dollar	LNG	Liquefied natural gas
ABS	Australian Bureau of Statistics	LPG	Liquefied petroleum gas
ANZISIC	The Australian New Zealand Standard Industrial Classification	LBMA	London Bullion Market Association
ASX	Australian Securities Exchange	m	Metre
bbl	Barrels of oil	Mct	Million carats
Bcm	Billion cubic metres	Mbbl	Million barrels
BFS	Bankable Feasibility Studies	Mkl	Million kilolitres
CFR	Cost, insurance and freight	Mmbtu	Million metric British thermal units
CIF	Cost including freight	MoU	Memorandum of Understanding
COMEX	The Commodity Exchange Inc.	Moz	Million ounces
DFS	Definitive Feasibility Studies	Mt	Million tonnes
DMIRS	Department of Mines, Industry Regulation and Safety	Mtpa	Million tonnes per annum
EIS	Exploration Incentive Scheme	NoI	Number of Individuals
EV	Electric vehicles	NWS	North West Shelf
FEED	Front End Engineering and Design	OoCE	Office of the Chief Economist
FID	Final Investment Decision	OPEC	Organization of Petroleum Exporting Countries
FLNG	Floating liquefied natural gas	oz	Ounce
FMG	Fortescue Metals Group	POSCO	Pohang Iron & Steel Co. Ltd.
FOB	Free-on-Board	PFS	Pre-Feasibility Studies
FPSO	Floating, Production, Storage and Offloading Facility	PJ	Petajoules
FTE	Full-time Equivalent	ppm	Parts per million
GJ	Gigajoule	sq kms	square kilometres
g/t	Grams per tonne	t	Tonnes
ha	Hectares	TJ	Terajoules
koz	Thousand ounces	TJ/d	Terajoules per day
ktpa	Kilotonnes per annum	tpa	Tonnes per annum
kg	Kilograms	TSI	The Steel Index
Kl	Kilolitres	TiO ₂	Titanium Dioxide
km	Kilometres	US\$	United States dollar
km ²	Kilometres square	WA	Western Australia
kt	Thousand tonnes	WATC	Western Australian Treasury Corporation
LME	London Metal Exchange		

UNITS AND CONVERSION FACTORS

	Metric Unit	Symbol	Imperial Unit
Mass	1 gram	g	= 0.032151 troy (fine) ounce (oz)
	1 kilogram	kg	= 2.204624 pounds (lb)
	1 tonne	t	= 1.10231 United States short ton [1 US short ton = 2,000 lb]
	1 tonne	t	= 0.98421 United Kingdom long ton [1 UK long ton = 2,240 lb]
	1 tonne LNG	t	= 52,000,000 British Thermal Units (Btu)
Volume	1 kilolitre	Kl	= 6.28981 barrels (bbl)
	1 cubic metre	m ³	= 35.3147 cubic feet (ft ³) [1 kilolitre (kl) = 1 cubic metre (m ³)]
Energy	1 kilojoule	kJ	= 0.94781 British Thermal Units (Btu)
Energy Content		Prefix	
Coal	19.7 GJ/t	kilo (k)	10 ³
Condensate	32.0 MJ/L	mega (M)	10 ⁶
Crude oil	37.0 MJ/L	giga (G)	10 ⁹
LNG	25.0 MJ/L	tera (T)	10 ¹²
Natural gas	38.2 MJ/m ³	peta (P)	10 ¹⁵
LPG-butane	28.7 MJ/L (1 tonne LPG-butane = 1,720 litres)		
LPG-propane	25.4 MJ/L (1 tonne LPG-propane = 1,960 litres)		

WEIGHTS AND MEASURES

kilo	10 ³	1,000
mega	10 ⁶	1,000,000
giga	10 ⁹	1,000,000,000
tera	10 ¹²	1,000,000,000,000
peta	10 ¹⁵	1,000,000,000,000,000
exa	10 ¹⁸	1,000,000,000,000,000,000
zetta	10 ²¹	1,000,000,000,000,000,000,000
yotta	10 ²⁴	1,000,000,000,000,000,000,000,000

DATA SOURCES

Data for minerals and petroleum in this publication are collected from a variety of sources including internal data, the Office of the Chief Economist, the Australian Bureau of Statistics and various commercial data suppliers.

Quantities and values specified relate to production or sales for mineral products as listed below and production for petroleum products.

Production
Clays
Coal
Construction materials
Dimension stone
Gypsum
Limesand–Limestone–Dolomite
Silica – Silica Sand
Talc
Sales
Alumina
Copper, Lead and Zinc
Chromite
Diamonds
Gem and semi-precious stones
Gold
Mineral sands
Industrial pegmatite minerals
Iron ore
Lithium industry (Tin, Tantalum and Spodumene)
Manganese
Nickel industry (Nickel, Cobalt, Platinum and Palladium)
Petroleum
Pigments
Rare earths
Salt
Silver
Spongolite
Vanadium

Government of Western Australia

**Department of Mines, Industry Regulation
and Safety**

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