



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

WESTERN AUSTRALIAN MINERAL AND PETROLEUM

STATISTICS DIGEST 2021–22



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Cover photo: Wind turbines at the Agnew gold mine, courtesy of Gold Fields Limited.

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FOREWORD

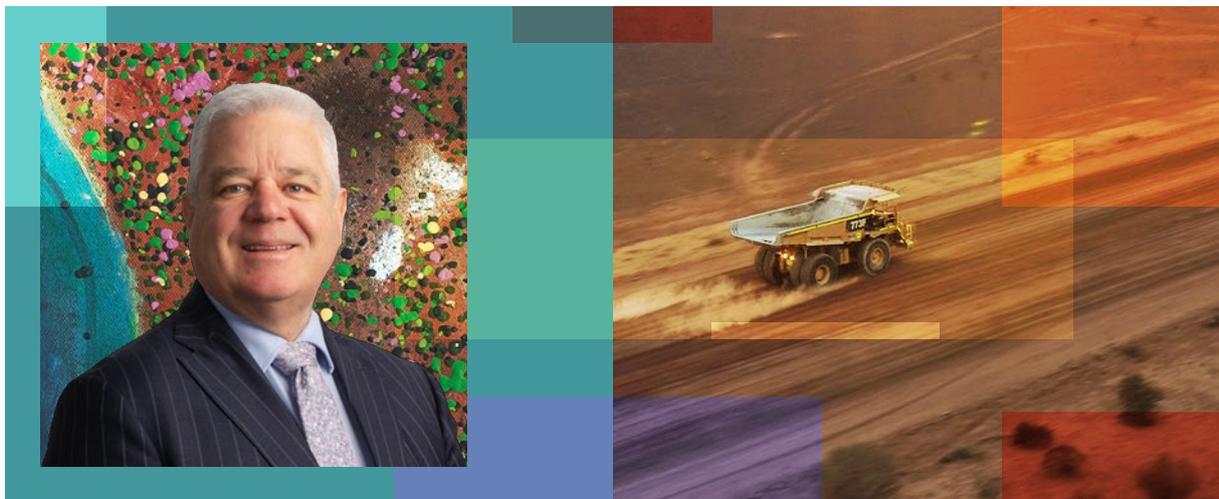


Photo: (on right) Wind turbines at the Agnew gold mine, courtesy of Gold Fields Limited.

I am pleased to introduce the Mineral and Petroleum Statistics Digest for 2021–22.

Globally, COVID-19 continued to dominate commodity markets while other significant factors emerged in the form of the Russia-Ukraine conflict; rising inflation, tighter monetary policy; and concerns about a global economic slowdown; and structural changes from initiatives to reduce the effects of climate change.

Oil, gas, nickel and gold prices increased significantly due to the conflict in Ukraine, while battery minerals such as lithium, nickel and cobalt benefitted from the global transition to electric vehicles (EV), renewable energy and energy storage systems.

Iron ore prices were characterised by volatility on Chinese demand but trended lower on China's zero-COVID and environmental policies. Nearly all commodity prices moved lower towards the end of the financial year as inflationary pressures and moderated expectations for global economic growth took hold.

These commodities represent a significant part of Western Australia's (WA) resources sector and our State economy.

Locally, WA emerged from behind its controlled borders with very high rates of vaccination. Our State also experienced its first widespread outbreaks of the COVID-19 virus through the Omicron variant, and transitioned to 'living with COVID'.

WA's resources sector successfully navigated this 'new normal', delivering historically high volumes for many commodities and taking advantage of higher commodity prices.

As a result, the resources sector delivered record sales, employment and royalty revenues over the past financial year.

All-time high levels of mineral exploration expenditure means the future also looks promising. This spending will increase the life of existing operations and help discover the mines of tomorrow. Petroleum exploration spending recovered from a 25-year low.

There was also stronger levels of mining investment in addition to the billions of dollars in projects currently under development. This will support further investment spending, sustain current production and potentially expand output in the coming years.

WA remains a trusted and globally significant minerals and petroleum producer. Our resources sector will continue to power the State's economy and deliver exceptional benefits to the community well into the future.

Richard Sellers
Director General
Department of Mines, Industry Regulation and Safety

OVERVIEW

WA's resources sector delivered another sales record of \$231 billion in 2021–22.

This was up marginally from the previous record of \$230 billion in 2021, and \$20 billion more than the previous financial year high of \$211 billion in 2020–21.

The iron ore industry remained the bedrock of the sector with sales valued at \$137 billion.

While this result for iron ore was still historically high, it was down from previous record levels. This was due to the price of iron ore falling from an all-time high in excess of United States (US) \$200 per tonne in mid-2021 to less than US\$100 per tonne towards the end of 2021.

The fall in the value of sales by the iron ore industry was largely offset by the continued recovery in the petroleum industry from rising oil and natural gas prices. Higher prices translated into liquefied natural gas (LNG) production valued at an all-time high of \$38 billion, condensate production valued at a record \$8.6 billion, and crude oil production value at a seven-year high of \$3.6 billion.

The sector's overall performance was supported by strength in several other commodity markets during the financial year.

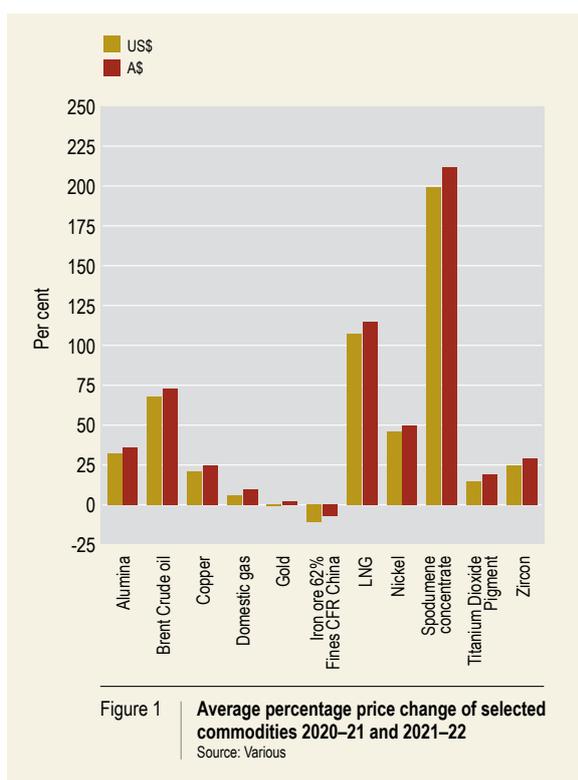
Gold sales were valued at a record \$17 billion, supported by the highest local volumes in 20 years and overall stronger Australian dollar prices from a weaker currency.

Surging lithium prices and higher local sales volumes drove the value of spodumene concentrate sales to a record \$6.8 billion (more than two and a half times the previous record), making it the State's third highest value mineral by sales in place of alumina.

Alumina (\$6.7 billion), nickel (\$4.9 billion and the highest level in almost 15 years), copper (a record \$2 billion), mineral sands (a record \$1.3 billion), rare earths (\$779 million), and cobalt (a record \$522 million) sales were all higher primarily on the back of increased prices.

The sector was also assisted by an overall weaker Australian dollar (as most commodities are priced in US dollars), which averaged 73 US cents for the financial year due to strength in the US dollar.

WA is currently the world's largest supplier of iron ore, lithium, garnet and zircon, the second largest exporter of alumina, and is among the top five jurisdictions for the production of cobalt, gold, LNG, nickel, rare earths, and salt. The State is also in the top 10 for manganese, ilmenite and rutile output.



Minerals

Minerals production was again the dominant activity in the State's resources sector with \$179 billion in sales. Minerals accounted for 78 per cent of all sales. While this was down on recent years, due predominantly to a fall in the value of iron ore sales and recovery in the value of petroleum production, minerals production was in keeping with historical levels.

Iron ore remained the most valuable mined commodity in WA, accounting for 76 per cent of all mineral sales and 59 per cent of total mineral and petroleum sales. While iron ore's share of sales was down, it remained the most dominant industry in the State's resources sector.

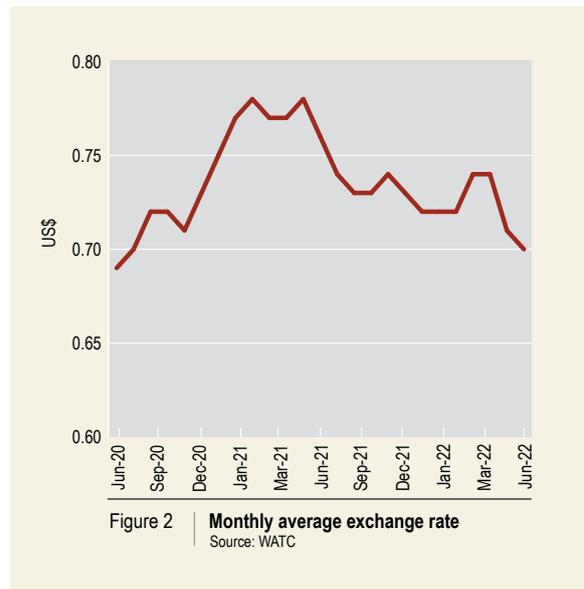
Iron ore achieved sales valued at \$137 billion – still historically high but down from previous record levels. This was due to the price of iron ore falling from an all-time high in excess of US\$200 per tonne in mid-2021 to less than US\$100 per tonne towards the end of 2021. This was the result of enforced steel production cuts in China to curb emissions, as well a downturn in the

country's property and construction sectors. The iron ore price recovered through the first half of 2022 on more accommodative macroeconomic policy from the Chinese government. This improved iron ore market sentiment, but not enough to offset the earlier losses.

WA sold 844 million tonnes (Mt) of iron ore, the second highest quantity on record for a single calendar or financial year after 2020. This was the result of increased sales from the majority of local producers, which compensated for lower output from Rio Tinto's operations and the impact of above average rainfall, cultural heritage management, as well as delays in growth and production replacement projects.

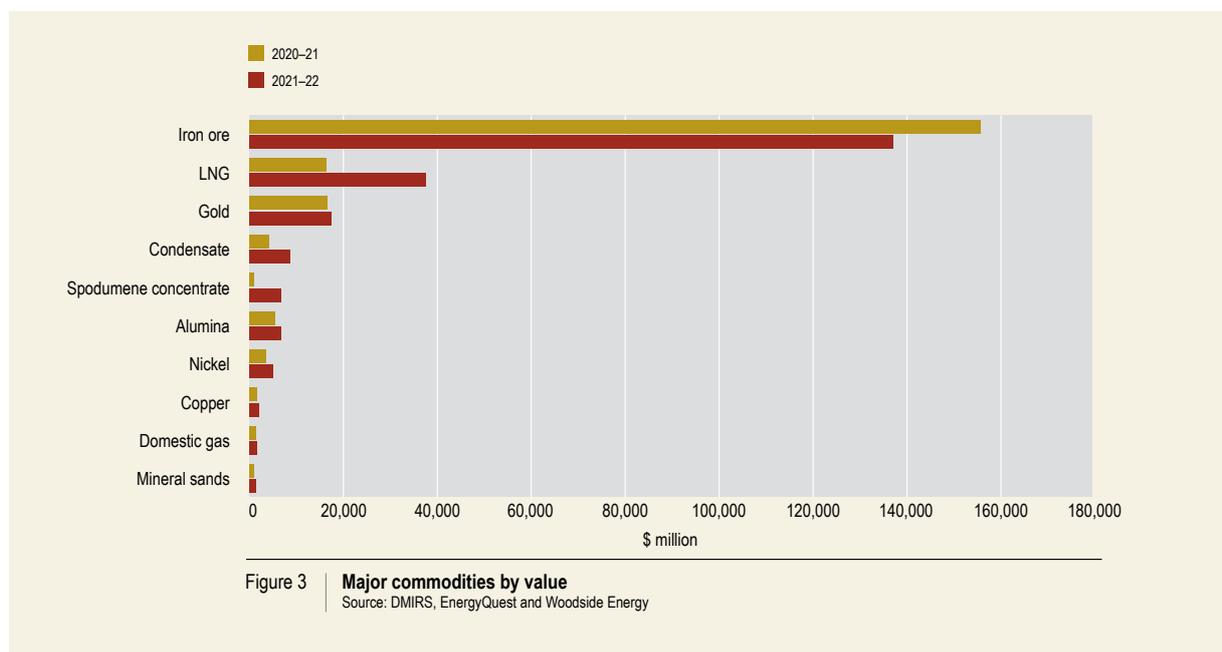
Gold sales were valued at a record \$17 billion. The price of gold was fairly stable in US dollar terms supported by the spread of the Omicron variant of COVID-19, economic uncertainty, and the Russia-Ukraine conflict. However, a weaker Australian dollar resulted in an overall price gain for local producers. There was the 6.9 million ounces (Moz) or 214 tonnes of gold sold in the State – the highest volume in 20 years. This was principally driven by higher sales from Granny Smith, Gruyere, Kanowna Belle, Gwalia, and St Ives, among other projects.

Lithium demand continued its rapid growth from the manufacture of batteries for EVs, which continued to outstrip supply. The spot price of spodumene concentrate mirrored tightness in the market, reaching greater than \$6,000 per tonne in June 2022. This was more than six times the price from a year earlier. Sales volumes were the second highest level on record (after 2017-18) at 2.05 Mt due largely to the ramp up of



expansions at Greenbushes and improved processing rates and recoveries at Mount Cattlin. Record prices and higher volumes translated into all-time high sales valued at \$6.8 billion, and the lithium industry displacing the alumina industry as the third most valuable mineral by sales in WA.

The value of alumina increased to \$6.7 billion on the back of higher prices that were supported by tighter supply, due to the Russia-Ukraine conflict as well as production curtailments to meet emissions targets in China. This was despite a fall in sales volumes due to impacts on output at Alcoa World Alumina and Chemicals' (AWAC) operations during the first half of 2022, which included operational issues, unplanned



Commodity	Western Australia	Rest of Australia	Rest of World	Global Ranking
Alumina	10.3%	4.7%	85.0%	2
Cobalt	3.2%	0.0%	96.8%	3
Copper	0.7%	3.2%	96.1%	>13
Crude oil	0.1%	0.04%	99.9%	42
Diamonds	0.1%	0.0%	99.9%	>5
Garnet	31.0%	0.0%	69.0%	1
Gold	6.9%	3.1%	90.0%	3
Ilmenite	3.2%	2.5%	94.3%	9
Iron Ore	33.6%	0.4%	66.0%	1
Lead	0.03%	11.2%	88.7%	>12
Lithium	52.4%	0.0%	47.6%	1
LNG	12.2%	9.4%	78.4%	3
Manganese	2.6%	13.9%	83.5%	8
Nickel	5.5%	0.0%	94.5%	5
Rare Earths	10.0%	0.0%	90.0%	4
Rutile	11.1%	20.7%	68.2%	7
Salt	4.3%	0.0%	95.7%	5
Zinc	0.5%	9.6%	89.8%	>11
Zircon	22.7%	10.2%	67.1%	1

maintenance events and reduced bauxite quality. Bauxite shipments from AWAC were discontinued at the end of 2021.

The nickel industry marked its highest sales value in almost 15 years, achieving \$4.9 billion in sales. This result was due to a dramatic increase in nickel prices that included a daily high of greater than US\$100,000 per tonne in March 2022 and causing the London Metal Exchange (LME) to suspend trading and impose limits on daily price movements. This was against a backdrop of the Russia-Ukraine conflict and related supply concerns, as well as strong demand from stainless steel production and EVs. Actual sales volumes though fell to their lowest level in 20 years, mainly due to worker shortages and unplanned downtime at Nickel West, in addition to planned maintenance at Murrin Murrin. This more than offset higher output from the Ravensthorpe operations as production ramped up at the Shoemaker-Levy deposit that came online, as well as the restart of the Savannah project in the Kimberley.

Copper sales were valued at a record \$2 billion as prices remained stable at greater than US\$9,000 per tonne (and even topped US\$10,000 per tonne). Prices for the red metal were supported by supply concerns stoked by the Russia-Ukraine conflict. Sales volumes were also higher with increased supply from most local producers.

The remaining significant other mineral sales included:

- Mineral sands – \$1.3 billion (the highest on record).
- Rare earths – \$779 million.
- Cobalt – \$522 million (the highest on record).
- Salt – \$558 million.
- Zinc – \$355 million.
- Coal – \$325 million.
- Manganese – \$324 million.

Petroleum

The petroleum sector, comprising LNG, condensate, crude oil, domestic gas and liquefied petroleum gas (LPG), continued to recover and achieved sales valued at \$52 billion. This was a record result.

The sector's share of total mineral and petroleum sales improved to 22 per cent, which is around pre-COVID-19 pandemic levels.

LNG was the most valuable petroleum product produced in WA at a record \$38 billion, or 72 per cent of all petroleum sales. Condensate followed at a record \$8.6 billion (17 per cent), crude oil at a seven-year high of \$3.6 billion (seven per cent), domestic gas at \$1.6 billion (three per cent) and LPG at a 10-year high of \$708 million (one per cent).

Rising sales values for oil and gas products were due to recovering demand that outpaced additions to supply. This was accelerated by the Russia-Ukraine conflict and the uncertainty it created for supplies. Gas supply concerns, particularly in Europe, supported higher prices in the Asia Pacific market (the main market for WA's LNG) as importers of Russian gas sought alternative sources of supply.

LNG production was at its highest level on record (46.1 Mt). This was due to operational issues being resolved at Gorgon allowing it to operate at full strength, and a longer period of production from Prelude despite further operational issues and an industrial dispute. This gain offset lower production from the North West Shelf due to scheduled maintenance.

Condensate production was 12.1 gigalitres (GL), an increase from 11.1 GL in 2020–21 and a historically high level. This was supported by higher output from the Ichthys floating production, storage and offloading facility (FPSO), Prelude, and Gorgon. These producers offset lower production from North West Shelf and Wheatstone.

Oil production was 4.8 GL, up from 4.3 GL but well below the record levels of 15 to 20 years ago. This was supported by output from Van Gogh since it returned to production in March 2021 as well as increased reliability at Enfield/Vincent.

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. It includes data relating to sales values and volumes, prices, exports, as well as production compared with the rest of Australia and the rest of the World.
2. **Economic indicators** – this file contains information about how the State's mineral and petroleum industry contributes to the economy through exploration, investment, employment and royalties.
3. **Spatial and regional** – this file contains information about mining and petroleum tenements, the distribution of the value of mineral and petroleum sales and royalties, and mining employment across the State.

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 129 predominantly higher value and export-oriented mining projects in 2021–22, up from 125 in 2020–21.

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 13 principal producers of these products in 2021–22.

With prices still comparatively high, three new iron ore projects entered production: Rio Tinto's Gudai-Darri project; Atlas Iron's Miralga Creek project and Mineral Resources' Parker Range project. With these new projects, and no sales recorded at Spinifex Ridge, the total number of iron ore projects increased to 34 from 32 the previous year.

The number of gold projects was down to 52 in 2021–22 from 53 in 2020–21. There were six new gold projects: Ramelius Resources' Tampia, Calidus Resources' Warrawoona, Capricorn Metals' Karlawinda, Resources and Energy Group's East Menzies, Bullseye Mining's North Laverton, and FMR Investments' Hawkins Find. Ramelius Resources also restarted operations at the Penny project.

Six projects were either under threshold or didn't make any sales in 2021–22. Some projects were also restructured: the Kundana project was integrated into the Mungari operations following its acquisition by Evolution Mining, while Westgold Resources' Cue and Meekatharra operations were combined into the Murchison gold project.

The number of nickel projects increased to eight this year from six in 2020–21 due to the start of Mincor Resources' Kambalda project and the restart of Panoramic Resources' Savannah project.

There was also one additional lithium project with the restart of Mineral Resources' Wodgina project (bringing the total number of lithium projects to six), and one more manganese project being Element 25's Butcherbird project (bringing the total number of manganese projects to two).

There were no diamonds projects following the completion and production and sales at Argyle the previous year.

There were also 14 major mineral processing operations which transform bauxite into alumina; gold dorè into gold bars; nickel concentrate into nickel matte, nickel powder, nickel briquettes and nickel sulphate; rutile and synthetic rutile into titanium dioxide pigment; zircon into fused zirconia; silica sand into silicon metal; and spodumene concentrate into lithium hydroxide.

This was up from 13 in 2020–21, following first production from the Kwinana lithium hydroxide plant in May 2022. The Kwinana nickel sulphate circuit, which is part of the Kwinana nickel refinery, also delivered first crystals in October 2021.

There were 20 principal petroleum projects producing oil, gas and condensates from 51 fields onshore and in the Commonwealth waters around WA.

These projects had associated processing plants for LNG exports and domestic gas sales.

This was down from 22 projects and 55 fields in 2020–21.

Blacktip was previously included as a petroleum project for WA, but was removed as its gas is supplied to the Northern Territory. Athena was more appropriately considered as a field under the North West Shelf project rather than a separate project and is no longer producing.

The number of fields declined largely due to changes in the active fields as part of the North West Shelf project.

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

1.2 Employment

WA's mining, mineral exploration, and onshore petroleum industries employed an average of 157,704 on-site personnel or 123,020 in full-time equivalent (FTE) terms during 2021–22. This was another record for a calendar or financial year.

The mining industry was responsible for the majority of employment with an average of 151,878 people (117,436 FTEs) on site during the year. This was also a record.

The major contributors to on-site employment continued to be the iron ore (78,974 people or 58,828 FTEs); gold (36,087 people or 30,683 FTEs); alumina and bauxite (9,936 people or 6,713 FTEs); nickel (8,294 people or 8,213 FTEs); and lithium (3,782 people or 3,545 FTEs) industries.

The numbers of people on mining operations was up year-on-year for most minerals, with the notable exception of diamonds (down 269 people or 226 FTEs) following the end of production at Argyle.

Employment on minerals exploration operations was its second highest level on record (after 2021) at 4,626 people or 4,347 FTEs.

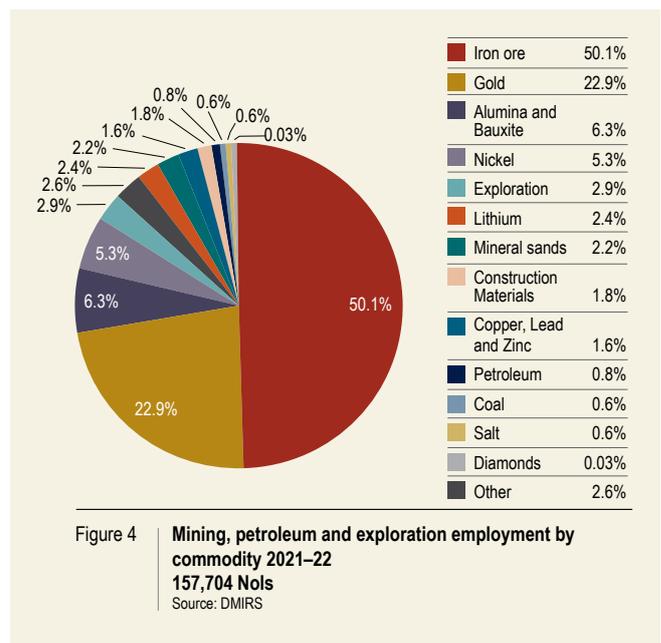
These results reflected strong levels of mining, construction, and exploration activity in the State.

An average of 1,200 people (1,237 FTEs) were on petroleum operations during the year. The level of employment in the onshore petroleum industry remained historically low at less than half the level of a decade ago.



The economic indicators file provides detailed employment data, including:

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



A note about employment data

The Department of Mines, Industry Regulation and Safety (DMIRS) reports employment data in two different ways:

1. Number of Individuals (NoI): The number of individual people who have performed at least one hours work on a mine site.
2. 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 the Australia and New Zealand Standard Industrial Classification.

A further note about employment data for 2021–22

Mining employment data for 2021–22 is based on monthly reporting from July 2021 to March 2022 only due to quality issues with data for the period of April, May and June 2022. This followed changes to reporting requirements under work health and safety legislation.

Petroleum employment data was not available for the April, May and June period, as it is no longer required to be reported under new work health and safety legislation. DMIRS is investigating alternative sources of petroleum employment data for future statistics releases.

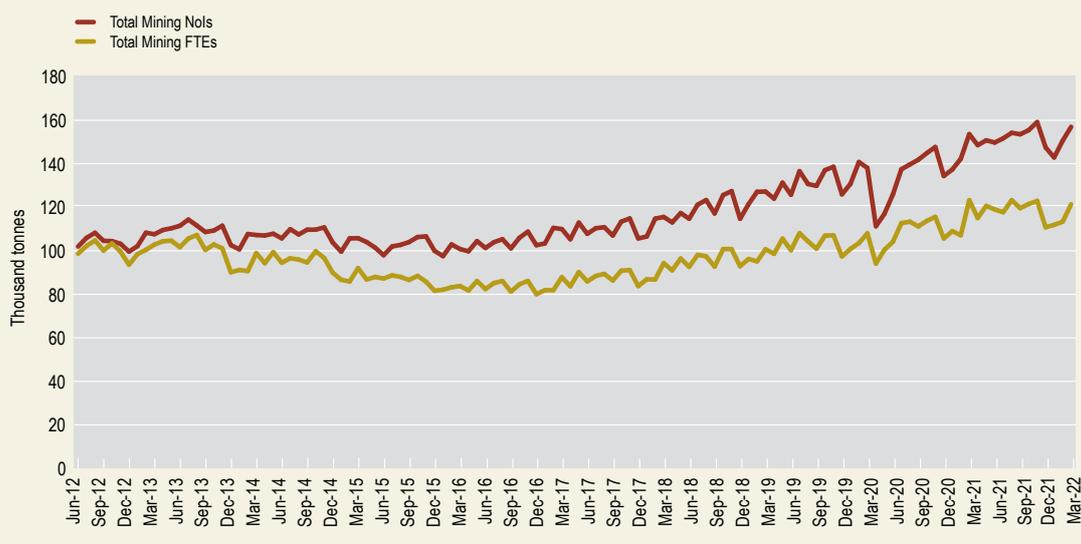


Figure 5 | Mining FTE and NoI employment
Source: DMIRS

1.3 Investment



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

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

1.3.1 Mining investment

More than \$24 billion was invested in WA's mining and petroleum sector in 2021–22.

This result was largely driven by production-sustaining projects across the iron ore industry, as well as the Iron Bridge magnetite project.

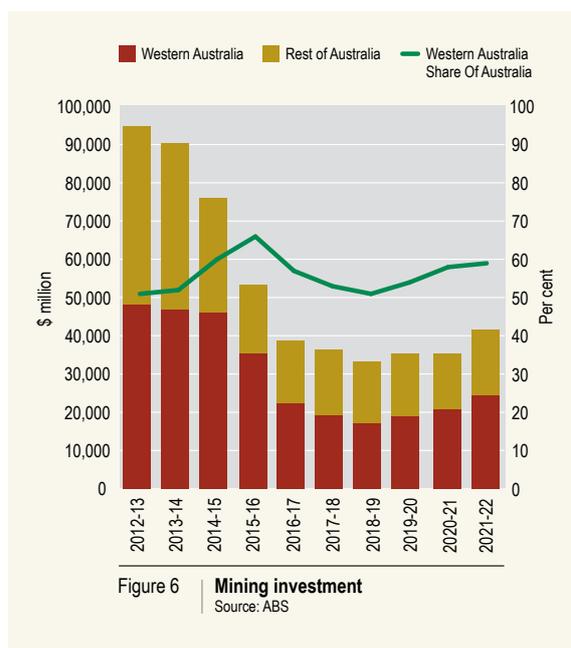
This was its highest level for a single calendar or financial since 2016, though it was still only half of the level observed during the mining investment boom between 2011 and 2015.

The level of mining and petroleum investment in WA has increased for the last 11 quarters after adjusting for seasonal variability.

This result was largely driven by production sustaining projects across the iron ore industry, as well as the Iron Bridge magnetite project.

WA's share of national mining and petroleum investment was 59 per cent due to higher levels of investment growth in WA compared to the rest of the country. The State's share was slightly above its 10-year average of 56 per cent.

The resources sector was a key contributor to growth in total new capital expenditure in WA (71 per cent), though its share remains well below the 80-plus per cent during the mining investment boom.



1.3.2 Investment pipeline

A note about investment pipeline data

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

Projects are categorised based on the following criteria:

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

TABLE 2. Mineral and petroleum investment in WA (as at September 2022)			
Sector	Commodity	Capital cost (\$ million)	
		Committed/ under construction	Planned/ possible
Minerals	Gold	1,565	4,069
	Iron ore	11,296	13,605
	Nickel, Copper, Lead and Zinc	170	8,077
	Lithium	3,596	1,900
	Infrastructure	1,287	5,600
	Other Minerals	4,396	11,608
	Sub-total Minerals	22,308	44,859
Petroleum	Crude oil	450	3,000
	Domestic gas	53	800
	LNG	33,666	38,637
	Pipelines and Infrastructure	460	0
	Sub-total Petroleum	34,629	42,437
Total		56,937	87,296

Source: DMIRS

DMIRS monitors and collects information on mineral, petroleum and associated infrastructure projects in the investment pipeline and estimates the capital costs of the projects.

This shows there is also a strong pipeline of investment projects under development in WA across a diverse range of commodities, including battery and critical minerals. This will help secure the State's position as a globally significant minerals and petroleum producer into the future.

Analysis of this information shows that as of September 2022, projects under construction or committed had an estimated capital cost of \$57 billion, up by almost \$5 billion from the March 2022 estimate.

Major iron ore production-sustaining projects including Gudai-Darri and Queens Valley, as well as LNG backfill projects including Greater Western Flank Phase 3 (for the North West Shelf) and Julimar–Brunello Phase 2 (for Wheatstone), all entered production during the year, which will contribute to the State's minerals and petroleum output in the coming years.

A number of significant projects that supported investment spending remain under development or at the FID stage, including:

- Pluto LNG expansion and Scarborough gas.
- Jansz-lo compression.
- Crux gas.
- Onslow iron ore.
- Western Range iron ore.
- Mount Holland lithium.
- Eneabba rare earths refinery.
- Mardie salt and potash.
- Mount Weld rare earths mine expansion and Kalgoorlie cracking and leaching plant.
- Super pit expansion.
- Kathleen Valley lithium.

The estimated capital cost of medium to longer-term projects (i.e. feasibility and pre-feasibility stage) was \$87 billion, up by \$3 billion from the March 2022 estimate.

Major projects at this stage included Browse gas, Clio-Acme gas, Dorado oil, the Pilbara hub iron ore, Western Ridge iron ore, Mallina gold, Caravel copper, Kalgoorlie nickel, expansion of the Kalgoorlie Consolidated Gold Mines mill, NiWest nickel, West Musgrave copper-nickel, the Australian vanadium project, and Yangibana rare earths.¹

¹ FID on the West Musgrave copper-nickel project was subsequently made by OZ Minerals in late September 2022.

1.4 Exploration



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

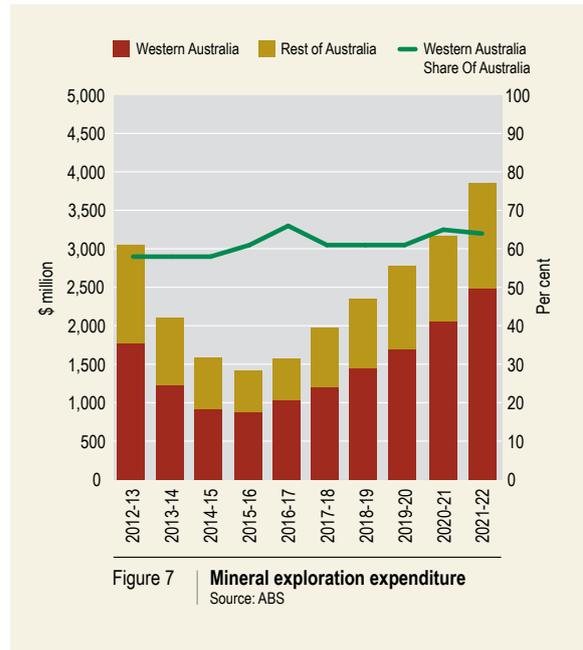
- Mineral exploration expenditure in WA and the rest of Australia.
- Minerals exploration expenditure by commodity in WA compared with the rest of Australia.
- Mineral exploration expenditure and drilling metres on new and existing mineral deposits.
- Petroleum exploration expenditure in WA and the rest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

1.4.1 Minerals

Activity in WA's exploration industry continued to grow in 2021–22.

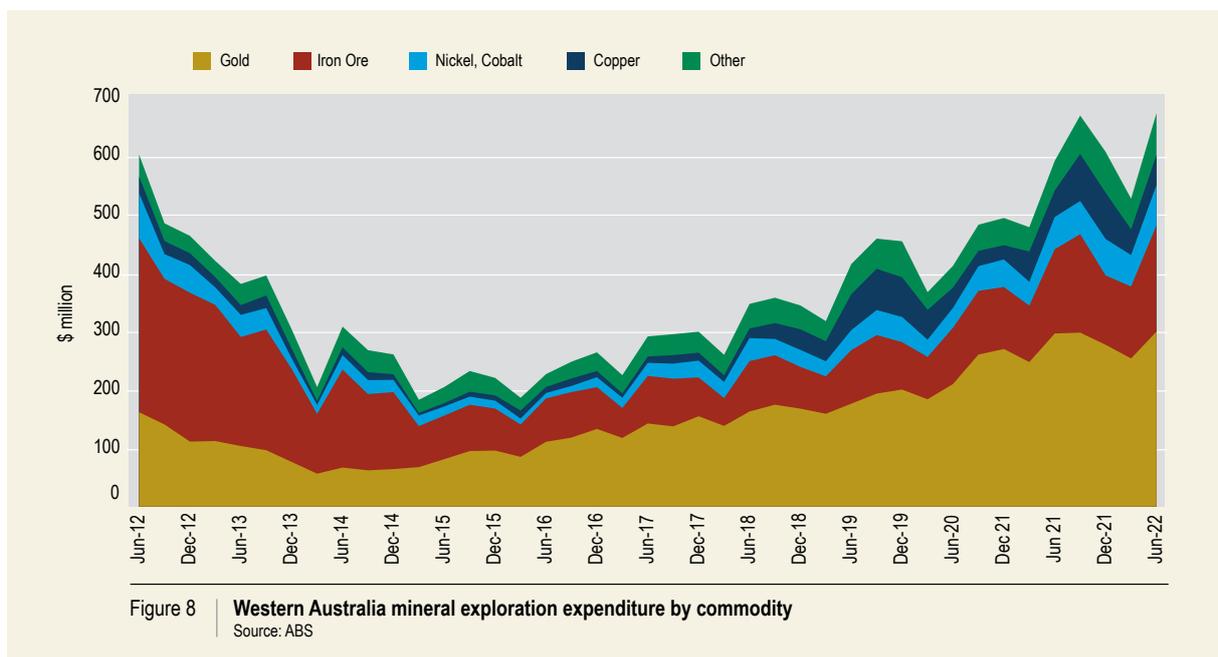
Minerals exploration expenditure in the State reached a new single calendar or financial year high of \$2.5 billion.

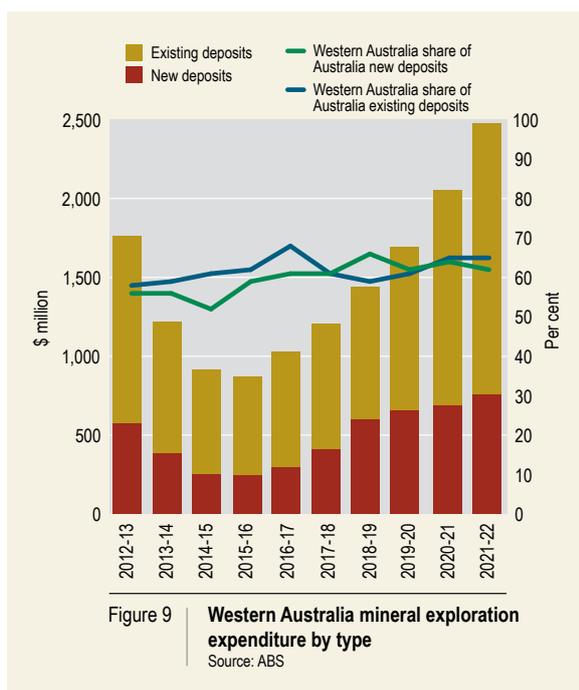
This result reflected strong levels of spending on exploration targeting gold (a new single year record of \$1.1 billion), copper (\$255 million), and other minerals including lithium and rare earths (also a new single year record of \$223 million), reflecting the move to green energy and transportation. Spending on iron ore exploration also grew (\$592 million), with renewed interest in magnetite deposits possibly due to its green steel potential. Exploration spending on nickel-cobalt increased to the highest levels in nearly a decade (\$241 million).



These commodities also represented the main targets of mineral exploration: gold (45 per cent), iron ore (24 per cent), copper (10 per cent), nickel-cobalt (10 per cent) and other minerals (nine per cent).

Most of the increased spending targeted brownfields areas or existing deposits with these areas attracting a new high of \$1.7 billion in expenditure. In comparison, spending in greenfields locations or on new deposits stabilised.





The share of expenditure in greenfields locations, compared to brownfields areas, was down compared to recent years at 31 per cent.

As a result, the share of expenditure in greenfields locations, compared to brownfields areas, was down compared to recent years.

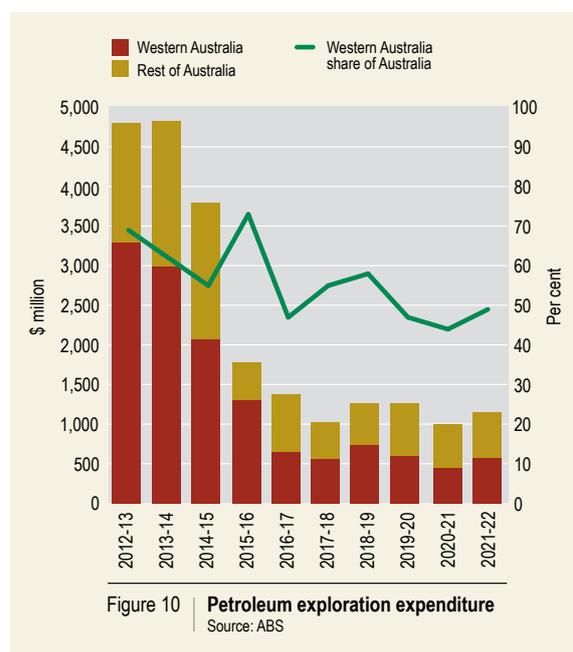
This suggests that even in the aftermath of COVID-19 restrictions that included limits on regional travel during 2020–21, exploration on existing deposits remains preferred over exploration targeting new deposits. It was also in keeping with an increase in exploration on mature ground for commodities which had not previously been targeted. Brownfields exploration is lower cost than greenfields exploration, and this preference is perhaps being reinforced by cost inflation.

WA remained the leading destination for exploration investment in Australia, accounting for 64 per cent of the national spend. This is around the same level it has been for several years.

1.4.2 Petroleum

Petroleum exploration expenditure in WA was valued at \$567 million in 2021–22. While this was an increase on recent years, the expenditure remained weak against historical levels.

A greater increase in petroleum exploration spending in WA, compared to the rest of Australia meant WA's share of the national spend increased to 49 per cent (an increase in expenditure in the Northern Territory was offset by a decline in expenditure in Queensland and Victoria).



1.5 Royalties

The WA Government received a record \$12.8 billion in royalties and related grants from minerals and petroleum producers in 2021–22.

This surpassed the previous record of \$11 billion in 2020–21 by \$1.8 billion.

Higher royalty receipts from the iron ore industry, amid a dramatic spike in prices in mid-2021, drove the record returns.

Royalty receipts from the iron ore industry alone were \$10.8 billion, just \$157 million less than the total royalties and related grants collected for all commodities in 2020–21.

Despite higher iron ore royalty receipts, the industry's share of total royalty revenue and grants decreased to 85 per cent from 89 per cent the previous year.

This reduction was due to a \$573 million increase in grants from the North West Shelf project on the back of high oil prices, and a \$107 million increase in royalties collected from the lithium industry (to a record total of \$150 million) amid record high prices.

Consistent with the strong market conditions, royalty payments from copper, lead and zinc, nickel and mineral sands industries all increased.

Gold was relatively stable with royalty payments falling just one per cent.

Following the end of production at Rio Tinto's Argyle mine, diamond royalty payments fell to near zero.

A note about royalties

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

The figure reported in this publication is the actual funds the State Government received for the relevant period, i.e. 2021–22. 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.

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

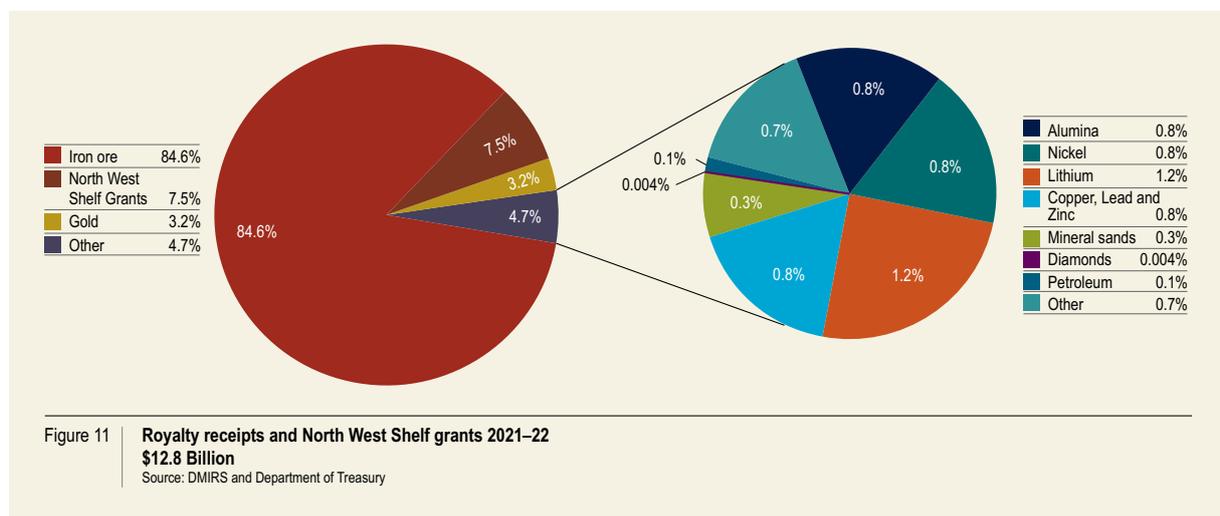
Included in the State's royalty receipts for iron ore is an additional lease rental amount, which is currently applied under Iron Ore State Agreement Acts and the Mining Act. The additional lease rental applies to iron ore obtained from a mining lease following 15 years from the date the iron ore was 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 a Commonwealth grant, in accordance with an agreement between the WA Government and Australian Government.



The economic indicators file contains:

- Royalty receipts by commodity and North West Shelf grants.



Commodity	2020-21	2021-22	2021-22 Growth	
	\$ million	\$ million	\$ million	%
Alumina	92.4	101.1	8.6	9%
Copper, Lead and Zinc	70.5	104.6	34.0	48%
Diamonds	9.4	0.5	-9.0	-95%
Gold	415.7	412.3	-3.4	-1%
Iron ore	9,796.8	10,848.0	1,051.2	11%
Lithium	43.3	150.4	107.1	247%
Mineral sands	31.0	44.2	13.1	42%
Nickel	83.5	107.6	24.0	29%
Petroleum	2.4	8.5	6.1	251%
Other Minerals	73.3	91.6	18.3	25%
North West Shelf grants	386.2	959.5	573.3	148%
Total royalty receipts	10,618.5	11,868.7	1,250.2	12%
Total revenue	11,004.7	12,828.2	1,823.5	17%

1.6 Exports

WA's minerals and petroleum exports were valued at an estimated \$226 billion in 2021-22, accounting for 94 per cent of the State's record merchandise exports of almost \$242 billion.

This was the second highest total for mineral and petroleum exports in a single year after the \$227 billion recorded in 2021.

The WA resources sector was responsible for 54 per cent of the nation's \$422 billion in resource sector exports. While this was down from 68 per cent the previous financial year, it was consistent with earlier levels.

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

Nevertheless, WA remained unrivalled as the nation's major export earner.

WA's resources exports had more than doubled over the past five years and this was driven, at least in part, by a strong prior period of project investment.

WA exported its mineral and petroleum resources to a wide range of countries in 2021-22, but the value of these exports remained highly concentrated with the top 10 destination countries responsible for approximately 95 per cent of all shipments.

A note about exports

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



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

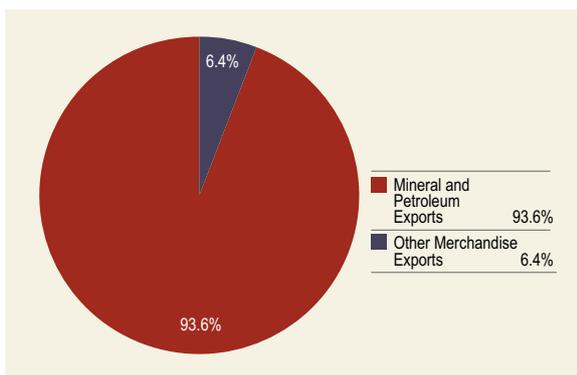


Figure 12 | **Merchandise exports 2021-22**
\$241.8 Billion
 Source: DMIRS and ABS

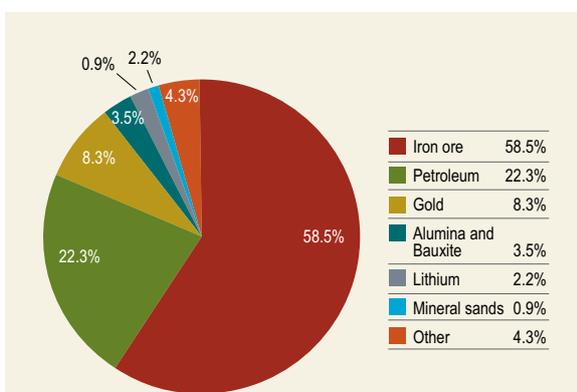


Figure 13 | **Mineral and petroleum exports 2021-22**
\$226.2 Billion
 Source: DMIRS and ABS

1.7 Tenements and titles

Tenements and titles are another indicators of the health of the mining and petroleum industries and the scale of sector activity across WA.

As of June 2022, more than 71 million hectares (MH) of land with WA (an area almost as large as Chile) was overlaid by mining tenure (i.e. prospecting and exploration licences, mining leases, miscellaneous licenses, general purpose leases, retention leases, special prospecting licences for gold, and mineral claims and *Mining Act 1904* tenure).

This was up from 58 MH the previous year, due predominantly to a larger area for exploration licences. However, actual exploration activities would have been over a much smaller area.

Mining leases, on which mining operations occur, covered 3.27 MH of land, up from 3.22 MH the previous financial year.

To put these figures into perspective, all mining tenure covered approximately 28 per cent of WA's total land area of almost 253 MH, with mining leases covering 1.3 per cent of the State's land area.

The total number of mining tenements in force was up 22 per cent at 23,948 compared to 22,400 in 2020-21.

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

The number and area of petroleum titles in force in WA's jurisdiction remained steady compared to 2020-21.

A note about tenements and titles

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

State petroleum titles are administered under three Acts:

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

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

In the reported petroleum titles in force, the total area for the *Petroleum (Submerged Lands) Act 1982* excludes Pipeline Licences due to different units (i.e. km² vs km). The total area is the sum of the Total Area for the *Petroleum (Submerged Lands) Act 1982* and *Petroleum and Geothermal Energy Resources Act 1967*, and does not include the Total Area of the *Petroleum Pipelines Act 1969* due to different units (i.e. km² vs km).



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

	2017-18		2018-19		2019-20		2020-21		2021-22	
	Number	'000 ha								
Prospecting Licences	3,039	377	3,786	471	5,147	634	5,362	658	5,633	692
Exploration Licences	3,792	22,342	4,516	28,145	5,791	41,937	6,581	48,854	7,659	61,074
Mining Leases	5,739	3,039	5,806	3,123	5,890	3,171	5,954	3,226	5,983	3,275
Other	3,572	2,655	3,776	3,010	4,160	3,320	4,187	3,475	4,357	3,874
Mineral Claims and Other 1904 Act	316	2,112	316	2,112	316	2,112	316	2,112	316	2,112
Total	16,458	30,526	18,200	36,860	21,304	51,174	22,400	58,325	23,948	71,026

Legislation	Title Type	Area	Blocks	Number of Titles
Petroleum (Submerged Lands) Act 1982		3,574.1433 km²	101	47
	Exploration Permit	1,007.1611 km ²	45	4
	Pipeline Licence	627.3461 km	0	26
	Production Licence	1,668.8048 km ²	31	10
	Retention Lease	898.1774 km ²	23	6
Petroleum and Geothermal Energy Resources Act 1967		82,817.8887 km²	1092	82
	Access Authority	-	12	6
	Exploration Permit	77,911.3314 km ²	1001	48
	Petroleum Lease	260.1000 km ²	9	1
	Production Licence	3,707.0407 km ²	56	21
	Retention Lease	939.4166 km ²	14	6
	Special Prospecting Authority			
Petroleum Pipelines Act 1969		7,366.1253 km	9	110
	Pipeline Licence	7,366.1253 km	9	110
Total		86,932.032 km²	1202	239

2 COMMODITY REVIEW

COVID-19 and the WA resources sector

While much of the world was in lockdown, the WA resources sector, as an essential service, was able to operate throughout the early stages of the COVID-19 pandemic behind a controlled State and international border.

During this time there were changes to workforce practices and movements. This included limits on the total number of workers on site at any one time and changes to fly-in, fly-out shift schedules due to State-based restrictions and social distancing measures. Management protocols and testing regimes were also introduced.

At the same time, exploration programs across the State, particularly in greenfields locations, were cancelled or scaled back. Exploration was a non-essential activity and challenging to undertake due to limits on regional travel in WA.

However, the resources sector was sheltered from the most severe impacts of COVID-19.

The outbreak of the Omicron variant of COVID-19 in WA from mid-January 2022 presented a new challenge for the industry, though it was better prepared and supported by very high rates of vaccination.

Nevertheless, as the number of positive cases of COVID-19 in the community increased, a significant number of resources companies reported infections in operational workforces.

This resulted in absenteeism and impacts on production and construction activities. These effects were mostly isolated to the March quarter 2022 with some of the more notable including:

- BHP and Rio Tinto reporting a temporary impact on iron ore production, but no impact on full year output.
- Fortescue Metals Group (FMG) reporting a delay in production (from December 2022 to the March quarter 2023) from its Iron Bridge magnetite project.
- BHP Nickel West reporting decreased nickel production.
- Gold producers Silver Lake Resources, Westgold Resources, and Wiluna Mining reporting production issues.

In other cases, despite high levels of absenteeism, there was minimal impact on productivity.

Overall, the impact was relatively minor and short-lived, particularly when compared to the critical effects of COVID-19 in other mining jurisdictions around the world.

The sector quickly transitioned to 'living with COVID' and managing it as part of its normal day-to-day operations.

COVID-19 related supply chain issues and disruptions remained a challenge, while other related issues emerged in the form of skills shortages and cost inflation.

2.1 Minerals

Minerals production was again the dominant activity in the State's resources sector with \$179 billion in sales. It accounted for 78 per cent of all sales.

While this was down on recent years, due predominantly to a fall in the value of iron ore sales and recovery in the value of petroleum production, it was in keeping with historical levels.

2.1.1 Iron ore

Prices

The price of iron ore declined from its previous record levels, but remained historically high.

The benchmark grade (62 per cent iron ore fines spot Cost and Freight (CFR) China) was in excess of US\$200 per tonne in mid-2021 before declining to less than US\$100 per tonne towards the end of the calendar year.

This fall was the result of reduced demand from enforced steel production cuts in China to curb emissions, as well a downturn in its property and construction sectors.

The iron ore price recovered through March and April 2022 to greater than US\$150 per tonne, on a more accommodative macroeconomic policy from the Chinese Government and an accompanying improvement in market sentiment.

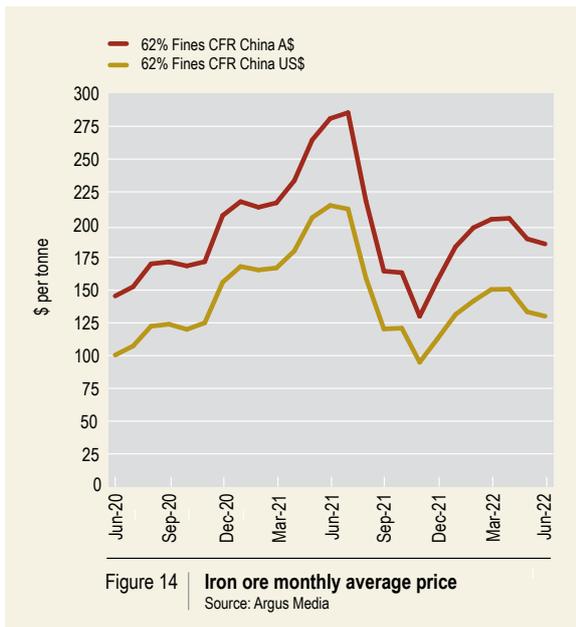


Figure 14 | Iron ore monthly average price
Source: Argus Media

While still at a historically high level, by the end of the financial year the price of iron ore had fallen to US\$130 per tonne.

The most recent falls were due to several factors including China’s zero-tolerance stance on COVID-19, weakness in the property sector and slower economic growth.

Quantity and value

Iron ore accounted for 76 of all mineral sales and 59 per cent of total mineral and petroleum sales in 2021–22.

While this was down from record high levels in recent calendar and financial years, iron ore was once again the most valuable mined commodity in WA and the dominant industry in the State’s resources sector.

The fall in the price of iron ore meant the industry achieved lower sales valued at \$137 billion in 2021–22.

These iron ore sales were the third highest for a calendar or financial year on record.

WA had 844 Mt in iron ore sales in 2021–22, the second highest level for a single calendar or financial year after 2020.

The big three producers – Rio Tinto, BHP, and FMG – continued to dominate sales volumes accounting for 87 per cent of the total.

BHP reported another year of record sales from the ramp up of the South Flank mine ahead of schedule and favourable weather, which offset labour constraints, track renewal works, and major maintenance on the Jimblebar train load out and car dumper.

FMG also achieved record sales through the ramp up of Eliwana and the stable performance from its Chichester and Solomon operations.

Above average rainfall, cultural heritage management issues, as well as delays in growth and production replacement projects including Gudai-Darri and Robe Valley, negatively affected Rio Tinto’s operations.

Higher output from Roy Hill and Mineral Resources’ operations also contributed to this result.

WA remained the world’s largest iron ore producer, accounting for 34 per cent of global output. The State was once again responsible for 99 per cent of Australia’s iron ore production.

Sales of iron ore from WA were again dominated by China (82 per cent), with Japan (eight per cent) and South Korea (six per cent) the next two largest markets. Taiwan (two per cent) and Vietnam (one per cent) rounded-out the top five.

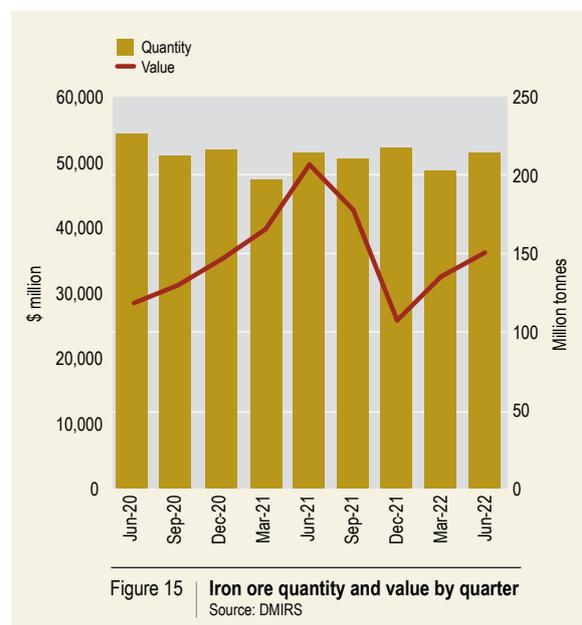
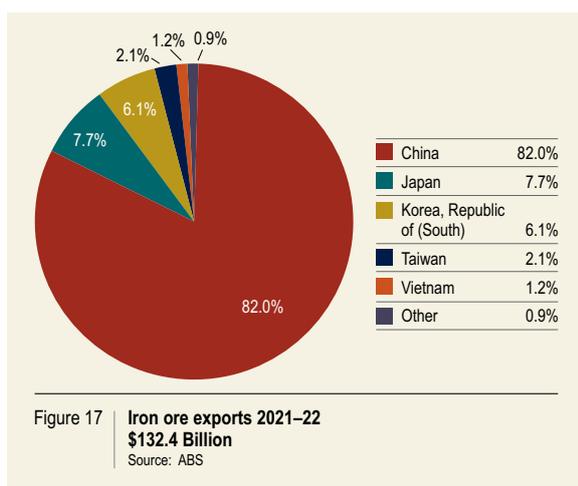
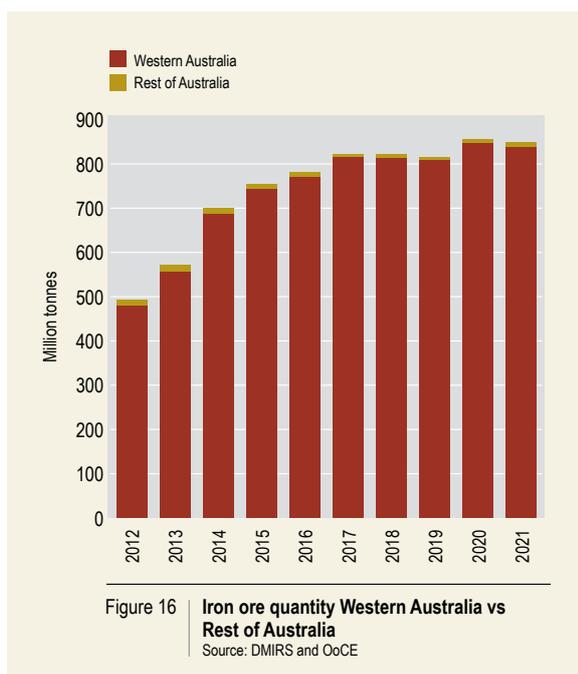


Figure 15 | Iron ore quantity and value by quarter
Source: DMIRS



Notable events

- Rio Tinto delivered first ore from production sustaining projects at Gudai-Darri in June 2022 and Western Turner Syncline Phase 2 in November 2021. The company also announced an investment in the Western Range development in September 2022.
- Mineral Resources and its joint venture partners announced a positive FID for development of the Onslow iron project in August 2022.
- Atlas Iron achieved first ore from its Miralga Creek mine in February 2022.
- Following the end of the 2021-22 financial year, several smaller operations were suspended due to a fall in the price of iron ore and higher costs:
 - CuFe suspended its JWD mining operations, part of the Wiluna West project, in October 2022.
 - Strike Resources made a maiden iron ore shipment from its Paulsens East project in August 2022 before pausing shipments.
- This followed several project suspensions in late 2021 in an environment of lower prices:
 - Sinosteel Midwest suspended operations at its Koolanooka and Blue Hills Mungada project in November 2021.
 - GWR Group halted its C4 mining operations, part of the Wiluna West project, in September 2021 due to lower prices. The company subsequently restarted operations in January after a rebound in prices.
 - Mount Gibson suspended its Shine project in October 2021, just months after first production and sales.
 - The Ridges operation in the East Kimberley was suspended in September 2021.



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

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

2.1.2 Gold

Prices

The price of gold was fairly stable year-on-year in US dollar terms.

The price was supported through the second half of 2021 as the spread of the Omicron variant of COVID-19 and related economic uncertainty promoted gold's safe haven appeal.

The gold price spiked to record levels of more than US\$2,000 per ounce in early 2022 on economic uncertainty associated with the Russia-Ukraine conflict. Russia is also a globally-significant gold producer.

Gold ended the financial year trending lower as investors favoured the US dollar over bullion amid rising interest rates, inflationary pressures, concerns about a recession and a stronger US dollar against almost all currencies.

A weaker Australian dollar softened the fall for local producers and resulted in an overall price gain for 2021–22.

Quantity and value

There was 6.9 Moz or 214 tonnes of gold sold in WA – the highest volume in 20 years but still shy of the record levels during the mid-to-late 1990s.

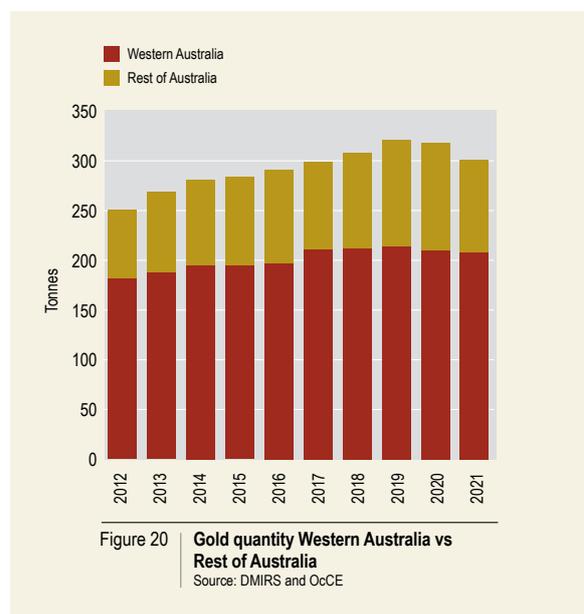
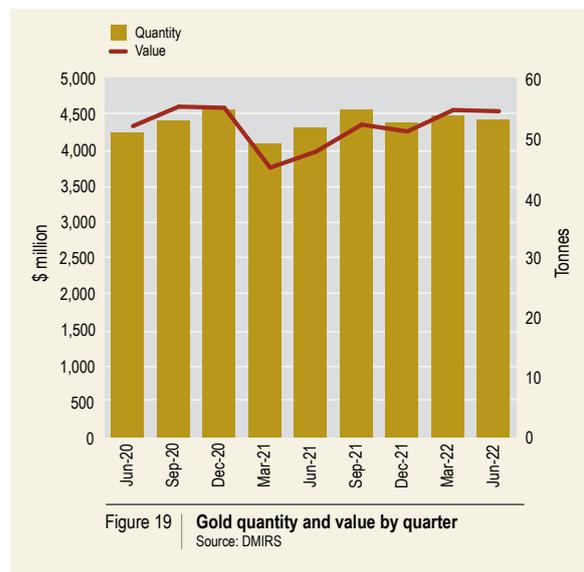
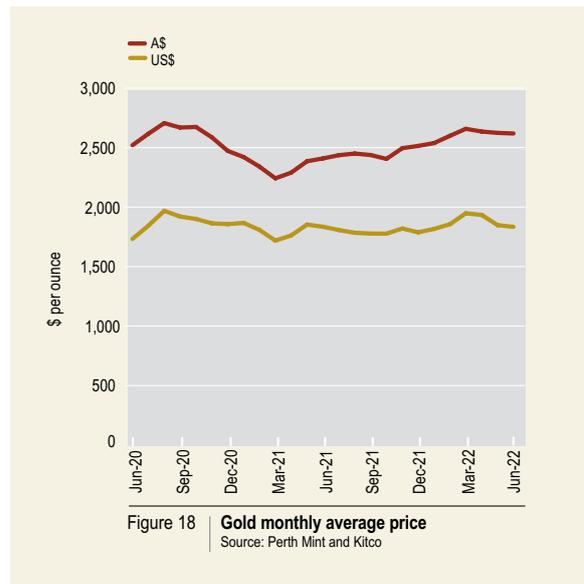
This was principally driven by higher sales from Granny Smith, Gruyere, Kanowna Belle, Gwalia, and St Ives, among other projects. It was also supported by the ramp up of the Davyhurst project, as well as the start-up of the Karlawinda and Tampia projects.

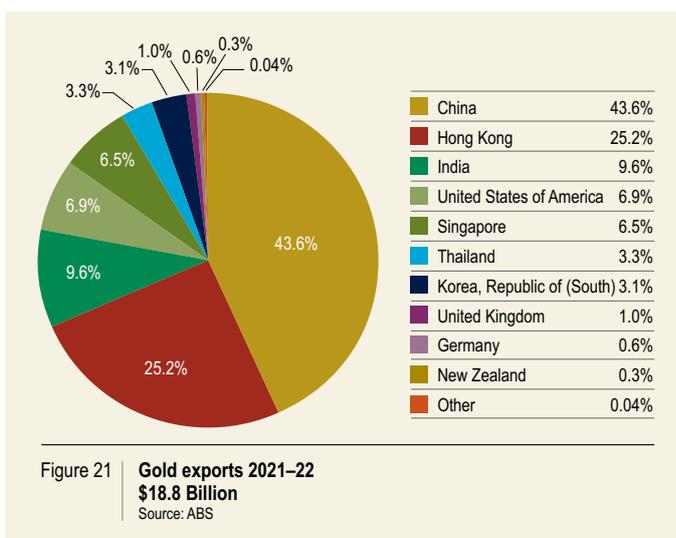
The top 10 gold projects in WA accounted for just more than half of the State's total gold production, largely the same as in previous years.

Increased volumes, combined with higher Australian dollar prices, meant the value of gold sales achieve a record \$17 billion.

Despite the record, gold slipped to the third most valuable resource overall after iron ore and LNG (from second after iron ore the previous year). Gold accounted for 10 per cent of the value of minerals sold and 8 per cent of the value total mineral and petroleum sales in 2021–22.

WA was still Australia's most significant gold producer, accounting for 69 per cent of the estimated output of 9.7 Moz (301.21 tonnes). Taken alone, the State was also the third largest gold producer globally after China and Russia.





Exports of gold from WA decreased to \$19 billion from a record \$22 billion the previous year. This was due to lower levels of refining and exporting of gold from interstate or overseas.

China (44 per cent) was the largest destination for gold exports from WA, followed by Hong Kong (25 per cent), India (10 per cent) and the US (6 per cent).

A note about gold exports from WA

The ABS releases WA 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, refines gold produced in other States and Territories, gold from surrounding countries and also secondary gold, mainly from Asia.

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

An update on recent trends in WA's gold exports

Last year's Statistics Digest reported that in 2020-21 the US had emerged as the second largest importer of gold from WA while at the same time the value of gold exports to China had decreased.

This was linked to the logistical constraints caused by COVID-19 pandemic restrictions and the suspension of gold mining and processing around the world.

With WA and the Perth Mint being one of the very few refineries still operating during early-mid 2020, it was able to meet demand and supply American banks that wanted to deliver gold into the Commodity Exchange (COMEX) to take advantage of an arbitrage opportunity that has developed relative to the London Bullion Market Association.

With the lifting of COVID-19 restrictions and easing of related logistical constraints China's demand for gold from WA increased and in 2021-22 it was once again the major destination for gold exports from WA. The value of exports to the US halved as its demand for gold was met by the return to production of major gold refineries in Switzerland and other parts of the world.

In 2021-22, another interesting trend emerged in the form of a fall in the approximate share of gold refined at the Perth Mint and exported from WA that was produced from mining operations in other States, Territories and overseas.

In 2020-21, approximately 25 per cent or \$5.4 billion of the gold exported from WA originated from outside of the State, with approximately 75 per cent or \$16.6 billion from operations in WA.

These shares changed significantly in 2021-22, with approximately 89 per cent or \$17 billion of gold exports originating in WA, and approximately 11 per cent or \$2 billion from other mining jurisdictions. This shift was possibly due to increased competition for WA and the Perth Mint from gold refineries in the Eastern states of Australia.

This resulted in a fall in the value of WA gold exports to \$18.8 billion from \$22 billion the previous financial year despite a \$783 million increase in the value of gold produced in WA.

Notable events

- Several gold projects commenced or were restarted during the year:
 - Capricorn Metals achieved first gold from its Karlawinda project at the end of June 2021.
 - Ramelius Resources Limited brought the Penny Gold project back into production during the September quarter 2021.
 - Calidus Resources achieved first gold from its Warawoona project in May 2022.
 - Red 5 made its first gold pour from its expanded King of the Hills project in June 2022.
 - Norton Gold Fields commenced operations at Binduli North, part of the broader Paddington operations, in July 2022.
- Some companies experienced financial difficulties while others decided to suspend operations, most particularly towards the end of the financial year.
 - Administrators were appointed to Wiluna Mining, operators of the Wiluna/Matilda project, in July 2022 due to increasing costs, COVID-19 related staffing issues, project ramp up issues and shipping constraints.
 - Dacian Gold suspended mining at its Mount Morgans project in June 2022, citing inflationary cost pressures. However, processing operations are continuing using stockpiles. The company was subsequently a takeover target of Genesis Minerals.
 - Novo Resources announced in June 2022 that its Beatons Creek project was to be placed on care and maintenance by the end of October 2022.
 - Northern Star Resources announced in July 2022 it would idle the Jubilee mill, part of its South Kalgoorlie operations, in response cost inflation and COVID-19 staffing issues.
 - Adaman Resources, owner and operator of the Kirkalocka project, went into voluntary administration in May 2021. In July 2021, the company was subsequently restructured and recapitalised.
- Evolution Mining Limited acquired the Kundana operations from Northern Star Resources Ltd in August 2021 and integrated it into its Mungari project.



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

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

2.1.3 Lithium

Prices

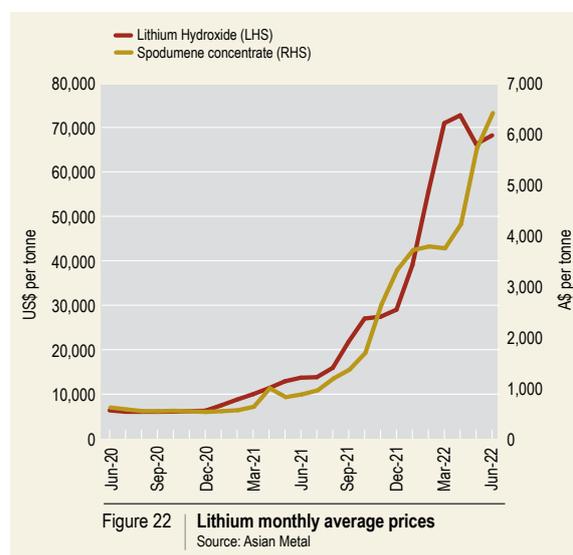
Lithium prices increased to previously inconceivable levels, shattering earlier records.

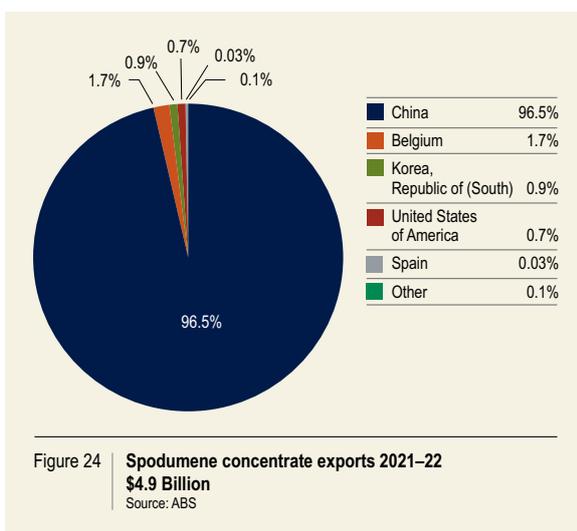
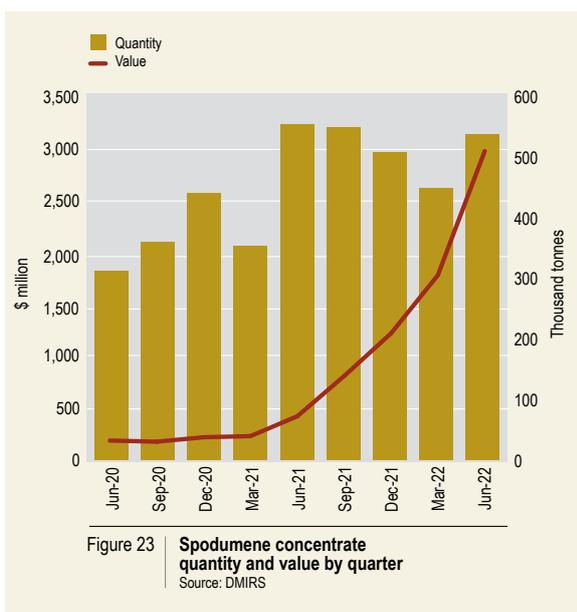
Spodumene concentrate spot prices increased to more than \$6,000 per tonne (six times previous highs), while the price of battery-grade lithium hydroxide in China was in excess of US\$70,000 per tonne (two and a half times previous highs).

The escalation in prices was the result of a supply deficit as rapid growth in demand for lithium-ion batteries, particularly from strong EV sales, outpaced supply and efforts to increase output throughout the value chain.

There was a plateau in the price of spodumene concentrate at the start of 2022. This was due to a temporary increase in the Australian dollar against the greenback, rather than any change in market fundamentals.

Lithium hydroxide trended down to end the financial year (the first fall since mid-2020) amid lockdowns in China to limit COVID-19 cases, as well as the impact of global inflationary pressures on consumer confidence and discretionary spending on products such as consumer electronics and EVs.





Quantity and value

Record prices helped the State's spodumene concentrate sales increase to an all-time high of \$6.8 billion.

This result was also supported by increased volumes of 2.05 Mt, the second highest level on record after 2017-18.

The increase in volumes was largely due to the ramp up of the Chemical Grade Plant 2 and Tailings Retreatment Plant expansions at Greenbushes, as well as improved processing rates and recoveries at Mount Cattlin.

Record prices and higher volumes meant the lithium industry displaced the alumina industry as the State's third most valuable minerals by sales value.

Exports of spodumene concentrate from WA were overwhelmingly to China (96 per cent), with Belgium (two per cent) and South Korea (one per cent) the next two largest markets.

Notable events

- The Kwinana lithium hydroxide plant produced its first battery-grade lithium hydroxide in May 2022.
- First product from the Kemerton lithium hydroxide plant was delivered in July 2022.
- Liontown Resources approved the development of the Kathleen Valley lithium project in June 2022, paving the way for its construction. The project will produce spodumene concentrate.
- The tailings retreatment plant at Greenbushes commenced in the March quarter 2022, boosting the project's capacity by 280 thousand tonnes per annum (ktpa).
- Two of the three processing trains at the Wodgina project were restarted with first spodumene concentrate production from Train I achieved in May 2022 and from Train II in early July.
- An upgrade to the processing facilities at Mount Marion was announced in April 2022. This increased its production capacity from 450 ktpa to 600 ktpa of mixed-grade product by April 2022, with a further expansion to 900 ktpa of mixed-grade product by the end of 2022.
- At Pilbara Minerals' Pilgangoora operations, improvements at the Pilgan plant were completed in October 2021. This increased its spodumene production capacity, with first spodumene concentrate from the restart of the Ngungaju plant also delivered in October 2021. Funding was also secured to expand the operations to 680 thousand tonnes (kt) and construct a new five million tonnes per annum (Mtpa) crushing and ore sorting facility. This will enable the potential expansion

of spodumene concentrate production capacity to one Mtpa. Construction was also completed and commissioning of a six Megawatt (MW) solar photovoltaic farm is ongoing. This will help meet the Pilgangoora project's energy requirements, with the potential for expansion in the future.

- Lithco No. 2 completed its acquisition of the Bald Hill project and recommenced operations in February 2022 for first sales in the June quarter 2022.
- Orocobre merged with Galaxy Resources, owner and operator of the Mount Cattlin project in August 2021. The merged company was trading as Orocobre, but subsequently changed its name in December 2021 to Allkem.



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

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

2.1.4 Alumina

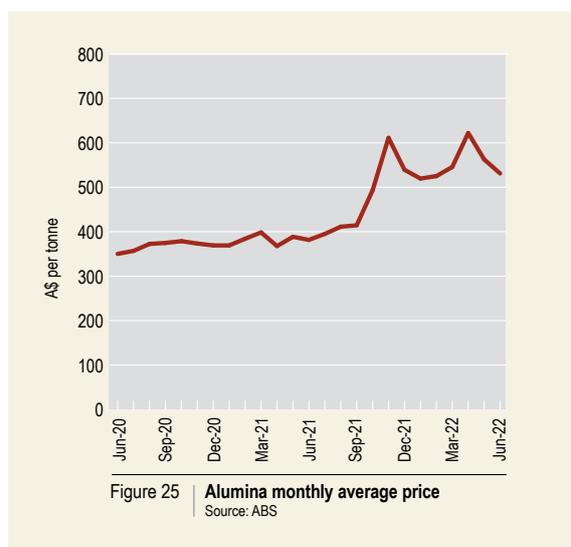
Prices

The price of Australian alumina was higher overall, but this masked considerable volatility across 2021–22.

The price was supported through most of the second half of 2021 by tight market balance from increasing demand in the aftermath of COVID-19 and restrictions on supply from strict environmental regulation in China, as well as disruptions at refineries in Brazil, the US and Jamaica.

Prices declined into the new calendar year on the back of restored production resulting in a surplus of alumina.

Global events including the Russia-Ukraine conflict and economic sanctions on Russia (a major alumina supplier), as well emissions targets in China and COVID-19 logistical issues. This resulted in further global supply disruptions and higher prices to April 2022, before another downwards trend to end the financial year.



Quantity and value

Higher overall prices saw the value of alumina sales from WA increase to \$6.7 billion.

This result was considerably lower than the record level of \$8.3 billion set in 2018-19.

Sales volumes declined from record levels of 16.22 Mt in 2020–21 to 14.33 Mt in 2021–22.

This was primarily due to operational issues, unplanned maintenance events and reduced bauxite quality at AWAC's operations during the first half of 2022.

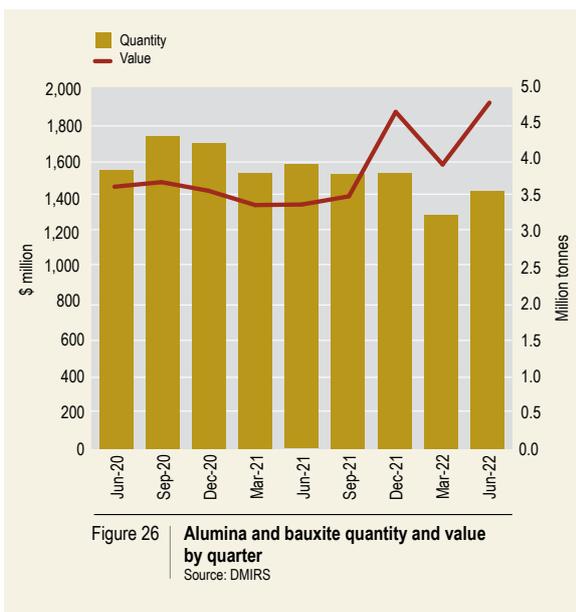
Worsley benefitted from processing improvement initiatives resulting in production above nameplate capacity. However, sales were down marginally due to ship scheduling issues.

Bauxite shipments from AWAC were discontinued at the end of 2021, resulting in lower direct bauxite sales volumes for the financial year.

Alumina slipped to the fourth most valuable mineral commodity produced in WA and sixth most valuable resource commodity overall. It was responsible for four per cent of all mineral sales and three per cent for total mineral and petroleum sales.

WA was responsible for 69 per cent of Australia's alumina production, 10 per cent of global output and was the world's largest alumina producer outside of China.

Alumina from WA was sent for smelting overseas to Bahrain (17 per cent), the United Arab Emirates (14 per cent), South Africa (10 per cent), Mozambique (eight per cent), and Qatar (eight per cent).



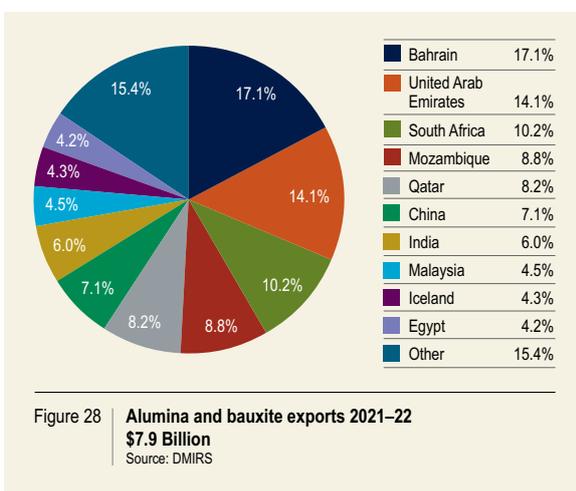
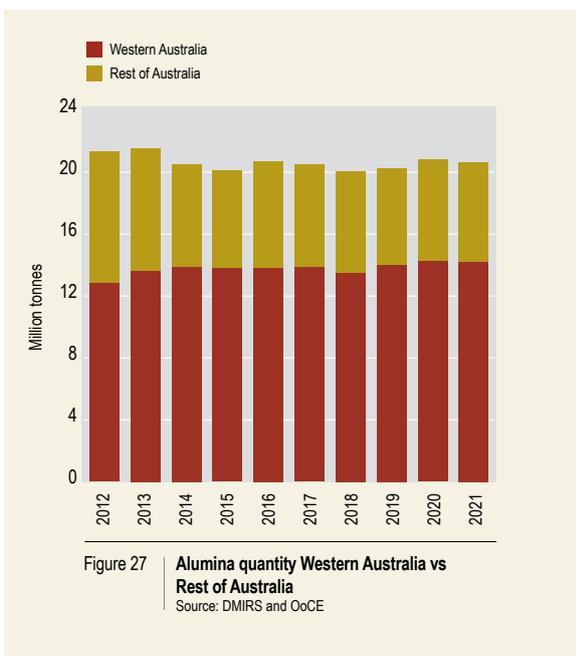
Notable events

- Alumina exports from Australia to Russia were suspended in March in response to Russia's invasion of Ukraine.
- A pilot trial of electric calcination (the final stage in alumina refining that traditionally uses natural gas to heat alumina hydrate crystals) at AWAC's Pinjarra refinery commenced in April 2022. This technology has the potential to significantly reduce carbon emissions and save water.



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

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



Decarbonisation and the WA resources sector

WA's resources sector is a global leader in industry decarbonisation efforts and emissions reduction.

The sector has led the way in the adoption of renewable energy solutions, reflecting a growing confidence in innovative energy options to deliver reliable, secure, low cost and low-emission electricity for operations.

Renewable energy is already providing a significant share of total energy requirements at WA resources projects including:

- FMG's Chichester Hub.
- Gold Fields' Agnew and Granny Smith gold mines.
- GMA Garnet's Port Gregory garnet project.
- Gold Fields and Gold Road Resources' Gruyere gold project.
- IGO's Nova nickel operations.
- Image Resources' Boonanarring mineral sands project.
- Mineral Resources' Wonmunna iron ore project.
- Northern Star Resources' Carosue Dam gold mine.
- Rio Tinto's Gudai-Darri iron ore project.
- Sandfire Resources' DeGrussa copper-gold project.
- Strandline Resources' Coburn mineral sands project.

A number of other significant off-grid solar energy projects are also under assessment and development:

- Woodside announced plans in December 2021 to build an initial 100 MW solar photovoltaic facility near Karratha to help power the Pluto LNG facility.
- FMG is progressing its integrated Pilbara Energy program comprising a hybrid solar gas energy solution. The company also announced plans in February 2022 for the Uaroo Renewable Energy Hub to power its Pilbara iron ore operations.
- BHP Nickel West has agreements in place with renewable energy providers, and with TransAlta for construction of a solar and battery storage system in the Northern Goldfields. These agreements and project will provide sufficient energy to power the Kambalda concentrator, Kalgoorlie smelter and Kwinana refinery.
- Construction was completed with commissioning ongoing on a six MW solar photovoltaic farm to help meet the energy requirements of Pilbara Minerals' Pilgangoora project, with the potential for expansion in the future.
- Bellevue Gold announced plans to generate 80 per cent of its power by renewable energy with the construction of a wind, solar and battery hybrid power solution at its namesake project.
- OZ Minerals announced it will initially source 80 per cent of the energy needs for its West Musgrave copper-nickel project through an off-grid hybrid renewable power solution.
- Liontown Resources' Kathleen Valley lithium project is proposed to include a hybrid power station with at least 60 per cent of energy met by renewables at start-up.
- The Abra lead-silver project will include hybrid power generation comprising natural gas and solar energy.

The State's major iron ore miners – BHP, Rio Tinto, FMG and Hancock Prospecting – have all announced the purchase of battery-electric trains.

Major iron ore and gold miners are actively developing and trialling battery-electric haulage and light vehicles as part of efforts to decarbonise operations.

Some of the State's largest resources companies are actively assessing hydrogen as a potential green energy source, while there has also been renewed interest among oil and gas producers in carbon capture sequestration as a means of reducing the carbon footprint of the WA economy.

There are also several other technical projects being undertaken by the WA resources sector with a focus on improved environmental outcomes:

- A pilot trial of electric calcination (the final stage in alumina refining that traditionally uses natural gas to heat alumina hydrate crystals) at AWAC's Pinjarra alumina refinery commenced in April 2022. This technology has the potential to significantly reduce carbon emissions and save water. AWAC also previously announced a project to trial using renewable energy in the alumina refining process at its Wagerup refinery.
- BHP Nickel West is working with leading Australian and international experts to investigate methods of increasing the mineral carbonation reaction into its mine tailings.² This has the potential to reduce or offset operational greenhouse gas emissions and lower the carbon footprint.

2.1.5 Nickel

Prices

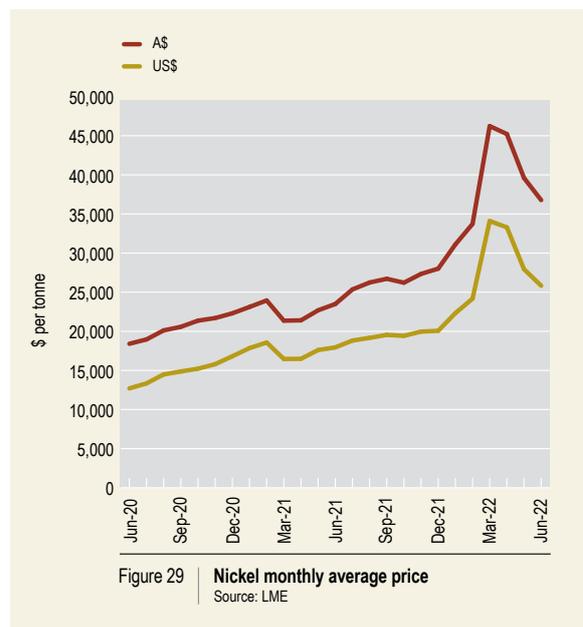
The price of nickel increased largely without interruption to March 2022, reaching its highest daily price on record of more than US\$100,000 per tonne and causing LME to suspend trading and impose limits on daily price movements.

Nickel's price was supported by supply and demand factors:

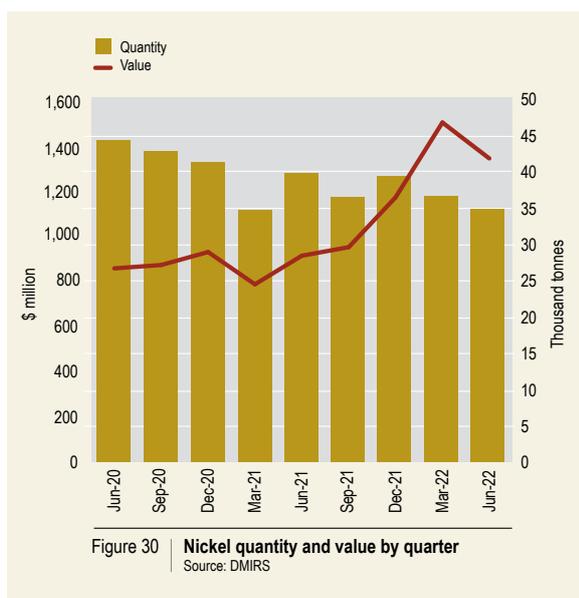
- Strong demand from the stainless steel industry as global economic activity return to pre-COVID-19 pandemic levels, and lithium-ion battery manufacturers amid growing EV sales.
- Dwindling LME inventories and supply concerns from the Russia-Ukraine conflict (Russia was the world's third largest nickel producer in 2021), as well as rumoured policy changes in Indonesia to promote the production of higher-value nickel-containing products such as stainless steel.

The price subsequently retreated, but was still higher than at any other point since 2011.

This highpoint was due to concerns that rising interest rates to curb surging inflation could lead to a global recession and a slowdown in nickel demand, as well as increasing supplies from Indonesia.



² Mineral carbonation is a carbon dioxide removal method and a natural rock weathering process, where carbon dioxide binds to minerals in the Earth's crust. This natural and passive process can permanently remove and store large volumes of carbon dioxide from the atmosphere, transforming it from a gas into solid materials. However, this process is slow to occur in nature so the work is being done to identify how this natural process can be accelerated.



Quantity and value

On the back of higher prices, the value of nickel increased to \$4.9 billion – the highest mark in almost 15 years.

Sales volumes though declined from 158 kt to 147 kt – the lowest level in 20 years.

This result mainly due to worker shortages and unplanned downtime at Nickel West in addition to planned maintenance at Murrin Murrin.

This more than offset higher output from the Ravensthorpe operations as production ramped up at the Shoemaker-Levy deposit, as well as the restart of the Savannah project in the Kimberley.

China was the major customer for WA nickel (64 per cent of exports), with Japan (17 per cent) and South Korea (10 per cent) representing the other key markets.

Nickel was WA's fifth most valuable mined commodity and sixth most valuable resource commodity. It accounted for three per cent of the value of mineral sales and an equivalent share of total mineral and commodity sales.

WA was Australia's only nickel producer, and has held this status since 1997. This position is set to end with the restarted Avelbury nickel project in Tasmania producing first nickel concentrate in October 2022.

WA was also a significant global producer, accounting for five per cent of world production which ranked the State fifth in the world.

Notable events

- BHP delivered first crystals from its Kwinana nickel sulphate plant in October 2021.
- BHP also ramped up its Nickel West decarbonisation efforts signing an agreement for the supply of power from the Flat Rocks Wind Farm under construction near Kojonup. Combined with an earlier agreement with TransAlta for construction of a solar and battery storage system in the Northern Goldfields, this will mean the energy requirements of the Kambalda concentrator, Kalgoorlie smelter and Kwinana refinery will be met by renewables.
- IGO acquired Western Areas and all of its assets including the Forrestania operations, in June 2022.
- First Quantum Minerals achieved first concentrate from its Shoemaker-Levy mine at Ravensthorpe in the December quarter 2021.
- Mincor Resources' Kambalda project achieved first concentrate production through BHP's Kambalda nickel concentrator in May 2022.
- The Savannah project restarted with first concentrate production achieved in October 2021 and a first shipment in December 2021.



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

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

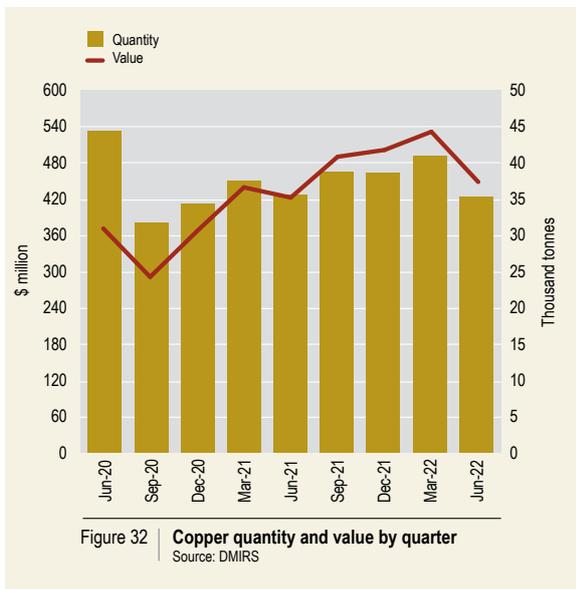
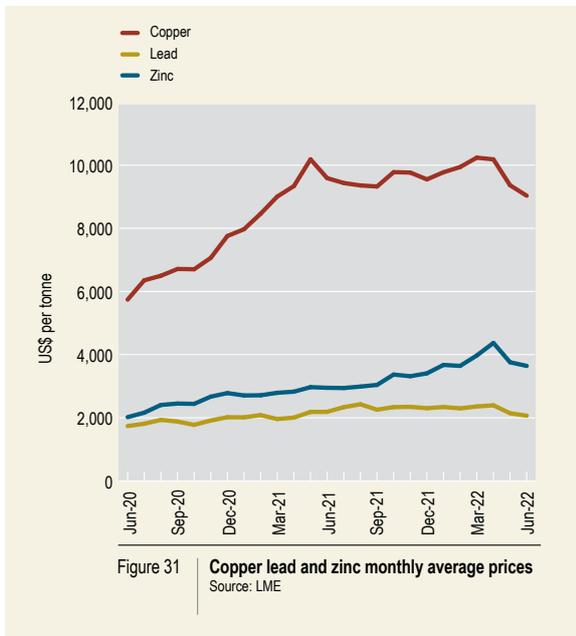
2.1.6 Copper

Prices

Copper prices remained high throughout 2021–22, averaging more than US\$9,600 per tonne and peaking at record levels in excess of US\$10,200 per tonne.

Prices for the red metal were supported by supply side factors, most notably production issues in Chile and Peru (the world’s top two copper producers) and the Russia-Ukraine conflict.

Prices trended down at the end of the fiscal year as China’s zero-COVID policy curbed domestic construction activity, and increases in interest rates to tackle inflation tempered the outlook for global economic growth and in turn, copper demand.



Quantity and value

Copper sales were valued at a record \$2 billion in 2021–22.

This result was due to the both record high prices in addition to higher sales volumes of 153 kt after a decade low in the previous financial year.

Copper output was higher for most local projects with the standouts being:

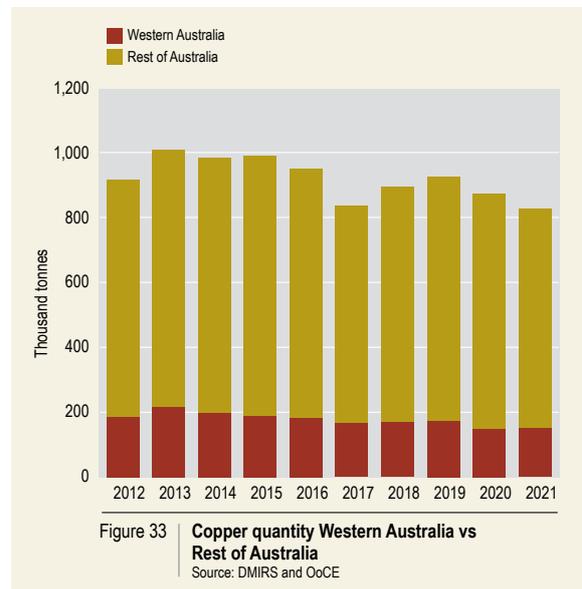
- Boddington due to higher ore grades milled.
- Nova due to higher processing throughput.
- Golden Grove due to mine sequencing promoting higher copper output and improvements in the mill throughput.

Copper output was also boosted by the restart of the Savannah project, which produces copper as a by-product of its nickel operations.

Copper dropped back to WA’s sixth most valuable mined commodity and eighth most value resource commodity overall due to the tremendous growth in the value of lithium sales.

WA remained a relatively minor copper producer in both an Australian and global context.

Copper produced in WA was largely exported with South Korea (27 per cent), the Philippines (24 per cent) and Japan (22 per cent) accounting for almost three-quarters of sales. Germany (nine per cent) and Finland (five per cent) were the next largest export destinations.



Notable events

- Panoramic Resources restarted the Savannah project with first concentrate production achieved in October 2021 and a first shipment in December 2021.
- OZ Minerals made a positive FID on the West Musgrave copper-nickel project in late September.
- Aeris Resources acquired Round Oak Minerals, the former owner of Jaguar, in July 2022.
- 29Metals, a subsidiary of EMR Capital, owner of the Golden Grove project, listed on the ASX in July 2021.



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

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

2.1.7 Mineral sands

Prices

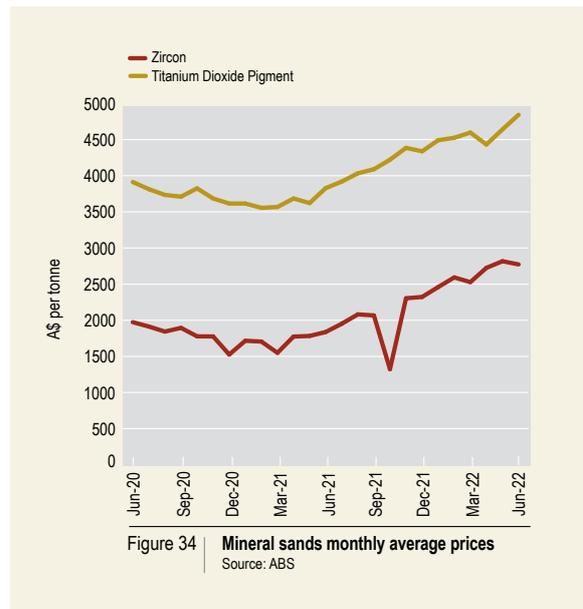
Mineral sands prices trended higher across the 2021–22 financial year.

Prices for titanium products and feedstocks increased, with titanium dioxide increasing to an all-time high for a single month of \$4,843 per tonne in June 2022.

These prices were supported by strong demand from pigment producers in China, as well as the US and Europe due to chlorine shortages (higher grades from WA reduce the requirements for chlorine). This outpaced supply amid titanium feedstock production challenges in South Africa and Sierra Leone, and low inventory levels from supply chain disruptions associated with the conflict in Ukraine (a significant source of ilmenite and rutile). Rising input costs including energy, process chemicals and logistics, are also pushing prices higher.

Zircon also shifted higher, recording a monthly average high of \$1,816 per tonne in May 2022.

Zircon was supported by strong demand across multiple geographies and markets including ceramics, photovoltaics (specifically refractories used in glass production), and foundries.



Quantity and value

Total mineral sands sales were a record \$1.3 billion in 2021–22 due to higher prices and volumes.

Volumes increased largely due to higher garnet, zircon, rutile and synthetic rutile sales:

- Garnet sales increased 35 per cent to 374,476 tonnes from the Port Gregory operations.
- Zircon sales increased 35 per cent to a 12-year high of 313,998 tonnes from higher ore treatment rates, grades, and recoveries at Iluka Resources' Cataby project, as well as the Tronox operations.
- Rutile sales increased 23 per cent to a 12-year high of 66,596 tonnes largely from higher ore treatment rates, grades, and recoveries at the Cataby project.
- Synthetic rutile sales increased four per cent to a four-year high of 281,991 tonnes from the running at full capacity of Synthetic Rutile Kiln 2 at Capel by Iluka Resources after a refurbishment in early 2021.

Ilmenite volumes were affected by lower sales from Image Resources, as mining at Boonanarring progresses to lower grades and the end of its current reserves.

Iluka Resources suspended monazite-zircon concentrate sales from Eneabba at the end of 2021 to preserve with the existing stockpile for further concentrating under Phase 2 of the Eneabba development, which was achieved in June 2022.

Mineral sands was the State's seventh most valuable mineral commodity in 2021–22, a position the industry has maintained since the growth of the lithium industry in recent years.

WA was once again a globally significant producer of mineral sands products. The State was the world's largest producer of garnet and zircon, and was in the top 10 for ilmenite and rutile production.

China remained the WA's biggest customer for mineral sand products, but its share of the value of exports dropped from 51 per cent to 42 per cent. The next largest mineral sands export destinations were Saudi Arabia (eight per cent), the US (seven per cent), Malaysia (six per cent), and India (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.

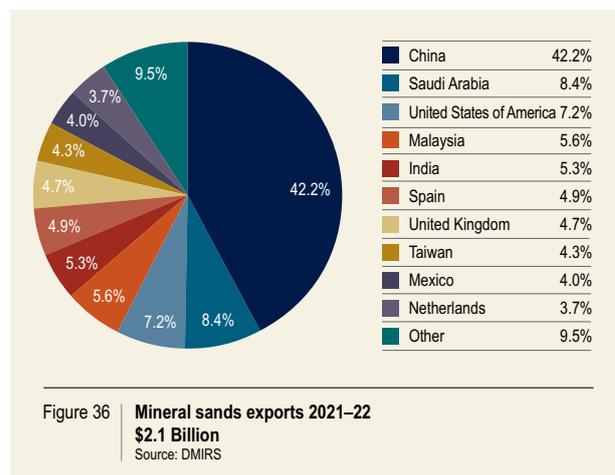
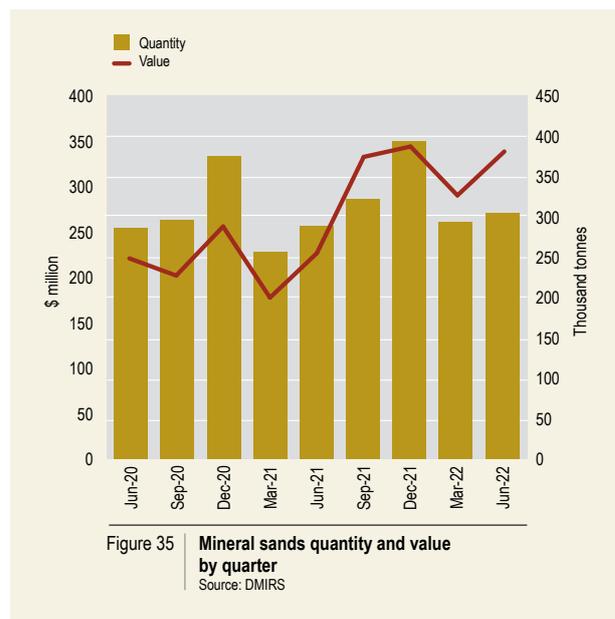
Notable events

- Iluka Resources achieved first production of a 90 per cent monazite concentrate and a zircon-ilmenite concentrate at Eneabba in June 2022. It also made a FID on the restart of Synthetic Rutile Kiln 1 at Capel in August 2021.
- Standline Resources processed first ore at the Coburn mineral sands project in November 2022, with a first shipment expected before the end of the year.
- Commissioning of the Mineral Separation Plant at Resource Development Group's Lucky Bay garnet project commenced in the September quarter 2022.
- Iluka Resources announced in April 2022 its intention to demerge its Sierra Rutile assets, subject to shareholder and other approvals.



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

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



2.1.8 Other minerals

Rare earths

Quantity and value

Thirty million kilograms (kg) of rare earths were sold in WA in 2021–22, up from 27 million kg in 2020–21.

Sales volumes increased on higher output from Lynas' operations as the COVID-19 situation improved, and despite water shortage related stoppages and unavailability of some chemical processing products affecting Malaysian processing operations. They were also boosted by the restart of the Browns Range operations.

The value of sales was \$779 million in 2021–22. The value for the previous financial year was not reported due to commercial sensitivities as Mount Weld was the only project operating.

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

Notable events

- Iluka Resources achieved first production of a 90 per cent monazite concentrate at Eneabba in June 2022. The company also announced a FID in April 2022 on construction of a rare earths refinery at Eneabba.
- In April 2022, construction began on Lynas' cracking and leaching plant in Kalgoorlie, which will further process rare earths concentrate from the company's Mount Weld operations. Lynas also committed to expanding the capacity of its Mount Weld mine and concentration plant.
- It was an active year for Northern Minerals. The company:
 - Completed commissioning of ore sorting equipment at the Browns Range pilot plant in May 2021 after finishing testing on ores. Sales of product recommenced in September 2021.
 - Announced and completed a review of its strategic direction. This confirmed the preferred near-term strategy for Browns Range is the production of a mixed heavy rare earth concentrate from a commercial-scale beneficiation plant, as distinct from commercial scale production of rare earth carbonate.
 - Placed the Browns Range pilot plant into care and maintenance in the March quarter 2022, with the final sale of rare earth carbonate in the June quarter 2022.

- Announced a strategic partnership with Iluka Resources in October 2022 encompassing a rare earths concentrate supply agreement (feedstock for Iluka Resources' Eneabba rare earths refinery), equity investment and funding support.

- Early construction works commenced at Hastings Technology Metals' Yangibana mine site in August 2021. This progressed across the year, with early works at Onslow, the site of a planned hydrometallurgical plant, commencing in the September quarter 2022.

Cobalt

Prices

Cobalt prices trended up over 2021–22.

The price rose from an average of US\$44,248 per tonne in June 2021 to US\$81,539 per tonne in April 2022 – the highest level since mid-2018.

The price was supported by persistent supply chain disruptions at South Africa's Port of Durban – 65 per cent of the world's annual output of cobalt raw material transits through South Africa. Price rises were further exacerbated by a global vessel shortage, shipping delays, higher fees and booming demand from the EV sector.

Renewed COVID-19 restrictions in China subsequently stifled demand throughout the value chain with the price averaging US\$71,828 per tonne in June 2022.

Quantity and value

Cobalt is produced in WA as a by-product by some of the State's nickel producers.

In 2021–22, these producers sold 5,314 tonnes of cobalt, which was broadly similar to the previous financial year.

These sales were valued at \$522 million, up 74 per cent on 2020–21 on the back of the higher prices.

Salt

Quantity and value

There was 11.6 Mt in salt produced in WA in 2021–22, down from 12.5 Mt in 2020–21.

Despite the decrease in production, higher prices over the year meant the value of sector increased marginally to \$558 million. This was lower than the record level of \$600 million set in the 2021 calendar year.

Dampier Salt, with operations at Dampier, Port Hedland, and Lake MacLeod, was the State's biggest producer, 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. WA was the fifth largest salt producer in the world in 2021.

Notable events

- BCI Minerals announced a FID in October 2021 and main construction in February 2022 of its Mardie salt and potash project.

A note about salt

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

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

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

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

Zinc

Prices

Zinc prices trended higher over 2021–22, peaking at over US\$4,370 per tonne in April before easing.

Stronger prices to April were primarily due to rising energy costs, which led to production curtailments in smelter production and booming demand from the EV sector.

Prices fell to an average of US\$3,643 per tonne in June 2022 from subdued demand amid a slowdown in economic activity as China reimposed lockdowns.

Quantity and value

Zinc sales increased to 74 kt from 64 kt in 2021–22.

This was on higher output from Jaguar offsetting lower zinc sales from Golden Grove reflecting production activity from nearer-to-surface ore sources over ore sources at depth (zinc is contained in ores at depth).

Higher volumes and prices meant the value of sales increased to \$355 million – the highest level in 15 years.

Notable events

- Aeris Resources acquired Round Oak Minerals, the former owner of Jaguar, in July 2022.
- 29Metals, a subsidiary of EMR Capital, owner of the Golden Grove project, listed on the ASX in July 2021.

Coal

Quantity and value

Collie coal sales decreased to a record low of 5.2 Mt in 2021–22. Despite this, the value of those sales increased to \$325 million.

Sales volumes were impacted by the Griffin Coal Mining Company declaring force majeure in July 2021. This related to a wet winter season affecting open-pit mining operations, as well another force majeure related to industrial action, labour difficulties and border closures.

Notable events

- Receivers and managers were appointed to the Griffin Coal Mining Company in September 2022.

Manganese

Quantity and value

In volume terms, manganese sales increased year-on-year to 539 kt from 467 kt.

This was off the back of higher output from Woodie Woodie and the start-up of the Butcherbird project with a first shipment in July 2021.

The value of sales was \$324 million in 2021–22.

The sales value for 2020–21 is not for publication as Woodie Woodie was the State's only manganese producer during that period.

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

Notable events

- Element 25 achieved a first shipment from its Butcherbird project in July 2021.

An update on potash developments

There have been a handful of potash projects at various stages of assessment and development in WA over the past few years.

These projects are focused on Sulphate of Potash (SOP) for the global fertiliser market, as opposed to Muriate of Potash (MOP).

MOP is the most commonly produced potash product and is used on a range of broad-acre, non-irrigated commercial crops such as corn, beets and celery. SOP is a more specialised, premium form of potash that attracts higher prices given its application to higher-value vegetables, fruit, cocoa, nuts and rubber crops.

Potash prices experienced unprecedented levels of growth during 2021–22 with SOP increasing from less than US\$600 per tonne to more than US\$1,000 per tonne. The price rise has been due to global market dynamics, including:

- Rising demand due to poor crop yields.
- Supply issues such as economic sanctions on two of the world's largest potash producers Belarus and Russia (following its conflict with Ukraine), and restrictions in China on the export of fertilisers.

Against this backdrop, there were several significant developments in the local potash industry in the past year, the most notable of which were:

- Kalium Lakes' Beyondie project achieved first production in October 2021. The project experienced a number of delays during commissioning due to technical issues related to the harvesting of potassium salts and the purification plant. As a

result, first commercial sales were not achieved until 31 July 2022. The project is now ramping up, targeting a production rate of approximately 80 ktpa by the March quarter 2023, and 120 ktpa by the September quarter 2024.

- The Lake Way project previously underwent commissioning. However, technical issues related to recovery grades and available feedstocks for processing resulted in a revised ramp-up timeframe and a funding shortfall for its then owner and operator Salt Lake Potash. Subsequently, in October 2021, receivers and managers were appointed for the company with an agreement completed in October 2022 for its purchase by Sevens Global Investment, a Czech family-owned investment group.
- BCI Minerals made a FID on the Mardie salt and SOP project in October 2021, with the project currently under construction. The project has a capital cost of more than \$1.2 billion and is expected to have an annual SOP production capacity of 140 kt, with production targeted to commence in 2026.

There were also some notable progress for other potash projects across the State at earlier stages of development and assessment that remain subject to financing and FID:

- Australian Potash completed FEED, and progressed early works involving construction of an accommodation village, earth works, in addition to borefield development at the Lake Wells project. An optimisation study on the project was released on 21 September 2022 outlining targeted annual production of 205 kt and a development cost of \$408 million.
- Agrimin was undertaking FEED on its Mackay project.
- Trigg Minerals released a Scoping Study on its Lake Throssell project in October 2021 outlining a production target of 245,000 tonnes per annum and an initial capital cost of \$387 million, and commenced a Pre-Feasibility Study.

The Government of WA has provided significant and extensive support to reduce costs for and facilitate development of the potash industry. This has included:

- The Potash Industry Royalty Rebate Scheme.
- Concessional mining lease rental rates and the resolution of issues with the timing of the concessional rates.
- Specific Mining Rehabilitation Fund levy rates.
- Investments in port and road infrastructure.
- Support through the Australian Government's Northern Australia Infrastructure Facility.

2.2 Petroleum

The WA petroleum sector, comprising LNG, condensate, crude oil, domestic gas and LPG, continued to recover and achieved record production valued at \$52 billion in 2021–22.

The majority of these sales were from fields in adjacent Commonwealth offshore areas with a relatively minor share in State onshore and offshore areas.

As a result, the sector's share of total mineral sales and petroleum production improved to 22 per cent, which is around its pre-COVID-19 pandemic levels.

Japan (33 per cent) was the major buyer of petroleum products from WA, followed by China (18 per cent) and Singapore (18 per cent). South Korea (11 per cent) and Taiwan (eight per cent) were the other major export destinations.

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/Devil Creek, 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:

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

2.2.1 LNG

Prices

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

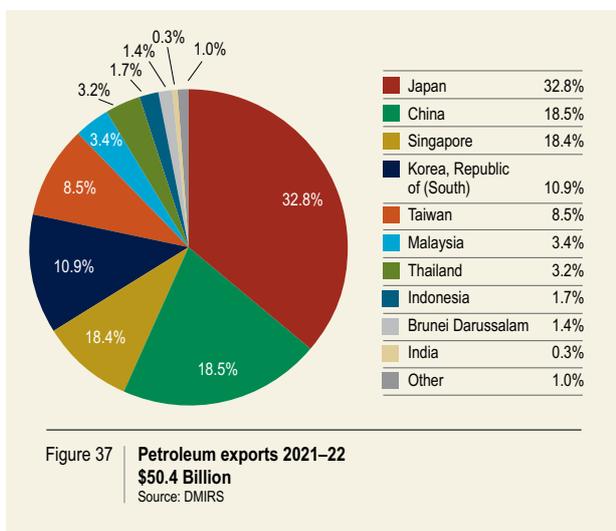
Almost all of LNG produced in WA is sold into the Asia Pacific region, via long-term contracts tied to the price of oil. Local producers are also exposed to LNG spot prices and increasingly so through production at above nameplate capacity.

Australian LNG prices more than doubled from year-to-year to an average of US\$12.45 per Million metric British thermal units (Mmbtu).

LNG traded higher through the second half of 2021 on recovering demand from the rollout of COVID-19 vaccines and the lifting of restrictions. This outpaced additions to supply, as well as tightness in the European market amid supply concerns ahead of the peak-usage winter months.

The Russia-Ukraine conflict created further supply issues, particularly in Europe. These concerns flowed through to and supported even higher LNG prices in the Asia Pacific market as importers of Russian gas sought alternative sources of supply.

These concerns were somewhat alleviated towards the end of the financial year with larger than expected inventories in the US and rising inventories in Europe giving rise to concerns about an oversupply.



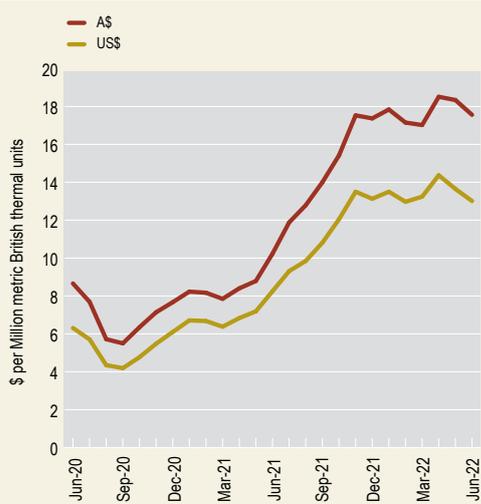


Figure 38 | **LNG monthly average price**
Source: ABS



Figure 39 | **LNG quantity and value by quarter**
Source: DMIRS, EnergyQuest and Woodside Energy

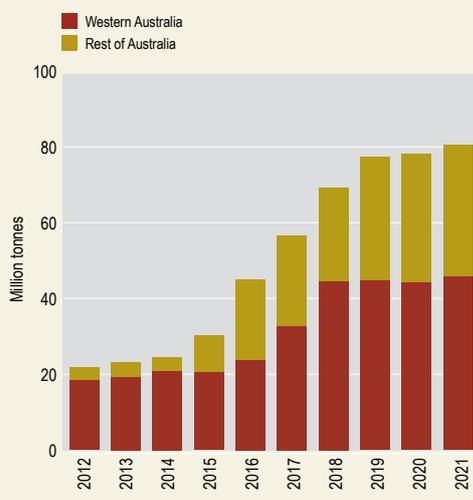


Figure 40 | **LNG quantity Western Australia vs Rest of Australia**
Source: DMIRS, EnergyQuest and Woodside Energy

Quantity and value

LNG re-established itself as the second most valuable resource produced and sold in WA in 2021–22.

LNG accounted for 72 per cent of the value of all petroleum sales and 16 per cent of the total value of mineral sales and petroleum production.

LNG was valued at a record \$38 billion on combination of all-time high prices and a rise in production to record levels.

Production across the five LNG facilities on or off the northern coast of the State – the Karratha gas plant, Pluto, Gorgon, Wheatstone and Prelude – was a record 46.1 Mt for the fiscal year.

This record was due to the increased availability at some facilities:

- Operational issues at Gorgon were resolved allowing it to operate at full capacity by the end of the financial year.
- Prelude had a more sustained period of production than the previous year.
 - The facility was offline between December 2021 and April 2022 following an electrical fire, and again in June 2022 due to an industrial dispute.
 - This followed a longer outage the previous year from February 2020 to January 2021 due to power generation and other technical issue.

The record sales were achieved despite lower production from the North West Shelf due to scheduled maintenance.

Australia was once again the world's largest exporter of LNG after displacing Qatar in 2020. More than half of Australia's LNG production came from WA. Taken alone, WA was again the world's third largest exporter, though it has been displaced by the US in the past few years due to the dramatic growth in that country's LNG exports.

Notable events

- Woodside Energy and BHP Petroleum announced a merger to combine their respective oil and gas portfolios on 17 August 2021 that was completed on 1 July 2022. This involved BHP's share of the North West Shelf Joint Venture, the Scarborough and Macedon gas fields and assets, and its share of Pyrenees.

- Woodside Energy made a FID on the Scarborough and Pluto Train 2 developments in November 2021. The company also reached an agreement in November with Global Infrastructure Partners for a 49 per cent non-operating interest in Pluto Train 2.
- In July 2021, Chevron announced it will proceed with the Jansz-10 compression project in order to maintain gas supply to its Gorgon LNG plant.
- Shell and SGH Energy approved the development of the Crux natural gas field in May 2022 to provide further supplies to the Prelude Floating LNG facility.
- Woodside Energy began processing gas from the offshore Pluto gas fields at the North West Shelf's Karratha gas plant, following the start-up of the Pluto-Karratha gas plant interconnector. This represents the first backfill gas processed through the facility.
- Woodside Energy reported in April 2022 it had completed the first phase of the Pyxis hub, comprising the tieback of the Pyxis, Pluto North and Xena fields to the Pluto offshore platform. Woodside Energy also reported in January 2022 the completion of the Phase 2 tieback of the Julimar field to the Wheatstone platform. These projects will contribute to LNG production in the coming years.

2.2.2 Crude oil and condensate

Prices

Oil prices ended 2020–21 on an upwards trajectory, and were fairly stable across the second half of 2021.

Factors affecting these price movements included:

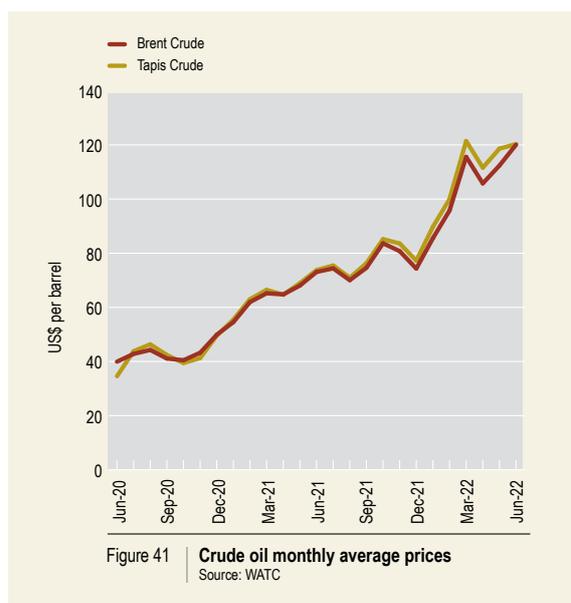
- Heightened demand stemming from increased mobility amid the relaxation of COVID-19 restrictions and rising COVID-19 vaccination numbers.
- Emerging concerns about the spread of the Omicron variant of COVID-19 on demand.
- Lagging supply and caution from the Organisation of Petroleum Exporting Countries and its allies in adding new supply.
- Low global oil inventories.

The Ukraine-Russia conflict and subsequent sanctions on Russia affected supply and drove oil prices to the highest levels in a decade.

Brent crude oil ended the financial year at more than US\$120 per barrel (bbl).

Concerns about a global recession and its impact on demand slowed the pace of oil price growth.

Condensate price trends were similar to oil.



Quantity and value

The combined crude oil and condensate production was 16.91 GL with a value of \$12.2 billion in 2021–22.

Historically, oil production had consistently been more than twice the volume and value of condensate production. Over the past five years condensate production has been significantly greater than the value and volume of crude oil. This was again the case in 2021–22.

The value of condensate production in WA, produced mostly as a by-product of LNG projects, was at a record \$8.6 billion in 2021–22.

As a result, condensate was the second most valuable petroleum product produced in WA and the fourth most valuable resource commodity overall.

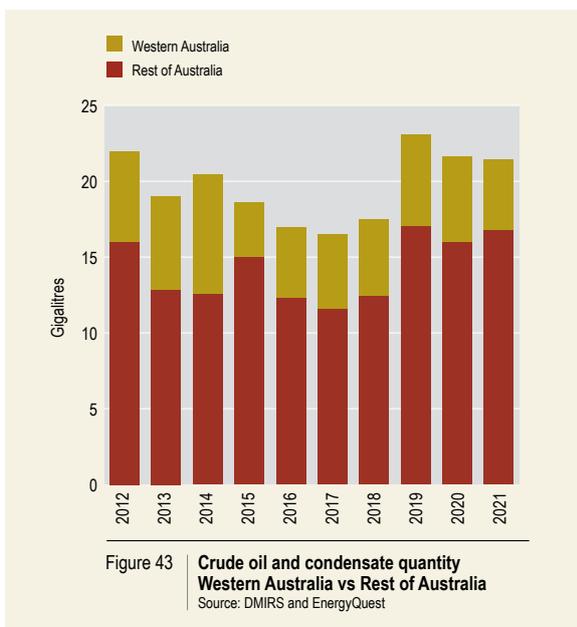
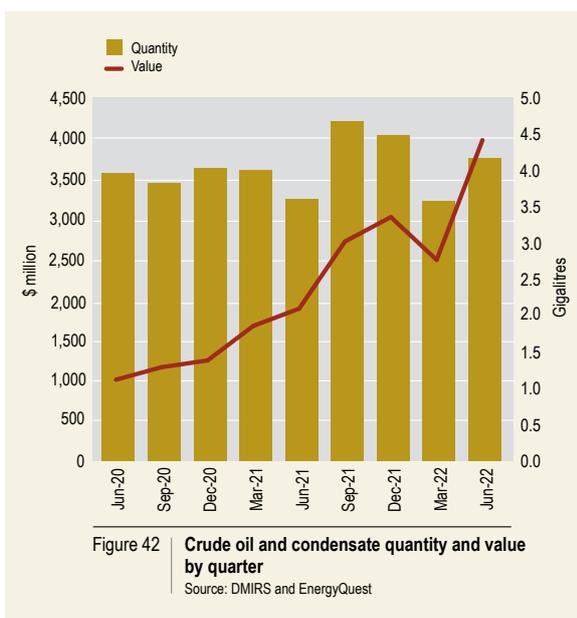
This was the result of higher prices and historically high production volumes of 12.1 GL (68.8 Million bbl), an increase from 11.1 GL (66.1 Million bbl) in 2020–21.

This result was supported by higher output from the Ichthys FPSO. Gorgon and Prelude also increased production due to increased availability (described in section on LNG).

This output offset lower production from North West Shelf and Wheatstone due to maintenance activities (described in section on LNG).

Crude oil production was valued at a seven-year high of \$3.6 billion (seven per cent of the value of all petroleum production).

Oil production was 4.8 GL, up from 4.3 GL but still well below the record levels of 15 to 20 years ago.



This result was supported by strong output from Van Gogh since its return to production in March 2021 following planned maintenance and delays associated with COVID-19 vessel restrictions. Output from Enfield/Vincent was fairly stable from the balance of increased reliability toward the end of the fiscal year and maintenance and weather effects in early 2022.

Oil was the third most valuable petroleum product produced in WA and the eighth most valuable resource commodity overall.

WA's share of national combined condensate and crude oil production was 78 per cent, up from 74 per cent the previous year. The State remains a relatively minor producer of oil on a global scale. Data was not available to enable a comparison of condensate production.

Notable events

- In June 2022, Chevron announced it would suspend its Barrow Island oil operations in 2025.
- Triangle Energy began oil exports from its Cliff Head project in July 2022 following the end of a supply agreement with BP's Kwinana refinery, which has been converted into a fuel import terminal.
- Jadestone Energy completed the acquisition of BP's 16.67 per cent interest in the North West Shelf oil assets in November 2022.

2.2.3 Domestic gas

Prices

The average price of WA domestic gas derived from domestic gas sales reported to the State Government was \$4.17 per Gigajoule (GJ) (\$4.49 per Mmbtu) in 2021–22. This was up by 10 per cent from the COVID-19 affected 2020–21, but around the same level as 2019–20.

By the end of 2021–22, WA's derived domestic gas price had increased to an average of \$4.43 per GJ (\$4.67 per Mmbtu) – its highest level in five years.

To put this into perspective, these prices remained considerably lower than the more than \$5 per GJ (\$5.27 per Mmbtu) reached in 2016, and WA still had one of the lowest gas prices in the developed world.

A note about domestic gas prices

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

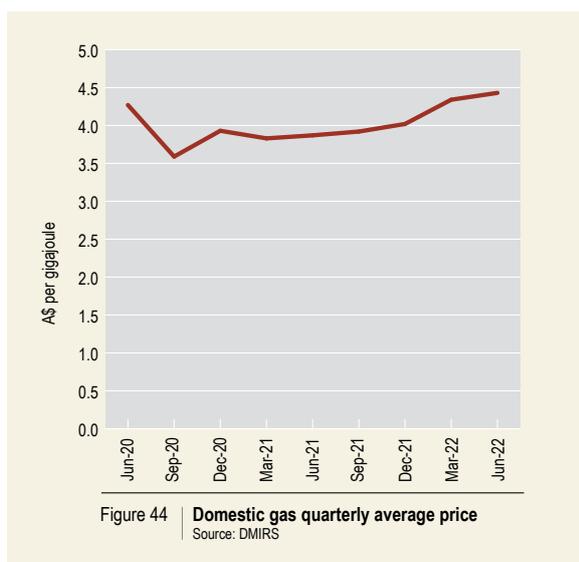
Beginning with the March quarter 2016, the average domestic gas price is derived only from domestic gas sales reported to the State Government in relation to the administration of royalties.

This means that recent average domestic gas prices reflect domestic gas sales from projects such as the North West Shelf, Waitsia and Beharra Springs, and do not reflect domestic gas sales from other WA offshore petroleum projects such as Varanus Island, Macedon, Wheatstone, Gorgon, Reindeer/Devil Creek, and Pluto. The domestic gas price therefore represents 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.

DMIRS is reviewing its methodology for deriving a domestic gas price.



Notable events

- The State Government executed agreements to secure domestic gas equivalent to 15 per cent of LNG exports from the Scarborough to Pluto Train 2 development.
- Santos' Varanus Island compression project achieved start-up on schedule in the December quarter 2021.
- In November 2021, APA Group announced it had committed to construct a 580 km pipeline connecting new domestic gas projects in the onshore Perth Basin with its Goldfields Gas Pipeline.
- The Walyering domestic gas project in the Perth Basin was sanctioned for development in August 2022 by Strike Energy and Talon Energy.

Quantity and value

The quantity of natural gas produced for the domestic market decreased two per cent to 10 billion cubic metres (378 Petajoules) in 2021–22 on falling consumption and demand, particularly for minerals processing and electricity generation.

This was the second year in a row that domestic gas production had declined after record production in 2019-20.

The falls over the past year was largely due to lower production from Varanus Island and Reindeer/Devil Creek. This was despite record levels of production from Gorgon.

At the end of 2021, a maintenance shutdown affected output from Varanus Island. Reindeer/Devil Creek was impacted by a major customer outage and lower spot sales during the first quarter of 2022.

Higher prices saw the value of domestic gas production increase seven per cent to \$1.6 billion (or three per cent of the value of total petroleum production).

Varanus Island and Gorgon were the State's largest domestic gas producers, followed by Macedon, Wheatstone, Reindeer/Devil Creek, the North West Shelf, Pluto, as well as Beharra Springs and Waitsia in the Perth basin.

3 SUPPLEMENTARY INFORMATION

TABLE 6. Quantity and value of minerals and petroleum

COMMODITY	UNIT	2020-21		2021-22	
		QUANTITY	VALUE \$	QUANTITY	VALUE \$
ALUMINA AND BAUXITE					
Alumina	t	14,371,923	5,509,914,224	13,928,030	6,695,295,399
Bauxite	t	1,844,090	58,801,821	397,970	13,530,239
TOTAL ALUMINA AND BAUXITE			5,568,716,045		6,708,825,638
COPPER-LEAD-ZINC					
Copper Metal	t	138,690	1,513,079,674	153,321	1,963,380,467
Lead Metal	t	1,266	3,787,056	0	0
Zinc Metal	t	63,747	232,251,717	74,049	355,379,606
TOTAL COPPER-LEAD-ZINC			1,749,118,447		2,318,760,073
CHROMITE	t	0	0	0	0
CLAYS	t	23,773	2,866,699	29,774	2,514,551
COAL	t	5,272,434	306,063,405	5,194,393	324,648,262
COBALT	t	5,363	299,048,040	5,314	521,594,312
CONSTRUCTION MATERIALS					
Aggregate	t	2,732,381	75,491,178	2,478,925	71,632,018
Gravel	t	164,265	1,576,189	205,972	3,554,548
Rock	t	493,510	10,469,150	673,121	12,408,414
Sand	t	3,007,350	34,195,652	4,048,706	40,920,042
TOTAL CONSTRUCTION MATERIALS			121,732,169		128,515,021
DIAMONDS	ct	8,083,056	112,100,235	43,073	1,195,627
DIMENSION STONE	t	7,850	1,322,376	4,928	2,026,481
GEM & SEMI-PRECIOUS STONES	kg	298,316	484,057	582,275	796,389
GOLD	kg	207,916	16,588,116,954	213,757	17,371,782,277
GYPSUM	t	832,758	19,173,364	1,286,847	30,021,699
IRON ORE	t	839,067,260	155,620,570,488	844,416,156	137,064,996,519
LIMESAND-LIMESTONE-DOLOMITE	t	4,733,530	49,040,708	4,755,444	49,096,720
LITHIUM INDUSTRY					
Spodumene	t	1,710,047	1,053,892,982	2,045,127	6,795,326,353
Lithium Hydroxide	t	0	0	0	0
TOTAL LITHIUM INDUSTRY			1,053,892,982		6,795,326,353
MANGANESE	t	467,655	nfp	539,260	324,115,745

TABLE 6. Quantity and value of minerals and petroleum (continued)

COMMODITY	UNIT	2020-21		2021-22	
		QUANTITY	VALUE \$	QUANTITY	VALUE \$
MINERAL SANDS					
Garnet	t	277,047	nfp	374,476	nfp
Ilmenite	t	322,479	71,997,886	230,358	80,280,242
Leucoxene	t	20,133	24,110,554	15,458	17,451,022
Rutile	t	54,322	46,637,428	66,596	95,616,219
Zircon	t	233,124	347,744,529	313,998	594,605,186
Synthetic Rutile	t	270,451	nfp	103,262	nfp
Other (may include Garnet, Staurolite and Monazite)	t		371,649,818		517,598,906
TOTAL MINERAL SANDS			862,140,215		1,305,551,575
NICKEL	t	158,430	3,485,129,021	147,190	4,946,390,249
PETROLEUM					
Condensate	kl	11,116,898	4,277,981,027	12,077,963	8,617,402,787
Crude oil	kl	4,343,810	1,674,850,864	4,836,090	3,575,946,759
LNG	t	43,269,085	16,339,353,508	46,052,284	37,522,960,109
LPG – Butane and Propane	t	480,856	294,627,474	687,493	708,319,537
Domestic gas	'000m ³	10,179,352	1,471,475,810	9,952,156	1,579,733,449
TOTAL PETROLEUM			24,058,288,682		52,004,362,641
PLATINUM GROUP ELEMENTS	kg	470	40,285,878	459	38,985,835
POTASH	t	0	0	0	0
RARE EARTHS	kg	27,103,719	nfp	29,976,636	778,781,157
SALT	t	12,498,613	553,353,637	11,646,755	557,530,879
SILICA SANDS	t	849,294	16,828,579	952,776	17,760,841
SILVER	kg	169,100	156,113,757	153,649	154,618,525
TIN AND TANTALUM					
Tantalite	t	175	nfp	158	nfp
Tin Metal	t	55	nfp	37	nfp
TOTAL TIN AND TANTALUM			21,625,543		28,400,547
OTHER (May include Rare Earths, Manganese, Spongolite, Talc, and Cesium)			658,703,509		15,266,677
TOTAL MINERALS			187,286,426,109		179,487,501,953
TOTAL MINERALS AND PETROLEUM			211,344,714,791		231,491,864,593

TABLE 7. Value of minerals and petroleum by region by commodity 2021–22

REGION	Value \$
Pilbara	
Iron ore	134,361,355,958
Gold, Silver and Copper	1,373,041,534
Spodumene and Tantalum Pentoxide	994,504,888
Salt	438,933,365
Manganese ore and Crude oil	431,154,700
Construction Materials	73,222,901
Dimension Stone and Gem and Semi Precious Stones	1,398,744
Pilbara Total	137,673,612,089
Offshore Petroleum	
Liquefied Natural gas	37,522,960,109
Condensate	8,617,402,787
Crude oil	3,397,374,642
Domestic gas	1,515,886,702
LPG Butane and Propane	708,319,537
Offshore Total	51,761,943,777
Goldfields–Esperance	
Gold and Silver	11,777,781,167
Nickel and Cobalt	4,860,820,867
Spodumene and Tantalum Pentoxide	1,517,557,676
Rare Earth Oxide and Iron ore	957,881,840
Copper and Zinc	385,483,813
Platinum and Palladium	38,985,835
Construction Materials and Dimension Stone	26,333,513
Gypsum and Limesand Limestone Dolomite	14,148,913
Goldfields–Esperance Total	19,578,993,624
Peel	
Alumina and Bauxite	6,708,825,638
Gold, Silver and Copper	2,296,486,678
Peel Total	9,005,312,316
Mid West	
Gold and Silver	2,145,772,805
Iron ore	1,385,871,502
Copper, Lead and Zinc	1,295,235,253
Mineral Sands and Gem and Semi Precious Stones	122,951,817
Petroleum	83,029,478
Manganese ore and Talc	41,379,950
Limesand Limestone Dolomite and Gypsum	2,676,559
Clays	1,024,671
Construction Materials	617,109
Mid West Total	5,078,599,144

REGION	Value \$
Wheatbelt	
Mineral sands	1,095,687,160
Iron ore and Gypsum	947,217,153
Nickel and Silver	476,913,433
Gold	473,723,127
Salt and Silica and Silica sand	16,944,657
Limesand Limestone Dolomite, Construction Materials and Clays	5,611,977
Wheatbelt Total	3,016,097,507
Kimberley	
Iron ore, Nickel and Cobalt	328,047,206
Diamonds, Gold and Silver	74,459,772
Copper and Rare Earth Oxide	27,735,543
Petroleum	26,023,670
Construction Materials, Dimension Stone and Limesand Limestone Dolomite	12,966,482
Kimberley Total	469,232,673
South West	
Spodumene, Tantalum Pentoxide and Tin Metal	4,311,664,336
Coal	324,648,262
Mineral sands	86,970,841
Limesand Limestone Dolomite and Dimension Stone	2,676,866
Construction Materials	805,892
South West Total	4,726,766,198
Gascoyne	
Salt	106,572,973
Gypsum and Spongolite	17,141,768
Construction Materials	1,201,906
Gem and Semi Precious Stones	445,138
Limesand Limestone Dolomite	437,763
Gascoyne Total	125,799,548
Perth Metropolitan	
Silica and Silica Sand and Limesand Limestone Dolomite	34,434,051
Construction Materials	13,720,940
Perth Metropolitan Total	48,154,991
Great Southern	
Spongolite, Silica and Limesand Limestone	7,392,727
Great Southern Total	7,392,727
TOTAL	231,491,864,593

TABLE 8. Value of minerals and petroleum by region by local government area 2021–22

REGION	Value \$
Pilbara	
East Pilbara	68,308,696,942
Ashburton	64,680,399,420
Karratha	4,429,877,673
Port Hedland	254,638,054
Pilbara Total	137,673,612,089
Offshore Petroleum	51,761,943,777
Goldfields–Esperance	
Laverton	5,580,494,683
Leonora	3,641,104,068
Coolgardie	3,186,837,123
Kalgoorlie–Boulder	2,360,764,033
Menzies	1,399,009,704
Ravensthorpe	1,209,803,182
Dundas	1,184,084,583
Wiluna	1,014,558,076
Esperance	2,338,173
Goldfields–Esperance Total	19,578,993,624
Peel	
Boddington and Murray	9,005,312,316
Peel Total	9,005,312,316
Mid West	
Meekatharra and Sandstone	1,624,069,903
Perenjori	1,141,241,419
Yalgoo	842,752,018
Cue	734,174,625
Mt Magnet	512,151,592
Murchison and Northampton	123,155,759
Irwin	84,436,655
Carnamah and Three Springs	15,178,189
Coorow	1,398,984
Mid West Total	5,078,559,144
Great Southern	
Albany, Plantagenet and Denmark	7,392,727
Great Southern Total	7,392,727

REGION	Value \$
Wheatbelt	
Yilgarn	1,172,659,885
Dandaragan and Wickepin	902,556,667
Kondinin	476,760,319
Gingin	201,031,285
Lake Grace and Narambeen	152,912,936
Westonia	101,187,825
Northam and Moora	5,162,117
Dalwallinu	1,939,480
Koorda and Kellerberrin	1,331,800
Wyalkatchem and Dowerin	555,193
Wheatbelt Total	3,016,097,507
Kimberley	
Derby–West Kimberley	181,895,982
Halls Creek	231,724,272
Wyndham–East Kimberley	44,942,951
Broome	10,669,467
Kimberley Total	469,232,673
South West	
Bridgetown–Greenbushes	4,311,664,336
Collie and Harvey	325,448,954
Busselton and Augusta–Margaret River	89,442,384
Donnybrook–Balingup and Manjimup	210,523
South West Total	4,726,766,198
Gascoyne	
Carnarvon	82,393,585
Shark Bay	42,098,714
Exmouth	1,306,723
Upper Gascoyne	526
Gascoyne Total	125,799,548
Perth Metropolitan	
Cockburn	17,646,097
Wanneroo	16,593,992
Swan	12,991,147
Kwinana	923,755
Perth Metropolitan Total	48,154,991
TOTAL	231,491,864,593

TABLE 9. Average annual employment in the mining, petroleum and exploration sector by commodity

Commodity	2020–21 Nol	2021–22 Nol	2020–21 FTE	2021–22 FTE
Alumina and Bauxite	10,079	9,936	6,840	6,713
Coal	1,002	900	642	651
Construction Materials	2,665	2,822	675	778
Copper–Lead–Zinc	2,319	2,471	1,894	2,024
Diamonds	320	50	258	32
Gold	34,155	36,087	28,406	30,683
Iron ore	76,137	78,974	60,488	58,828
Lithium	2,419	3,782	1,846	3,545
Mineral sands	2,833	3,470	1,870	2,353
Nickel	7,348	8,294	7,553	8,213
Salt	878	988	622	799
Other	3,889	4,103	2,793	2,816
Exploration	4,331	4,626	4,170	4,347
Petroleum	1,045	1,200	1,126	1,237
Total Mining and Exploration	148,374	156,504	118,058	121,783
Total Mining, Exploration and Petroleum	149,419	157,704	119,183	123,020

TABLE 10. Average annual employment in the mining sector by region

	2020–21 Nol	2021–22 Nol	2020–21 FTE	2021–22 FTE
Pilbara				
Ashburton	22,050	24,432	18,236	18,996
East Pilbara	42,779	43,705	33,570	32,453
Karratha	6,501	6,549	5,755	5,767
Port Hedland	6,154	6,560	3,693	3,912
Total	77,484	81,246	61,254	61,128
Goldfields–Esperance				
Coolgardie	4,210	4,054	3,217	3,223
Dundas	1,083	1,000	939	1,046
Esperance	362	396	181	189
Kalgoorlie–Boulder	6,485	6,726	4,738	5,514
Laverton	6,703	7,776	6,385	6,954
Leonora	5,305	5,889	4,511	5,336
Menzies	3,490	3,752	2,823	3,110
Ravensthorpe	1,545	1,679	1,284	1,342
Wiluna	3,034	3,241	3,128	3,153
Total	32,215	34,514	27,204	29,866
Peel				
Boddington	2,934	2,848	2,074	1,929
Mandurah	1	1	1	1
Murray	3,571	3,613	2,109	2,161
Serpentine-Jarrahdale	386	367	113	115
Waroona	2,424	2,231	1,301	1,120
Total	9,316	9,060	5,598	5,326
Mid West				
Carnamah	156	208	86	128
Coorow	17	15	4	3
Cue	813	909	793	934
Geraldton	787	890	321	359
Irwin	100	98	35	33
Meekatharra	2,557	2,641	2,286	2,375
Mt Magnet	624	710	845	809
Murchison	8	3	13	2
Northampton	117	188	68	138
Perenjori	1,702	1,894	1,500	1,500
Sandstone	17	120	12	84
Three Springs	48	52	12	17
Yalgoo	1,886	1,811	1,790	1,714
Total	8,832	9,538	7,766	8,096

TABLE 10. Average annual employment in the mining sector by region (continued)

	2020–21 Nol	2021–22 Nol	2020–21 FTE	2021–22 FTE
Great Southern				
Albany	111	124	21	24
Denmark	9	10	0	1
Plantagenet	14	18	8	11
Woodanilling	1	1	0	0
Total	134	152	30	36
Wheatbelt				
Brookton	4	1	1	0
Chittering	196	280	267	196
Dalwallinu	19	25	2	2
Dandaragan	565	610	559	605
Dowerin	1	1	0	0
Gingin	326	292	232	220
Goomalling	0	1	0	0
Kellerberrin	36	60	6	10
Kondinin	350	310	327	281
Koorda	12	19	1	1
Lake Grace	259	241	200	192
Moora	37	39	13	13
Mt Marshall	3	3	3	2
Narambeen	42	186	32	178
Narrogin	9	7	3	3
Northam	305	317	66	79
Toodyay	36	41	18	20
Wagin	1	1	0	0
West Arthur	2	2	0	0
Westonia	169	154	337	299
Wickepin	15	28	5	20
Wyalkatchem	2	2	0	0
Yilgarn	1,743	2,226	1,712	2,229
Total	4,130	4,846	3,785	4,349
Kimberley				
Broome	8	67	6	60
Derby–West Kimberley	594	667	612	695
Halls Creek	159	508	264	542
Wyndham–East Kimberley	399	97	393	80
Total	1,160	1,338	1,275	1,378

TABLE 10. Average annual employment in the mining sector by region (continued)

	2020–21 Nol	2021–22 Nol	2020–21 FTE	2021–22 FTE
South West				
Augusta–Margaret River	13	14	8	9
Bridgetown–Greenbushes	255	322	207	285
Bunbury	1,046	1,570	537	847
Busselton	124	143	45	50
Capel	677	696	297	331
Collie	2,536	2,380	2,314	2,279
Donnybrook–Balingup	4	4	4	3
Harvey	589	631	660	721
Total	5,244	5,760	4,072	4,525
Gascoyne				
Carnarvon	143	155	106	133
Exmouth	6	7	2	3
Shark Bay	77	204	77	310
Upper Gascoyne	0	1	0	1
Total	225	367	185	447
Perth Metropolitan				
Armadale	76	84	83	95
Belmont	153	151	87	93
Cockburn	33	38	20	18
Fremantle	4	3	2	3
Gosnells	496	519	114	128
Kwinana	2,599	2,928	1,418	1,587
Mundarring	7	8	7	8
Rockingham	919	837	678	623
Swan	389	382	96	96
Wanneroo	479	526	91	108
Total	5,156	5,476	2,595	2,759
Grand Total	143,897	152,297	113,763	117,909

TABLE 11. Royalties by region 2021–22

REGION	\$ million
Pilbara	10,747,398,000
Goldfields–Esperance	479,866,603
Peel	168,048,617
Mid West	206,685,027
Great Southern	229,648
Wheatbelt	143,296,747
Kimberley	14,715,067
South West	101,695,207
Gascoyne	1,182,514
Perth Metropolitan and Offshore	5,567,715
Total Royalty Receipts	11,868,685,147



Beyondie Sulphate of Potash project. Image: Kalium Lakes Limited.

TABLE 12. Principal mining projects 2021–22

Company	Project(s)	Comments
Copper–Lead–Zinc		
29Metals	Golden Grove	
Aeris Resources	Jaguar	Aeris Resources acquired Round Oak Minerals, the former owner of Jaguar, in July 2022.
Sandfire Resources	DeGrussa	
Bauxite		
Alcoa World Alumina and Chemicals	Huntly Willowdale	Alcoa World Alumina and Chemicals was a joint venture of Alcoa and Alumina.
South32	Boddington	
Coal		
Griffin Coal Mining Company	Griffin	Receivers and managers were appointed to the Griffin Coal Mining Company in September 2022.
Yancoal	Premier	
Gold		
Adaman Resources	Kirkalocka	Adaman Resources was a subsidiary of Remagen Lend ADA. Adaman Resources went into the voluntary administration in May 2021. The company was subsequently restructured and recapitalised in July 2021.
AngloGold Ashanti	Sunrise Dam Tropicana	Tropicana was owned by a joint venture of AngloGold Ashanti (70 per cent) and Regis Resources (30 per cent).
Beacon Minerals	Jaurdi	
Billabong Gold	Plutonic	Billabong Gold was a subsidiary of Superior Gold Inc.
Bullseye Mining	North Laverton	New project. First gold was poured in September 2021.
Calidus Resources	Warrawoona	New project. A first gold pour was achieved in May 2022.
Capricorn Metals	Karlawinda	New project. First gold was poured in June 2021.
Dacian Gold	Mt Morgans	Dacian Gold suspended mining at its Mt Morgans project in June 2022.
Evolution Mining	Mungari	Evolution Mining acquired the Kundana operations from Northern Star Resources in August 2021 and integrated it into its Mungari project. The Kundana operations were comprised of Kundana (100 per cent owned by Evolution Mining), the East Kundana Joint Venture (owned by Evolution Mining, 51 per cent; Tribune Resources, 36.75 per cent; Rand Mining, 12.25 per cent), and the West Kundana Joint Venture (owned by Evolution Mining, 75 per cent; Tribune Resources, 25 per cent).
FMR Investments	Gordon – Sirdar Hawkins Find	Hawkins Find was a new project. It was 100 per cent owned by Michael Photios and is managed and operated by FMR Investments.

TABLE 12. Principal mining projects 2021–22 (continued)

Company	Project(s)	Comments
Gascoyne Resources	Dalgaranga	Gascoyne Resources Limited announced on 8 November 2022 that the Dalgaranga project would be suspended.
Gold Fields	Agnew Granny Smith Gruyere St Ives	Gruyere was a joint venture of Gold Fields (50 per cent) and Gold Road Resources (50 per cent).
Horizon Minerals	Boorara	Sales occurred during March quarter 2022.
Karora Resources	Beta Hunt Higginsville	
Linden Gold Alliance	Linden	
Minjar Gold	Southern Cross	Minjar Gold was a subsidiary of Shandong Tianye Real Estate Development Group.
Newcrest Mining	Telfer	
Newmont	Boddington	
Northern Star Resources	Carosue Dam Jundee Kanowna Belle South Kalgoorlie Super Pit / Mt Charlotte Thunderbox	
Norton Gold Fields	Paddington	Norton Gold Fields was a subsidiary of Zijin Mining. This project includes the Binduli North operations, which commenced in July 2022.
Novo Resources	Beatons Creek	Novo Resources announced in June 2022 that its Beatons Creek project was to be placed on care and maintenance by the end of October 2022.
Ora Banda Mining	Davyhurst	
Pantoro	Halls Creek	The Halls Creek project included the Nicolsons mine.
Ramelius Resources	Edna May Marda Mt Magnet Penny Tampia Vivien	Penny was a re-opened project. Mining and sales commenced during the September quarter 2021. Tampia was a new project. Mining commenced in May 2021 with the processing of ores at Edna May commencing in July 2021.
Red 5	Darlot King of the Hills	Operations at King of the Hills were suspended in January 2021 to enable an expansion. A first gold pour from the expanded project was achieved in June 2022.
Regis Resources	Duketon	
Resources and Energy Group	East Menzies	New project. First gold was poured in October 2021.
Rose Dam Resources	Rose Dam	

TABLE 12. Principal mining projects 2021–22 (continued)

Company	Project(s)	Comments
Shine Resources	Scotia	Shine Resources was placed into voluntary administration in October 2021. Sales were made during September quarter 2021 and March quarter 2022.
Silver Lake Resources	Deflector Mt Monger	
St Barbara	Gwalia	
Westgold Resources	Murchison Bryah	Murchison included the Cue and Meekatharra operations. Bryah included the Fortnum operations.
Wiluna Mining	Wiluna	Wiluna Mining entered voluntary administration in July 2022.
Iron ore		
Atlas Iron	Miralga Creek Mt Webber Sanjiv Ridge	Atlas Iron was a subsidiary of Hancock Prospecting. Miralga Creek was a new project with first sales achieved during March 2022.
BCI Minerals	Iron Valley	Iron Valley was 100 per cent owned by BCI and operated by Mineral Resources. It was part of Mineral Resources' Pilbara Hub.
BHP	Jimblebar Mining Area C Newman Yandi	Jimblebar comprised the South Jimblebar, Wheelarra 1/2/3 and 4 mines. Mining Area C comprised the South Flank, Deposit C/D/E/F and Packsaddle Range P3 mines. Newman comprised the Mt Whaleback, Orebody 24 / 25 (Eastern Ridge), Orebody 29 / 30 / 35, and Orebody 18 mines. Yandi comprised the Marillana Creek Central Mesa 1 and 5, Eastern Mesa 1/2/3/5/6, Western Mesa 1 and 4 mines.
CITIC Pacific Mining Management	Sino Iron	
Fenix Resources	Iron Ridge	
Fortescue Metals Group	Chichester Solomon Western	Chichester included the Cloudbreak and Christmas Creek mines. Solomon comprised the Firetail, Kings Valley and Queens Valley mines. Western comprised the Eliwana mine.
GWR Group	Wiluna West	Wiluna West is wholly owned by GWR Group. It included the C4 and JWD mines. Gold Valley Iron Ore was the operator of the C4 mine. CuFe was the operator of the JWD mine. Mining operations at C4 were suspended between September 2021 and January 2022, while the JWD mining operations were suspended in October 2022.
Hancock Prospecting	Roy Hill	
Karara Mining	Karara	

TABLE 12. Principal mining projects 2021–22 (continued)

Company	Project(s)	Comments
Kimberley Metals Group	Ridges	Operated by a joint venture of Ridges Iron Ore and Habrok (Ridges). Ridges was placed into care and maintenance in September 2021.
Mineral Resources	Carina Koolyanobbing Parker Range Wonmunna	The Carina, Koolyanobbing, and Parker Range projects were part of Mineral Resources' Yilgran Hub. Parker Range was a new project. First sales were achieved in the September quarter 2021. The Wonmunna project was part of Mineral Resources' Pilbara Hub.
Mount Gibson Iron	Koolan Island Mid West	Mid West comprised the Shine operations. The Shine operations were suspended in October 2021.
Rio Tinto	Brockman 2 – Nammuldi – Silvergrass Brockman 4 Greater Paraburdoo Gudai-Darri Hope Downs Marandoo Mt Tom Price Robe Valley West Angelas Yandicoogina	Greater Paraburdoo comprised the Paraburdoo and Eastern Ranges mines. Gudai-Darri was a new project. The first iron ore at Gudai-Darri was produced in June 2022. Hope Downs comprised the Hopes Downs 1 and 4, and Baby Hope mines. Robe Valley comprised the Warramboe-Mesa A, and Deepdale Mesa A and J mines.
Sinosteel Midwest	Blue Hills	Operations were suspended in November 2021.
Lithium		
Allkem	Mt Cattlin	Orocobre merged with Galaxy Resources in August 2021, with the merged company trading as Orocobre. In December 2021, the company name was changed from Orocobre to Allkem. Galaxy Resources remains a wholly owned subsidiary of Allkem.
Lithco No.2	Bald Hill	Re-started project. Operations re-commenced in February 2022, with first sales in the June quarter 2022. The project was acquired by Lithco No. 2 through a Deed of Company Arrangements following the receivership of previous owner Alita Resources.
Mineral Resources	Mount Marion Wodgina	Mount Marion was owned under a joint venture between Mineral Resources (50 per cent) and Jiangxi Ganfeng Lithium Co., (50 per cent). The project was operated by Mineral Resources. Wodgina was a re-started project. First spodumene concentrate production and sales were achieved in May 2022. Wodgina is owned by the MARBL Joint Venture, with Mineral Resources holding a 40 per cent interest and Albemarle holding a 60 per cent interest. The project was operated by Mineral Resources.
Pilbara Minerals	Pilgangoora	

TABLE 12. Principal mining projects 2021–22 (continued)

Company	Project(s)	Comments
Talison Lithium Australia	Greenbushes Lithium	Talison Lithium Australia was a joint venture of Tianqi Lithium and IGO (51 per cent) and Albemarle (49 per cent).
Manganese		
Consolidated Minerals	Woodie Woodie	
Element 25	Butcherbird	New project. A first shipment was achieved in July 2021.
Mineral Sands		
Doral	Yoongarillup mine and Picton dry separation plant Keysbrook	
GMA Garnet	Port Gregory	
Iiluka Resources	Mid West South West	Active operations at Mid West comprised the Cataby mine, Narngulu mineral separation plant and the Eneabba screening and concentrator plants. First production from the concentrator plant at Eneabba was achieved in June 2022. 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.
Image Resources	Boonanarring	
Tronox	Cooljarloo mine and Chandala mineral separation plant Wonnerup mine and North Shore mineral separation plant	
Nickel		
BHP	Leinster Mt Keith	
First Quantum Minerals	Ravensthorpe	
IGO	Forrestania Nova	IGO acquired the Forrestania project through its acquisition of Western Areas in June 2022.
Minara Resources	Murrin Murrin	Minara Resources was a subsidiary of Glencore Plc.
Mincor Resources	Kambalda	Included the Cassini mine. First concentrate production through BHP's Kambalda nickel concentrator using ore from the new Cassini mine was achieved in May 2022.
Panoramic Resources	Savannah	Re-started project. First concentrate production from the re-started project was achieved in October 2021 with a first shipment in December 2021.

TABLE 12. Principal mining projects 2021–22 (continued)

Company	Project(s)	Comments
Rare Earths		
Lynas	Mt Weld	
Salt		
Dampier Salt	Dampier Lake MacLeod Port Hedland	Dampier Salt was a joint venture of Rio Tinto (68 per cent), Marubeni (22 per cent) and Sojitz (10 per cent).
Onslow Salt	Onslow	
Shark Bay Salt	Shark Bay	
WA Salt Koolyanobbing	Lake Deborah	
Silica sand		
Hanson	Gnangara	
TT Sand	Mindijup	
Talc		
Imerys Talc Australia	Three Springs	
Tantalum		
Global Advanced Metals	Greenbushes Tantalum	
Basic Raw Materials		
Adelaide Brighton		
Archipelago Nominess / Spinifex Crushing & Screening Services		
BGC		
Boral		
Elazac Mining / Buckski Holdings		
Hanson		
Holcim		
MLG Oz		
Mobile Concreting Solutions		
Supajet / Kimberley Quarry		
Urban Resources		
WA Limestone		
Westdeen Holdings		

TABLE 13. Principal mineral processing operations 2021–22

Company	Project(s)	Comments
Alumina		
Alcoa World Alumina and Chemicals	Kwinana alumina refinery Pinjarra alumina refinery Wagerup alumina refinery	Alcoa World Alumina and Chemicals was a joint venture of Alcoa and Alumina.
South32	Worsley alumina refinery	
Gold		
Gold Corporation	Perth Mint	
Lithium		
Tianqi Lithium Energy Australia	Kwinana lithium hydroxide plant	Tianqi Lithium Energy Australia was a joint venture of Tianqi Lithium (51 per cent) and IGO (49 per cent). The Kwinana lithium hydroxide plant achieved first production in May 2022 and production continued on a trial basis.
Nickel		
BHP	Kalgoorlie nickel smelter Kambalda nickel concentrator Kwinana nickel refinery	The Kambalda nickel concentrator was successfully recommissioned and processed first ores in May 2022 from Mincor Resources' Kambalda project. It had been on care and maintenance since 2018. The Kwinana nickel refinery included the Kwinana nickel sulphate circuit, which delivered first crystals in October 2021.
Minara Resources	Murrin Murrin nickel refinery	
Mineral sands		
Tronox	Bunbury pigment plant Kwinana pigment plant	
Doral	Rockingham fused zirconia plant	
Silica sand		
Simcoa	Kemerton silicon smelter	

TABLE 14. Principal petroleum projects 2021–22

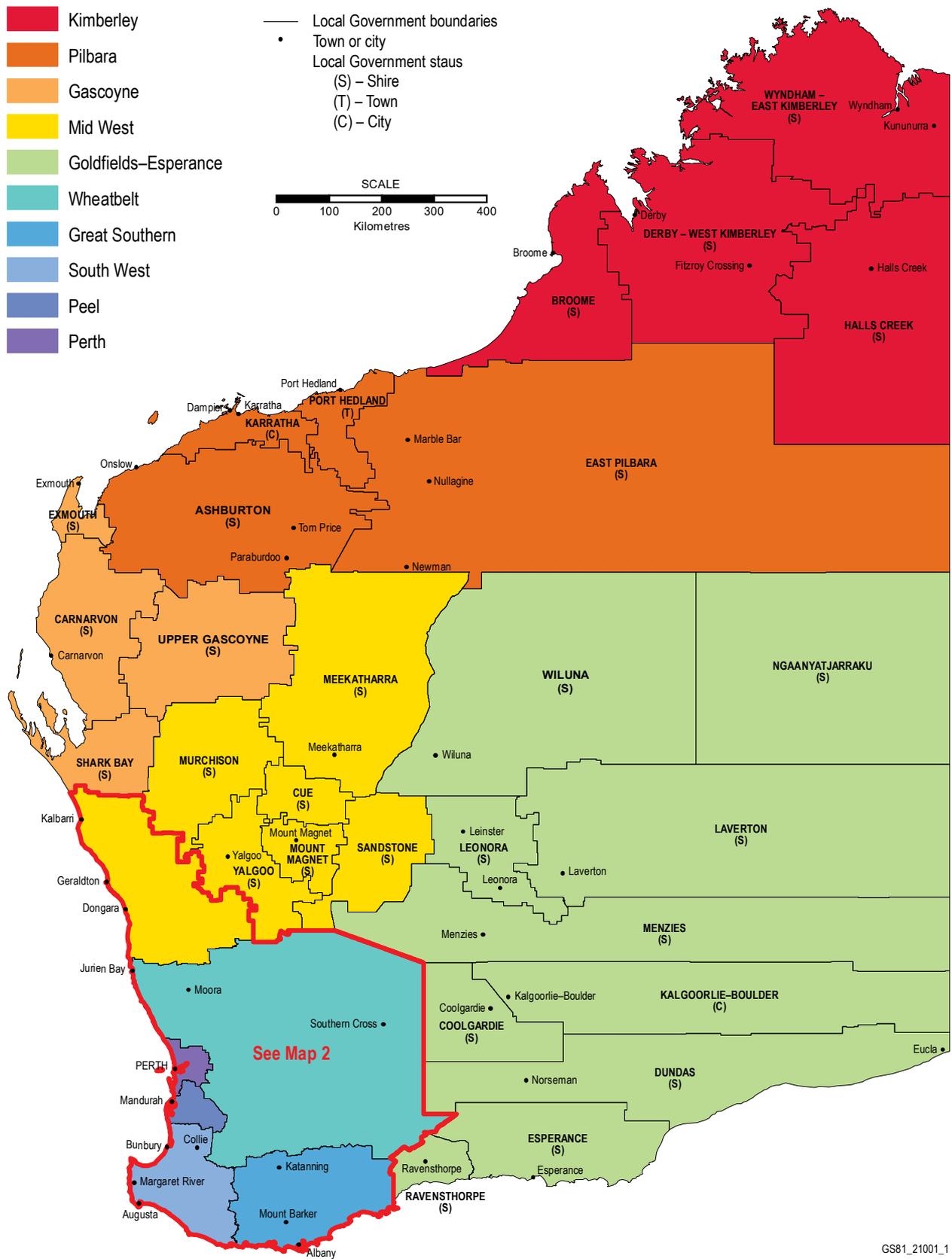
Operator	Projects	Field	Type	Area	Comments
Beach Energy	Beharra Springs	Redback, Redback South	Domestic gas	Onshore	
Buru Energy	Ungani	Ungani	Oil	Onshore	
Chevron	Barrow Island Gorgon Wheatstone	Barrow Island Jansz-lo, Gorgon Brunello, Iago, Julimar, Wheatstone	Oil LNG, condensate and domestic gas LNG, condensate and domestic gas	Onshore Offshore Offshore	Woodside Energy operates the Brunello field within the Wheatstone LNG project. Production from the Julimar field of the Wheatstone project commenced in the March quarter 2022.
INPEX	Ichthys	Ichthys	Condensate	Offshore	
Jadestone Energy	Stag	Stag	Oil	Offshore	
Mitsui & Co	Waitsia	Waitsia	Domestic gas	Onshore	
RCMA Energy	Jingemia	Jingemia	Oil	Onshore	
Santos	Reindeer/Devil Creek Van Gogh Varanus Island	Reindeer-Caribou Coniston, Novara, Van Gogh Greater East Spar (Spar, Halyard, East Spar), John Brookes	Domestic gas and condensate Oil Domestic gas and condensate	Offshore Offshore Offshore	
Shell	Prelude FLNG	Prelude	LNG, condensate, and LPG	Offshore	Prelude was offline between December 2021 and April 2022 following an electrical fire, and again in June 2022 due to an industrial dispute.
Triangle Energy	Cliff Head	Cliff Head	Oil	Offshore	
Vermilion Energy	Wandoo	Wandoo	Oil	Offshore	

TABLE 14. Principal petroleum projects 2021–22 (continued)

Operator	Projects	Field	Type	Area	Comments
Woodside Energy	Enfield/Vincent	Cimatti, Laverda Canyon, Norton over Laverda, Vincent	Oil	Offshore	<p>On 1 June 2022, Woodside Energy and BHP completed a merger involving BHP's oil and gas portfolio. As a result, Woodside Energy became the operator of the Macedon and Pyrenees projects.</p> <p>Production from the Angel and Searipple fields of the North West Shelf project was completed in 2020–21, while production from the Persephone and Wanaea fields was completed in 2021–22.</p> <p>Production from the Pyxis field of the Pluto project commenced in April 2022.</p> <p>The Pluto-KGP Interconnector, a pipeline transporting gas from Pluto LNG to the North West Shelf Project's Karratha Gas Plant, commenced in the first quarter of 2022.</p>
	Macedon	Macedon	Domestic gas	Offshore	
	North West Shelf	Cossack, Goodwyn, Hermes, Keast/Dockrell, Lady Nora/Pemerton, Persephone, Perseus, Sculptor, Tidepole, Wanaea	LNG, condensate, oil, domestic gas, and LPG	Offshore	
	Pluto	Pluto, Xena, Pyxis	LNG, condensate, domestic gas, and LPG	Offshore	
	Pyrenees	Crosby, Moondyne, Ravensworth, Stickle, Tanglehead, Wild Bull	Oil	Offshore	

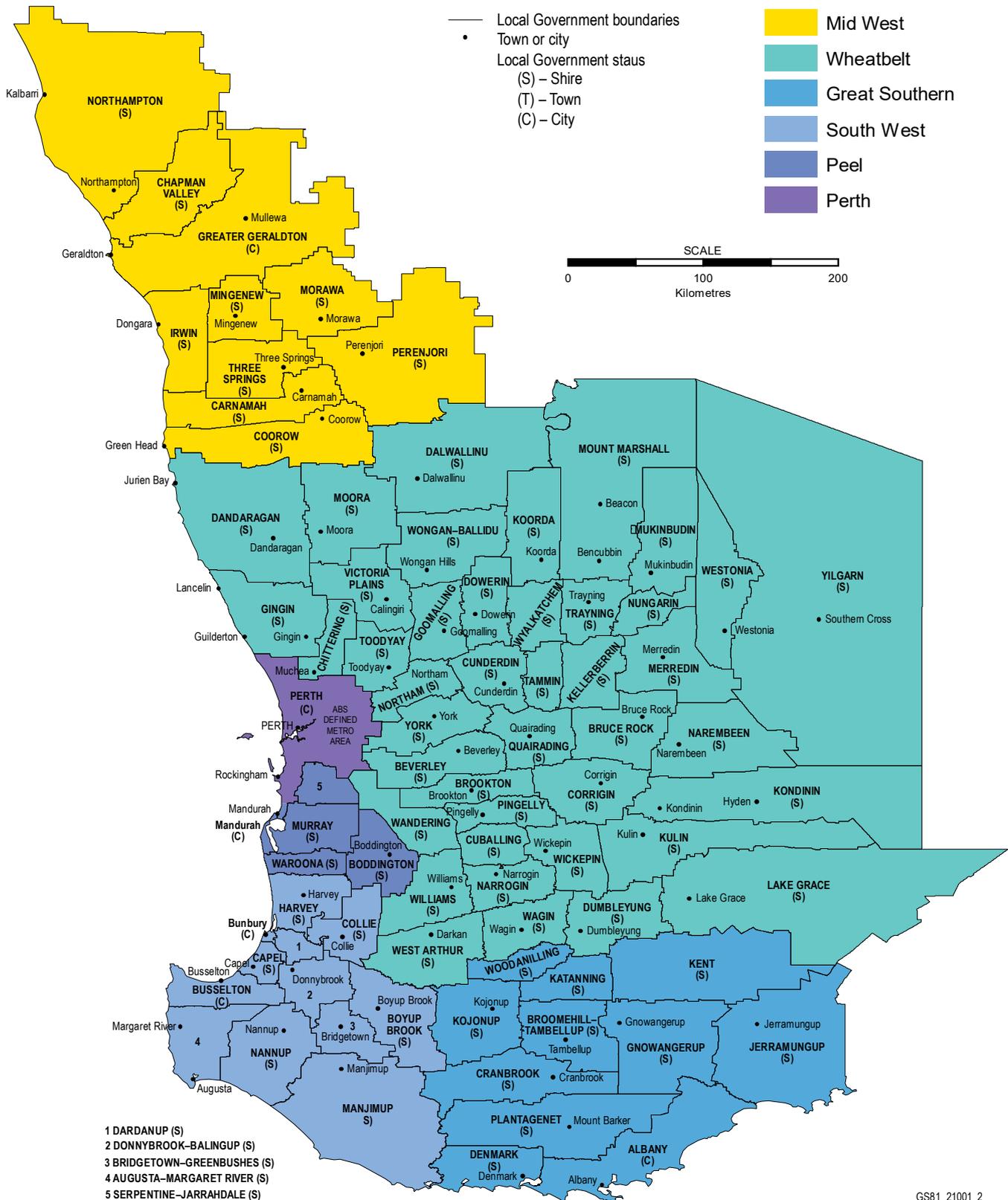
ABBREVIATIONS

A\$	Australian dollar
ABS	Australian Bureau of Statistics
ASX	Australian Securities Exchange
AWAC	Alcoa World Alumina and Chemicals
bbl	Barrels
CFR	Cost, insurance and freight
ct	Carat
DMIRS	Department of Mines, Industry Regulation and Safety
EV	Electric vehicles
FEED	Front End Engineering and Design
FID	Final Investment Decision
FMG	Fortescue Metals Group
FOB	Free-on-Board
FPSO	Floating, Production, Storage and Offloading Facility
FTE	Full-time Equivalent
GJ	Gigajoule
ha	Hectares
ktpa	Thousand tonnes per annum
kg	Kilograms
kl	Kilolitre
km	Kilometres
km ²	Kilometres square
kt	Thousand tonnes
LME	London Metal Exchange
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
MH	Million Hectares
Mmbtu	Million metric British thermal units
MOP	Muriate of Potash
Moz	Million ounces
Mt	Million tonnes
Mtpa	Million tonnes per annum
MW	Megawatt
nfp	Not for publication
NoI	Number of Individuals
OoCE	Office of the Chief Economist
REE	Rare earth elements
SOP	Sulphate of Potash
US	United States of America
US\$	United States dollar
WA	Western Australia
WATC	Western Australian Treasury Corporation
000m ³	Thousand cubic metres



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Map 1. Local Government and Regional boundaries



Map 2. Local Government and Regional boundaries – enlargement

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