



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

WESTERN AUSTRALIAN MINERAL AND PETROLEUM

# STATISTICS DIGEST

2019–20



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# CONTENTS

Foreword	3
Overview	4
Available data	6

## 1 INDUSTRY ACTIVITY 7

1.1 Principal resource projects	7
1.2 Employment	7
1.3 Investment	9
1.3.1 Mining investment	9
1.3.2 Investment pipeline	10
1.4 Exploration	12
1.4.1 Minerals	12
1.4.2 Petroleum	14
1.5 Royalties	15
1.6 Exports	17
1.7 Tenements and titles	18

## 2 COMMODITY REVIEW 19

2.1 Minerals	19
2.1.1 Iron ore	19
2.1.2 Gold	22
2.1.3 Alumina and bauxite	25
2.1.4 Nickel	27
2.1.5 Base metals	29
2.1.6 Lithium	31
2.1.7 Mineral sands	33
2.1.8 Other commodities	35
2.2 Petroleum	37
2.2.1 LNG	38
2.2.2 Crude oil and condensate	40
2.2.3 Natural gas	42

## 3 SUPPLEMENTARY INFORMATION 43



# FOREWORD

It is a privilege to introduce the 2019–20 Mineral and Petroleum Statistics Digest.

Over the years, the Statistics Digest has grown to become a highly anticipated document of record on the performance of the Western Australian resources sector and its place in the world. Today, each release attracts international news coverage and is utilised by government organisations, academics, market analysts, consultants, investment banks, industry associations, and industry professionals all over the world.

WA has a globally significant, diversified resources sector. It is currently the world's largest single supplier of iron ore, garnet and lithium, the second largest exporter of LNG, alumina and diamonds, and was among the top five jurisdictions for the production of cobalt, gold, rare earths, and zircon. The State was also a top 10 producer of nickel, manganese, ilmenite, rutile, and salt.

The events of the past year have been extremely challenging with the COVID-19 pandemic having a disastrous impact on global health and economic conditions. Global commodity markets also felt the impact of the pandemic.

While iron ore and gold producers continued to benefit from high prices, other producers in the oil and gas, alumina, nickel, lithium and base metals industries did not manage as well. This was largely due to supply chain disruptions and the impact of shutdowns on economic activity and demand, which flowed through to lower prices and reduced revenues.

The pandemic also hit the global exploration sector with exploration programs being cancelled and scaled back, particularly in greenfields locations.



The WA resources sector successfully adapted to the new conditions by changing operating models to comply with health and safety, and physical distancing measures, as well as managing border restrictions.

The sector was resilient and largely able to continue operating throughout the pandemic to achieve a banner year.

**David Smith**  
**Director General**  
**Department of Mines, Industry Regulation and Safety**

# OVERVIEW

Western Australia's (WA) resources sector successfully navigated and continued operating throughout the COVID-19 pandemic to deliver record sales of \$172 billion in 2019–20.

This result was principally driven by:

- Iron ore sales valued at a record \$103 billion on the back of near record sales volumes and an eight-year price high.
- Gold sales reaching another all-time high of almost \$16 billion supported by a record annual average gold price of more than \$2,300 per oz.
- Oil sales increasing to \$2.6 billion despite dramatic price falls across the first half of 2020, on the back of higher output through the start-up of new projects and others returning to production.
- Nickel sales recovering amid higher prices in the second half of 2019 to more than \$3.1 billion, the highest level since 2014–15.

WA's resources sector was also supported by a weaker Australian dollar (it was down six per cent), amplifying higher prices received for some commodities and helping to offset price falls for others.

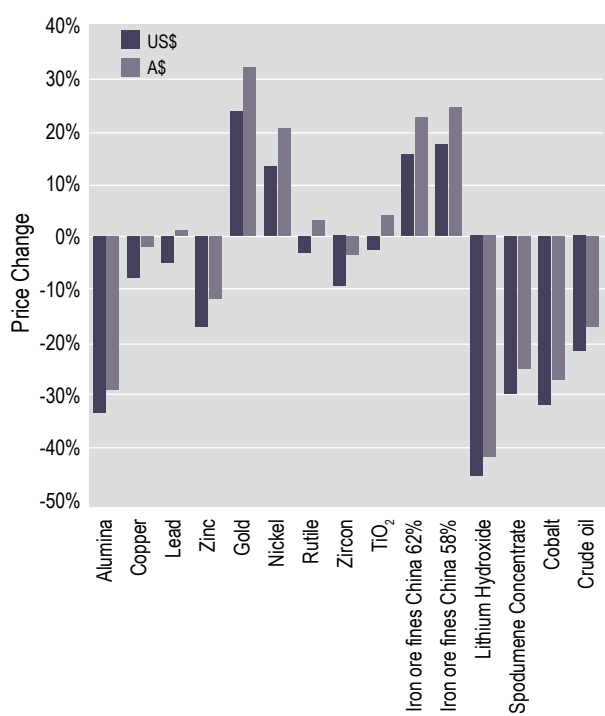


Figure 1 | **Percentage price change between 2018–19 and 2019–20**  
Source: ABS, LME, Kitco, Asian Metal, WATC and Perth Mint



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

## Minerals highlights

The mining of minerals continued to be the dominant activity in the State's resources sector with \$134 billion in sales, accounting for 78 per cent of all sales.

Iron ore was by far the most valuable mined commodity in WA. It accounted for 77 per cent of the value of all mineral sales and 60 per cent of all mineral and petroleum sales in 2019–20 (up from 74 per cent and 54 per cent respectively in 2018–19).

The iron ore sector achieved record sales of \$103 billion in 2019–20, up by 26 per cent on the previous year. This was due to a combination of:

- Higher sales volumes of 836 Mt based on increased output from the major producers, ramp-up at Koolyanobbing and Sino Iron, and the restart of the Koolan Island project.
- The ongoing strength of iron ore prices, principally driven by continued supply disruptions in Brazil following the failure of an upstream tailings dam and the impact of COVID-19.

Gold sales reached an all-time high of almost \$16 billion, up 32 per cent from 2018–19. These sales were supported by a record annual average gold price of more than \$2,300 per oz. High prices were underpinned by the uncertainty created by the COVID-19 pandemic, weak global economic growth, as well as trade and geopolitical tensions. The volume of gold sales from WA was stable.

Weaker prices amid a global market surplus and subdued demand meant the value of alumina and

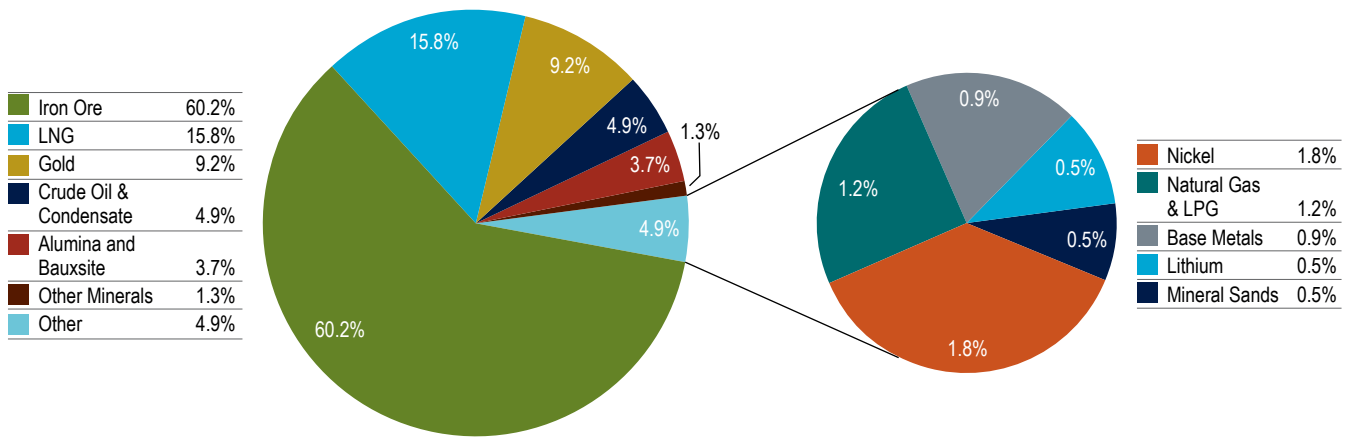


Figure 3 | **Financial year 2019–20 mineral and petroleum summary**  
**\$172 Billion**  
 Source: DMIRS

bauxite sales declined 22 per cent to \$6.4 billion in 2019–20. The volume of alumina sales increased three per cent, while bauxite sales were relatively stable.

The value of nickel sales increased to more than \$3.1 billion – the industry’s highest level in four years. This was largely the result of prices surging to an eight-year-high in the second half of 2019. The surge was driven by a speculative drawdown on LME stocks leading up to and following the announcement of the Indonesian nickel ore export ban. This countered price falls throughout the first half of 2020 on rising LME stocks and demand concerns brought on by the COVID-19 pandemic. The volume of nickel sales was fairly stable year-on-year.

Base metals sales were relatively stable at \$1.6 billion with higher volumes of copper offsetting overall weaker prices due primarily to the impact of the COVID-19 pandemic on economic activity and demand.

Market conditions in the lithium sector were challenging with prices falling amid:

- Excess supplies as the ramp-up of lithium mines outpaced the development of chemical conversion capacity.
- Issues further down the supply chain including delays in the construction of battery mega factories and slowing demand for EV.

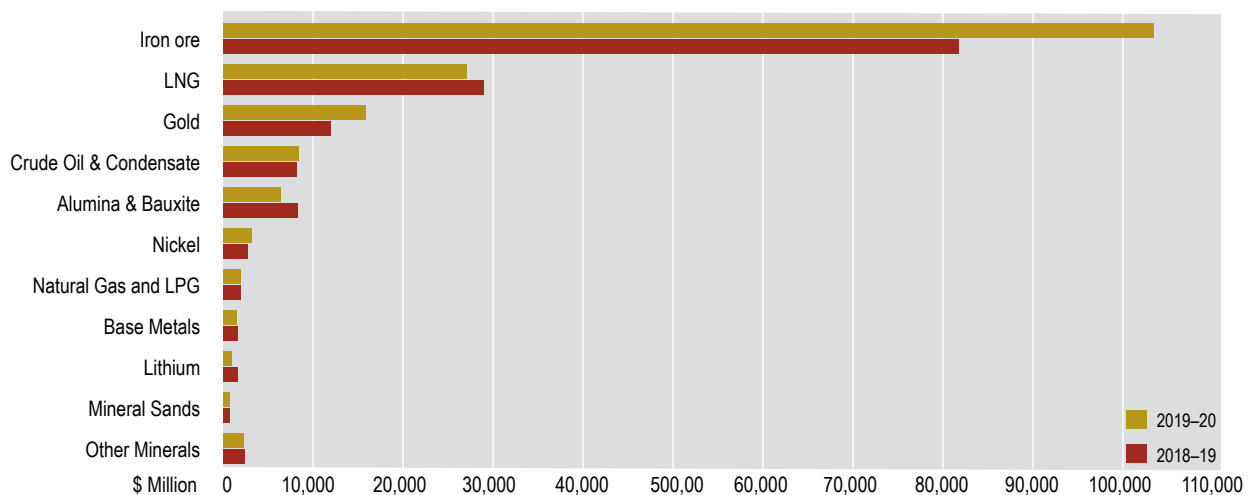


Figure 4 | **Major commodities by value**  
**\$172 Billion**  
 Source: DMIRS, EnergyQuest and Woodside

The quantity of sales also declined after producers shifted focus to producing volumes to meet customer demand, and the Bald Hill and Wodgina projects were put into care and maintenance. These factors saw the value of spodumene concentrate sales (including small volumes of direct shipping lithium ores) decline 45 per cent to \$917 million. This is the first time sales of spodumene concentrate have dropped below \$1 billion since the beginning of the lithium boom in 2016–17.

The remaining minerals sales included:

- Mineral sands sales of \$777 million (up 10 per cent).
- Salt sales of \$375 million (up 24 per cent).
- Coal sales of \$327 million (up two per cent).
- Cobalt sales of \$293 million (down 12 per cent).
- Rare earths sales of \$259 million (down 25 per cent).
- Diamond sales of \$225 million (up two per cent).

### Petroleum highlights

The petroleum sector, which comprises crude oil, condensate, LNG, natural gas and LPG, had sales of \$37 billion in 2019–20, a decrease of four per cent from \$39 billion in 2018–19.

The sector's share of total mineral and petroleum sales also dropped to 22 per cent in 2019–20 from 26 per cent in 2018–19.

LNG remained the most valuable petroleum product produced in WA at \$27 billion or 72 per cent of petroleum sales, followed by condensate at \$5.7 billion (15 per cent) and oil at \$2.6 billion (seven per cent).

The value of LNG and condensate sales declined (each down seven per cent), most dramatically in the June quarter 2020, as oil prices fell to their lowest level in 20 years. This was from a combination of excess supply amid a price war between Russia and Saudi Arabia, and subdued global demand due to the COVID-19 pandemic and related economic shutdowns.

Despite weaker prices, LNG and condensate output reached record levels with more than 47 Mt of LNG (up eight per cent) and more than 14 million KL of condensate (up 26 per cent) produced. This reflected

projects including Wheatstone and Pluto operating at above nameplate capacity and the first sales from Prelude FLNG (prior to its suspension in February 2020 due to electrical issues). The output was also achieved despite the shutdown of Train 2 at Gorgon in May over safety concerns. Condensate production was also boosted by the ramp-up of the Ichthys project.<sup>1</sup>

While negatively affected by lower prices, oil sales were up on a 63 per cent increase in production volumes to five million KL, a level last observed in 2016–17. Production was boosted by the start-up of the Greater Enfield project fields, the Vincent field's return to production, as well as the ramp-up of the Pyrenees project after an extended maintenance shutdown.

## AVAILABLE 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.
2. **Economic indicators** – this file contains information about how the State's mineral and petroleum industry contributes to the economy through exploration, investment, employment and royalties.
3. **Spatial and regional** – this file contains information about mining and petroleum tenements, the distribution of the value of mineral and petroleum sales, and mining employment across the State.

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



<sup>1</sup> The majority of condensate from Ichthys is produced direct from the field via a Floating Production Storage and Offloading vessel. As such, it is included in WA figures.



# 1 INDUSTRY ACTIVITY

## 1.1 Principal resource projects

WA's mining industry consists of 123 predominantly higher value and export-oriented mining projects.

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

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

The number of gold projects increased from 47 in 2018–19 to 52 in 2019–20. The increase was predominantly due to high prices providing an incentive for small-scale gold mines to restart.

The number of iron ore and nickel projects increased with operations at Kimberley Metals Group's Ridges iron ore project and First Quantum Minerals' Ravensthorpe nickel project restarting amid more favourable market conditions.

There were 22 principal petroleum projects producing oil, gas and condensates from 53 fields onshore and in the Commonwealth waters around WA. These projects had 13 processing plants, predominantly for LNG exports and domestic gas sales.

The total number of petroleum projects was down from 23 in 2018–19 due to Mitsui and Co's Dongara gas project ceasing production. The number of producing fields decreased from 57, largely due to a change in fields at the North West Shelf, Varanus Island, Waitsia and Enfield projects.



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

## 1.2 Employment

WA's mining and petroleum sector employed a record average of 135,001 people (107,457 in FTE terms) during 2019–20, up from an average of 128,374 people (102,392 FTEs in 2018–19).

Mining (including exploration) was responsible for the lion's share of employment, with an average of 133,713 people (106,291 FTEs) working in the industry during the year.

Most of the growth in employment was due to increases in construction activities in the iron ore (up 5,385 persons or 5,637 FTEs) and nickel (up 1,275 persons or 1,325 FTEs) industries, while employment in mineral exploration was also up 382 persons (417 FTEs) or 12 per cent.

The average number of people employed in the lithium industry fell from 3,606 in 2018–19 to 2,663 in 2019–20. The fall was even more substantial in FTE terms, which dropped from 4,855 in 2018–19 to 2,564 in 2019–20.

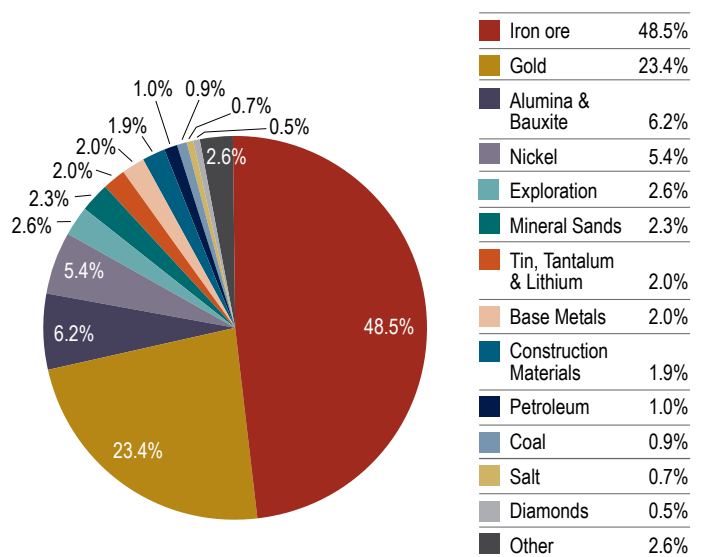


Figure 5 **WA mining and petroleum employment by commodity 2019–20**  
135,001 individuals  
Source: DMIRS

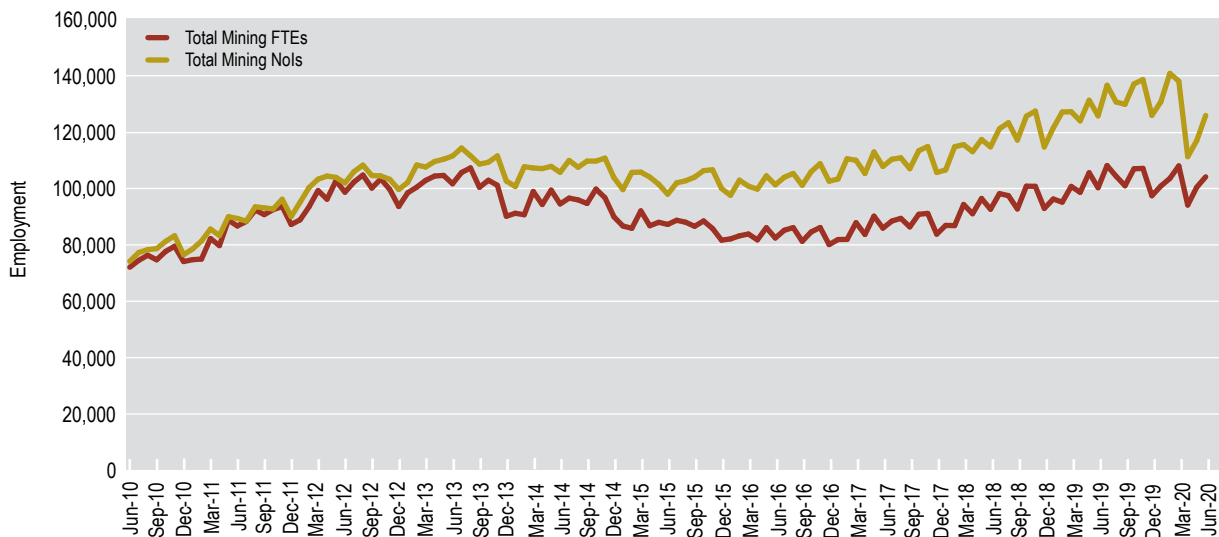


Figure 6 **FTE and Nol employment in WA's mining industry**  
Source: DMIRS

Employment in onshore and coastal petroleum operations also declined from 1,396 people (1,238 FTEs) in 2018–19 to 1,288 people (1,166 FTEs) in 2019–20.

The largest number of people were employed in iron ore mining (65,466 persons or 50,753 FTEs), while gold and alumina-bauxite mining and refining were the next highest with average employment of 31,567 (26,414 FTEs) and 8,434 persons (6,765 FTEs) respectively.

The overall growth in mining sector employment was impacted by the COVID-19 pandemic, which changed workforce practices. This included limits on the total number of workers on site at any one time and changes to fly-in, fly-out rosters due to State-based restrictions and social distancing measures. Resources sector wages were also significantly impacted by COVID-19.

The impact of restrictions and measures became evident in April with average employment numbers and FTE employment (excluding exploration) declining by 19 and 13 per cent respectively compared to March. Average employment numbers and FTEs increased in May and June.

However, while FTE employment had largely returned to pre-COVID-19 levels by the end of the financial year, average employment numbers remained down, likely due to ongoing efforts to curb the spread of the pandemic.

COVID-19's impact on mining employment was also evident in the difference between average employment numbers and FTEs, which fell to its lowest level in five years within the same period.

A fall in average employment numbers and FTEs in the mineral exploration sector was evident in April, reflecting cuts to exploration programs and spending during the height of WA's COVID-19 restrictions, including limits on regional travel. By June, average employment numbers and FTEs in the exploration sector had largely returned to pre-COVID-19 levels.

In the onshore petroleum sector, the average number of individuals on site and FTEs at the end of the financial year remained below March levels. This likely reflected job cuts associated with the impact of COVID-19 on oil and gas demand.



The economic indicators file provides detailed employment data including:

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

## A note about employment data

The department reports employment data in two different ways:

1. Number of Individuals: The number of individual people who have performed at least one hour's work on a mine site.
2. Full-time Equivalent: The number of people employed according to standardised full-time equivalent hours.

These figures are based on 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.

Employment data collected and published by the ABS is classified using ANZSIC, and is not directly comparable to data collected by DMIRS.

## 1.3 Investment



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

- Mining investment in WA.
- New capital investment for mining in WA.

### 1.3.1 Mining investment

Almost \$19 billion was invested in the WA mining and petroleum sector, up from \$17 billion in 2018–19.

This represents the first year-on-year increase in mining and petroleum investment in WA since the peak of the iron ore and LNG investment boom in 2012–13.

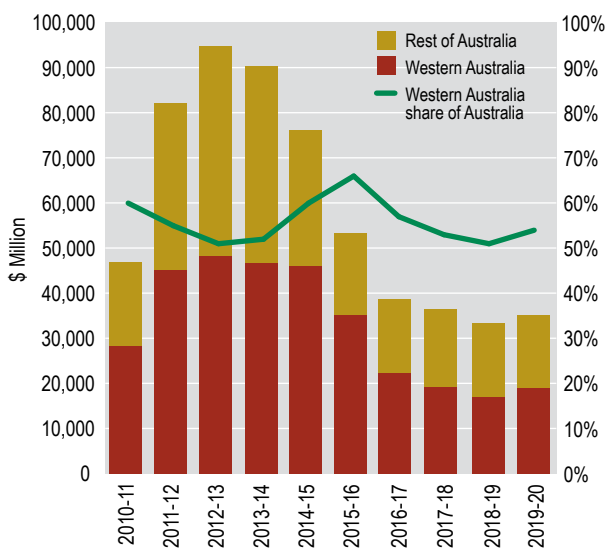


Figure 7 | Mining investment  
Source: ABS

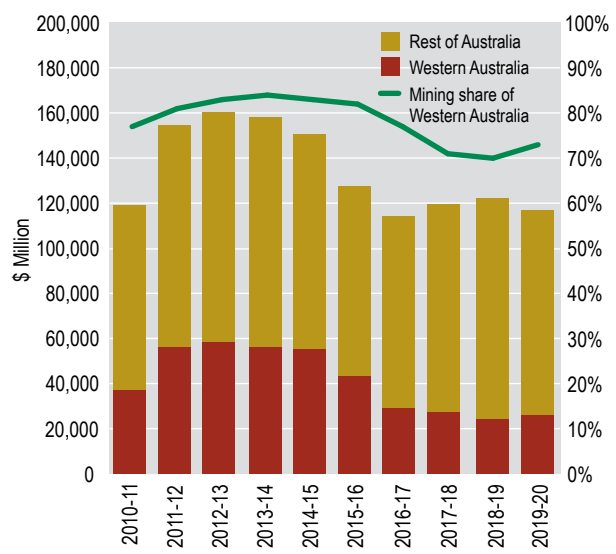


Figure 8 | New capital expenditure  
Source: ABS

While the scale of investment is still well below the boom-time peak, this is a positive development that was largely on the back of major iron ore producers Rio Tinto, BHP and FMG investing in large-scale production sustaining projects, as well as FMG's Iron Bridge magnetite project.

WA's share of national mining and petroleum investment increased to 54 per cent due to greater levels of investment in WA and weaker investment across the rest of the country. The State's share remains below its 10-year average of 56 per cent.

The resources sector was primarily responsible for growth in total new capital expenditure in WA to \$26 billion, up from \$24 billion in 2018–19. The sector's share of total new capital expenditure in WA increased to 73 per cent but remains below its 10-year average of 79 per cent.

COVID-19 did not have an immediate impact on levels of mining investment in WA in the June quarter 2020, with investment up 14 per cent compared to the March quarter. It was also up 20 per cent compared to the same period in 2019. However, the impact of more than \$60 billion in delayed investment decisions that coincided with COVID-19 is expected to become more apparent in the medium to long term. The projects deferred included:

- Woodside's Scarborough, Pluto Train 2 and Browse developments.
- Shell's Crux gas field development.
- Expansions of the Wagerup and Pinjarra alumina refineries.

### 1.3.2 Investment pipeline

DMIRS also monitors and collects information on mineral and petroleum development projects in WA to estimate levels of future investment.

As of September 2020, WA had an estimated \$129 billion of resources projects in the development pipeline, up from the March 2020 estimate of \$118 billion and September 2019 estimate of \$108 billion.

Significant new projects announced during the year included:

- Mineral Resources' iron ore development plans in the West Pilbara and Koolyanobbing iron ore expansion.
- Santos' Dorado Phase 1 oil project.
- Rio Tinto's Western Turner Syncline Phase 2 iron ore project.
- Lynas Corporation's cracking and leaching plant in Kalgoorlie.
- Strike Energy's West Erregulla gas project.

There were also a large number of gold projects announced and updated amid favorable market conditions including:

- Ausgold's Katanning gold project.
- Norton Gold Fields Paddington mill expansion and Binduli heap leaching project.
- Bardoc Gold's namesake gold project.
- Newcrest Mining and Greatland Gold's Havieron gold project.
- Growth options at KCGM's Superpit including Oroya Brownhill and Fimiston South.
- Vango Mining's Marymia project.
- ACH Minerals' Ravensthorpe gold project.
- Poseidon Nickel's Windarra gold tailings project.
- Ora Banda Mining's Davyhurst re-start.
- Ramelius Resources' Penny Gold and Eridanus underground projects.

#### A note about investment pipeline data

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

- Under construction – those actually under construction.
- Committed – company has reached a positive FID.
- Planned – those undergoing advanced feasibility studies including DFS, BFS and FEED.
- Possible – those at an early stage of development including exploration and/or initial scoping and PFS.

Sector	Commodity	CAPEX (\$ million)	
		Committed/ under construction	Planned/ possible
Minerals	Gold	679	1,714
	Iron ore	17,093	11,692
	Nickel, copper and zinc	356	5,772
	Lithium	1,333	2,164
	Infrastructure	1,306	5,698
	Other minerals	609	10,071
	<b>Sub-total Minerals</b>	<b>21,375</b>	<b>37,112</b>
Petroleum	Crude oil and condensate	0	2,200
	Gas	0	200
	LNG	6,995	61,007
	Pipelines and infrastructure	0	0
	<b>Sub-total Petroleum</b>	<b>6,995</b>	<b>63,407</b>
<b>Total</b>		<b>28,371</b>	<b>100,518</b>

Source: DMIRS

The value of projects under construction or in the committed stage of development was an estimated \$28.4 billion at September 2020, up from \$27.2 billion in March 2020 and \$25.4 billion in September last year.

This increase reflects, in part, a decision by DMIRS to capture investment figures in power generation projects built for the exclusive purpose of providing energy and/or transmission infrastructure to resource projects, specifically:

- FMG's Pilbara Generation and Pilbara Transmission projects.
- Alinta Energy's Chichester solar gas hybrid project.

The increase was also due to projects moving into the construction phase during the past year including Woodside's Julimar-Brunello Phase 2 project and Rio Tinto's Western Turner Syncline Phase 2 expansion, and the Beyondie Sulphate of Potash project. There were also revisions and updates to several capital expenditure estimates.

Construction on some projects was also completed most notably at lithium developments.

Other projects were greenlit including FMG's Queens Valley project and Woodside's interconnector pipeline to connect Pluto LNG to the Karratha gas plant and its Greater Western Flank Stage 3 projects.

The value of planned or possible projects increased to \$100.5 billion from \$91.1 billion in March 2020 and \$82.4 billion in September 2020.

This increase is due in part to the announcement of Santos's Dorado phase one oil project and Lynas Corporation's cracking and leaching plant to be built in Kalgoorlie. It is also the result of positive developments regarding Flinders Mines' Pilbara Iron Ore Project, BBI Group's Balla Balla port and rail project, as well as Grange Resources' Southdown magnetite project, that mean these projects are now reflected in DMIRS estimates.

New gold and iron ore projects have also been captured, as were a slew of upward revisions in capital expenditure estimates across a range of commodities.

Another key development over the past 12 months is that while project developments in most sub-sectors increased, challenging market conditions in the lithium industry caused the delay or deferment of several investment projects including:

- Stages 3 to 5 of the Kemerton lithium hydroxide facility.
- Tianqi Lithium's second lithium hydroxide processing plant at Kwinana.
- Covalent Lithium's Mt Holland lithium project.
- Talison Lithium's further expansion at Greenbushes.
- Expansion of Pilbara Minerals' Pilgangoora project.

## Renewables and the mining sector

The WA resources sector is leading the way in using renewable energy to reduce its carbon footprint.

The sector has been proactive in commencing the transition to renewables and there are many recent and current examples of resources projects using renewable energy to power projects.

Four renewable energy projects are already operating and providing a significant share of total energy requirements at Sandfire Resources' DeGrussa copper-gold project, Gold Fields Agnew and Granny Smith mines, and IGO's Nova operations.

Building on this foundation, a wave of new renewable projects are under development that include:

### Rio Tinto's Koodaideri Solar plant

A 34MW solar plant comprising 100,000 solar panels that will provide 65 per cent of the Koodaideri iron ore project's average electricity demand. The solar plant will also supply the Tom Price operation with a new battery storage system, designed to generate electricity to the entire Pilbara power network.

### FMG's Pilbara Energy Connect Program

A hybrid solar gas energy project consisting of 275km of high-voltage transmission lines connecting the company's mine sites, 150MW of gas-fired generation and 150MW of solar PV generation. This will be supplemented by large-scale battery storage.

### Alinta's Chichester Solar Gas Hybrid

Alinta Energy will build, own and operate a 60MW solar PV generation facility at the Chichester Hub and 60km of transmission lines linking the Christmas Creek and Cloudbreak mining operations with Alinta's Newman gas-fired power station. On completion, the project will integrate with the Pilbara Energy Connect Program.

## 1.4 Exploration



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

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

### 1.4.1 Minerals

Mineral exploration expenditure in WA was \$1.7 billion, an increase of 17 per cent from \$1.4 billion in 2018-19.

Growth in mineral exploration expenditure was mainly due to increased spending on gold (up \$110 million) supported by record high prices. The next largest expenditure increases were for copper (up \$66 million), likely owing to increased activity in the Paterson Province, iron ore (up \$38 million), and nickel/cobalt (up \$32 million).

The main targets of mineral exploration in WA were gold (46 per cent), iron ore (21 per cent), copper (13 per cent) and other minerals (9 per cent).

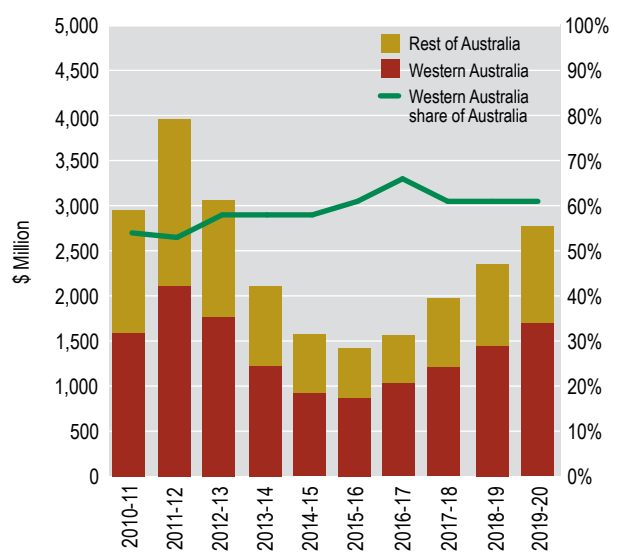


Figure 9 | Mineral exploration expenditure  
Source: ABS

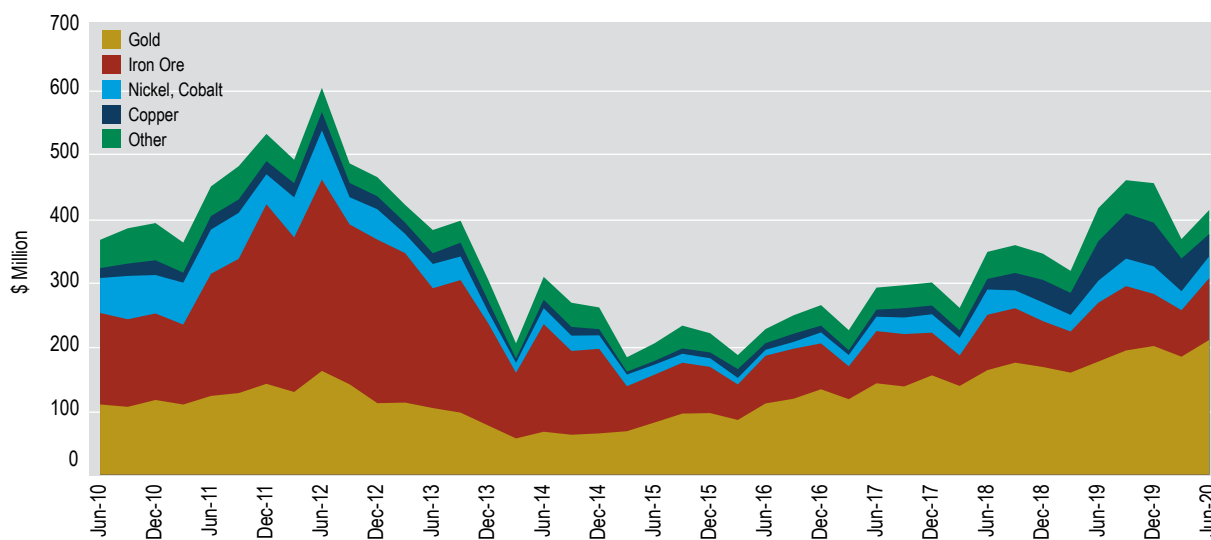


Figure 10 | **WA mineral exploration expenditure by commodity**  
Source: ABS

The State's share of national expenditure was fairly stable at 61 per cent, suggesting increased spending in WA was matched in the rest of the country.

While mineral exploration expenditure in WA increased overall, spending in the June quarter declined compared to the same period in 2019. This was due, in part, to the impact of COVID-19 restrictions in WA including regional travel restrictions, and the resultant cancellation and scaling back of exploration programs across the State.

The restrictions affected exploration programs in greenfields areas the most, which contributed to a fall in the share of exploration on new deposits for the first time since 2014–15. The share declined to 38 per cent in 2019–20 from 42 per cent in 2018–19.

Mineral exploration activities during the year targeted a range of prospects.

Drilling results and resource upgrades for gold, nickel and platinum group elements, as well as copper, were particularly strong in 2019–20. The most notable were discoveries at Julimar, Ngapakarra (Winu), Havieron, Hemi, Rockford and Lantern prospects, as well as new gold lodes identified across a number of prospects in the Yilgarn craton (described below).

The Yilgarn craton remained a hotspot of exploration activity with significant discoveries that included:

- Bellevue Gold's discovery of a new high-grade lode in the historic Bellevue underground mine, as well as its announcement of significant drilling results for the Deacon and Viago lodes prospect. Total resources are now 7 Mt at 10 g/t.
- The discovery of high-grade gold prospects called Panda and Green Lantern at Central Norseman Gold Corporation's Central Norseman project.
- Multiple high-grade results by Silver Lake Resources at Deflector South West with a maiden resource estimate of 634kt at 14.9 g/t gold and 0.6 per cent copper.

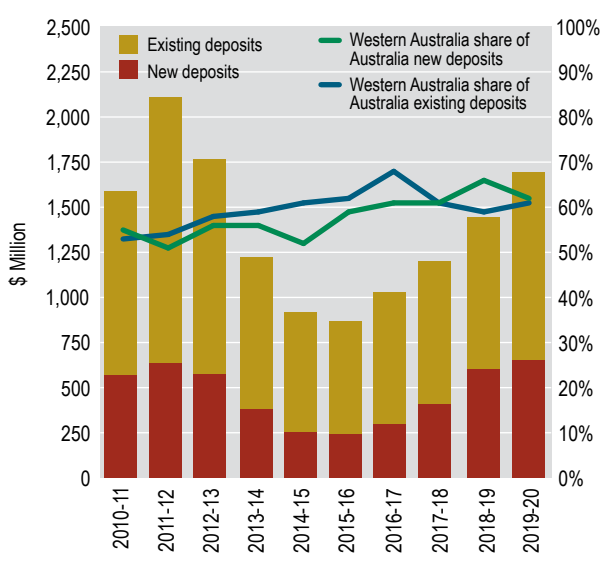


Figure 11 | **WA mineral exploration expenditure by type**  
Source: ABS

- A nickel discovery by Toro Energy at the Dusty prospect, marking the first discovery of massive nickel sulfides within the typically gold-enriched Yandal greenstone belt.
- Estrella Resources intersected bonanza-grade gold from drilling north of the Munda pit as well as in the Starlight Lode and Break of Day.

Increased interest and drilling activity across other parts of the State, including the Paterson province, Albany-Fraser, South West, Musgrave province, and Pilbara craton, also led to significant exploration announcements over the past year:

- **Paterson**

Rio Tinto announced a maiden inferred mineral resource for Winu at 503 Mt at 0.45 per cent copper equivalent, 0.27 g/t of gold, and 2.15 g/t of silver, with a new gold discovery also announced at Ngapakarra.

Drilling continued at Newcrest Mining and Greatland Gold's Havieron project ahead of a maiden mineral resource estimate later this year.

- **Musgrave**

A maiden probable ore reserve of 220 Mt at 0.33 per cent nickel and 0.36 per cent copper was announced for the Babel and Nebo deposits at West Musgrave.

- **South West**

Chalice Gold Mines at Julimar discovered high-grade nickel-copper-palladium mineralisation.

- **Capricorn**

Bryah Resources and OM Holdings discovered nickel-copper-cobalt mineralisation at the Mt Labouchere prospect at Bryah Basin, within an area traditionally prospective for manganese.

Vango Mining announced high-grade gold intersections from the newly discovered PHB-1 at Marymia.

- **Albany-Fraser**

Legend Mining discovered massive nickel sulphides at the Mawson prospect (part of Rockford).

Galileo Mining and the Creasy Group discovered nickel sulfides at the Lantern prospect within the Fraser Range project.

- **Pilbara**

De Grey Mining's Hemi deposit has three zones of significant mineralisation – the Brolga, Aquila and Crow zones. Another discovery at Falcon further extends mineralisation at Hemi.

## 1.4.2 Petroleum

After showing growth in 2018–19, petroleum exploration expenditure was down by 19 per cent to \$596 million.

This was largely the result of the lowest June quarter spend since 1996, as exploration budgets were cut in response to the fall in oil prices to a 20-year low as well as COVID-19 restrictions.

WA's share of petroleum exploration spend declined to 47 per cent, due to increased spending in Victoria and Queensland.

Exploration activity has been led by work on the Dorado field, the Bratwurst discovery for future tieback to Prelude, as well as in the Perth basin at West Erregulla and Beharra Springs.

Most of the exploration spending across Australia is in offshore rather than onshore areas. This remained the case in 2019–20 with offshore areas responsible for 37 per cent of total petroleum exploration expenditure in Australia.

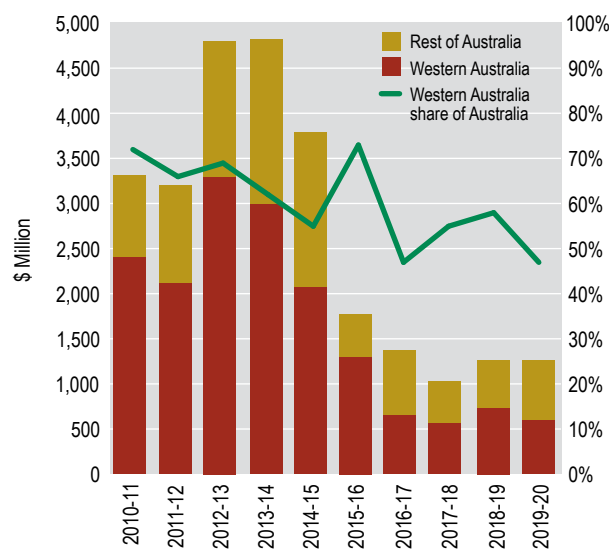


Figure 12 | **Petroleum exploration expenditure**  
Source: ABS



## 1.5 Royalties

The WA Government received a record \$9.3 billion of royalty revenue in 2019–20 from the State's minerals and petroleum producers, an increase of 42 per cent on 2018–19.

Royalty receipts from the iron ore industry grew 60 per cent on the previous year due to higher volumes and prices. The industry's share of total royalty revenue also increased to 84 per cent from 75 per cent the previous year.

Consistent with strong market conditions, the gold industry's royalty payments increased by 24 per cent to a record \$361 million.

Conversely, challenging market conditions for the lithium and petroleum industries resulted in royalty payments falling 20 per cent and 41 per cent respectively.

WA also received \$690 million in grants for the North West Shelf project, a decrease of 22 per cent on 2018–19 amid lower prices.

### A note about royalties

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

The figure reported in this publication is the 'royalty receipts' for the relevant period, i.e. the actual funds the State Government received during 2019–20. This means the royalty receipts are offset from sales figures by one quarter and comprise the royalties accrued in the June, September, December 2019 quarters and the March 2020 quarter.

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

Included in the royalty receipts for petroleum is the Commonwealth's share of royalties collected under the *Petroleum (Submerged Lands) Act 1967*.

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

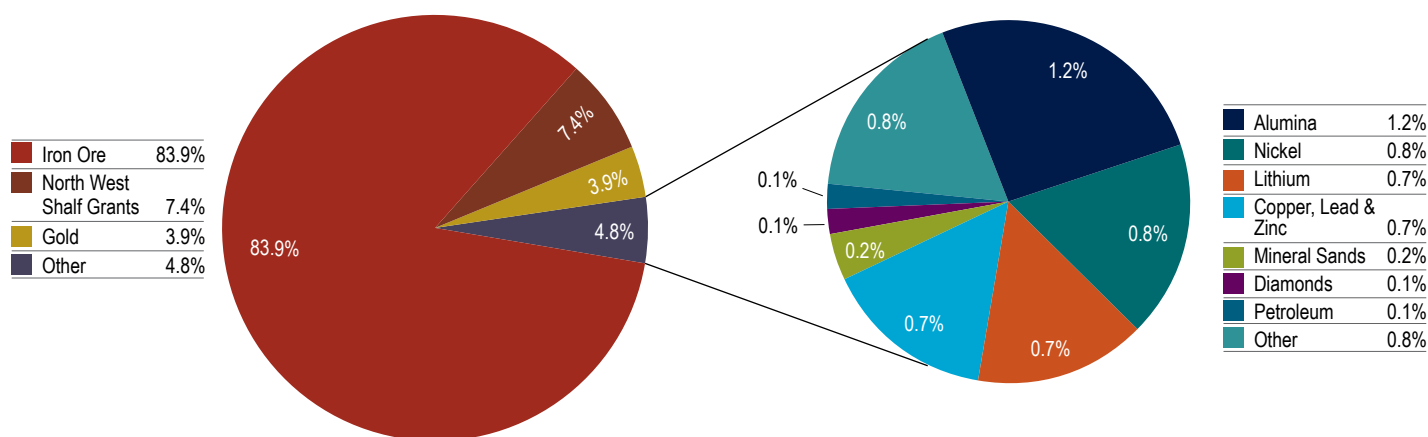


Figure 13 | **Royalty receipts and North West Shelf grants 2019–20**  
**\$9.3 Billion**  
 Source: DMIRS and Department of Treasury

<b>TABLE 2. Royalty receipts and North West Shelf grants 2018–19 and 2019–20</b>				
<b>Commodity</b>	<b>2018–19</b>	<b>2019–20</b>	<b>2019–20 growth</b>	
	<b>Total \$</b>	<b>Total \$</b>	<b>\$</b>	<b>%</b>
Alumina	135,004,000	113,602,584	-21,401,416	-16%
Copper, Lead & Zinc	76,167,000	67,643,885	-8,523,115	-11%
Diamonds	11,625,000	11,335,632	-289,368	-2%
Gold	291,416,000	361,428,949	70,012,949	24%
Mineral sands	18,560,000	23,004,163	4,444,163	24%
Iron ore	4,884,196,000	7,802,720,539	2,918,524,539	60%
Lithium	83,247,252	66,311,831	-16,935,421	-20%
Nickel	65,991,000	76,155,817	10,164,817	15%
Petroleum	11,676,000	6,922,254	-4,753,746	-41%
Other	86,701,748	78,304,997	-8,396,751	-10%
<b>Total royalty receipts</b>	<b>5,664,583,000</b>	<b>8,607,430,650</b>	<b>2,942,847,650</b>	<b>52%</b>
<b>North West Shelf Grants</b>	<b>889,356,000</b>	<b>690,202,284</b>	<b>-199,153,716</b>	<b>-22%</b>
<b>Total revenue</b>	<b>6,553,938,000</b>	<b>9,297,632,934</b>	<b>2,743,694,934</b>	<b>42%</b>



The economic indicators file contains:

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

## 1.6 Exports

WA's total merchandise exports totalled almost \$184 billion in 2019–20, the highest for any 12-month period since records began.

Minerals and petroleum exports were valued at an estimated \$174 billion, accounting for 94 per cent of total exports from the State. The WA resources sector was also responsible for 60 per cent of the nation's \$290 billion in resource sector exports in 2019–20.

While WA exported resources to 104 countries in 2019–20, the value of these exports was highly concentrated with the top 10 destination countries responsible for more than 90 per cent of all shipments.

China, in particular, continues to play a massive role in the State's trade, accounting for \$98.3 billion in exports or more than half of total shipments.

Japan was the State's second largest export market, though the value of merchandise exports fell from \$24.1 billion to \$22.5 billion. The United Kingdom was ranked third with exports increasing by more than 163 per cent from 2018–19.

Overall, Australia's resources exports have doubled over the past 10 years with a strong period of project investment driving record export volumes. Australia's resources sector accounted for 76 per cent of Australia's total export revenue in 2019–20.



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

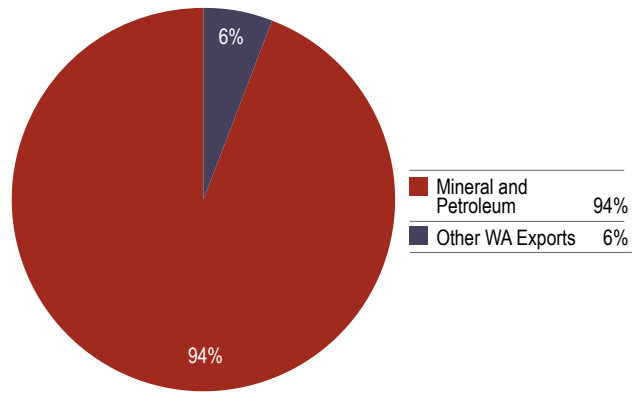


Figure 14 **WA merchandise exports 2019–20**  
\$184 Billion

Source: DMIRS and ABS

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

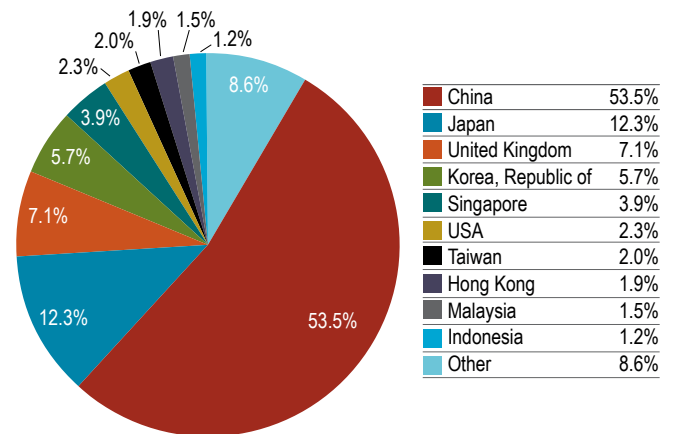


Figure 15 **WA merchandise exports by country 2019–20**  
\$184 Billion

Source: ABS

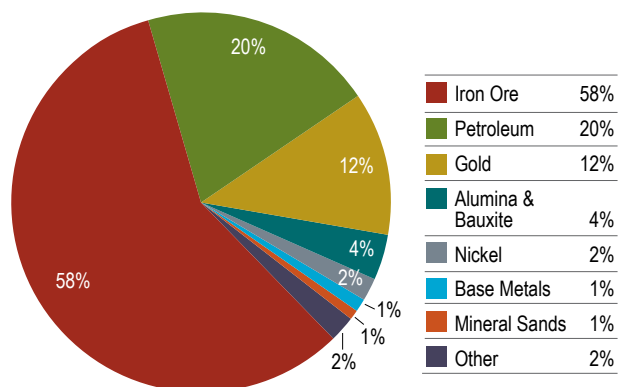


Figure 16 **WA mineral and petroleum exports 2019–20**  
\$174 Billion

Source: DMIRS and ABS

## 1.7 Tenements and titles

Tenement activity is one of several indicators of the resources industry's health and the scale of mining activities across WA.

As of June 2020, more than 49 million ha of land within WA (roughly three times the area of California) was overlaid by mining tenure (i.e. prospecting and exploration licences, mining leases and other mineral claims). To put this into perspective, WA has a total land area of almost 253 million ha.

This was up from 47 million ha the previous year, but remains down from an all-time high of almost 70 million ha in 2011–12.

The total number of mining tenements in force was up slightly at 21,574 compared to 21,348 in the last financial year.

Most notably, the number of mining leases and exploration licences in force increased, supporting a rise in mining and exploration activities.

The area (70,264 sq. km from 70,372 sq. km) and number of petroleum titles (222 from 225) in force in WA's jurisdiction were both down marginally, reflecting, at least in part, weaker market conditions in the petroleum sector.

### A note about petroleum titles

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.



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

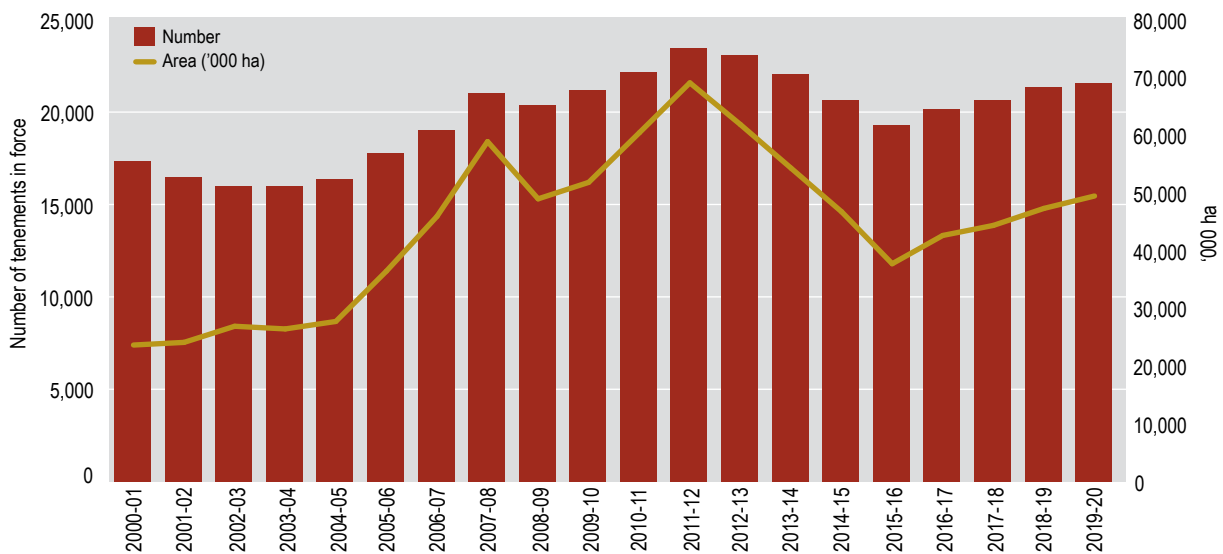


Figure 17 | Mining tenements in force  
Source: DMIRS

## 2 COMMODITY REVIEW

### COVID-19 and the WA resources sector

The WA resources sector was largely able to continue operating throughout the COVID-19 pandemic.

However, the sector did have to adapt by changing operating models including fly-in, fly-out workforce arrangements, shift schedules and workplace interactions to comply with health and safety and physical distancing measures, as well as managing border restrictions.

Resources sector wages were also significantly affected by COVID-19, as were commodity prices.

While iron ore and gold producers maintained production and access to markets, and benefitted from price rises, other parts of sector did not manage as well.

The alumina, nickel, lithium, base metals, and oil and gas industries were affected by supply chain disruptions, and the impact of shutdowns on economic activity and demand, flowing through to lower prices and reduced revenues.

The oil and gas sector, in particular, was significantly impacted by a sharp decline in global demand, which, combined with a price war between Saudi Arabia and Russia, pushed down prices to a 20-year low in April 2020. This resulted in financial losses, write-downs in the value of assets, and significant job losses for both operations and contractors. It also manifested in the deferral of planned investments.

While mineral exploration remained strong overall, it too was hit hard by the COVID-19 pandemic in the June quarter with the cancellation and scaling back of exploration programs, particularly in greenfields locations. With oil prices falling to a 20-year low, petroleum exploration did not fare as well and was down after its lowest June quarter spend since 1996.

### 2.1 Minerals

The minerals sold in WA totalled \$134 billion in 2019–20, up 21 per cent from \$111 billion in 2018–19.

Mineral sales accounted for 78 per cent of the value of all resources sales for WA in 2019–20.

#### 2.1.1 Iron ore

##### Prices

Iron ore prices further strengthened in 2019–20, with the average price of 62 per cent iron increasing to \$138 per tonne and the average price of 58 per cent iron increasing to \$123 per tonne.

Prices reached \$172 per tonne and \$159 per tonne in July 2019, the highest monthly averages since mid-2011.

Prices were driven higher by a range of supply and demand factors including:

- Supply disruptions in Brazil and a slower than expected ramp-up in output after the re-start of operations.
- Production downgrades and supply disruptions in WA because of weather related events including Tropical Cyclones Blake (in January) and Damien (in February).
- Despite COVID-19 related shutdowns, ongoing robust demand from China supported by announcements the Government would provide additional economic stimulus to speed up infrastructure spending.
- The drawdown of iron ore stockpiles at Chinese ports.

Australian dollar prices were also boosted by a weaker Australian dollar against the US dollar.

Amid ongoing tightness in the iron ore market, the year-on-year price difference between high and low grades was fairly stable at around \$14–\$15 per tonne. It remains below its peak of almost \$20 per tonne in mid-2017.

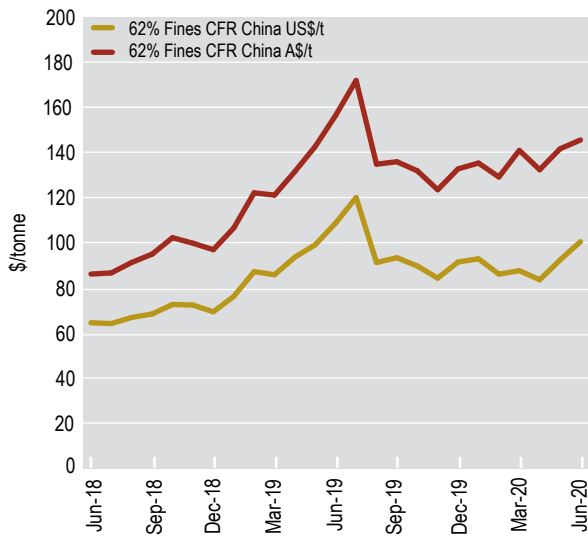


Figure 18 | **62% Fe iron ore price**  
Source: Argus Metals

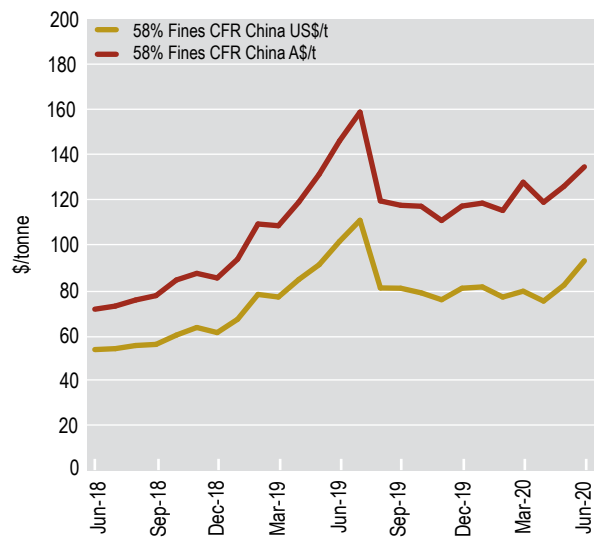


Figure 19 | **58% Fe iron ore price**  
Source: Argus Metals and TSI

### Quantity and value

Iron ore was WA's most valuable commodity once again in 2019–20, accounting for 60 per cent of all sales and 77 per cent of mineral sales.

Higher prices, combined with strong sales quantities, saw the value of iron ore sales reach \$103 billion in 2019–20 up by 26 per cent from \$82 billion in 2018–19. This marks the first time that a single commodity produced in WA has ever been valued at more than \$100 billion. To put this into perspective, only four years ago total sales from the WA minerals and petroleum industry were valued at \$88 billion.

The State had 836 Mt in iron ore sales in 2019–20, the second highest level on record after 839 Mt in 2017–18. This was achieved despite adverse weather during the Pilbara cyclone season in the March quarter causing sales volumes to fall by nine per cent. Sales quantities rebounded to 226 Mt in June, an all-time record for a quarter, to end the year on a high.

Three major producers – Rio Tinto, BHP, and FMG – once again dominated sales with 88 per cent of total sales volumes.

The three majors were also largely responsible for the year-on-year increase in volumes as they recovered from the impact of Tropical Cyclone Veronica in March 2019. The ramp-up of Sino Iron, Koolyanobbing, and Koolan Island also provided a boost.

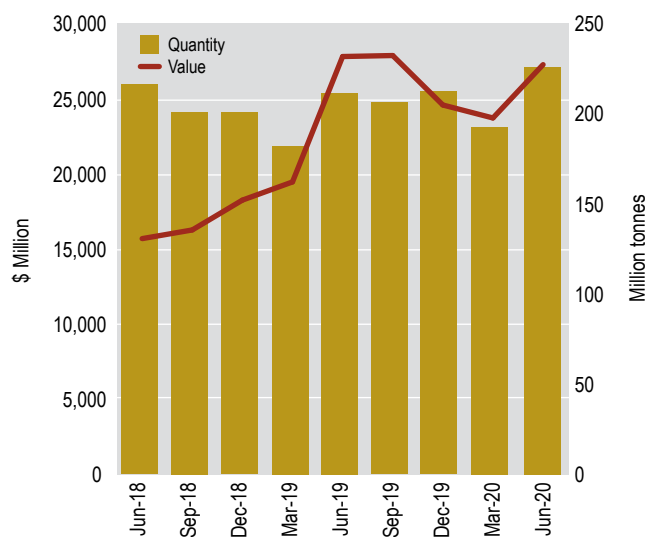


Figure 20 | **Iron ore quantity and value by quarter**  
Source: DMIRS

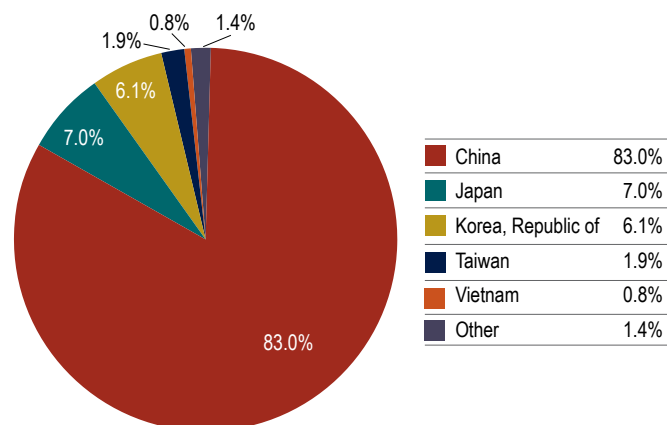


Figure 21 | **Iron ore exports 2019–20**  
**\$101 Billion**  
Source: ABS

WA was still the world's largest seaborne producer in 2019, accounting for more than 30 per cent of global iron ore production. WA was also responsible for 99 per cent of Australia's iron ore production.

Sales from WA were mostly exported to China (83 per cent), with Japan (seven per cent) and South Korea (six per cent) the next two largest markets.

### Notable events

- China's General Administration of Customs announced new inspection rules regarding iron ore imports that commenced on 1 June 2020. Under the new rules, iron ore will be inspected at the request of the trader or importer instead of mandated for all shipments.



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



Figure 23 | **Iron ore exploration expenditure 2019-20**  
Total WA spend \$349 Million  
Source: ABS

- From March 2020 interstate or overseas fly-in, fly-out workers were unable to enter the State without completing a mandatory 14-day quarantine period due to COVID-19. Iron ore miners relocated staff, with an estimated 700 movements of staff by Rio Tinto, 300 by BHP, and 320 by FMG.
- Rio Tinto approved an investment in the Western Turner Syncline Phase 2 project in December 2019 that will create more than 1,000 construction jobs and enable the company to sustain existing production from the Greater Tom Price hub.
- Atlas Iron commenced construction on the Corunna Downs project with first mining targeted in mid-2021.
- Mineral Resources completed the purchase of the Parker Range iron ore project from Cazaly Resources in August 2019 and agreed to purchase the Buckland iron ore project from BCI Minerals in March 2020.
- Flinders Mines and BBI Group signed a farm-in and joint venture agreement on development of the Pilbara iron ore project in September 2019.
- FMG opened its expanded remote operations centre, known as the Fortescue Hive, on 1 July 2020, allowing around-the-clock monitoring of its integrated iron ore operations in the Pilbara.
- BHP introduced a fleet of autonomous trucks at its Newman East iron ore mine (also known as Eastern Ridge), which will transition to fully autonomous haulage by the end of 2020.

Local iron ore producers also announced investments in renewable energy projects to lower carbon emissions:

- FMG announced plans for its Pilbara Generation Project, consisting of 275km of high voltage transmission lines connecting the company's mine sites, 150MW of gas-fired generation and 150MW of solar photovoltaic generation.
- Rio Tinto is planning to build a 34MW solar plant comprising 100,000 solar panels to provide approximately 65 per cent of the Koodaideri mine's average electricity demand.

There were also several development studies progressed by junior iron ore companies including Fenix Resources (Iron Ridge), Strike Resources (Paulsens East) and Corizon Resources (Robe Mesa) that could result in the development of small-scale direct shipping ore operations at a relatively small capital cost.



The major commodities file contains:

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

## 2.1.2 Gold

### Prices

The price of gold continued to rise throughout 2019–20 to its highest ever annual value of \$2,339 per oz.

The gold price increased fairly consistently across the year achieving an all-time high for a monthly average of \$2,680 per oz in April.

Prices were supported across the year by a weaker Australian dollar as well as a range of global factors including:

- Persistent low interest rates and US dollar weakness.
- Ongoing concerns regarding impacts to global economic growth from US-China trade issues.
- A weaker global economic outlook amid the growing number of COVID-19 cases around the world.

### Quantity and value

The gold sector remained WA's second most valuable mineral commodity after iron ore, accounting for 12 per cent of the total minerals sales.

Gold sales volumes were largely unchanged in 2019–20 with 211 t (6.8 Moz) sold during the year.

WA was still Australia's most significant gold producer with 67 per cent of the nation's estimated 319 t (10.3 Moz) of production. The State was also the third largest gold producer in the world when compared to other countries, accounting for seven per cent of global output.

Record Australian dollar gold prices saw the value of those sales increase to an all-time high of almost \$16 billion, up 32 per cent from the previous record of \$12 billion in 2018–19.

The top 10 gold projects in WA accounted for 53 per cent of the State's total gold production, largely the same as in previous years. However, the new Gruyere project entered the top 10 for the first time, replacing the Agnew project.

Exports of gold from WA also increased (by 29 per cent) to a record \$21.5 billion. The United Kingdom (59 per cent) was the largest destination for gold exports from WA, followed by the United States of America (14 per cent), Hong Kong (14 per cent) and Singapore (4 per cent). China accounted for just four per cent of exports after being ranked as the number one export destination in 2018–19.

### A note about gold exports from WA

The ABS releases WA export trade data that shows a value for the export of gold that is significantly higher than the gold actually produced. This export data should be interpreted with some caution. The Perth Mint operates Australia's only London Bullion Market Association accredited gold refinery. It refines gold produced in other Australian States and territories, as well as from surrounding countries. It also refines secondary gold, mainly from Asia. This refined gold is then exported from WA. Therefore, the ABS export figure for WA includes gold produced in other jurisdictions.

### Notable events

- Gold Road Resources and Gold Fields achieved first sales from Gruyere, with the new project already ranking in the top 10 largest projects of 2019–20.
- Matsa Resources delivered the first ore from its Red October mine and Beacon Minerals sold the first gold from its Jaurdi project.
- Northern Star Resources and Saracen Mineral Holdings outlined an additional 15-year mine life and a doubling of annual production on 2019 levels by 2022 at its KCGM operations. This expansion was supported by updated resources.
- Newmont approved an investment in an autonomous haul truck fleet for its Boddington gold mine. The autonomous haulage system will be a world first for an open pit gold mine and is expected to be operational in 2021.



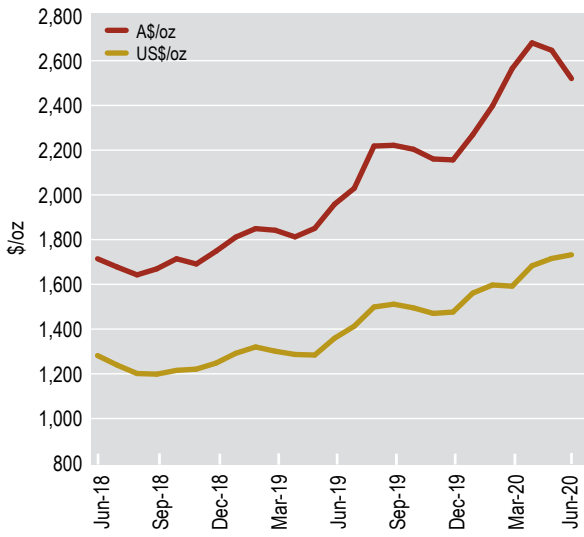


Figure 24 **Gold price**  
Source: Perth Mint and Kitco

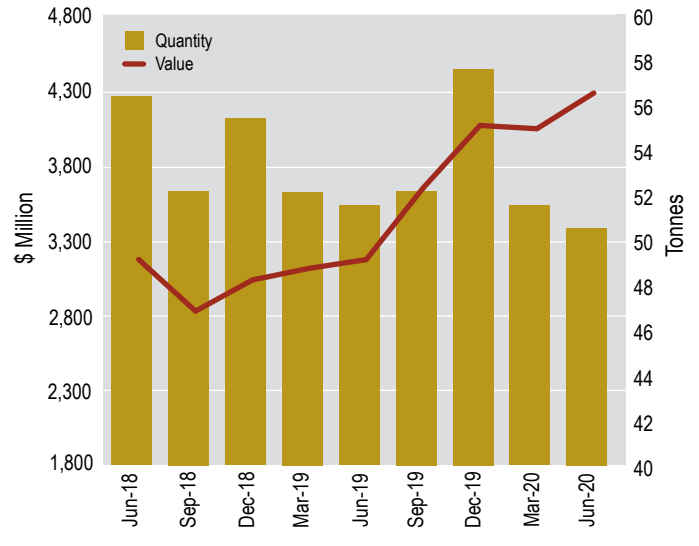


Figure 25 **Gold quantity and value by quarter**  
Source: DMIRS

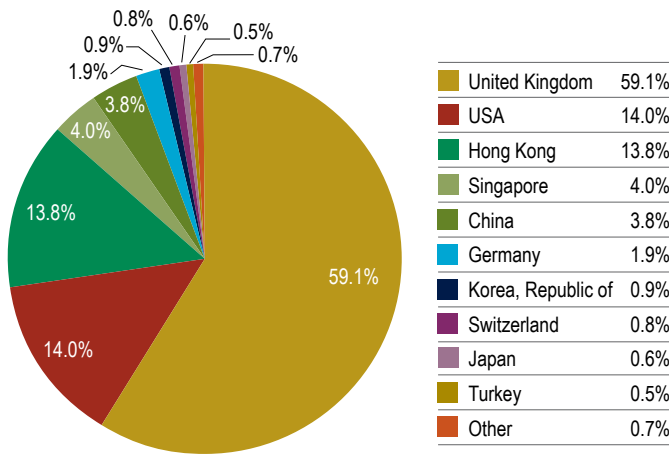


Figure 26 **Gold exports 2019-20**  
**\$22 Billion**  
Source: ABS  
*Note: Includes gold refined/processed and exported from WA that is produced from mining operations in other states, territories and overseas.*

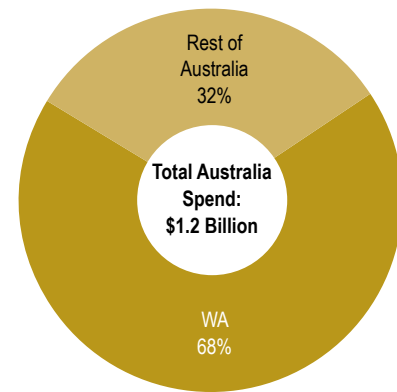


Figure 27 **Gold exploration expenditure 2019-20**  
**Total WA spend \$786 Million**  
Source: ABS

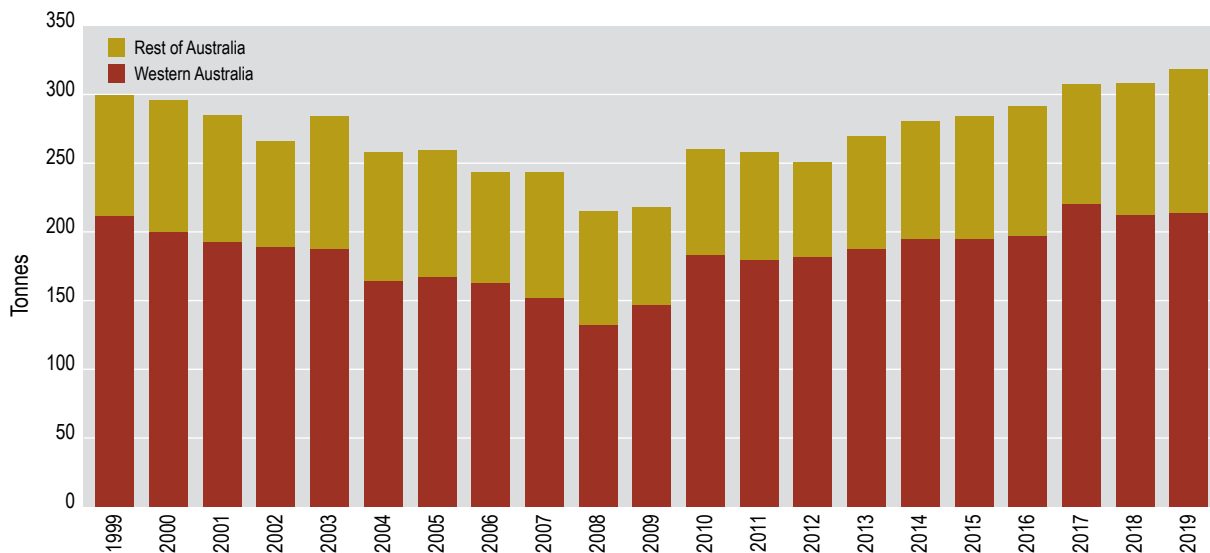


Figure 28 **WA gold production v rest of Australia**  
Source: DMIRS and OoCE

- Gascoyne Resources released a new life-of-mine plan for its Dalgarranga gold project outlining estimated production of 400,000 oz for the next seven years.
- The Perth Mint officially launched its gold exchange-traded fund (a way for investors to gain exposure to price movements of gold without actually owning any gold) on the New York Stock Exchange.
- Newcrest Mining announced a 40 per cent earn-in relating to its Havieron joint venture with Greatland Gold. This development is considered critical to extending the life of the Telfer operations. Newcrest Mining also entered into a farm-in agreement with Antipa Minerals to acquire a share of the Wilki project.
- Ora Banda Mining returned to Australian Securities Exchange listing following a successful recapitalisation after coming out of administration under its previous guise Eastern Goldfields.
- Gold Fields completed construction of Australia's largest hybrid renewable microgrid at its Agnew mine.

### Gold industry consolidation

2019–20 was a year of consolidation for the gold sector, which was supported by record prices.

There was a flurry of merger and acquisition activity with many miners looking to expand or replace depleting gold assets. Most notably:

- In November 2019, Saracen Mineral Holdings purchased Barrick Gold Corporation's 50 per cent stake in KCGM. In January 2020, Newmont Goldcorp sold its 50 per cent share of the operations to Northern Star Resources. Saracen Mineral Holdings and Northern Star Resources later agreed to a 'merger of equals' in October 2020.
- Saracen Mineral Holdings also acquired Bligh Resources, the owner of tenements near its Thunderbox project, and acquired the Box Well tenements (near its Carosue Dam project) from Hawthorn Resources.
- Silver Lake Resources acquired Egan Street Resources, owner of the Rothsay project nears its Deflector operations.
- Northern Star Resources acquired Echo Resources, owner of the Yandal project and the Bronzewing mill, and bought out joint venture partner Artemis Resources from the Mt Clement gold project. The company also sold its Ashburton gold project to Kalamazoo Resources.
- Newcrest Mining announced it had earned an interest in the Havieron project under a farm-in agreement with Greatland Gold. This project is considered critical to extending the life of the Telfer operations. The company also reached a farm-in agreement with Antipa Minerals to acquire a share of its tenement package on the Wilki project.
- Ramelius Resources completed a takeover of Spectrum Metals, owner of the Penny West project located near its Mt Magnet processing plant.

There were also a number of name changes among WA gold miners with Intermin Resources changing its name to Horizon Minerals, Blackham Resources changing its name to Wiluna Mining and RNC Minerals changing its name to Karora Resources.

Other companies with projects in WA took advantage of gold's status to strengthen their balance sheets and raise funds for future investments and developments. Some of the more notable capital raisings during 2019–20 included Newcrest Mining (\$1.1 billion and \$200 million); Blackham Resources (\$52 million); Bellevue Gold (\$26.5 million, \$120 million and \$35 million); Red 5 (\$125 million); Dacian Gold (\$98 million); Gascoyne Resources (\$85 million); De Grey Mining (\$28 million and \$31 million); Ora Banda Mining (\$55 million); Westgold Resources (\$45 million); Chalice Gold Mines (\$30 million); Calidus Resources (\$25 million); Bardoc Gold (\$24 million); Genesis Minerals (\$19.5 million); Vango Mining (\$17.4 million); Horizon Minerals (\$16 million); and Galena Mining (\$12 million).

### 2.1.3 Alumina and bauxite

#### Prices

The price of alumina lost the momentum it had gained in the previous two years, falling to an average of \$420 per tonne in 2019–20.

Prices staged a brief rally at the beginning of 2020 fuelled by increased imports into China as aluminium refiners scrambled to replace domestic supplies impacted by COVID-19 related lockdowns. Prices declined again as Chinese domestic supply returned, ending the year at just \$350 per tonne – 31 per cent lower than where they started.

Prices were driven lower across the year by an oversupplied seaborne market. Contributing to the oversupply was the late May 2019 announcement of the removal of legal constraints on Alunorte in Brazil (the world’s largest alumina refinery), permitting it to increase output towards capacity after being restricted to half-capacity for the past year, as well as the start-up of a new refinery in the United Arab Emirates. During the year, the first signs of a global supply side response did emerge with Alcoa announcing the closure of the Point Comfort refinery in Texas.

Alumina prices were also affected on the demand side by issues across the aluminium supply chain including US-China trade tensions and constrained aluminium smelter supply growth in China.

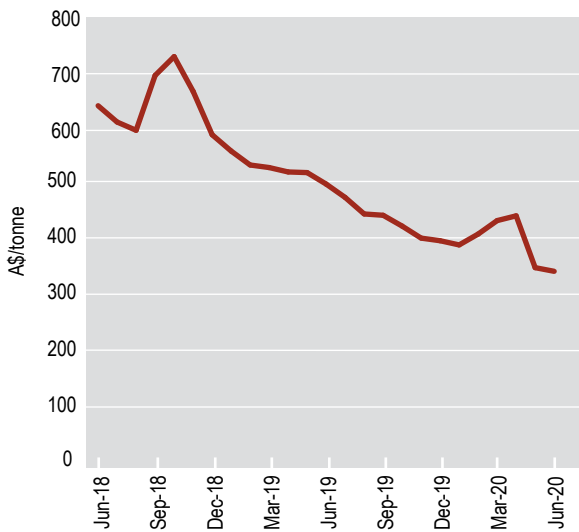


Figure 29 | Alumina price  
Source: ABS

#### Quantity and value

Alumina was the State’s third most valuable mined commodity and fifth most valuable commodity overall, accounting for almost five per cent of mineral sales value and four per cent of total mineral and petroleum sales in 2019–20.

Weaker alumina prices meant that despite WA selling a record 15.8 Mt of alumina and bauxite in 2019–20, the value of those sales declined by 22 per cent to \$6.4 billion.

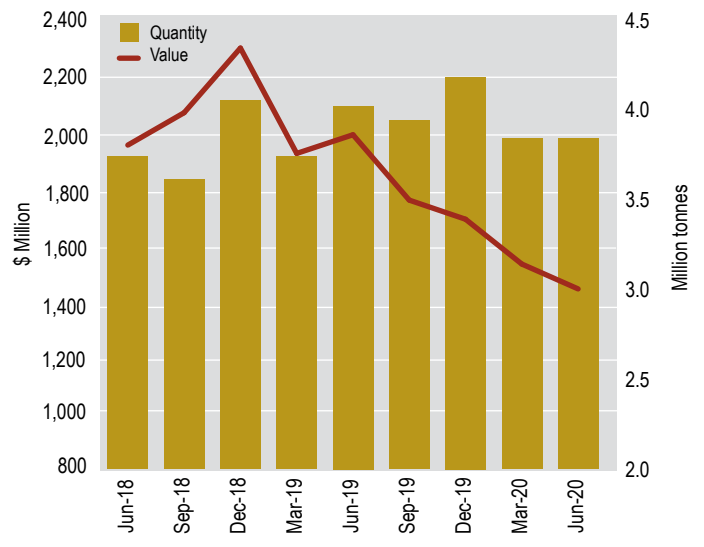


Figure 30 | Alumina and bauxite quantity and value by quarter  
Source: DMIRS

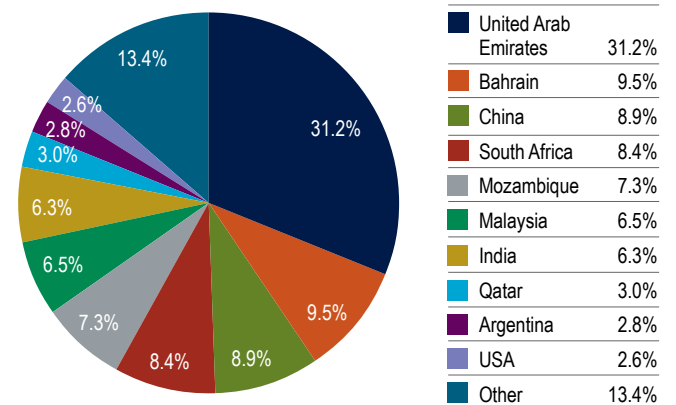


Figure 31 | Alumina and bauxite exports 2019–20  
\$6.1 Billion  
Source: DMIRS

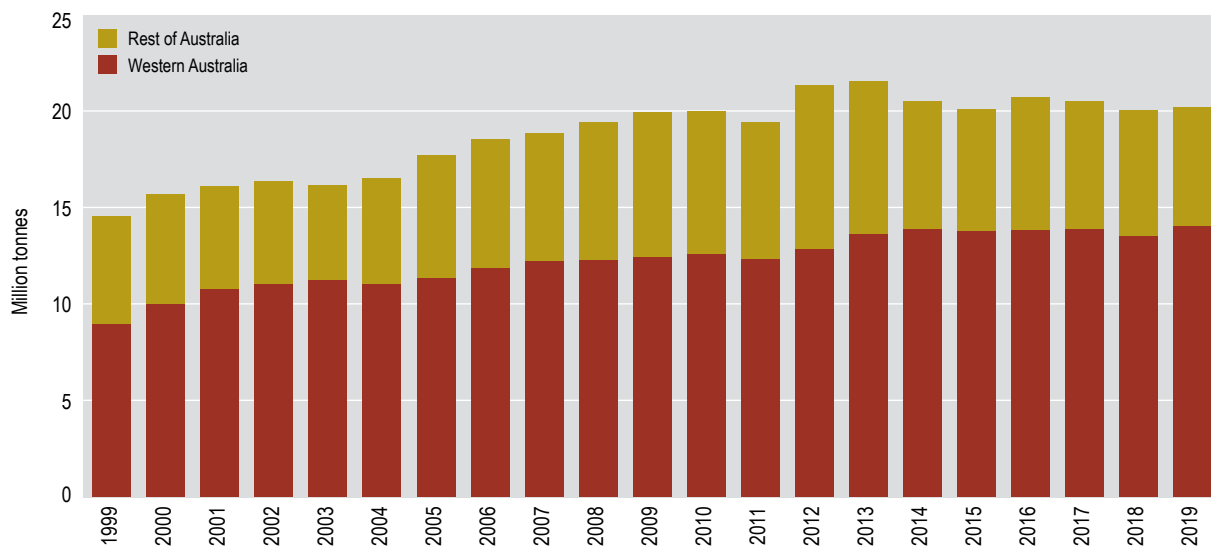


Figure 32 | **WA alumina production v rest of Australia**  
Source: DMIRS and OoCE

WA accounted for more than 11 per cent of global alumina production, making it the world's second largest producer. WA was also responsible for almost 70 per cent of Australia's alumina production. The State's share of Australian output was up from 67 per cent the previous year because of record output from local operations.

WA sold a record 14 Mt of alumina in 2019–20 with the completion of processing improvements and a maintenance cycle at South32's Worsley operations.

The quantity and value of bauxite sales from Alcoa was relatively stable at 1.8 Mt.

Sales were to the United Arab Emirates (31 per cent), followed by Bahrain (10 per cent), China (nine per cent), South Africa (eight per cent), and Mozambique (seven per cent).

#### Notable events

- Alcoa and Alumina Limited deferred indefinitely a FID on expansions of the Wagerup and Pinjarra alumina refineries.
- Alcoa did not renew a contract with Adbri subsidiary Cockburn Cement for the supply of lime, instead opting to import the additive used in alumina production from 1 July 2021.



The major commodities file contains detailed information about alumina including:

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

## 2.1.4 Nickel

### Prices

The price of nickel rallied overall, increasing by 20 per cent in 2019–20 to \$20,775 per tonne, up from \$17,255 per tonne in 2018–19.

This increase was primarily due to a price surge to more than \$25,000 per tonne in September and October 2019, the highest monthly average price in more than eight years.

This surge followed confirmation that the Indonesian Government will bring forward restrictions on nickel ore exports from the country to 1 January 2020 from 1 January 2022, to accelerate the development of a domestic nickel smelting industry amid dwindling reserves. The surge was driven by a speculative squeeze on LME stocks leading up to and coinciding with the announcement, and not justified by current supply and demand fundamentals.

Through the first half of 2020, rising LME stocks, combined with the impact of the COVID-19 pandemic on market sentiment and the auto-manufacturing sector, put downward pressure on nickel prices.

The average price of cobalt declined a further 27 per cent in 2019–20 to \$47,748 per tonne, following a 31 per cent decrease in 2018–19.

Cobalt prices remained suppressed by abundant stocks and concerns about EV sales, particularly amid the COVID-19 pandemic.

### Quantity and value

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

WA remained Australia's only nickel producer, a position it has held since 1997. WA was also a significant global producer, accounting for six per cent of world production, ranking it sixth.

Nickel sales volumes in 2019–20 were on par with the previous year, decreasing by less than one per cent to 153,516 t.

Sales volumes were supported by the restart of the Ravensthorpe project in April, but negatively impacted by the temporary suspension of Savannah in the same month.

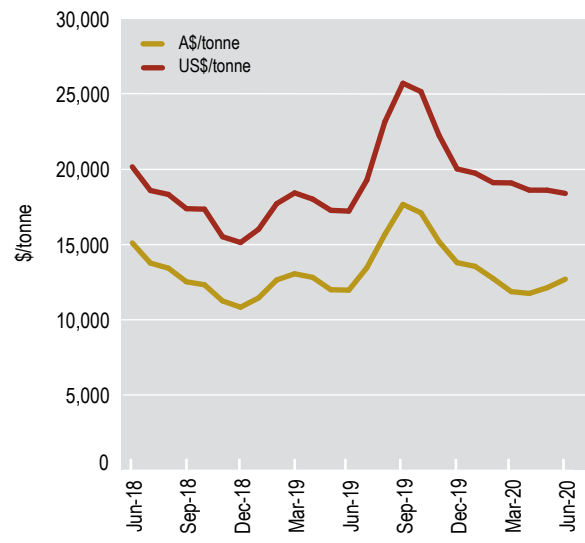


Figure 33 | Nickel price  
Source: LME

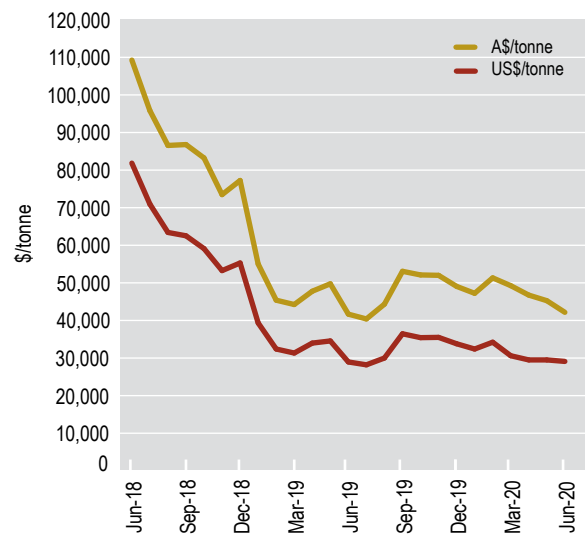


Figure 34 | Cobalt price  
Source: LME

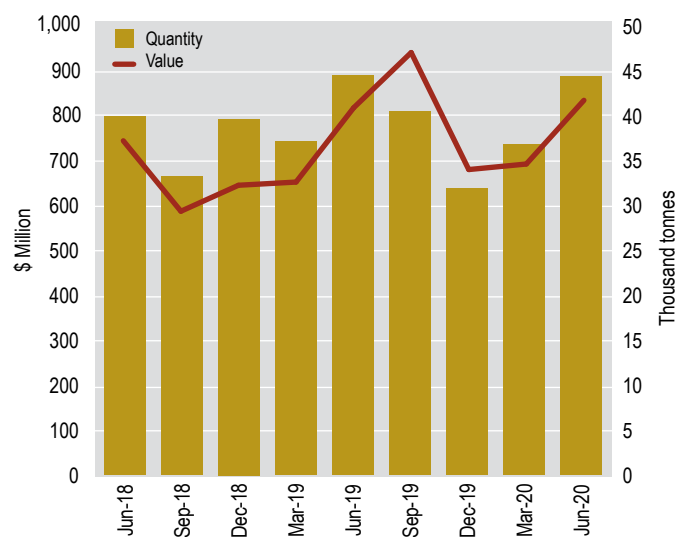


Figure 35 | Nickel quantity and value by quarter  
Source: DMIRS

The value of nickel sales rose by 16 per cent on the back of higher overall prices to \$3.1 billion, up from \$2.7 billion in 2018–19.

The result reflects, in part, the highest quarterly sales value for nickel in five years during a price surge in the September quarter.

The total value of nickel exports rose significantly in 2019–20 to \$3.9 billion, up from \$2.7 billion in 2018–19. China (40 per cent), Malaysia (10 per cent), Japan (10 per cent), South Korea (9 per cent), and Taiwan (8 per cent) were the State’s top nickel customers.

The State’s nickel producers also sold 5,810 t in by-product cobalt sales valued at \$293 million. While volumes increased 11 per cent, lower prices resulted in a 12 per cent decline in the value of sales compared to 2018–19.

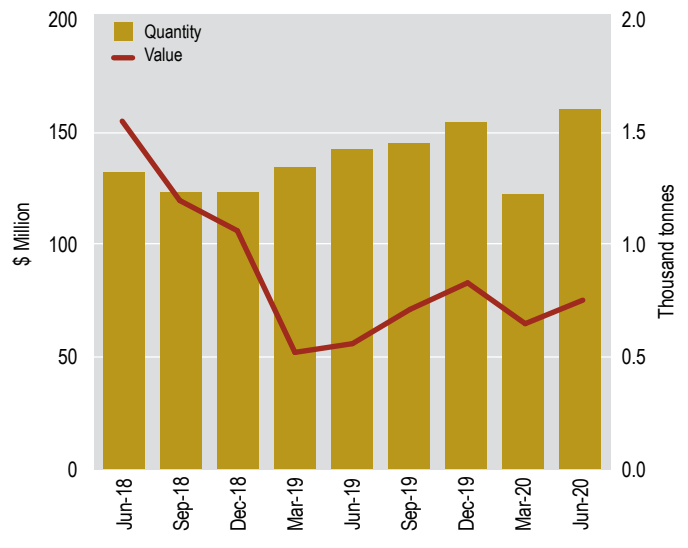


Figure 36 | **Cobalt quantity and value by quarter**  
Source: DMIRS

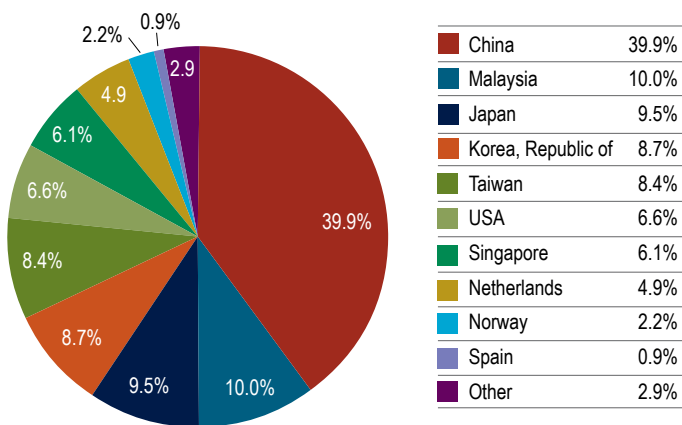


Figure 37 | **Nickel exports 2019–20**  
**\$3.9 Billion**  
Source: DMIRS

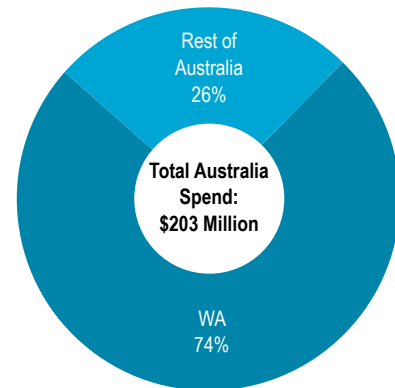


Figure 38 | **Nickel cobalt exploration expenditure 2019–20**  
**Total WA spend \$149 Million**  
Source: ABS

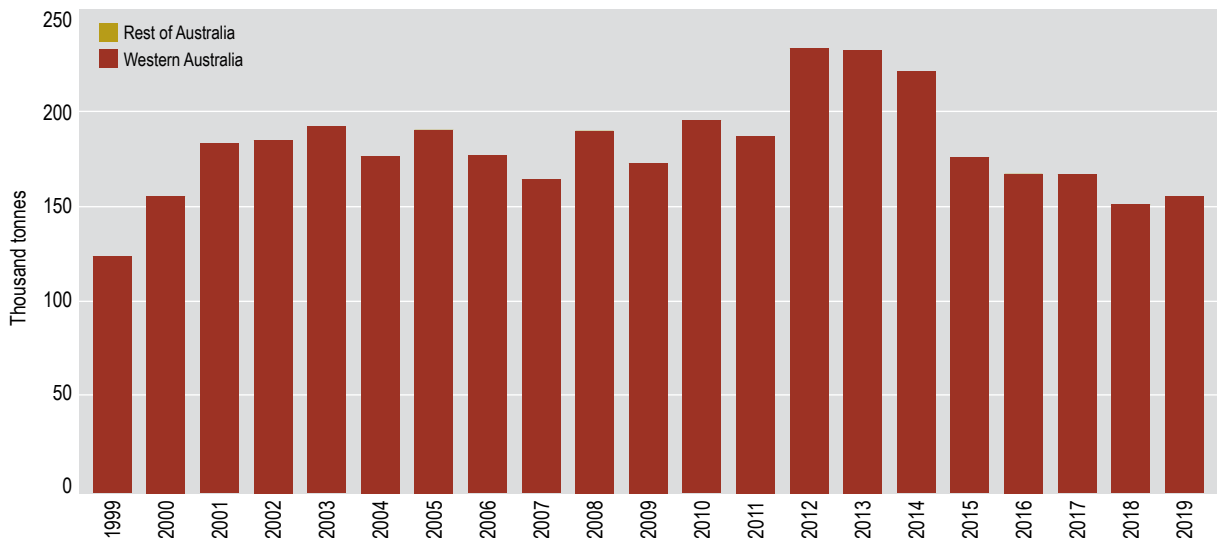


Figure 39 | **WA nickel production v rest of Australia**  
Source: DMIRS and OoCE

## Notable events

- Panoramic Resources put its Savannah project into care and maintenance in April 2020 with the company citing operational uncertainties, increased transportation costs, and poor availability of supplies, equipment and personnel brought on by COVID-19 related travel restrictions in the Kimberley.
- First Quantum Minerals restarted its Ravensthorpe project in April 2020. It is also in the middle of expanding production through the Shoemaker-Levy orebody.
- Mincor Resources announced in September 2020 a positive FID on development of its Kambalda operations. Earlier in the year, the company also announced an ore tolling agreement with Nickel West, which will facilitate a restart of the Kambalda nickel concentrator.
- IGO decided not to progress development studies on a downstream nickel sulphate facility, effectively shelving the project, after achieving improved terms on nickel and copper concentrate sales from its Nova project.
- Western Areas announced a sale and purchase agreement with Sumitomo Metal Corporation for a high-grade nickel sulphide precipitate, which is being delivered as part of its Mill Recovery Enhancement Project at Forrestania. The company also announced new offtake agreements with Nickel West (three years and 30,000 t) and Jinchuan Co. (two years and 20,000 t) for nickel concentrate production.
- BHP Nickel West acquired Norilsk Nickel's WA assets including the Honeymoon Well project and its share of the Albion Downs joint venture.
- Talisman Mining sold its mothballed Sinclair nickel project located south of Leinster to Saracen Mineral Holdings.
- OZ Minerals gained full ownership of Cassini Resources and the West Musgrave project. A PFS on the West Musgrave project was released in February 2020 outlining capital costs of \$995 million for 28 ktpa of copper and 22 ktpa of nickel concentrate over a 26-year mine life.
- The Mount Thirsty cobalt-nickel project joint venture between Barra Resources and Conico Limited released a PFS outlining an expected development cost of \$371 million and annual production of 19,100 t of cobalt and 24,800 t of nickel mixed sulphide over a 12-year mine life.



The major commodities file contains information about nickel including:

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

## 2.1.5 Base metals

### Prices

While base metals prices were generally weaker once again in 2019–20, for local producers these falls were largely offset by a softer Australian dollar.

- Copper declined by two per cent to an average of \$8,431 per tonne.
- Lead increased by one per cent to an average of \$2,821 per tonne.
- Zinc decreased by 12 per cent to an average of \$3,277 per tonne.

Base metals prices were affected throughout the year by the state of US-China relations, and the impact of the COVID-19 pandemic on economic activity. There were signs of a recovery in base metals prices in mid-2020 that further developed into the new financial year. The winding back of COVID-19 restrictions, as well as the announcement of economic stimulus packages and supply curtailments around the world aided the recovery.

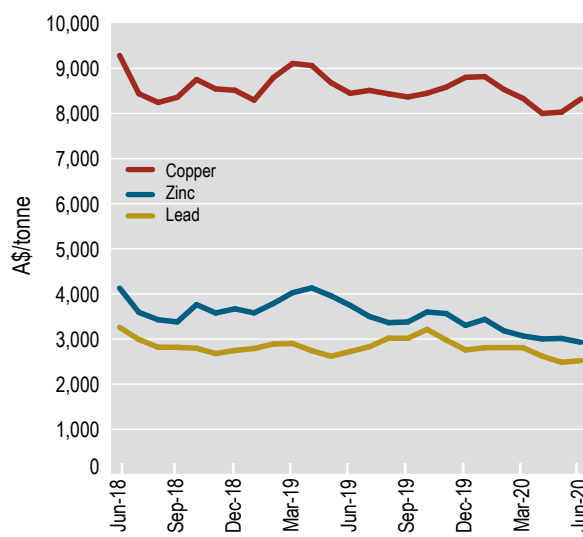


Figure 40 | Copper, zinc and lead price  
Source: LME

The price of copper, for example, was weighed down in mid-2019 by US-China trade tensions, but ended the year on a high note after the countries agreed to a 'Phase 1' trade deal. The agreement eased tensions and provided a more positive outlook for global economic growth. Any positive price gains from the 'Phase 1' trade deal were more than offset by the impact of COVID-19 on economic activity and demand, which saw copper prices fall to a near three-year low of \$7,999 per tonne in April. Prices rebounded in May and June on the back of stimulus packages in response to the economic impact of the pandemic.

### Quantity and value

Base metals were WA's fifth most valuable mined commodity, re-entering the top five after being displaced by the lithium industry in the previous two years. This was despite weaker prices resulting in a three per cent fall in the value of base metals sales to just over \$1.5 billion in 2019–20.

Copper increased its position as the major base metal produced in WA, accounting for 85 per cent of all sales (\$1.3 billion), while zinc was responsible for 14 per cent (\$221 million) and lead just one per cent (\$7.8 million) of sales.

The quantity of copper sales increased by five per cent to almost 170 kt with record sales from DeGrussa, offsetting the temporary suspension of the Nifty operations in November 2019, while zinc sales also increased marginally to more than 72 kt.

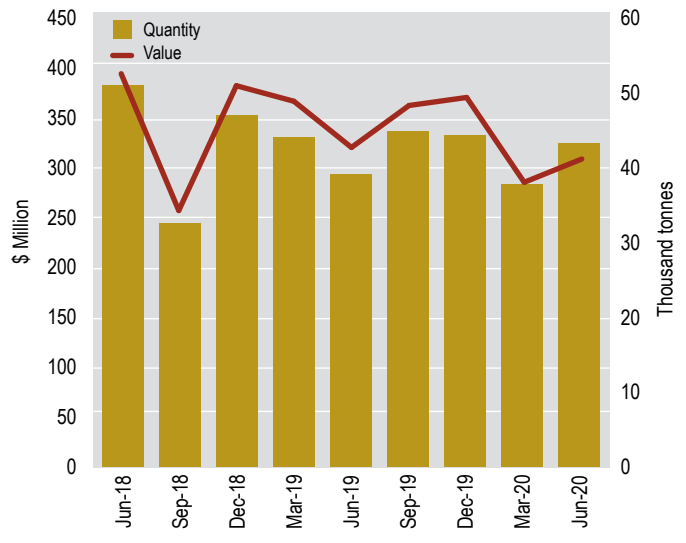


Figure 41 | **Copper quantity and value by quarter**  
Source: DMIRS

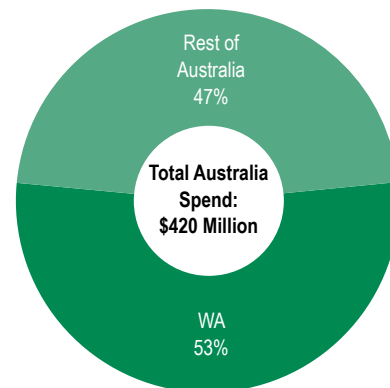


Figure 42 | **Copper exploration expenditure 2019–20**  
**Total WA spend \$224 Million**  
Source: ABS

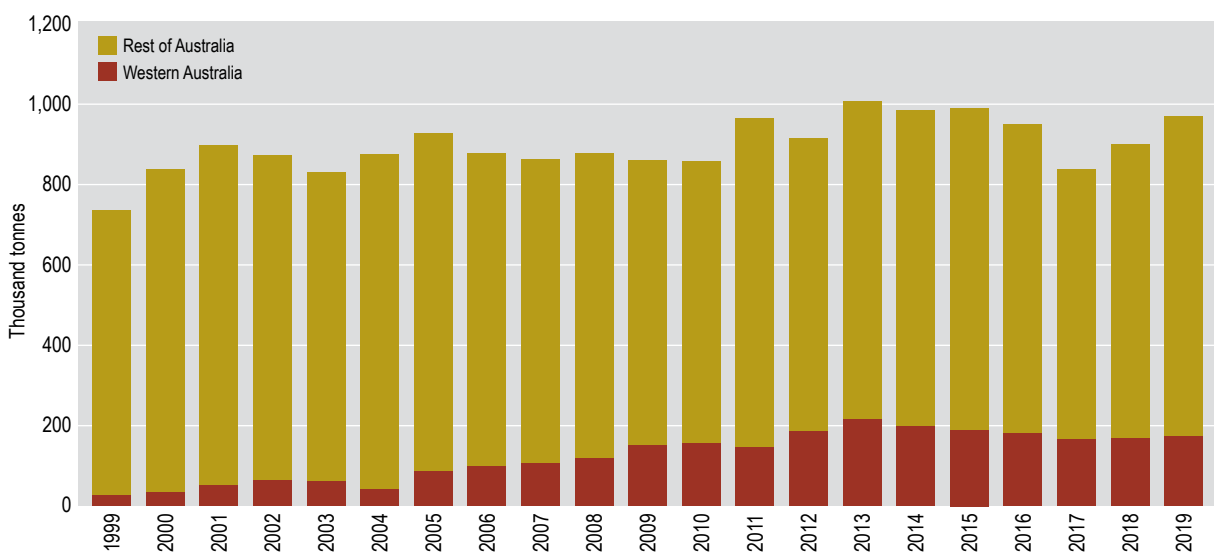


Figure 43 | **WA copper production v rest of Australia**  
Source: DMIRS and OoCE



The volume of lead sales was down 40 per cent with the Golden Grove project operating on a campaign basis.

WA remains a relatively minor producer of base metals in both an Australian and global context.

The majority of sales were exported to China (52 per cent), followed by Taiwan (12 per cent), the Philippines (11 per cent), South Korea (nine per cent), and Japan (nine per cent).

### Notable events

- Metals X suspended operations at Nifty in November 2019 due to a range of legacy and performance issues. Following a strategic review into its copper assets, the company announced in early July its intention to seek offers for the sale of Nifty. Metals X also signed a farm-in and joint-venture agreement with IGO in relation to undeveloped Paterson province copper exploration assets.



The major commodities file contains:

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

## 2.1.6 Lithium

### Prices

2019–20 was a tough year for the WA lithium sector.

Lithium prices fell consistently throughout the year due to ongoing oversupply and depressed demand for EV. The COVID-19 pandemic also negatively affected lithium prices through its impact on supply and demand across supply chains.

Spodumene averaged \$762 per tonne in 2019–20, down from \$1,018 per tonne in 2018–19, a 25 per cent decrease. This fall was driven by the ramp-up at lithium mines outpacing construction on new and expanded lithium carbonate and hydroxide conversion capacity, particularly in China. As a result, some spodumene concentrate was temporarily left without a home.

The price for battery-grade lithium hydroxide averaged \$11,569 per tonne, down from \$19,929 per tonne in 2018–19, representing a 42 per cent decrease. Delays in the introduction of nickel-rich cathodes (those that rely on lithium hydroxide) in batteries across Asia and in the construction of new battery mega factories were the main factors behind weaker lithium hydroxide prices.

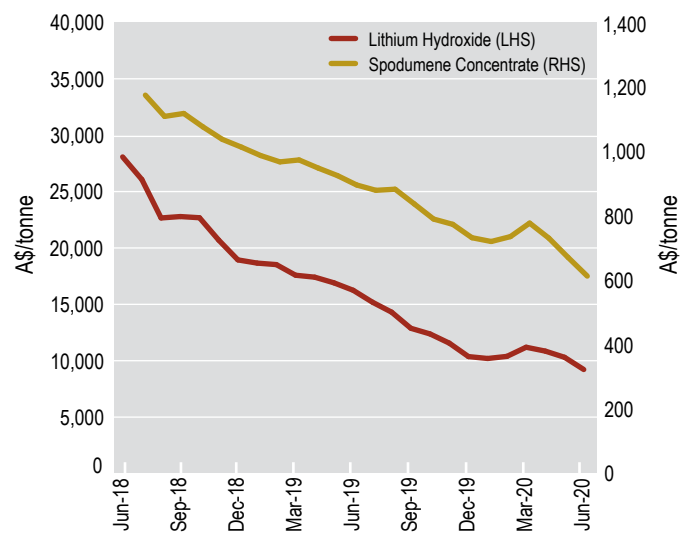


Figure 44 | Lithium prices  
Source: Asian Metal

### A note about lithium prices

The lithium market is relatively immature and involves small traded volumes.

Lithium products are non-exchange traded speciality products, with prices generally negotiated privately under offtake agreements between buyer and seller.

As such, there are no single widely accepted benchmark prices for lithium products including spodumene concentrate, lithium hydroxide and lithium carbonate.

In 2019, in lieu of a widely accepted benchmark for lithium prices, LME contracted Fastmarkets to develop a reference price for lithium. LME now publishes two weekly mid-point prices for lithium chemicals:

- Lithium carbonate: Min 99.5 per cent Li<sub>2</sub>CO<sub>3</sub> battery grade, spot prices CIF China, Japan & South Korea.
- Lithium hydroxide monohydrate: Min 56.5 per cent LiOH<sub>2</sub>O battery grade, spot prices CIF China, Japan & South Korea.

There are also a range of other agencies that report lithium prices including Benchmark Minerals Intelligence, Platts, and Asian Metal.

However, it is still claimed that a reference price is impossible as lithium is sold in a myriad of forms with different qualities that are based on end-use and the specifications of particular processing and manufacturing operations.

In this publication, spodumene prices are based on the Asian Metal mid-point CIF price grading six per cent lithium oxide, while lithium hydroxide prices are based on the Asian Metal mid-point price with a minimum grade of 56.5 per cent as delivered to China.

### Quantity and value

The effect of weaker prices and supply curtailments was evident in lower sales and volumes in WA across the year.

Lithium miners in WA produced well under their capacities, instead focusing on producing volumes to match subdued customer demand.

For example, Pilbara Minerals scaled back production at Pilgangoora to focus on optimising operations and reducing costs in a weaker price environment. Galaxy

Resources announced in early October 2019 it would scale back shipments in the December quarter 2019 by between 50 per cent and 65 per cent to offset planned reductions in mining in 2020.

At the same time, Alita Resources was forced into administration in August 2019 and subsequently placed its Bald Hill lithium-tantalum mine into care and maintenance. The Wodgina project was put care and maintenance in order to retain resources for future conversion into lithium hydroxide. The Wodgina project had been selling direct shipping lithium ore and only recently commenced sales of trial spodumene concentrate following the completion of construction on the Wodgina processing plant. Altura Mining was also put into administration in October 2020 with its Pilgangoora operation expected to be put into care and maintenance within weeks.

In more positive news, Talison Lithium announced the start-up of its Chemical Grade Plant 2 expansion at Greenbushes in August 2019 boosting output from the project.

On the back of these supply curtailments and production stoppages, spodumene concentrate sales totalled 1.35 Mt in 2019–20, down 20 per cent from 1.69 Mt in 2018–19. In June 2020, the value and volume of spodumene concentrate sales was at its lowest level since prior to the lithium boom in March 2017.

Overall, WA's lithium sector was valued at \$0.92 billion in 2019–20, down 45 per cent from \$1.65 billion in 2018–19.

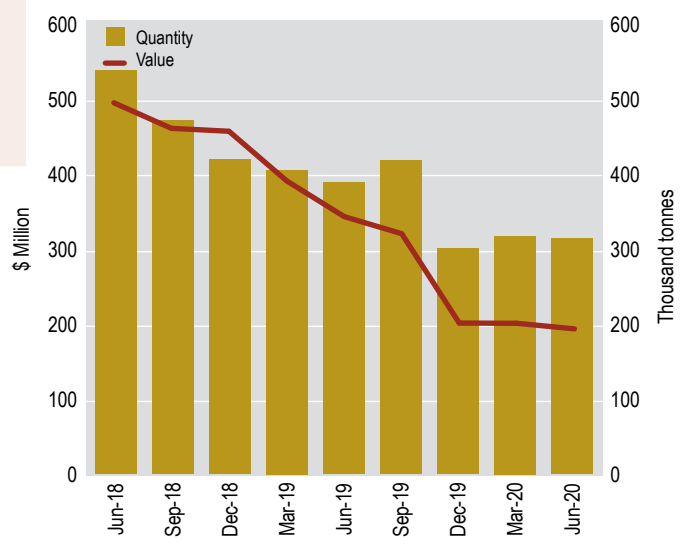


Figure 45 Spodumene concentrate quantity and value by quarter  
Source: DMIRS

## Notable events

- Altura Mining entered administration in late October 2020 with its Pilgangoora operation expected to be put into care and maintenance within weeks.
- Alita Resources entered administration in August 2019 and placed its Bald Hill lithium-tantalum mine operation into care and maintenance, resulting in some 350 job losses. In January 2020, China Hydrogen Energy put forward a deed of company arrangement to acquire Alita's assets.
- Tianqi Lithium announced in January 2020, it had postponed the commissioning of the first phase of its lithium hydroxide processing facility in Kwinana. Construction on the plant was completed in September 2019 and it was scheduled to ramp up to its nameplate capacity of 24 ktpa within 12 to 18 months. The company also announced a halt to development on stage two of the Kwinana lithium hydroxide plant in September 2019 to focus on the ramp-up of Stage 1.
- In August 2019 Albemarle announced stages 3 to 5 of the Kemerton lithium hydroxide facility had been deferred indefinitely.
- Talison Lithium completed construction on an expansion of the Greenbushes project (known as the Chemical Grade Plant 2 expansion) in August 2019. Construction activities on a further expansion (known as the Chemical Grade Plant 3 expansion) paused in September 2019 pending the outcomes of a review into the timing of construction and the need for additional volumes of spodumene concentrate.
- In September 2020 Pilbara Minerals raised capital and secured a new loan on improved terms to strengthen its balance sheet and provided much need cash flow. The company also revised its stage two expansion at Pilgangoora into incremental stages and executed a joint venture with POSCO for development of a lithium chemical conversion plant in South Korea. Plans to sell a 49 per cent interest in its Pilgangoora project were shelved.
- Wesfarmers completed its acquisition of Kidman Resources (part owner of the Mt Holland Lithium project with SQM through Covalent Lithium) in September 2019. FID by Covalent Lithium on the Mt Holland lithium project was also deferred by 12 months to the March quarter 2021 allowing for additional actions to enhance the value of the project.
- Neometals signed a memorandum of understanding with Indian energy trading business Manikaran Power to undertake feasibility work on a lithium hydroxide refinery in India, deferring development of a facility in Kalgoorlie.
- Several spodumene producers in WA entered into new offtake agreements:
  - Pilbara Minerals signed a five-year offtake agreement with China-based Yibin Tianyi (backed by China's largest EV battery manufacturer CATL).
  - BMW signed a five-year lithium supply contract with Ganfeng Lithium (50% owner of the Mt Marion project and offtake partner of Pilbara Minerals' Pilgangoora project).
  - Altura Mining signed a binding offtake deal with Hunan Yongshan Lithium to supply 120 ktpa of spodumene concentrate over five years.
  - Galaxy Resources extended its offtake agreement with Yahua International Investment and Development to the end of 2025 for a minimum of 120 ktpa.

## 2.1.7 Mineral sands

### Prices

Mineral sands prices were mixed in 2019–20.

The market price of titanium products continued to trend higher, with rutile prices increasing by three percent to an average of \$1,565 per tonne. This trend is being driven by tightening supplies and declining resources.

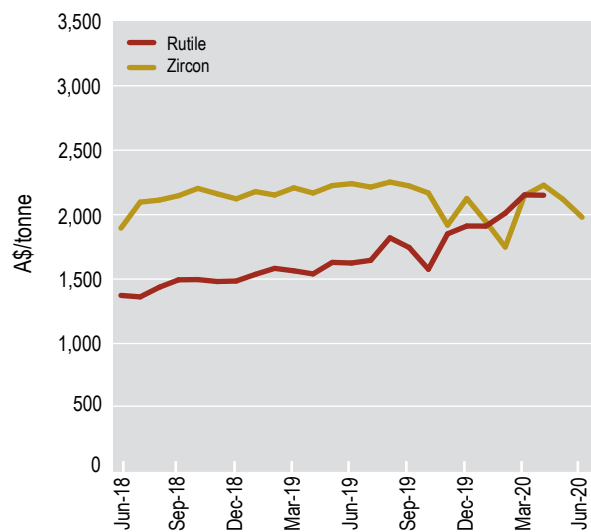


Figure 46 | Mineral sands prices  
Source: ABS

By contrast, zircon prices trended lower, falling four per cent to an average of \$2,089 per tonne. This was due to a combination of increased supply and ongoing global economic uncertainties amid the COVID-19 pandemic.

These trends, however, obscure some volatility:

- Prices for rutile lowered in September and October 2019 after demand from the pigment and welding industries eased.
- Zircon began the year on an upwards trajectory that was disrupted by subdued demand from the ceramics industry amid US-China trade conflict. Prices were further dampened at the beginning of 2020 by the COVID-19 pandemic and the Lunar New Year, before rising again in March and April as demand for ceramics increased in China after the easing of lockdown measures. This rise was short lived, however, as COVID-19 restrictions began to impact other key markets including the United States, Europe and India.

### Quantity and value

Mineral sands remained the State’s seventh most valuable mineral commodity. Total mineral sands sales were \$777 million in 2019–20, up 10 per cent from the previous year.

The State was once again a significant producer of mineral sands products. It was the world’s largest producer of garnet and third largest producer of zircon. WA is also in the top 10 for ilmenite and rutile production.

The mining and processing of titanium products made up more than half of the value of all sales from the WA mineral sales industry, with the remainder from zircon, garnet, and other minerals production including staurolite and monazite.

Titanium product sales from WA increased by 19 per cent to more than \$403 million, off the back of higher sales volumes.

The volume of ilmenite sales increased by 20 per cent to a seven-year high on the back of the ramp-up of Image Resources’ Boonanarring project. Synthetic rutile sales were boosted by the start-up of ilmenite feedstock production from Iluka Resources’ Cataby project and the return to full capacity of Iluka Resources’ synthetic rutile kiln two at Capel after a major maintenance outage. Rutile and leucoxene sales were also up.

Weaker zircon prices were offset by increased sales volumes through the ramp-up of Boonanarring – the ramp-up of Boonanarring, as well as the start up of Iluka Resources’ Cataby project and its Eneabba monazite (a rare earth-rich mineral) and zircon recovery project, delivering an eight per cent increase in the value of sales to \$267 million.

China remained the State’s biggest customer for mineral sand products, accounting for 41 per cent of the value of all exports. The next largest mineral sands export destinations were the United Kingdom (10 per cent) and the Netherlands (eight per cent).

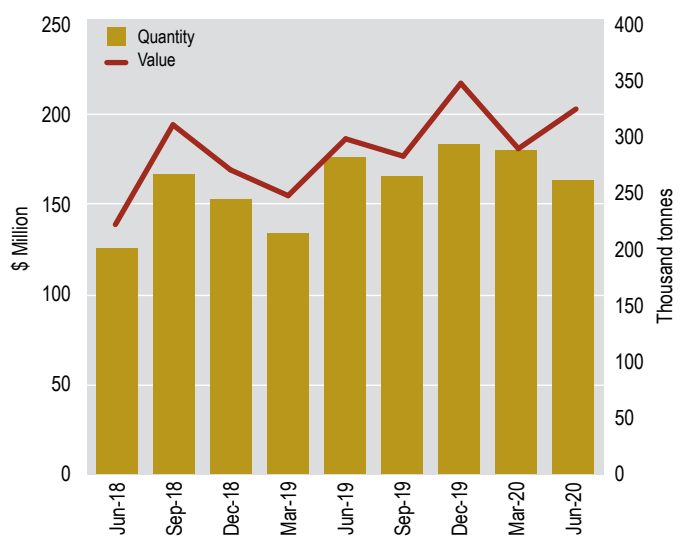


Figure 47 | Mineral sands quantity and value by quarter  
Source: DMIRS

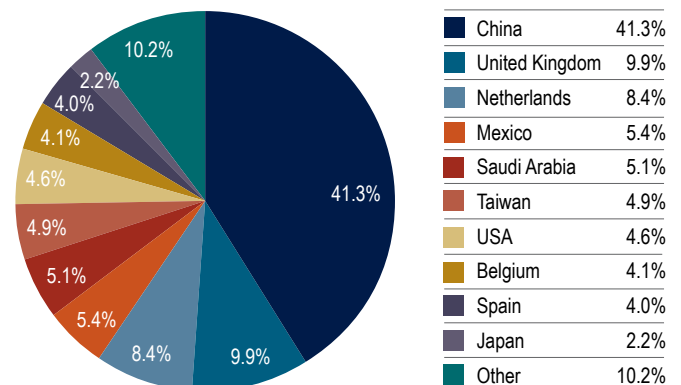


Figure 48 | Mineral sands exports \$1.2 Billion  
Source: DMIRS

## A note about mineral sands exports from WA

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

## Notable events

- It was an active year for Iluka Resources with the company:
  - Commencing sales from its Cataby operations in the September quarter 2019.
  - Commissioning phase one of the Eneabba monazite and zircon recovery project in April 2020.
  - Announcing a spin off from its Mining Area C royalty business into a new company known as Deterra Resources.
- In June 2020, Strandline Resources released an updated DFS on its Coburn mineral sands project. It outlined development costs of \$260 million, annual production and sales of 34 kt of premium zircon, 54 kt of zircon concentrate, 110 kt of chloride-grade ilmenite, and 24 kt of rutile, an estimated peak construction workforce of more than 300 people, and a production workforce of approximately 150 people. The project is to include an integrated gas and renewables micro grid utilising trucked LNG supplied by Woodside and EDL. A FID on the project is expected soon, with construction to start soon after for first ore to be processed 18 months later.
- Sheffield Resources announced in August it had entered into a 50:50 joint venture with Yansteel to develop the Thunderbird mineral sands project, subject to final agreement and regulatory and shareholder approvals. The parties have commenced a BFS into a Stage 1 development concept incorporating a 10.4 Mtpa mine and process plant producing zircon concentrate and ilmenite.

## 2.1.8 Other commodities

### Salt

#### Quantity and value

WA accounts for the majority of Australia's salt production and a significant share of global supply. It is currently the sixth largest salt producer in the world.

There were 11.2 Mt in salt sales from WA in 2019–20, down marginally from 11.7 Mt.

However, higher realised prices meant the value of the sector increased by 24 per cent from \$304 million to \$375 million.

Rio Tinto subsidiary Dampier Salt, with operations at Dampier, Port Hedland, and Lake MacLeod, was once again the State's biggest producer accounting for 66 per cent of total salt sales volumes from WA.

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

### A note about salt

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

The reported sales value here is the FOB sales value received by WA salt producers. Comparisons between FOB sales and CIF or CFR sales paid in the destination country may suggest a discrepancy if full shipping costs were not taken into account.

Highly-detailed audits are carried out and include invoice examinations for the various services associated with getting the salt to market, such as shipping and handling, as well as the price ultimately paid by the customer in the destination nation.

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

### Notable events

- BCI Minerals completed a DFS on its Mardie salt and potash project. The study outlined a capital cost of \$779 million and annual production of 120 kt of salt and 120 kt of sulphate of potash. FID is expected by early 2021 with first sales anticipated in 2024. The project was also awarded major project status by the Commonwealth Government in recognition of its significant to the Australian economy.
- Leichart Industrials completed a PFS on its Erarmurra project near Karratha, outlining a capital cost of \$280 million and a construction workforce of 200 people and operational workforce of 70 people. It was also awarded lead agency status by the Department of Jobs, Tourism, Science and Innovation. This project brings the total value of salt projects currently planned in WA to \$1.4 billion (the others are Mardie and Ashburton). These projects are forecast to fill a shortfall in global salt supply expected to emerge in the mid-2020s.

## Coal

### Quantity and value

Collie coal sales decreased slightly to 6.2 Mt in 2019–20 from 6.3 Mt the previous financial year.

However, the value of these sales increased to \$326 million in 2019–20 from \$319 million in 2018–19, suggesting improved terms under sales contracts.

### Notable events

- In August 2020, Griffin Coal was issued with a default notice in relation to a supply contract with Bluewaters Power, owner of the Bluewaters coal-fired power station near Collie.

## Rare earth elements

### Quantity and value

More than 22,149,362 kg of rare earth elements were sold in WA in 2019–20, down by 24 per cent from sales of 29,044,627 kg.

Lower sales volumes resulted in the value falling to \$259 million in 2019–20 from \$345 million the previous year.

The decline in sales volumes was due, at least in part, to a shutdown of mining activities at Mt Weld during the June quarter 2020. This followed the suspension of Lynas Corporation's Advanced Materials Plant in Malaysia to comply with COVID-19 movement

restrictions and was due to sufficient concentrate stocks being available for the restart of processing operations in Malaysia.

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

### Notable events

- Operations at Browns Range were placed on care and maintenance in March 2020 due to the impact of the COVID-19 pandemic and travel and biosecurity restrictions applied across the Kimberley region. Operators, Northern Minerals, announced on 1 July 2020 a decision to partially restart operations after the lifting of some of these restrictions.
- Lynas Corporation announced its intention to construct a cracking and leaching plant in Kalgoorlie. The plan is to upgrade rare earth concentrates from Mt Weld by removing impurities to deliver a rare earth carbonate precipitate.
- In August 2019, Northern Minerals announced an offtake agreement with German company ThyssenKrupp, one of the world's leading raw material distributors, for 100 per cent of production from the Browns Range pilot project. The company also announced an increase to its Dazzler resource at Browns Range during the year.
- Hastings Technology Metals announced the capital cost requirements for its Yangibana rare earths project will decrease from \$517 million to \$449 million. The company also announced an increase in resources at Yangibana, and a 10-year offtake agreement with major German automotive supplier Schaeffler Technologies.

## Diamonds

### Quantity and value

Diamond sales volumes in WA increased to 17.4 Mct in 2019–20, its highest level in over 10 years and up from 11.1 million Mct in 2018–19.

This increase offset lower prices to deliver growth in the value of these sales to \$225 million up from \$219 million.

This increase was almost entirely due to higher sales from Rio Tinto's Argyle mine. India Bore Diamond Holdings also exported a small first batch of diamonds from its India Bore project in the Ellendale area.

With the Argyle mine reaching the end of its life and closing on 3 November 2020, domestic diamond production is expected to fall to near zero. Global diamond production will also drop off by an estimated 10 per cent.

### Notable events

- In December 2019, the Minister for Mines and Petroleum announced that Gibb River Diamonds had accepted an offer to apply for new tenements at the abandoned Ellendale mine area, while India Bore Diamond Holdings was invited to apply for other tenements at the site.

### Argyle diamonds

On 3 November 2020, Rio Tinto's Argyle diamond mine in the East Kimberley had its final day of mining, having exhausted its economic reserves.

Since commencing production in 1983, it produced over 865 million carats of rough diamonds.

It was the world's largest producer of coloured diamonds and virtually the only consistent source of rare pink diamonds in the world.

The operations were also an important contributor to the local economy, representing approximately six per cent of the region's gross regional product. During peak production, the proportion of Indigenous people working at Argyle was the highest of any mine in WA.

Decommissioning and rehabilitation of the site will now commence, with Rio Tinto expecting the process to take five years and over 300 people to complete.

### Manganese

#### Quantity and value

In volume terms, manganese sales declined year-on-year from around 573 kt in 2018–19 to just above 553 kt in 2019–20.

However, compared to the seven-year low recorded in 2016–17, sales quantities were more than two times greater with volumes having increased steadily since the restart of the Woodie Woodie operations in late 2017.

Due to confidentiality, the value of manganese sales from WA cannot be disclosed.

### Notable events

- In May 2020, Element 25 Limited released a PFS for its Butcherbird Manganese Project south of Newman. The company reported that the project provided pre-production capital cost of \$14.5 million, annual production of 357 kt of 33 per cent manganese concentrate and a mine life of 42 years. Approvals for the project are well advanced and construction is expected to commence in late 2020 with production scheduled for the first quarter of 2020.

## 2.2 Petroleum

The value of petroleum products produced in WA (including State onshore and offshore areas as well as adjacent Commonwealth offshore areas) totalled \$37 billion in 2019–20 down four per cent from \$39 billion in 2018–19.<sup>2</sup>

The majority of these sales (more than 95 per cent) were sourced from fields in adjacent Commonwealth offshore areas.

Petroleum production accounted for 22 per cent of the value of all mineral and petroleum sales for WA.

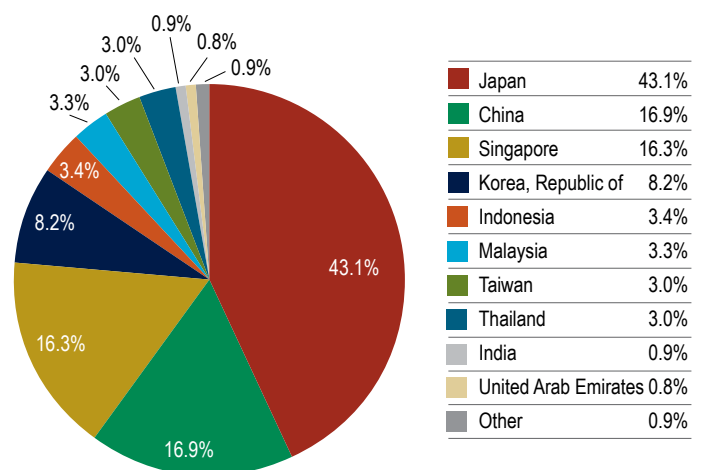


Figure 49 | **Petroleum exports 2019–20**  
**\$35 Billion**  
Source: DMIRS

<sup>2</sup> In early 2016, changes in information sharing between the Australian and WA Governments resulted in the department needing to source alternative petroleum production data. This new dataset was not comparable with the sales data previously provided by the National Offshore Petroleum Titles Administrator resulting in the need for some estimates. From Q1 2016, DMIRS has relied on externally-sourced production data and estimated the value of production from these offshore fields based on total production and prevailing market prices at the time.

Japan (43 per cent) was the major destination for petroleum exports from WA, followed by China (17 per cent), Singapore (16 per cent), South Korea (8 per cent) and Indonesia (3 per cent). While Japan has been the leading import of LNG from WA for decades, China has emerged as an increasingly important market in recent years.



The major commodities file contains more detailed information including:

- Quarterly quantity and value figures for crude oil and condensate.
- Quarterly quantity and value figures for natural gas, LNG and LPG (butane and propane).
- Historic annual average Tapis crude oil prices and recent monthly prices.
- Value of exports of petroleum products from WA by destination.
- Annual historic crude oil and condensate production in WA compared with the rest of Australia.
- Production and domestic consumption of natural gas in WA compared with the east coast of Australia.
- Global trade in LNG, including WA and Australia's position within the global market.
- Proven global oil reserves, by country and OPEC affiliation.

## 2.2.1 LNG

### Prices

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

Most LNG from WA is sold into the Asia Pacific region including Japan, China, and South Korea via long-term contracts in which the price of LNG is tied to oil and lags prices movements by around three months. However, local producers are also increasingly exposed to LNG spot prices through production at above nameplate capacity.

Prices received for LNG exported from Australia into key markets declined across the board in 2019–20 compared to 2018–19, albeit from recent highs:

- Japan's Australian imports price declined from US\$10.21 per GJ to US\$9.26 per GJ.
- China's Australian imports price declined from US\$9.28 per GJ to US\$7.87 per GJ.
- South Korea's Australian imports price declined from US\$9.92 per GJ to US\$8.30 per GJ.

These falls reflected, in part, a shift in LNG spot prices to record lows at the end of the financial year on rising LNG supplies as well as demand factors including reduced energy requirements from unseasonably warm weather during the northern winter, and COVID-19 related restrictions on travel and the manufacturing sector.

However, the decline in LNG import prices is not as great as it might have been due to the lag in oil prices applied to LNG contracts. This meant the full impact of the decline in oil prices through March and April had yet to flow through to LNG prices.

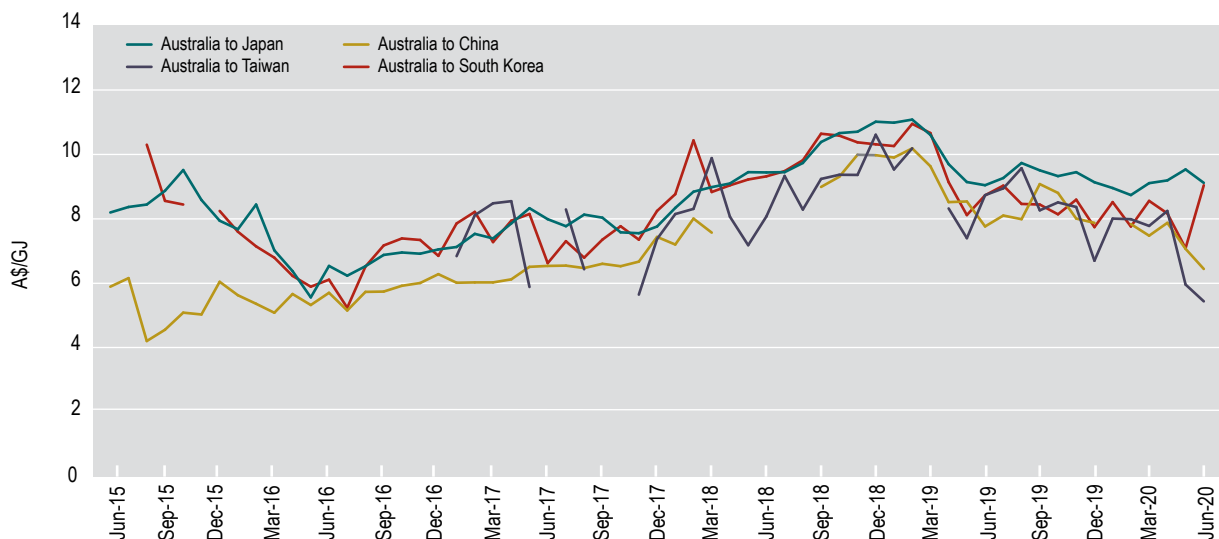


Figure 50 | **LNG import prices**  
Source: EnergyQuest



## Quantity and value

Weaker prices resulted in the value of LNG produced in WA declining by seven per cent to \$27 billion in 2019–20 from \$29 billion in 2018–19.

To put this into perspective, LNG remained the most valuable petroleum product and second most valuable resource commodity overall produced or sold in WA. It accounted for 72 per cent of the value of petroleum production and 16 per cent of total sales.

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

The quantity of LNG from WA reached record levels with more than 47 Mt of LNG produced (up eight per cent from 2018–19).

This result came in the aftermath of port closures caused by Tropical Cyclone Veronica as well as operational outages and maintenance shutdowns during the first half of 2019. It reflected the Wheatstone and Pluto projects operating at above nameplate capacity, as well as first sales from Prelude (prior to its suspension in February 2020 due to electrical issues). It was also achieved despite the shutdown of Train 2 at Gorgon in May over safety concerns.

While Qatar remains the world’s largest exporter of LNG, WA solidified its position as the world’s second largest exporter.

## Notable events

- Amid falling oil prices in the first half of 2020:
  - Scheduled maintenance at the Gorgon and North West Shelf LNG projects was deferred until later in 2020 or 2021 to reduce capital expenditure.
  - A FID on Woodside’s Scarborough, Pluto Train 2 and Browse developments, as well as Shell’s Crux gas field development were also deferred.
  - Major oil and gas producers operating in WA including BP, Shell, Woodside, Santos, Chevron and INPEX Corporation announced asset write downs.

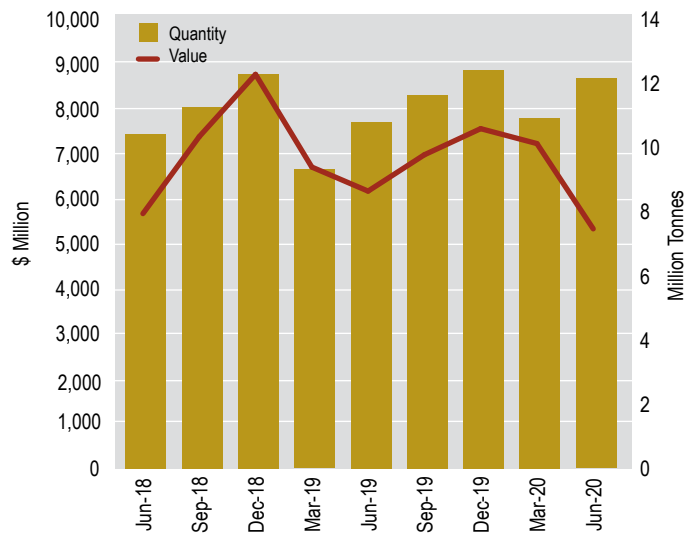


Figure 51 | **LNG quantity and value by quarter**  
Source: DMIRS, EnergyQuest and Woodside

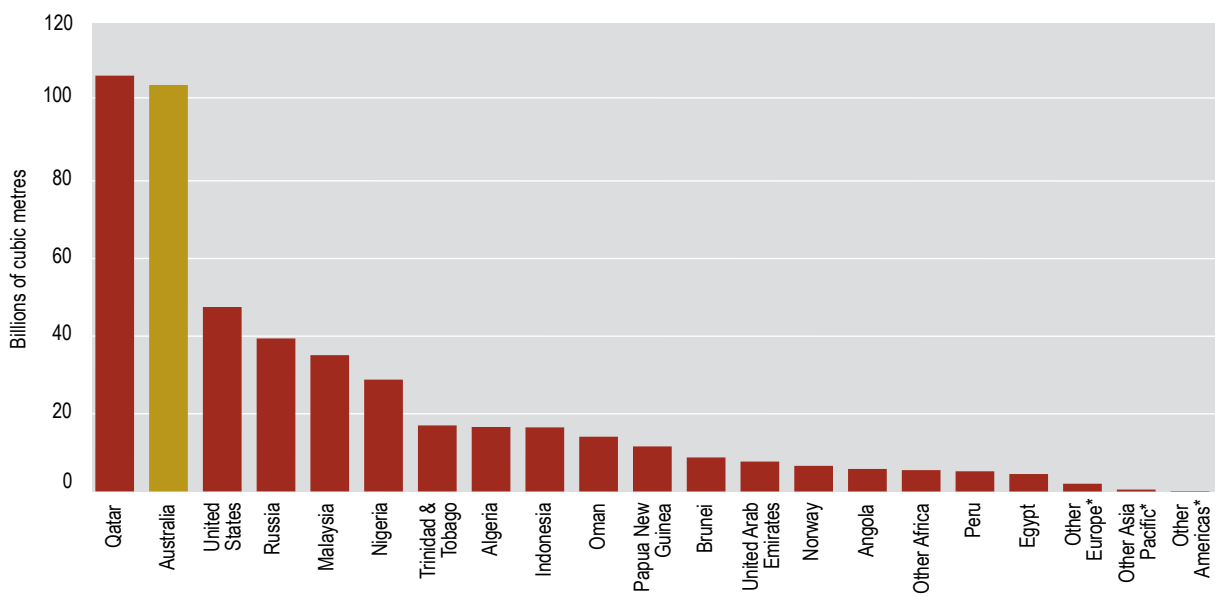


Figure 52 | **Global LNG exports 2019**

Source: BP

\*Note: Includes Re-Exports

- Train 2 of Chevron's Gorgon LNG facility was shut down in May over safety concerns after cracks were discovered in propane heat exchangers.
- Shell's Prelude FLNG facility was suspended in February following power generation and other issues at the plant. The project was also affected by industrial disputes.
- Woodside announced development of the interconnector pipeline to connect Pluto LNG to the Karratha gas plant and its Greater Western Flank Stage 3 project.
- Legislation to extend the life of the North West Shelf project by a further 25 years to 31 December 2059 and facilitate the planned third party tolling of gas at the Karratha Gas Plant, received royal assent in March 2020. Woodside subsequently announced the North West Shelf joint venture partners had agreed on non-binding principles to process gas from Waitsia Stage 2 through the Karratha gas plant for export starting in 2023. The State Government also announced its in-principle support to allow the Waitsia project to backfill available capacity at the Karratha Gas Plant and export some of its gas as LNG for a short period of time.
- Chevron announced its intention to sell its 16.7 per cent share in the North West Shelf project.
- Chevron commenced operations at the carbon capture and storage facility on Barrow Island in August 2019.
- Santos completed the acquisition of ConocoPhillips' northern Australia operating interests. This included acquisition of the Poseidon gas field in the Browse Basin, as well as increased shares in Darwin LNG, the Bayu-Undan field, and the Barossa development in the Northern Territory.
- The State Government announced it is working with Woodside Petroleum to establish Australia's first ship-to-ship LNG bunkering hub and largest re-fueling hub in the Pilbara.
- Woodside announced a 13-year agreement with German company Uniper to supply 500,000 t of LNG per year from 2021, rising to 1 Mt by 2025.

## 2.2.2 Crude oil and condensate

### Prices

The Tapis oil price fell to an average of \$82 per bbl in 2019–20, down 17 per cent from \$98 per bbl the previous year. This fall followed three consecutive years of growth.

After ending 2019 in a relatively strong position at more than \$100 per bbl, oil prices declined dramatically in



Figure 53 | Tapis crude oil price  
Source: WATC

early 2020, falling to a 20-year monthly average low of \$43 per bbl in April.

Prices were pushed higher in late 2019 by:

- A drone attack on Saudi Arabia's oil infrastructure that temporarily cut the country's output by more than five MMbbl a day, or five per cent of global supply.
- The commitment by China to increase its energy imports from the US by US\$50 billion (from 2017 levels) under the 'phase one' trade agreement.
- The extension of production cuts by OPEC and its allies.

However, in early 2020, plummeting demand attributable to the COVID-19 pandemic and related economic shutdowns resulted in global oil storage nearing or exceeding capacity which saw prices fall. The initial COVID-19 related price falls were then exaggerated by excess supplies amid a price war between Russia and Saudi Arabia.

There were some positive signals by mid-2020 as prices staged a mini recovery on the back of Saudi Arabia, Russia and other major oil suppliers agreeing to further supply cuts, storage capacity in the US filling up slower than expected, and the relaxation of COVID-19 related restrictions around the world.

### Quantity and value

The value of oil production increased by 30 per cent to \$2.6 billion (a five-year high) with higher output offsetting the dramatic price falls across the first half of 2020.

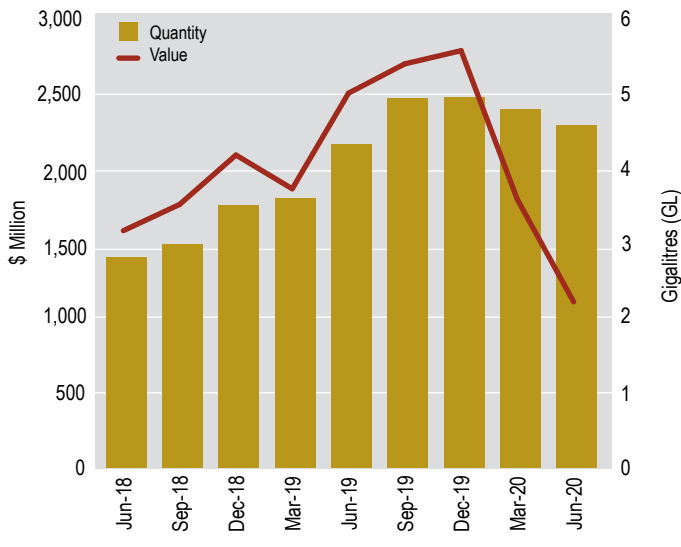


Figure 54 **Crude oil and condensate quantity and value by quarter**  
Source: DMIRS and EnergyQuest

Oil production was up by 63 per cent to five million KL, a level last observed in 2016–17, on account of the start up of new projects and the return to production of others:

- The Vincent field returned to production in July 2019 while the Greater Enfield project fields (Cimatti and Laverda) were commissioned in late August 2019.
- The Pyrenees project continued to ramp-up after an extended maintenance shutdown.
- Output from Santos' Ningaloo Vision floating production, storage and offloading vessel was boosted after horizontal development wells came on-stream in 2018.

The volume of condensate produced in WA also increased, achieving a record of more than 14 million KL, up by one-quarter from 2018–19 which is more than double the production of 2017–18.

Produced predominantly as a by-product of LNG production, increased condensate sales reflected the Wheatstone and Pluto projects operating at above nameplate capacity, the ramp-up of the Ichthys project,<sup>3</sup> as well as first sales from Prelude prior to its suspension in February 2020 due to electrical issues. It was also achieved despite the shutdown of Train 2 at Gorgon in May over safety concerns.

However, as distinct from the oil sector, volumes did not increase enough to offset the impact of lower prices with the overall value of condensate sales dropping by seven per cent to \$5.7 billion.

Liquids were the second most valuable petroleum products produced in WA, and the fourth most valuable resource commodity overall.

The composition of WA's liquids production continued to shift to condensate. Condensate production in WA is now almost three times the volume and more than two times the value of crude oil production. This is the complete opposite of the situation just 15 years ago.

WA's share of national liquids production increased to 79 per cent from 73 per cent the previous year. The State remains a minor oil producer globally.

<sup>3</sup> The majority of condensate from Ichthys is produced direct from the field via a Floating Production Storage and Offloading vessel. As such, it is included in WA figures.

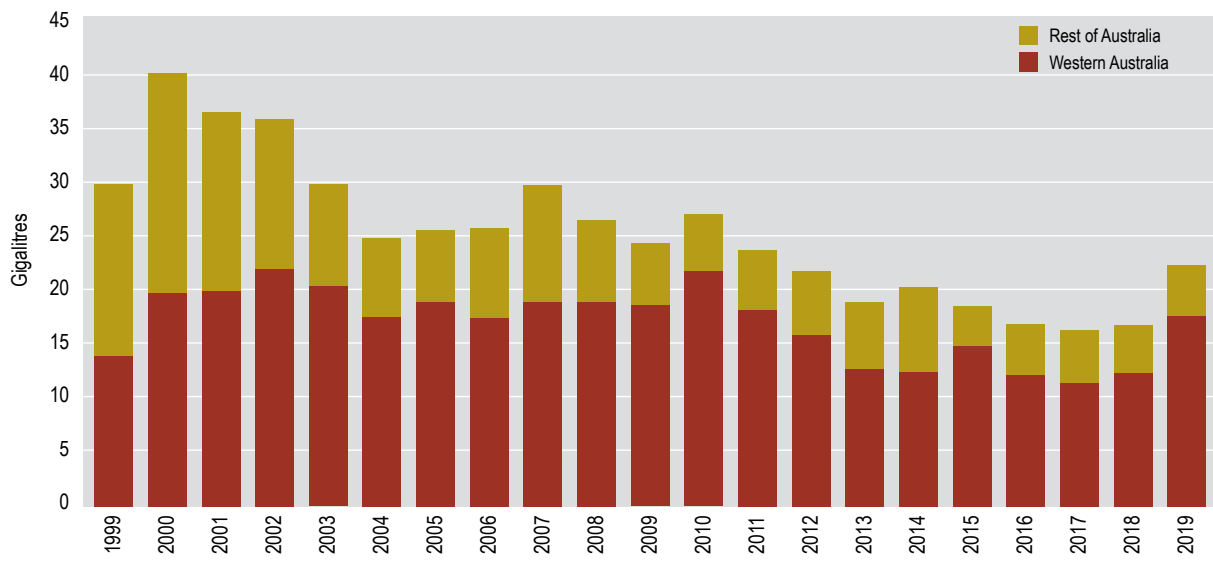


Figure 55 **Crude oil and condensate production WA v rest of Australia**  
Source: DMIRS and EnergyQuest

### Notable events

- Woodside returned the Vincent field to production in July 2019 while the Greater Enfield project fields (Cimatti and Laverda) were commissioned in late August 2019.

### 2.2.3 Natural gas

#### Prices

The average price of domestic gas sold into the Dampier to Bunbury Natural Gas Pipeline, Parmelia pipeline and Goldfields pipeline in WA increased by three per cent to an average of \$4.18 per GJ, from \$4.07 per GJ the previous year. Prices remained at around \$4.00 per GJ since late 2017.

In comparison, gas prices on the East Coast were an average of \$9.32 per GJ. While this is up by just one per cent from \$9.24 per GJ in 2018–19, it remains more than double the average price of \$4.59 per GJ in 2014–15.

Ongoing low gas prices in WA have been supported by adequate supplies and the State’s domestic gas policy. New sources of domestic gas including from projects currently in the development pipeline including Browse, Scarborough and West Eregulla will be required to maintain adequate supplies and keep prices low.

#### Quantity and value

The quantity of natural gas sold into the domestic market increased to a new record of 11.1 Bcm (423 PJ) in 2019–20.

Higher sale quantities combined with higher prices to increase the value of sales by 10 per cent to \$1.8 billion. This was below the record sales value of \$1.9 billion achieved in 2015–16.

The North West Shelf project fields remained the largest contributor to WA’s domestic gas supply, followed by Varanus Island, Macedon, Wheatstone and Gorgon.

#### Notable events

- In August 2020, the State Government announced that the WA domestic gas policy has been amended to prevent the export of local gas. Under the updated policy, local gas cannot be exported to the Eastern States or overseas. Gas used to power ships will also not be considered domestic gas.
- Mitsui & Co acquired 17 per cent of the Beharra Springs project from Beach Energy, aligning interests in Perth Basin assets (Beharra Springs, Waitsia and the Xyris gas processing facility) between Beach Energy and Mitsui & Co at 50:50.
- Chevron signed a domestic gas sales agreement with BHP Nickel West to deliver 22 PJ of gas from its Wheatstone facility over three and a half years.
- Beach Energy and Mitsui & Co announced a 4.5 year sales agreement with Alinta Energy for up to 0.02 PJ of gas per day (approximately 33 PJ in total) from Waitsia.
- Chevron and Newcrest Mining agreed on the supply of 16 PJ of gas from its Wheatstone, Gorgon and North West Shelf facilities to the Telfer gold project over a period of 3.5 years (until July 2023).

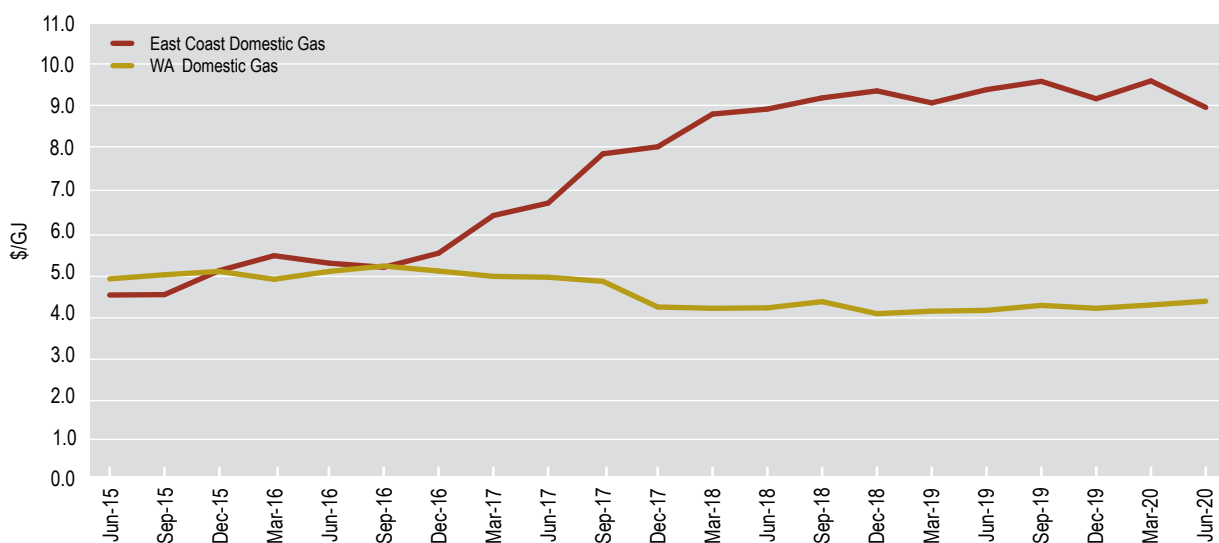


Figure 56 | Average quarterly natural gas prices  
Source: EnergyQuest and DMIRS

## 3 SUPPLEMENTARY INFORMATION

**TABLE 4. Quick resources facts – 2019–20**

<b>Output of Minerals and Energy</b>	<b>\$ million</b>
Western Australia	171,729
WA minerals	134,297
WA petroleum	37,432
<b>Major Western Australian Commodities</b>	<b>\$ million</b>
Iron Ore	103,426
Petroleum	37,432
Gold	15,840
Alumina and Bauxite	6,417
Nickel	3,145
<b>Crude Oil and Condensate</b>	<b>Million barrels</b>
Western Australia	121
Australia	150
WA share	80%
<b>Natural Gas (inc. LNG feedstock and CSG)</b>	<b>Million cubic metres</b>
Western Australia	76,724
Australia	141,057
WA share	54%
<b>Merchandise Exports</b>	<b>\$ million</b>
Western Australia	183,793
Australia	381,866
WA share	48%
Minerals and energy share of Western Australia merchandise exports	94%
<b>Mineral and Energy Exports</b>	<b>\$ million</b>
Western Australia	173,662
Australia	290,399
WA share	60%
<b>Mineral Exploration</b>	<b>\$ million</b>
Western Australia	1,693
Australia	2,772
WA share	61%
<b>Petroleum Exploration</b>	<b>\$ million</b>
Western Australia	596
Australia	1,263
WA share	47%
<b>Private New Capital Expenditure</b>	<b>\$ million</b>
Western Australia	26,078
Australia	116,839
WA share	22%
<b>Mining Investment</b>	<b>\$ million</b>
Western Australia	18,907
Australia	35,112
WA share	54%
Mining investment share of Western Australia new capital expenditure	73%
<b>Economic Impact</b>	<b>\$ million</b>
Western Australian minerals and energy GVA 2018–19	84,472
Australian minerals and energy GVA 2018–19	160,614
WA share	53%
Western Australian GSP 2018–2019	260,640
Australia GDP 2018–2019	1,884,969
Mining component of WA GSP **	32%

\*\* The ABS categorise alumina as manufacturing and therefore it is not included in the GSP mining component above. All data is for the 2019-20 financial year unless otherwise stated.

**TABLE 5. Quantity and value of minerals and petroleum last two years**

COMMODITY	UNIT	FINANCIAL YEAR 2018–19		FINANCIAL YEAR 2019–20	
		QUANTITY	VALUE \$	QUANTITY	VALUE \$
<b>ALUMINA AND BAUXITE</b>	t	15,427,533	8,279,440,429	15,804,011	6,416,570,525
<b>BASE METALS</b>					
Copper Metal	t	162,483	1,321,630,656	169,888	1,322,356,602
Lead Metal	t	4,852	13,344,177	2,905	7,786,281
Zinc Metal	t	72,263	263,162,703	72,263	221,060,069
<b>TOTAL BASE METALS</b>			<b>1,598,137,536</b>		<b>1,551,202,952</b>
<b>CLAYS</b>	t	19,259	1,662,231	18,920	1,985,156
<b>COAL</b>	t	6,275,190	319,370,156	6,195,614	326,981,226
<b>CONSTRUCTION MATERIALS</b>					
Aggregate	t	1,608,274	54,031,240	3,281,726	86,994,448
Gravel	t	168,084	2,240,932	158,017	2,106,263
Rock	t	381,791	11,071,975	330,067	7,277,466
Sand	t	2,016,367	27,266,347	2,424,683	29,366,535
<b>TOTAL CONSTRUCTION MATERIALS</b>			<b>94,610,494</b>		<b>125,744,712</b>
<b>DIAMONDS</b>	ct	11,149,895	219,221,184	17,489,950	224,655,241
<b>DIMENSION STONE</b>	t	8,910	2,257,771	10,868	2,043,976
<b>GEM &amp; SEMI-PRECIOUS STONES</b>	kg	129,385	343,859	267,977	423,148
<b>GOLD</b>	kg	211,152	11,957,719,375	211,761	15,840,174,637
<b>GYPSUM</b>	t	1,004,402	20,770,368	617,285	14,606,512
<b>MINERAL SANDS</b>					
Garnet	t	388,470	n/a	323,842	n/a
Ilmenite	t	224,718	47,419,700	268,608	60,855,827
Leucoxene	t	15,176	18,209,118	26,889	27,460,298
Rutile	t	23,906	29,470,430	31,996	35,958,581
Zircon	t	133,958	247,119,166	168,597	267,362,728
Synthetic Rutile	t	218,274	244,256,417	277,931	279,208,914
Other (includes Garnet and Staurolite)	t		116,708,350		105,776,254
<b>TOTAL MINERAL SANDS</b>			<b>703,183,181</b>		<b>776,622,603</b>
<b>IRON ORE</b>	t	794,651,793	81,783,119,466	836,234,645	103,425,648,457

**TABLE 5. Quantity and value of minerals and petroleum last two years (continued)**

COMMODITY	UNIT	FINANCIAL YEAR 2018–19		FINANCIAL YEAR 2019–20	
		QUANTITY	VALUE \$	QUANTITY	VALUE \$
<b>LIMESAND–LIMESTONE–DOLOMITE</b>	t	4,305,108	50,981,574	4,009,523	39,385,237
<b>MANGANESE ORE</b>	t	572,836	477,281,090	553,234	n/a
<b>NICKEL INDUSTRY</b>					
Cobalt	t	5,228	332,389,018	5,805	292,902,646
Nickel	t	154,383	2,699,898,111	153,516	3,144,711,974
Palladium and Platinum By-Product	kg	512	28,075,813	482	39,618,802
<b>TOTAL NICKEL INDUSTRY</b>			<b>3,060,362,942</b>		<b>3,477,233,422</b>
<b>PETROLEUM</b>					
Condensate	kl	11,299,302	6,161,313,787	14,190,290	5,719,726,284
Crude Oil	kl	3,096,522	2,034,851,570	5,034,695	2,646,721,161
LNG	t	43,635,291	29,005,992,287	47,113,045	27,078,672,195
LPG – Butane and Propane	t	447,229	327,635,740	431,562	217,253,672
Natural Gas	'000m <sup>3</sup>	10,410,026	1,612,372,460	11,137,899	1,769,627,944
<b>TOTAL PETROLEUM</b>			<b>39,142,165,844</b>		<b>37,432,001,257</b>
<b>RARE EARTHS</b>	kg	29,044,627	345,358,353	22,149,362	258,928,067
<b>SALT</b>	t	11,729,482	303,646,875	11,266,385	375,128,730
<b>SILICA-SILICA SAND</b>	t	992,208	21,269,502	990,278	19,637,072
<b>SILVER</b>	kg	129,425	84,831,658	134,296	104,617,751
<b>TIN–TANTALUM–LITHIUM</b>					
Spodumene	t	1,687,964	1,653,501,315	1,351,934	916,836,034
Tantalite	t	200	n/a	166	n/a
Tin Metal	t	83	n/a	131	n/a
<b>TOTAL TIN-TANTALUM-LITHIUM</b>			<b>1,693,794,719</b>		<b>942,629,035</b>
<b>OTHER (May include Rare Earths, Manganese, Spongolite, Talc, and Cesium)</b>			26,715,755		373,010,927
<b>TOTAL VALUE</b>			<b>150,186,244,363</b>		<b>171,729,623</b>

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

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

**TABLE 6. Quantity and value of minerals and petroleum historic**

		2012-13		2013-14		2014-15	
COMMODITY	UNIT	Quantity	Value	Quantity	Value	Quantity	Value
<b>ALUMINA AND BAUXITE</b>							
Alumina	t	13,530,752	4,027,810,217	13,717,952	4,295,348,699	13,771,412	5,022,721,218
Bauxite	t	0	0	0	0	0	0
<b>TOTAL ALUMINA &amp; BAUXITE</b>	t	13,530,752	4,027,810,217	13,717,952	4,295,348,699	13,771,412	5,022,721,218
<b>BASE METALS</b>							
Copper Metal	t	209,266	1,423,043,554	211,186	1,559,565,610	184,495	1,283,046,797
Lead Metal	t	16,641	35,049,525	78,651	178,764,058	59,248	136,949,662
Zinc Metal	t	55,848	103,867,913	54,060	118,261,576	77,831	197,040,406
<b>TOTAL BASE METALS</b>			1,561,960,992		1,856,591,245		1,617,036,865
<b>CHROMITE</b>	t	195,772	n/a	66,540	n/a	0	0
<b>CLAYS</b>	t			5,139	345,148	17,670	1,043,438
<b>COAL</b>	t	7,494,280	310,812,886	6,275,422	263,701,680	6,553,064	306,733,911
<b>CONSTRUCTION MATERIALS</b>							
Aggregate	t	4,391,376	148,775,764	2,154,534	47,255,402	1,963,871	69,239,676
Gravel	t	561,135	3,947,125	51,853	338,431	172,556	993,903
Rock	t	1,109,761	27,142,818	402,652	10,070,061	1,746,693	46,504,731
Sand	t	5,415,504	62,093,160	3,796,749	28,420,888	5,658,758	46,314,767
Other		0	0	0	0	0	0
<b>TOTAL CONSTRUCTION MATERIALS</b>			241,958,866		86,084,782		163,053,077
<b>DIAMONDS</b>	ct	9,608,685	355,964,877	11,610,631	398,210,926	10,387,926	342,313,664
<b>DIMENSION STONE</b>	t	4,196	1,221,243	5,021	1,365,020	21,250	2,892,731
<b>GEM &amp; SEMI-PRECIOUS STONES</b>	kg	197,832	254,158	309,575	401,960	720,552	1,402,333
<b>GOLD</b>	kg	179,849	9,022,522,018	196,074	8,890,995,046	193,162	9,107,167,942
<b>GYPSUM</b>	t	1,575,769	7,027,903	532,919	9,496,857	576,880	12,240,632
<b>MINERAL SANDS</b>							
Garnet	t	317,336	64,834,324	357,266	68,896,504	299,022	n/a
Ilmenite	t	270,770	72,680,422	78,900	19,515,066	99,674	21,000,789
Leucoxene	t	29,071	31,231,788	29,268	26,205,650	16,965	14,636,208
Rutile	t	46,938	80,261,379	65,084	65,938,306	30,206	29,582,184
Zircon	t	215,831	189,547,782	212,068	114,307,405	182,859	136,321,656
Synthetic Rutile	t	n/a	n/a	n/a	n/a	198,232	215,809,868
Other (may include Garnet, Monazite, Rutile, Synthetic Rutile, Staurolite)	t		372,123,979		176,168,377		53,279,846
<b>TOTAL MINERAL SANDS</b>		1,355,357	810,679,675	1,078,271	471,031,306	1,017,169	470,630,551



2015-16		2016-17		2017-18		2018-19		2019-20	
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
13,893,540	4,937,279,870	13,855,382	5,073,995,897	13,669,467	6,596,818,325	13,643,445	8,211,863,758	14,015,168	6,349,740,265
47,703	1,952,600	310,341	14,563,469	1,117,323	46,704,951	1,784,088	67,576,671	1,788,843	66,830,260
13,941,243	4,939,232,470	14,165,722	5,088,559,366	14,786,790	6,643,523,276	15,427,533	8,279,440,429	15,804,011	6,416,570,525
190,275	1,181,262,087	170,730	1,240,528,049	174,074	1,347,798,371	162,483	1,321,630,656	169,888	1,322,356,602
5,988	14,810,595	3,507	10,146,717	7,397	22,799,223	4,852	13,344,177	2,905	7,786,281
82,676	195,494,453	82,943	204,161,259	93,373	323,504,398	71,405	263,162,703	72,263	221,060,069
	1,391,567,135		1,454,836,025		1,694,101,992		1,598,137,536		1,551,202,952
0	0	0	0	0	0	0	0	0	0
21,969	1,104,708	20,865	1,390,448	18,278	1,274,478	19,259	1,662,231	18,920	1,985,156
6,890,951	336,466,825	6,806,389	338,435,045	6,679,935	331,959,622	6,275,190	319,370,156	6,195,614	326,981,226
1,313,696	42,256,613	1,053,311	29,764,624	1,236,605	37,736,095	1,608,274	54,031,240	3,281,726	86,994,448
177,243	1,055,083	261,219	1,652,110	155,130	1,067,114	168,084	2,240,932	158,017	2,106,263
220,402	1,828,018	411,658	6,367,558	267,388	4,417,888	381,791	11,071,975	330,067	7,277,466
3,434,992	34,591,599	2,580,585	25,287,679	4,099,134	28,281,901	2,016,367	27,266,347	2,424,683	29,366,535
0	0	0	0	0	0	0	0	0	0
	79,731,313		63,071,972		71,502,997		94,610,494		125,743,692
13,869,547	354,047,664	12,607,032	268,383,094	15,281,303	249,759,751	11,149,895	219,221,184	17,489,950	224,655,241
4,113	2,205,326	4,795	1,823,218	6,397	2,372,892	8,910	2,257,771	10,868	2,043,976
243,376	627,546	334,786	725,557	204,227	443,041	129,385	343,859	267,977	423,148
195,968	10,104,514,299	203,003	10,859,574,221	221,042	11,435,572,304	211,152	11,957,719,375	211,761	15,840,174,637
551,910	13,830,966	531,399	12,980,853	895,502	20,462,106	1,004,402	20,770,368	617,285	14,606,512
251,162	n/a	565,618	n/a	379,724	n/a	388,470	n/a	323,842	n/a
174,687	39,692,103	178,528	42,912,243	120,227	25,279,255	224,718	47,419,700	268,608	60,855,827
18,137	16,452,584	7,144	6,492,778	14,287	13,031,604	15,176	18,209,118	26,889	27,460,298
45,888	44,260,114	21,562	21,953,547	20,596	22,170,174	23,906	29,470,430	31,996	35,958,581
191,551	151,297,003	184,700	101,083,491	72,567	100,649,559	133,958	247,119,166	168,597	267,362,728
271,220	254,260,587	298,482	252,213,036	264,427	279,071,093	218,274	244,256,417	277,931	279,208,914
	65,585,669		158,791,842		110,190,573		116,708,350		215,768,989
1,170,840	571,548,060	1,457,133	583,446,937	1,118,276	550,392,258	1,179,678	703,183,181	1,327,983	776,622,603

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

		2012-13		2013-14		2014-15	
COMMODITY	UNIT	Quantity	Value	Quantity	Value	Quantity	Value
<b>IRON ORE</b>	t	511,760,416	56,204,322,877	623,507,315	75,165,715,685	718,806,408	54,375,667,290
<b>LIMESAND-LIMESTONE-DOLOMITE</b>	t	4,091,849	24,239,571	3,116,623	23,378,197	4,903,039	33,175,834
<b>MANGANESE ORE</b>	t	649,695	n/a	711,536	n/a	800,985	n/a
<b>NICKEL INDUSTRY</b>							
Cobalt	t	6,200	159,147,805	6,236	175,117,788	6,036	210,567,512
Nickel	t	227,463	3,511,711,762	232,673	3,419,023,120	183,320	3,169,605,001
Palladium and Platinum By-Product	kg	658	15,045,619	1,015	18,855,882	464	13,380,730
<b>TOTAL NICKEL INDUSTRY</b>			3,685,905,186		3,612,996,790		3,393,553,243
<b>PETROLEUM</b>							
Condensate	kl	6,116,968	3,922,032,524	4,399,263	3,199,879,402	6,753,213	3,528,826,231
Crude Oil	kl	8,609,425	5,972,058,200	6,867,302	5,385,519,964	7,952,478	4,567,638,161
LNG	t	19,804,919	12,147,214,397	19,826,065	14,651,522,774	20,447,845	13,817,042,487
LPG – Butane and Propane	t	752,910	634,052,635	389,533	353,541,334	553,055	405,565,516
Natural Gas	'000m <sup>3</sup>	8,713,949	1,434,550,772	8,217,579	1,446,935,711	9,875,339	1,820,197,055
<b>TOTAL PETROLEUM</b>			24,109,908,528		25,037,399,184		24,139,269,449
<b>RARE EARTHS</b>	kg	1,403,906	n/a	7,653,061	n/a	13,762,327	n/a
<b>SALT</b>	t	12,389,643	381,652,888	12,992,042	410,097,849	11,726,606	374,622,315
<b>SILICA-SILICA SAND</b>	t	498,232	16,886,756	449,587	15,847,051	483,809	31,981,604
<b>SILVER</b>	kg	123,740	100,560,679	137,179	93,414,212	150,578	95,972,009
<b>TIN-TANTALUM-LITHIUM</b>							
Spodumene	t	485,879	178,786,684	342,065	150,564,378	489,074	245,874,387
Tantalite	t	201	17,940,739	58	4,074,774	70	n/a
Tin Metal	t	193	2,703,339	0	0	14	n/a
<b>TOTAL TIN-TANTALUM-LITHIUM</b>			199,430,762		154,639,152		251,051,748
<b>OTHER</b> (May include Manganese, Rare Earths, Spongolite, Talc, Vanadium, Chromite, Cesium and Feldspar)	t		425,002,389		494,402,726		507,533,600
<b>TOTAL VALUE</b>			<b>101,488,122,472</b>		<b>121,281,118,367</b>		<b>100,272,139,777</b>

2015-16		2016-17		2017-18		2018-19		2019-20	
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
748,100,421	48,767,740,598	792,984,563	64,319,249,452	839,424,190	62,074,172,938	794,651,793	81,783,119,466	836,234,645	103,425,648,457
4,446,486	28,826,046	4,178,360	26,012,783	3,943,155	30,401,104	4,305,108	50,981,574	4,009,523	39,385,237
425,303	146,188,090	236,565	n/a	378,889	282,549,758	572,836	477,281,090	553,234	n/a
5,479	174,846,826	4,759	239,639,935	5,200	510,247,330	5,228	332,389,018	5,805	292,902,646
175,752	2,202,734,451	157,564	2,094,500,242	163,374	2,635,829,872	154,383	2,699,898,111	153,516	3,144,711,974
687	16,656,441	783	21,808,381	645	26,219,908	512	28,075,813	482	39,618,802
	2,394,237,718		2,355,948,558		3,172,297,110		3,060,362,942		3,477,233,422
6,775,142	2,213,709,834	6,037,603	2,228,572,828	7,114,021	3,356,383,307	11,299,302	6,161,313,787	14,190,290	5,719,726,284
7,685,922	3,089,384,046	5,404,294	2,111,578,898	4,877,411	2,354,717,007	3,096,522	2,034,851,570	5,034,695	2,646,721,161
20,955,641	10,764,545,353	28,685,477	12,728,310,038	37,893,517	18,920,841,693	43,635,291	29,005,992,287	47,113,045	27,078,672,195
531,595	249,059,073	527,391	273,097,308	451,242	331,271,410	447,229	327,635,740	431,562	217,253,672
10,223,641	1,913,134,894	9,708,934	1,830,012,904	10,174,920	1,655,176,000	10,410,026	1,612,372,460	11,137,899	1,769,627,944
	18,229,833,199		19,171,571,976		26,618,389,416		39,142,165,844		37,432,001,257
18,773,690	n/a	26,829,580	n/a	29,676,877	n/a	29,044,627	345,358,353	22,149,362	258,928,067
10,974,721	336,253,755	10,874,279	292,285,826	12,963,778	302,930,944	11,729,482	303,646,875	11,266,385	375,128,730
581,966	18,072,793	728,859	20,364,867	974,445	18,775,811	992,208	21,269,502	990,278	19,637,072
155,292	104,786,546	142,868	98,465,480	163,098	105,327,204	129,425	84,831,658	134,296	104,617,751
465,817	260,721,540	914,056	595,472,095	2,138,226	1,698,466,967	1,687,964	1,653,501,315	1,351,934	916,836,034
183	n/a	54	n/a	81	n/a	200	n/a	166	n/a
22	n/a	41	n/a	62	n/a	83	n/a	131	n/a
	269,771,196		605,720,928		1,717,016,340		1,693,794,719		942,629,035
	199,236,526		300,923,570		365,503,055		26,715,755		373,010,927
<b>88,289,828,780</b>		<b>105,863,770,175</b>		<b>115,688,728,398</b>		<b>150,186,244,363</b>		<b>171,729,229,623</b>	

**TABLE 7. Value of minerals and petroleum by region by commodity**

REGION	2019–20 Value
<b>Pilbara</b>	
Iron Ore	101,252,585,615
Gold	910,594,816
Silver and Manganese Ore	358,150,825
Salt	274,238,815
Copper	191,893,943
Tin Tantalum Lithium	190,428,640
Construction Materials, Dimension Stone and Limesand Limestone Dolomite	84,986,681
Gem and Semi Precious Stones	110,981
<b>Pilbara Total</b>	<b>103,262,990,316</b>

<b>Offshore Petroleum</b>	
Liquefied Natural Gas	27,078,672,195
Condensate	5,719,726,284
Crude Oil	2,604,693,848
Natural Gas and LPG Butane and Propane	1,974,013,314
<b>Offshore Total</b>	<b>37,377,105,642</b>

<b>Goldfields-Esperance</b>	
Gold	10,383,210,350
Nickel, Platinum and Palladium	2,702,711,704
Tin Tantalum Lithium	337,389,120
Rare Earth Oxide and Cesium	264,120,432
Cobalt	283,022,225
Copper and Zinc	212,017,131
Silver	39,325,804
Construction Materials	19,478,417
Gypsum, Limesand Limestone Dolomite and Dimension Stone	11,133,245
<b>Goldfields-Esperance Total</b>	<b>14,252,408,428</b>

<b>Peel</b>	
Gold, Silver and Copper	1,768,944,111
<b>Peel Total</b>	<b>1,768,944,111</b>

<b>Mid West</b>	
Gold	2,599,268,027
Iron Ore	1,011,849,903
Copper, Lead and Zinc	913,679,850
Mineral Sands	138,659,960
Silver	45,646,410
Petroleum	32,360,020
Talc, Attapulgitite and Saponite	12,066,835
Limesand Limestone Dolomite and Gypsum	1,628,904
Construction Materials	1,872,689
Gem and Semi Precious Stones	226,571
<b>Mid West Total</b>	<b>4,757,259,168</b>

REGION	2019–20 Value
<b>Wheatbelt</b>	
Iron Ore and Gypsum	856,042,506
Mineral Sands	527,464,460
Nickel, Copper and Silver	411,114,295
Gold	314,097,078
Salt and Silica and Silica Sand	16,163,642
Limesand Limestone Dolomite, Construction Materials and Clays	10,609,088
<b>Wheatbelt Total</b>	<b>2,135,491,075</b>

<b>Kimberley</b>	
Iron ore and Petroleum	333,835,555
Diamonds and Nickel	298,247,718
Gold, Copper and Silver	110,173,753
Cobalt and Rare Earth Oxide	12,832,793
Construction Materials and Dimension Stone	9,952,040
<b>Kimberley Total</b>	<b>765,041,859</b>

<b>South West Total</b>	
Alumina and Construction Materials	2,299,980,057
Tin Tantalum Lithium	414,811,275
Coal	326,981,226
Mineral Sands	110,498,177
Limesand Limestone Dolomite and Dimension Stone	2,068,598
<b>South West Total</b>	<b>3,154,339,333</b>

<b>Gascoyne</b>	
Salt	89,572,896
Gypsum and Spongolite	7,269,477
Construction Materials	783,981
Gem and Semi Precious Stones	85,596
Limesand Limestone Dolomite	83,292
<b>Gascoyne Total</b>	<b>97,795,242</b>

<b>Perth Metropolitan</b>	
Alumina, Bauxite and Kaolin	4,117,258,300
Silica and Limesand Limestone	24,010,884
Construction Materials	9,282,971
<b>Perth Metropolitan Total</b>	<b>4,150,552,155</b>

<b>Great Southern</b>	
Spongolite, Silica and Limesand Limestone	7,302,294
<b>Great Southern Total</b>	<b>7,302,294</b>

**TABLE 8. Value of minerals and petroleum by region by local government area**

REGION	2019–20 Value
<b>Pilbara</b>	
East Pilbara	51,798,400,145
Ashburton	51,239,823,971
Karratha	137,030,295
Port Hedland	87,735,905
<b>Pilbara Total</b>	<b>103,262,990,316</b>

<b>Offshore Petroleum</b>	<b>37,377,105,642</b>
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<b>Goldfields-Esperance</b>	
Laverton	3,675,188,884
Coolgardie	3,594,037,264
Kalgoorlie-Boulder	2,829,223,269
Leonora	2,264,283,820
Menzies	845,694,243
Dundas	813,444,552
Ravensthorpe	126,428,747
Esperance	104,107,650
<b>Goldfields-Esperance Total</b>	<b>14,252,408,428</b>

<b>Peel</b>	
Boddington	1,768,944,111
<b>Peel Total</b>	<b>1,768,944,111</b>

<b>Mid West Total</b>	
Meekatharra	1,218,838,832
Perenjori	894,590,881
Yalgoo	866,119,424
Wiluna	850,383,552
Mt Magnet	576,323,363
Cue	166,323,567
Geraldton	110,666,803
Irwin	33,480,662
Carnamah and Three Springs	39,075,189
Coorow	1,456,895
<b>Mid West Total</b>	<b>4,757,259,168</b>

<b>Great Southern</b>	
Albany, Plantagenet and Denmark	7,302,294
<b>Great Southern Total</b>	<b>7,302,294</b>

REGION	2019–20 Value
<b>Wheatbelt</b>	
Yilgarn	1,052,966,847
Kondinin	410,718,125
Dandaragan	375,894,196
Gingin	161,921,557
Westonia	123,299,121
Northam, Kellerberrin and Moora	5,297,513
Lake Grace	3,113,964
Dalwallinu	1,136,650
Wyalkatchem and Dowerin	711,828
Koorda	431,273
<b>Wheatbelt Total</b>	<b>2,135,491,075</b>

<b>Kimberley</b>	
Derby–West Kimberley	319,802,570
Wyndham–East Kimberley	241,339,127
Halls Creek	197,484,439
Broome	6,415,723
<b>Kimberley Total</b>	<b>765,041,859</b>

<b>South West</b>	
Collie	2,626,808,538
Bridgetown–Greenbushes	414,811,275
Capel and Bunbury	90,740,131
Busselton and Augusta–Margaret River	21,649,065
Donnybrook-Balingup	179,233
Manjimup	151,091
<b>South West Total</b>	<b>3,154,339,333</b>

<b>Gascoyne</b>	
Shark Bay	51,233,044
Carnarvon	45,777,901
Exmouth	782,873
Upper Gascoyne	1,424
<b>Gascoyne Total</b>	<b>97,795,242</b>

<b>Perth Metropolitan</b>	
Kwinana	4,116,747,941
Swan	16,465,290
Cockburn	13,476,502
Wanneroo	3,228,214
Kalamunda and Rockingham	634,208
<b>Perth Metropolitan Total</b>	<b>4,150,552,155</b>

**TABLE 9. Average annual employment in the WA mineral sector**

<b>Primary Commodity</b>	<b>2018–19 Nol*</b>	<b>2019–20 Nol*</b>	<b>2018–19 FTE*</b>	<b>2019–20 FTE*</b>
Alumina – Bauxite	7,360	8,434	6,924	6,765
Base Metals	2,627	2,636	2,256	2,075
Chemicals	165	129	58	49
Clays	73	148	37	124
Coal	1,139	1,280	711	700
Construction Materials	2,736	2,634	766	700
Diamond	902	665	836	618
Diatomite – Spongolite	2	2	2	1
Dimension Stone	237	179	59	51
Gem & Semi-Precious Stones	4	3	0	0
Gold	31,369	31,679	25,651	26,433
Gypsum	72	52	19	18
Iron Ore	60,089	65,454	45,116	50,738
Limestone – Limesand	789	584	137	124
Manganese Ore	486	530	497	522
Mineral Sands	3,084	3,086	2,053	1,957
Nickel	6,064	7,340	6,232	7,559
Other	70	68	24	21
Phosphate	172	137	157	114
Potash	26	122	33	183
Rare Earths	326	262	298	228
Salt	1,024	965	614	645
Silica – Silica Sand	567	553	297	275
Silver	11	6	3	1
Talc	95	65	40	29
Tin – Tantalum – Lithium	3,606	2,673	4,855	2,563
Unassigned	759	631	588	528
Vanadium – Titanium	9	13	6	5
<b>Grand Total</b>	<b>123,865</b>	<b>130,332</b>	<b>98,268</b>	<b>103,031</b>

**TABLE 10. Principal mining projects 2019–20**

Company	Project(s)	Comments
<b>Base metals</b>		
<b>EMR Capital Pty Ltd</b> Level 2, 150 Collins Street, Melbourne VIC 3000 (03) 9669 9999 www.emrcapital.com	Golden Grove	
<b>Metals X Ltd</b> Level 5, 197 St Georges Terrace Perth WA 6000 (08) 9220 5700 www.metalsx.com.au	Nifty	
<b>Round Oak Minerals Pty Ltd</b> Level 10, 120 Edward St Brisbane Qld 4000 (07) 3835 6200 www.roundoakminerals.com.au	Jaguar	
<b>Sandfire Resources NL</b> Level 2, 10 Kings Park Road West Perth WA 6005 (08) 6430 3800 www.sandfire.com.au	DeGrussa	
<b>Bauxite</b>		
<b>Alcoa Corporation</b> 181–205 Davy Street, Booragoon WA 6154 (08) 9316 5111 www.alcoa.com/australia	Huntly Willowdale	Huntly and Willowdale are owned by a joint venture of Alcoa Corporation (60%) and Alumina Limited (40%)
<b>South32 Limited</b> Level 35, 108 St Georges Tce, Perth WA 6000 (08) 9324 9000 www.south32.net	Boddington	Boddington is a joint venture of South32 Limited (86%) Sojitz Corporation (9%), and Press Metal Bintulu (5%).
<b>Caesium</b>		
<b>Pioneer Resources Limited</b> 72 Kings Park Road, West Perth WA 6005 (08) 9322 6974 www.pioneerresources.com.au	Pioneer Dome	
<b>Coal</b>		
<b>Griffin Coal Mining Company Pty Ltd</b> 1st Floor, 677 Murray Street, Perth WA 6005 (08) 6188 2200 www.griffincoal.com.au	Griffin	
<b>Yancoal Australia Limited</b> Level 18, Darling Park Tower 2, 201 Sussex Street Sydney NSW 2000 (02) 8583 5300 www.yancoal.com.au	Premier	
<b>Diamonds</b>		
<b>Rio Tinto Ltd</b> Level 16, Central Park 152-158 St Georges Terrace Perth WA 6000 (08) 9168 4900 www.riotinto.com	Argyle	
<b>Gold</b>		

**TABLE 10. Principal mining projects 2019–20 (continued)**

<b>Company</b>	<b>Project(s)</b>	<b>Comments</b>
<b>Adaman Resources Pty Ltd</b> Level 3, 140 St Georges Terrace, Perth WA 6000 (08) 6216 9900 www.adamanresources.com.au	Kirkalocka	Re-opened project. Mining began in 2019 with first sales in October 2019.
<b>AngloGold Ashanti Limited</b> Level 10, 140 St Georges Terrace, Perth WA 6000 (08) 9425 4600 www.anglogoldashanti.com	Sunrise Dam Tropicana	Tropicana is a joint venture of AngloGold Ashanti Limited (70%) and Independence Group NL (30%).
<b>Bar Twenty Pty Ltd</b>	Bar Twenty	Re-opened project. Sales between September and November 2019.
<b>Beacon Minerals Limited</b> 144 Vivian Street Boulder 6432 WA (08) 9093 2477 www.beaconminerals.com.au	Jaurdi	New project. First production in September 2019.
<b>Billabong Gold Pty Ltd</b> Level 1, 30 Richardson Street, West Perth WA 6005 (08) 6324 0000 www.superior-gold.com	Hermes Plutonic	Billabong Gold Pty Ltd is a subsidiary of Superior Gold Inc. Mining activities concluded in May 2019, with processing activities concluding in December 2019.
<b>Dacian Gold Limited</b> Level 2, 1 Preston Street, Como WA 6152 (08) 6323 9000 www.daciangold.com.au	Mt Morgans	
<b>Evolution Mining Limited</b> Level 15, 37 St Georges Terrace, Perth WA 6000 (08) 6216 9700 www.evolutionmining.com.au	Mungari	
<b>FMR Investments Pty Ltd</b> Level 2, 2 Hardy Street, South Perth WA 6151 (08) 6216 5400 www.fmrinvestments.com.au	Gordon-Sirdar	
<b>Gascoyne Resources Limited</b> Office Level 1, 41-47 Colin Street, West Perth WA 6005 (08) 9481 3434 www.gascoyneresources.com.au	Dalgaranga	
<b>Gold Fields Limited</b> Level 5, 50 Colin Street, West Perth WA 6005 (08) 9211 9200 www.goldfields.com.au	Agnew Granny Smith St Ives Gruyere	Gruyere is a joint venture of Gold Fields Limited (50%) and Gold Road Resources (50%). First gold was delivered in June 2020.
<b>Habrok Pty Ltd</b> 63 Dowd Street, Welshpool WA 6106 (02) 8920 0700 www.habrokmining.com	Battler Bullabulling North	Battler is a new project. Achieved first pour in January 2020.  Bullabulling North is also a new project. Bullabulling North is a joint venture of Habrok Pty Ltd (70%) and Bulletin Resources Limited (30%). Habrok Pty Ltd acquired its share in January 2020. First pour was achieved in September 2019.
<b>Hawthorn Resources Ltd</b> Level 2, 90 William St, Melbourne VIC 3000 (03) 9605 5950 www.hawthornresources.com	Trouser Legs	



**TABLE 10. Principal mining projects 2019–20 (continued)**

<b>Company</b>	<b>Project(s)</b>	<b>Comments</b>
<b>Kalgoorlie Consolidated Gold Mines Pty Ltd</b> Black Street, PMB 27, Kalgoorlie WA 6433 (08) 9022 1100 www.superpit.com.au	Super Pit / Mt Charlotte	Kalgoorlie Consolidated Gold Mines Pty Ltd is the management company for the joint venture owners. Saracen Mineral Holdings Ltd acquired Barrick Gold Corporation's 50% stake in November 2019 and Newmont Goldcorp sold its 50% stake to Northern Star Resources Ltd in January 2020.
<b>Karora Resources Inc.</b> 6 Outram Street, West Perth WA 6005 www.karoraresources.com	Beta Hunt Higginsville	RNC Minerals Corporation changed its name to Karora Resources on 17 June 2020.
<b>Lord Byron Mining Pty Ltd</b> 312 Victoria Road, Malaga WA 6090 (08) 6465 8000	Jasper Hills	New project. Achieved first sales in January 2020.
<b>Matsa Resources Limited</b> Suite 11, 139 Newcastle Street, Perth WA 6000 (08) 9230 3555 www.matsa.com.au	Lake Carey	
<b>Millennium Minerals Limited</b> Unit 7, 140 Abernethy Road, Belmont WA 6104 (08) 9216 9011 www.novoresources.com	Nullagine	Millennium Minerals Limited went into voluntary administration in November 2019. Final sales from the project were in January 2020.
<b>Mincor Resources NL</b> Ground Floor, 9 Havelock Street, West Perth WA 6005 (08) 9476 7200 www.mincor.com.au	Widgiemooltha	Re-opened project. Gold production commenced in July 2018 and ceased on 1 August 2019. Final sales from the project were in December 2019.
<b>Minjar Gold Pty Ltd</b> Level 3, 66 Kings Park Road, West Perth WA 6005 (08) 9212 8900 www.minjargold.com.au	Southern Cross	
<b>NBT Metals Pty Ltd</b> Level 1, 31-35 Dugan Street, Kalgoorlie WA 6430	Kalpini	Horizon Minerals announced it was to acquire the Kalpini project from NBT Metals Pty Ltd in October 2020.
<b>Newcrest Mining Limited</b> Level 1, 1 Centro Ave, Subiaco WA 6008 (08) 9270 7070 www.newcrest.com.au	Telfer	
<b>Newmont GoldCorp Corporation</b> Level 2, 388 Hay Street, Subiaco WA 6008 (08) 9423 6100 www.newmont.com	Boddington	
<b>Northern Star Resources Ltd</b> Level 1, 388 Hay Street, Subiaco WA 6008 (08) 6188 2100 www.nsr ltd.com	Jundee Kanowna Belle Kundana South Kalgoorlie	
<b>Norton Gold Fields Ltd</b> Paddington Site, Menzies Highway, Kalgoorlie WA 6430 (08) 9080 6800 www.nortongoldfields.com.au	Paddington	

**TABLE 10. Principal mining projects 2019–20 (continued)**

<b>Company</b>	<b>Project(s)</b>	<b>Comments</b>
<b>Orminex Limited</b> Suite 5, Level 1, 460 Roberts Road, Subiaco WA 6008 (08) 6149 1550	Comet Vale	Mining activities were suspended at Comet Vale in September 2020.
<b>Pantoro Limited</b> 1187 Hay Street, West Perth WA 6000 (08) 6263 1110 www.pantoro.com.au	Halls Creek	The Halls Creek operation includes the Nicolsons and Wagtail mines.
<b>Ramelius Resources Ltd</b> Level 1, 130 Royal Street, East Perth WA 6004 (08) 9202 1127 www.rameliusresources.com.au	Edna May Marda Mt Magnet Vivien	Marda is a new project. Ramelius Resources Ltd acquired the Marda Gold Project from Black Oak Minerals Ltd in 2018. Mining activities commenced in November 2019 with first sales in February 2020.
<b>Red 5 Limited</b> 35 Ventnor Avenue, West Perth WA 6005 (08) 9322 4455 www.red5limited.com	Darlot King of the Hills	
<b>Regis Resources Ltd</b> Level 2, 516 Hay Street, Subiaco WA 6008 (08) 9442 2200 www.regisresources.com.au	Duketon	
<b>Rose Dam Resources NL</b> Level 8, 350 Collins St, Melbourne VIC 3000	Rose Dam	Re-opened project. Mining recommenced in October 2019.
<b>Saracen Mineral Holdings Ltd</b> Level 11, 40 The Esplanade, Perth WA 6000 (08) 6229 9100 www.saracen.com.au	Carosue Dam Thunderbox	
<b>Silver Lake Resources Ltd</b> Suite 4, Level 3, 85 South Perth Esplanade South Perth WA 6151 (08) 6313 3800 www.silverlakeresources.com.au	Deflector Mt Monger	
<b>St Barbara Mines Ltd</b> 7 Rheola Street, West Perth WA 6005 (08) 9476 5555 www.stbarbara.com.au	Gwalia	
<b>Westgold Resources Limited</b> Level 6, 197 St Georges Tce, Perth WA 6000 (08) 9462 3400 www.westgold.com.au	Meekatharra Cue Fortnum	
<b>Wiluna Mining Corporation Limited</b> Level 3, 1 Altona Street, West Perth WA 6005 (08) 9322 6418 www.wilunamining.com.au	Matilda / Wiluna	Blackham Resources Limited changed its name to Wiluna Mining Corporation Limited on 18 June 2020.

**TABLE 10. Principal mining projects 2019–20 (continued)**

Company	Project(s)	Comments
<b>Iron ore</b>		
<b>Atlas Iron Limited</b> Level 17, Raine Square 300 Murray Street Perth WA 6000 (08) 6228 8000 www.atlasiron.com.au	Mt Webber	Atlas Iron Limited is a subsidiary of Hancock Prospecting Pty Ltd.
<b>BCI Minerals Limited</b> Level 2 1 Altona Street West Perth WA 6005 (08) 6311 3400 www.bciron.com.au	Iron Valley	Operated by a subsidiary of Mineral Resources Limited.
<b>BHP</b> 125 St Georges Terrace, Perth WA 6000 1300 55 47 57 www.bhpbilliton.com	Jinglebar / Wheelara Mining Area C Newman Yandi	Newman comprised the Mt Whaleback, Orebody 24 / 25 (Eastern Ridge), Orebody 29 / 30 / 35, and Orebody 18 mines.
<b>CITIC Pacific Mining Management Pty Ltd</b> 45 St Georges Terrace, Perth WA 6000 (08) 9226 8888 www.citicpacificmining.com	Sino Iron	
<b>Fortescue Metals Group Ltd</b> Level 2, 87 Adelaide Terrace, East Perth WA 6004 (08) 6218 8888 www.fmgl.com.au	Chichester Solomon	Chichester comprised the Christmas Creek and Cloudbreak mines, while Solomon comprised the Firetail and Kings Valley mines.
<b>Hancock Prospecting Pty Ltd</b> 28-42 Ventnor Avenue, West Perth WA 6005 (08) 9429 8222 www.hancockprospecting.com.au	Roy Hill	
<b>Karara Mining Limited</b> Level 2, London House, 216 St Georges Terrace Perth WA 6000 (08) 6298 1888 www.kararamining.com.au	Karara	Karara Mining Limited is wholly owned by Anshan Iron and Steel Group.
<b>Mineral Resources Limited</b> 1 Sleat Road, Applecross WA 6153 (08) 9329 3600 www.mineralresources.com.au	Carina Koolyanobbing	Sales of stockpiled materials from Carina continued in 2019-20.
<b>Mount Gibson Iron Limited</b> Level 1, 2 Kings Park Road, West Perth WA 6005 (08) 9426 7500 www.mtgibsoniron.com.au	Koolan Island Mid West	Mid West includes the Extension Hill mine. Shipments of stockpiled low-grade materials from Extension Hill commenced in early June 2019 and continued throughout 2019-20. They are expected to continue to the end of 2020.
<b>Kimberley Metals Group Pty Ltd</b> Level 1, 10 Ord Street, West Perth WA 6005 (08) 9225 3100 www.kmetgroup.com	Ridges	

**TABLE 10. Principal mining projects 2019–20 (continued)**

Company	Project(s)	Comments
<b>Rio Tinto Ltd</b> 152–158 St Georges Terrace Perth WA 6000 (08) 9327 2000 www.riotinto.com/en	Brockman 2 – Nammuldi – Silvergrass Brockman 4 Greater Paraburdoo Hope Downs Marandoo Mt Tom Price Robe Valley (Mesa A & Mesa J) West Angelas Yandicoogina	Greater Paraburdoo comprised the Paraburdoo, Channar and Eastern Ranges mines, Hope Downs comprised the Hopes Downs 1 and 4 mines, and Mt Tom Price included the Western Turner Syncline mine.
<b>Lithium</b>		
<b>Alita Resources Limited</b> Level 3, 20 Parkland Road, Osborne Park WA 6017 (08) 9489 2600 www.allianceminerals.com.au	Bald Hill	Alita Resources Limited went into receivership in August 2019 and as a result suspended operations at Bald Hill.
<b>Altura Mining Limited</b> Level 2, 23 Barrack Street, Perth WA 6000 (08) 9488 5100 www.alturamining.com	Pilgangoora	
<b>Galaxy Resources Limited</b> Level 4 / 21 Kintail Road, Applecross WA 6153 (08) 9215 1700 www.gxy.com	Mt Cattlin	
<b>Mineral Resources Limited</b> 1 Sleat Road, Applecross WA 6153 (08) 9329 3600 www.mineralresources.com.au	Mount Marion Wodgina	Mount Marion is a joint venture of Mineral Resources Limited (50%) and Ganfeng Lithium Company (50%).  Mineral Resources (40%) and Albemarle Corporation (60%) entered into the MARBL joint venture for the Wodgina project in August 2019. The project was placed into care and maintenance in November 2019.
<b>Pilbara Minerals Limited</b> Level 2, 88 Colin Street, West Perth WA 6005 (08) 6266 6266 www.pilbaraminerals.com.au	Pilgangoora	
<b>Talison Lithium Australia Pty Ltd</b> Level 15, 216 St Georges Terrace, Perth WA 6000 (08) 9263 5555 www.talisonlithium.com	Greenbushes Lithium	Talison Lithium Australia Pty Ltd is a joint venture of Tianqi Lithium Pty Ltd (51%) and Albemarle Corporation (49%).
<b>Manganese</b>		
<b>Consolidated Minerals Pty Ltd</b> Level 2, 7 Ventnor Avenue, West Perth WA 6005 (08) 9460 7000 www.consmin.com	Woodie Woodie	

**TABLE 10. Principal mining projects 2019–20 (continued)**

<b>Company</b>	<b>Project(s)</b>	<b>Comments</b>
<b>Mineral sands</b>		
<b>Doral Pty Ltd</b> 1 Alumina Road, East Rockingham WA 6168 (08) 9439 2236 www.doral.com.au	Yoongarillup mine and Picton dry separation plant Keysbrook	Doral Pty Ltd acquired the Keysbrook project from MZI Resources Ltd in July 2019.
<b>GMA Garnet Pty Ltd</b> Level 4, 108 St Georges Terrace Perth WA 6000 (08) 9287 3200 www.gmagarnet.com/en-au/	Port Gregory	
<b>Iluka Resources Limited</b> Level 17, 240 St Georges Terrace Perth WA 6000 (08) 9360 4700 www.iluka.com	South West Mid West	Active operations at South West comprised the Capel dry plant, the North Capel mineral separation plant, and one of two synthetic rutile kilns at North Capel.  Active operations at Mid West comprised the Cataby mine and Narngulu mineral separation plant.
<b>Image Resources</b> Ground Floor, 23 Ventnor Avenue, West Perth WA 6005 (08) 485 2410 www.imageres.com.au	Boonanarring	New project. Achieved first production in December 2018.
<b>Tronox Limited</b> Lot 22 Mason Road, Kwinana Beach WA 6167 (08) 9411 1444 www.tronox.com	Cooljarloo mine and Chandala mineral separation plant  Wonnerup mine and North Shore mineral separation plant	
<b>Nickel</b>		
<b>BHP</b> 125 St Georges Terrace, Perth WA 6000 1300 55 47 57 www.bhpbilliton.com	Leinster Mt Keith	
<b>First Quantum Minerals Ltd</b> 1/24 Outram St, West Perth WA 6005 (08) 9346 0100 www.first-quantum.com	Ravensthorpe	Re-opened project. Sales commenced in Match quarter 2020, having previously being suspended in October 2017.
<b>IGO Limited</b> Suite 4, Level 5, 85 South Perth Esplanade South Perth WA 6151 08 9238 8300 www.igo.com.au	Nova	Independence Group NL changed its name to IGO Limited in January 2020.
<b>Minara Resources Ltd</b> Level 3, 30 The Esplanade, Perth WA 6000 (08) 9212 8400 www.minara.com.au	Murrin Murrin	Minara Resources Ltd is a subsidiary of Glencore Plc.

**TABLE 10. Principal mining projects 2019–20 (continued)**

Company	Project(s)	Comments
<b>Panoramic Resources Ltd</b> Level 9, 553 Hay Street Perth WA 6000 (08) 6266 8600 www.panoramicresources.com	Savannah	Operations were suspended in April 2020 as a result of the COVID-19 pandemic.
<b>Western Areas Ltd</b> 2 Kings Park Rd, West Perth WA 6005 (08) 9334 7777 www.westernareas.com.au	Forrestania	
<b>Rare earths</b>		
<b>Lynas Corporation Ltd</b> Level 1, 45 Royal Street East Perth WA 6004 (08) 6241 3800 www.lynascorp.com	Mt Weld	
<b>Salt</b>		
<b>Dampier Salt Ltd</b> 152-158 St Georges Terrace Perth WA 6000 (08) 9327 2000 www.riotinto.com/en	Dampier Lake MacLeod Port Hedland	Dampier Salt Ltd is a joint venture of Rio Tinto (68%), Marubeni Corporation (22%) and Sojitz Corporation (10%).
<b>Onslow Salt Pty Ltd</b>	Onslow	
<b>Shark Bay Salt Pty Ltd</b> Level 16, 2 The Esplanade Perth WA 6000 (08) 9265 8000 www.salt.com.au	Shark Bay	
<b>WA Salt Koolyanobbing Pty Ltd</b> Lot 102 Cockburn Road North Coogee, 6163 Australia (08) 9335 9911 www.wasalt.com.au	Lake Deborah	
<b>Silica sand</b>		
<b>Hanson Australia Pty Ltd</b> Level 1, 35 Gt Eastern Hwy, Rivervale WA 6103 (08) 9311 8811 www.hanson.com.au	Gnangara	
<b>Simcoa Operations Pty Ltd</b> 973 Marriott Road, Wellesley WA 6232 (08) 9780 6666 www.simcoa.com.au	Moora	
<b>T T Sand Pty Ltd</b> Suite 5, 363-367 Albany Hwy Victoria Park WA 6100 (08) 9361 6288 www.austsandmining.com.au	Mindijup	
<b>Talc</b>		
<b>Imerys Talc Australia Pty Ltd</b> 21 Glyde Street, Three Springs WA 6519 (08) 9954 1427 www.imerystalc.com	Three Springs	
<b>Tantalum</b>		
<b>Global Advanced Metals Pty Ltd</b> Level 3, 123B Colin Street, West Perth WA 6005 (08) 6217 2500 www.globaladvancedmetals.com	Greenbushes Tantalum	

**TABLE 10. Principal mining projects 2019–20 (continued)**

<b>Basic Raw Materials</b>	
<b>Company</b>	<b>Location(s)</b>
<p><b>Adelaide Brighton Ltd</b> Level 9, 88 Phillip Street, Sydney NSW 2000 (02) 8248 9999 www.adbri.com.au</p>	Cockburn, Dongara, Lancelin, Nowergup, Parkeston, Woodman Point
<p><b>BGC Pty Ltd</b> 6th Floor, 22 Mount St, Perth WA 6000 (08) 6220 4800 www.bgc.com.au</p>	Chidlow, Perth Metro, Port Hedland
<p><b>Boral Limited</b> 130 Fauntleroy Ave, Perth Airport WA 6105 (08) 9333 3400 www.boral.com.au</p>	Ashburton, Kalgoorlie, Kununurra, Mt Regal, Onslow, Orange Grove, Perth North, Pilbara (Tabba Tabba), Port Hedland
<p><b>Hanson Australia Pty Ltd</b> Level 1, 35 Gt Eastern Hwy, Rivervale WA 6103 (08) 9311 8811 www.hanson.com.au</p>	Ashburton, Bunbury, Byford, Ellenbrook, Learmonth, Mt Barker, Mt Regal, North of Perth, Port Hedland, Red Hill, South of Perth
<p><b>Holcim (Australia) Pty Ltd</b> Level 3, 200 Adelaide Terrace, East Perth WA 6004 (08) 9212 2000 www.holcim.com.au</p>	Albany, Baldivis, Bunbury, Esperance, Geraldton, Gosnells, Jandabup, Kalgoorlie-Boulder, Karratha, Newman, Port Hedland
<p><b>Kimberley Quarry Pty Ltd</b> 230 Barrington St, Bibra Lake WA 6163 (08) 9434 4188 www.kimberleyquarries.com.au</p>	Broome, Geraldton
<p><b>MLG Oz Pty Ltd</b> 10 Yindi Way, Kalgoorlie WA 6433 (08) 9022 7746 www.mlgoz.com.au</p>	Coolgardie (Canegrass, Eight Mile, Jonah Bore), Tarmoola
<p><b>Mobile Concreting Solutions Pty Ltd</b> Level 1, 985 Wellington Street, West Perth 6005 (08) 9200 1840 www.mobileconcrete.com.au/</p>	Indee, Tom Price
<p><b>WA Limestone Pty Ltd</b> 401 Spearwood Avenue, Bibra Lake WA 6163 (08) 9434 7777 www.walimestone.com/</p>	Byford, North Metro, Onslow, Port Hedland, Perth Metro, Roebourne, South Metro
<p><b>Westdeen Holdings Pty Ltd</b> Suite 1, 110 Robinson Ave, Belmont WA 6104 (08) 9277 5529 www.aglime.com.au/</p>	Cowcowing, Dongara, Jurien Bay, Lancelin

**TABLE 11. Principal mineral processing operations 2019–20**

Company	Project
<b>Alumina</b>	
<b>Alcoa Corporation</b> 181–205 Davy Street, Booragoon WA 6154 (08) 9316 5111 www.alcoa.com/australia	Kwinana alumina refinery Pinjarra alumina refinery Wagerup alumina refinery
<b>South32 Limited</b> Level 35, 108 St Georges Tce, Perth WA 6000 (08) 9324 9000 www.south32.net	Worsley alumina refinery
<b>Gold</b>	
<b>Gold Corporation</b> 310 Hay Street, East Perth WA 6004 (08) 9451 7222 http://www.perthmint.com	Perth Mint
<b>Nickel</b>	
<b>BHP</b> 125 St Georges Terrace, Perth WA 6000 1300 55 47 57 www.bhpbilliton.com	Kalgoorlie nickel smelter Kambalda nickel concentrator Kwinana nickel refinery
<b>Minara Resources Ltd</b> Level 3, 30 The Esplanade, Perth WA 6000 (08) 9212 8400 www.minara.com.au	Murrin Murrin nickel refinery
<b>Mineral sands</b>	
<b>Tronox Limited</b> Lot 22 Mason Road, Kwinana Beach WA 6167 (08) 9411 1444 www.tronox.com	Bunbury pigment plant Kwinana pigment plant
<b>Doral Pty Ltd</b> 1 Alumina Road, East Rockingham WA 6168 (08) 9439 2236 www.doral.com.au	Rockingham fused zirconia plant
<b>Silica sand</b>	
<b>Simcoa Operations Pty Ltd</b> 973 Marriott Road, Wellesley WA 6232 (08) 9780 6666 www.simcoa.com.au	Kemerton silicon smelter



**TABLE 12. Principal petroleum project 2019–20**

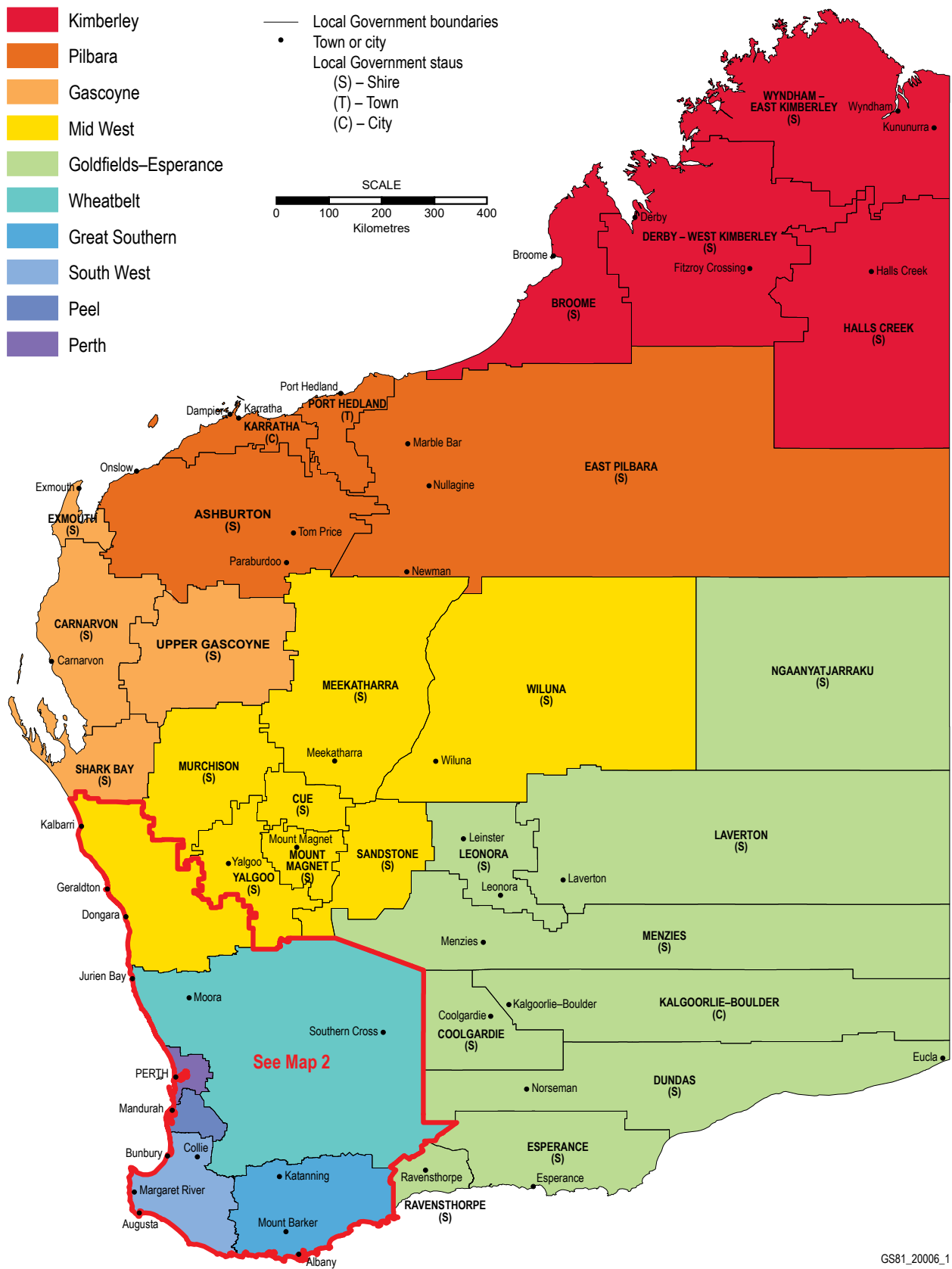
Operator	Project(s)	Processing plant(s)	Operating field(s)	Type	Area	Comments
<b>Beach Energy</b> Level 8, 80 Flinders Street Adelaide SA 5000 (08) 8338 2833 www.beachenergy.com.au	Beharra Springs	Beharra Springs Gas Facility	Redback, Redback South	Gas	Onshore	
<b>BHP</b> 125 St Georges Terrace Perth WA 6000 1300 55 47 57 www.bhpbilliton.com	Macedon  Pyrenees	Macedon Domestic Gas Plant	Macedon,  Crosby, Moondyne, Ravensworth, Stickle	Gas and condensate  Oil	Offshore  Offshore	
<b>Buru Energy</b> Level 2, 16 Ord Street West Perth WA 6005 1800 337 330 www.buruenergy.com	Ungani	Ungani Production Facility	Ungani	Oil	Onshore	
<b>Chevron Corporation</b> 250 St. Georges Terrace Perth WA 6000 (08) 9216 4000 www.australia.chevron.com	Barrow Island  Gorgon  Wheatstone	  Gorgon LNG  Wheatstone LNG	Barrow Island  Jansz-lo, Gorgon  Iago, Wheatstone, Brunello	Oil  Gas and condensate  Gas and condensate	Onshore  Offshore  Offshore	Woodside Petroleum operates the Brunello field within the Wheatstone LNG project
<b>ENI</b> 226 Adelaide Terrace Perth WA 6000 (08) 9 320 1111 www.eni.com	Blacktip		Blacktip	Gas and condensate	Offshore	
<b>Exxon Mobil</b> Level 9, 664 Collins Street Docklands Vic 3008 (03) 9261 0000 www.exxonmobil.com.au	Athena		Athena	Gas and condensate	Offshore	
<b>INPEX Corporation</b> Level 22, 100 St Georges Terrace Perth WA 6000 (08) 6213 6000 www.inpex.com.au	Ichthys		Ichthys	Condensate	Offshore	

**TABLE 12. Principal petroleum projects (continued)**

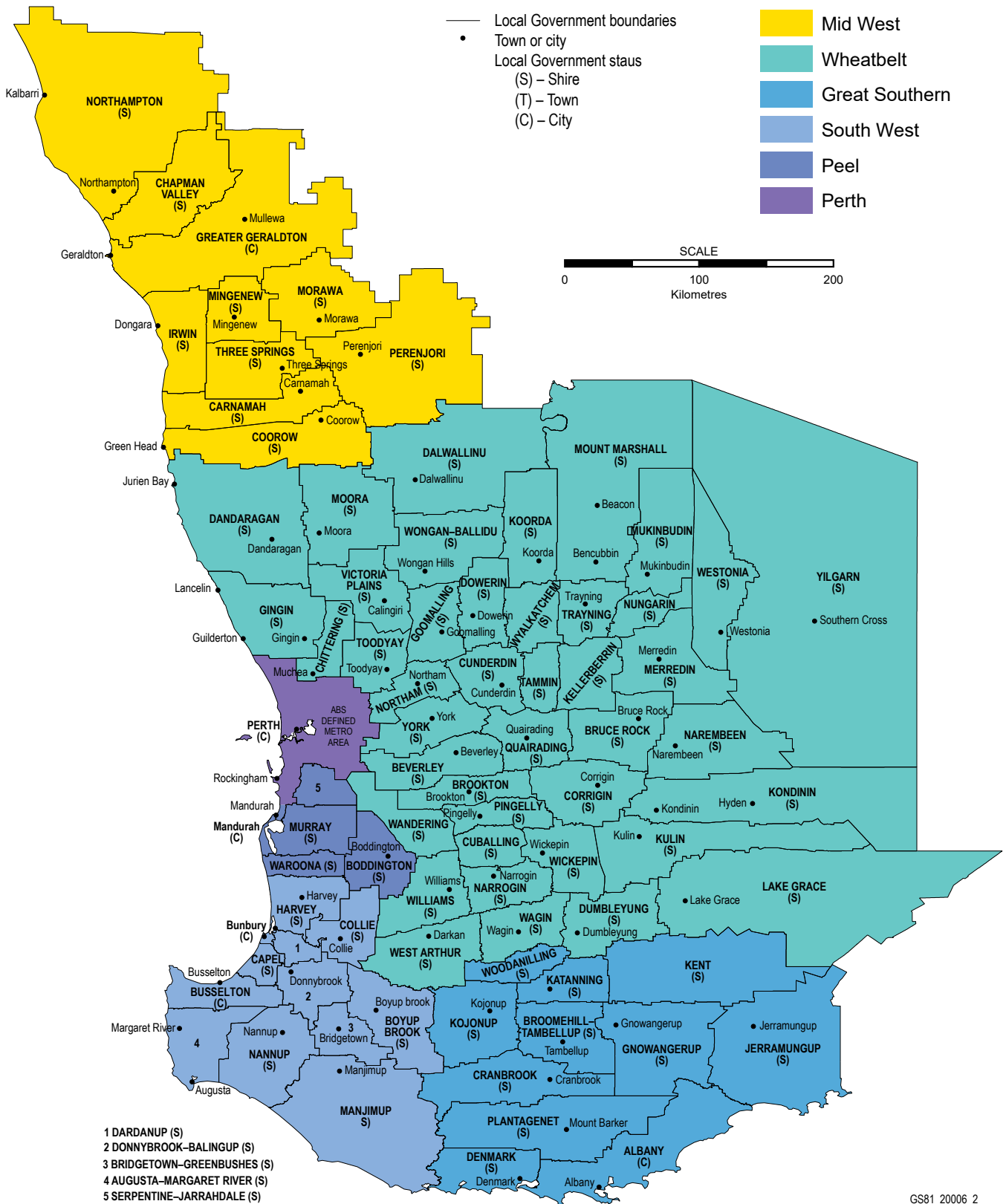
<b>Operator</b>	<b>Project(s)</b>	<b>Processing plant(s)</b>	<b>Operating field(s)</b>	<b>Type</b>	<b>Area</b>	<b>Comments</b>
<b>Jadestone Energy</b> 1 William Street Perth, WA 6000 (08) 9486 6600 www.jadestone-energy.com	Stag		Stag	Oil	Offshore	
<b>Mitsui &amp; Co</b> Level 16, 2 The Esplanade Perth WA 6000 (08) 9476-2333 www.mitsui.com/au	Waitsia	Xyris Production Facility	Waitsia	Gas	Onshore	
<b>RMCA Group</b> 120 Robinson Road Singapore 068913 +65 6332 2282 www.rcma.com	Jingemia	Jingemia Production Facility		Oil	Onshore	
<b>Santos</b> Level 7, 100 St Georges Terrace Perth WA 6000 (08) 6218 7100 www.santos.com	Reindeer Van Gogh Varanus Island	Devil Creek Processing Plant, Varanus Island Processing Facility	Reindeer Coniston, Novara, Van Gogh Bambra, Halyard, John Brookes, Lee, Spar	Gas Oil Oil, gas and condensate	Offshore Offshore Offshore	Van Gogh was renamed from Ningaloo Vision.
<b>Shell</b> 562 Wellington Street Perth WA 6000 (08) 9338 6600 www.shell.com.au	Prelude	Prelude FLNG	Prelude	Gas	Offshore	
<b>Triangle Energy (Global) Limited</b> Suite 2, Ground Floor 100 Havelock Street West Perth WA 6005 (08) 9219 7111 www.triangleenergy.com.au	Cliff Head	Arrowsmith Stabilisation Plant	Cliff Head	Oil	Offshore	
<b>Vermillion</b> Level 5, 30 The Esplanade Perth WA 6000 (08) 9215 0300 www.vermilionenergy.com	Wandoo		Wandoo	Oil	Offshore	

**TABLE 12. Principal petroleum projects (continued)**

Operator	Project(s)	Processing plant(s)	Operating field(s)	Type	Area	Comments
<b>Woodside Petroleum</b> 11 Mount Street Perth WA 6000 (08) 9348 4000 www.woodside.com.au	Enfield		Vincent, Cimatti and Laverda	Oil and gas	Offshore	Production from Greater Enfield project areas including the Cimatti and Laverda fields commenced on 26 August 2019.
	North West Shelf	Karratha Gas Plant	Angel, Cossack, Dockrell, Goodwyn, Hermes, Keast, Lady Nora, Lambert, North Rankin, Pemberton, Persephone, Perseus, Rankin, Sculptor, Searipple, Tidepole, Wanaea	Oil, gas, and condensate	Offshore	
	Pluto	Pluto LNG	Pluto, Xena	Gas	Offshore	



Map 1. Local Government and Regional boundaries



Map 2. Local Government and Regional boundaries- enlargement

## ABBREVIATIONS

A\$	Australian dollar	ktpa	kilotonnes per annum
ABS	Australian Bureau of Statistics	LME	London Metal Exchange
bbl	barrels of oil	LNG	liquefied natural gas
Bcm	billion cubic metres	LPG	natural gas and liquefied petroleum gas
BFS	Bankable Feasibility Studies	m	metre
CFR	cost and freight	Mct	million carats
CIF	cost including freight	MMbbl	million barrels
DFS	Definitive Feasibility Studies	Moz	million ounces
DMIRS	Department of Mines, Industry Regulation and Safety	Mt	million tonnes
EV	electric vehicles	Mtpa	million tonnes per annum
FEED	Front End Engineering and Design	MW	Megawatt
FID	Final Investment Decision	NoI	Number of Individuals
FLNG	floating liquefied natural gas	OoCE	Office of the Chief Economist
FMG	Fortescue Metals Group	OPEC	Organization of Petroleum Exporting Countries
FOB	Free-on-Board	oz	ounce
FTE	Full-time Equivalent	PFS	Pre-Feasibility Studies
GDP	Gross Domestic Product	PJ	petajoules
GJ	Gigajoule	PV	photovoltaic
g/t	grams per tonne	sq kms	square kilometres
ha	hectares	t	tonne
KCGM	Kalgoorlie Consolidated Gold Mines	TJ/d	terajoules per day
kg	kilograms	tpa	tonnes per annum
KL	kilolitres	TSI	The Steel Index
km	kilometres	US\$	United States dollar
kt	thousand tonnes	WATC	Western Australian Treasury Corporation

## UNITS AND CONVERSION FACTORS

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

## WEIGHTS AND MEASURES

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

## DATA SOURCES

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

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

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

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