



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



WESTERN AUSTRALIAN MINERAL AND PETROLEUM

STATISTICS DIGEST

2017-18

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

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During 2017–18, global commodity markets generally showed improvement. About half of the world's countries experienced an increase in economic growth, creating a period of synchronised global upturn with most Western Australian producers benefitting from the recovery in prices seen throughout 2017 and into the start of 2018.

However, in the latter half of the period, growing tensions between the US and China and talk of a potential trade war became a major headline, creating some investor uncertainty. Other factors to influence global commodity markets this period included:

- the moderation of China's economic growth, particularly in property and infrastructure, which has flow on effects on demand for raw materials such as iron ore
- a sustained lift in crude oil prices following OPEC's coordinated supply constraints
- a series of events e.g. the stalling of the typical Chinese seasonal commodity restock, the announcement of US trade tariffs and unresolved disputes between the US and Russia
- a persistent lack of project investment which saw minimal mine supply growth in some commodities.

While these factors created uncertainty in financial markets, WA's commodity driven export market remained steady with the exception of the LNG sector which grew substantially over the period.

We also saw the emergence of WA as a potential supplier of the battery related materials needed to support substantial green energy initiatives around the world. Stemming from this, it is pleasing to see a new wave of investment in lithium and related sectors which will help sustain our minerals and petroleum sector into the future.

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



For much of 2017–18 some optimism returned to the global commodity market, with the volatility of previous years easing across a number of commodities. However, political tensions played a part in the latter half of the year with the threat of a trade war between the US and China affecting the strength of some markets in mid-2018.

Locally, the Australian dollar was up slightly from an average of 75 US cents in 2016–17 to 77 US cents in 2017–18. Generally, global commodity prices held up well with the financial year average price of most commodities increasing on the gains made in 2016–17. Iron ore was an exception to this trend.

In 2017–18, Western Australia's (WA's) mineral and petroleum industry reported sales of just less than \$115 billion. The bulk of the \$10 billion increase on 2016–17 was the result of increased LNG volumes and improvement in the petroleum sector more broadly.

Mineral sector highlights

Mineral commodities still dominate the State's resources sector, accounting for 77 per cent, or \$88 billion, of total sales value. Iron ore was by far the most valuable commodity, accounting for 70 per cent of mineral sales and 54 per cent of overall sales.

Iron ore recorded sales valued at \$61.7 billion in 2017–18, down slightly (3 per cent) on the previous year. Record sales volumes of almost 826 million tonnes were not enough to offset the lower prices received by WA producers.

Gold sales volumes increased for the third year in a row to reach a record 212 tonnes (7.5 million ounces) in 2017–18. Increased volumes combined with strong gold prices to deliver a 5 per cent increase in the value of the sector, from \$10.9 billion in 2016–17 to \$11.4 billion in 2017–18.

Alumina and bauxite sales accounted for 7.5 per cent of mineral sales and 6 per cent of total sales. Sales volumes increased more than 4 per cent year-on-year, attributable to a substantial increase in bauxite sales, which offset a decrease in alumina sales. This meant that the value of the sector increased 30 per cent to \$6.6 billion in 2017–18.

WA's nickel sector has struggled in recent years, with the value of the sector declining year-on-year since 2010–11. However, in 2017–18, fortunes turned with the value of the sector increasing 26 per cent from \$2.1 billion in 2016–17 to \$2.6 billion in 2017–18.

The remaining minerals sales values comprised:

- Base metal sales of \$1.6 billion (up 16 per cent)
- Coal sales of \$332 million (down 1.9 per cent)
- Cobalt sales of \$514 million (up 115 per cent)
- Mineral sands sales of \$358 million (down 29 per cent)
- Salt sales of \$301 million (up 3 per cent)
- Spodumene sales of \$1.6 billion (up 167 per cent).

Petroleum sector highlights

The petroleum sector, which comprises crude oil, condensate, LNG, natural gas and LPG, accounted for 23 per cent of the total value of WA's mineral and petroleum sales in 2017–18. This made it the second most valuable sector after iron ore.

The sector was valued at \$26.6 billion in 2017–18, an increase of 39 per cent from \$19.2 billion in 2016–17.

LNG remains WA's most valuable petroleum product, accounting for almost 17 per cent of all mineral and petroleum sales in 2017–18. The value of LNG sales rose more than \$6 billion from \$12.7 billion in 2016–17 to \$19.1 billion in 2017–18.

The volume of LNG produced in WA increased 45 per cent during the five years to 2016–17 and a further 32 per cent in 2017–18. This followed the start-up of several new LNG projects marking the last of the "mega" LNG investment projects to reach production.

In 2017–18, crude oil volumes were down 11 per cent to 4.8 gegalitres (GL), while condensate production increased 18 per cent to 7.1GL. Improvements in the prices received by WA producers contributed to the increase in the value of crude oil and condensate sales, which rose for the first time in seven years from \$4.3 billion in 2016–17 to \$5.6 billion in 2017–18.

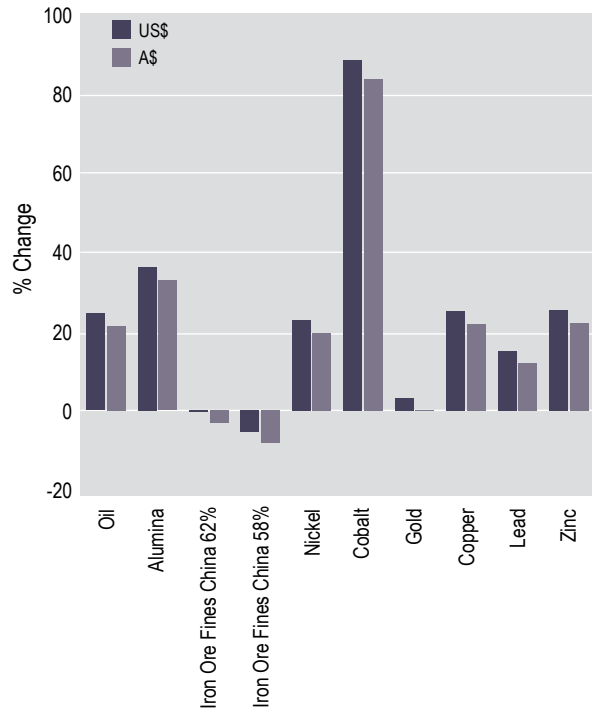


Figure 1 | **Percentage price change between 2016–17 and 2017–18**
 Source: LME, Kitco, Argus Metals, WATC and DMIRS

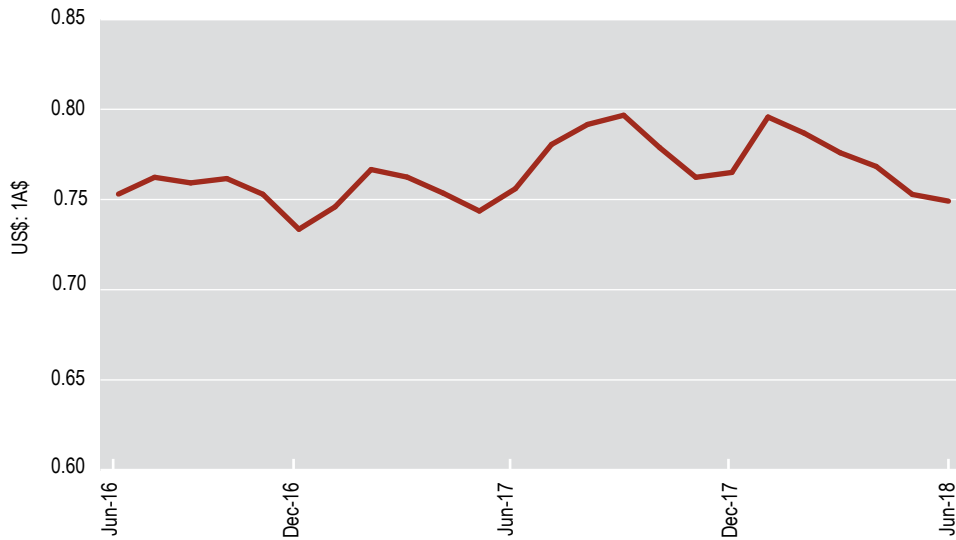


Figure 2 | **Monthly average exchange rate**
 Source: Reserve Bank of Australia

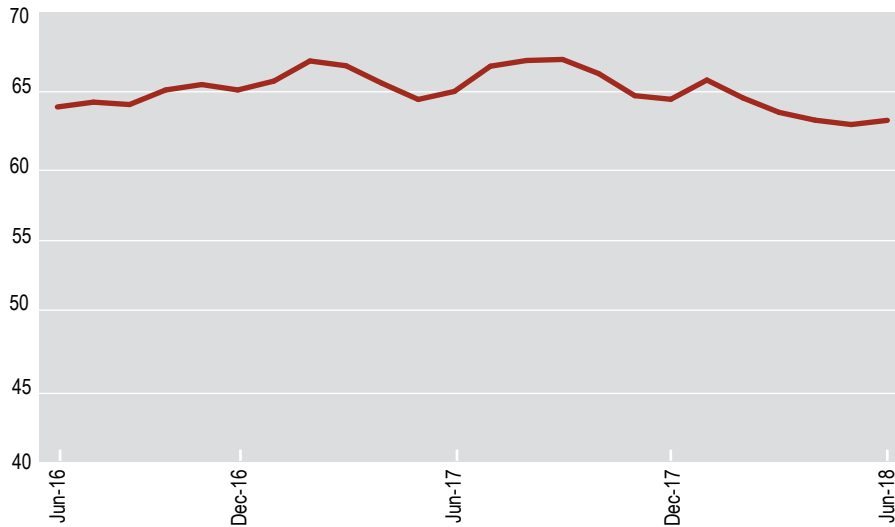


Figure 3 Trade-weighted index (units of foreign currency per A\$)
Source: Reserve Bank of Australia

"Trade-weighted index" is the average value of A\$ in relation to the currencies of Australia's major trading partners.

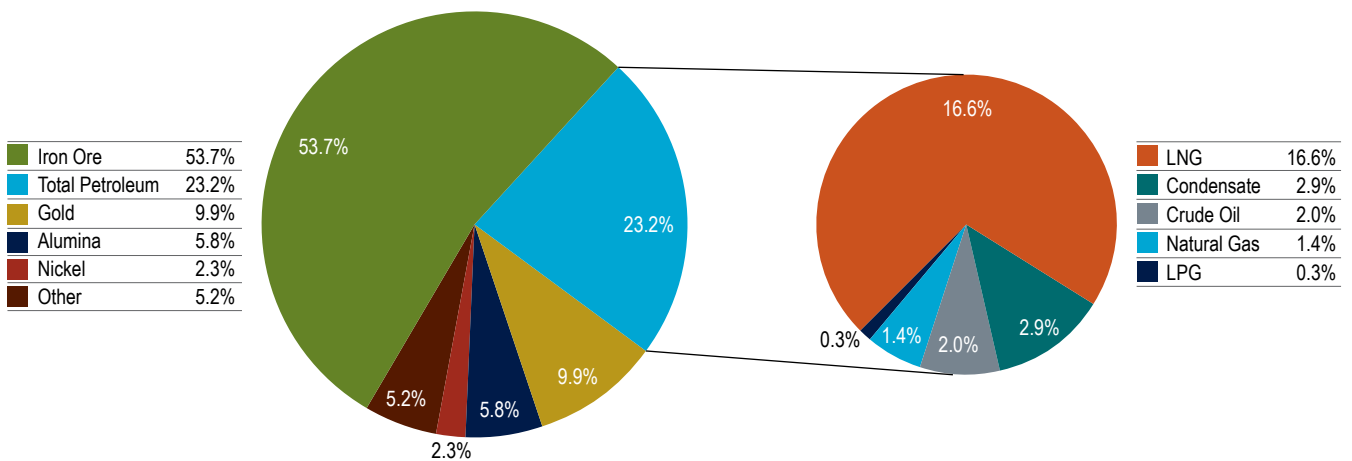


Figure 4 Financial year 2017-18 mineral and petroleum summary
Total value \$114.9 Billion
Source: DMIRS

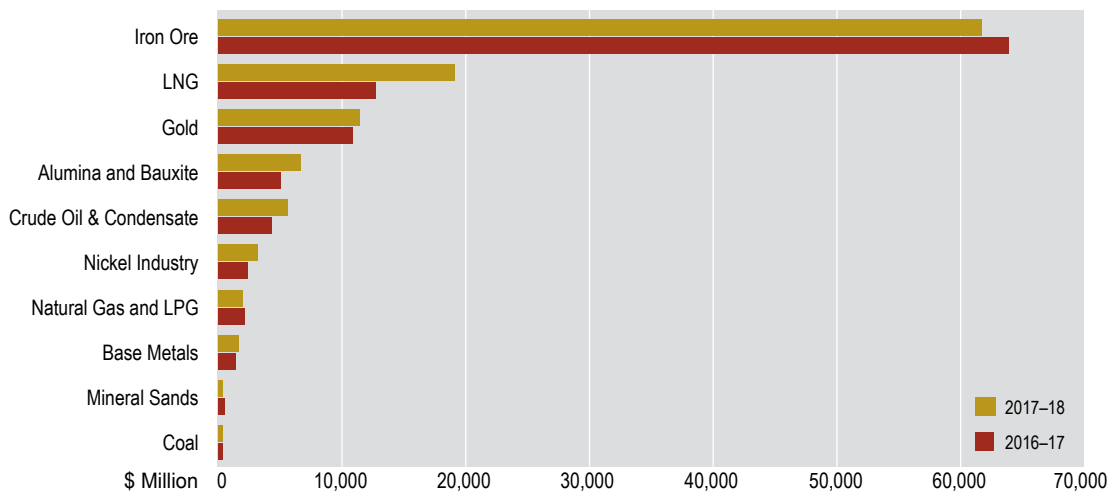


Figure 5 Major commodities by value
Total value \$114.9 Billion
Source: DMIRS

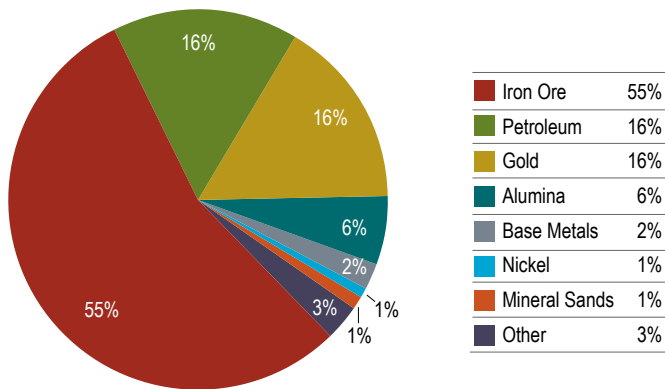


Figure 6 | **WA mineral and petroleum exports 2017–18**
\$109.6 Billion
 Source: DMIRS and ABS

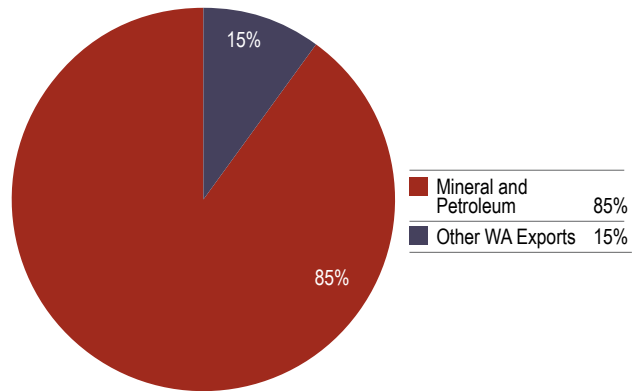


Figure 7 | **WA merchandise exports 2017–18**
\$129.7 Billion
 Source: DMIRS and ABS
Note: Minerals and Petroleum includes \$5.53 billion worth of gold and \$332.1 million worth of Mineral Sands is refined or processed in WA but produced in other States/Territories/overseas.

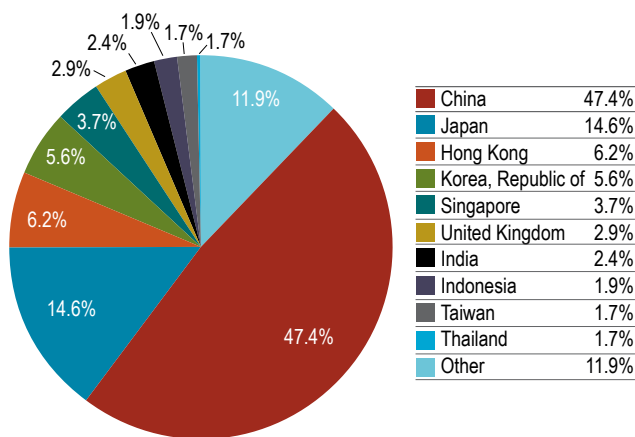


Figure 8 | **WA merchandise exports by country 2017–18**
\$129.7 Billion
 Source: ABS

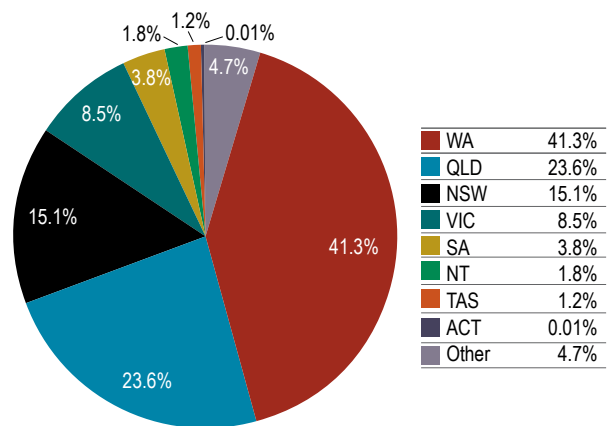


Figure 9 | **Australian merchandise exports 2017–18 by state/territory**
\$314.2 Billion
 Source: ABS
Note: "Other" refers to exports where state of origin is not released by ABS or where merchandise is re-exported.

AVAILABILITY OF DETAILED RESOURCE 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 industry, as well as detailed information about the State's major commodities, including sales value and volumes, prices, exports and production, compared to 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 and investment, employment and royalty receipts.
3. Spatial and regional – this file contains information about mining and petroleum tenements and how the value of mineral and petroleum sales is distributed across the State.

Throughout this digest you will find references indicating where in the resource data files to find more detailed information about the topics discussed. These hints are identified by this symbol:



1 INDUSTRY ACTIVITY

1.1 MINERAL TITLES

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

In 2017–18, 44.2 million hectares of land was covered by mining tenements – up from 42.5 million hectares in 2016–17.

Exploration licences accounted for most of the increase with the number increasing from 5020 to 5474 year-on-year.

Mining leases accounted for just 6 per cent (2.5 million hectares) of the total area. The number of mining leases rose by 13 over the period from 5827 in 2016–17 to 5840 in 2017–18.

The following graph identifies three aspects of tenement activity:

- applied for – the number of applications for mining tenements received by the department
- granted – the number of tenements approved by the department
- died – the number of dead tenements that occurred (dead tenements occur when a former holder no longer has exploration or mining rights over the land area, either because the time period of the tenement has expired, or the tenement has been surrendered or forfeited).



The spatial and regional data file provides historic information about the number and type of mineral titles.

1.2 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 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.

As at 21 August 2018, the area covered by petroleum titles regulated by WA State legislation was 78,550 square kilometres. This compares with the 76,766 square kilometres reported in July 2017, and is well down on the 181,963 square kilometres reported in March 2016.

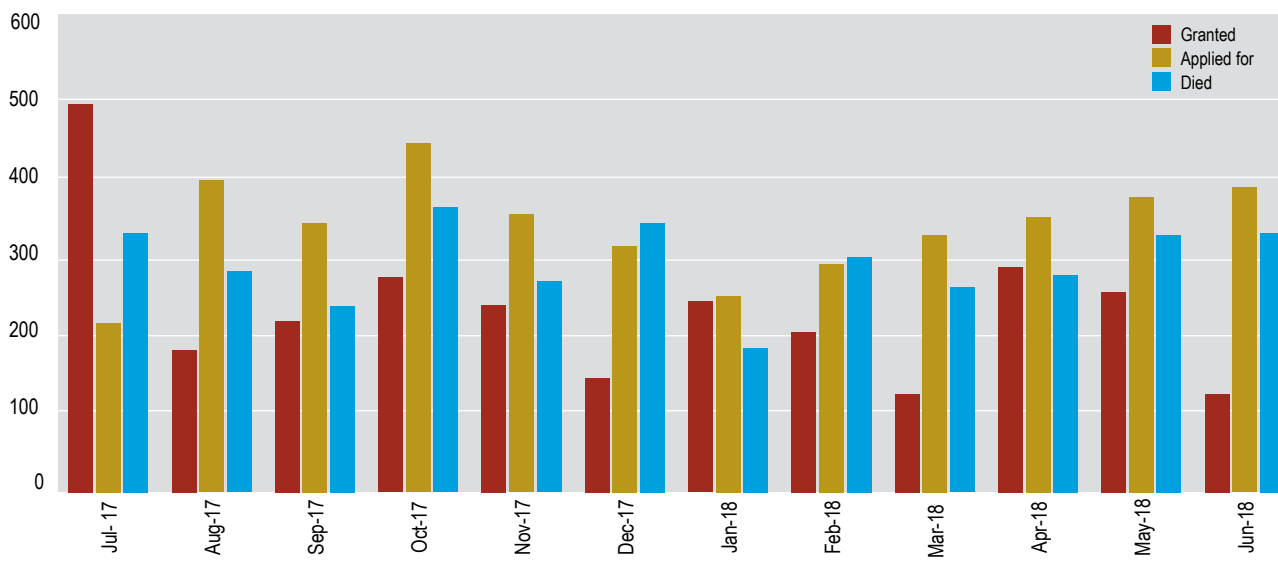


Figure 10 | **Tenement activity 2017–18**
Source: DMIRS

1.3 EXPLORATION



The economic indicators resources data 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 to 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 to the rest of Australia.

1.3.1 Minerals exploration

Australia's mineral exploration expenditure was \$2 billion in 2017–18, up from \$1.6 billion in 2016–17. WA contributed \$1.2 billion (61 per cent) of this spend with the gold and iron ore sectors attracting the largest shares. Gold exploration expenditure in WA continued to increase from \$509.5 million in 2016–17 to \$591.5 million in 2017–18. Iron ore exploration decreased, but only marginally from \$281.6 million in 2016–17 to \$274.1 million in 2017–18.

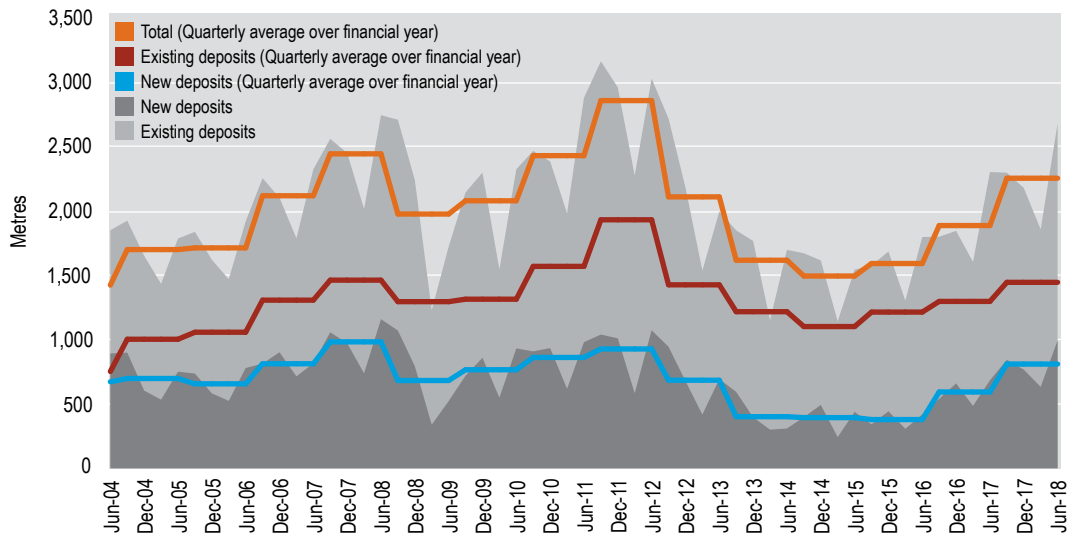


Figure 11 | **Australia-wide drill metres – new and existing deposits**
Source: ABS

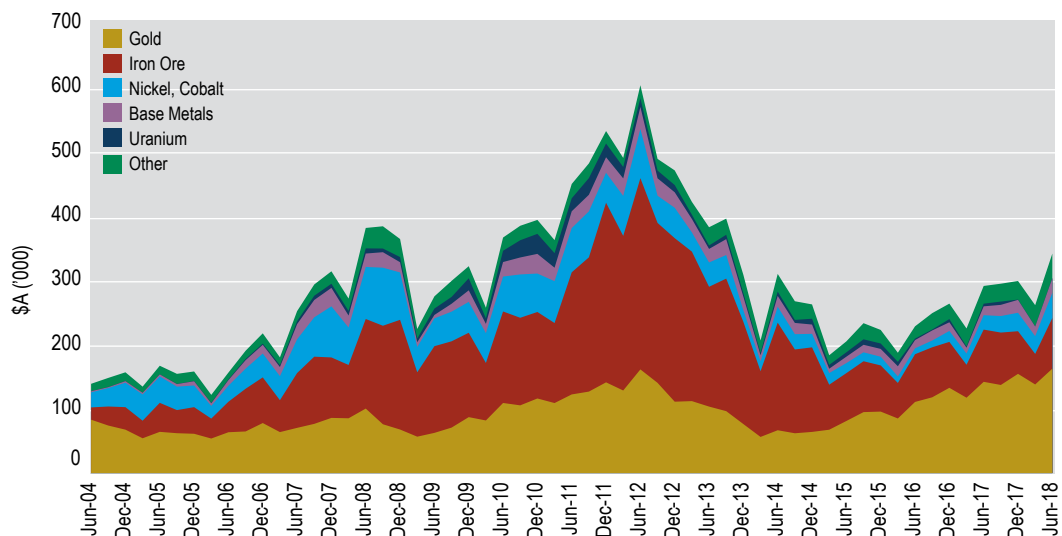


Figure 12 | **WA mineral exploration spend by commodity**
Source: DMIRS and ABS

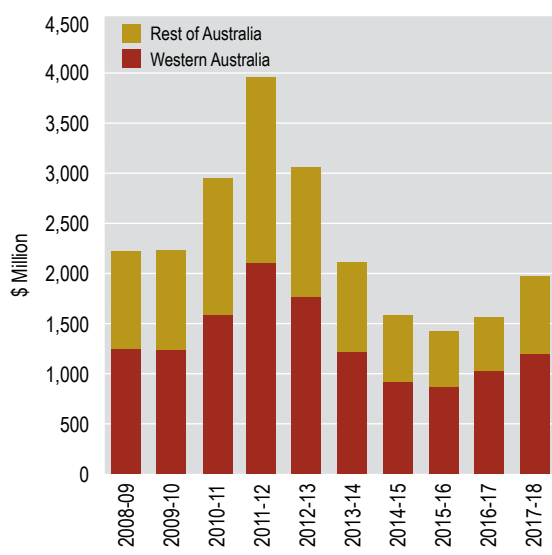


Figure 13 | **Mineral exploration expenditure**
Source: ABS

Globally, exploration budgets have declined since 2012 with the mix between greenfield and brownfield exploration shifting towards the latter. In terms of expenditure, the mix of Australian exploration has remained static over the past five years, roughly weighted 70:30 towards brownfield exploration.

Notable events

- The so-called “Pilbara gold rush” attracted heavy media attention this year with Novo Resources leading the charge. Novo published pictures of gold nugget finds and outlined the similarities between the size and shape of the nuggets found in the Pilbara to nuggets found in the Witwatersrand gold province in South Africa, however the connection is yet to be proven.
- Dacian Gold announced significant results from the Cameron Well deposit at Mt Morgans with a skinny but “spectacular” result of 2.3 metres grading 3.11 grams per tonne gold.
- Nickel West began drilling at the Venus deposit hoping results will support an extension of mine life to 2040.
- Gold Fields announced a \$100 million exploration budget for Australian mines, roughly one third of Gold Fields’ global exploration budget.

- The WA Government announced an ongoing \$10 million per year in funding for the Exploration Incentive Scheme.
- The Commonwealth Government approved \$50 million in funding for the Mineral Exploration Cooperative Research Centre. In tandem with industry funding, this will establish a \$215 million national research initiative, with a headquarters in Perth, aimed at developing technologies to increase the discovery of mineral deposits.
- Northern Star resources claimed the record for the deepest exploration drill hole in Australian mining history (3217m) at its Jundee project.

1.3.2 Petroleum exploration

National petroleum exploration expenditure continued to decline, falling from \$1.4 billion in 2016–17 to \$1 billion in 2017–18. National petroleum exploration expenditure continues to decline rapidly, having fallen 79 per cent (\$3.8 billion) since 2013–14.

WA’s share of the petroleum exploration spend increased to 55 per cent in 2017–18, up from 47 per cent on 2016–17. This was still well below the 70 per cent share the State averaged in the 10 years prior to 2016–17.

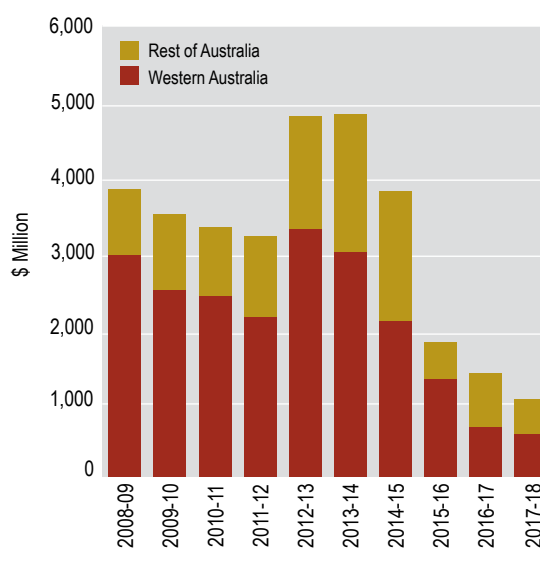


Figure 14 | **Petroleum exploration expenditure**
Source: ABS

Notable events

- Quadrant Energy and Carnarvon Petroleum’s Dorado-1 oil discovery in the Roebuck Basin is the biggest news in offshore oil exploration since the Vincent discovery in 1998 opened a new oil province just off WA’s North West Cape.
 - The nature of petroleum systems means there is a real prospect of other oil discoveries near Dorado and it could ultimately be at the centre of a much larger pool of reserves.
 - Only 18 wells have been drilled in the entire history of the Roebuck Basin, with the last six wells (for six discoveries) drilled by Quadrant and Carnarvon Petroleum in the past four years.
- Carnarvon Petroleum’s 100 per cent owned Labyrinth project is immediately north-west of the Phoenix/Roc area. Based on reprocessing of 2D seismic survey results, Carnarvon Petroleum estimate a prospective recoverable oil resource of 252GL across eight prospects. The best prospect, Ivory, is estimated to hold 67GL of oil across two target levels.
- Beehive is a new carbonate oil play in the Bonaparte Basin. Melbana Energy suggest it is potentially the largest undrilled hydrocarbon prospect in Australia. The project’s potential has attracted investment from Santos and Total. The location of the play close to several existing facilities, including the Ichthys project and Blacktip field and pipeline, offers several options for future development.

Further information on WA petroleum exploration activity is available in the DMIRS publication *Petroleum in WA*. It includes a comprehensive overview of the State’s petroleum exploration activities and details about the award of petroleum exploration permits. The next edition will be available on the department’s website in 2019.

1.4 INVESTMENT ACTIVITY



The economic indicators resource data file contains historic and current ABS investment data released in catalogue 5625.0 – *Private New Capital Expenditure and Expected Expenditure*. This data includes:

- mining investment in Australia, including WA
- new capital investment for mining in Australia, including WA.

1.4.1 Mining investment and new capital expenditure

WA’s share of national mining investment has averaged about 58 per cent for the past 10 years. In 2017–18, more than \$19 billion was invested in the State, representing about 53 per cent of national expenditure.

Decreasing investment is not just a local issue. A PwC study found that capital expenditure by the world’s 40 largest miners is at a 10-year low. This is despite revenue surging 23 per cent and profit rising 126 per cent in the last year.

Nationally, mining investment fell for the fifth consecutive year, down more than \$59 billion (62 per cent) in just five years. The decline has been only slightly less severe for WA, with mining investment falling 60 per cent over the same period.

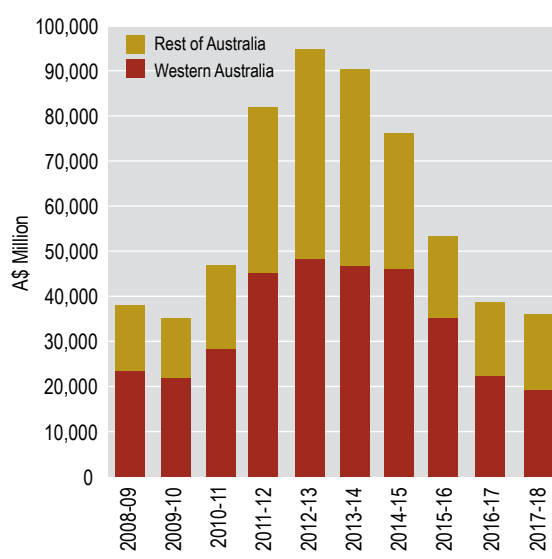


Figure 15 | Mining investment
Source: ABS

The substantial decline in investment is the result of the completion of major, multi-billion dollar iron ore and LNG projects. While the scale of investment seen between 2010–11 and 2013–14 is unlikely to be repeated soon, there is still interest and investment in the resource sector, albeit at a smaller scale.

Lithium and other battery material sectors have attracted much of this investment, while the more traditional gold and iron ore sectors continue to be a target for mergers and acquisitions as well as new and expanded projects.

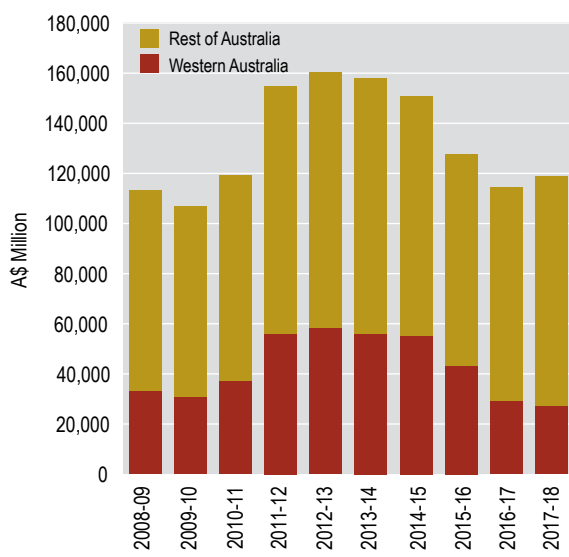


Figure 16 | **New capital expenditure**
Source: ABS

1.4.2 Major projects

Business News recently released a new database looking at major projects in WA. The research identifies nearly 140 major projects worth around \$130 billion across the resources, transport and construction sectors. The resources sector dominates this list with 11 mining projects and eight petroleum projects in the top 30.

The department maintains a mineral and petroleum major projects database that aims to estimate actual and possible investment in WA's resources industry¹.

Where possible, information is collated relating to expected capital expenditure, project timing and employment during the construction and operation

phases. Mineral and petroleum projects are categorised as:

- Projects under construction – those actually under construction at the time of updating the estimates of total capital expenditure.
- Committed projects – have company commitment, i.e. a final investment decision (FID), but are waiting for approval to proceed with construction.
- Planned projects – those undergoing advanced feasibility studies, i.e. definitive and bankable feasibility studies. For oil and gas projects, the planning phase typically involves detailed engineering design.
- Possible projects – those raising capital and not yet as advanced as those projects conducting definitive and bankable feasibility studies.

As of September 2018, WA had resource projects in the pipeline valued at an estimated \$108 billion, up slightly from the March 2018 estimate of \$104 billion.

Recently announced new projects include:

- FMG's \$1.7 billion Eliwana iron ore project
- BHP's \$4.2 billion South Flank iron ore project which will replace production from its depleting Yandi operations
- BHP's Nickel West division announced a US\$43 million investment to add a nickel sulphate hydroxide plant to the Kwinana nickel refinery with an option to further expand this investment
- A further \$516 million expansion at the Greenbushes lithium mine
- Woodside's expansion of the Scarborough project, increasing capital cost estimates by \$1 billion to \$11 billion
- Regis Resources approved development of an underground mine at Duketon with a capital cost of \$29 million.

The value of projects under construction, or in the committed stage of development, was an estimated \$36 billion, down from \$53 billion in

¹ Information is obtained from various sources including the Office of the Chief Economist's list of major mineral and energy projects, EnergyQuest, REPS' Major WA Projects Listing, online company research consultancy systems, media announcements and company websites.

Sector	Commodity	CAPEX (A\$ million)	
		Committed/ under construction	Planned/ possible
Minerals	Gold	1,343	646
	Iron ore	6,117	5,458
	Nickel, copper and zinc	145	2,280
	Lithium	2,268	1,901
	Infrastructure	0	5,670
	Other minerals	334	5,029
	Sub-total Minerals	10,207	20,983
Petroleum	Crude oil and condensate	2,519	0
	Gas	2,652	0
	LNG	21,066	50,609
	Pipelines and infrastructure	0	180
	Sub-total Petroleum	26,237	50,789
Total forecast investment		36,444	71,772

Source: DMIRS

March this year. This is attributable to several projects being completed or placed on hold due to prevailing market conditions.

The number of planned or possible projects increased from \$50 billion to \$72 billion between March and September. The increase follows proposed investments in the Browse, Gorgon and Pluto LNG projects.

1.5 PRINCIPAL MINING PROJECTS

WA's mining industry consists of 127 predominantly higher-value and export-oriented mining projects, as well as hundreds of quarries and small mines producing clays, construction materials, dimension stone, gypsum, limestone, limesand, spongolite, gems and semi-precious stones².

These principal mining projects accounted for 99 per cent of the State's \$88 million in mineral sales for 2017–18.

In total, more than 50 minerals are produced and several major mineral processing operations transform bauxite into alumina, nickel concentrate into nickel matte and silica sand into silicon metal.

The total number of principal mining projects is up almost 10 per cent from 116 in 2016–17. The increase is largely due to the start-up and re-opening of several gold projects with the number of these projects up from 43 in 2016–17 to 53 in 2017–18.

The number of principal mining projects for most other commodities was fairly stable year-on-year.



A list of the principal mining projects and key basic raw materials producers is available on the department's website.

1.6 EMPLOYMENT



The economic indicators resources data file provides detailed employment data, including:

- current and previous period employment data in the mineral industry
- current and previous period employment data in the petroleum industry
- a breakdown of employment by commodity for the mineral industry

² The State's principal mining projects are those that produce commodities valued at more than \$5 million per annum or, in the case of gold producers, more than 2500 ounces of gold. Projects on private land, for which production values are not required to be reported, are also classified as principal projects where employee numbers are greater than 50.

- calendar year employment by commodity data for the mineral industry since 2001
- financial year employment by commodity data for the mineral industry since 2001–02
- employment data for the mineral and exploration industries by commodity on a monthly basis since 2001
- historic calendar year employment data (by commodity) for 1987–2000.

1.6.1 Mining

WA's mining industry recorded the highest number of individuals employed in the State's history, at an average of 112,008 people during 2017–18, up from 106,490 the previous year. This figure included people employed in mineral exploration, mine site infrastructure construction, mineral processing, mine site surveying, transport and catering – essentially those people operating on site³.

However, this figure should be used with caution as the full-time equivalent (FTE) employment in 2017–18 was 89,819, only the tenth highest on record. This is consistent with the growing disparity

between FTE employment and the number of individuals employed since 2009–10.

The iron ore sector remained the State's largest mineral employer, with an average of 53,716 people, or 48 per cent. Gold and alumina were the next largest employers with 29,266 and 6,850 people.

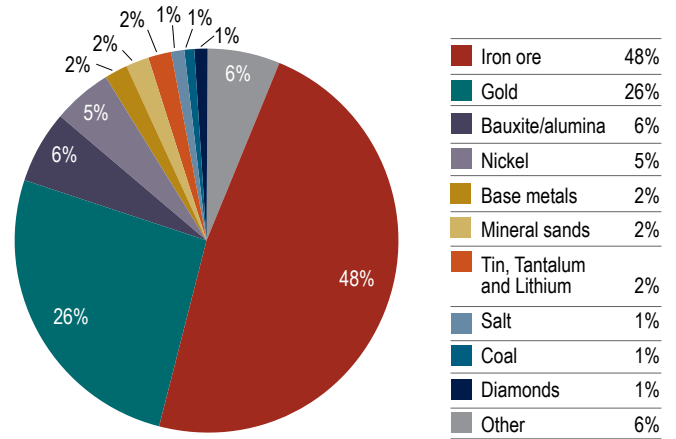


Figure 17 | WA minerals direct employment by mineral commodity 2017–18
Source: DMIRS

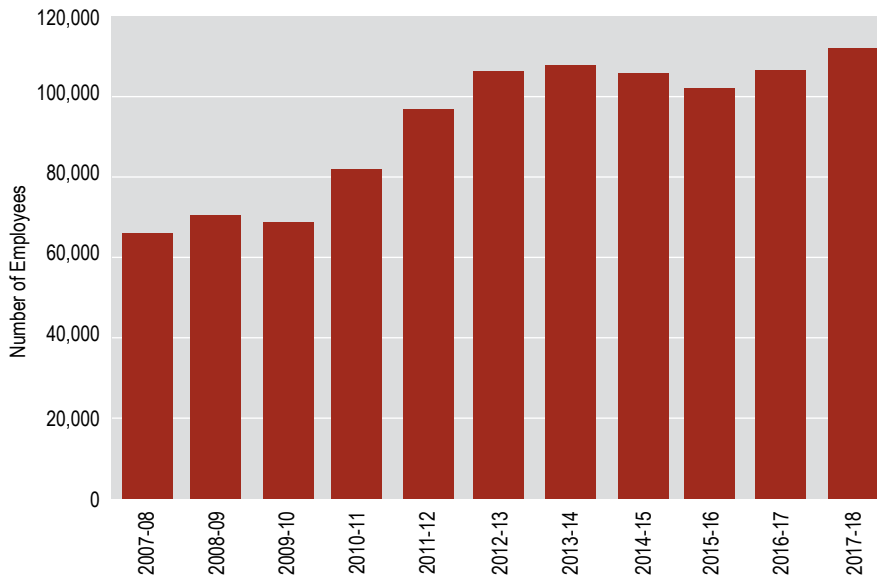


Figure 18 | WA mining employment 2007–08 to 2017–18
Source: DMIRS
Does not include petroleum data.

³ DMIRS collects mining employment data 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 on operating sites. Employment data collected and published by the ABS is classified using ANZSIC and is not directly comparable to data collected by DMIRS.

The difference between the number of individual and FTE data

The department reports employment data in two ways:

1. Full-Time Equivalent (FTE): The total number of positions that would be available within the mining industry if all work was performed by standardised full-time employees.
2. Total Number of Individuals (NoI): The number of individual people who have performed at least one hour's work on a mine site or for a mining company.

In a typical industry, the average number of individuals would be expected to be higher than the number of FTEs because a part-time employee is counted as one in NoI figures, but only as a fraction of one for FTE purposes.

The graph below shows monthly NoI and FTE employment from June 2008 to June 2018. It tells us that the mining industry is not typical in terms of the NoI/FTE numbers and that during some periods, FTE numbers are actually higher than the NoI numbers.

Historically, this is attributed to the relatively low proportion of part-time workers and individuals working hours greater than the equivalent of one FTE.

In the past, mining employment FTE and NoI figures have been fairly close, with the average disparity rarely exceeding 5 per cent from 2001 to 2012.

However, this changed markedly in 2013 when the number of FTEs began to decline relative to NoIs, reflecting the rise in contractor and consultant-based work among mining professionals as companies cut costs in response to declining commodity prices (especially iron ore).

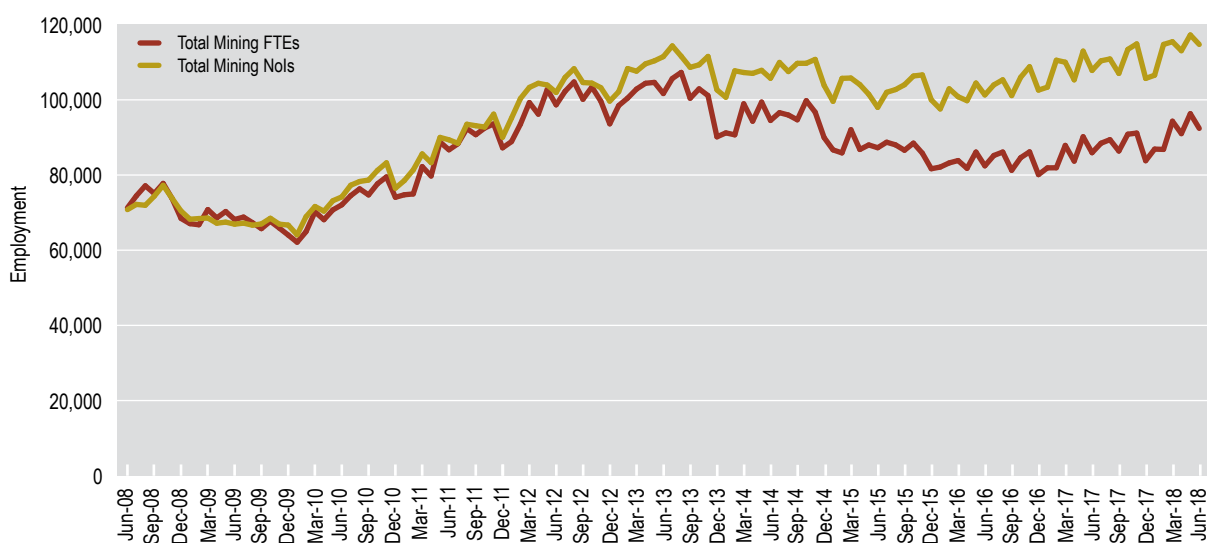


Figure 19 | **FTE vs NoI Employment in WA's Mining Industry 2008–18**
Source: DMIRS

1.6.2 Petroleum

The average number of people employed by the State's onshore petroleum sector improved slightly on the previous year, from 1203 to 1253.⁴ The data represents the average number of people employed at operating sites, including contractor employees.

The Dampier to Bunbury Natural Gas Pipeline is regularly the State's largest petroleum employer with an average of 299 people employed in 2017–18.

1.7 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 State 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.

The WA Government received royalty revenue from the State's mineral and petroleum producers totalling \$5.8 billion in 2017–18, a small increase of 1.6 per cent on 2016–17⁵.

Iron ore provided the bulk of collections (77 per cent) for 2017–18, however this was down 3 per cent on the previous year's receipts. Consistent with the better market conditions seen in the gold sector, contributions rose almost 4 per cent to \$273 million in 2017–18.

Petroleum royalty receipts were down for a second consecutive year. After declining almost 53 per cent in 2015–16, the decline was a more modest 6.4 per cent in 2017–18 with \$3.2 million in receipts. The State also received \$682 million in grants for the North West Shelf project, an increase of 19 per cent on 2017–18.

The figure reported in this digest is the "royalty receipts" for the relevant period, i.e. the cash that was actually received by the State Government during 2017–18. This means that the royalty receipts are offset from sales value figures by one quarter and include the June, September, December 2017 quarters and the March 2018 quarter.

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



The economic indicators resources data file contains:

- a breakdown of royalty receipts per commodity for the most recent calendar and financial year
- historic royalty receipts and North West Shelf grants from 1984–present.

⁴ This figure comprises only operations subject to State petroleum legislation, and excludes LNG operations and land based service operations.

⁵ 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 rate is 25 cents per tonne. In the case of some older Agreement Acts, the rate is 25 cents per imperial ton. The additional lease rental applies to iron ore obtained from a mining lease following 15 years from the date the iron ore was first obtained from the mining tenement, by the lessee.

TABLE 2. Royalty receipts and North West Shelf grants 2016–17 and 2017–18				
Commodity	2016–17 Total A\$	2017–18 Total A\$	2017–18 growth A\$	%
Alumina	81,082,000	99,232,000	18,150,000	22.4%
Copper, Lead & Zinc	59,916,000	70,778,000	10,862,000	18.1%
Diamonds	13,020,000	12,094,000	-926,000	-7.1%
Gold	262,874,000	272,771,000	9,897,000	3.8%
Mineral sands	14,317,000	12,291,000	-2,026,000	-14.2%
Iron ore	4,619,551,000	4,476,871,000	-142,680,000	-3.1%
Nickel	49,169,000	56,958,000	7,789,000	15.8%
Petroleum *	3,432,000	3,212,000	-220,000	-6.4%
Other	68,541,000	148,350,000	79,809,000	116.4%
Total royalty receipts	5,171,902,000	5,152,557,000	-19,345,000	-0.4%
North West Shelf Grants	573,000,000	681,965,000	108,965,000	19.0%
Total revenue	5,744,902,000	5,834,522,000	89,620,000	1.6%

Note: All royalty revenue shown above is paid into the State's Consolidated Revenue Fund. Added to the table, shown separately, is the State's share of the North West Shelf project royalty payments to the Commonwealth (which are provided as a grant from the Commonwealth to the State).

* Includes the Commonwealth's share of royalties collected under the Western Australian Petroleum Submerged Land Act (PSLA).

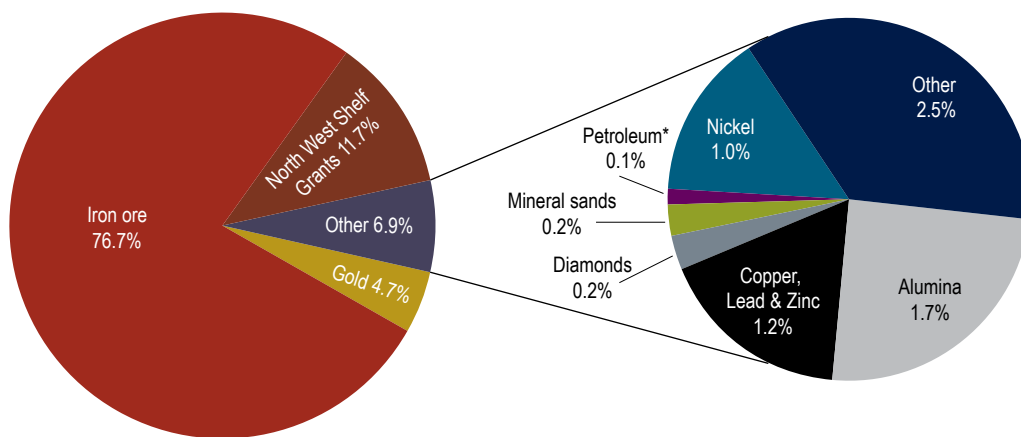


Figure 20 | **Royalty receipts and North West Shelf grants 2017–18**
\$5.8 Billion
 Source: DMIRS and Department of Treasury

2.1 IRON ORE

Pricing

The average annual iron ore price decreased slightly from US\$69.55 per tonne in 2016–17 to US\$69.21 per tonne in 2017–18. Due to movements in the US-Australian dollar exchange rate, this meant a decrease in the Australian dollar annual average from \$92.12 per tonne to \$89.23 per tonne over the same period.

Iron ore price spread

The iron ore price spread remained a topic of conversation in 2017–18.

While the 'benchmark' iron ore price is for 62 per cent iron content ore, the grade of iron ore used in steelmaking usually ranges between 58 to 65 per cent iron content. Premiums and discounts are applied to the price paid for higher and lower grade ores.

The gap that emerged in early 2017 remained in effect, with the 58 per cent iron ore price averaging US\$55.27 over the year.

The discounts are linked with high coking coal prices and penalties for high alumina content in iron ore supplies. Steelmakers need to use more metallurgical coal in the blast furnace when smelting iron ore of high alumina content. The rising levels of alumina

content in the global supply chain points towards a greater demand for higher grade iron ore supplies.

High steel prices, and China's ongoing government push to improve air quality through increasingly stringent air pollution policies, are expected to maintain the price premium for high grade iron ore and discounts for impurities contained in iron ore, namely alumina and silica.

While WA typically hosts mid-quality iron ore reserves (close to the 62 per cent benchmark), there are a number of producers operating lower grade mines, which may be exposed to persistently lower prices.

Quantity and value

WA's iron ore sales reached a record 826 million tonnes in 2017–18, an increase of almost 8.5 per cent on 2016–17. Iron ore sales have increased year-in-year-out, with annual volumes growing 161 per cent in the last 10 years alone.

In 2017–18, iron ore volumes increased mostly due to production growth by Rio Tinto following the ramp up of the 10Mtpa Silvergrass mine, as well as the continued ramp up of Roy Hill and CITIC Pacific's Sino Iron project. This growth was enough to more than offset lower production from Mineral Resources, Cleveland-Cliffs and Atlas Iron.

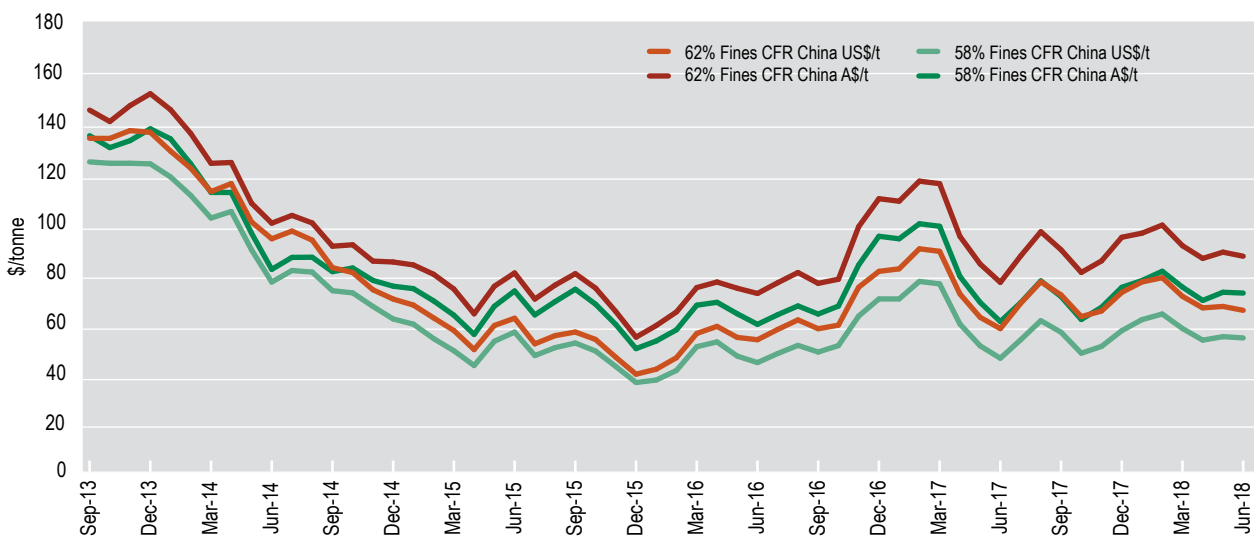


Figure 21 | Iron ore price
Source: Argus Metals

Despite the increase in sales volumes, the lower prices received by WA producers actually meant that the value of the iron ore sector fell 3.4 per cent from \$63.9 billion in 2016–17 to \$61.7 billion in 2017–18.

Iron ore accounted for 54 per cent of all mineral and petroleum sales, 70 per cent of mineral sales and about 77 per cent of WA’s royalty receipts, making the sector a substantial contributor to the State’s prosperity.

China remained the State’s largest iron ore customer, accounting for 82 per cent (\$50 billion) of iron ore exports. Japan and South Korea were the next two largest markets, accounting for \$5 billion (9 per cent) and \$4 billion (6 per cent) in exports respectively.

Notable events

- Rio Tinto officially opened its \$468 million Silvergrass mine in August 2017.
- Atlas Iron’s sales fell 27 per cent in the December quarter after the depletion of its Abydos mine, as well as issues with berth availability at Utah Point.
- In February 2018, BHP received approval to increase the capacity of its Port Hedland operations to 290 million tonnes per annum (up from 270 million tonnes per annum). The new rate of production is expected to be reached by the end of 2019.
- In March 2018, Cleveland-Cliffs announced the closure of Koolyanobbing mine, raising concerns that jobs at the Esperance Port would be at risk. In June 2018, a deal was reached between Cleveland-Cliffs and Mineral Resources for the purchase of the mine which will continue valuable throughput for the Esperance Port for the next five years. The purchase was timely for Mineral Resources with the completion of operations at its Carina mine allowing it to relocate its assets to the Koolyanobbing mine. Mineral Resources expect to restart operations in September 2018.
- Roy Hill announced it will aim to increase output from 55 million tonnes per annum to 60 million tonnes per annum, applying for additional capacity at Port Hedland as the first step towards increasing supply.
- Mt Gibson progressed its plans to recommence its Koolan Island operations, with plans to begin shipping in early 2019.

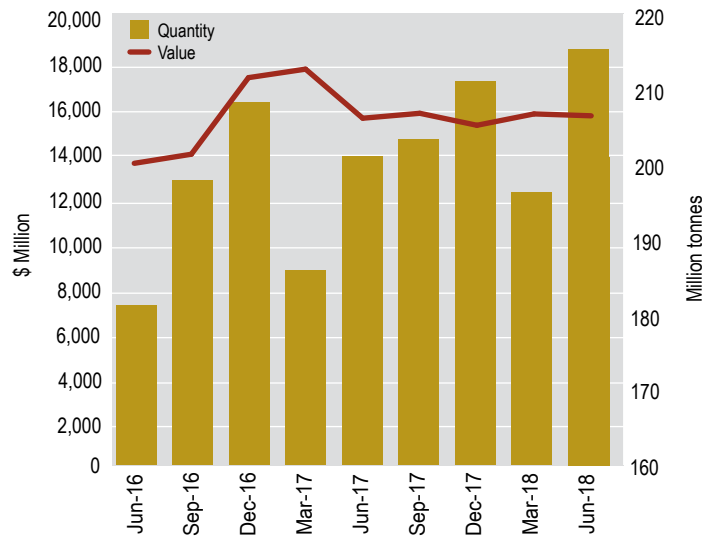


Figure 22 | Iron ore quantity and value by quarter
Source: DMIRS

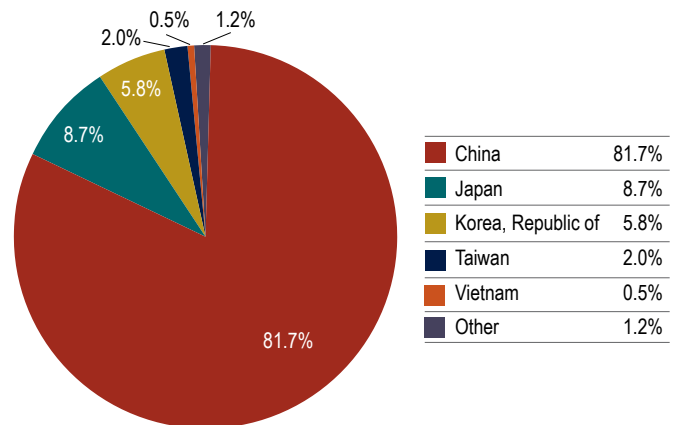


Figure 23 | Iron ore exports 2017–18
\$60.7 Billion
Source: ABS



Figure 24 | Iron ore exploration expenditure 2017–18
Total Australian spend \$284.4 Million
Source: ABS

- The Magnetite Financial Assistance Program was conditionally extended for nine months (to 31 December 2018), pending a review of the sector by the Departments of Mines, Industry Regulation and Safety; Jobs, Tourism, Science and Innovation; and Treasury.
- Quarterly iron ore exports from Port Hedland Port reached a record 47.3 million tonnes in June 2018.
- Also in June, BHP approved the \$4.5 billion, 80 million tonnes per annum South Flank

development with first production expected by 2021. Similarly, FMG approved the \$1.7 billion, 30 million tonnes per annum Eliwana project. Both projects are aimed at maintaining current production levels.



The major commodities resources data file contains:

- quarterly production and sales value figures for iron ore in WA
- historic annual average price of iron ore and recent monthly prices
- value of iron ore exports from WA by destination
- annual historic iron ore production in WA compared to the rest of Australia
- annual historic 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.

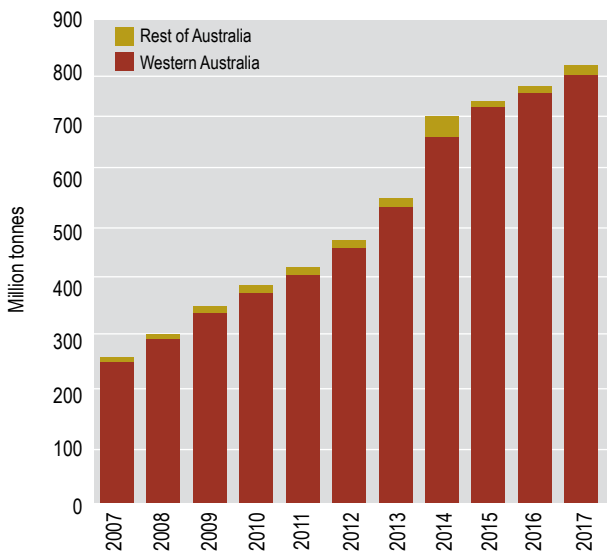


Figure 25 | **WA iron ore production v rest of Australia**
Source: DMIRS and DIIS

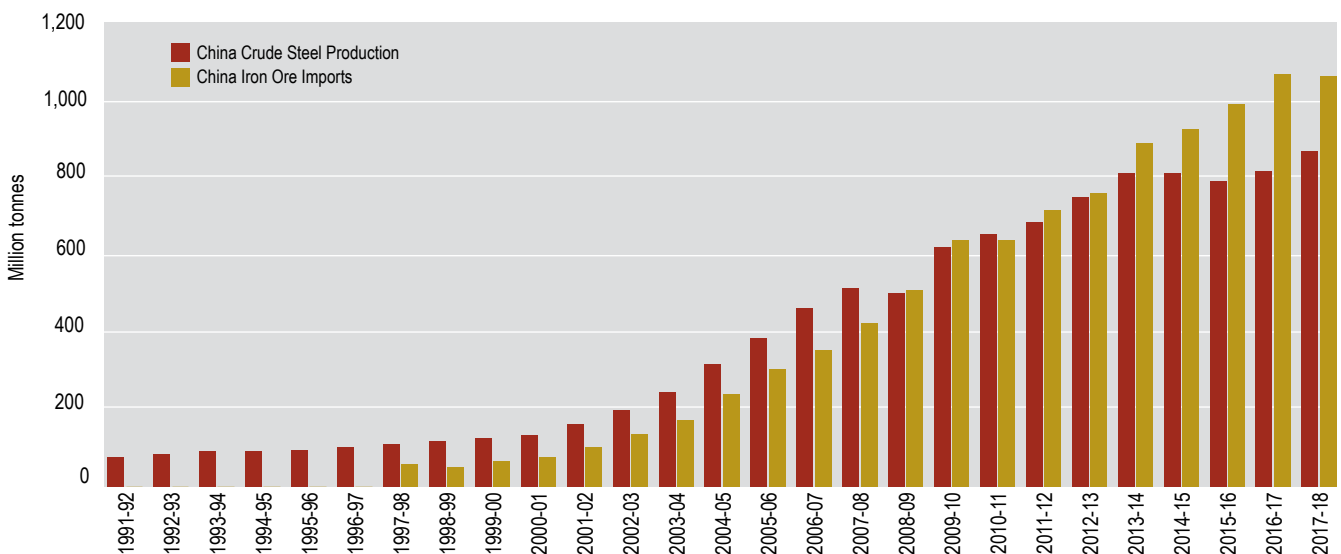



Figure 26 | **China's crude steel production and iron ore imports**
Source: World Steel Association and TEX Report

2.2 PETROLEUM

In 2017–18, the value of petroleum products produced in State areas, onshore and offshore, and in adjacent Commonwealth offshore areas totalled \$26.6 billion, up 39 per cent from \$19.2 billion in 2016–17⁶.

Petroleum production accounted for 23 per cent of the value of mineral and petroleum sales for WA, making the petroleum sector the second most valuable after iron ore. The majority of petroleum production (more than 90 per cent) originates from projects in adjacent Commonwealth offshore areas.

Japan remained the primary export destination for petroleum, taking 52 per cent, or \$12.8 billion, of WA's petroleum production. Singapore and South Korea were the next largest with 12 per cent and 10 per cent of petroleum exports respectively.

 The major commodities resources data 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 to the rest of Australia
- production and domestic consumption of natural gas in WA compared to 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.

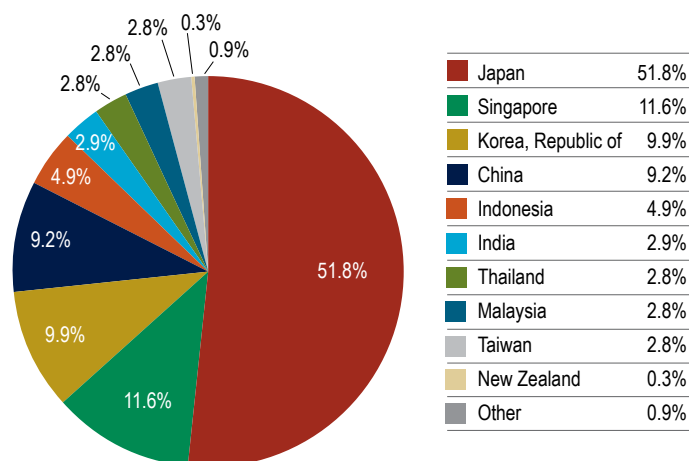


Figure 27 **Petroleum exports 2017–18**
\$24.7 Billion
Source: DMIRS and ABS

2.2.1 Liquefied natural gas (LNG)

Pricing

Gas prices and gas pricing mechanisms vary from region to region. Most LNG in Asia is sold under long-term contracts in which the price of LNG is linked to the price of oil.

Prices in US\$ per million British thermal units (MMbtu) are generally set by applying a scaling factor (about 14 per cent) to an oil price in US\$ per barrel, such as Japan Customs-cleared Crude (JCC), with a lag of about three months⁷.

LNG spot prices in Asia have generally trended upwards since early 2016 and have shown considerable volatility over the past two northern hemisphere winters. During the last northern winter (over late 2017 and early 2018), spot prices increased sharply on the back of strong seasonal demand from major buyers in Asia, particularly China. Spot prices subsequently held those gains over the northern hemisphere summer, in part due to increased oil prices.

On average, the annual price of LNG from Australia to Japan was US\$8.42 per GJ, slightly more than the price for LNG from Australia to South Korea at US\$8.37 per GJ.

⁶ In early 2016, changes in information sharing between the Australian and WA State Governments resulted in the department needing to source alternative 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 DMIRS estimated the value of production from these offshore fields, based on total production and the prevailing market prices at the time.

⁷ As Australia uses the metric system, prices can also be quoted in \$ per Gigajoule (GJ)

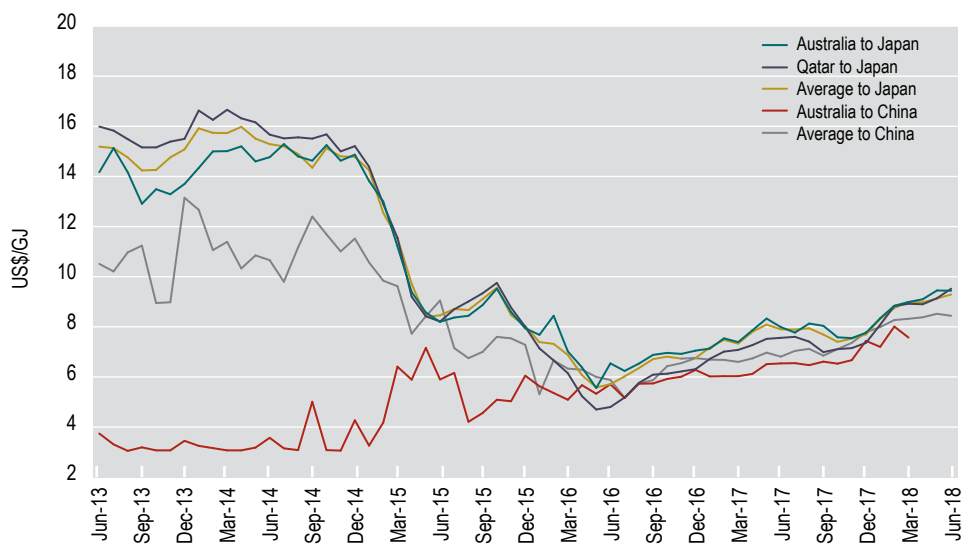


Figure 28 LNG import prices
 Source: Argus Monthly LNG and EnergyQuest
 Note: Australia to China data for the June 2018 quarter was not available at the time of publication.

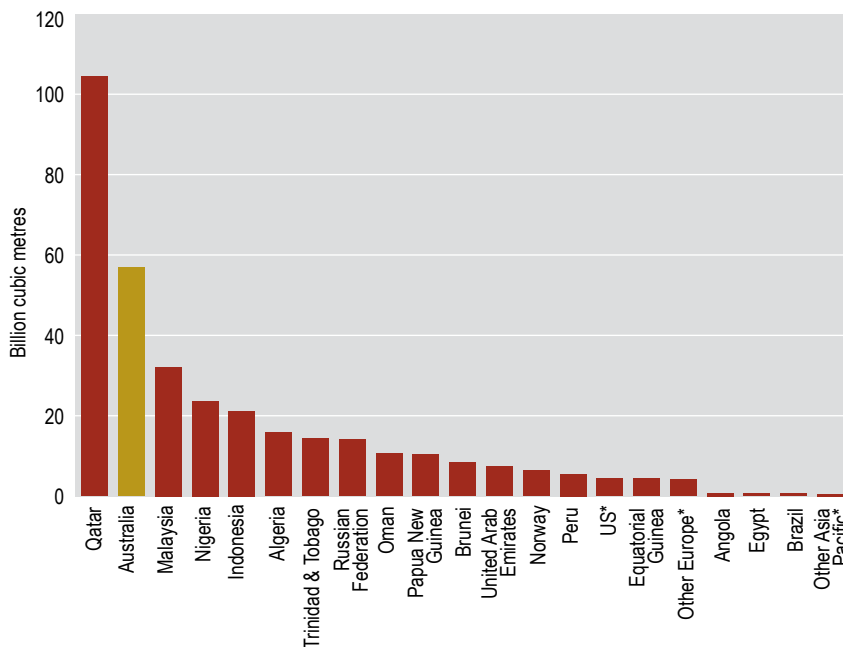


Figure 29 Global LNG exports by country
 Source: BP World Energy Statistics 2018
 *Note: Includes re-exports

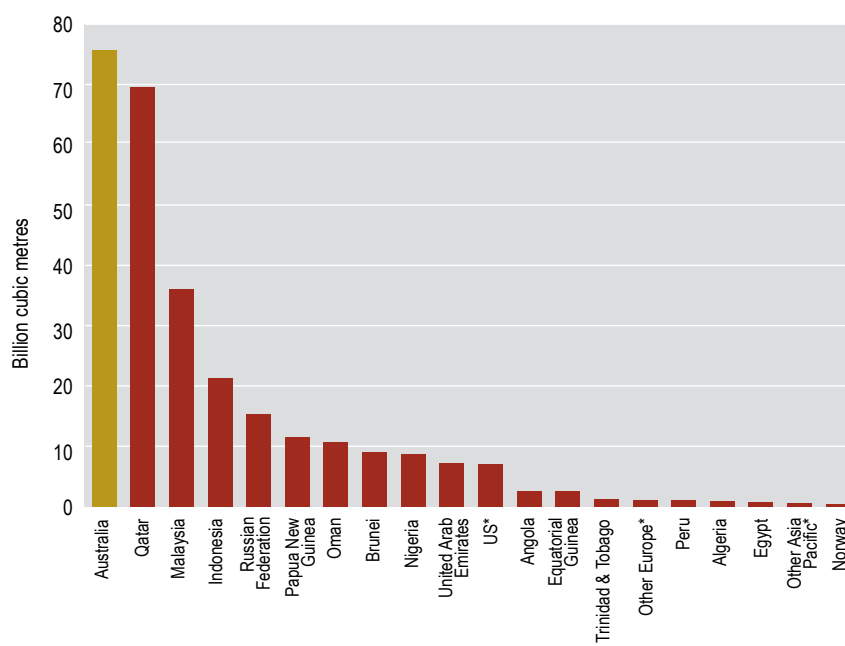


Figure 30 | **Asia Pacific region imports by country**
Source: BP World Energy Statistics 2018

Quantity and value

The volume of LNG produced in WA increased 45 per cent in the five years to 2016–17. In 2017–18, a further 32 per cent increase was achieved with production reaching a record 37.9 million tonnes.

LNG was easily WA’s most valuable petroleum product in 2017–18, accounting for 17 per cent of the value of the State’s mineral and petroleum sales. LNG sales rose from \$12.7 billion in 2016–17 to \$19.1 billion in 2017–18.

The increase in LNG sales volumes was driven in part by the ramp up of Chevron’s LNG projects over the last year. Wheatstone has produced 2.1 million tonnes since it began shipping in November 2017 and Gorgon has seen considerable production growth in the past year from 6.9 million tonnes to 12.7 million tonnes. This is close to its 15.6 million tonnes per annum nameplate capacity.

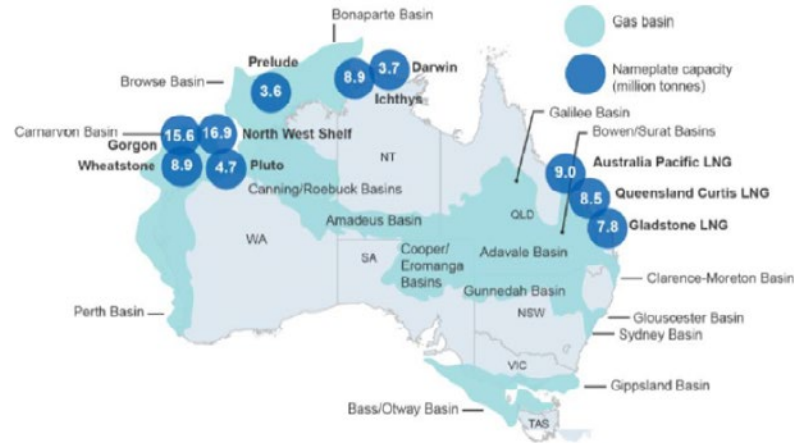
Most of WA’s LNG is exported to Japan which has been the leading importer of LNG in the world since the 1970s. In 2017–18, WA LNG exports rose 48 per cent from \$8.6 billion to \$12.8 billion. However, Japan’s LNG imports have declined by 2 per cent in the first seven months of 2018,

compared with the same period last year. The main factor affecting gas demand is the pace at which offline nuclear reactors are recommissioned. To date, the pace of nuclear restarts has been slow, with nuclear energy continuing to face public opposition and legal challenges.

Notable events

- Woodside formally began production from the Persephone gas field in August 2018. Persephone is the first major new source of gas into the North West Shelf since the Angel field several years ago.
- Buru shipped the first cargo from the Ungani oil field in a year with another six cargoes planned over the next 12 months.
- The onshore Waitsia development continued to deliver positive results with drilling of Waitsia-4 confirming a further extension to the field. Along with Waitsia-3 this well has exceeded expectations and should support a project life extension beyond 10 years. Frontend engineering and design (FEED) should be completed by the end of November and Mitsui is planning first gas sales from 2020.

Australia's LNG projects and gas basins



(Source: Office of the Chief Economist)

- Woodside acquired Exxon Mobil's 50 per cent stake in the Scarborough gas field. Woodside now owns 75 per cent of the WA-R-1 permit which contains most of the Scarborough field.
- Technical studies are underway for a second train at Woodside's Pluto project, likely in the 4-5 million tonne per annum range. The additional train at the Pluto LNG project forms part of Woodside's plans to develop the Scarborough gas resource in the Carnarvon Basin, connecting the offshore resource to the Pluto LNG plant via a 430 kilometre pipeline. A FID is being targeted for 2020, and first LNG is being targeted for 2024. The cost estimate is US\$11 billion in 2018 dollar terms.
- The first shipment of LNG (from Darwin) from Inpex's Ichthys project occurred on 1 October 2017 and Shell indicated that the Prelude Floating LNG project will begin LNG production before the end of the year.
- The Office of the Chief Economist projects that Australia will edge past Qatar as the world's largest LNG exporter in 2019 when exports reach 76 million tonnes, and extend its lead slightly in 2020. However, given the narrow difference between the projected exports of the two nations, Australia overtaking Qatar is not a certainty.

2.2.2 Crude oil and condensate

Pricing

The annual average oil price, based on a combination of Brent, West Texas Intermediate and Tapis, was US\$62 per barrel in 2017–18, up from US\$50 per barrel in 2016–17. This is the second consecutive year of price growth.

Increasing political tensions in the Middle East and a nine-month extension of the OPEC supply cuts were the main contributors to the price strength over the year. Some analysts suggest that tensions in the Middle East could lead to the closing of the Strait of Hormuz, through which about 5 per cent of the world's oil supplies pass. If this eventuates, it could lead to a doubling of the oil price.

Quantity and value

About 70 per cent of Australia's crude oil and condensate production comes from the Carnarvon Basin in WA.

Crude oil volumes in 2017–18 fell for the third consecutive year, down 11 per cent from 5.4GL to 4.8GL. The improvement in the oil price meant that the value of WA crude oil increased from \$2.1 billion to \$2.3 billion.

WA's condensate production is produced as a by-product of natural gas production from the North West Shelf fields, and so as expected with the increase in LNG volumes, the volume of condensate sales also increased year-on-year. In 2017–18, condensate sales reached 7.1GL, the second largest financial year volume recorded. The highest recorded sales volume (7.4GL) was reached in 2009–10.

Before this reporting period, the value of crude oil and condensate sales had fallen for six consecutive periods. Decreasing from \$12.5 billion in 2010–11 to \$4.3 billion in 2016–17. In 2017–18, the sector saw a return to growth with sales of \$5.6 billion.

Notable events

- The 2017 production agreement, established between OPEC, Russia, Mexico and eight other countries (collectively known as OPEC+) was upheld in 2018. The agreement targets a 1.8 million barrel a day combined decrease in production. In July 2018, the OPEC+ agreement was adjusted in response to concerns about production shortages.
- New condensate production from the Wheatstone and Prelude projects is expected online before the end of 2018.
- Woodside's Greater Enfield project, with a capacity of 40 thousand barrels a day, is expected to be producing by mid-2019.
- Although lower oil prices have contributed to subdued exploration activity in the petroleum sector, the Dorado-1 oil discovery is the biggest news since the Vincent discovery in 1998 opened a new oil province just off WA's North West Cape. This ranks the discovery as the third largest in the history of the North West Shelf, behind Barrow Island and Wanaea. There is a real prospect of other oil discoveries near Dorado.

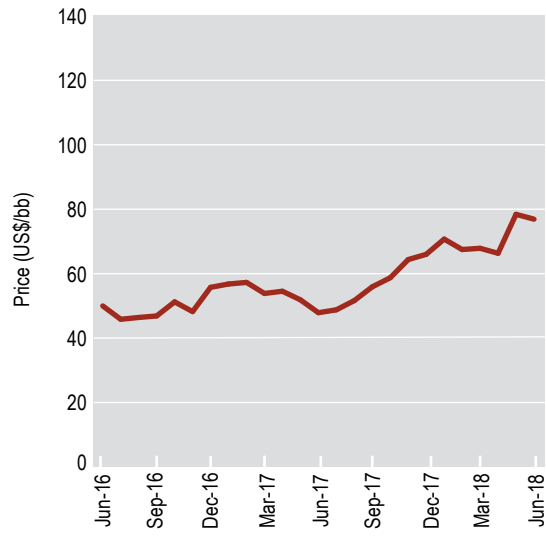


Figure 31 | **Tapis crude oil price**
Source: WA Treasury Corporation and DMIRS

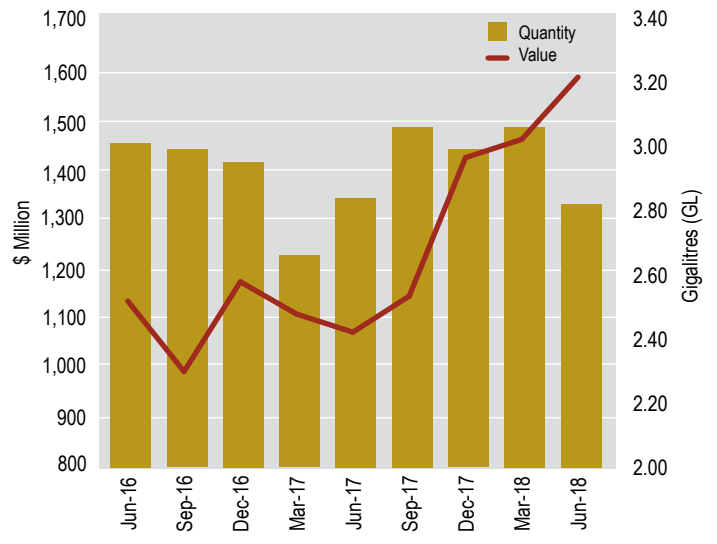


Figure 32 | **Crude oil and condensate quantity and value by quarter**
Source: DMIRS and EnergyQuest

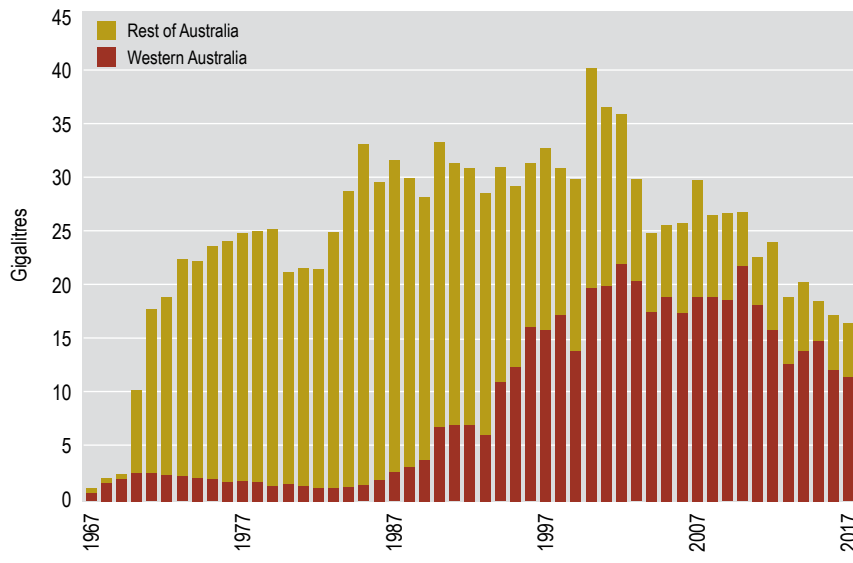


Figure 33 | **Crude oil and condensate production WA v rest of Australia**
Source: DMIRS and EnergyQuest

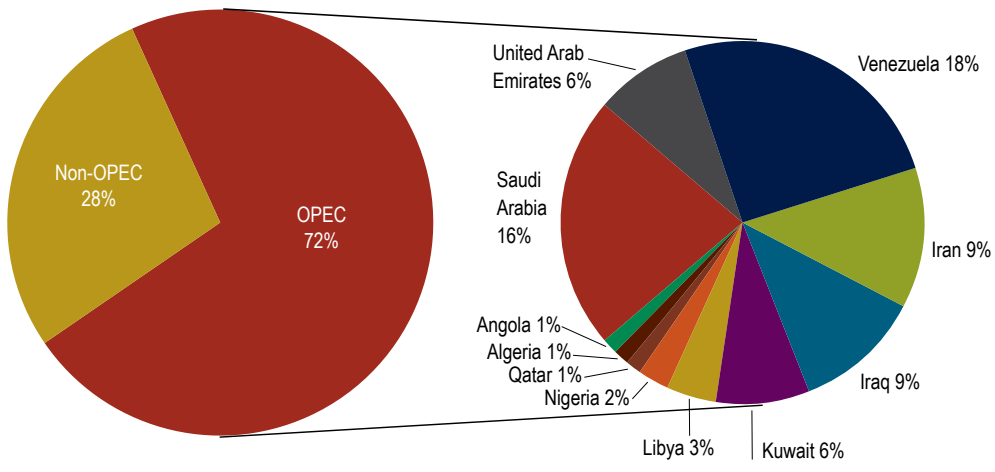


Figure 34 | **OPEC share of world crude oil reserves 2017**
Source: BP Statistical Review of World Energy 2018

2.2.3 Domestic natural gas supply

Pricing

In 2017–18, the average price of gas sold into the Dampier to Bunbury Natural Gas Pipeline (DBNGP), Parmelia pipeline and Goldfields pipeline was \$4.28 per gigajoule (GJ), representing a decrease of almost 14 per cent from the 2016–17 average of \$4.96/GJ.

WA has ample supply of domestic gas over the short to mid-term and is about to be further supplemented with supply from the Wheatstone project, expected in

November 2018. This will likely place more downwards pressure on WA's domestic gas prices over the short to mid-term. Longer term, prices are likely to increase as large domestic gas supply contracts come to an end.

Quantity and value

In 2017–18, the quantity of natural gas supplied into the domestic market increased from 393PJ (9.7 billion cubic metres) to 374PJ (10 billion cubic metres), the second highest volume recorded.

The value of domestic gas sales is based on the total sales value at the points of entry into the DBNGP,

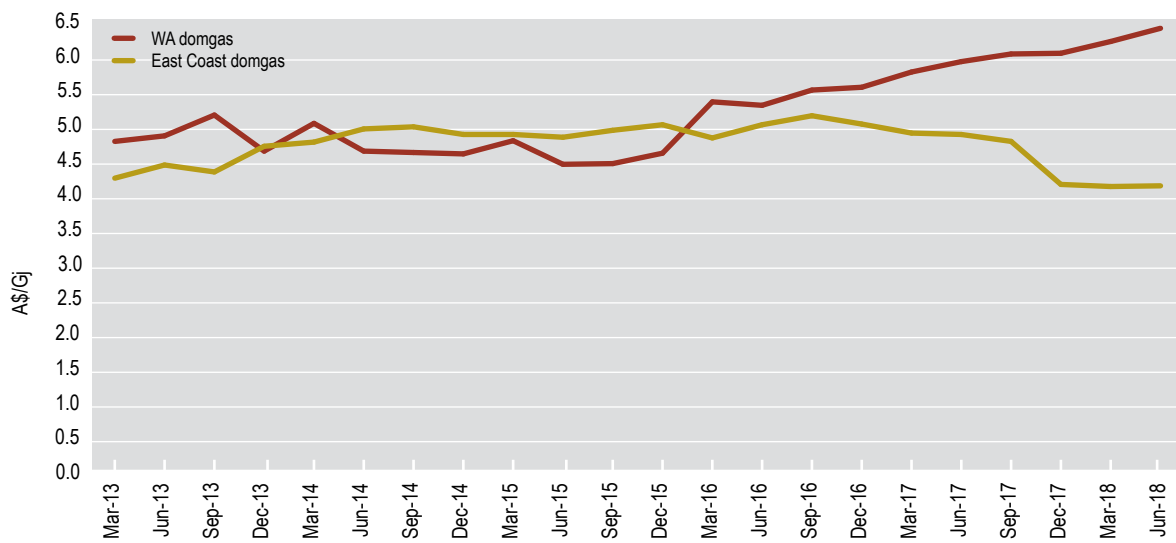


Figure 35 | Average quarterly natural gas price
Source: EnergyQuest and DMIRS

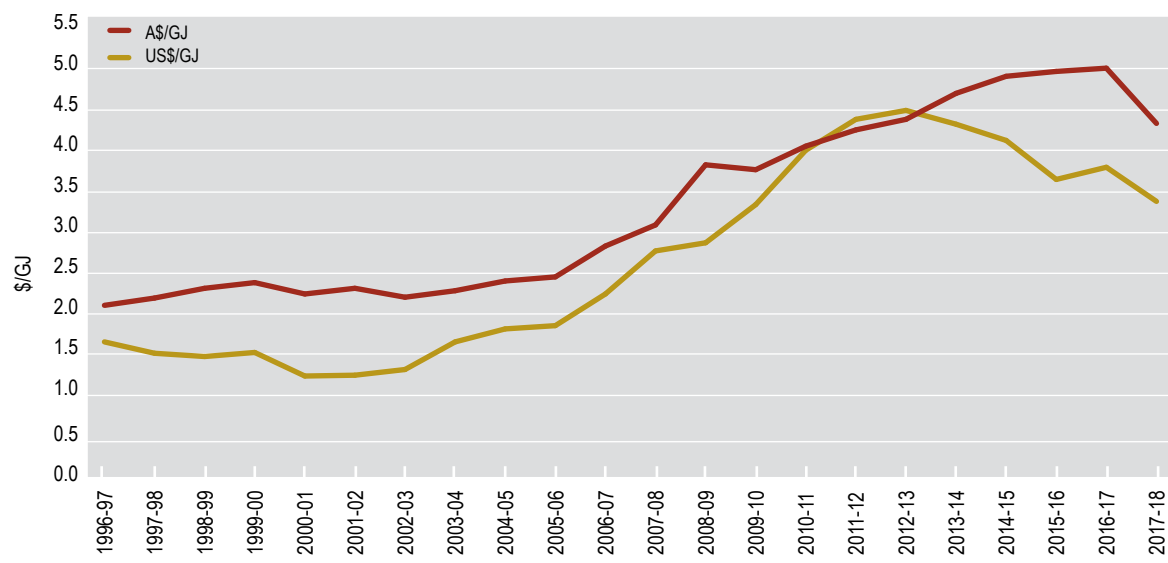


Figure 36 | Western Australian average domestic natural gas price
Source: DMIRS

The value of Western Australian domestic gas sales is based on the summation of total domestic gas sale values as at the point of entry into the Dampier to Bunbury Natural Gas Pipeline (DBNGP) or where applicable, the Parmelia and Goldfields pipeline.

Parmelia pipeline and Goldfields pipeline. The increase in domestic gas sales volumes was not enough to offset the lower prices and, as a result, the value of domestic gas sales decreased from \$1.8 billion in 2016–17 to \$1.6 billion in 2017–18.

The North West Shelf project is the largest contributor to Western Australia’s domestic gas supply, however this is expected to change as the project’s offshore gas fields near the end of their productive life and domestic gas contracts begin to end in the early 2020s.

If demand remains at current levels, the commissioning of new domestic gas plants by the Gorgon and Wheatstone LNG projects, and new commitments secured from the North West Shelf, should see the market well supplied into the mid-2020s. However, new sources of supply will be required beyond mid-2020.

Future supplies could come from:

- new domestic gas obligations for LNG producers tolling gas through the North West Shelf facility, such as from the Browse and Equus fields
- the implementation of the Pluto LNG Project’s domestic gas commitments
- development resources by existing or new domestic gas only projects.

Notable events

- Woodside has executed a non-binding memorandum of understanding with Perdaman Chemicals and Fertilisers to supply 125 TJ/d of domestic gas for use in a proposed 2 million tonnes per annum urea export plant in Karratha. Natural gas will be supplied from Woodside’s portfolio of domestic gas underpinned by the proposed Scarborough development. Supply is expected to start from the early 2020s for up to 20 to 25 years.
- Notwithstanding a plentiful supply of domestic gas, there was significant merger and acquisition activity in the reporting period. The Mitsui takeover of AWE and the Beach purchase of Lattice changed the ownership of the Waitsia field, with the two partners each holding 50 per cent, with Mitsui as operator. The field has proven and probable reserves of 800PJ.
- Santos successfully made a bid for Quadrant Energy, giving full ownership of Devil Creek and Varanus Island plus a share of Macedon and interests in two oil facilities, the Ningaloo Vision and Pyrenees. Santos now holds about 35 per cent of the WA domestic gas market.

2.3 GOLD

Pricing

Historically, when large, global issues threaten world economic growth, investors would move funds into gold to keep them safe. However, the gold price was relatively stable during the year, hovering about the high US\$1200s and low US\$1300s per ounce, despite a number of apparent serious world issues.

Downwards pressure on gold prices was led by the strength of the US dollar against developed and emerging market currencies, particularly a weakening of the Chinese yuan and Turkish lira. The dollar’s strength has been one of the most important drivers of gold’s performance as the US-China trade tensions have so far played in favour of the US.

Over the reporting period, the highest average monthly gold price reached was US\$1334 per ounce in April 2018. The average annual gold price rose 3 per cent from US\$1257 per ounce in 2016–17 to US\$1297 in 2017–18. Movements in the exchange rate meant that the average Australian dollar price of gold increased only slightly from \$1675 per ounce in 2016–17 to \$1678 per ounce in 2017–18.

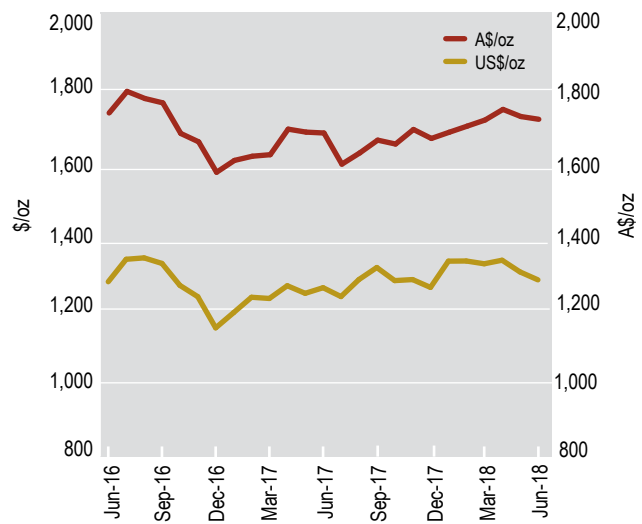


Figure 37 | Gold price
Source: Perth Mint and Kitco

Quantity and value

WA gold sales volumes increased for the third consecutive year to reach a record 212 tonnes (7.5 million ounces) in 2017–18. Increased volumes, combined with the small improvement in gold prices, delivered a 5 per cent increase in the value of the sector, from \$10.9 billion in 2016–17 to \$11.4 billion in 2017–18⁸.

The gold sector is WA's second most valuable mineral commodity and accounts for about 70 per cent of Australia's total gold production (estimated to be about 10 million ounces). According to some industry commentators, most Australian treatment plants are operating at full (or even above) capacity, but this is not expected to continue.

The top 10 gold projects in WA accounted for 58 per cent of the State's total gold production. They were:

- Newmont Mining Corporation's Boddington mine (11 per cent with 824,211 ounces)
- KCGM's Kalgoorlie Super Pit/Mt Charlotte mines (11 per cent with 815,922 ounces)
- Newcrest's Telfer mine (6 per cent with 445,086 ounces)
- Gold Field's St Ives mine (5 per cent with 405,580 ounces)
- AngloGold Ashanti's Tropicana mine (5 per cent with 354,820 ounces)
- Northern Star Resources' Jundee mine (4 per cent with 312,597 ounces)
- Gold Field's Granny Smith mine (4 per cent with 310,305 ounces)
- AngloGold Ashanti's Sunrise Dam mine (4 per cent with 297,888 ounces)
- St Barbara Ltd's Gwalia operations (4 per cent with 297,465 ounces)
- Regis Resources' Duketon operations (4 per cent with 279,828 ounces)

Notably, all 10 projects recorded an increase in gold sales for 2017–18.

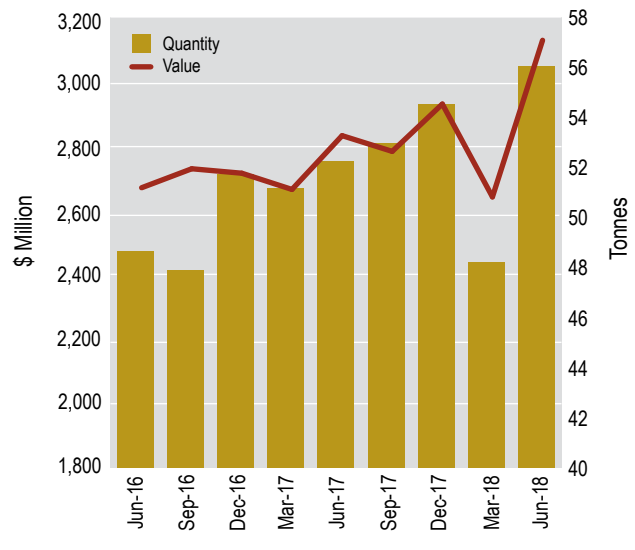


Figure 38 | **Gold quantity and value by quarter**
Source: DMIRS

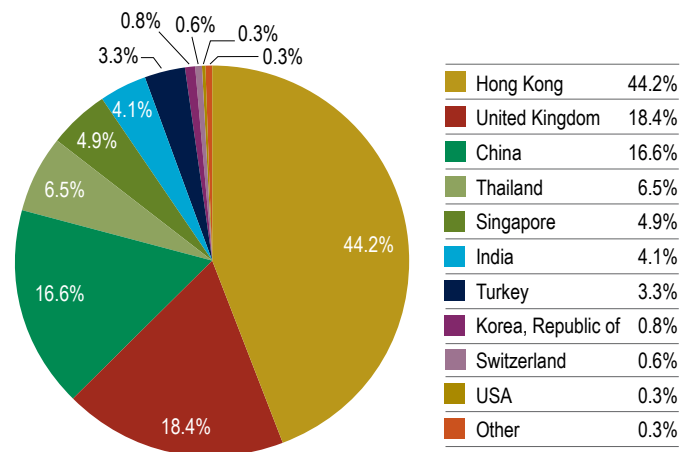


Figure 39 | **Gold exports 2017–18**
\$17.7 Billion
Source: ABS and DMIRS estimate
Note: Includes gold refined/processed and exported from Western Australia, but produced from mining operations in other states, territories and overseas.

⁸ The ABS releases WA export trade data which 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

- Dacian Gold began underground mining at its Mount Morgans project which is expected to produce 150,000 to 200,000 ounces per annum with an initial mine life of eight years.
- Several new projects or expansions were approved during the December quarter, including an extension of Tropicana, which will add 2.1 million ounces of production and extend the mine life by seven years to 2027. Kin Mining also approved development of the Leonora project in the Goldfields. The project should produce 55,000 ounces a year for seven years, with first gold expected in the December 2018 quarter.
- Sales volumes declined between the December 2017 and March 2018 quarters due to several factors:
 - Telfer experienced a 42 per cent fall in volume due to wet weather, higher waste to ore ratios and outages and shut downs.
 - Boddington volumes fell by 31 per cent due to higher waste-to-ore ratio, lower grade and lower recovery rates.
 - Tropicana, Mt Magnet and Duketon also experienced 20 per cent plus falls in volumes due to lower grade and/or lower recovery or waste-to-ore ratios.
 - The Andy Well project ceased operations due to depletion.
 - St Barbara experienced a 13 per cent fall in production due to a change in the Gwalia mine sequence.

- Westgold Resources began commissioning of its Tukabianna processing plant. The plant will initially process low-grade stock from the Comet underground mine before ramping up to include feed mainly from the Big Bell underground mine by 2020 (both mines are part of the Cue mining area).
- Westgold Resources sold its South Kalgoorlie operations to Northern Star Resources for \$80 million.
- In terms of new projects, Gold Roads' Gruyere gold mine (260,000 ounces per year) is expected to come online in early 2019, Capricorn Metals' Karlawinda gold mine project (141,000 ounces per year) is expected to be commissioned in 2020 and Northern Star's Jundee expansion project (39,000 ounces per year) is expected to finish by 2020.

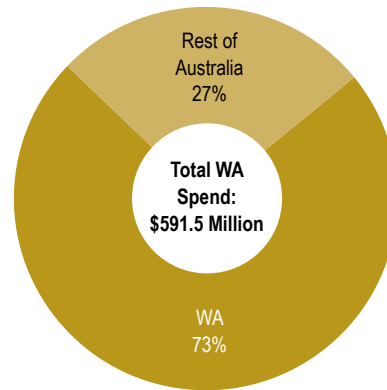


Figure 40 | **Gold exploration expenditure 2017-18**
Total Australian spend \$812.6 Million
 Source ABS

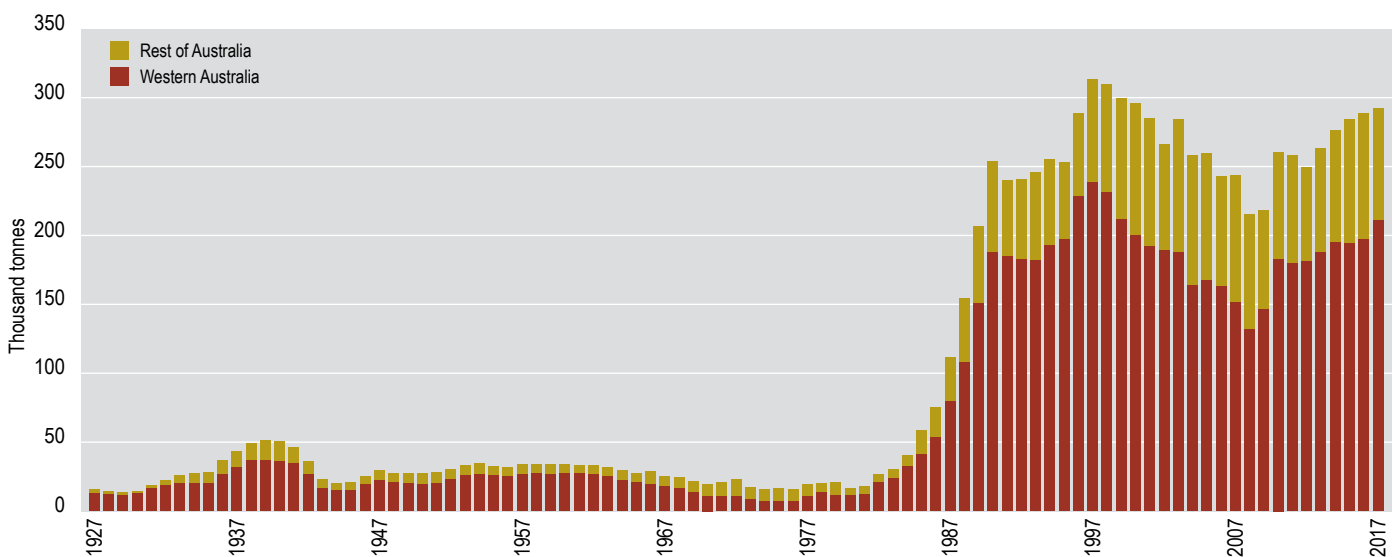


Figure 41 | **WA gold production v rest of Australia**
 Source: DMIRS and DIIS

Did you know?

The World Gold Council publishes some interesting gold facts. Did you know that:

- if all the existing gold in the world was pulled into a 5 micron thick wire, it could wrap around the world 11.2 million times?
- the boiling point of gold is 2808 degrees centigrade, while its melting point is 1064 degrees centigrade?
- it is rarer to find a one-ounce gold nugget than it is to find a five-carat diamond?
- an estimated 187,000 tonnes of gold has been mined since the dawn of civilisation?
- the largest coin ever created was cast by the Perth Mint in 2011? Measuring 80cm wide and more than 12cm deep it is the biggest, heaviest and inherently most valuable gold bullion coin in the world, estimated to be worth more than \$50 million.

2.4 ALUMINA AND BAUXITE

Pricing

The Australian dollar alumina price increased from an average of \$368 per tonne in 2016–17 to \$489 per tonne in 2017–18, up 33 per cent. This is the highest annual average price recorded since the department began tracking alumina prices in 1985.

Aluminium and alumina prices increased due to concerns of supply shortages resulting from US sanctions on United Company Rusal – the world’s second largest aluminium supplier, with 6 per cent of both global aluminium and alumina production.

Prices were buffeted by uncertainty associated with the recent imposition of tariffs on some US aluminium imports.

Quantity and value

WA accounts for about 67 per cent of Australia’s alumina production. This share has been fairly consistent over the past 10 years, with WA’s producers operating at near capacity for much of that time.

WA alumina and bauxite sales volumes have gradually increased year-on-year since 2010–11, reaching a record 14.8 million tonnes in 2017–18. The 4 per cent increase in annual sales volumes was entirely attributed to an increase in bauxite sales, with alumina sales actually decreasing slightly year-on-year.

The increase in volume, combined with strong prices, resulted an increase of more than 30 per cent to the value of the sector, up from \$5.1 billion in 2016–17 to \$6.6 billion in 2017–18.

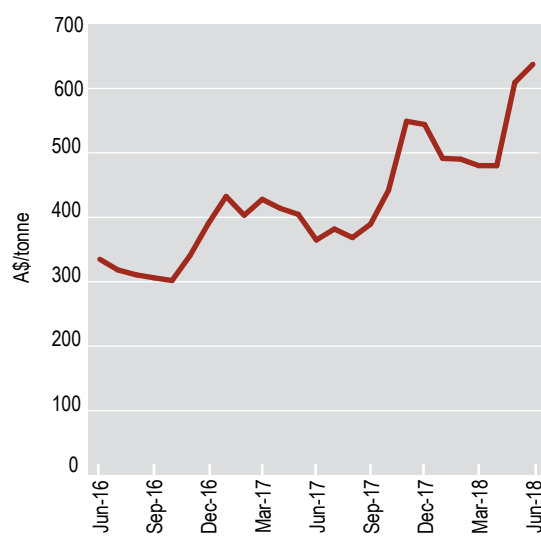


Figure 42 | Alumina price
Source: ABS

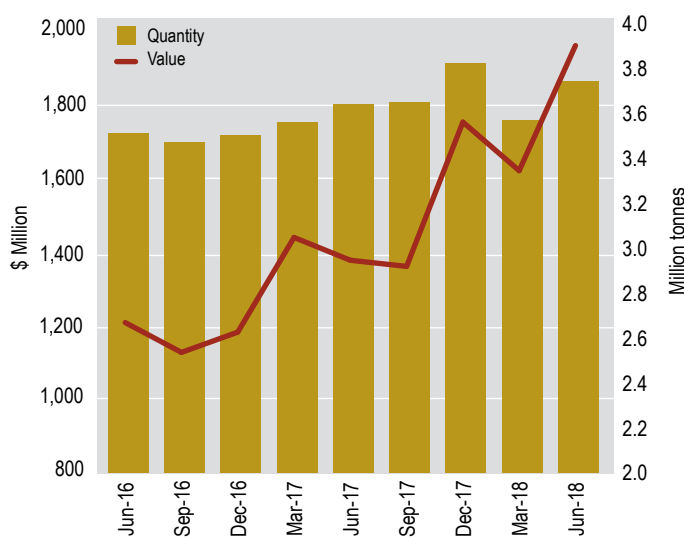


Figure 43 | Alumina and bauxite quantity and value by quarter
Source: DMIRS

Alumina is the State's third most valuable mineral commodity, accounting for almost 6 per cent of mineral sales value and 5 per cent of total mineral and petroleum sales for 2017–18.

Notable events

- Bauxite sales increased significantly over the year, up by 260 per cent, as Alcoa continued to grow its export market. Alcoa has approval to export 2.5 million tonnes per annum so further growth in bauxite sales is expected in the coming years.
- Aside from the US sanctions aimed at Rusal, global supply was also affected by a Brazilian government instruction for a 50 per cent curtailment of the 6.4 million tonne per annum Alunorte refinery in Brazil.
- The slight drop in March alumina sales volumes was due to industrial action at the Kwinana refinery when 200 workers walked off the job for four days in relation to their enterprise bargaining agreement.
- Due to the high aluminium and alumina prices Alcoa has stated that it would consider restarting idled capacity in the US and Brazil. A prominent trading house has also stated recently that it plans to sell down stockpiled aluminium worth around \$1.5 billion. Both of these events could dampen the aluminium price over the coming months.

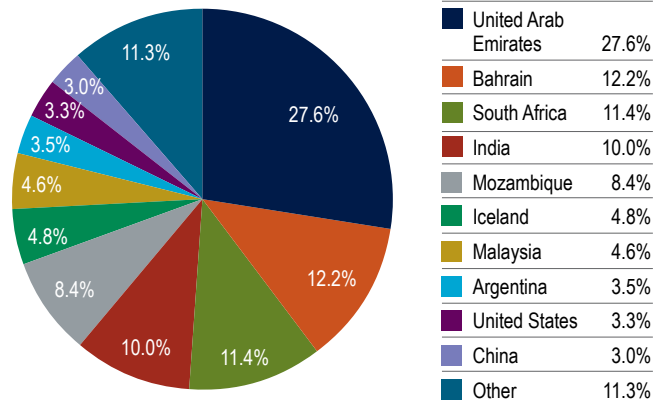


Figure 44 | **Alumina exports 2017–18**
\$6.6 Billion
 Source: DMIRS estimate



The major commodities resources data 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 to the rest of Australia.

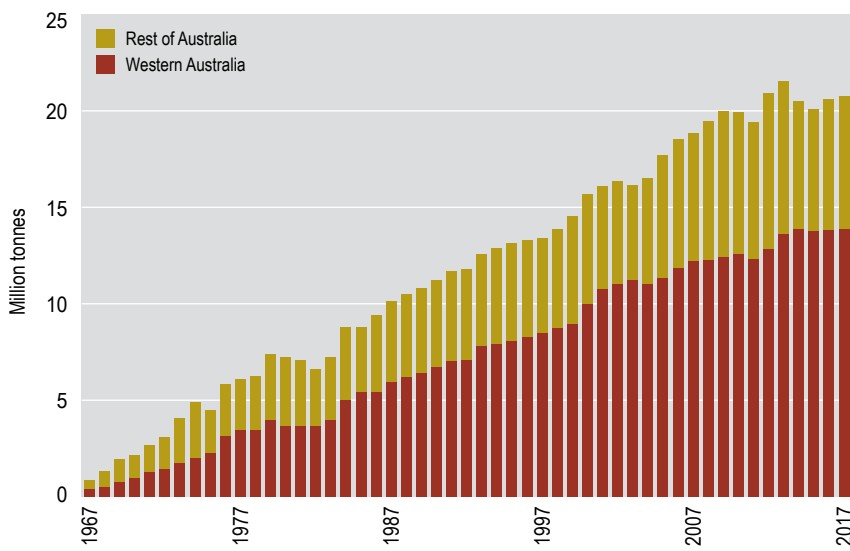


Figure 45 | **WA alumina production v rest of Australia**
 Source: DMIRS and DIIS

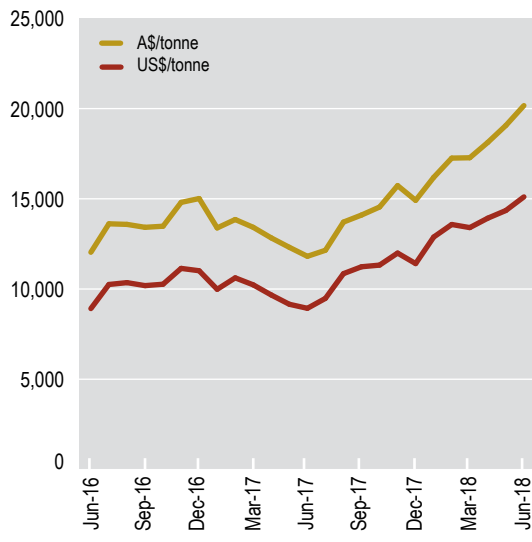


Figure 46 **Nickel price**
Source: DMIRS and DIIS

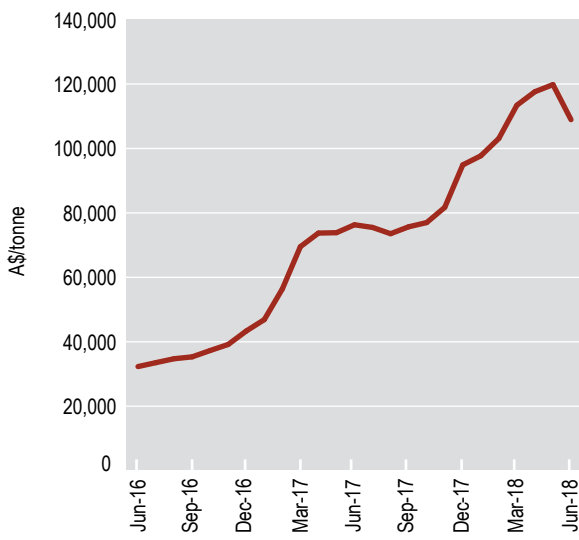


Figure 47 **Cobalt price**
Source: LME via Argus Metals

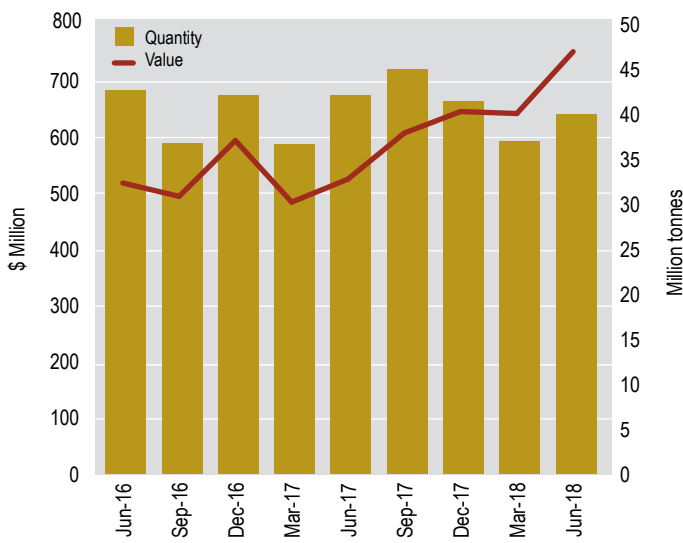


Figure 48 **Nickel quantity and value by quarter**
Source: DMIRS

2.5 NICKEL

Pricing

The nickel industry has finally seen a reprieve with prices generally improving during the last year. Healthy Chinese demand for stainless steel and a decline in London Metal Exchange (LME) inventories helped to keep prices positive in the first half of 2018.

The average annual nickel price increased 23 per cent from US\$10,150 in 2016–17 to US\$12,462 in 2017–18.

Nickel miners producing cobalt as a by-product continued to take advantage of strong prices with the annual average cobalt price hitting \$94,906 for 2017–18, an increase of 84 per cent on the average for 2016–17. In terms of the month average, May delivered a monthly average price of \$119,807, the highest since the department started tracking cobalt prices in January 1995.

Quantity and value

WA has some of the world's largest known reserves of nickel and some of the world's largest and highest-grade nickel deposits. The largest of these have been mined or are currently operating.

WA sales volumes have been trending down since 2012–13 and has led to a number of nickel mine closures. In 2017–18, nickel volumes finally saw a return to growth with sales increasing from 157,564 tonnes in 2016–17 to 163,401 tonnes in 2017–18. These sales were generated from just eight operating mines (a few years earlier there were 12 operating mines).

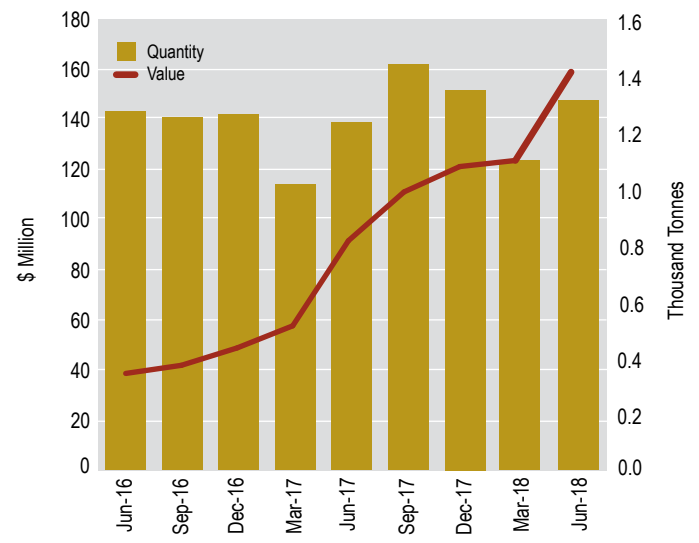


Figure 49 **Cobalt quantity and value by quarter**
Source: DMIRS

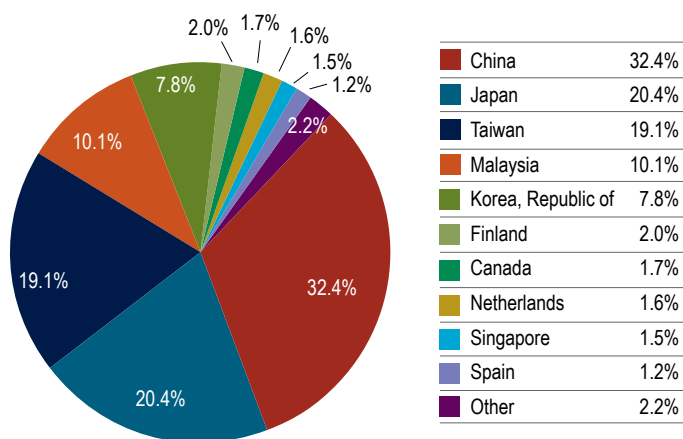


Figure 50 **Nickel exports 2017–18**
\$1.7 Billion
Source: DMIRS

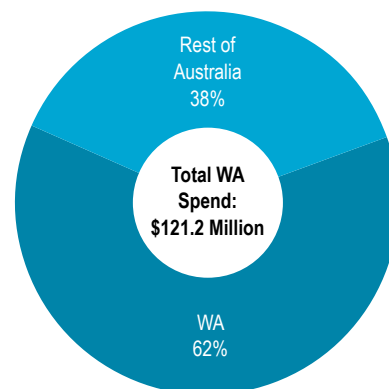


Figure 51 **Nickel cobalt exploration expenditure 2017–18**
Total Australian spend \$200 Million
Source: ABS

The improvement in nickel prices, combined with the increase in sales volumes, meant that the value of the sector increased 26 per cent year-on-year from \$2.1 billion to \$2.6 billion. This was the first increase in the value of the nickel sector since 2010–11.

China, Japan, South Korea, Malaysia and Taiwan were the State's top five nickel customers, accounting for almost 90 per cent of WA's nickel exports.

In terms of exploration, expenditure across Australia has trended upwards since 2016, with the biggest share of investment targeting the large untapped deposits of WA. A total of \$121 million was spent on nickel cobalt exploration in 2017–18, accounting for 61 per cent of national expenditure.

Cobalt

In WA, several nickel miners produce cobalt as a by-product and recent increases to the cobalt price have provided a small buffer against the persistently low nickel price.

Although Australia has significant cobalt reserves, there are no dedicated cobalt mines. Most cobalt is mined as a by-product of copper, gold or nickel, and about 40 of Australia's gold and nickel operations are co-located with some form of cobalt deposit. These mines produce varying quantities of cobalt as a secondary commodity.

Most deposits are in WA, though there are small producers in Queensland, New South Wales and South Australia. Australia accounted for 5 per cent of cobalt production in 2017.

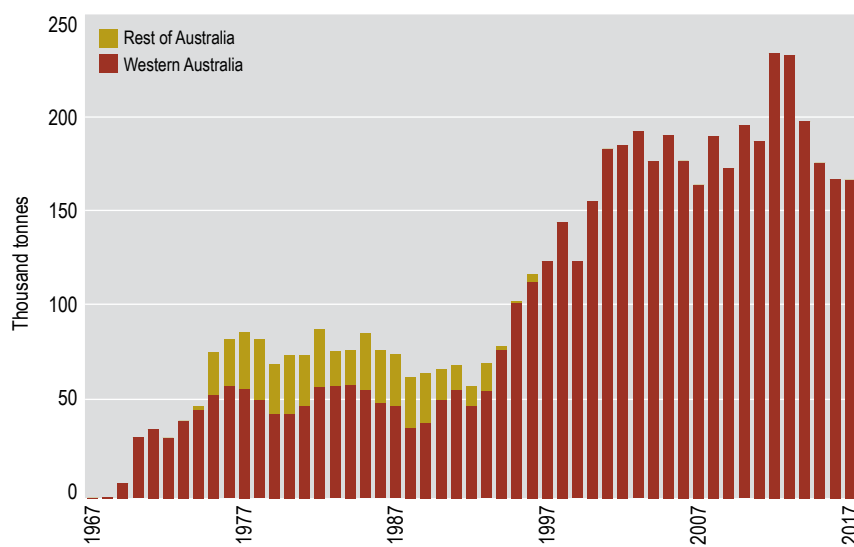


Figure 52 **WA nickel production v rest of Australia**
Source: DMIRS and DIIS

Notable events

- Recent increases in nickel and cobalt prices has led to greater activity in the sector. Panoramic Resources is pushing ahead with plans to restart mining at Savannah, Mincor Resources has increased exploration efforts and Royal Nickel Corporation announced plans to double production from the Beta Hunt mine in 2018.
- The Nova nickel mine reached a record production rate during the June quarter and recoveries were better than expected.
- BHP has placed part of its Kambalda nickel concentrator on care and maintenance after failing to convert the facility into a gold plant. BHP was unable to secure supply of gold ore to feed a potential converted plant. The idea of converting the plant came after the announcement of the closure of the Long nickel mine, which was the main supply of ore for the plant. The previous closures of Mincor and Panoramic Resources' nickel mines also resulted in loss of feed for the concentrator. The bulk of the plant is still operational and is fed by the Nova and Forrestania mines.
- Panoramic Resources executed a four-year concentrate sales agreement with Sino Nickel and Jinchuan Group for all concentrate that may be produced from the Savannah nickel-copper-cobalt mine in WA. The new contract replaces the previous agreement. Savannah has been on care and maintenance since May 2016 pending a sustained recovery in the nickel price. A feasibility study, completed in October 2017, outlined production of 10.8ktpa of nickel, 6.1ktpa of copper and 0.8ktpa of cobalt in bulk concentrate over eight years. Estimated pre-production and ramp-up capital required is \$36 million (US\$27 million).



The major commodities resources data 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 to the rest of Australia.

2.6 BASE METALS

For the purposes of the Statistics Digest, 'base metals' refer to copper, lead and zinc.

Pricing

Base metal prices continued to rise in 2017–18, with copper, lead and zinc all making substantial increases in the past two years.

Copper

Copper prices strengthened for most of 2017–18 with prices rising 44 per cent since July 2016. The monthly average copper price increased to its highest level since March 2011 to reach \$9283 per tonne in June 2018.

In US dollar terms, the average annual copper price increased to US\$6746 per tonne in 2017–18, up 25 per cent from 2016–17. For Australian producers, this equated to an increase of 22 per cent from \$7146 per tonne to \$8707 per tonne for the same period.

Lead

The annual average lead price increased 12 per cent between 2016–17 and 2017–18 to reach \$3140 per tonne. In US dollar terms, the price averaged US\$2434 per tonne in 2017–18, up 15 per cent from US\$2116 in 2016–17.

Zinc

The annual average zinc price increased 22 per cent between 2016–17 and 2017–18 to reach \$4106 per tonne. This is well above the 5 and 10-year annual averages of \$2936 and \$2499 respectively.

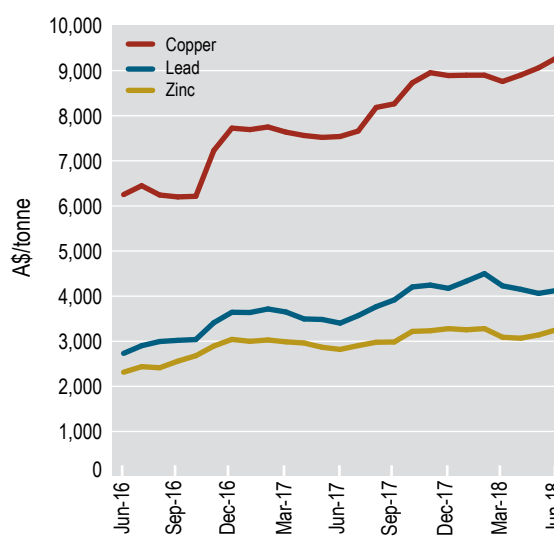


Figure 53 | Copper, zinc and lead price
Source: LME via Argus Metals

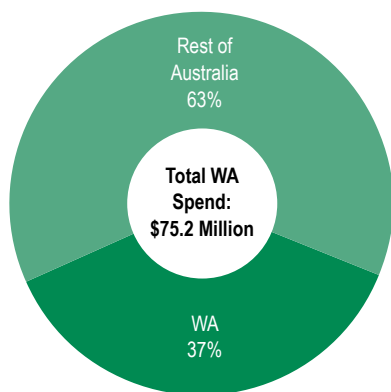


Figure 54 | **Copper, lead, zinc exploration expenditure 2017–18**
Total Australian spend \$296.2 Million
 Source: ABS

Prices appear to have hit an 11-year peak in early 2018 and are now moderating in response to increased output from a number of new and expanded projects.

Quantity and value

The value of base metals sold in 2017–18 increased 16 per cent to \$1.7 billion in 2017–18, up from \$1.5 billion in 2016–17. This represented the highest financial year value since 2013–14. The increase was predominantly due to the rising base metals prices as production volumes only rose 3 per cent year-on-year.

Copper accounted for 79 per cent (\$1.3 billion) of base metals sales in 2017–18, up 7 per cent on 2016–17. This was largely the result of price improvements as the volume of sales actually fell 4 per cent to 164,454 tonnes.

Zinc output increased a modest 13 per cent to 93,552 tonnes in 2017–18. The higher zinc prices resulted in a 63 per cent increase in sales value to \$333 million.

Lead production rose 110 per cent to 7365 tonnes in 2017–18, up from a 12-year low of 3507 tonnes in 2016–17. The increased production and higher prices resulted in a 130 per cent increase in the sales value in 2017–18.

Notable events

- In May, Independence Group sold the Jaguar mine for \$73 million to CopperChem Limited, a wholly owned subsidiary of Washington H. Saul Pattinson and Company Limited.



The major commodities resources data 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 to the rest of Australia.

2.7 MINERAL SANDS

In WA, the mineral sands industry is primarily focused on titanium minerals such as ilmenite, which can be sold directly, or upgraded to synthetic rutile. These minerals represented around 45 per cent of the value of the mineral sands industry in 2017–18.

Pricing

The annual average price of mineral sands products increased about 22 per cent year-on-year from \$1199 per tonne in 2016–17 to \$1647 per tonne in 2017–18.

Quantity and value

Despite generally improved prices for mineral sands products, sales fell year-on-year from 1.5 million tonnes in 2016–17 to 1.1 million tonnes in 2017–18. This fall was a return to more usual sales levels after unusually high sales from GMA Garnet's Port Gregory project in 2016–17.

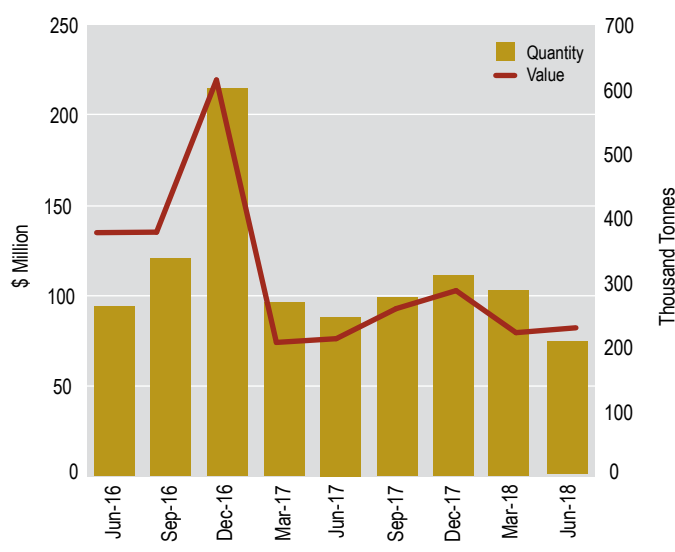


Figure 55 | **Mineral sands quantity and value by quarter**
 Source: DMIRS

Despite a general improvement in prices, lower production volumes led to a \$148 million reduction in the value of the mineral sands industry from \$505 million in 2016–17 to \$358 million in 2017–18.

China, Malaysia and the United States were the State's top three customers, accounting for more than half (\$543 million) of WA's mineral sands exports in 2017–18.

Mineral sands exports from WA

WA export data shows exports of mineral sands that are significantly higher than mineral sand produced. This difference is largely attributable to the use of our local mineral sand refining and export capacity for products produced in 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) that are not required to report sales or production to the department.

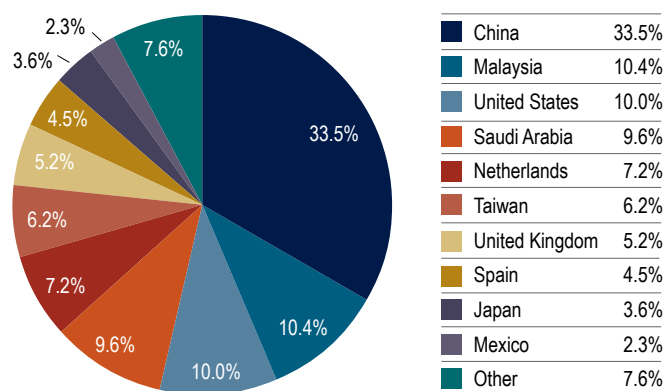


Figure 56 **Mineral sands exports**
\$1 Billion

Source: DMIRS estimate

Note: Exports include titanium dioxide and product sourced from private land, overseas and other states and processed in Western Australia.

Notable events

- The Thunderbird project continued to move towards production with several off-take agreements signed during the September quarter.
- In October, the State Government and Tronox agreed to vary their State Agreement allowing new mine development. The planned new mines, which are still subject to positive final investment decisions, would generate about \$220 million in new capital expenditure and 110 construction jobs. The planned mines are near Cervantes and Dongara with the Dongara mine having already gained environmental approval.
- Iluka approved its \$275 million Cataby project after securing off-take agreements for more than 85 per cent of production. The project will employ 250 people at construction and 160 during operation. It has an 8.5 year initial mine life and will produce 200,000 tonnes of synthetic rutile, 50,000 tonnes of zircon and 30,000 tonnes of rutile.

2.8 LITHIUM

Price

The emerging spot market for lithium carbonate equivalent continued to mature over the year with more transparency making its way into the market.

In 2017–18, the average price for lithium carbonate equivalent in China averaged \$22,092, a 38 per cent improvement on the previous reporting period. Increasing demand for lithium as a key component in high-energy density batteries for use in consumer electronics, clean energy storage and electric vehicles continues to be the driver behind the strong price growth, however many analysts believe that the prices will begin moderating with a steady stream of new supply now coming online.

Quantity and value

WA is now home to seven lithium projects, all of which are hard rock based and most of which are currently exporting a spodumene concentrate product. Some sales of direct shipping ore have occurred while projects are bringing their concentrators online.

The increase in lithium producing projects has meant substantial increases in sales quantity and value in the last two years. In 2017–18, 2.1 million

tonnes of spodumene concentrate was produced worth \$1.6 billion. This was an increase of 140 per cent and 167 per cent respectively.

Notable events

- Galaxy Resources signed an off-take agreement with its customers to 2023.
- Mineral Resources announced intentions to build a lithium concentrate plant at Wodgina followed by a lithium carbonate plant in the long term.
- The Bald Hill project became the State’s fifth lithium producer, and at full capacity will be shipping 155,000 tonnes of concentrate annually.

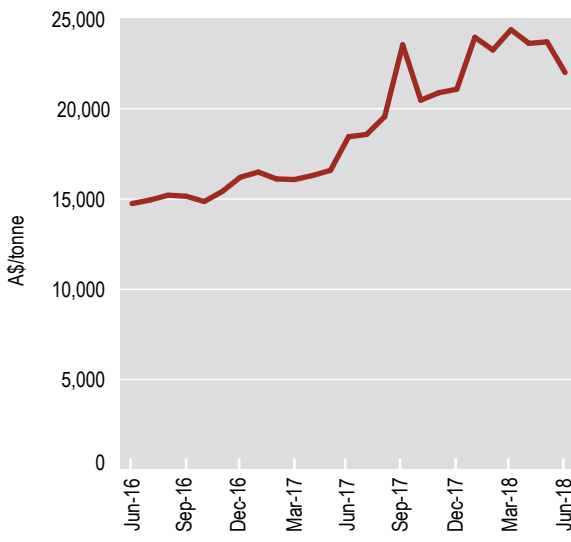


Figure 57 | **Lithium carbonate price**
Source: LME via Argus Metals

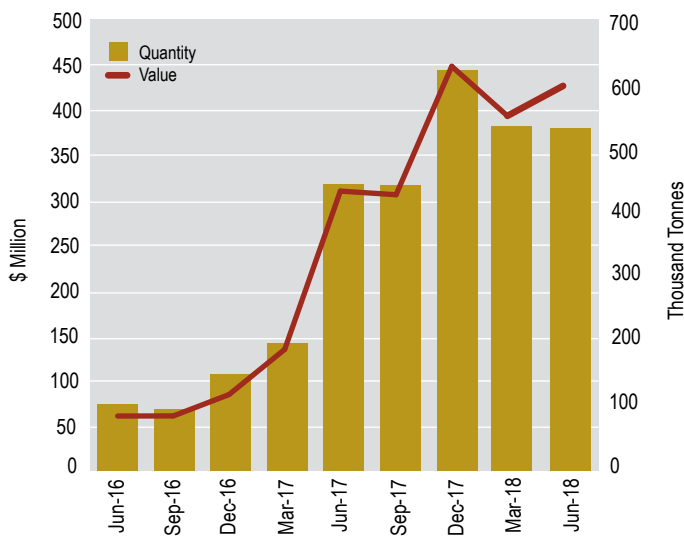


Figure 58 | **Spodumene concentrate quantity and value by quarter**
Source: DMIRS

- Neometals, part owner of the Mt Marion lithium mine, acquired the lithium rights over the Mt Edwards project for \$2.5 million.
- Pilbara Minerals signed an off-take agreement with Korean steel company POSCO for part of the output from stage two of its Pilgangoora project.

The lithium party continues

WA is an important contributor to the battery minerals market, given it is home to major deposits of key commodities, notably lithium, cobalt and nickel.

The electric vehicle revolution is moving faster than many expected and lithium is driving that growth. China is doubling its electric vehicle (EV) production capacity every 12 months with carmakers including Volvo, Volkswagen and Tesla driving growth elsewhere with big EV manufacturing targets.

While lithium has been the focus for investors and governments, other metals have also joined the party: cobalt demand and prices have soared, interest in high-quality nickel is growing, while copper, used in battery charging infrastructure, is expected as a late guest.

The emerging policy priorities surrounding the “green energy revolution” have also been interesting to watch. The focus on sustainably-developed supplies, establishing local content requirements, appropriate royalty levels and community development initiatives have all emerged as key priorities for governments across the world.

While there is no shortage of lithium supplies throughout the world, the race is on in the move to downstream processing. WA has been active in this space, attracting investment in lithium hydroxide plants.

Although many new carbonate projects are in the global pipeline, there is a shift towards hydroxide output amongst brines projects and new rock converters. This stems from the shift in battery technology in EVs, which favour hydroxides.

2.9 OTHER

2.9.1 Coal

Pricing

Neither global nor Australian prices have a substantial effect on WA coal prices as the coal is produced and sold locally, based on long-term contracts.

About 90 per cent of Collie coal is used as thermal coal, mostly in power stations, with some used to fire cement kilns in Perth. The remainder is for metallurgical purposes in the mineral sands industry where it is used to transform ilmenite to synthetic rutile. A small amount is also used to reduce silica sand to silicon.

Outside WA, Australia's metallurgical coal export earnings reached a record \$38 billion in 2017–18 and Australia's thermal coal export earnings reached a record \$23 billion in 2017–18, both driven by strong prices⁹.

Global coal prices have also seen a divergence in price for higher and lower quality coal, similar to that seen in the iron ore market, owing to China's domestic environmental policies affecting their local steel producers.

Quantity and value

WA's two black coal mines are in Collie, in the South West. The amount of coal sold decreased slightly less than 2 per cent from 6.8 million tonnes in 2016–17 to 6.7 million tonnes in 2017–18. Sales values also declined by just less than 2 per cent to \$332 million, indicating the local market was relatively stable over the period.

⁹ DIIS, Resources Energy Quarterly, September 2018.

2.9.2 Salt

Pricing

The price received for WA salt dropped slightly in the reporting period, from \$26.87 per tonne in 2016–17 to \$23.23 per tonne on average.

A note about salt pricing

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. Combined, these factors mean that prices vary across the world.

The DMIRS reported salt price is the average free-on-board (FOB) price received by all WA salt producers and is based on information received from WA producers. Comparisons between FOB prices and the cost including freight (CIF) or cost and freight (CFR) price paid in the destination country, may suggest a discrepancy if full shipping costs were not taken into account.

Under State Agreements, which govern the royalty rates for salt, highly detailed price audits are carried out and include examination of invoices 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.

While the details of the audits are confidential, they confirm that once all costs are considered, DMIRS' reported price is an accurate representation of the value of the salt produced.

Quantity and value

WA accounts for most of Australia's salt production. Dampier Salt, with operations in Dampier and Port Hedland in the Pilbara and Lake MacLeod in the Gascoyne, is the State's biggest producer. The company accounted for about 65 per cent of the salt sold from WA by volume in 2017–18. Almost all of this production was exported, making Dampier Salt the world's largest exporter of high-quality bulk, solar salt.

Onslow Salt's operation at Onslow is WA's next-largest operation, with 23 per cent of production by volume. The remainder comes from smaller producers, including those focused primarily on domestic production.

In 2017–18, salt sales totalled 13 million tonnes, up 19 per cent on 2016–17. The small price decrease was not enough to impact sales value with the value of the sector increasing 3 per cent year-on-year to \$301 million.

Notable events

- Leichhardt Industrials' \$230 million Eramurra salt project has been undergoing pre-feasibility study (PFS) since April 2018 and aims to produce up to 1.83 million tonnes a year of high-grade chemical salt for the Asia-Pacific market. The project is expected to use natural salt pan areas south of Forty Mile Beach as a source for its production. The project's \$2 million PFS is funded by mining-focused RCF Opportunities Fund. It is the third salt project to be announced in WA in the past two years, following K+S's Ashburton project in 2016 and BC Iron's Mardie project, which completed PFS in June 2018.

2.9.3 Diamonds

Pricing

With no universal, transparent market price for diamonds and little publicly available data, it is difficult to determine the true situation regarding the prices received by mining companies.

Quantity and value

Diamond sales volumes in WA were 15.3 million carats in 2017–18, up 21 per cent on 2016–17.

Notable events

- It was announced in January 2018 that Lucapa Diamond Company had made a significant discovery only 50km east of the old Ellendale mine that once produced half the world's rare fancy yellow diamonds. Only a few weeks after drilling began for lamproite on its Brooking project, it uncovered 119 diamonds, including seven macro diamonds.

2.9.4 Manganese

Pricing

Globally, the manganese market is driven primarily by steel demand and prices move in a way that is broadly comparable to the iron ore price. Manganese prices have trended upwards since early 2016 with a sharp drop seen at the start of 2017 before recovering to slightly elevated levels.

Quantity and value

Currently, all economic resources for manganese in Australia are located in Western Australia and the Northern Territory. Groote Eylandt, a world-class manganese deposit in the Northern Territory, is the centre of most manganese-mining activity in the country.

In 2017–18, the volume of manganese sold in WA increased 66 per cent in line with the restart of operations at Woodie Woodie in late 2017.

Notable events

- Manganese exploration and development company Element 25, formerly Montezuma Mining, is working towards its flagship project Butcherbird in the north of Western Australia. The Butcherbird manganese deposit is suggested as Australia's largest onshore manganese resource comprising large tonnages of near surface manganese oxide ore in seven deposits. In May 2018, a scoping study returned robust results with indicated and inferred resource estimates of 180 tonnes at 10.8 per cent manganese. The study also encouraged the start of a pre-feasibility study.

2.9.5 Rare earth elements

Demand for rare earth elements is driven by niche uses, primarily in the high-tech industries. They have applications in nuclear reactors, consumer electronics, electric and hybrid vehicles, batteries, lighting (phosphors) and lasers. However, the dominant driver of growth for many key rare earths (including neodymium, dysprosium and praseodymium) is the demand for high-powered permanent magnets, primarily in electric vehicles (which require high-powered magnets for efficient electric motors) and wind turbines.

Quantity and value

WA's rare earths are mostly lanthanum, cerium, neodymium and praseodymium oxides. Lynas Corporation Ltd operates WA's only rare earths mine at Mount Weld, supplying rare earth concentrates to the Lynas Advanced Materials Plant in Malaysia. The mine started production in 2011 with an expected mine life of 25 years. The mine operates on a campaign mining basis.

In 2017–18, rare earth sales tonnages increased 11 per cent, while sales values increased 49 per cent compared to 2017–16 values.

Notable events

- Lynas completed pilot test work for the expansion of its rougher flotation circuit at Mt Weld.
- From April 2018, production at Mt Weld increased to 500 tonnes per month. This is expected to increase to 600 tonnes per month in January 2019.
- The Browns Range pilot plant was commissioned in June 2018 and has since achieved mechanical completion. The operation has already produced and stockpiled about 100 tonnes of xenotime concentrate through its beneficiation.
- In November 2017, Hastings Technology Metals completed a definitive feasibility study on its Yangibana project. The project has one of the highest known neodymium and praseodymium to total rare earth oxide ratios of 41 per cent. There are plans to produce up to 15,000 tonnes per annum of mixed rare earths carbonate on site in Yangibana.

TABLE 3. Quick resources facts – 2017–18	
Output of minerals and energy	\$ million
Western Australia	\$114,950
Australia (DMIRS estimate only)	\$206,491
WA minerals	\$88,307
WA petroleum	\$26,643
Major Western Australian commodities	\$ million
Iron Ore	\$61,692
Petroleum	\$26,643
Gold	\$11,400
Alumina and Bauxite	\$6,630
Nickel	\$2,643
Crude oil and condensate	Million barrels
Western Australia	75
Australia	104
WA share	72%
Natural gas (inc. LNG feedstock and CSG)	Million cubic metres
Western Australia	67,641
Australia	118,175
WA share	57%
Merchandise exports	\$ million
Western Australia	\$129,657
Australia	\$314,225
WA share	41%
WA exports of minerals and energy as % share of all State Merchandise exports	85%
Mineral and energy exports	\$ million
Western Australia	\$109,600
Australia (DMIRS estimate only)	\$216,815
WA share	51%
Exploration expenditure (mineral)	\$ million
Western Australia	\$1,195
Australia	\$1,973
WA share	61%
Exploration expenditure (petroleum)	\$ million
Western Australia	\$562
Australia	\$1,028
WA share	55%
Private new capital investment	\$ million
Western Australia	\$27,115
Australia	\$118,928
WA share	23%
Mining investment	
Western Australia	\$19,140
Australia	\$36,051
WA share	53%
Economic impact	\$ million
Australia GDP 2016-17	\$1,693,452
Western Australian GSP 2016-17	\$233,152
Mining component of WA GSP *	31%

* Note: The ABS categorise alumina as manufacturing and is not included in the GSP mining component above. All data is for the 2017–18 financial year unless otherwise stated.

TABLE 4. Quantity and value of minerals and petroleum

COMMODITY	FINANCIAL YEAR 2016-17			FINANCIAL YEAR 2017-18	
	UNIT	QUANTITY	VALUE	QUANTITY	VALUE
ALUMINA AND BAUXITE	t	14,165,722	5,088,559,366	14,786,800	6,630,060,360
BASE METALS					
Copper Metal	t	170,730	1,240,528,049	164,454	1,332,405,971
Lead Metal	t	3,507	10,146,717	7,365	23,202,770
Zinc Metal	t	82,943	204,161,259	93,552	333,549,431
TOTAL BASE METALS		257,180	1,454,836,025	265,370	1,689,158,172
CLAYS		20,919	1,407,547	18,121	1,215,601
COAL	t	6,806,389	338,435,045	6,679,935	331,959,622
CONSTRUCTION MATERIALS					
Aggregate	t	1,052,609	29,218,464	1,236,979	34,886,656
Gravel	t	261,219	1,652,110	155,354	1,069,398
Rock	t	409,316	5,718,563	267,629	3,943,486
Sand	t	2,578,123	25,260,514	4,085,649	28,201,264
TOTAL CONSTRUCTION MATERIALS			61,849,651		68,100,804
DIAMONDS	ct	12,607,032	268,383,094	15,281,303	n/a
DIMENSION STONE		4,795	1,823,218	6,397	2,372,892
GEM & SEMI-PRECIOUS STONES	kg	335,976	738,207	204,107	442,543
GOLD	kg	202,979	10,858,268,382	211,663	11,399,774,835
GYPSUM	t	531,399	12,980,853	895,510	20,424,477
MINERAL SANDS					
Garnet	t	565,618	n/a	379,724	n/a
Ilmenite	t	178,528	42,912,243	93,965	19,583,099
Leucoxene	t	7,144	6,492,778	14,287	13,031,604
Zircon	t	184,700	101,083,491	62,205	87,474,648
Other	t		354,787,338		237,480,416
TOTAL MINERAL SANDS			505,275,850		357,569,767
IRON ORE	t	793,102,291	63,866,327,788	825,980,978	61,692,012,649
LIMESAND-LIMESTONE-DOLOMITE	t	4,178,360	26,012,783	3,943,155	26,685,585
MANGANESE ORE	t	236,565	n/a	392,654	n/a
NICKEL INDUSTRY					
Cobalt	t	4,759	239,639,935	5,194	514,496,641
Nickel	t	157,564	2,094,500,242	163,401	2,643,240,706
Palladium and Platinum By-Product	kg	9,081	21,808,381	10,795	26,219,908

COMMODITY	FINANCIAL YEAR 2016-17			FINANCIAL YEAR 2017-18	
	UNIT	QUANTITY	VALUE	QUANTITY	VALUE
TOTAL NICKEL INDUSTRY			2,355,948,558		3,183,957,255
PETROLEUM					
Condensate	kl	6,037,603	2,228,626,174	7,115,286	3,304,673,707
Crude Oil	kl	5,404,294	2,111,578,898	4,807,722	2,295,452,854
LNG	t	28,685,477	12,728,310,038	37,893,517	19,077,592,020
LPG – Butane and Propane	t	527,391	273,097,308	451,242	331,271,410
Natural Gas	'000m ³	9,708,934	1,830,012,904	10,039,526	1,634,082,335
TOTAL PETROLEUM			19,171,625,322		26,643,072,327
SALT	t	10,874,279	292,285,826	12,963,778	301,119,173
SILICA-SILICA SAND	t	728,859	20,364,867	974,445	18,775,811
SILVER	kg	142,868	98,465,480	153,468	98,581,882
TIN-TANTALUM-LITHIUM		n/a	605,595,575	n/a	1,592,473,662
OTHER (Includes Vanadium, Manganese, Rare Earths, Spongolite and Talc)			300,923,570		892,620,260
TOTAL VALUE			105,330,107,007		114,950,377,676

Note: 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 Act 2006* and relevant State Agreement Acts.

(r) Revised from previous edition

n/a Breakdown of chromite, garnet, manganese, talc, spodumene, vanadium, rare earths, tin, tantalite and lithium not available.

TABLE 5. Quantity and value of selected major commodities

COMMODITY	UNIT	2010-11		2011-12		2012-13	
		Quantity	Value	Quantity	Value	Quantity	Value
ALUMINA AND BAUXITE							
Alumina	t	12,280,629	3,990,376,375	12,424,860	4,010,219,382	13,530,752	4,027,810,217
Bauxite	t	-	0	-	0	-	0
TOTAL ALUMINA & BAUXITE			3,990,376,375		4,010,219,382		4,027,810,217
BASE METALS							
Copper Metal	t	150,030	1,332,356,150	159,171	1,180,779,699	209,266	1,423,043,554
Lead Metal	t	40,764	100,068,469	6,922	13,839,831	16,641	35,049,525
Zinc Metal	t	70,537	162,108,265	63,503	121,984,210	55,848	103,867,913
TOTAL BASE METALS			1,594,532,884		1,316,603,740		1,561,960,992
CHROMITE	t	81,925	n/a	164,219	n/a	195,772	n/a
CLAYS							
COAL	t	7,234,455	296,259,551	6,986,433	289,629,252	7,494,280	310,812,886
CONSTRUCTION MATERIALS							
Aggregate	t	1,934,860	43,801,514	3,722,254	97,854,121	4,391,376	148,775,764
Gravel	t	230,785	1,760,531	283,899	2,454,938	561,135	3,947,125
Rock	t	298,262	3,251,624	509,983	6,262,935	1,109,761	27,142,818
Sand	t	4,818,062	34,712,549	6,286,702	54,502,065	5,415,504	62,093,160
Other							
TOTAL CONSTRUCTION MATERIALS			83,526,218		161,074,059		241,958,866
DIAMONDS	ct	10,121,587	303,092,471	8,689,501	343,293,394	9,608,685	355,964,877
DIMENSION STONE		8,669	861,017	7,590	1,450,510	4,196	1,221,243
GEM & SEMI-PRECIOUS STONES	kg	292,458	288,460	227,963	280,727	197,832	254,158
GOLD	kg	183,751	8,184,187,456	180,771	9,421,483,327	179,849	9,022,522,018
GYPSUM	t	587,374	10,931,443	334,178	4,690,980	1,575,769	7,027,903
MINERAL SANDS							
Garnet	t	226,620	42,689,083	301,945	59,591,878	317,336	64,834,324
Ilmenite	t	394,033	52,763,228	332,012	58,190,544	270,770	72,680,422
Leucoxene	t	26,030	12,165,130	22,231	16,691,847	29,071	31,231,788
Rutile	t	49,745	35,431,242	38,870.25	52,250,227	46,938	80,261,379
Zircon	t	298,644	197,514,001	180,429	219,219,649	215,831	189,547,782
Other	t	421,723	135,619,863	540,074	458,168,418	475,411	372,123,979
TOTAL MINERAL SANDS		1,416,795	476,182,547	1,415,561	864,112,563	1,355,357	810,679,675
IRON ORE	t	397,604,213	57,533,101,329	454,385,064	60,972,726,991	511,760,416	56,204,322,877
LIMESAND-LIMESTONE-DOLOMITE		3,721,270	17,742,838	4,157,630	21,403,515	4,091,849	24,239,571
MANGANESE ORE	t	873,064	392,302,135	846,293	331,693,574	649,695	n/a
NICKEL INDUSTRY							
Cobalt	t	3,767	146,480,315	4,950	143,627,596	6,200	159,147,805
Nickel	t	194,177	4,686,173,467	209,370	3,721,964,396	227,463	3,511,711,762
Palladium and Platinum By-Product	kg	440	7,036,097	626	14,909,443	658	15,045,619
TOTAL NICKEL INDUSTRY			4,839,689,879		3,880,501,435		3,685,905,186
PETROLEUM							
Condensate	kl	6,881,791	3,988,524,336	5,888,608	3,842,111,571	6,116,968	3,922,032,524
Crude Oil	kl	13,924,847	8,528,862,521	11,121,616	7,676,633,459	8,609,425	5,972,058,200
LNG	t	17,290,205	8,328,719,118	15,610,570	9,495,543,132	19,804,919	12,147,214,397
LPG - Butane and Propane	t	923,763	774,197,459	835,271	734,484,653	752,910	634,052,635
Natural Gas	'000m ³	8,981,495	1,364,589,067	9,080,655	1,449,810,229	8,713,949	1,434,550,772
TOTAL PETROLEUM			22,984,892,501		23,198,583,045		24,109,908,528
SALT	t	12,246,504	366,935,890	12,807,461	353,776,447	12,389,643	381,652,888
SILICA-SILICA SAND	t	430,363	13,304,556	452,638	14,742,316	498,232	16,886,756
SILVER	kg	83,550	76,065,087	120,080	115,704,896	123,740	100,560,679
TIN-TANTALUM-LITHIUM							
Spodumene	t	352,418	103,317,680	461,121	138,413,821	485,879	178,786,684
Tantalite	t	95	n/a	347	49,931,724	201	17,940,739
Tin Metal	t	22	281,633	62	1,372,580	193	2,703,339
TOTAL TIN-TANTALUM-LITHIUM			131,425,734		189,718,125		199,430,762
OTHER (May include Feldspar, Red Oxide, Manganese, Vanadium, Chromite, Rare Earths, Spongolite, Talc and Diamonds)	t		64,129,732		103,198,080		425,002,389
TOTAL VALUE			101,359,828,103		105,594,886,357		101,488,122,472

2013-14		2014-15		2015-16		2016-17		2017-18	
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
13,717,952	4,295,348,699	13,771,412	5,022,721,218	13,893,540	4,937,279,870	13,855,382	5,073,995,897	13,669,477	6,583,355,409
-	0	-	0	47,703	1,952,600	310,341	14,563,469	1,117,323	46,704,951
	4,295,348,699		5,022,721,218		4,939,232,470		14,165,722	5,088,559,366	14,786,800
211,186	1,559,565,610	184,495	1,283,046,797	190,275	1,183,262,087	170,730	1,240,528,049	164,454	1,332,405,971
78,651	178,764,058	59,248	136,949,662	5,988	14,810,595	3,507	10,146,717	7,365	23,202,770
54,060	118,261,576	77,831	197,040,406	82,676	195,494,453	82,943	204,161,259	93,552	333,549,431
	1,856,591,245		1,617,036,865		1,393,567,135		1,454,836,025		1,689,158,172
66,540	n/a	-	0	-	0	-	0	-	0
5,139	345,148	17,670	1,043,438	21,969	1,104,708	20,919	1,407,547	18,121	1,215,601
6,275,422	263,701,680	6,553,064	306,733,911	6,890,951	336,466,825	6,806,389	338,435,045	6,679,935	331,959,622
2,154,534	47,255,402	1,963,871	69,239,676	1,313,696	42,256,613	1,052,609	29,218,464	1,236,979	34,886,656
51,853	338,431	172,556	993,903	177,243	1,055,083	261,219	1,652,110	155,354	1,069,398
402,652	10,070,061	1,746,693	46,504,731	220,402	1,828,018	409,316	5,718,563	267,629	3,943,486
3,796,749	28,420,888	5,939,321	49,279,152	3,477,403	34,966,248	2,578,123	25,260,514	4,085,649	28,201,264
	-		-		-		-		-
	86,084,782		166,017,462		80,105,962		61,849,652		68,100,803
11,646,712	401,672,122	10,423,822	342,313,665	13,869,547	354,047,664	12,607,032	268,383,094	15,281,303	n/a
5,021	1,365,020	21,250	2,892,731	4,113	2,205,326	4,795	1,823,218	6,397	2,372,892
309,575	401,960	720,552	1,402,333	242,919	623,746	335,976	738,207	204,107	442,543
196,074	8,890,995,046	193,162	9,107,167,942	195,968	10,104,514,299	202,979	10,858,268,382	211,663	11,399,774,835
532,919	9,496,857	576,880	12,240,632	551,910	13,830,966	531,399	12,980,853	895,510	20,424,477
357,266	68,896,504	299,022	n/a	251,162	n/a	565,618	n/a	379,724	n/a
78,900	19,515,066	99,674	21,000,789	174,687	39,692,103	178,528	42,912,243	93,965	19,583,099
29,268	26,205,650	16,965	14,636,208	18,137	16,452,584	7,144	6,492,778	14,287	13,031,604
65,084	65,938,306	30,206	29,582,184	45,888	44,260,114	21,562	21,953,547	15,595	16,156,980
212,068	114,307,405	182,859	136,321,656	191,551	151,297,003	184,700	101,083,491	62,205	87,474,648
335,684	176,168,377	440,970	291,166,037		319,846,256		332,833,791		221,323,436
1,078,271	471,031,307		492,706,874	1,170,840	571,548,060	1,457,133	505,275,850	1,083,646	357,569,767
623,507,315	75,165,582,340	718,806,504	54,375,654,674	748,100,421	48,767,746,598	793,102,291	63,866,327,788	825,980,978	61,692,012,649
3,116,623	23,378,197	4,903,039	33,175,834	4,446,486	28,826,046	4,178,360	26,012,783	3,943,155	26,685,585
711,536	n/a	800,985	n/a	425,303	146,188,090	236,565	n/a	392,654	n/a
6,236	175,117,788	6,036	210,567,512	5,479	174,846,826	4,759	239,639,935	5,194	514,496,641
209,710	3,419,023,118	183,315	3,169,605,001	175,752	2,202,734,451	157,564	2,094,500,242	163,401	2,643,240,706
1,015	28,523,097	464	13,380,730	687	16,656,441	9,081	21,808,381	10,795	26,219,908
	3,622,664,003		3,393,553,243		2,394,237,718		2,355,948,558		3,183,957,255
5,559,221	4,032,961,171	6,753,212	3,488,373,293	6,775,142	2,213,709,834	6,037,603	2,228,626,174	7,115,286	3,304,673,707
7,303,854	5,724,962,343	7,844,408	4,493,521,248	7,685,922	3,089,384,046	5,404,294	2,111,578,898	4,807,722	2,295,452,854
20,049,826	14,804,193,332	20,447,845	13,817,045,230	20,955,641	10,764,545,353	28,685,477	12,728,310,038	37,893,517	19,077,592,020
630,636	586,349,207	553,055	405,561,785	531,595	249,059,073	527,391	273,097,308	451,242	331,271,410
9,368,839	1,655,819,689	9,875,339	1,826,592,934	10,223,641	1,913,134,982	9,708,934	1,830,012,904	10,039,526	1,634,082,335
	26,804,285,741		24,031,094,489		18,229,833,288		19,171,625,322		26,643,072,327
12,992,042	410,097,847	11,726,606	374,622,315	10,974,721	336,253,755	10,874,279	292,285,826	12,963,778	301,119,173
449,587	15,847,051	483,809	17,927,564	581,966	18,072,793	728,859	20,364,867	974,445	18,775,811
137,180	93,414,212	150,581	95,972,011	155,292	104,786,546	142,868	98,465,480	153,468	98,581,882
342,065	150,564,377	489,074	245,874,387	417,286	241,996,770	887,408	589,513,148	2,130,016	1,573,933,340
58	4,074,774	70	n/a	183	n/a		n/a		n/a
-	n/a	14	n/a	22	n/a		n/a		n/a
	154,639,152		251,051,748		269,771,196		605,595,575		1,592,473,662
	494,402,726		507,533,600		53,048,436		300,923,570		892,620,260
123,060,999,987		100,152,862,549		87,999,823,537		105,330,107,008		114,950,377,676	

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

REGION	2017-18 Value
Pilbara Region	
Iron Ore	60,219,016,785
Gold and Silver	842,968,513
Manganese Ore and Salt	490,414,918
Copper	262,516,623
Construction Materials	31,933,544
Other	534,873,219
Pilbara Total	62,381,723,602

Offshore Petroleum	
Crude Oil and Condensate	5,539,042,506
Liquefied Natural Gas	19,077,592,020
Natural Gas and LPG Butane and Propane	1,932,626,608
Offshore Total	26,549,261,134

Goldfields-Esperance Region	
Gold	7,485,241,070
Silver	33,113,787
Nickel and Cobalt	2,816,449,461
Copper and Zinc	216,973,233
Spodumene and Tantalum Pentoxide	561,726,413
Gypsum and Limesand Limestone	11,680,317
Construction Materials and Granite	10,935,939
Other	368,779,464
Goldfields-Esperance Total	11,504,899,684

Peel Region	
Gold, Silver and Copper	1,556,308,032
Peel Total	1,556,308,032

Mid West Region	
Gold and Silver	1,481,409,328
Iron Ore	869,357,022
Copper, Lead and Zinc	919,273,408
Mineral Sands	121,247,467
Natural Gas	31,406,394
Condensate and Crude Oil	38,667,171
Gypsum and Talc	20,005,278
Limesand Limestone	1,547,771
Clays	1,197,001
Manganese Ore and Sand	12,194,663
Gem and Semi Precious Stones	123,907
Mid West Total	3,496,429,410

REGION	2017-18 Value
Wheatbelt Region	
Iron Ore	603,638,842
Nickel and Copper	345,921,916
Mineral Sands	138,795,519
Gold and Silver	299,823,237
Condensate and Natural Gas	1,760,970
Salt and Silica and Silica Sand	12,806,082
Gypsum	6,565,398
Limesand Limestone Dolomite, Construction Materials and Clays	6,985,127
Wheatbelt Total	1,416,297,091

Kimberley Region	
Diamonds and Gem and Semi Precious Stones	249,759,751
Gold and Silver	85,253,628
Construction Materials	6,647,058
Crude Oil and Sandstone	22,071,658
Kimberley Total	363,732,095

South West Region	
Alumina, Sand and Aggregate	1,762,962,529
Coal	331,959,622
Tantalum Pentoxide, Spodumene and Tin Metal	497,740,077
Mineral Sands	97,526,781
Sandstone and Limesand Limestone	1,748,976
South West Total	2,691,937,985

Gascoyne Region	
Salt	72,217,131
Gypsum, Limesand Limestone and Spongolite	10,629,949
Construction Materials and Gem and Semi Precious Stones	1,014,270
Gascoyne Total	83,861,349

Perth Metropolitan Region	
Alumina and Bauxite	4,867,184,543
Construction Materials	17,299,210
Silica and Limesand Limestone	13,379,702
Perth Metropolitan Total	4,897,863,455

Great Southern Region	
Spongolite, Silica and Limesand Limestone	8,063,838
Great Southern Total	8,063,838

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

REGION	2017-18 Value
Pilbara Region	
East Pilbara	31,296,144,655
Ashburton	30,404,599,885
Port Hedland Town and Marble Bar	594,184,065
Karratha	86,794,998
Pilbara Total	62,381,723,602

Offshore Petroleum	26,549,261,134
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Goldfields-Esperance Region	
Coolgardie	3,138,043,635
Kalgoorlie-Boulder	2,410,448,894
Leonora	1,906,901,062
Laverton	2,499,394,044
Ravensthorpe and Dundas	885,197,381
Menzies and Esperance	664,914,669
Goldfields-Esperance Total	11,504,899,684

Peel Region	
Waroona/Murray and Boddington	1,556,308,032
Peel Total	1,556,308,032

Mid West Region	
Meekatharra and Morawa	1,026,612,408
Yalgoo	769,408,941
Wiluna and Three Springs	617,747,651
Cue, Coorow and Geraldton	129,781,256
Mullewa and Mt Magnet	134,676,424
Northampton and Perenjori	740,054,107
Irwin	71,180,836
Carnamah	6,967,787
Mid West Total	3,496,429,410

Great Southern Region	
Albany, Denmark and Plantagenet	8,063,838
Great Southern Total	8,063,838

REGION	2017-18 Value
Wheatbelt Region	
Yilgarn	765,629,330
Kondinin	346,242,764
Dandaragan	140,868,799
Lake Grace and Westonia	147,487,674
Gingin and Koorda	8,453,336
Moora and Wyalkatchem	6,364,320
Dalwallinu	1,235,474
Northam and Kellerberrin	15,395
Wheatbelt Total	1,416,297,091

Kimberley Region	
Derby-West Kimberley	22,152,578
Wyndham-East Kimberley	251,627,801
Halls Creek	85,253,628
Broome	4,698,088
Kimberley Total	363,732,095

South West Region	
Collie	2,094,835,439
Bridgetown-Greenbushes and Bunbury	506,676,487
Capel and Dardanup	73,491,430
Harvey and Busselton	15,187,591
Donnybrook-Balingup, Manjimup and Augusta-Margaret River	1,747,038
South West Total	2,691,937,985

Gascoyne Region	
Carnarvon	31,746,913
Exmouth, Shark Bay and Upper Gascoyne	52,114,437
Gascoyne Total	83,861,349

Perth Metropolitan Region	
Kalamunda, Swan and Mundaring	21,682,159
Wanneroo	2,962,001
Cockburn, Kwinana and Rockingham	4,873,219,295
Perth Metropolitan Total	4,897,863,455

TABLE 8. Average annual employment in the WA mineral sector

Primary Commodity	2016–17 Nol*	2017–18 Nol*	2016–17 FTE*	2017–18 FTE*
Barite	1	1	0	0
Bauxite – Alumina	6,645	6,850	6,145	6,482
Base Metals	2,249	2,548	1,894	2,152
Chemicals	115	160	49	58
Chromite – Platinoids	3	0	2	0
Clays	116	84	44	31
Coal	1,098	1,153	769	754
Construction Materials	2,459	2,619	766	763
Diamond	821	824	762	789
Diatomite – Spongolite	2	2	1	2
Dimension Stone	202	239	69	61
Dolomite		1		0
Gem & Semi-Precious Stones	1	3	0	0
Gold	27,075	29,266	21,764	23,776
Gypsum	38	70	17	18
Mineral Sands	2,394	2,308	1,325	1,490
Iron Ore	52,922	53,716	41,807	42,032
Limestone – Limesand	558	741	142	134
Manganese Ore	74	391	74	380
Nickel	5,900	5,461	5,831	5,579
Phosphate	181	180	174	162
Potash		2		2
Rare Earths	175	299	127	291
Salt	845	978	503	567
Silica – Silica Sand	567	678	318	294
Silver	10	12	2	3
Talc	92	108	44	44
Tin – Tantalum – Lithium	1,084	2,471	1,253	3,320
Vanadium – Titanium	6	8	6	6
Other	859	812	690	630
Grand Total	106,492	111,984	84,580	89,819

* **Nol:** Number of Individuals (Average on-site) **FTE:** Full time equivalents

Please note: Slight discrepancies are expected between annual employment figures on a site by site basis and an overall commodity basis. This is due to variations associated with rounding when averaging employee numbers throughout the year, and data collection methodology generally. Discrepancies are anticipated to be very small, <0.1%.



The Economic Indicators data file provides full site-by-site breakdown of employment within the WA minerals and onshore petroleum sector.

SOURCE: Safety Regulation System (SRS) and Petroleum Reporting Database (PetReps), Resources Safety Division, Department of Mines, Industry Regulation and Safety. Figures include employees as well as contractors.

TABLE 9. Principal mineral and petroleum producers (effective Sep 2018)

BASE METALS

(copper–lead–zinc)

Birla Minerals Ltd

Level 3, 256 Adelaide Terrace
Perth WA 6000
E: investorrelations@adityabirla.com.au
www.adityabirlaminerals.com.au
Nifty

BHP Billiton Ltd (Nickel West)

125 St Georges Terrace
Perth WA 6000
(08) 6321 0000
www.bhp.com
Kambalda

Doray Minerals Ltd

Level 1, 1292 Hay Street
West Perth WA 6005
(08) 9226 0600
www.dorayminerals.com.au
Deflector

EMR Capital Group

Level 2, 150 Collins Street
Melbourne VIC 3000
(03) 9669 9999
E: office@emrcapital.com
Golden Grove

Independence Group NL

Level 5, South Shore Centre
85 South Perth Esplanade
South Perth WA 6151
(08) 9238 8300
www.igo.com.au
Kambalda, Teutonic Bore – Jaguar

Newcrest Mining Ltd

234 Railway Parade
West Leederville WA 6007
(08) 9270 7070
www.newcrest.com.au
Telfer

Newmont Mining Corporation

Level 2, 388 Hay Street
Subiaco WA 6008
(08) 9423 6100
www.newmont.com
Boddington Gold

Sandfire Resources NL

Level 1, 31 Ventnor Avenue
West Perth WA 6005
(08) 6430 3800
www.sandfire.com.au
DeGrussa-Doolgunna

BAUXITE–ALUMINA

Alumina

Alcoa of Australia Ltd

181–205 Davy Street
Booragoon WA 6154
(08) 9316 5111
www.alcoa.com/australia
Jarrahdale – Kwinana

South32 Ltd

Level 35, 108 St Georges Tce
Perth WA 6000
(08) 9324 9000
www.south32.net
Worsley Alumina

CLAY

Attapulgit

Hudson Resources Ltd

Level 2, 131 Macquarie Street
Sydney NSW 2000
(02) 9251 7177
www.hudsonresources.com
Lake Nerraminyne

Saponite

Watheroo Minerals Pty Ltd

14 Brushwood Brook Drive
Yallingup WA 6282
(08) 9756 6121
www.bentonitewa.com.au
Watheroo Clays

COAL

Lanco Infratech Ltd

1st Floor, 677 Murray Street
Perth WA 6005
(08) 6188 2200
www.griffincoal.com.au
Lanco

Yancoal Australia Ltd

Level 26, 363 George Street
Sydney NSW 2000
(02) 8583 5300
www.yancoal.com.au
Premier

CONSTRUCTION MATERIALS

Aggregate

Boral Resources (WA) Ltd

63-69 Abernethy Road
Belmont WA 6104
(08) 9333 3400
Mt Regal, Pilbara Area, Seven Mile Hill

Holcim (Australia) Pty Ltd

200 Adelaide Terrace
East Perth WA 6004
(08) 9212 2000
www.holcim.com.au
Newman, Nickol Bay, Turner River

MLG OZ Pty Ltd

22 Coath Road
West Kalgoorlie WA 6433
(08) 9022 7746
www.mlgoz.com.au
Tarmoola

WA Limestone

401 Spearwood Avenue
Bibra Lake WA 6163
(08) 9434 7777
www.walimestone.com
Gregory West, Mount Minnie Granite

Gravel

MLG OZ Pty Ltd

22 Coath Road
West Kalgoorlie WA 6433
(08) 9022 7746
www.mlgoz.com.au
Eight Mile Rock Hole, Jonah Bore

Norwest Sand & Gravel Pty Ltd

Lot 5 Wilson Way
Wickham WA 6720
(08) 9187 1488
Cossack, Mt Welcome, Nickol River

WA Limestone

401 Spearwood Avenue
Bibra Lake WA 6163
(08) 9434 7777
www.walimestone.com
Pickering Brook

Rock

Holcim (Australia) Pty Ltd

200 Adelaide Terrace
East Perth WA 6004
(08) 9212 2000
www.holcim.com.au
Golden Mile Rock

WA Limestone

401 Spearwood Avenue
Bibra Lake WA 6163
(08) 9434 7777
www.walimestone.com
Port Hedland

Sand

Holcim (Australia) Pty Ltd

200 Adelaide Terrace
East Perth WA 6004
(08) 9212 2000
www.holcim.com.au
*Baldivis, Turner River Dune,
Widgiemooltha*

Hanson Constructions Pty Ltd

Level 1, 35 Great Eastern Highway
Rivervale WA 6103
(08) 9311 8811
www.hanson.com.au
Gnangara, Jandabup

DIAMONDS

Argyle Diamond Mine

Lissadell Road
East Kimberley WA 6740
(08) 9168 4900
www.riotinto.com
Argyle

GOLD

AngloGold Ashanti Australia Ltd

Level 13, 44 St Georges Terrace
Perth WA 6000
(08) 9425 4600
www.anglogoldashanti.com
Sunrise Dam, Tropicana

Barrick Gold of Australia Ltd

Level 9, 125 St Georges Terrace
Perth WA 6000
(08) 9212 5777
www.barrick.com
Golden Mile

Doray Minerals Ltd

1292 Hay Street
Perth WA 6005
(08) 9226 0600
www.dorayminerals.com.au
Andy Well, Deflector

Evolution Mining Ltd

Level 15, 37 St Georges Terrace
Perth WA 6000
(08) 6216 9700
www.evolutionmining.com.au
Edna May, Mungari

Gold Fields Australia Pty Ltd

Level 5, 50 Colin Street
West Perth WA 6005
(08) 9211 9200
www.goldfields.com.au
*Agnew, Lawlers, Darlot, Granny Smith,
St Ives*

Hanking Gold Mining Pty Ltd

Level 26, 140 St Georges Terrace
Perth WA 6000
(08) 6210 8900
www.hanking.com.au
Marvel Loch – Southern Cross

Metals X Ltd

Level 3, 18-32 Parliament Place
West Perth WA 6005
(08) 9220 5700
www.metalsx.com.au
*Central Murchison, Higginsville, Mt Henry,
South Kalgoorlie*

Newcrest Mining Ltd

234 Railway Parade
West Leederville WA 6007
(08) 9270 7070
www.newcrest.com.au
Telfer

Newmont Mining Corporation

Level 2, 388 Hay Street
Subiaco WA 6008
(08) 9423 6100
www.newmont.com
Boddington

Northern Star Resources Ltd

Level 1, 388 Hay Street
Subiaco WA 6008
(08) 6188 2100
www.nsrld.com
*Jundee, Kanowna, Kundana East,
Paulsens, Plutonic*

Norton Gold Fields Ltd

Level 36, Exchange Plaza
2 The Esplanade
Perth WA 6000
www.nortongoldfields.com.au
Paddington, Binduli

Ramelius Resources Ltd

Level 1, 130 Royal Street
East Perth WA 6004
(08) 9202 1127
www.rameliusresources.com.au
*Kathleen Valley Gold, Mt Magnet,
Vivien Gold*

Regis Resources Ltd

Level 1, 1 Alvan Street
Subiaco WA 6008
(08) 9442 2200
www.regisresources.com.au
Garden Well, Moolart

Sandfire Resources NL

Level 1, 31 Ventnor Avenue
West Perth WA 6005
(08) 6430 3800
www.sandfire.com.au
DeGrussa

Saracen Mineral Holdings Ltd

Level 11, 40 The Esplanade
Perth WA 6000
(08) 6229 9100
www.saracen.com.au
*Carosue Dam, Deep South, Porphyry,
Red October, Tarmoola, Thunderbox gold*

Silver Lake Resources Ltd

Suite 4, Level 3
85 South Perth Esplanade
South Perth WA 6151
(08) 6313 3800
www.silverlakeresources.com.au
Randalls

St Barbara Ltd

7 Rheola Street
West Perth WA 6005
(08) 9476 5555
www.stbarbara.com.au
Gwalia

GYPSUM

CSR Ltd

Triniti 3
39 Delhi Road
North Ryde NSW 2113
(02) 9235 8000
www.csr.com.au
Jurien Bay North

Dampier Salt Ltd

37 Belmont Avenue
Belmont WA 6104
(08) 9270 9270
www.riotinto.com.au
Lake MacLeod

Gypsum Industries of Australia

Suite 1, 110 Robinson Avenue
Belmont WA 6104
1800 644 951
www.aglime.com.au
Cowcowing Lakes South

Whitfield Minerals Pty Ltd

32 Tuckey Street
Mandurah WA 6210
(08) 9535 9299
Lake Cowan

MINERAL SANDS

Garnet Sand

GMA Garnet Pty Ltd

122 Goulds Road
Narngulu WA 6532
(08) 9923 6000
www.garnetsales.com
Port Gregory

Ilmenite, Leucoxene, Rutile, Staurolite and Zircon

Doral Mineral Sands Pty Ltd

Lot 501 Harris Road
Picton WA 6229
(08) 9725 5444
www.doral.com.au
Dardanup

Iluka Resources Ltd

Level 23, 140 St Georges Terrace
Perth WA 6000
(08) 9360 4700
www.iluka.com
Capel, Eneabba

Tronox Australia Ltd

Brand Highway
Cataby WA 6507
(08) 9690 9200
www.tronox.com.au
Cooljarloo

IRON ORE

Atlas Iron Ltd

Level 18, Raine Square
300 Murray Street
Perth WA 6000
(08) 6228 8000
www.atlasiron.com.au
Abydos, Mt Webber, Wodgina

BC Iron Ltd

Level 1, 15 Rheola Street
West Perth WA 6005
(08) 6311 3400
www.bciron.com.au
Iron Valley

BHP Billiton Ltd

125 St Georges Terrace
Perth WA 6000
1300 55 47 57
www.bhpbilliton.com
*Jimblebar, Mining Area C,
Newman, Yandi*

Citic Pacific Mining Management Pty Ltd

45 St Georges Terrace
Perth WA 6000
(08) 9226 8888
www.citicpacificmining.com
Sino – Cape Preston Iron

Cliffs Natural Resources Pty Ltd

The Quadrant Building
Level 12, 1 William Street
Perth WA 6000
(08) 9422 3405
www.cliffsnaturalresources.com
Koolyanobbing

Fortescue Metals Limited

Level 2, 87 Adelaide Terrace
East Perth WA 6004
(08) 6218 8888
www.fmgil.com.au
East Pilbara, Solomon

Gindalbie Metals Ltd

6 Altona Street
West Perth WA 6059
(08) 9480 8700
www.gindalbie.com.au
Karara–Blue Hills

Hammersley Iron Pty Ltd

152 St Georges Terrace
Perth WA 6000
(08) 9327 2000
www.hammersleyiron.com
*Hammersley Iron, Robe River –
Deepdale, Yandicoogina*

Hancock Prospecting Pty Ltd

28-42 Ventnor Avenue
West Perth WA 6005
www.hancockprospecting.com.au
Roy Hill

Mineral Resources Ltd

1 Sleaford Road
Applecross WA 6153
(08) 9329 3600
www.mineralresources.com.au
Carina

Mt Gibson Iron Ltd

Level 1, 2 Kings Park Road
West Perth WA 6005
(08) 9426 7500
www.mtgibsoniron.com.au
*Koolan Island, Mt Gibson Iron,
Talling Peak*

LIMESAND–LIMESTONE

Aglime of Australia

Suite 1, 110 Robinson Avenue
Belmont WA 6104
(08) 9277 5529
www.aglime.com.au
Dongara–Denison, Lancelin, Jurien Bay

Archistone Pty Ltd

27 Jandakot Road
Jandakot WA 6164
(08) 9417 2444
www.archistone.com.au
*Moore River,
Yanchep Reconstituted Stone*

Cockburn Cement Ltd

Lot 242, Russell Road
Munster WA 6166
(08) 9411 1000
www.cockburncement.com.au
*Cockburn, Coogee, Denison,
Ledge Point, Wesco Rd*

FQM Australia Nickel Pty Ltd

1/24 Outram Street
West Perth WA 6005
(08) 9346 0100
www.first-quantum.com
Ravensthorpe Limestone

Lime Industries Pty Ltd

43 Hector Street
Osborne Park WA 6017
(08) 9241 1100
www.limeindustries.com.au
Boranup Limesand

Minara Resources

Level 10, Alluvion
58 Mounts Bay Road
Perth WA 6000
(08) 9212 8400
www.minara.com.au
Mt Zephyr Calcrete

WA Limestone

401 Spearwood Avenue
Bibra Lake WA 6163
(08) 9434 7777
www.walimestone.com
Postans

NICKEL**BHP Billiton Ltd (Nickel West)**

125 St Georges Terrace
Perth WA 6000
1300 55 47 57
www.bhpbilliton.com
Kambalda

FQM Australia Nickel Pty Ltd

1/24 Outram Street
West Perth WA 6005
(08) 9346 0100
www.first-quantum.com
Ravensthorpe Nickel

Minara Resources

Level 10, 58 Mounts Bay Road
Perth WA 6000
(08) 9212 8400
www.minara.com.au
Murrin Murrin

Western Areas Ltd
2 Kings Park Road
West Perth WA 6005
(08) 9334 7777
www.westernareas.com.au
Forrestania

PALLADIUM**BHP Billiton Ltd (Nickel West)**

125 St Georges Terrace
Perth WA 6000
1300 55 47 57
www.bhpbilliton.com
Kambalda

PETROLEUM**BHP Billiton Petroleum (North West Shelf) Pty Ltd**

125 St Georges Terrace
Perth WA 6000
1300 55 47 57
www.bhpbilliton.com
Macedon, Pyrenees

Chevron Australia Pty Ltd

Level 24, QV1 Building
250 St Georges Terrace
Perth WA 6000
(08) 9216 4000
www.chevronaustralia.com
Barrow Island, Gorgon

Origin Energy Resources Ltd

34 Colin Street
West Perth WA 6005
(08) 8635 3485
www.originenergy.com.au
Beharra Springs

Quadrant Energy Pty Ltd

Level 9, 100 St Georges Terrace
Perth WA 6000
(08) 6218 7100
www.quadrantenergy.com.au
*East Spar, Harriet, John Brookes,
Reindeer, Stag, Van Gogh*

Roc Oil (WA) Pty Ltd

Suite 2, Ground Floor
100 Havelock Street
West Perth WA 6005
(08) 9219 7111
www.rocoil.com.au
Cliff Head

Santos Ltd

Level 2, 40 The Esplanade
Perth WA 6000
(08) 9333 9500
www.santos.com.au
Mutineer-Exeter

Vermilion Oil and Gas Australia Pty Ltd

Level 5, 30 The Esplanade
Perth WA 6000
(08) 9215 0300
www.vermilionenergy.com
Wandoo

Woodside Energy Ltd

240 St Georges Terrace
Perth WA 6000
(08) 9348 4000
www.woodside.com.au
*Amanda Claire/Belnaves/Brunello, Angel,
Athena, Cossack, Enfield, Goodwyn,
Hermes, North Rankin, North West Shelf,
Pluto, Vincent, Wanaea*

PLATINUM**BHP Billiton Ltd (Nickel West)**

125 St Georges Terrace
Perth WA 6000
1300 55 47 57
www.bhpbilliton.com
Kambalda

RARE EARTHS**Lynas Corporation Ltd**

7 Tully Road
East Perth WA 6004
(08) 6241 3800
www.lynascorp.com
Mount Weld

SALT

Dampier Salt Ltd

37 Belmont Avenue
Belmont WA 6104
(08) 9270 9270
www.dampiersalt.com.au
*Dampier, Lake MacLeod,
Port Hedland*

Shark Bay Salt Pty Ltd

Level 16, 2 The Esplanade
Perth WA 6000
(08) 9265 8000
www.salt.com.au
Onslow Salt, Shark Bay Salt

WA Salt Supply Ltd

185-187 Cockburn Road
North Coogee WA 6163
(08) 9431 9431
www.wasalt.com.au
Lake Deborah East

SILICA – SILICA SAND

AustSand Mining

Suite 5, 363-367 Albany Hwy
Victoria Park WA 6100
(08) 9361 6288
www.austsandmining.com.au
Mindijup

Simcoa Operations Pty Ltd

973 Marriott Road
Wellesley WA 6232
(08) 9780 6666
www.simcoa.com.au
Kemerton

Hanson Constructions Pty Ltd

Level 1, 35 Gt Eastern Hwy
Rivervale WA 6103
(08) 9311 8811
www.hanson.com.au
Gnangara

SPONGOLITE

Southern Spongolite Industries Pty Ltd

Red Gum Pass
Kendenup WA 6323
(08) 9841 7549
Red Gum Spongolite

TALC

Imerys Talc Australia Pty Ltd

21 Glyde Street
Three Springs WA 6519
(08) 9954 1427
www.imerystalc.com
Three Springs Talc

TIN-TANTALUM-LITHIUM

Spodumene

Galaxy Resources Limited

Level 4 / 21 Kintail Road
Applecross WA 6153
(08) 9215 1700
www.gxy.com
Mt Cattlin

Mineral Resources Limited

1 Sleaf Road
Applecross WA 6153
(08) 9329 3600
www.mineralresources.com.au
Wodgina

Pilbara Minerals Limited

Level 2, 88 Colin Street
West Perth WA 6005
(08) 6266 6266
www.pilbaraminerals.com.au
Pilgangoora

Talison Lithium Pty Ltd

Level 4, 37 St Georges Terrace
Perth WA 6000
(08) 9263 5555
www.talisonlithium.com
Greenbushes

Tawana Resources NL

Level 3, 20 Parkland Road
Osborne Park WA 6017
(08) 9489 2600
tawana.com.au
Bald Hill

Tantalum

Global Advanced Metals

Level 3, Centrepoint Tower
123B Colin Street
West Perth WA 6005
(08) 6217 2500
www.globaladvancedmetals.com
Greenbushes

Tin

Global Advanced Metals

Level 3, Centrepoint Tower
123B Colin Street
West Perth WA 6005
(08) 6217 2500
www.globaladvancedmetals.com
Greenbushes

ABBREVIATIONS

A\$	Australian dollar	Mct	million carats
ABS	Australian Bureau of Statistics	Mha	million hectares
bbbl	barrels of oil	MMbbl	million barrels
bbbl/d	barrels per day	Moz	million ounces
Bcm	billion cubic metres	Mt	million tonnes
Btu	British Thermal Units	Mtoe	million tonnes of oil equivalent
ct	carat	Mt/a	million tonnes per annum
DIIS	Department of Industry, Innovation and Science	OPEC	Organization of Petroleum Exporting Countries
GDP	Gross Domestic Product	oz	ounce
GJ	Gigajoule	oz/a	ounce per annum
Gm ³	billion cubic metres	PJ	petajoules
ha	hectares	RBA	Reserve Bank of Australia
kl	kilolitres	t	tonne
km	kilometres	t/a	tonnes per annum
km ²	square kilometres	Tcf	trillion cubic feet
kt	thousand tonnes	t/d	tonnes per day
LME	London Metal Exchange	TJ/d	terajoules per day
m	metre	US\$	United States dollar
Mboe	millions of barrels of oil equivalent		

WEIGHTS AND MEASURES

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

UNITS AND CONVERSION FACTORS

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

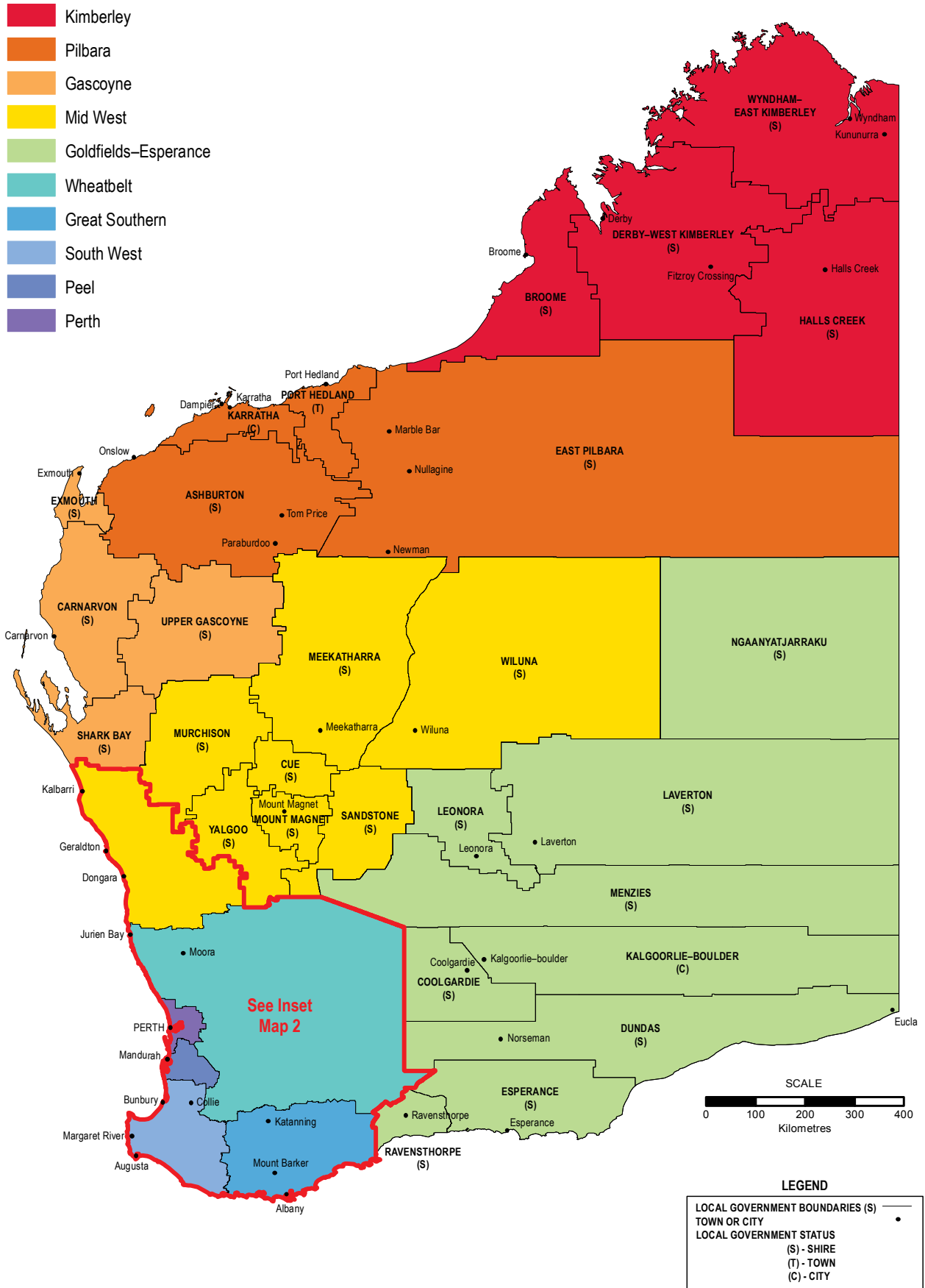
DATA SOURCES

Quantities and values for minerals and petroleum in this publication are collected from a variety of sources including royalty returns, various company annual reports, quarterly Australian Stock Exchange reports, State port authority statistics, the ABS, DIIS and various commercial data suppliers.

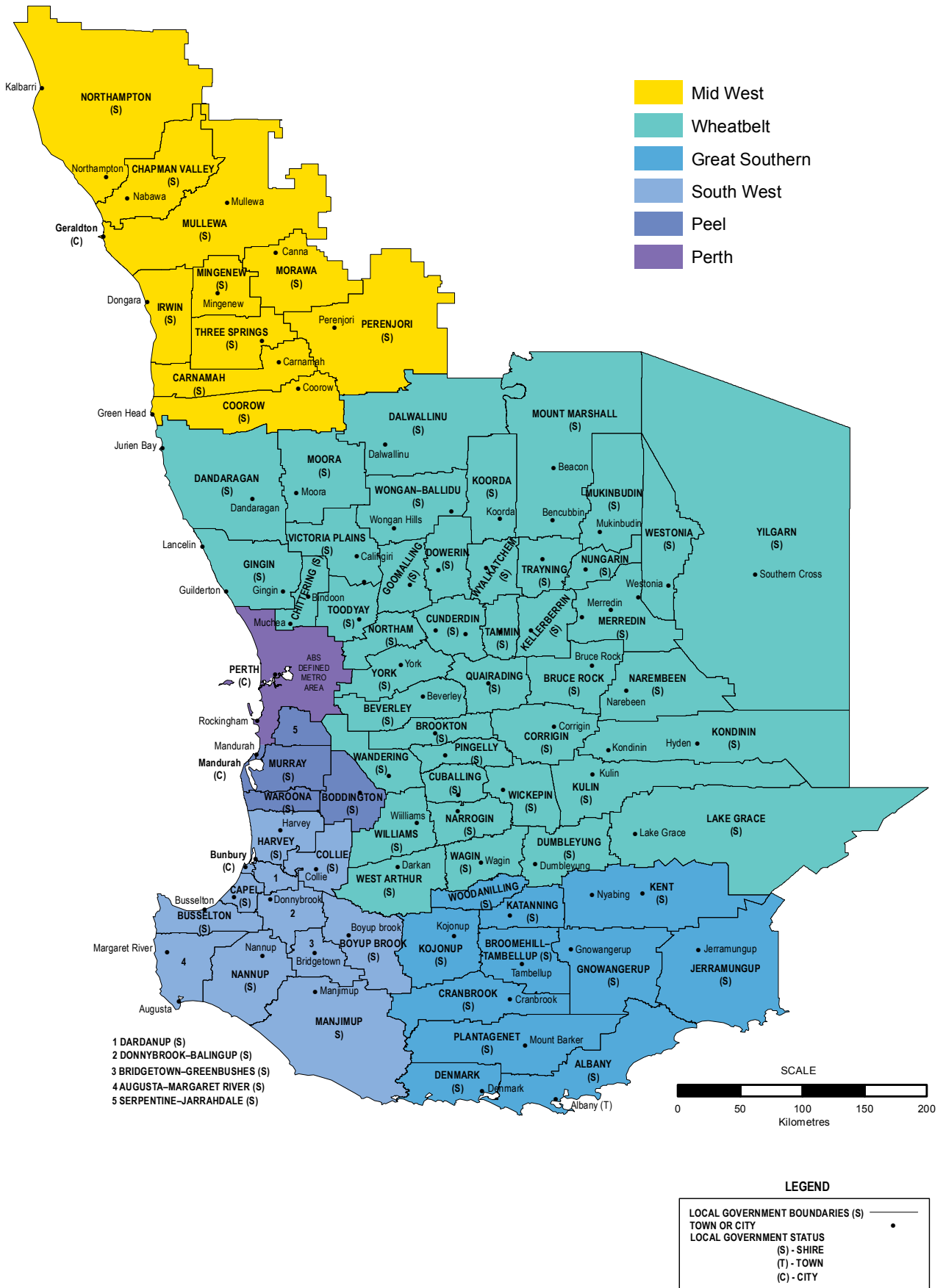
Quantities specified relate to either mine production or sales as listed below for each commodity.

Mine Production
Clays
Coal
Construction materials
Dimension stone
Gypsum
Limesand–Limestone–Dolomite
Silica – Silica Sand
Talc
Sales
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

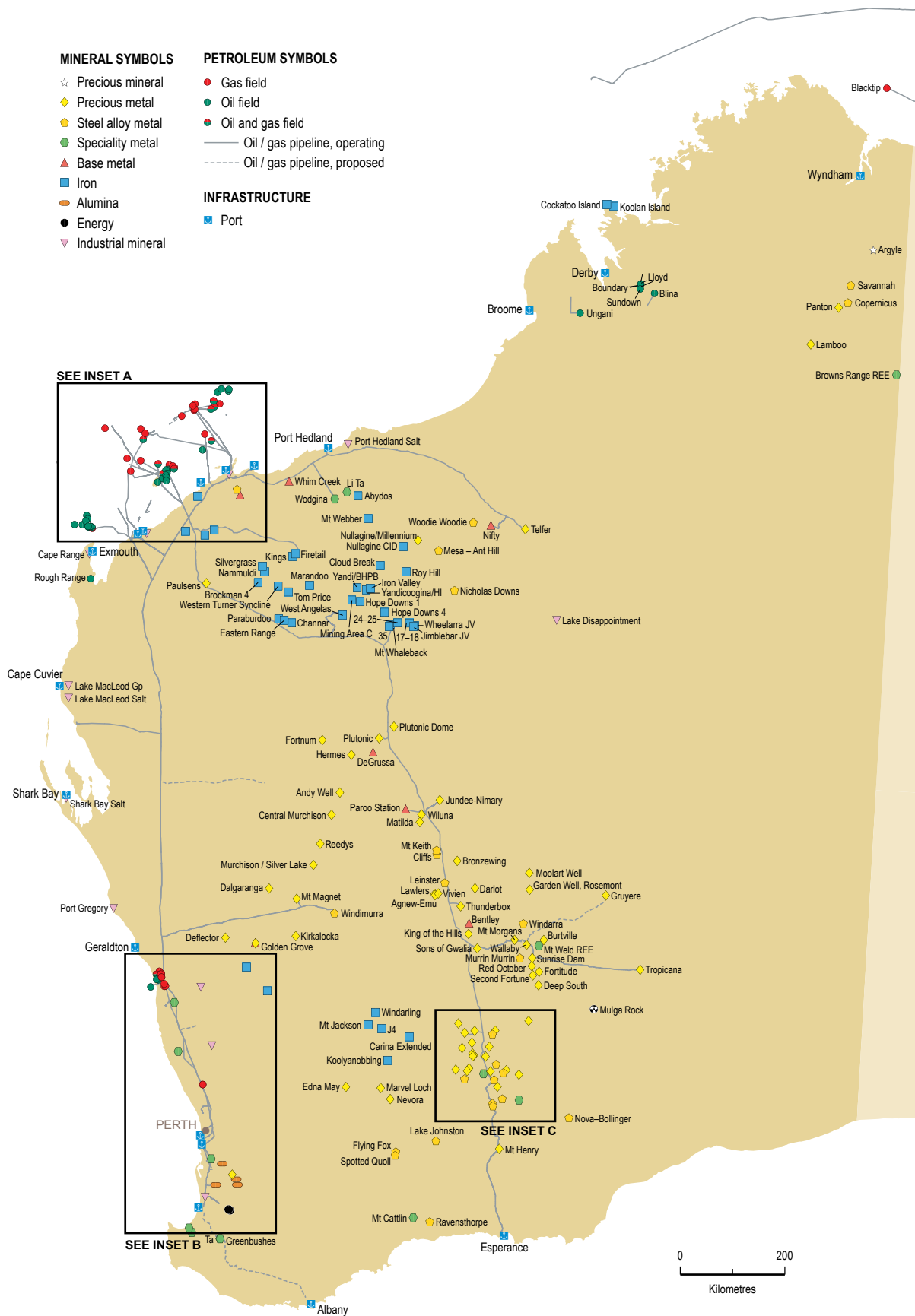
4 MAPS



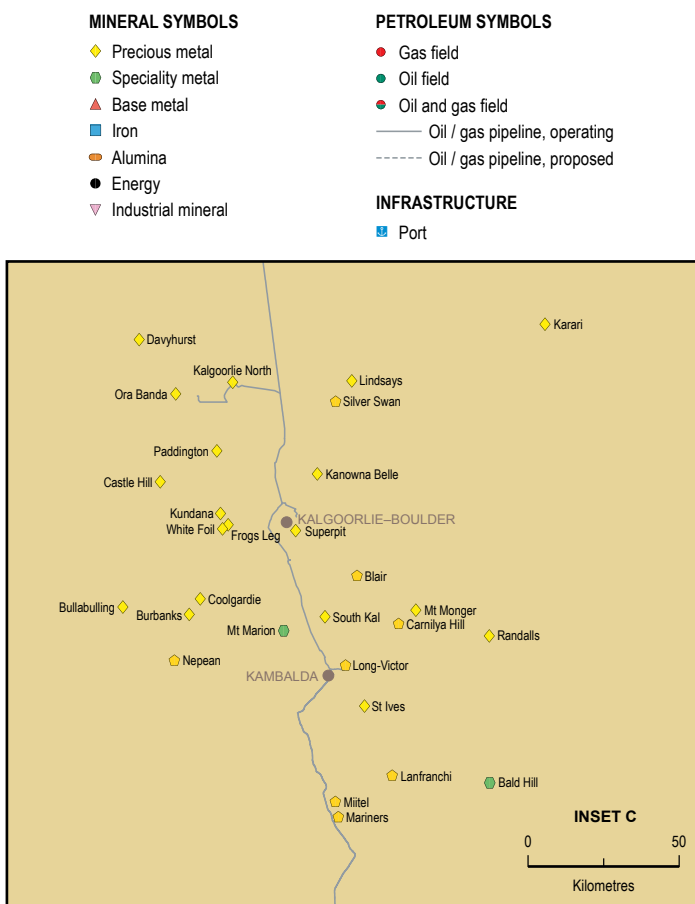
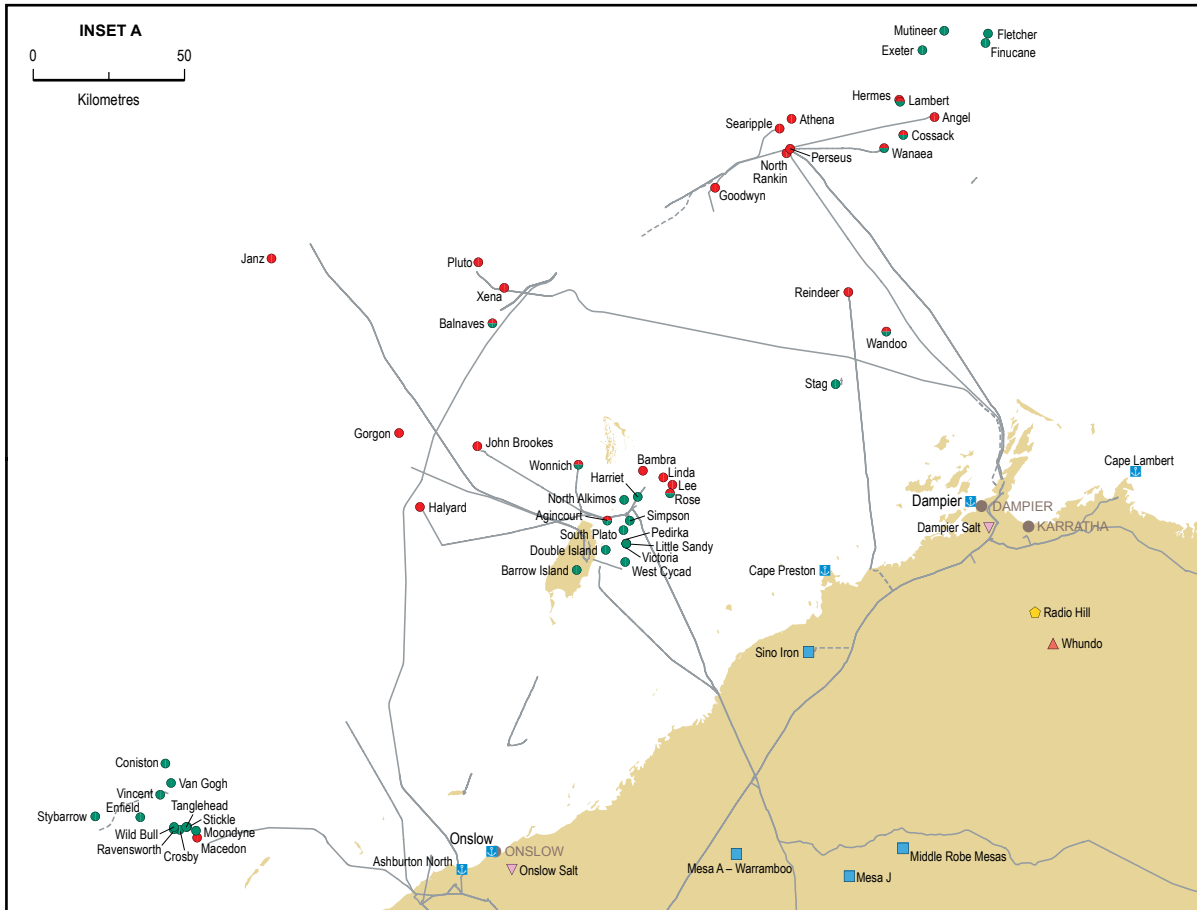
Map 1. Local Government and Regional Boundaries



Map 2. Local Government and Regional Boundaries Insert



Map 3. Major Mineral and Petroleum Projects in Western Australia



MINERAL SYMBOLS

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

PETROLEUM SYMBOLS

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

INFRASTRUCTURE

- Port

Map 4. Major Mineral and Petroleum Projects in Western Australia Insert

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Published October 2018
DMIRSOCT18_5445

