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Chief Economist



Resources and Energy Major Projects

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Notes

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Resources and Energy Major Projects Overview

A year on from the release of our last publication, the value of committed projects — those where a final investment decision has been taken and construction activity is likely underway — has fallen by 12 per cent.

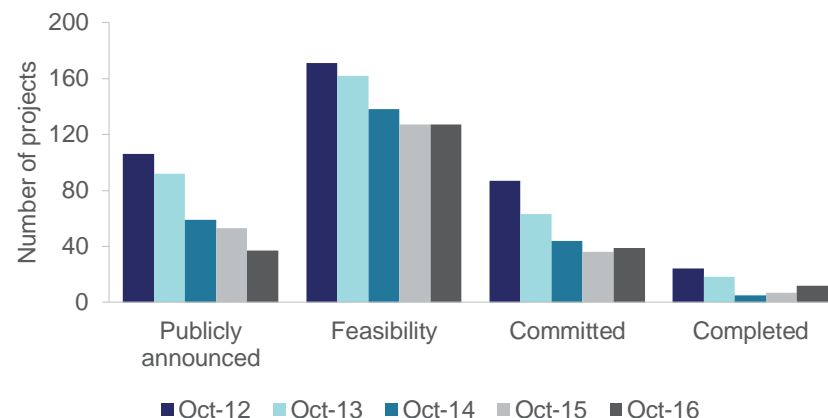
Producers are diverting their focus from developing new projects to cutting costs and ensuring the commercial viability of existing assets. Final investment decisions for many projects have been delayed to 2017 or later, with producers considering factors such as the price cycle, access to infrastructure, business conditions, and Australian cost competitiveness.

These results are illustrative of the ongoing transition from the investment phase to the production phase of the mining boom. They are also a sign of the more challenging operating and market conditions that Australian producers have faced over the last year. A combination of low commodity prices over much of the past 12 months, and expectations of growth in supply in a number of markets, have created a more difficult outlook for investment across the resources and energy sector.

The rally in some commodity prices in the second half of 2016 — particularly for coal and iron ore — will alleviate some of the pressure on Australian producers. However, investment decisions are taken with a long-term view of market conditions, and short-term price lifts are unlikely to have a significant effect on exploration activity and the progression of projects along the pipeline.

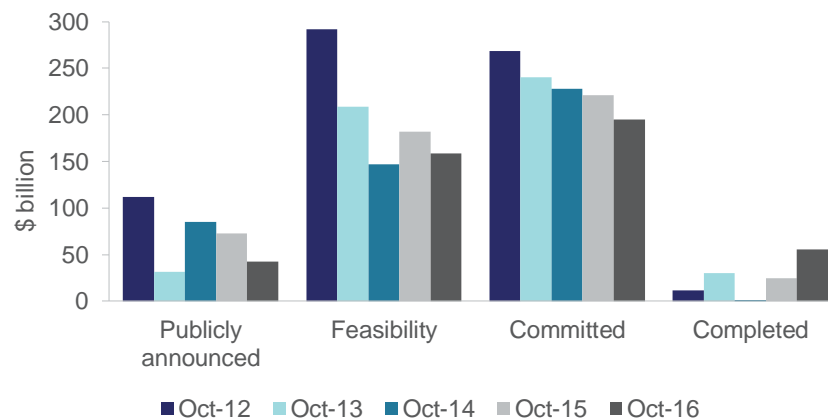
The outlook for resources and energy investment remains subdued over the short to medium term. The mega projects that have been a key driving force of the investment boom have reached, or are close to reaching, completion. Remaining mega projects account for 88 per cent of the value of projects at the committed stage. The largest LNG project — Gorgon in Western Australia — is worth an estimated \$60 billion, and is scheduled for completion in mid-2017. The \$11 billion Roy Hill iron ore project, the last of the non-energy mega projects, is also expected to reach nameplate capacity in early 2017.

Figure 1.1: Number of projects in the investment pipeline, 2012 to 2016



Source: Department of Industry, Innovation and Science (2016)

Figure 1.2: Value of projects in the investment pipeline, 2012 to 2016



Source: Department of Industry, Innovation and Science (2016)

Notes: Value publicly announced projects is estimated as the mid-point of the range.

Table 1.1: Summary of projects in the investment pipeline

	Publicly announced		Feasibility		Committed		Completed	
	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m
Aluminium, Bauxite, Alumina	0	0	1	63	1	1,900	0	0
Coal	7	8500–11,744+	37	55,172	8	7,603	2	837
Copper	1	0–249	7	2,641	1	316	0	0
Gold	1	0–250	12	2,551	5	867	3	328
Infrastructure	5	5,800–7,797	10	8,258	1	326	3	4,580
Iron ore	7	5,339–8,335	10	15,836	5	12,004	0	0
Lead, Zinc, Silver	2	0–498	3	560	3	1,434	0	0
LNG, Gas, Petroleum	3	15,000+	9	58,238	12	169,767	3	49,141
Nickel	6	2,036–2,285	2	2,960	1	443	0	0
Other Commodities	4	500–1,496	4	1,915	0	0	0	0
Uranium	1	250–499	32	10,662	2	133	1	800
Total	37	37,425–48,153+	127	158,855	39	194,793	12	55,686

Source: Department of Industry, Innovation and Science (2016)

Introduction

Resources and Energy Major Projects provides a review of the mining, infrastructure and processing facilities projects that increase, extend or improve the output of mineral and energy commodities in Australia. This edition of the report is an update on project developments over the 12 months from November 2015 to October 2016. Its purpose is to measure the value of the current and potential investment in the mining and energy sectors, and to provide an analysis of the key trends and issues underpinning the level of investment. The value of this investment is an important economic indicator for Australia. Capital expenditure associated with resources and energy major projects has been a major source of economic activity over the past five years.

The Department of Industry, Innovation and Science (DIIS) gathers information on major projects from a number of sources, including company websites, ASX quarterly activity reports and media releases, and from direct contact with company representatives. Although there is substantial investment by mining and energy companies in replenishing equipment, plant and other property, the focus of this report is on 'major' investments — those over \$50 million. Smaller scale operations are also an important contributor to the sector and the broader Australian economy. However gathering data on such projects is challenging, as many are undertaken by private companies which have fewer obligations to report progress. Such projects also typically have shorter development cycles.

Developers of resources and energy projects often use different planning processes and assessment methods to support a Final Investment Decision (FID). Thus, there is no standard project development model with clearly defined stages and terminology that can be applied to every resources and energy project.

To broadly represent the general lifecycle of a project, DIIS use a four-stage model of the investment pipeline to measure the potential investment in Australia's resources and energy sectors. Earlier stages of developing mining and energy projects, such as identifying deposits and exploration activities, are not included in the model. While these activities remain important, it is beyond the scope of this report to assess exploration activities on a project-by-project basis. Instead, a summary and analysis of

aggregate exploration expenditure is provided.

To be included on the major projects list that accompanies this report, there must be evidence of project activities that support the project progressing to an FID within the next five years.

The four stages in the DIIS investment pipeline model are:

1. Publicly announced stage

Projects at the publicly announced stage are usually very early in their development, and are typically undergoing an initial feasibility study to assess the commercial aspects of developing an identified resource. To include a project on the list at this stage, preliminary information on the project schedule, planned output or cost must be publicly available. Projects that have stalled in progressing towards an FID, and that are investigating alternative development options, are also classified as Publicly Announced to reflect their longer planning times.

As they are still in early planning stages, projects at the publicly announced stage may not have finalised engineering designs or construction costs. To reflect this uncertainty, project costs are quoted as a cost band in the Major Projects list when they have not been announced by the project proponent. In most cases, this is based upon an estimate developed by DIIS using industry averages for similar construction activities. The cost bands used by DIIS in this report for publicly announced projects are:

- \$0 – \$249m
- \$250m – \$499m
- \$500m – \$999m
- \$1,000m – \$1,499m
- \$1,500m – \$2,499m
- \$2,500m – \$4,999m
- \$5,000m+

2. Feasibility stage

This stage of the project development cycle is where the initial feasibility study for a project has been completed and the results support further development. Projects that have progressed to the feasibility stage have undertaken initial project definition studies and commenced more detailed planning. These include Front-End Engineering Design studies, Bankable Feasibility Studies, developing final project scope, commercial plans and environmental surveys (in support of finalising an Environmental Impact Statement).

While there is an opportunity to progress projects at the feasibility stage to the committed stage, this is not guaranteed to occur, as evaluation of commercial prospects has not yet been finalised and all regulatory approvals are yet to be received. Projects at the feasibility stage have not been committed to, and are only potential investments that may occur under the appropriate conditions. Therefore, the total value of projects at the feasibility stage cannot be directly compared to the value of the projects at the committed stage in order to forecast the future of capital investment in Australia's resources and energy sectors.

3. Committed stage

Projects at the committed stage have completed all commercial, engineering and environmental studies, received all necessary Government regulatory approvals, and finalised the financing of the project to allow construction. Such projects are considered to have received a positive FID from the owner (or owners). In most cases, projects at this stage of development have already started construction, as there are typically pre-works undertaken as part of exploration and design activities.

Projects at the committed stage typically have cost estimates, schedules, and mine outputs that are well defined and often publicly released. Most projects that progress to the committed stage will eventually commence production. Nevertheless, post-FID, there are still technical and financial risks that, if realised, can result in delays, scope changes and cost overruns, or even affect the commercial viability of a project and possibly lead to its cancellation.

4. Completed stage

A project reaches the completed stage when construction and commissioning activities are substantially completed and full commercial level production has commenced. As many projects include multiple stages and scope elements that can be independent of each other, the timing around when a project reaches the completed stage can be difficult to assess.

Exploration

Exploration is a key stage in the mining project development cycle. It is an investment in knowledge about the location, type, quantity and quality of deposits, which helps to inform future development. Before making the decision to undertake exploration activities, resources and energy companies consider a range of factors to ensure the benefits of exploration activities exceed the costs. Factors to be considered include prevailing and expected commodity prices, regulatory environments, geological prospects, and tax and royalties arrangements.

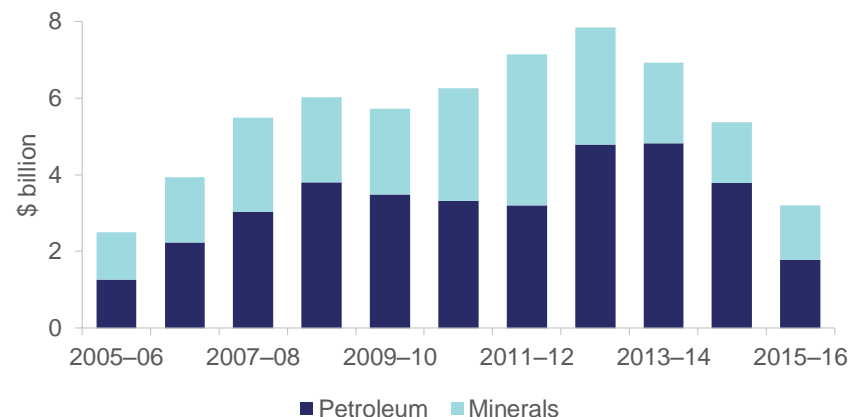
Exploration expenditure continues to decline

Australian exploration expenditure recorded its largest ever annual decline in 2015–16, falling by 40 per cent to \$3.2 billion. Low commodity prices — at least relative to prices observed during the mining boom — continued to weigh on exploration expenditure, with the price of most commodities finishing the year lower than they started. In some markets, such as iron ore and LNG, expectations of further strong future supply growth also deterred investment.

The main contributor to the fall was lower petroleum exploration expenditure, which fell by 53 per cent to \$1.8 billion. Both onshore and offshore exploration recorded sharp declines.

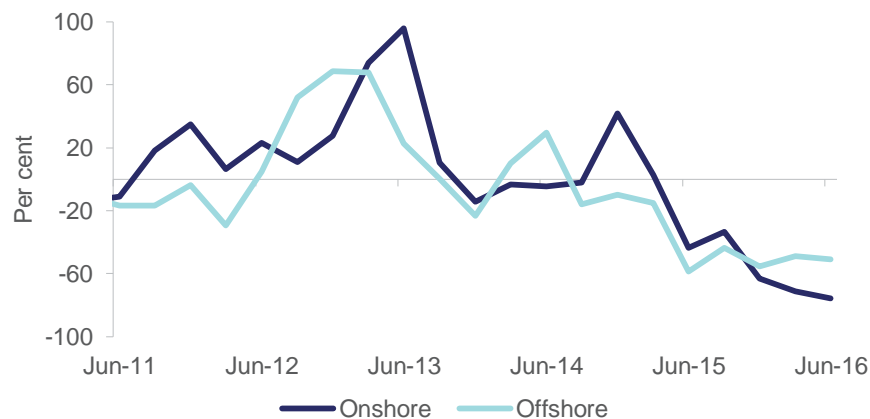
Minerals exploration expenditure decreased by 10 per cent over the year to \$1.4 billion. Exploration expenditure on coal and iron ore declined by 31 per cent and 35 per cent, respectively, with expenditure for each commodity at its lowest level since 2006 and 2007, respectively. Spending on both base metals and other commodities (which includes uranium, mineral sands and diamonds) continued the steady downward trend observed since prices peaked around 2012.

Figure 1.3: Exploration expenditure



Source: ABS (2016) Mineral and Petroleum Exploration, Australia, 8412.0

Figure 1.4: Petroleum exploration, year-on-year change

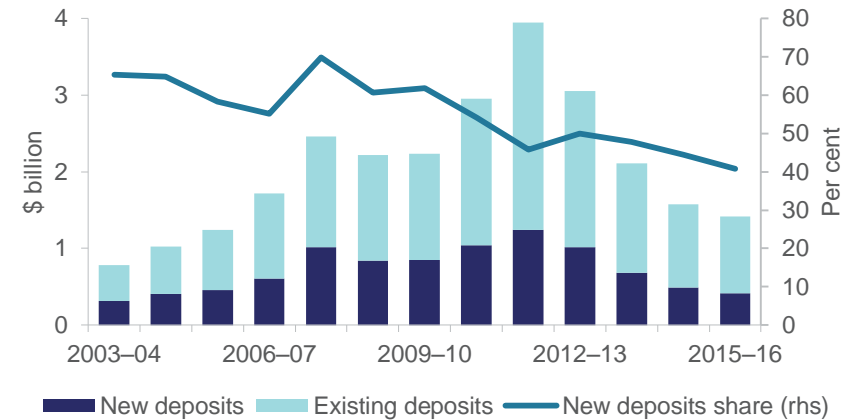


Source: ABS (2016) Mineral and Petroleum Exploration, Australia, 8412.0

Mineral exploration expenditure targeting existing deposits declined by 8 per cent to \$1 billion, while expenditure on newly discovered deposits fell by 15 per cent to \$412 million. Exploration directed at new deposits continues to decline as a share of total expenditure. Market conditions were likely a contributing factor, with less risky brownfield development becoming more appealing in a difficult operating environment.

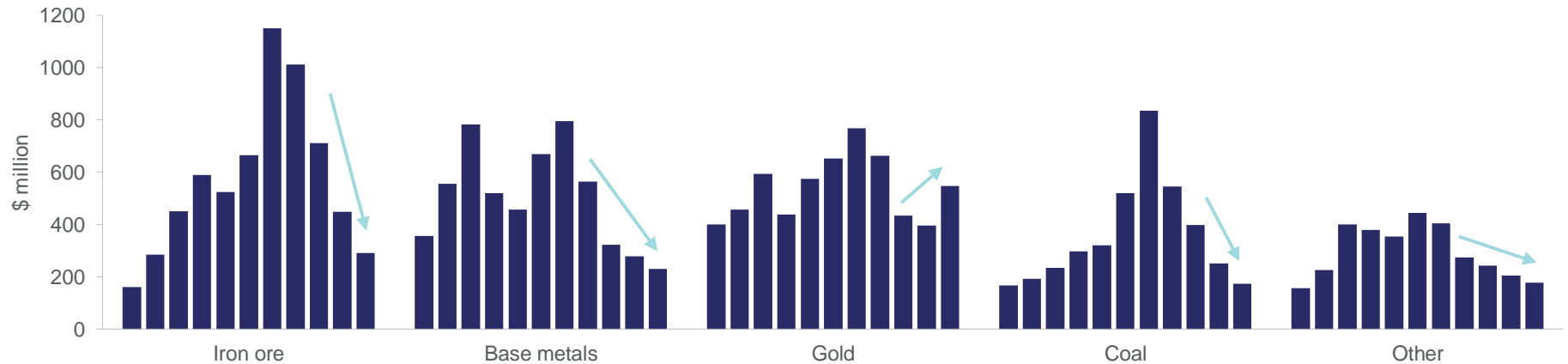
Breaking with the trend, gold exploration expenditure increased by \$152 million to around \$548 million in 2015–16 — the largest annual increase in almost 20 years. Exploration activity has been encouraged by the depreciation of the Australian dollar and rising US dollar gold prices from early 2016, both of which have improved the margins of Australian producers.

Figure 1.5: Minerals exploration by deposit type



Source: ABS (2016) Mineral and Petroleum Exploration, Australia, 8412.0

Figure 1.6: Exploration expenditure by commodity, 2005–06 to 2015–16

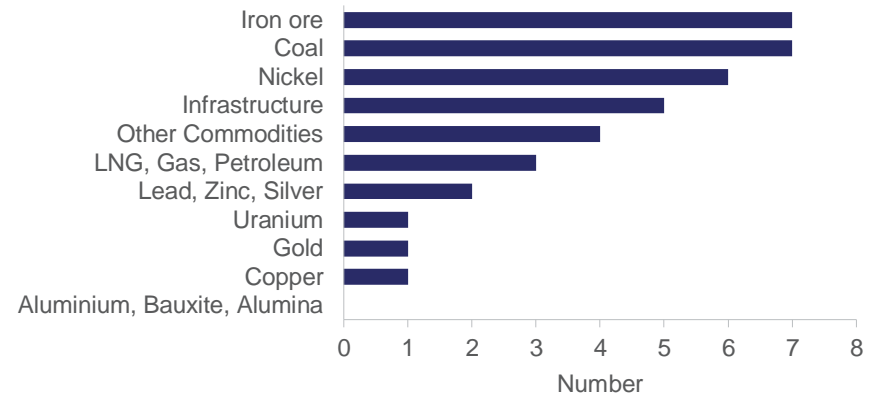


Source: ABS (2016) Mineral and Petroleum Exploration, Australia, 8412.0

Projects at the publically announced stage

The value of projects at the publically announced stage has declined over the past 12 months. In addition to a relatively low number of new projects being added to the pipeline, a number of projects in the early stages of development were cancelled or scaled back during the year. The \$1.4 billion West Pilbara Iron Ore project was formally halted, as a result of a subdued outlook for iron ore prices. The Olympic Dam copper mine expansion, the largest of the metals projects, has been changed to a low risk, lower cost underground expansion, replacing previous plans for a high-cost open pit mine.

Figure 1.7: Number of projects at the publically announced stage



Source: Department of Industry, Innovation and Science (2016)

Projects at the feasibility stage

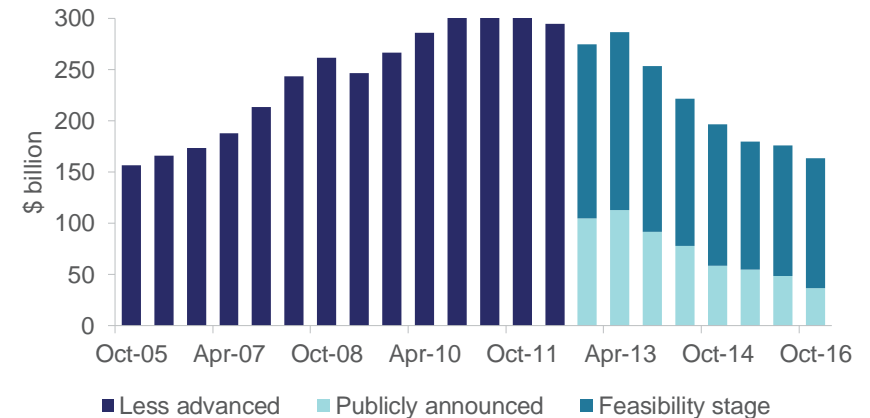
The number of projects advancing from the feasibility stage has slowed

Current market conditions have led to a backlog of projects at the feasibility stage of the investment pipeline, as companies delay decisions to see how market conditions unfold. There are currently 37 coal projects at the feasibility stage, with only two coal projects having proceeded to the committed stage over the past year. FIDs for several iron ore and base metals projects were delayed to 2017, with ongoing progress depending on the outlook for prices, access to infrastructure, and funding arrangements.

Despite a relatively stable number of projects at the feasibility stage, there has been a decline in the value of projects, which fell 13 per cent to \$159 billion over the 12 months to October 2016.

The decline in the value of projects at the feasibility stage reflects both project cancellations and projects advancing to the committed stage. Four infrastructure projects with a combined value of \$7.4 billion were removed from the list of major projects. AGL will not proceed with the Gloucester Coal Seam Gas Project. Woodside is currently considering a range of options for the development of the Browse resources, but will not progress the floating LNG concept selected in 2015 (estimated value of US\$40 billion). Several gas projects that will provide feedstock for LNG plants advanced to the committed stage, which also contributed to the decline in the value of projects at the feasibility stage.

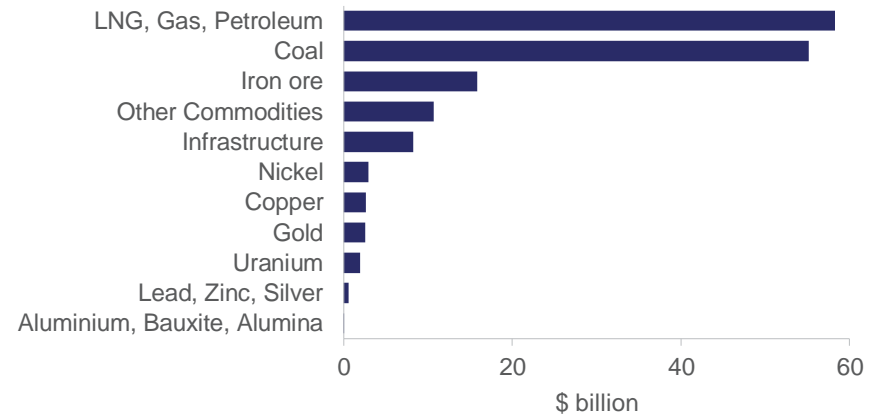
Figure 1.8: Number of uncommitted projects



Notes: 'Less advanced' was the previous classification for projects at the publically announced and feasibility stage.

Source: Department of Industry, Innovation and Science (2016)

Figure 1.9: Value of projects at the feasibility stage by commodity



Source: Department of Industry, Innovation and Science (2016)

Projects at the committed stage

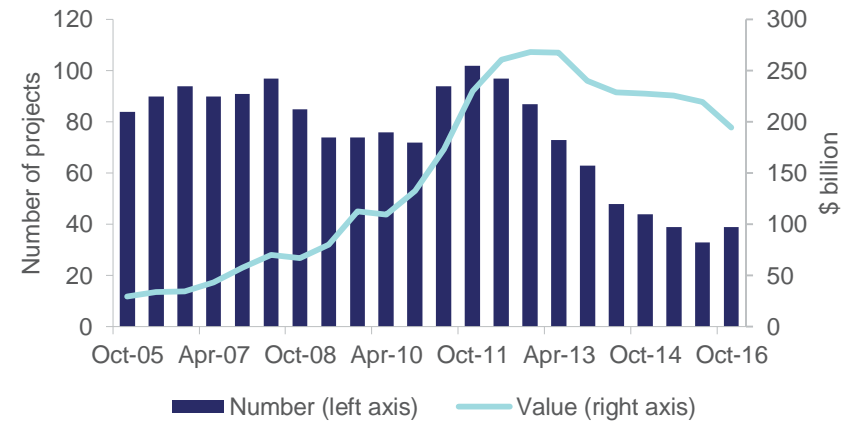
Despite an increase in the number of committed projects, their value has declined noticeably

The value of projects at the committed stage declined from \$221 billion to \$195 billion over the 12 months to October 2016. The largest falls were in oil and gas, due to the completion of two mega projects (those valued at over \$5 billion) — Australia Pacific LNG and Gladstone LNG. The two projects are estimated to be worth a combined \$47 billion.

The decline resulting from the completion of these projects was partially offset by final investment decisions for a number of projects across gas, oil, coal, gold, iron ore and metals. The value of coal projects rose as two large coking coal projects — Grosvenor underground and Byerwen — proceeded to the committed stage. Three iron ore expansion projects worth \$705 million were approved in 2016, including Rio Tinto's Oxbow and Silvergrass deposits and the Robe River joint venture iron ore project. Of the base metals, only the \$316 million Little Eva copper project advanced to the committed stage.

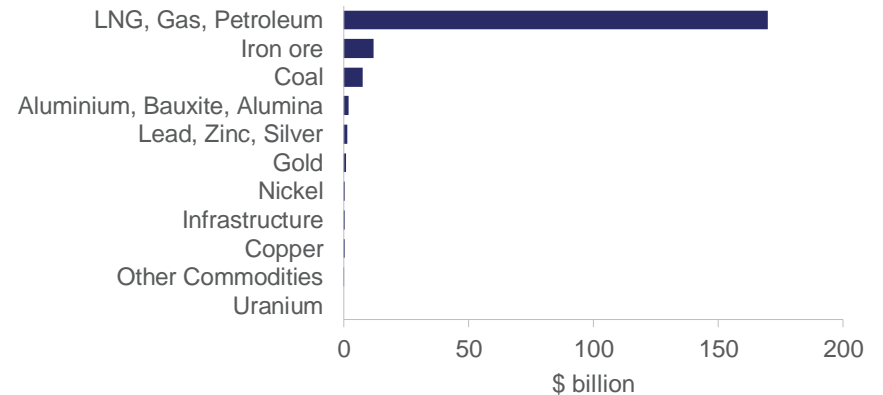
In addition, a US\$5 billion cost overrun at the Wheatstone LNG project provided support to the overall value of projects at the committed stage.

Figure 1.10: Number and value of committed projects



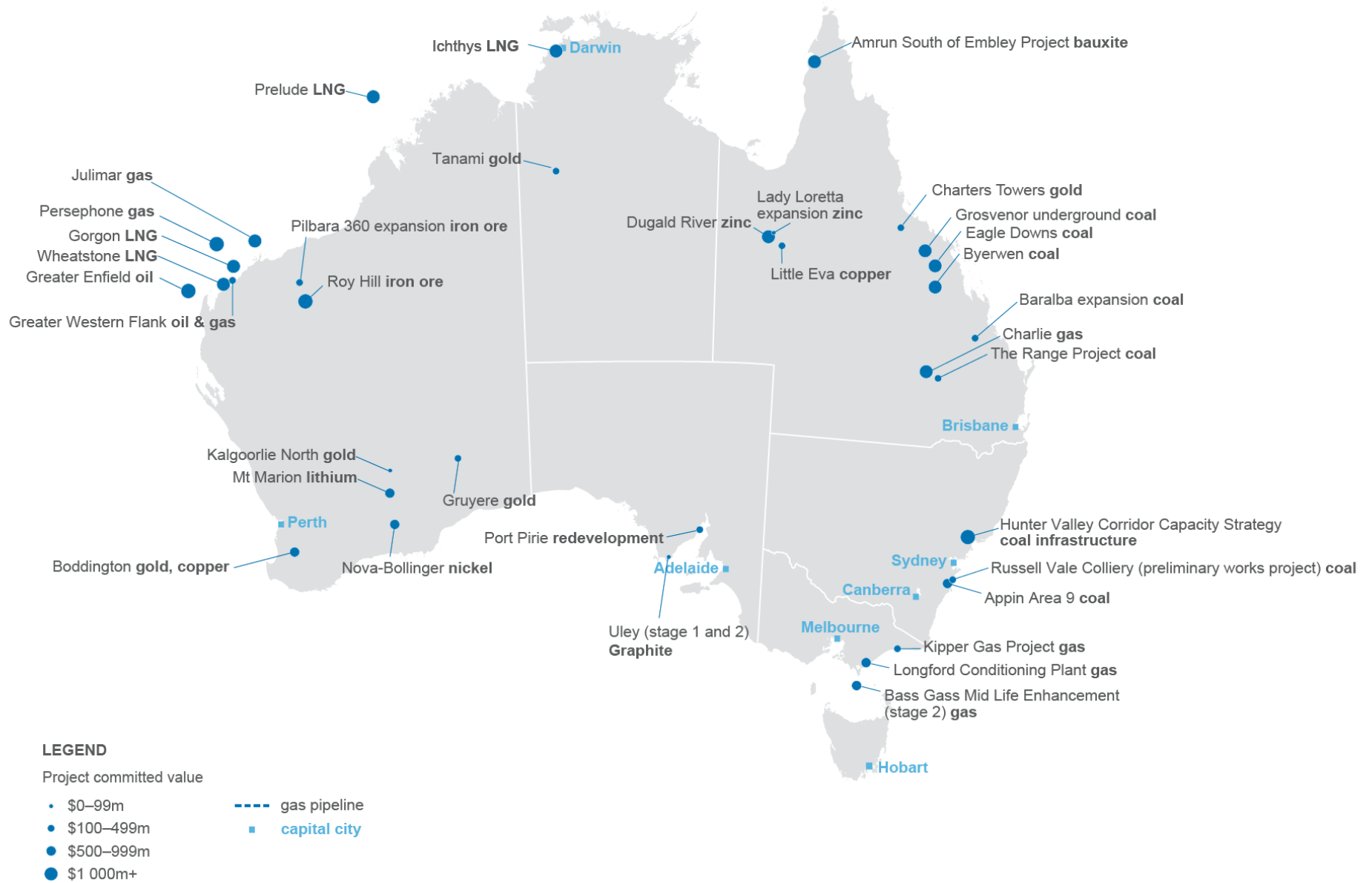
Source: Department of Industry, Innovation and Science (2016)

Figure 1.11: Value of projects at the committed stage by commodity



Source: Department of Industry, Innovation and Science (2016)

Figure 1.12: Location of projects at the committed stage



Source: Department of Industry, Innovation and Science (2016)

Projects at the completed stage

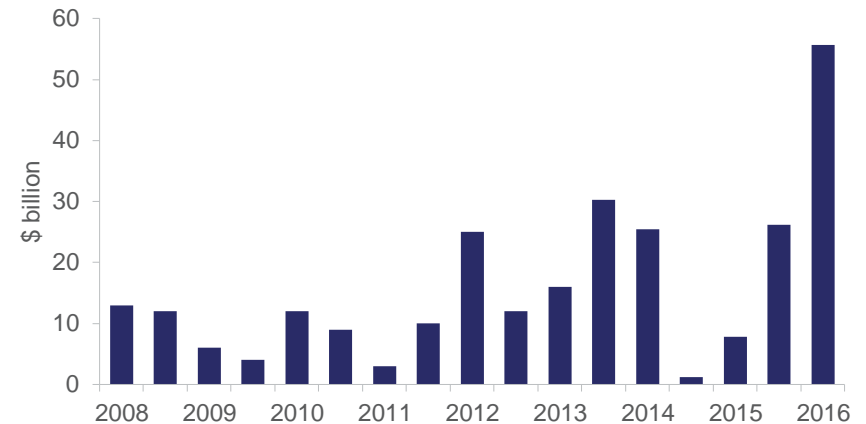
The value of projects at the completed stage has increased, as the mining sector moves to the production phase

Twelve projects, valued at \$56 billion, progressed to the completed stage in the 12 months to October 2016. These included two large LNG projects, three infrastructure, three gold and a coal project.

The total value of projects completed is more than double that of 12 months ago, reflecting the sector's transition to the production phase. This was due to the completion of two large oil and gas projects in Queensland with a combined value of \$47 billion. \$4.6 billion of infrastructure projects — Phase 3 of the Hay Point Coal Terminal, the Eastern goldfields pipeline expansion and the Wiggins Island rail project — were also completed.

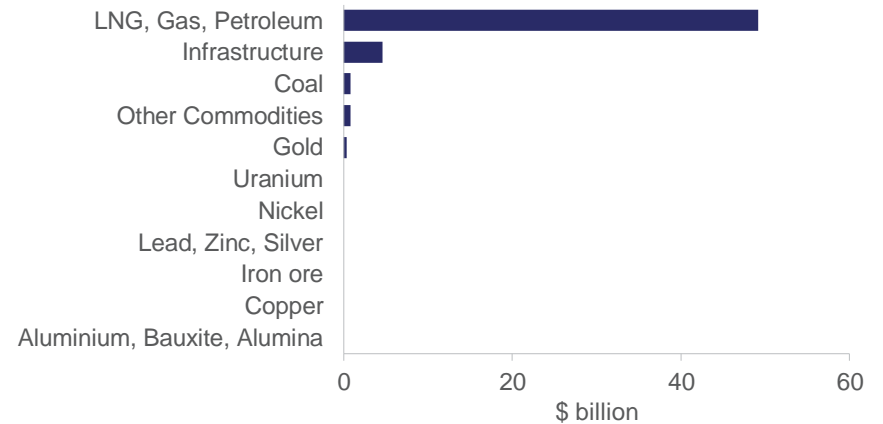
While no iron ore or base metals projects progressed to the completed stage in the 12 months to October 2016, a number are due for completion over the next year. The Roy Hill iron ore mine is expected to reach nameplate capacity in early 2017, while the \$443 million Nova-Bollinger nickel project is expected to reach nameplate capacity by mid-2017.

Figure 1.13: Value of completed projects



Source: Department of Industry, Innovation and Science (2016)

Figure 1.14: Value of projects at the completed stage by commodity



Source: Department of Industry, Innovation and Science (2016)

Outlook for resources and energy investment

Methodology

While the resources boom over the past decade stimulated considerable investment in Australia's resources and energy sector, not all projects that were initiated progressed through to construction. Accordingly, projects at the publicly announced and feasibility stages can only be viewed as potential investment. Further analysis is required to produce an outlook for future investment in the resources and energy sector.

Resources and Energy Major Projects employs a project-level analysis to provide a profile of future investment. Projects at the feasibility and publically announced stages are rated as either 'likely', 'possible' or 'unlikely' to progress to the committed stage. This assessment is based on a range of internal and external factors. Where data is available, projects are assessed based on their position on the relevant commodity cost curve. The timing of when projects are likely to progress to the committed stage is based on schedules announced by project developers. Projects that have been assessed as 'unlikely' to proceed are not included in the forward projection of the value of committed investment.

Although assessments are made at a project level, these are not provided in *Resources and Energy Major Projects* because some of the information used is treated as commercial in confidence.

Overview

Market conditions for Australian producers have been challenging over the past few years. Low interest rates and a lower Australian dollar relative to the US dollar have not been sufficient to offset the impact of a prolonged period of lower prices.

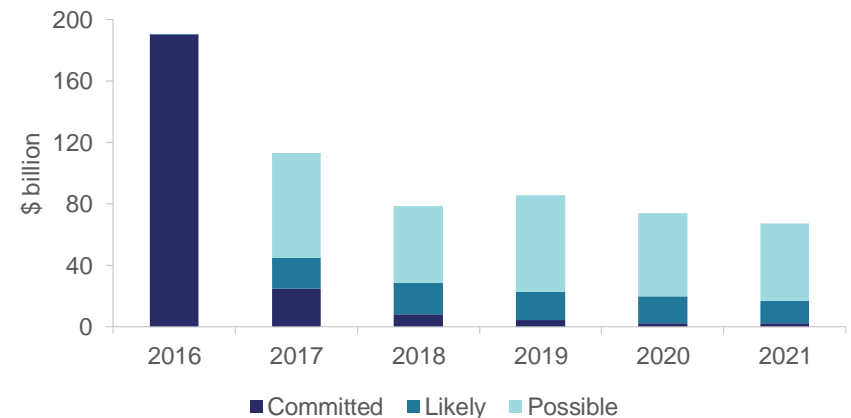
The outlook for resources and energy investment remains subdued over the next five years. The value of committed resources and energy projects has decreased from a peak of \$268 billion in April 2013 to \$195 billion at the end of October 2016. A further fall in the value of committed

projects is expected in 2017. Many of the mega projects that have been a key driving force of the investment boom are nearing completion. The remaining mega projects account for 88 per cent of the value of projects at the committed stage.

The number of final investment decisions will need to increase in order to boost capital expenditure in the resources industry after this time. However, even if all possible and likely projects proceed to the committed stage, it will at best only partially offset the decline in value from projects being completed.

Nevertheless, the long-term prospects and opportunities for further investment in Australia's resources and energy sector remain positive. Supply trends and price cycles vary across commodities, with potential opportunities emerging in different areas over time. Australia has many high quality mineral and petroleum deposits that can be developed when the price cycle rebounds.

Figure 1.15: Scenarios for committed project investment



Source: Department of Industry, Innovation and Science (2016)

Table 1.2: Summary of projects at the publically announced stage

	NSW		Qld		WA		NT		SA		Vic		Tas		Total	
	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m
Aluminium, Bauxite, Alumina																
Coal	2	2,000–3,498	5	6,500–8,246+											7	8,500–11,744
Copper					1	0–249									1	0–249
Gold							1	0–250							1	0–250
Infrastructure			2	2,000–3,498	3	3,800–4,299									5	5,800–7,797
Iron ore					5	3,589–6,337			2	1,750–1,998					7	5,339–8,335
Lead, Zinc, Silver	1	0–249			1	0–249									2	0–498
LNG, Gas, Petroleum					3	15,000+									3	15,000
Nickel					6	2,036–2,285									6	2,036–2,285
Other Commodities					1	0–249					2	500–998	1	0–249	4	500–1,496
Uranium			1	250–499											1	250–499
Total	3	2,000–3,747	8	8,750–12,243+	20	24,425–28,668+	1	0–250	2	1,750–1,998	2	500–998	1	0–249	37	37,425–48,153

Source: Department of Industry, Innovation and Science (2016)

Table 1.3: Summary of projects at the feasibility stage

	NSW		Qld		WA		NT		SA		Vic		Tas		Total	
	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m
Aluminium, bauxite, alumina			1	63											1	63
Coal	11	5,052	25	49,977							1	143			37	55,172
Copper	1	148			1	202	1	190	3	1,810	1	291			7	2,641
Gold	2	380	1	123	6	849	1	1,046	2	153					12	2,551
Infrastructure	1	351	5	4,950	2	1,494	1	800	1	663					10	8,258
Iron ore	1	2,900			7	8,886			2	4,050					10	15,836
Zinc	2	490			1	70									3	560
Lead, zinc, silver	1	2,000	2	2,000	4	53,000					2	1,238			9	58,238
LNG, gas, petroleum					2	2,960									2	2,960
Nickel	7	1,803	5	2,351	11	2,690	4	2,688	1	49	3	901	1	180	32	10,662
Other			1	350	3	1,565									4	1,915
Total	26	13,124	40	59,814	37	71,716	7	4,724	9	6,725	7	2,573	1	180	127	158,855

Source: Department of Industry, Innovation and Science (2016)

Table 1.4: Selected projects advanced to the feasibility stage in the 12 months to October 2016

Resource	Project	Company	State	Estimated start-up	Estimated new capacity	Capacity unit	Indicative cost (A\$m)
Gas and oil	Lambert Deep West	Woodside, BHP, BP, Chevron, Shell, Japan Australia LNG	WA	2021+	20 – 30	Pj pa	1,000 – 1,500
Infrastructure	Buckland road and port infrastructure project	BC Iron	WA	2021+	18,000	ktpa	1250
Copper	Carrapateena	Oz Minerals Limited	SA	n/a	61a, 63,000a	kt, oz	980
Infrastructure	Northern Gas Pipeline	Jemena	NT	2018	n/a	n/a	800
Uranium	Yeelirrie	Cameco	WA	2021+	3850	tonne	500 – 1,000
Coal	New Lenton	New Hope Coal, MPC	QLD	2019	2	2	400
Zircon, ilmenite, leucoxene	Thunderbird	Sheffield Resources	WA	2019	114, 439, 30	kt	393

Source: Department of Industry, Innovation and Science (2016)

Table 1.5: Summary of projects at the committed stage

	NSW		Qld		WA		NT		SA		Vic		Tas		Total	
	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m
Aluminium, bauxite, alumina			1	1,900											1	1,900
Coal	2	1,116	6	6,487											8	7,603
Copper			1	316											1	316
Gold			1	246	3	501	1	120							5	867
Infrastructure	1	326													1	326
Iron ore					5	12,004									5	12,004
Zinc			2	871					1	563					3	1,434
Lead, zinc, silver			1	1,700	7	123,600	1	42,567			3	1,900			12	169,767
LNG, gas, petroleum					1	443									1	443
Nickel					1	83			1	50					2	133
Other															0	0
Total	3	1,442	12	11,520	17	136,631	2	42,687	2	613	3	1,900			39	194,793

Source: Department of Industry, Innovation and Science (2016)

Table 1.6: Selected projects advanced to committed stage in the 12 months to October 2016

Resource	Project	Company	State	Estimated start-up	Estimated new capacity	Capacity unit	Indicative cost (A\$m)
Gas and oil	Greater Western Flank - Phase 2	Woodside/ BHP Billiton / BP / Chevron / Shell / Japan Australia LNG	WA	2019	n/a	n/a	2,000
Coal	Grosvenor underground	Anglo American	QLD	2016	5	Mt	1,950
Gas and oil	Greater Enfield	Woodside / Mitsui E&P Australia	WA	2019	40,000	bbl/d	1,900
Bauxite	Amrun (South of Embley Project)	Rio Tinto	QLD	2019	22,800	kt	1,900
Gas and oil	Charlie	BG Group / CNOOC / Tokyo Gas	QLD	2017	n/a	n/a	1,700
Coal	Byerwen Coal Project	Qcoal Group	QLD	2016	10	Mt	1,591
Zinc	Dugald River	MMG	QLD	2018	170	Kt	812

Source: Department of Industry, Innovation and Science (2016)

Table 1.7: Summary of projects at the completed stage

	NSW		Qld		WA		NT		SA		Vic		Tas		Total	
	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m	No. of projects	Value A\$m
Aluminium, bauxite, alumina															0	0
Coal	2	837													2	837
Copper															0	0
Gold					3	328									3	328
Infrastructure			2	4,440	1	140									3	4,580
Iron ore															0	0
Zinc															0	0
Lead, zinc, silver			2	46,641	1	2,500									3	49,141
LNG, gas, petroleum															0	0
Nickel					1	800									1	800
Other															0	0
Total	2	837	4	51,081	6	3,768									12	55,686

Source: Department of Industry, Innovation and Science (2016)

Table 1.8: Selected projects advanced to completed stage in the 12 months to October 2016

Resource	Project	Company	State	Estimated start-up	Estimated new capacity	Capacity unit	Indicative cost (A\$m)
Gas and oil	Australia Pacific LNG	Origin / ConocoPhillips / Sinopec	QLD	2016	9	Mt	25,400
Gas and oil	Gladstone LNG	Santos / Petronas / Total / Kogas	QLD	2015	7.8	Mt	21,200
Infrastructure	Hay Point Coal Terminal (phase 3)	BHP Billiton Mitsubishi Alliance (BMA)	QLD	2015	11,000	ktpa	3,540
Gas and oil	Greater Western Flank - Phase 1	Woodside/ BHP Billiton / BP / Chevron / Shell / Japan Australia LNG	WA	2016	n/a	n/a	2,500
Infrastructure	Wiggins Island rail project	Aurizon	QLD	2015	27,000	ktpa	900
Other commodities	Burrup ammonium nitrate plant	Orica / Yarra / Apache	WA	2016	330	kt	800
Gold	Mt Henry	Metals X	WA	2016	116,000	oz	195

Source: Department of Industry, Innovation and Science (2016)