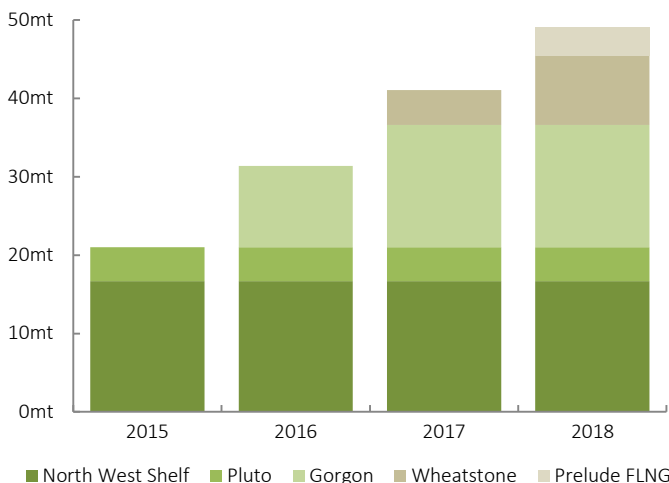




- Western Australia has an established and reliable liquefied natural gas (LNG) export industry, with the State’s first LNG project – the North West Shelf – celebrating 25 years of LNG exports in 2014.
- Western Australian LNG projects are located close to Asia, the region with the largest consumption of LNG.
- As foundation investment partners and customers, Japanese utility companies helped establish Western Australia’s LNG industry. Japan remains the destination for most of Western Australia’s LNG exports.
- In 2006, Western Australia became the first jurisdiction in the world to export LNG to China. Western Australian LNG projects also have long-term contracts signed with customers in South Korea and India.
- High gas prices in the 2000s prompted major investment in Western Australia’s LNG industry. Western Australia currently has three operating LNG export projects: the North West Shelf, Pluto and Gorgon. By 2018, the State will have five operating LNG export projects with a total capacity of close to 50 million tonnes per annum (mtpa).
- In April 2016 Perth, Western Australia hosted the 18<sup>th</sup> International Conference and Exhibition on Liquefied Natural Gas (LNG 18). More information on the event is available online at <http://LNG18.org>

Western Australia’s LNG export capacity

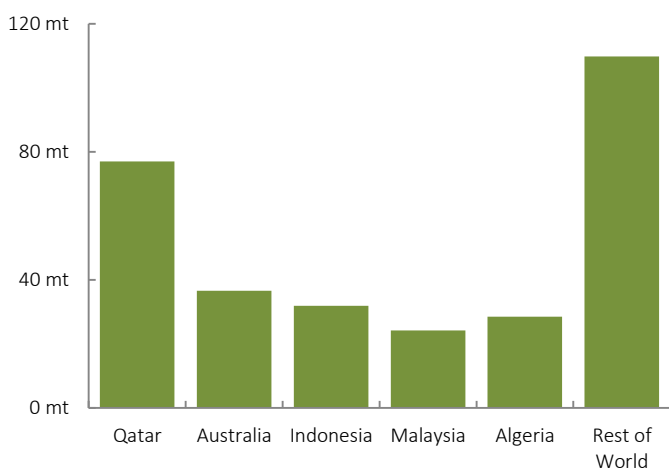


Note – Additions to LNG export capacity reflect the start-up of LNG trains during a particular year; however not all the export capacity of a new LNG train may be available in the same year.

Source: WA Department of State Development estimates based on public company announcements.

- The North West Shelf’s foundation project had two trains and began exporting LNG in 1989. A third train was added in 1992, a fourth in 2004 and a fifth in 2008. The total capacity of these five trains is now 16.7 mtpa.
- The Pluto project began exporting LNG in May 2012. The project operates a single LNG train with 4.3 mtpa capacity.
- The Gorgon project began exports from its first LNG train in March 2016 and production from its second LNG train in October 2016. When construction of the third LNG train is complete, the project will have a total capacity of 15.6 mtpa.
- The other two Western Australian LNG projects under construction are:
  - Wheatstone, 8.9 mtpa capacity, two trains
  - Prelude, 3.6 mtpa capacity, one train on a floating vessel.
- By 2018, when construction of these projects is scheduled to be complete, the State’s LNG export capacity will be 49.1 mtpa.

Global LNG export capacity: 2015

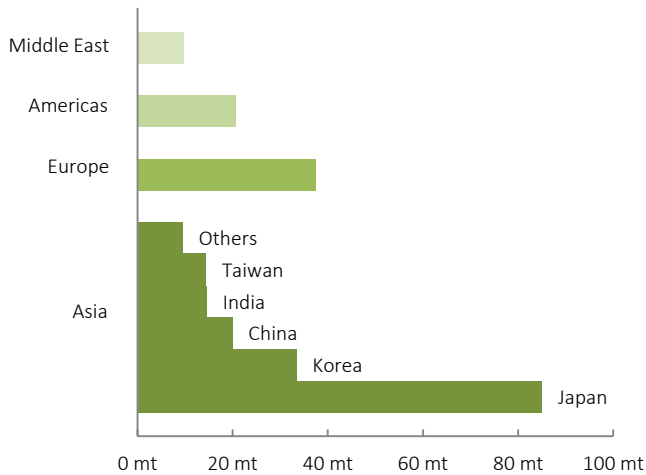


Source: International Group of LNG importers (GIIGNL).

- The International Group of LNG importers estimates that at the end of 2015, global LNG export capacity was 308 mtpa.
- Qatar had the largest capacity at 77 mtpa.
- Australia’s capacity at the end of 2015 was 36.6 mtpa, which included the North West Shelf and Pluto projects in Western Australia, the Darwin project in the Northern Territory and the Queensland Curtis and Gladstone (first train) projects in Queensland.
- Since the end of 2015, the Australia Pacific project in Queensland began exports from its first train in January 2016 and production from its second train in October 2016; the Gorgon project in Western Australia began exports from its first train in March 2016 and production from its second train in October 2016; and the second train of the Gladstone project in Queensland began production in May 2016.
- If all Australian projects currently under construction proceed as scheduled, Australia will have a total capacity of 87 mtpa by 2018.



Regional LNG imports: 2015



Source: International Group of LNG importers (GIIGNL).

- In 2015, global LNG trade was around 245 million tonnes, with the five largest importers – Japan, South Korea, China, India and Taiwan – located in Asia.
- Asia accounted for 72 per cent of global LNG imports in 2015:
  - Japan and South Korea together accounted for 48 per cent of LNG imports in 2015.
  - China and India together accounted for 14 per cent of LNG imports in 2015, with this proportion expected to grow as both countries increase their demand for energy.
- Europe (15 per cent), the Americas (8 per cent) and the Middle East (4 per cent) made up the balance of LNG imports. LNG demand in Europe in particular can be volatile depending on the price, availability of competing energy sources and weather conditions.

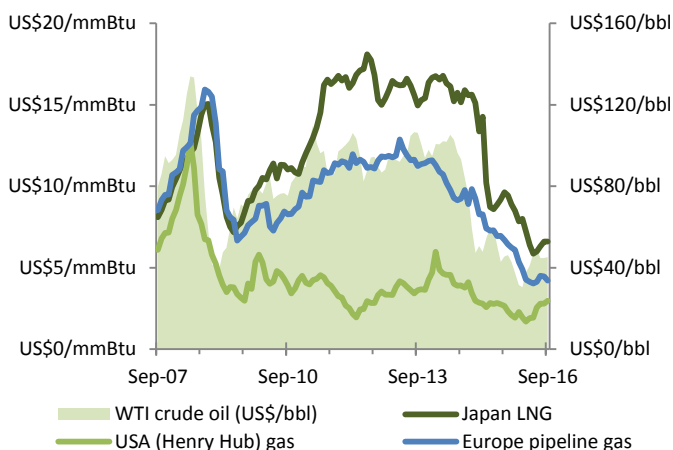
International LNG shipping duration (days)

From:	To: Japan (Tokyo)	China (Shanghai)	Korea (Incheon)	Taiwan (Yung-an)	India (Gujarat)
Australia West coast	8	7	8	6	9
Australia East coast	8	9	9	8	14
Qatar	14	12	13	11	2
USA Gulf coast	20	22	21	22	21
South East Asia Singapore	6	5	6	4	6
Russia Sakhalin	2	3	3	4	12
Nigeria	23	22	23	20	15

Note – days shipping is based on a vessel at maximum speeds of 19.5 knots.  
Source: Shipperscene; International Group of LNG importers (GIIGNL).

- Western Australia’s LNG projects are located relatively close to the world’s biggest LNG importers in Asia.
- The shipping distance from Western Australia to Japan is 3,400 nautical miles or about 8 days travel, with similar shipping durations from Western Australia to South Korea, China, Taiwan and India.
- The shipping distances from Western Australia to Asian customers compares favourably to the shipping distances from Qatar (with the exception of India).
- The expansion of the Panama Canal, completed in late-June 2016, means that most LNG tankers can now pass through, providing a shorter trade route for LNG exports from the USA to Asian customers. However, shipping to Asian customers from the US Gulf Coast will still take more than twice the time of shipping from Western Australia.

Regional LNG/pipeline prices

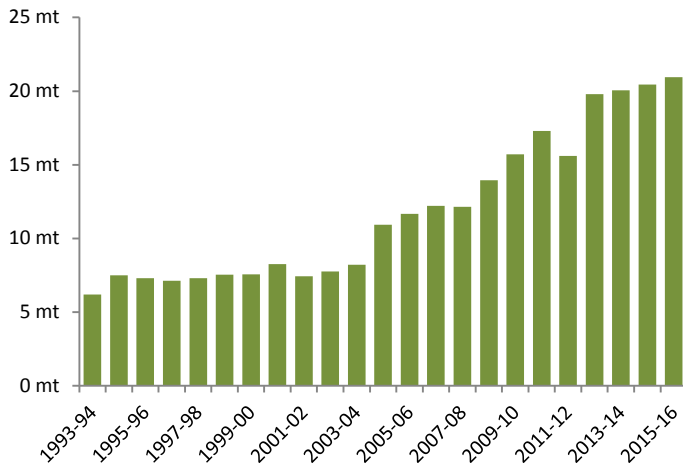


Source: World Bank.

- LNG sales in Asia have generally been based on long-term contracts with prices derived from a formula linked to the price of Japanese oil imports.
- LNG prices in Asia generally move with the oil price (with a timing lag of a few months). This differs from gas prices in the USA, which respond to the regional gas market.
- In recent years, this led to a large gap between the Japanese LNG import price and the Henry Hub gas price in the USA: higher oil prices led to higher LNG prices in Japan, while gas prices were falling in the USA as additional supply from shale gas was brought to market. The fall in the oil price from late 2014 has reduced the size of this gap.
- The average price of LNG to Japan in September 2016 was US\$6.60 per mmBtu, down 32 per cent on September 2015. The average price of LNG to Japan in 2015-16 was US\$7.99 per mmBtu, down 41 per cent on 2014-15.



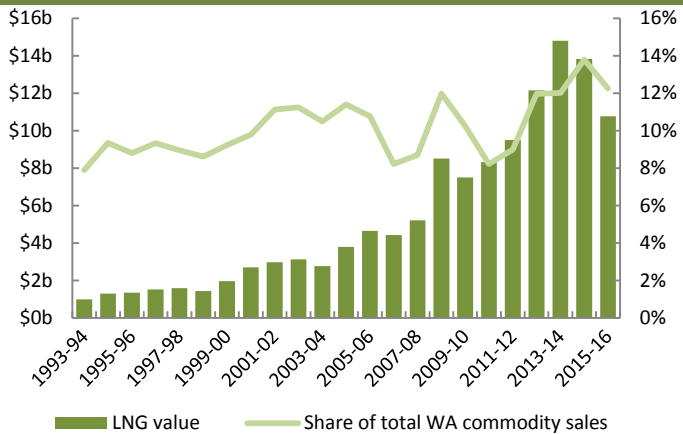
Western Australia's LNG sales – volume



Source: WA Department of Mines and Petroleum.

- The volume of Western Australia's LNG sales rose 2.5 per cent to 21.0 million tonnes in 2015-16.
- Japan was the first customer of Western Australia's LNG exports in 1989 and it remains the largest customer.
- While Japan is expected to remain the State's largest destination for LNG exports, new long-term contracts with customers in China and India will make the distribution of the State's future LNG exports more diverse.
- As new projects move into production, the volume of Western Australia's LNG exports will increase significantly. The proportion of Western Australia's LNG export capacity used will depend on a number of factors, including the ability of LNG projects to sell production capacity not committed through long-term contracts into the spot market.

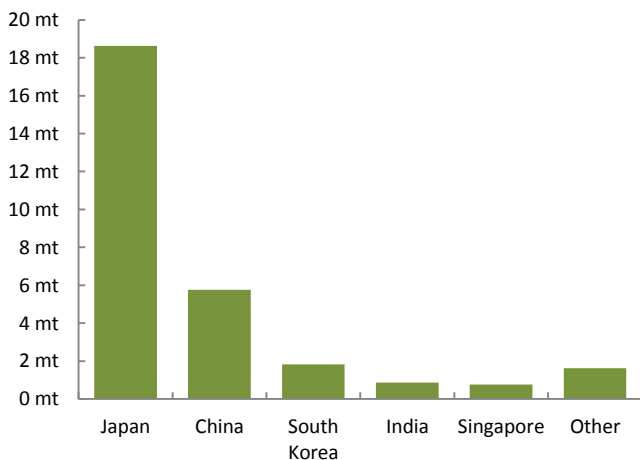
Western Australia's LNG sales – value



Source: WA Department of Mines and Petroleum.

- The value of Western Australia's LNG sales fell 22 per cent to \$10.8 billion in 2015-16.
- LNG accounted for 12 per cent of Western Australia's total commodity sales (\$87.9 billion) in 2015-16, down from 14 per cent in 2014-15.
- The large fall in the value of Western Australia's LNG sales was mainly due to the fall in the oil price as most sales from Western Australia's LNG projects are through long-term contracts with prices linked to the oil price.
- Spot market sales make up a small but growing share of LNG trade in Asia. According to the International Group of LNG Importers, 26 per cent of Asia's LNG imports and 21 per cent of Australia's LNG exports in 2015 were through spot and short-term trade (contract duration of four years or less).

Australia's LNG sales by destination: 2015



Source: International Group of LNG importers (GIIGNL), The LNG Market 2015; and WA Department of State Development Estimates.

- The volume of Australia's LNG sales in 2015 was 29.4 million tonnes, with Western Australia accounting for around 70 per cent of Australia's total.
- Australia overtook Qatar in 2012 to become the largest LNG exporter to Japan. In 2015, Australia accounted for 22 per cent (18.6 million tonnes) of Japan's LNG imports.
- Western Australia became the first exporter of LNG to China in 2006. In 2015, Australia was the largest LNG exporter to China, accounting for 29 per cent (5.8 million tonnes) of China's LNG imports. The North West Shelf, through its contract with Guangdong Dapeng LNG, was Australia's biggest supplier of LNG to China in 2015.
- Australia's next biggest markets in 2015 were South Korea (1.8 million tonnes), India (0.9 million tonnes) and Singapore (0.8 million tonnes).
- According to EnergyQuest, Western Australia exported 6.4 million tonnes of LNG in the September quarter 2016, with Japan (4.6 million tonnes), China (1.2 million tonnes) and India (0.4 million tonnes) the main destinations.



Western Australia LNG (and associated infrastructure) investment project list (as at 31 October 2016)

Project	Stakeholders	Capex (A\$b)	Capacity (mtpa)	Start-up	Other Project Information
<b>North West Shelf</b> <i>Trains 1-5</i>	Woodside (16.67%) BHP (16.67%) BP (16.67%) Chevron (16.67%) MIMI (16.67%) Shell (16.67%)	29.5	16.7	1989	Trains 1 and 2 began in 1989. Train 3 began in 1992. Train 4 began in 2004. Train 5 began in 2008. In February 2016, Woodside announced that the total capacity of the North West Shelf's five LNG trains has increased from 16.3 mtpa to 16.7 mtpa.
<b>Pluto</b> <i>Train 1</i>	Woodside (90%) Tokyo Gas (5%) Kansai Electric (5%)	14.0	4.3	2012	Xena 1 field commenced production in June 2015. Expansion to a second train depends on the discovery of more gas.
<b>North Rankin</b> <i>Redevelopment</i>	see North West Shelf	5.0	n/a	2013	North Rankin Platform B will recover about 5 trillion cubic feet of gas from the North Rankin and Perseus fields.
<b>Greater Western Flank (Phase 1)</b> <i>Development</i>	see North West Shelf	2.5	n/a	Dec 2015	Phase 1 will recover 1.1 trillion cubic feet of gas to maintain North West Shelf output, via subsea tie-back to the existing Goodwyn A platform. Target fields in Phase 1 include Goodwyn GH and Tidepole. Production commenced in December 2015.
<b>Gorgon</b> <i>Trains 1-3</i>	Chevron (47.3%) ExxonMobil (25%) Shell (25%) Osaka Gas (1.25%) Tokyo Gas (1%) Chubu Electric (0.417%)	55.0	15.6	Mar 2016	Gorgon exported its first LNG cargo on 21 March 2016. Train 2 began production in October 2016. Train 3 first LNG is expected in the second quarter of 2017.
<b>Julimar-Brunello</b> <i>Development</i>	Woodside (65%) KUFPEC (35%)	1.4	n/a	Oct 2016	Woodside announced in October 2016 that it had completed construction and commissioning work. Commercial operation will commence once Wheatstone construction is complete. The Julimar and Brunello fields will feed 2.1 trillion cubic feet of gas to the Wheatstone LNG project. Woodside acquired Apache's interests in April 2015.
<b>Wheatstone</b> <i>Train 1 &amp; 2</i>	Chevron (64.14%) KUFPEC (13.4%) Woodside (13%) PE Wheatstone (8%) Kyushu Electric (1.46%)	40.0 <sup>^</sup>	8.9	Jun 2017	Chevron announced in January 2016 that the first LNG export from Train 1 has been delayed to mid-2017. Train 2 first LNG is expected six to eight months after first LNG from Train 1. In October 2016, Chevron announced an increase in project cost from US\$29 billion to US\$34 billion, with the cost increase attributed to a delay in module delivery. As at October 2016, all modules for Train 1 and Train 2 are on site.
<b>Ichthys</b> <i>Train 1 &amp; 2</i>	Inpex (62.3%) Total (30%) CPC (2.6%) Tokyo Gas (1.6%) Osaka Gas (1.2%) Kansai Electric (1.2%) Chubu Electric (0.7%) Toho Gas (0.4%)	19.0 <sup>1</sup>	n/a <sup>2</sup>	Sep 2017	Construction 81 per cent complete in December 2015. First LNG expected in 2017. <sup>1</sup> Western Australia has an estimated 50 per cent share of the project's total capital expenditure of A\$38.0 billion. <sup>2</sup> All LNG production is attributed to the Northern Territory.
<b>Persephone</b> <i>Development</i>	see North West Shelf	1.2	n/a	Dec 2017	FID made in November 2014. 68 per cent complete in July 2016. The Persephone Development will maintain Karratha Gas Plant output via subsea tie-back to the existing North Rankin complex.
<b>Prelude</b> <i>FLNG vessel</i>	Shell (67.5%) Inpex (17.5%) KOGAS (10%) OPIC (5%)	12.6	3.6	2018-20	Prelude's hull was floated out of dry dock in December 2013. Shell's Q4 2015 report states a 2018-20 start-up date for Prelude, rather than the previously announced June 2017 date. In addition to LNG, 1.3 mtpa of condensate and 0.4 mtpa of LPG will be produced. The vessel will operate at the Prelude gas field for 25 years.
<b>Greater Western Flank (Phase 2)</b> <i>Development</i>	see North West Shelf	2.8	n/a	Dec 2019	FEED commenced in December 2014 with FID made in December 2015. Phase 2 will recover 1.7 trillion cubic feet of gas to maintain North West Shelf output, via subsea tie-back to the existing Goodwyn A platform. Target fields in Phase 2 include Dockrell, Kreast, Lady Nora, Pemberton and Sculptor-Rankin.

Capex = capital expenditure mtpa = million tonnes per annum (export capacity addition) FEED = front-end engineering and design FID = final investment decision FLNG = Floating LNG

Note: <sup>^</sup> DSD estimate of Wheatstone capital expenditure in Australian dollar terms, taking into account the profile of capital expenditure and movements in the exchange rate across the construction period.

Sources: Deloitte Access Economics 'Investment Monitor', EnergyQuest 'Energy Quarterly', WA Chamber of Commerce and Industry 'Resources and Energy Projects Service', project proponent websites, reports, presentations and media.





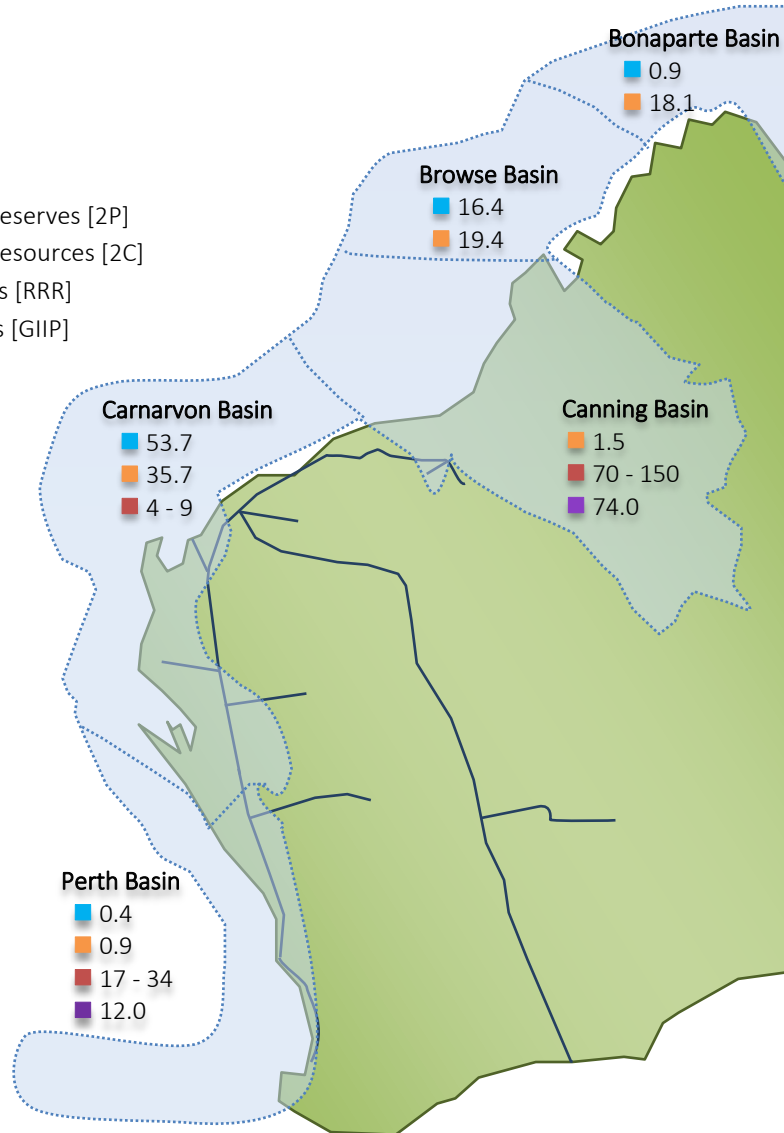
Western Australia's gas reserves and resources

- Western Australia's current and committed LNG projects source gas from offshore in the Carnarvon and Browse basins.
- The State's domestic gas needs are supplied through production facilities located in the Carnarvon and Perth basins.
- The State also has onshore shale and tight gas resources in the Canning, Carnarvon and Perth basins. While onshore drilling and exploration is occurring, it is in its early stages.

Gas reserves and resources in WA and the Joint Authority Jurisdiction (trillion cubic feet) – August 2016

LEGEND

- Gas pipeline
- ⋯ Gas basin
- Conventional gas reserves [2P]
- Conventional gas resources [2C]
- Shale gas resources [RRR]
- Tight gas resources [GIIP]



Reserves are categorised by probability or likelihood of recovery  
2P = reserves that are proved (90%) + probable (50%).

Contingent resources are known and recoverable, however are considered sub-economic at this point in time  
2C = contingent resources.

Resources can be assessed against the geologic and technical likelihood of success plus the amount that is technically able to be produced now  
RRR = DMP's current, best estimates of risked, recoverable resources.

GIIP = Gas-initially-in-place, referring to the estimated total amount of gas contained within the basin, including volumes that are deemed sub-economic, and which may never be recovered

Joint Authority Jurisdiction = the offshore area of Western Australia's coastline in which Commonwealth and State Ministers share decision-making powers under the *Offshore Petroleum Greenhouse Storage Act 2006*.

Note – map is indicative only. For more information on reserves and resources classification, see the Society of Petroleum Engineers' *Petroleum Resources Management System*.  
Source: *EnergyQuest Quarterly*; and *WA Department of Mines and Petroleum*.