Gas Resources in Australia: resources assessment and operation overview 2017

Upstream Petroleum Resources Working Group report to the COAG Energy Council
Executive summary

This report updates the 2016 report produced for the COAG Energy Council. Previous reports only considered unconventional gas resources. This version has been expanded to cover all gas resources; both conventional and unconventional. The table below shows a summary of conventional and unconventional gas production, reserves and resources by Australian jurisdiction. These datasets are incomplete as different data are collected and reported in each jurisdiction.

Annual production, reserves and resources by jurisdiction for 2017. This data is for unconventional and conventional gas unless otherwise stated.

<table>
<thead>
<tr>
<th></th>
<th>Annual production PJ</th>
<th>Reserves 2P PJ</th>
<th>Contingent Resources 2P PJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore</td>
<td>2,175</td>
<td>83,355</td>
<td>115,779</td>
</tr>
<tr>
<td>NSW</td>
<td>4</td>
<td>41</td>
<td>0</td>
</tr>
<tr>
<td>NT</td>
<td>4.98</td>
<td>207</td>
<td>7,411</td>
</tr>
<tr>
<td>QLD</td>
<td>1,413</td>
<td>39,832</td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>89</td>
<td>6,881</td>
<td></td>
</tr>
<tr>
<td>TAS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIC</td>
<td></td>
<td>37</td>
<td>29</td>
</tr>
<tr>
<td>WA</td>
<td>13.2</td>
<td>488</td>
<td>12,569</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,699.18</strong></td>
<td><strong>123,960</strong></td>
<td><strong>142,669</strong></td>
</tr>
</tbody>
</table>

Note: An empty field denotes a lack of data rather than a zero value. It indicates that data has not been collected and/or reported. Production refers to annual production, rather than cumulative production. New South Wales conventional and contingent resources, Queensland contingent resources, South Australia production, reserves and prospective resources are not included in the summary as this data is not reported. This table differs from the SPE PRMS classification as unrecoverable resources are not considered.

Key points

Commonwealth waters

The bulk of Australia’s Commonwealth waters reserves and contingent resources are located in offshore Western Australia, mostly in the Carnarvon Basin. The offshore Perth, Browse and Bonaparte basins in Western Australia, and the Bass (Victoria), Gippsland (Victoria) and Otway (Victoria and South Australia) basins are also prospective, with identified reserves and production.

New South Wales

There have been major changes in NSW exploration legislation, including new legislation, codes, guidelines, policies and conditions. New areas for conventional gas exploration must not conflict with local community and environmental interests.
Northern Territory
There is a moratorium on the hydraulic fracturing of shale reservoirs while a scientific inquiry is being conducted. The Inquiry is expected to be complete by the end of December 2017.

Queensland
Exploration drilling increased significantly in 2017, rebounding from the lowest levels observed since the late 1970’s. Production has significantly increased, which has accelerated the depletion of reserves, and focus has shifted onto transitioning mature resources to reserves through drilling and testing. Much of the drilling is related to the ongoing development of coal seam gas (CSG) resources in the Surat and Bowen basins.

South Australia
Exploration drilling activity in the Cooper Basin has slowed markedly associated with the global exploration downturn. Exploration targets include low permeability (tight) sandstones, as well as shale gas and deep coal seam gas resources. Despite three unconventional wells being in production, no reserves for unconventional petroleum have been reported in South Australia. Beach Energy recently reduced contingent resources from unconventional Cooper Basin gas acreage to nil due to a combination of high project costs and low gas prices, making commercial development unlikely. As such it is unlikely that substantial volumes of unconventional gas will be available to the gas market in the near term.

Tasmania
The moratorium on hydraulic fracturing remains in place until March 2020. There is only one active hydrocarbon exploration licence onshore in onshore Tasmania and no exploration activity has taken place in recent years.

Victoria
The state government has funded the $40 million Victorian Gas program from 2017–18 State Budget. It is a science-led initiative to understand Victoria’s conventional onshore and offshore gas potential. The program will provide a rigorous and auditable assessment and estimate of the prospective onshore conventional gas resources under Victoria’s jurisdiction by mid-2020. The program also includes resource planning, regulatory improvements and a comprehensive community engagement program. The program is focussed on the Otway Basin in south west Victoria and the Gippsland Basin in south east Victoria. There are currently no proved or probable onshore conventional and unconventional gas reserves in Victoria. The Victorian Gas Program follows a legislated extension to the moratorium on onshore conventional gas activities through to 30 June 2020. The program does not include onshore unconventional gas or hydraulic fracturing which the Government has permanently banned.

Western Australia
The state government has implemented a ban on hydraulic fracturing. However, Western Australia is considered to hold significant shale and tight gas resources, particularly in the Canning and Northern
Perth basins. The Northern Perth Basin is more likely to be able to produce unconventional shale and tight gas in the near term, being better placed near markets, infrastructure and pipelines. Due to the remoteness of other basins, transport and infrastructure will be a significant issue for future unconventional resource development.

The Waitsia Gas Project in the state's Northern Perth Basin is the largest onshore gas discovery in Western Australia in the last 30 years. First commercial gas flow has commenced and production will likely last for more than two decades. The Tubridgi gas storage facility is the largest gas storage facility in Western Australia and commenced gas injection on 10 June 2017.
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Northern Territory .................................................................................................................. 28
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South Australia ......................................................................................................................... 28
Victoria .................................................................................................................................... 29
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Prospective resources ............................................................................................................. 29
1 Methodology

1.1 Scope and assumptions

This report summarises onshore and offshore conventional and unconventional gas production, reserves and contingent resources in Australia by jurisdiction. Each section provides exploration highlights, the best estimate of reserves (2P) and contingent resources (2C), as well as drilling activity. Data is sourced from publicly available data published by state, territory and Commonwealth authorities. An overview of prospective resources is sourced from the Australian Energy Resources Assessment published by Geoscience Australia (AERA, 2017).

1.2 Petroleum reserves and resource classification

The Society of Petroleum Engineers has published the Petroleum Resources Management System (SPE PRMS) to standardise the reporting of petroleum reserves and resource volumes. The reporting matrix lists reserves and resources by commercial uncertainty in the vertical direction and technical uncertainty in the horizontal direction (Table 1.1). For the purposes of this report only 2P reserves and 2C contingent resources are reported.

It should be noted that only petroleum that is developed or is part of a current development project can be booked as reserves and petroleum that has been demonstrated to exist through exploration and testing can be booked as a contingent resource; the remainder should be booked as a prospective resource. There is a possibility that a contingent resource or a prospective resource may never become recoverable due to cost or the limitations of technology. A prospective resource may not exist at all as the assumptions used to predict its existence may be found to be invalid.

Table 1.1 PRMS resource classification system. Both conventional and unconventional resources are reported in this document.

<table>
<thead>
<tr>
<th>TOTAL PETROLEUM INITIALLY-IN-PLACE (PIIP)</th>
<th>PRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RESERVES</td>
</tr>
<tr>
<td></td>
<td>1P</td>
</tr>
<tr>
<td></td>
<td>2P</td>
</tr>
<tr>
<td></td>
<td>3P</td>
</tr>
<tr>
<td>DISCOVERED PIIP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CONTINGENT</td>
</tr>
<tr>
<td></td>
<td>RESOURCES</td>
</tr>
<tr>
<td></td>
<td>1C</td>
</tr>
<tr>
<td></td>
<td>2C</td>
</tr>
<tr>
<td></td>
<td>3C</td>
</tr>
<tr>
<td>SUB-COMMERCIAL</td>
<td></td>
</tr>
<tr>
<td>UNRECOVERABLE</td>
<td></td>
</tr>
<tr>
<td>UNDISCOVERED PIIP</td>
<td></td>
</tr>
<tr>
<td>PROSPECTIVE RESOURCES</td>
<td></td>
</tr>
<tr>
<td>Low Estimate</td>
<td></td>
</tr>
<tr>
<td>Best Estimate</td>
<td></td>
</tr>
<tr>
<td>High Estimate</td>
<td></td>
</tr>
<tr>
<td>UNRECOVERABLE</td>
<td></td>
</tr>
</tbody>
</table>
Resource estimates, including Contingent and Prospective, range from estimates of the number of methane molecules in all the rocks in a basin, to estimates of the volume that could be produced without consideration of technical factors and economics, or the amount likely to be produced given current technology and commercial considerations. It is important to consider the nature of these different types of estimates when looking at resources in the PRMS matrix.

A description of the definitions used can be found in the SPE Guidelines (SPE 2011). A non-technical guideline and the full guideline are also available (SPE 2007a and 2007b).
2 Australian Commonwealth waters

Summaries of the reserves, contingent resources and production from Commonwealth waters are shown in Table 2.1, Table 2.2 and Table 2.3.

2.1 Reserves and production

Table 2.1 Commonwealth waters conventional gas reserves and resources. Source: NOPTA (2017) based on 2015 resource reports. Note: conversion factors have been sourced from AERA (2017).

<table>
<thead>
<tr>
<th>COMMERCIAL</th>
<th>ANNUAL PRODUCTION 2,175 PJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESERVES</td>
<td>2P: 83, 355 PJ</td>
</tr>
<tr>
<td>SUB-COMMERCIAL</td>
<td>CONTINGENT RESOURCES 2C: 115, 779 PJ</td>
</tr>
</tbody>
</table>

Table 2.2 Commonwealth waters gas reserves and resources. Source: NOPTA (2017) based on 2015 resource reports. Note: conversion factors have been sourced from AERA (2017). An empty field does not denote a zero value. It indicates that data has not been collected and/or reported. Ashmore Cartier resources are included in the Western Australia reserves and resources.

<table>
<thead>
<tr>
<th>Offshore Area</th>
<th>Reserves 2P PJ</th>
<th>Contingent Resources 2C PJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Territory</td>
<td>22,454</td>
<td></td>
</tr>
<tr>
<td>Western Australia</td>
<td>78,441</td>
<td>89,752</td>
</tr>
<tr>
<td>Victoria and Tasmania</td>
<td>4,914</td>
<td>3,572</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>83,355</strong></td>
<td><strong>115,779</strong></td>
</tr>
</tbody>
</table>

Table 2.3 Gas production in Commonwealth waters. Source: NOPTA (2017).

<table>
<thead>
<tr>
<th>State</th>
<th>Cumulative production PJ</th>
<th>Annual production PJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria/Tasmania</td>
<td>11,388</td>
<td>365</td>
</tr>
<tr>
<td>Western Australia</td>
<td>29,091</td>
<td>1,810</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>40,479</strong></td>
<td><strong>2,175</strong></td>
</tr>
</tbody>
</table>
2.2 Drilling activity

Figure 2.1 Commonwealth waters drilling activity. Source: NOPTA (2017).
3 New South Wales

The New South Wales Government is taking steps to increase conventional gas exploration in the state by implementing the Strategic Release Framework in the NSW Gas Plan (from 2015 onwards). Potential areas will focus on conventional gas opportunities only and which will be subject to a rigorous regime that puts community and the environment first. No areas will be released for exploration unless the Government is convinced that exploration can be done safely and appropriately. These areas will be put to a competitive auction process where only fit and proper companies will be considered.

As such, there was a significant amount of regulatory and legislative change in New South Wales over 2015–2016, including the introduction of new legislation, codes, guidelines, policies and conditions. Most changes are now complete with new processes in place. It is envisaged that requirements for petroleum explorers and producers in New South Wales will be consistent with each other.

Major changes included:

- Revised Petroleum (Onshore) Act and Regulations (as of 1 March 2016).
- Work Health and Safety (Mines and Petroleum Sites) legislation (as of 1 February 2016).
- New petroleum title conditions. Existing title conditions will remain unchanged until next title renewal.
- Legislation to enact Strategic Release of petroleum titles (as of December 2015).
- Strategic Release Framework for Coal and Petroleum Exploration.
- Several new codes and guidelines related to drilling, community consultation, compliance, work programs, geoscientific reporting and annual activity reporting.

On 6 June 2017, the New South Wales Government began considering the release of two new areas for potential petroleum exploration in the Darling Basin. The identified areas lie within the Bancannia Trough (north of Broken Hill) and the Pondie Range Trough (north of Wilcannia) of the Darling Basin. These two areas in the Far West of New South Wales are located away from prime agricultural land and residential areas. Overseeing and advising on the release of new areas is the Advisory Body for Strategic Release (Advisory Body). The Advisory Body is an interagency group, with an independent Chair. The Advisory Body makes recommendations to the Minister.

3.1 Reserves and production

The only gas commercially produced in New South Wales is from AGL’s Camden Gas Project, which produces 4 PJ per annum (coal seam gas) from 91 wells (Table 3.1). There is also coal seam gas being produced from 17 surface wells in the Narrabri Gas Project, which includes Bibblewindi East, Bibblewindi West, Tintsfield and Dewhurst. AGL has announced that they will be withdrawing early from their Camden Gas Project in 2023, twelve years earlier than previously proposed. This follows a strategic decision from AGL that exploration and production of natural gas assets will no longer be a core business for the company due to the volatility of commodity prices and long development lead times.
Table 3.1 NSW gas reserves and resources (as of June 2015). Source: AGL Annual Reserves Assessment (2015). Note: New South Wales has no contingent resources.

<table>
<thead>
<tr>
<th></th>
<th>ANNUAL PRODUCTION</th>
<th>RESERVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMERCIAL</td>
<td>4 PJ (estimated)</td>
<td>2P: 41 PJ</td>
</tr>
<tr>
<td>SUB-COMMERCIAL</td>
<td>CONTINGENT RESOURCES</td>
<td>2C: 0 PJ</td>
</tr>
</tbody>
</table>

An application has been submitted to the New South Wales Department of Planning for Santos’s Narrabri Gas Project (SSD6456). The Environmental Impact Statement (EIS) was publicly available between 21 February and 22 May 2017. Currently the project is subject to the States rigorous planning process. The Narrabri Gas Project involves the potential development of a coal seam gas field comprising up to 850 gas wells on up to 425 well pads over 20 years. The construction of the project is expected to involve an estimated nominal capital investment of $3.6 billion. It also involves the construction and operation of gas processing and water treatment facilitates, including:

- A central gas processing facility for the compression, dehydration and treatment of gas.
- A water management facility for the storage and treatment of produced water.
- An in-field gas compression and water management facility.
- Water and gas gathering pipelines and ancillary infrastructure.

New South Wales, which imports more than 95% of its natural gas, is at risk of supply shortages and increasing prices. The New South Wales Government has identified the need to increase gas supply within the state to increase energy security and place downward pressure on prices. The Narrabri Project has the potential to supply up to 200 terajoules of natural gas per day, meeting up to half of NSW’s natural gas demand. Subject to project approval, the gas would be made available to the New South Wales market via a high pressure gas transmission pipeline (known as the proposed Western Slopes Pipeline) which would connect to the existing Moomba to Sydney gas pipeline.

### 3.2 Drilling activity

No petroleum wells have been drilled in NSW since 2014.
4 Northern Territory

Following the change in government in 2016, the Northern Territory Labor government commissioned Justice Rachel Pepper to conduct a *Scientific Inquiry into Hydraulic Fracturing in the Northern Territory*. During the course of the inquiry there is a moratorium on hydraulic fracturing on shale reservoirs. The Inquiry is expected to be completed by the end of December 2017 with the release of the final report in March 2018. At the end of this process the government will assess the inquiry recommendations and decide either to ban hydraulic fracturing or allow hydraulic fracturing in highly regulated and tightly prescribed areas.

4.1 Reserves and production

Summaries of the reserves, contingent resources and annual production from the Northern Territory are shown in Table 4.1 and Table 4.2.

*Table 4.1 Northern Territory gas reserves and resources. Source: Northern Territory Geological Survey (2017).*

<table>
<thead>
<tr>
<th>COMMERCIAL</th>
<th>ANNUAL PRODUCTION</th>
<th>RESERVES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.98 PJ</td>
<td>2P: 207 PJ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SUB-COMMERCIAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONTINGENT RESOURCES</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2C: 7,411 PJ</td>
</tr>
</tbody>
</table>

*Table 4.2 Northern Territory contingent resources and reserves. Source: Northern Territory Geological Survey (2017).*

<table>
<thead>
<tr>
<th></th>
<th>Reserves 2P PJ</th>
<th>Contingent Resources 2C PJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional resources</td>
<td>207</td>
<td>361</td>
</tr>
<tr>
<td>Unconventional resources</td>
<td>0</td>
<td>7,050</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>207</strong></td>
<td><strong>7,411</strong></td>
</tr>
</tbody>
</table>

4.2 Drilling activity

No drilling in 2017 for either exploration or development purposes.
5 Queensland

In 2017, petroleum exploration and appraisal increased by 204% in the state, with 73 wells spudded, following the lowest levels observed since the late 1970’s. This trend was not unique to Queensland. Investor certainty showed signs of improvement, as the price of oil rose from less than $40 USD/barrel in 2016 to over $60 USD/barrel in early 2018. The lull in exploration from 2015 was also likely a factor. As reserves continue to deplete through production, the need to discover and mature resources to reserves through drilling and testing grows. As such, a majority of the activity was related to pilot testing and near-field exploration, to support ongoing development of coal seam gas (CSG) resources in the play fairways of the Surat and Bowen basins.

Greater than 99% of development and 96% of production activities were focussed on CSG. Whilst the ramp up to bring the three LNG projects at Curtis Island online required an enormous amount of drilling, the future of development will be more cyclical; alternating between periods of drilling and production or workover activities. Petroleum drilling and production history in Queensland is shown in Figure 5.1 while further information on petroleum data can be found at https://data.qld.gov.au/dataset/petroleum-gas-production-and-reserve-statistics.

Improvements in the upstream side of the industry were notable, as were the outcomes of the downstream industry in Queensland. In Gladstone, the combined QCLNG, GLNG, and APLNG projects were working at 81% of the nameplate capacity of 20.2 Mt in 2017 up from 17.5 Mt in 2016 (http://www.gpcl.com.au/Pages/Trade-Statistics.aspx accessed 14 March 2018). AEMO’s Gas Statement of Opportunities (GSOO), updated in September 2017, showed a forecast demand of around 1300 PJ\(^1\) per year in 2018 and 2019 for LNG export while the domestic East Coast market is forecast at just above 460 PJ per year. It is clear that the need to explore and appraise will continue to increase to meet ongoing and growing international and domestic demand.

\(^1\) Conversion factor of 5.88 PJ/Mmbbl applied. Source: AERA, 2018.
5.1 Reserves and production

Summaries of the reserves, contingent resources and annual production from Queensland are shown in Table 5.1, Table 5.2 and Table 5.3.


<table>
<thead>
<tr>
<th>COMMERCIAL</th>
<th>ANNUAL PRODUCTION 1,413 PJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESERVES</td>
<td>2P: 39,832 PJ</td>
</tr>
<tr>
<td>SUB-COMMERCIAL</td>
<td>CONTINGENT RESOURCES 2C: No data</td>
</tr>
</tbody>
</table>

Table 5.2 Queensland reserves as of 31 December 2016. Source: Geological Survey of Queensland (2017).

<table>
<thead>
<tr>
<th>Reserves (PJ)</th>
<th>Adavale</th>
<th>Bowen</th>
<th>Clarence-Moreton</th>
<th>Cooper</th>
<th>Eromanga</th>
<th>Surat</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>0</td>
<td>165</td>
<td></td>
<td>130</td>
<td>4</td>
<td>11</td>
<td>309</td>
</tr>
<tr>
<td>Coal Seam Gas</td>
<td>9,157</td>
<td>86</td>
<td></td>
<td></td>
<td></td>
<td>30,21</td>
<td>39,523</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0</strong></td>
<td><strong>9,322</strong></td>
<td><strong>86</strong></td>
<td><strong>130</strong></td>
<td><strong>4</strong></td>
<td><strong>11</strong></td>
<td><strong>30,292</strong></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Production (PJ)</th>
<th>Bowen</th>
<th>Cooper</th>
<th>Eromanga</th>
<th>Surat</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>12</td>
<td>37</td>
<td>2</td>
<td>4</td>
<td>55</td>
</tr>
<tr>
<td>Coal Seam Gas</td>
<td>306</td>
<td></td>
<td></td>
<td>1,052</td>
<td>1,358</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>318</strong></td>
<td><strong>37</strong></td>
<td><strong>2</strong></td>
<td><strong>1,056</strong></td>
<td><strong>1,413</strong></td>
</tr>
</tbody>
</table>

Gas Resources in Australia: resources assessment and operation overview 2017
5.2 Drilling activity

*Figure 5.1 Historical petroleum drilling and production activity in Queensland from 1964 to 2017.*
6 South Australia

Exploration drilling activity in the Cooper Basin has slowed markedly as a result of the global downturn in the industry caused by the significant and sustained drop in the oil price. As a result, the main players in the Cooper have significantly reduced their operational expenditures, impacting drilling activity.

Over 850 fracture stimulations have been undertaken in the South Australian part of the Cooper Basin since production commenced in 1969. Some of these stimulations were in low permeability (tight) sandstones in the REM and Patchawarra Formation sequence that contain the shale gas and deep coal seam gas resources. Better than expected well performance suggests that these wells have been producing from unconventional reservoirs adjacent to tight sands.

Refer to Table 6.1 for estimates of recoverable (pending contingencies) resource volumes in unconventional reservoirs in the Cooper Basin across South Australia and Queensland. Potential exists in other basins – but less data is available to underpin estimates.

With regard to the timing of production, although three unconventional wells (Moomba 191, 193H and 194) have been producing for over four years, no reserves for unconventional petroleum have been reported in South Australia. It is unlikely that substantial volumes of gas from this resource will be available to the gas market in the short term.

The nature of resource plays is fully described in Chapters 2 and 4 of the Roadmap for Unconventional Gas Projects in South Australia (DMITRE South Australia, 2012). Core Energy (2016) also provides a summary of gas play types and potential.

6.1 Reserves and production

Minor production from recent shale gas exploration wells. The challenges associated with accelerating shale gas production are described at pages 158 and 159 of the Roadmap for Unconventional Gas Projects in South Australia (DMITRE South Australia, 2012).

Beach Energy reduced contingent resources associated with its operated unconventional gas acreage (PRLs 33 to 49 and ATP 855) to nil, following its completion of the Nappamerri Trough Natural Gas (NTNG) stage 1 exploration program. Analysis of the program results demonstrated that the high costs of the project and the low gas price environment means the NTNG project is unlikely to be developed commercially in the medium term (Beach 2016).
Table 6.1 South Australian reserves and resources. Resources are recoverable pending technical/financial contingencies. Note: No conventional resources are reported. Source: DMITRE South Australia (2012), Santos (2015), Strike Energy (2015, 2016).

<table>
<thead>
<tr>
<th>COMMERCIAL</th>
<th>ANNUAL PRODUCTION 89 PJ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RESERVES No data</td>
</tr>
<tr>
<td>SUB-COMMERCIAL</td>
<td>CONTINGENT RESOURCES 2C: 6,881 PJ</td>
</tr>
</tbody>
</table>

6.2 Drilling activity

Drilling activity has been low since the fall in the price of oil in late 2014. Santos, Beach Energy and Senex are exploring deep source rock plays in the Patchawarra Trough. Strike Energy is continuing to progress its deep coal project in the southern Cooper Basin. Senex Energy in their Joint Venture with Origin, drilled Silverstar 1 in mid-2017 to test basin centred and stratigraphic gas plays in the Patchawarra Trough. This is the only well drilled so far in 2017 to test unconventional reservoirs and the first since Senex Ethereal 1 was drilled in 2015–16.

Exploration for unconventional reservoir plays in the Cooper Basin has a long history, going back to the 1980s when tight gas reservoirs were targeted and massive fracture stimulations were trialled. Since 2010, focus shifted to lacustrine shale plays and deep source rocks (coal) and drilling activity peaked in 2012–13 (Table 6.2), largely driven by the Beach-Chevron JV and Santos JV drilling programs in the Nappamerri Trough.

Drilling activity has tapered off since then. Four wells were drilled during 2015 and one well in 2016 and so far in 2017 (Table 6.2 and Figure 6.1).

Table 6.2 Number of wells targeting natural gas in unconventional reservoirs, South Australia (to 20 September 2017). Source: Department of the Premier and Cabinet, South Australia (2017).

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of wells drilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2</td>
</tr>
<tr>
<td>2011</td>
<td>2</td>
</tr>
<tr>
<td>2012</td>
<td>13</td>
</tr>
<tr>
<td>2013</td>
<td>13</td>
</tr>
<tr>
<td>2014</td>
<td>6</td>
</tr>
<tr>
<td>2015</td>
<td>4</td>
</tr>
<tr>
<td>2016</td>
<td>1</td>
</tr>
<tr>
<td>2017</td>
<td>1</td>
</tr>
</tbody>
</table>
Figure 6.1 Number of wells targeting natural gas in unconventional reservoirs, South Australia (to 20 September 2017). Source: Department of the Premier and Cabinet, South Australia (2017).
7 Tasmania

The moratorium on hydraulic fracturing remains in place until March 2020. There is one active hydrocarbon exploration licence onshore Tasmania. No activity has taken place in recent years.

7.1 Reserves and production

No identified reserves or production.

7.2 Drilling activity

No drilling activity.
8 Victoria

The Victorian Government allocated funding in the State Budget 2017/18 to deliver the Victorian Gas Program, which includes onshore conventional gas, offshore gas and underground gas storage.

Studies will be undertaken by the Geological Survey of Victoria and will focus on the Otway Basin in south west Victoria and the Gippsland Basin in south east Victoria. All study results will be made publicly available.

Supporting programs include resource planning, regulatory improvements and a comprehensive engagement program for farmers, industry, local government and regional communities.

The COAG Energy Council agreed to expand the Gas Supply Strategy (GSS) on 25 August 2017 to include onshore gas more explicitly, offshore gas and underground gas storage.

The Victorian Gas Program supports commercial exploration for further discoveries of offshore gas off the Victorian coastline to help increase gas supply. This work will acquire new geoscientific information to identify prospective areas in the offshore part of the Otway Basin.

The Victorian Gas Program will investigate the opportunities for further underground gas storage in the onshore Otway Basin to help secure more reliable gas supplies and to mitigate short term price peaks, particularly during any interruptions in gas supply. This component of the Program incorporates analysis and modelling of geoscientific information to assess the potential of known subsurface geological structures for underground gas storage. The Program will also assess the economic potential of these geological formations.

There are no proved or probable onshore unconventional gas reserves in Victoria. The Resources Legislation Amendment (Fracking Ban) Act 2017 commenced on the 16 March 2017. The Act permanently bans onshore hydraulic fracturing and coal seam gas activities.

There are currently no proved or probable onshore conventional gas reserves in Victoria. The Fracking Ban Act extends the moratorium on onshore conventional gas through to 30 June 2020 to allow time to undertake comprehensive geoscientific and environmental studies on the risks, benefits and impacts of onshore conventional gas. This component of the Victorian Gas Program will be overseen by the Victorian Government’s Lead Scientist and a Stakeholder Advisory Panel with farmers, industry, local governments and communities. It will provide onshore conventional gas prospectivity and resource estimates, and evidence on any potential risks and benefits to inform future decisions by the Victorian Government.

Victoria’s gas reserves and contingent resources are located in coastal waters of the Otway Basin. The largest independent provider of storage services to the east coast gas market is the Iona Gas Plant in south west Victoria.

8.1 Reserves and production

Summaries of the reserves, contingent resources and annual production from Victoria are shown in Table 8.1 and Table 8.2.
Table 8.1 Victorian reserves and resources. Source: Department of Economic Development, Jobs, Transport and Resources (2017).

<table>
<thead>
<tr>
<th></th>
<th>ANNUAL PRODUCTION</th>
<th>RESERVES</th>
<th>CONTINGENT RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMERCIAL</td>
<td>No data</td>
<td>2P: 37 PJ</td>
<td>2C: 29 PJ</td>
</tr>
<tr>
<td>SUB-COMMERCIAL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 8.2 Victorian coastal waters and onshore reserves for the Halladale, Speculant and Blackwatch projects (as of 30 June 2017). Source: Origin Energy (2017).

<table>
<thead>
<tr>
<th></th>
<th>Reserves 2P PJ</th>
<th>Contingent Resources 2C PJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onshore</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Offshore – coastal waters</td>
<td>37</td>
<td>29</td>
</tr>
</tbody>
</table>

8.2 Drilling activity

There has been no drilling onshore in 2017.
Western Australia is considered to hold significant shale and tight gas resources in the Kimberley, East Pilbara and Midwest regions. Department of Mines, Industry Regulation and Safety, Western Australia, has shown that the state potentially contains an estimated 1,624,257 PJ (1,381 Tcf) of shale and tight gas initially in place (GIIP). Of this, approximately 1,240,810 PJ (1,054 Tcf) are in the Canning Basin (Kimberley and East Pilbara regions); 271,401 PJ (232 Tcf) are in the Northern Perth Basin (Midwest region); and 112,046 PJ (95 Tcf) are in the onshore Northern Carnarvon Basin (onshore).

The Canning Basin is recognised as having great shale and tight gas potential. Prospective formations have great areal extent although the extent of unconventional resources within them is currently unknown. Resource estimates assessing the whole of a formation across the basin should, therefore, be suitably discounted for this uncertainty. Due to the remoteness of the basin, transport and infrastructure will also be a significant issue in any unconventional resource development.

The Northern Perth Basin, however, is better placed near markets, infrastructure and pipelines and is more likely to see unconventional gas reach market first. It also holds the only tight gas fields currently progressed to the assessment stage of exploration, or as containing contingent resources.

The Waitsia Gas Project, located approximately 16.5 km east-southeast of Dongara in the state’s Midwest, is the largest onshore gas discovery in Western Australia in the last 30 years. The first commercial gas flow commenced from Waitsia Stage 1A in August 2016. Once in full production the Waitsia Gas Project is forecast to produce 2.67 Mm³/d (100 TJ/d) of gas from approximately 20 wells, for more than two decades.

The Tubridgi gas storage facility, located 30 km southwest of Onslow, is the largest gas storage facility in Western Australia. The facility commenced gas injection on 10 June 2017.

On 5 September 2017 state government announced its decision to implement a ban on hydraulic fracturing in existing and future petroleum titles in the South West, Peel and Perth metropolitan regions.

It has also placed a moratorium on hydraulic fracturing for the remainder of the state pending the results of a scientific inquiry.

### 9.1 Reserves and production

The reserves and resources for Western Australia are from both onshore and state coastal waters (Table 9.1 and Table 9.2). This includes Western Australia’s share of the Torosa field.
Table 9.1 Western Australia gas reserves and resources. Source: Department of Mines, Industry Regulation and Safety (2017).

<table>
<thead>
<tr>
<th>COMMERCIAL</th>
<th>ANNUAL PRODUCTION</th>
<th>13.2 PJ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RESERVES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2P: 488 PJ</td>
<td></td>
</tr>
<tr>
<td>SUB-COMMERICAL</td>
<td>CONTINGENT RESOURCES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2C: 12,569 PJ</td>
<td></td>
</tr>
</tbody>
</table>

Table 9.2 Western Australia gas reserves/resources and production. Source: Department of Mines, Industry Regulation and Safety (2017).

<table>
<thead>
<tr>
<th></th>
<th>Conventional Reserves 2P PJ</th>
<th>Conventional Contingent Resources 2C PJ</th>
<th>Production PJ</th>
<th>Unconventional Reserves 2P PJ</th>
<th>Unconventional Contingent Resources 2C PJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onshore</td>
<td>481.4</td>
<td>2,361</td>
<td>10.7</td>
<td>0</td>
<td>1,946</td>
</tr>
<tr>
<td>Offshore – coastal waters</td>
<td>6.6</td>
<td>8,262</td>
<td>2.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>488.0</strong></td>
<td><strong>10,623</strong></td>
<td><strong>13.2</strong></td>
<td><strong>0</strong></td>
<td><strong>1,946</strong></td>
</tr>
</tbody>
</table>

In the 2016–17 financial year only one appraisal well, Waitsia 3, was drilled. Nine wells were drilled for gas storage at Tubridgi.
10 Prospective resources

The following has been sourced from Australian Energy Resource Assessment (AERA) 2017. Table 10.1 summarises Geoscience Australia’s current best estimate of prospective resources in Australia, while acknowledging the broad range of available previous and current estimates, and the high degree of uncertainty associated with those estimates.

The development of new technologies and play concepts, and the advance of exploration into proven basins and frontier areas, mean that there are further opportunities for large conventional gas discoveries on- and offshore, and for unconventional discoveries onshore.

Table 10.1 Australia’s prospective gas resources. AERA (2017).

<table>
<thead>
<tr>
<th></th>
<th>PJ</th>
<th>Tcf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional gas</td>
<td>235,913</td>
<td>215</td>
</tr>
<tr>
<td>Coal seam gas</td>
<td>6,890</td>
<td>7</td>
</tr>
<tr>
<td>Tight gas</td>
<td>2,650,622</td>
<td>2,410</td>
</tr>
<tr>
<td>Shale gas</td>
<td>9,577,353</td>
<td>8,707</td>
</tr>
<tr>
<td>Total</td>
<td>12,470,778</td>
<td>11,339</td>
</tr>
</tbody>
</table>

10.1 Geoscience Australia onshore unconventional resources assessment

Geoscience Australia has assessed the potential for unconventional gas and oil in the onshore Gippsland, Otway, Perth, Cooper and Canning basins. This desktop assessment used only publicly available Australia-specific data as inputs and used a probabilistic volumetric methodology. Results of the assessment are quoted at confidence levels of 10%, 50%, 90% (P10, P50 and P90), and mean.

Not all the gas-in-place will be extractable and an estimate of 5% recovery was used. This recognises two factors. First, with few exceptions, there is no experience of how productive these reservoirs will be in Australia. Second, in the medium term (10–15 years), only a small fraction of the gas-in-place could be extracted because of the very early stage of exploration and the time needed to better define resources before production commences. The assessments indicate large volumes of gas-in-place but with a high degree of uncertainty. The ‘potentially recoverable gas resources’ in Table 10.2 can be regard as prospective resources.

Table 10.2 Shale and tight gas assessments by Geoscience Australia in selected basins.

<table>
<thead>
<tr>
<th>Basin / resource</th>
<th>Estimated gas-in-place (Tcf)</th>
<th>Potentially recoverable gas resource (5% of P50, Tcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P90</td>
<td>P50</td>
</tr>
<tr>
<td>Gippsland Basin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shale resources</td>
<td>66.5</td>
<td>111.7</td>
</tr>
<tr>
<td>Basin</td>
<td>Tight resources</td>
<td>Total</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>98.0</td>
<td>271.9</td>
</tr>
<tr>
<td></td>
<td>558.7</td>
<td>307.3</td>
</tr>
<tr>
<td></td>
<td>13.6</td>
<td>19.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Perth Basin</th>
<th>Shale resources</th>
<th>133.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shale resources</td>
<td>220.9</td>
<td>348.3</td>
</tr>
<tr>
<td>Shale resources</td>
<td>232.6</td>
<td>11.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cooper Basin</th>
<th>Shale resources</th>
<th>94.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shale resources</td>
<td>138.3</td>
<td>197.1</td>
</tr>
<tr>
<td>Shale resources</td>
<td>142.8</td>
<td>6.9</td>
</tr>
<tr>
<td>Tight resources</td>
<td>718.7</td>
<td>1,019.0</td>
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<tr>
<td>Tight resources</td>
<td>1,538.9</td>
<td>1,096.4</td>
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<tr>
<td>Total</td>
<td>57.9</td>
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</table>

<table>
<thead>
<tr>
<th>Canning Basin</th>
<th>Shale resources</th>
<th>5,305.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shale resources</td>
<td>7,799.4</td>
<td>12,013.0</td>
</tr>
<tr>
<td>Shale resources</td>
<td>8,339.7</td>
<td>390.0</td>
</tr>
<tr>
<td>Tight resources</td>
<td>246.8</td>
<td>969.1</td>
</tr>
<tr>
<td>Tight resources</td>
<td>2,520.8</td>
<td>1,213.4</td>
</tr>
<tr>
<td>Total</td>
<td>452.3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Otway Basin</th>
<th>Shale resources</th>
<th>24.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shale resources</td>
<td>31.8</td>
<td>40.8</td>
</tr>
<tr>
<td>Shale resources</td>
<td>32.2</td>
<td>1.6</td>
</tr>
<tr>
<td>Tight resources</td>
<td>26.7</td>
<td>115.2</td>
</tr>
<tr>
<td>Tight resources</td>
<td>421.6</td>
<td>180.0</td>
</tr>
<tr>
<td>Total</td>
<td>7.3</td>
<td></td>
</tr>
</tbody>
</table>
11 References


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