

Chapter 2

Background to unconventional gas mining

2.1 This chapter will:

- set out the status of unconventional gas mining in Australia;
- explain what unconventional gas mining is and where it occurs, including information on coal seam gas mining, shale and tight gas mining, hydraulic fracturing ('fracking') and underground coal gasification; and
- discuss the unconventional gas mining industry as a job creator and employer.

Status of unconventional gas mining in Australia

2.2 Unconventional gas mining, specifically, coal seam gas mining, is currently operational on a commercial production scale in Queensland and New South Wales. In Queensland, unconventional gas mining activity is underway in the Western Downs Region.

2.3 There is currently no commercial production of shale and tight gas in Australia.

2.4 On 4 February 2016, AGL announced that it expected to sell its natural gas assets in Queensland, cease production on the NSW Camden Gas Project in 2023, and not proceed with the planned NSW Gloucester Gas Project.¹

2.5 Exploration for unconventional gas mining is currently under way in Queensland,² and South Australia, Western Australia and the Northern Territory, which have shale and tight gas exploration.³

2.6 An immediate ban on underground coal gasification, a process by which coal is transformed into synthesis gas in situ, was announced on 18 April 2016 by the Queensland Minister for Natural Resources and Energy.⁴

1 AGL, 'Review of gas assets and exit of gas exploration and production', *Media release*, <https://www.agl.com.au/about-agl/media-centre/article-list/2016/february/review-of-gas-assets-and-exit-of-gas-exploration-and-production> (accessed 21 April 2016).

2 Queensland Department of Natural Resources and Mines, *Deep gas and oil in Queensland*, <https://www.dnrm.qld.gov.au/our-department/policies-initiatives/mining-resources/resources-policies/deep-gas-oil/deep-gas-oil-qld> (accessed 21 April 2016).

3 Santos, *Shale gas*, <https://www.santos.com/what-we-do/production/natural-gas/shale-gas/> (accessed 7 January 2016); Northern Territory Department of Mines and Energy, *Submission 37*, p. 6.

4 Minister for State Development and Minister for Natural Resources and Mines The Honourable Anthony Lynham, Minister for Environment and Heritage Protection and Minister for National Parks and the Great Barrier Reef The Honourable Steven Miles, 'Underground coal gasification banned in Queensland', *Joint statement*, <http://statements.qld.gov.au/Statement/2016/4/18/underground-coal-gasification-banned-in-queensland> (accessed 19 April 2016).

Unconventional gas mining

2.7 'Unconventional' resources are natural resources which require technology and investment greater than the industry standard in order to be recovered. Unconventional gas is found in complex geological systems, and includes coal seam gas (CSG), shale gas and tight gas. Unconventional gas resources include natural gas which is extracted from coal seams (coal seam gas/CSG) and from shale rock layers (shale gas).⁵

2.8 Natural gases like methane (CH₄) are fossil fuels formed naturally in the earth from decayed organic material.⁶ Methane makes up the majority of natural gas mixtures which are extracted by coal seam gas mining.

2.9 According to CSIRO, 'Australia has vast resources of unconventional gas', but it 'can be difficult to produce'.⁷ CSIRO explained the difference between conventional and unconventional gas:

Conventional natural gas and CSG are chemically similar. CSG is almost pure methane; conventional gas is around 90 per cent methane with ethane, propane, butane and other hydrocarbons making up the remainder. The difference between CSG/shale gas and conventional gas is the type of geological rock they are found in.⁸

2.10 According to Geoscience Australia, at the current rate of production in Australia there is a gas reserve life of around 150 years, however, they note that production rates are likely to substantially increase.⁹

Coal seam gas (CSG)

2.11 Gas from coal seams is typically extracted from depths of 300 to 1,000 metres and is a colourless, odourless mixture of gases, although the predominant gas is methane, making up 95-97 per cent of the mixture.¹⁰

5 Geoscience Australia, *Unconventional petroleum resources*, <http://www.ga.gov.au/scientific-topics/energy/resources/petroleum-resources/unconventional-resources> (accessed 3 November 2015).

6 Roger Beckman, *Guide to gas*, Australian Parliamentary Library Publication, http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/4133159/upload_binary/4133159.pdf;fileType=application%2Fpdf#search=%22guide%20to%20gas%22 (accessed 24 November 2015).

7 CSIRO, *What is unconventional gas?*, <http://www.csiro.au/en/Research/Energy/Hydraulic-fracturing/What-is-unconventional-gas> (accessed 24 November 2015).

8 CSIRO, *What is unconventional gas?*, <http://www.csiro.au/en/Research/Energy/Hydraulic-fracturing/What-is-unconventional-gas> (accessed 24 November 2015).

9 Geoscience Australia, *Atlas of minerals resources, mines and processing centres*, http://www.australianminesatlas.gov.au/education/fact_sheets/coal_seam_gas.html (accessed 7 January 2016).

10 CSIRO, *What is unconventional gas?*, <http://www.csiro.au/en/Research/Energy/Hydraulic-fracturing/What-is-unconventional-gas> (accessed 24 November 2015).

2.12 Coal seam gas (CSG) can be extracted vertically or horizontally to access as much of the gas reservoir as possible. In order to access coal seam gas, a well is drilled to a depth of 300 to 1,000 metres to reach a coal seam. The well is lined with cement and steel casings near the surface in order to protect groundwater from becoming contaminated. Water in the coal seam is pumped out in order to release stored gas, although if the water and gas do not flow freely, hydraulic fracturing may be used.¹¹

Hydraulic fracturing

2.13 Hydraulic fracturing requires a perforation to the well casing to allow access to the coal, after which water containing chemical additives (hydraulic fracturing fluid) is pumped at high pressure to open existing fractures called 'cleats'. A proppant (such as sand) is then added to the water, which keeps the fractures open, allowing gas to flow to the well and up to the surface. Once at the surface, the extracted gas is separated from the water and is processed for transportation and use. Chemicals and salts are removed from the water, and the water is then re-used or disposed of.¹²

2.14 The Department of Environment and Heritage Protection (QLD) set out the process for the disposal of hydraulic fracturing fluid:

After a reservoir rock formation has been fraced, fracing fluids mixed with groundwater (collectively known as fracc flowback water) are pumped out of the well. This water is stored in specially designed and constructed dams or above ground holding tanks. Fracc flowback water may be reused in subsequent fracing activities or treated to the appropriate environmental and human health standards for other uses.

After fracing has occurred, the quality and quantity of fracc flowback water must be monitored until one-and-a-half times (150 per cent) the amount of the fluid used in the fracc has been removed from the well. This is to ensure that all water used for the fracc is removed.

Comprehensive impact monitoring requirements for landholders (sic) bores can continue for up to five years after fracing has occurred.¹³

2.15 According to the industry sector, the fluid used to open fractures during the hydraulic fracturing process is made up of water (84 to 96 per cent), proppant (3 to 15 per cent), and chemical and toxic substances. CSIRO set out some commonly used additives in hydraulic fracturing fluid:

- guar gum (a food thickening agent) is used to create a gel that transports sand through the fracture

11 CSIRO, *What is unconventional gas?*, <http://www.csiro.au/en/Research/Energy/Hydraulic-fracturing/What-is-unconventional-gas> (accessed 24 November 2015).

12 CSIRO, *What is unconventional gas?*, <http://www.csiro.au/en/Research/Energy/Hydraulic-fracturing/What-is-unconventional-gas> (accessed 24 November 2015).

13 Department of Environment and Heritage Protection (QLD), *Disposal of fracing fluid*, <https://www.ehp.qld.gov.au/management/non-mining/disposal-fracing-fluid.html> (accessed 6 January 2016).

- bactericides, such as sodium hypochlorite (pool chlorine) and sodium hydroxide (used to make soap), are used to prevent bacterial growth that contaminates gas and restricts gas flow
- 'breakers', such as ammonium persulfate (used in hair bleach), that dissolve hydraulic fracturing gels so that they can transmit water and gas surfactants, such as ethanol and the cleaning agent orange oil, are used to increase fluid recovery from the fracture
- acids and alkalis, such as acetic acid (vinegar) and sodium carbonate (washing soda) to control the acid balance of the hydraulic fracturing fluid.¹⁴

2.16 The Queensland Government estimates that of the 5,000 conventional and domestic petroleum and gas wells currently in Queensland, around 400 wells (or eight per cent) have been fracked. They further estimate that 'as the industry expands, between 10 and 40 per cent of wells may be fracked'.¹⁵

2.17 The NSW Department of Industry, Energy and Resources states that horizontal drilling has emerged 'as an alternative to hydraulic fracturing and [is] increasingly used in NSW'.¹⁶ Horizontal drilling was developed in the 1980s in the United States, and has enabled unconventional deposits to be reached more easily.¹⁷ Once a vertical well has been drilled to the coal seam and lined with cement, smaller holes are drilled horizontally into the coal seam, removing the need for hydraulic fracturing.¹⁸ Horizontal wells can extend several kilometres.

2.18 Coal seam gas has been used for energy in Australia since 1997. Currently, CSG production fields are located in the Bowen and Surat Basins in Queensland.

Shale gas

2.19 Shale is a fine-grained rock made up of compressed deposits of mud, silt, clay and organic matter, and makes up more than half of the earth's sedimentary rock.

2.20 Shale has a low permeability, allowing fluid and gas to pass through it. Over time, the heat of burial causes the organic matter to transform into oil, and then into

14 CSIRO, *What is hydraulic fracturing?*, <http://www.csiro.au/en/Research/Energy/Hydraulic-fracturing/a-What-is-hydraulic-fracturing> (accessed 24 November 2015).

15 Department of Environment and Heritage Protection (QLD), *Fracking*, <https://www.ehp.qld.gov.au/management/non-mining/fracking.html> (accessed 6 January 2016).

16 NSW Department of Industry, *How is coal seam gas extracted?*, <http://www.resourcesandenergy.nsw.gov.au/landholders-and-community/coal-seam-gas/the-facts/how-is-coal-seam-gas-extracted> (accessed 6 January 2016).

17 Victorian Parliament, *Inquiry into onshore unconventional gas in Victoria - Final Report*, December 2015, p. 10.

18 NSW Department of Industry, *How is coal seam gas extracted?*, <http://www.resourcesandenergy.nsw.gov.au/landholders-and-community/coal-seam-gas/the-facts/how-is-coal-seam-gas-extracted> (accessed 6 January 2016).

natural gas (shale gas). Shale gas is mainly made up of methane, and is typically found at depths greater than 1,000 metres.¹⁹

2.21 Shale gas can travel to an overlying rock layer, such as sandstone, and form a reservoir, which can be exploited as conventional gas. However, the gas can be trapped in the shale, or be absorbed onto clay minerals and organic matter. Shale gas reservoirs require fracturing in order to allow the gas to flow.²⁰ Horizontal drilling is often used in the exploitation of shale gas to maximise the recovery of the gas.²¹

2.22 The process for shale gas production includes an exploration phase and a production phase:

The exploration phase of shale gas production involves drilling and fracturing vertical wells to verify the presence of gas, characterise it and determine whether it can be economically produced. The number of wells drilled in the exploration phase can range from two to 15 wells in a lease area. Up to 30 wells may be drilled to gain more data on the pressure and geology of the resource.

...

Once a shale formation is located by vertical drilling, the direction of the drill bit is changed to run horizontally to maximise the wells exposure to the reservoir.²²

2.23 During the production phase, gas is 'recovered' from the wells:

Recovery of the gas from an individual well can range from 28-40 per cent of the total gas present...Historically the average well spacing for vertical wells is 400 metres while spacing between horizontal wells is a function of the shape of the induced fractures, but is often at least 800 metres. Operators aim to increase well spacing to reduce costs and environmental impacts.²³

19 CSIRO, *Shale gas production*, <http://research.csiro.au/oilandgas/wp-content/uploads/sites/49/2015/10/Shale-Gas-Production-2015.pdf> (accessed 24 November 2015).

20 CSIRO, *Shale gas production*, <http://research.csiro.au/oilandgas/wp-content/uploads/sites/49/2015/10/Shale-Gas-Production-2015.pdf> (accessed 24 November 2015).

21 Victorian Parliament, *Inquiry into onshore unconventional gas in Victoria - Final Report*, December 2015, p. 12.

22 CSIRO, *Shale gas production*, <http://research.csiro.au/oilandgas/wp-content/uploads/sites/49/2015/10/Shale-Gas-Production-2015.pdf> (accessed 24 November 2015).

23 CSIRO, *Shale gas production*, <http://research.csiro.au/oilandgas/wp-content/uploads/sites/49/2015/10/Shale-Gas-Production-2015.pdf> (accessed 24 November 2015).

Underground coal gasification

2.24 Underground coal gasification is a process by which coal is transformed into a gas. In this process, coal seams are partially burnt in situ to release a mixture of carbon monoxide and hydrogen, known as synthesis gas or 'syngas'.²⁴ Syngas can be used to generate electricity once at the surface and 'offers the potential to extract energy from coal seams that are too deep to mine economically'.²⁵

2.25 Syngas refers to:

...a mixture primarily of hydrogen (H₂) and carbon monoxide (CO) which may also contain significant but lower concentrations of methane (CH₄) and carbon dioxide (CO₂) as well as smaller amounts of impurities such as chlorides, Sulfur compounds, and heavier hydrocarbons.

...

Syngas is used as an intermediate in the industrial synthesis of ammonia and fertilizer...One of the uses of this syngas is as a fuel to manufacture steam or electricity. Another use is as a basic chemical building block for many petrochemical and refining processes.²⁶

2.26 Underground coal gasification has occurred in Australia in three locations:

- Kingaroy, Queensland;
- Bloodwood Creek, near Dalby, Queensland; and
- near Chinchilla, Queensland.²⁷

2.27 On 18 April 2016, the Queensland State Development Minister and Minister for Natural Resources and Mines, Dr Anthony Lynham, announced an immediate ban on underground coal gasification.²⁸ Dr Lynham said:

24 Linc Energy, *Overview of Underground Coal Gasification 01 UCG Series*, http://www.lincenergy.com/data/info_sheets/Underground_Coal_Gasification.pdf (accessed 19 April 2016).

25 Roger Beckman, *Guide to gas*, Australian Parliamentary Library Publication, http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/4133159/upload_binary/4133159.pdf;fileType=application%2Fpdf#search=%22guide%20to%20gas%22 (accessed 24 November 2015).

26 Abhishek Nandan, Nihal Anwar Siddiqui, Prasenjit Mondal, Kanishak Chaudhary, Rishi Pandey, 'Hazards Associated to Synthesis Gas and its Mitigation Measures', *Research J. Engineering and Tech.* 5(3): July - September, 2014, 144-146, p. 144.

27 Minister for State Development and Minister for Natural Resources and Mines The Honourable Anthony Lynham, Minister for Environment and Heritage Protection and Minister for National Parks and the Great Barrier Reef The Honourable Steven Miles, 'Underground coal gasification banned in Queensland', *Joint statement*, <http://statements.qld.gov.au/Statement/2016/4/18/underground-coal-gasification-banned-in-queensland> (accessed 19 April 2016).

We have looked at the evidence from the pilot-operation of UCG and we've considered the compatibility of the current technologies with Queensland's environment and our economic needs.

The potential risks to Queensland's environment and our valuable agricultural industries far outweigh any potential economic benefits...

The ban applies immediately as government policy, and I will introduce legislation to the Parliament by the end of the year to make it law.²⁹

2.28 The ban was announced in response to serious environmental and health issues associated with the Chinchilla project.

2.29 On 10 June 2015, the Queensland Government commenced legal action against Linc Energy, alleging that their underground coal gasification plant had contaminated the soil around the Hopeland area of Queensland with carbon monoxide, hydrogen and hydrogen sulphide.³⁰

2.30 Issues related to the health impacts associated with unconventional gas mining and evidence considered by the committee is discussed in Chapter 3.

Location and operation of unconventional gas mining in Australia

Coal seam gas mining

2.31 Queensland and New South Wales are the only states with commercial production of coal seam gas, although exploration has occurred in other states. Unconventional gas has been mined in Queensland since 1996, and in New South Wales since 2001.

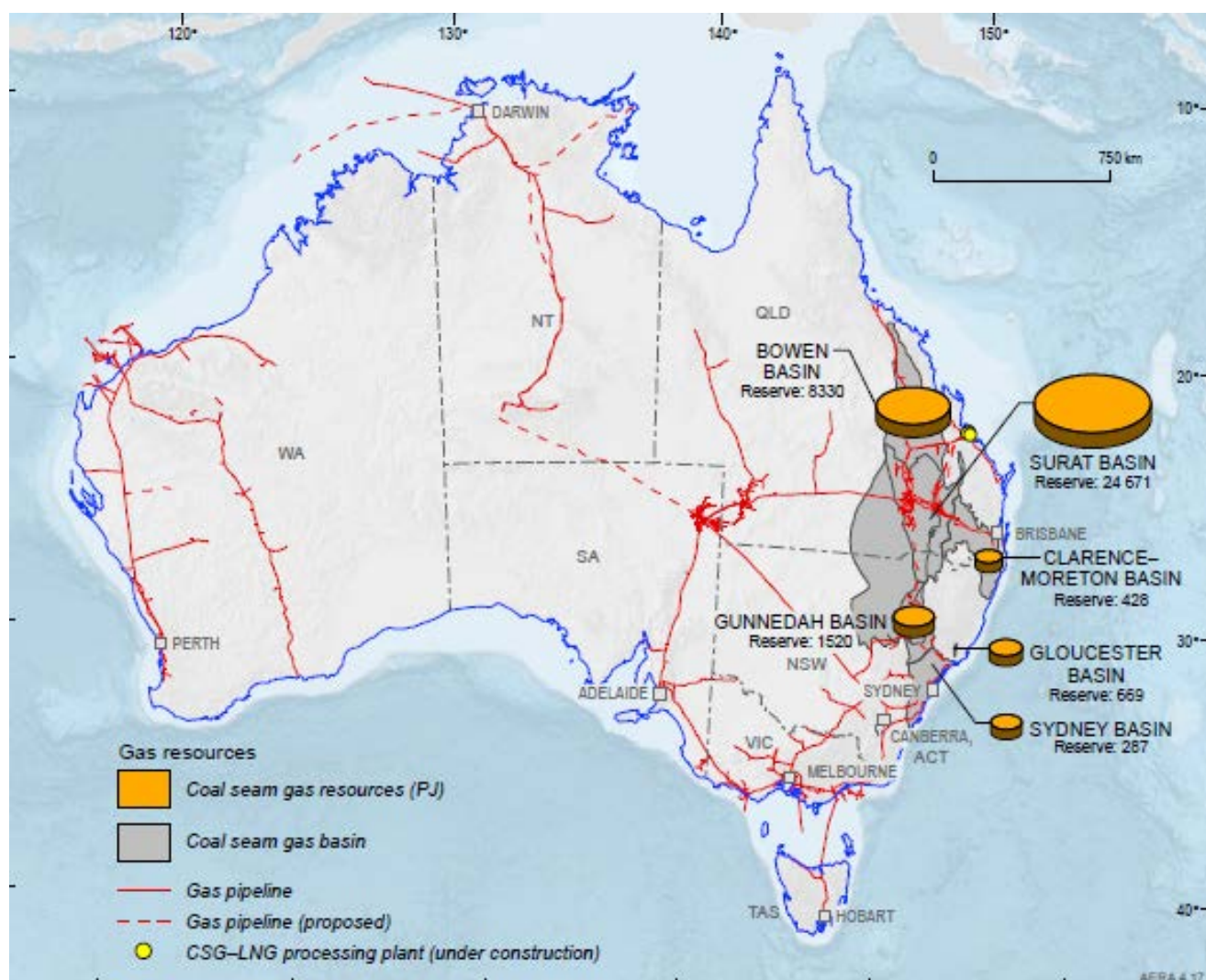
2.32 Australia's main reserves of coal seam gas are found on the eastern side of the country, in Queensland and New South Wales, with the two largest basins (the Surat Basin and the Bowen Basin) located in Queensland. The map below (Map 1) shows coal seam gas reserves and gas infrastructure.

28 Minister for State Development and Minister for Natural Resources and Mines The Honourable Anthony Lynham, Minister for Environment and Heritage Protection and Minister for National Parks and the Great Barrier Reef The Honourable Steven Miles, 'Underground coal gasification banned in Queensland', *Joint statement*, <http://statements.qld.gov.au/Statement/2016/4/18/underground-coal-gasification-banned-in-queensland> (accessed 19 April 2016).

29 Minister for State Development and Minister for Natural Resources and Mines The Honourable Anthony Lynham, Minister for Environment and Heritage Protection and Minister for National Parks and the Great Barrier Reef The Honourable Steven Miles, 'Underground coal gasification banned in Queensland', *Joint statement*, <http://statements.qld.gov.au/Statement/2016/4/18/underground-coal-gasification-banned-in-queensland> (accessed 19 April 2016).

30 Queensland Department of Environment and Heritage Protection, *Legal action follows Hopeland soil investigations*, <https://www.ehp.qld.gov.au/mediareleases/2015-06-10-legal-action-hopeland-soil-investigations.html> (accessed 21 April 2016).

2.33 Smaller amounts are found on the Queensland-New South Wales border in the Clarence-Moreton Basin, and in New South Wales in the Gunnedah, Gloucester and Sydney Basins.



Map 1: Locations of coal seam gas reserves and gas infrastructure (Source: Australian Energy Resource Assessment, Second Edition, p. 97)

Queensland

2.34 The Western Downs Region of Queensland, including Dalby, Tara and Chinchilla, has been at the centre of Queensland's power generation industry.

Arrow Energy

2.35 The Dalby area's main gas field is part of the Surat Gas Project, managed by Arrow Energy. Arrow Energy plans to expand its operations in the Surat Basin with 'a major coal seam gas (CSG) exploration, development and production project',

providing 'gas for both domestic and export markets', which will cover an area from Wandoan to Dalby, and down to the south-west of Millmerran.³¹

2.36 The expansion is projected to include around 6,500 coal seam gas wells, with produced gas expected to supply coal seam gas to a train on Curtis Island, and to domestic uses such as electricity generation at two power stations.³²

2.37 Around 6,000 km of transportation pipelines will move the gas and water from the wells to treatment facilities.³³

2.38 The project is expected to require around 7,500 production wells, with a peak rate of around 400 wells drilled per year. In addition, 18 production facilities will be constructed, requiring a range of gas pipelines, water pipeline, and generators.³⁴

Queensland Gas Company (QGC)

2.39 QGC is a major producer of coal seam gas from the Surat and Bowen Basins in Queensland. QGC stated that in 2010, they produced around 20 per cent of Queensland's natural gas.³⁵

2.40 QGC has constructed the Queensland Curtis LNG (QCLNG) coal seam gas liquefaction plant, on Curtis Island, off the coast of central Queensland. A 540km buried pipeline transports gas from the gas fields to Curtis Island, for export.

2.41 QGC's drilling operations are concentrated in the Western Downs, near Dalby, Chinchilla and Miles, with exploration work taking place in the Bowen Basin:

QGC expects to drill 6000 wells over more than 4500 sq km of tenements by 2030. These wells tap the Walloon Coal Measures about 300 to 800 metres underground.³⁶

2.42 The Kenya gas plant is operated by QGC near Tara, Queensland, and draws gas from three gas fields known as 'Lauren', 'Codie' and 'Kate'.

2.43 QGC have stated that they 'do not operate on private land without landholder agreement'.³⁷

31 Arrow Energy, *Surat Gas Project*, <https://www.arrowenergy.com.au/projects/surat-gas-project> (accessed 12 January 2016).

32 Arrow Energy, *Surat Gas Project*, <https://www.arrowenergy.com.au/projects/surat-gas-project> (accessed 12 January 2016).

33 Arrow Energy, *Surat Gas Project*, <https://www.arrowenergy.com.au/projects/surat-gas-project> (accessed 12 January 2016).

34 Arrow Energy, *Surat Gas Project Environmental Impact Statement – Executive Summary*, p. 3.

35 Mr Jim Knudsen, Senior Vice President, QGC, Address to Rural Press Club, July 2011, <http://www.qgc.com.au/media/142210/qgcruralpressclub.pdf> (accessed 11 February 2016).

36 QGC, *Where we work*, <http://www.qgc.com.au/qclng-project/where-we-work.aspx> (accessed 11 February 2016).

37 QGC, *Where we work*, <http://www.qgc.com.au/qclng-project/where-we-work.aspx> (accessed 11 February 2016).

Linc Energy

2.44 Linc Energy established a Demonstration Facility near Chinchilla in Queensland in 1999 to demonstrate underground coal gasification and gas-to-liquids (GTL). As discussed above, underground coal gasification converts coal to a gas (sometimes called syngas or synthesis gas) where it lies under the ground.

2.45 In 2013, the facility entered the 'decommissioning stage'. According to Linc Energy, this stage is 'an important part of the process to demonstrate that the area can be effectively rehabilitated'.³⁸

2.46 As noted above, underground coal gasification was banned in Queensland on 18 April 2016.

2.47 The committee notes that on 15 April 2016, Linc Energy announced that they had entered voluntary administration.³⁹

2.48 As discussed above, the Queensland Government has commenced legal action against Linc Energy, alleging that the soil around the Hopeland area of Queensland has been contaminated with carbon monoxide, hydrogen and hydrogen sulphide as a result of underground coal gasification.⁴⁰

New South Wales

2.49 A report of the NSW Legislative Council Committee noted in 2012 that unconventional gas mining activity was increasing in New South Wales:

Technological advancements, including improved techniques to identify and drill for coal targets, have stimulated the emergence of the coal seam gas industry in New South Wales. However, industry activity has been mostly limited to exploration, with only a small number of coal seam gas projects given approval to commence production, including:

- Camden Gas Project (Stages 1 and 2) - AGL Energy Limited
- Gloucester Gas Project - AGL Energy Limited
- Narrabri Gas Project - Santos
- Richmond Valley Power Station and Casino Gas Project - Metgasco⁴¹

38 Linc Energy, *UGC in Australia*, http://www.lincenergy.com/clean_energy_australia.php (accessed 11 February 2016).

39 Linc Energy, *Linc Energy enters into Voluntary Administration*, http://lincenergy.listedcompany.com/newsroom/20160415_142826_BRE_VPRNW41R87KXGD92.1.pdf (accessed 21 April 2016).

40 Queensland Department of Environment and Heritage Protection, *Legal action follows Hopeland soil investigations*, <https://www.ehp.qld.gov.au/mediareleases/2015-06-10-legal-action-hopeland-soil-investigations.html> (accessed 21 April 2016).

41 New South Wales Legislative Council General Purpose Standing Committee (No. 5), *Final report – Coal seam gas*, May 2012, p. 11, http://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/29AE48525CFAEA7CCA2578E3001ABD1C?open&refnavid=CO4_2.

2.50 AGL announced on 4 February 2016 that it would not pursue the Gloucester Gas Project, and would cease production on the Camden Gas Project in 2023. Metgasco is continuing to seek the formal award of a production licence from the NSW Government for the Richmond Valley Power Station and Casino Gas Project.⁴²

2.51 Currently, the two producers of coal seam gas in New South Wales are Santos and AGL, who run the Narrabri Gas Project and Camden Gas Project respectively.

2.52 The Narrabri Gas Project, operated by Santos, is producing small amounts (0.2 PJ) of coal bed methane which is being used to power the Wilga Park Power Station.⁴³ The AGL-owned Camden Gas Project is the largest producer of coal seam gas in New South Wales. In 2009, it produced 5.6 PJ and aimed to supply around six per cent of the New South Wales domestic gas market.

2.53 On 4 February 2016, AGL announced that it would divest itself of gas assets in New South Wales and that it would not be proceeding with the Gloucester Gas Project, north of Newcastle, where it had proposed more than 300 gas wells. AGL is reportedly planning to sell its natural gas assets in Queensland at Moranbah, Silver Springs and Spring Gully.⁴⁴

2.54 AGL said that:

...following a review, [AGL] has taken a strategic decision 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.⁴⁵

Shale and tight gas mining

2.55 Shale and tight gas resources are spread across the interior of Australia. The map below (See Map 2) shows locations of these gas reserves. There is currently no commercial production of shale or tight gas in Australia, although exploration has

42 Metgasco, *Quarterly activities report 30 June 2015*, <http://www.metgasco.com.au/asx-announcements/quarterly-activities-report-3> (accessed 26 April 2016). According to Metgasco, the production licence has not yet been issued owing to issues relating to native title.

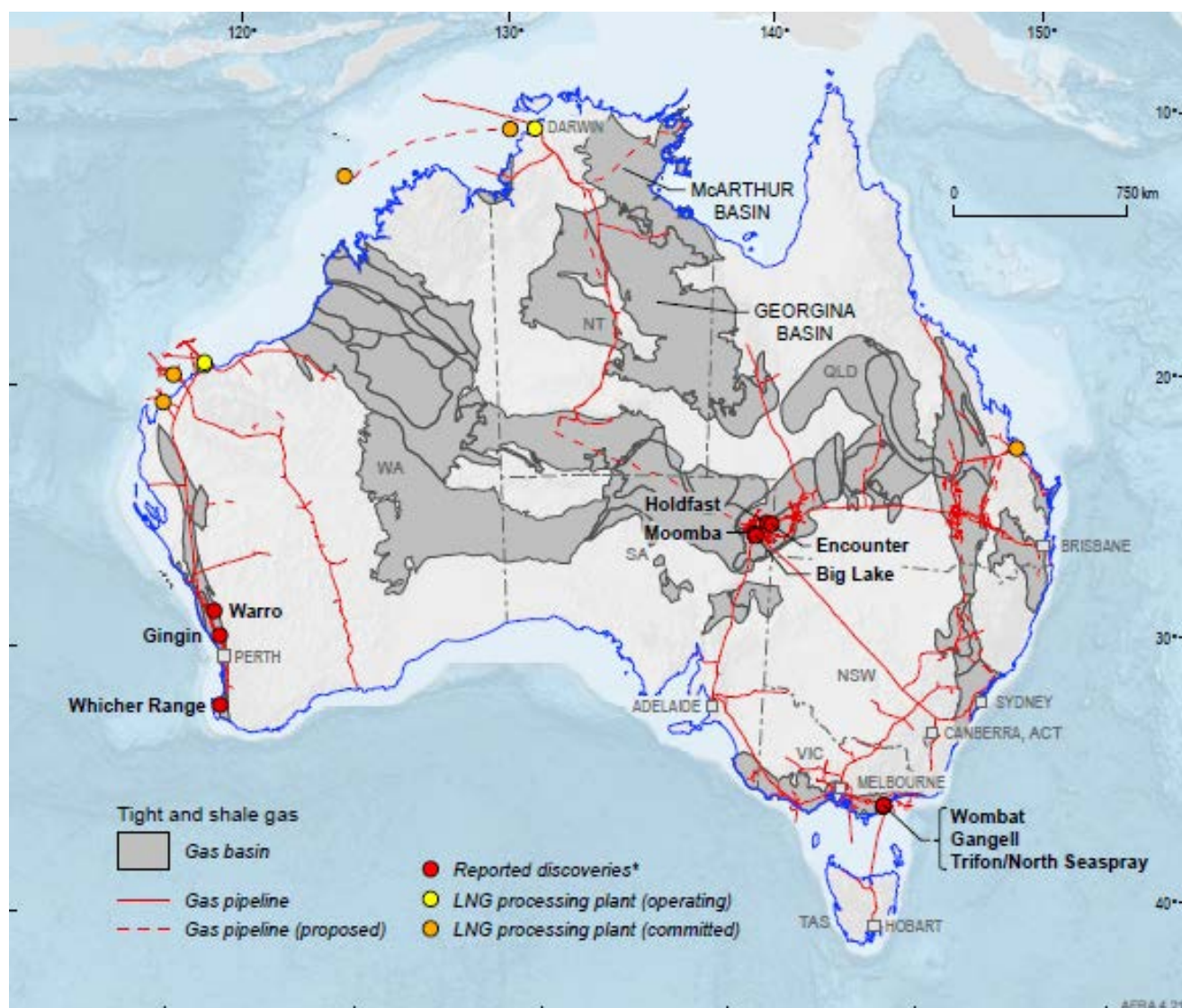
43 New South Wales Legislative Council General Purpose Standing Committee (No. 5), *Final report – Coal seam gas*, May 2012, p. 11, http://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/29AE48525CF8EA7CCA2578E3001ABD1C?open&refnavid=CO4_2.

44 AGL, 'Review of gas assets and exit of gas exploration and production', *Media release*, <https://www.agl.com.au/about-agl/media-centre/article-list/2016/february/review-of-gas-assets-and-exit-of-gas-exploration-and-production> (accessed 21 April 2016).

45 AGL, 'Review of gas assets and exit of gas exploration and production', *Media release*, <https://www.agl.com.au/about-agl/media-centre/article-list/2016/february/review-of-gas-assets-and-exit-of-gas-exploration-and-production> (accessed 21 April 2016).

occurred and in 2012 Santos announced the successful extraction of shale gas from the Cooper Basin in South Australia.⁴⁶

2.56 The Australian Energy Resource Assessment, produced by Geoscience Australia, reviews 'factors likely to influence the use of Australia's energy resources to 2035'. The most recent assessment, published in 2014, notes that Australia currently has no reserves of tight gas, although sources have been identified in the Cooper, Gippsland and Perth Basins. Resources of tight gas in 'established conventional gas-producing basins are located relatively close to infrastructure and are currently being considered for commercial production'.⁴⁷



Map 2: Locations of shale and tight gas resources (Source: Australian Energy Resource Assessment, Second Edition, p. 97)

46 Victorian Parliament, *Inquiry into onshore unconventional gas in Victoria - Final Report*, December 2015, p. 26. See also: Santos, *Shale gas*, <https://www.santos.com/what-we-do/production/natural-gas/shale-gas/> (accessed 7 January 2016).

47 Australian Energy Resource Assessment, Second Edition, p. 98.

The unconventional gas mining industry as a job provider

2.57 In February 2014, the Australian Petroleum Production and Exploration Association (APPEA) claimed that the liquefied natural gas (LNG) industry had created 100,000 jobs across the Australian economy.⁴⁸

2.58 However, this figure was disputed by The Australia Institute who said that:

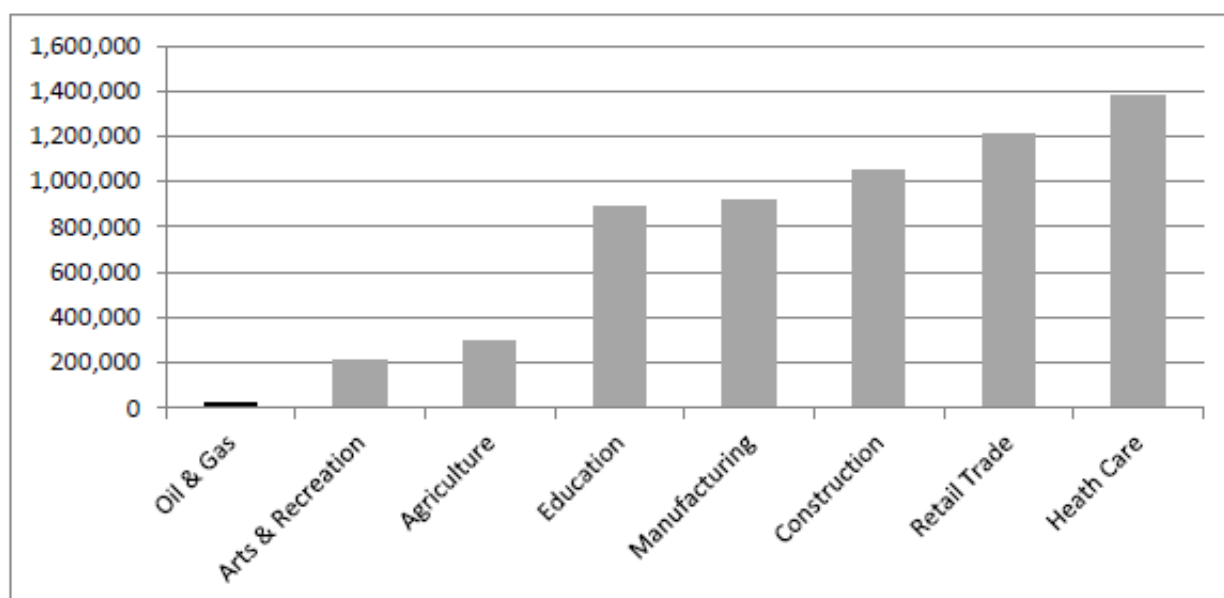
[t]he CSG industry clearly does create some jobs. But the number of people it employs is far lower than many of the industry's exaggerated claims suggest.⁴⁹

2.59 The Australia Institute noted that the Australian Bureau of Statistics (ABS) does not draw a distinction between oil and gas mining, but instead provides a combined employment figure.⁵⁰

2.60 According to the ABS, in May 2015 there were 27,500 people employed full time in oil and gas extraction.⁵¹

2.61 The Australia Institute provided the following table of employment in Australia by selected industry. In August 2013, that figure was 20,700 people.⁵²

Figure 1: Employment in Australia by selected industry



Source: ABS (2013a) 6291.0.55.003 - Labour Force.

48 APPEA, *Policy reform would deliver big dividends*, <http://www.appea.com.au/2014/02/policy-reform-will-deliver-big-dividends/> (accessed 5 April 2016).

49 The Australia Institute, *Frack the future*, pp ix-x.

50 The Australia Institute, *Frack the future*, p. ix.

51 ABS, 6291.0.55.003 Labour Force, Australia, Detailed, Quarterly.

52 The Australia Institute, *Frack the future*, p. x.

2.62 Although specific employment data for coal seam gas mining is not available from the ABS, APPEA provide data on the coal seam gas industry by quarter. APPEA's fourth quarter 2015 statistics set out the following data for employment in the coal seam gas industry:⁵³

Employment		No. added in last half	No. at half year end
Direct Employees	number	-1,489	3,981
Contractor Employees	number	-7,699	9,095
Total	number	-9,188	13,076

2.63 The Northern Territory Department of Mines and Energy (DME) submitted that the unconventional gas mining industry would provide employment opportunities in the Northern Territory:

At some stage, a workforce will be required to enable this industry to grow, and the majority of the people living in the remote regions of the NT are Indigenous. While the work in the next few years in the sector will be seasonal and intermittent in nature, job opportunities will exist in this period leading up to more sustained employment opportunities, as the industry moves into the development and production phases.⁵⁴

2.64 APPEA and the major gas companies have submitted that the unconventional gas mining industry is a strong job creator and offers employment opportunities in regional and remote locations.⁵⁵

2.65 Further, the DME note that although employment is generally a corporate consideration, there is a legislative requirement to consider Indigenous employment:

...when a petroleum title is granted on Aboriginal Land Rights (NT) Act 1976 (ALRA) affected land, Indigenous employment is incorporated in the terms and conditions of the access agreements.⁵⁶

2.66 Santos submitted that they have developed voluntary land agreements with Traditional Owners, and have worked towards employment of Indigenous people:

Santos has specific programs, managed in-house, to create employment resulting from our projects and supports programs that focus on school retention and participation in education and training.⁵⁷

53 APPEA, *CSG Industry data 2015*, http://www.appea.com.au/wp-content/uploads/2016/03/Q4-2015-Total-CSG-Industry-Data_FINAL.pdf (accessed 5 April 2016). In the fourth quarter of 2014, the total number of people employed in the CSG industry was 29,000, APPEA, *CSG industry data 2014*, http://www.appea.com.au/wp-content/uploads/2015/05/Q4-2014-Total-CSG-Industry-Data_Final.pdf (accessed 5 April 2016).

54 Northern Territory Department of Energy and Mines, *Submission 37*, p. 6.

55 APPEA, *Submission*, p. 4.

56 Northern Territory Department of Energy and Mines, *Submission 37*, p. 7.

2.67 Santos highlighted one particular example of engagement with Indigenous people:

As part of its commitment to Aboriginal participation, Santos engaged a local Aboriginal owned and operated earthmoving business, Rusca Bros Mining Pty Ltd, to prepare the access road and lease pad for an exploration hole drilled the McArthur Basin.

Rusca had an impressive record for Aboriginal employment, but on this project increased its workforce through employment of local Traditional Owners.⁵⁷

2.68 The Lock the Gate Alliance Northern Territory raised concerns over the sustainability of the jobs created:

Employment opportunities in the gas industry are limited. Almost all gas industry jobs are for the construction phase only. Ongoing local employment opportunities are minimal with the majority of skilled workers fly-in-fly-out.⁵⁸

2.69 Mr Eddie Mason, a traditional owner of the Bulachani clan and member of Protect Arnhem Land, submitted that:

My people have training in health, trades and education. We have walls covered in certificates and yet we are not given a chance to get a job on our country, as the Government keeps flying people in.⁵⁹

57 Santos, *Submission 57*, p. 26.

58 Santos, *Submission 57*, p. 26.

59 The Lock the Gate Alliance Northern Territory, *Submission*, p. 6.

60 Protect Arnhem Land, *Submission*, p. 2.

