Report to the CoAG Energy Council

australian petroleum production & exploration association limited

Unconventional Gas in Australia

July 2016

the voice of Australia's oil and gas industry

About APPEA

The Australian Petroleum Production & Exploration Association Ltd (APPEA) is the peak national body representing the oil and gas exploration, development and production industry in Australia. The Association's members account for more than 95 per cent of Australia's petroleum production and the vast majority of exploration. APPEA's membership also includes many companies providing services to the industry.

APPEA works with Australian governments to promote the development of the nation's oil and gas resources in ways that maximise the return to the Australian industry and community. APPEA aims to secure regulatory and commercial conditions that enable member companies to operate safely, sustainably and profitably. The Association also seeks to increase community and government understanding of the upstream petroleum industry by publishing information about the sector's activities and economic importance to the nation.

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Executive Summary

For decades, natural gas has been a major part of Australia's energy mix and an essential feedstock for the manufacturing sector. Gas demand has risen steadily over the last 40 years.

Until recently, the demand for natural gas has been met from 'conventional' gas reserves onshore and offshore (e.g. the Cooper, Gippsland and Carnarvon basins). However, in eastern Australia production from established sources has generally peaked and is now in decline.

Since 1996, Queensland has pioneered the use of coal seam gas (CSG) for the production of domestic gas supplies and liquefied natural gas (LNG) exports. Queensland's growing unconventional reserves are easily the largest single source of natural gas in eastern Australia.

Outside Queensland, unconventional gas production is in its infancy. Other jurisdictions have significant unconventional gas resources which could be developed to supply domestic users. Santos's proposed Narrabri project, for example, could supply 50 per cent of New South Wales' gas demand. The Northern Territory and Western Australia have promising resources which could underwrite significant industrial development. In some instances, difficult market conditions and political issues have inhibited development of these resources.

As production from established, conventional gas fields will begin to fall as early as 2017, eastern Australia will need to rapidly develop unconventional gas reserves to meet the demand for gas. The shift to greater use of unconventional gas in Australia parallels developments in other countries: the International Energy Agency (IEA) forecasts unconventional gas production will almost triple from 2013 to 2040, with 60 per cent of the growth in global gas supply from unconventional sources.[1]

This report is a first attempt to collate across jurisdictions a consistent data set for unconventional gas activities. The report shows that substantial activities are underway to find and develop unconventional gas reserves.

[1] IEA, World Energy Outlook 2015.

Background

On 4 December 2015, the Council of Australian Governments' (COAG) Energy Council met in Canberra. At the meeting, Energy and Resources Ministers noted:

"The Council has released a Gas Supply Strategy which includes four key streams:

- *Increased sharing of geoscience and other information about potential resources to improve certainty around gas supply data;*
- *Strengthening scientific rigour and the sharing of information to improve baseline and monitoring data of unconventional gas resources across the community;*
- *Harmonising regulatory frameworks to manage risk and address issues; and*
- *Improving collaboration to promote industry best practice.*

The Strategy will be complemented by a range of other measures."

The Council requested the Australian Petroleum Production & Exploration Association (APPEA) prepare an "Unconventional Gas Activities Report" which would, for the first time, collate nationally consistent information on unconventional gas developments in Australia. As data is primarily held by State and Territory agencies, APPEA is working with jurisdictions to collect data and identify information gaps. This report is a first step towards a comprehensive national report. APPEA acknowledges the support given by the States and the Northern Territory.

Some of the information in this report is drawn from APPEA's submission to the Senate Select Committee on Unconventional Gas Mining in March 2016 (available on the APPEA website).

APPEA welcomes feedback on this report.

What is Unconventional Gas?

"Unconventional" gas is simply natural gas. Both "conventional" gas and "unconventional" gas are predominantly methane. Coal seam gas (CSG) is almost pure methane whereas conventional gas may also contain ethane, propane, butane, and other hydrocarbons. In general, gas reserves are classified as "conventional" or "unconventional' according to the geology of the resource:

- "Conventional" gas reservoirs largely consist of porous sandstone formations capped by impermeable rock, with the gas stored at high pressure. Australia's remaining conventional gas reserves are largely (but not exclusively) offshore. Conventional gas usually flows to the production well and to the surface under pressure, though some wells need compression to flow. This type of production has historically been the source of most natural gas, hence the term "conventional". Onshore conventional gas has been produced in many jurisdictions in Australia for decades.
- "Unconventional" gas reservoirs include coal seams, shale, and tight sandstone formations. CSG is found in coal seams where methane is bonded to the surface of coal particles and held there by water pressure. The technical term for this is 'adsorption'. To extract CSG, water already in the coal seam, known as formation water, must be pumped out to reduce the reservoir pressure and release the gas. Shale gas and tight gas occur within rock formations that have extremely low permeability, making it difficult for gas to flow to wells.

Different geologies can require different techniques to extract natural gas. While hydraulic fracturing is often associated with unconventional gas extraction, the frequency of fracturing varies considerably. Hydraulic fracturing has been rarely used in CSG and conventional gas production (to date only about 6 per cent of wells in Queensland have required hydraulic fracturing).

However, hydraulic fracturing is necessary in shale gas and tight gas wells to increase the flow of gas from the reservoir.

Underground coal gasification (UCG) is often confused with coal seam gas production, but it is an entirely different process to natural gas extraction. UCG involves partially burning coal seams in situ and then extracting the "syngas" produced. Syngas is not methane, but a mixture of carbon monoxide and hydrogen. As UCG is not part of the natural gas industry, APPEA does not represent UCG operators and this report does not provide data on UCG operations.

Australia's Unconventional Gas Resources

By world standards, Australia has substantial unconventional gas resources. The US Energy Information Administration (EIA) estimates that Australia has the sixth largest shale oil resource (18 billion barrels) and the seventh largest shale gas resource (437 trillion cubic feet) in the world.[2] Australia's CSG resources are estimated to be around 6 per cent of the world's coal seam gas resources at 235 trillion cubic feet (4.6 million PJ) (Geoscience Australia 2012)[3] .

The EIA notes that "these shale oil and shale gas resource estimates are highly uncertain and will remain so until they are extensively tested with production wells." The Australian Council of Learned Academies' investigation into shale gas agrees:

> *"… there is an urgent need to encourage shale gas exploration in Australia to provide a clearer picture of the extent of the resources and to safeguard Australia's position as a major world gas exporter and to improve resource and reserve estimates."*[4]

Australia's oil and gas supplies are categorised as either resources or reserves. Resources refer to the total estimated stock of oil and gas. Reserves is a narrower measure that estimates the quantities of the resource which can be extracted *on a commercial basis*.

The Society of Petroleum Engineers[5], in conjunction with other global bodies, has established a framework for the reporting of reserves and resources (the Petroleum Resource Management System). The system has three broad categories:

- **Proved Reserves** (1P) are quantities of petroleum which, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be commercially recoverable, from a given date forward, from known reservoirs and under defined economic conditions, operating methods, and government regulations. If deterministic methods are used, the term 'reasonable certainty' is intended to express a high degree of confidence that the quantities will be recovered. If probabilistic methods are used, there should be at least a 90 per cent probability that the quantities actually recovered will equal or exceed the estimate.
- **Probable Reserves** are those additional reserves that geoscience and engineering data indicate are less likely to be recovered than Proved Reserves but more likely to be recovered than Possible Reserves. It is equally likely that the quantities recovered will be greater than or less than the sum of the estimated Proved plus Probable Reserves (2P). If

[2] US Energy Information Administration, 'Shale oil and shale gas resources are globally abundant', http://www.eia.gov/todayinenergy/detail.cfm?id=14431.

[3] Australian Gas Resource Assessment 2012 http://www.ga.gov.au/webtemp/image_cache/GA21116.pdf

[4] Australian Council of Learned Academies, 'Securing Australia's Future – Engineering energy: unconventional gas production', www.acola.org.au/index.php/projects/securing-australia-s-future/project-6, P.22.

[5] See: www.spe.org/industry/reserves.php

probabilistic methods are used, there should be at least a 50 per cent probability that the actual quantities recovered will equal or exceed the 2P estimate.

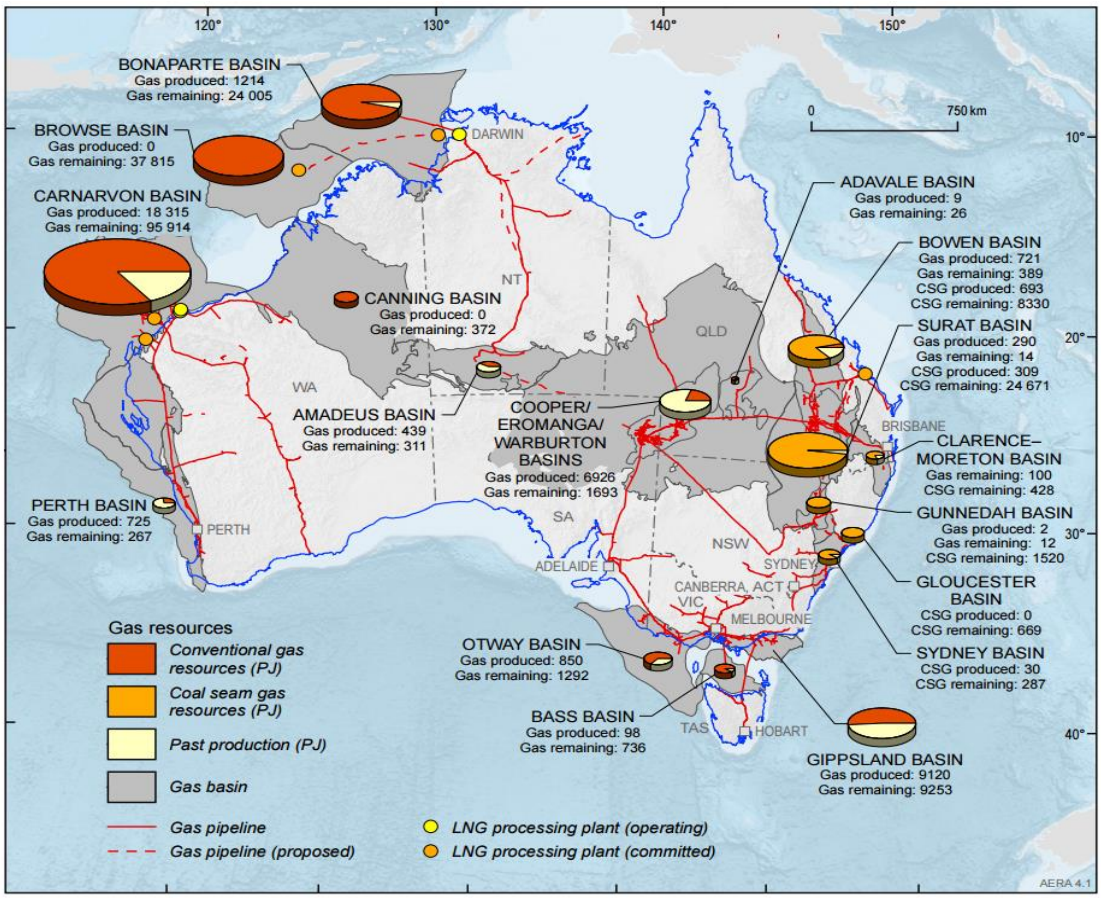
- **Possible Reserves** are additional reserves that geoscience and engineering data suggest are less likely to be recoverable than Probable Reserves. The total quantities recovered have a low probability to exceed the sum of Proved plus Probable plus Possible (3P) Reserves, which is equivalent to the high estimate scenario. If probabilistic methods are used, there should be at least a 10 per cent probability that the actual quantities recovered will equal or exceed the 3P estimate.

The best estimate of recovery from committed projects is generally considered to be the 2P sum of proved and probable reserves; 2P estimates are generally used in this report. **Contingent Resources** are less certain than reserves. Contingent resources are quantities considered recoverable but are not yet feasible due to technological or business hurdles, or environmental and/or governmental approval constraints. **Prospective Resources** are an estimate of the potential volumes associated with undiscovered accumulations.

Estimates will change over time as more information is obtained from geoscience research and exploration or as changing market conditions make some deposits more or less commercial. [6]

The location of Australia's gas resources is illustrated in Figure 1.

Figure 1: Location of Australia's Gas Resources and Infrastructure[7]



[6] The full technical definition of resources and reserves is available through the Society of Petroleum Engineers - www.spe.org/industry/docs/Petroleum_Resources_Management_System_2007.pdf.

[7] Geoscience Australia – Note For remaining resources, conventional gas values represent total demonstrated resources; CSG values show 2P reserves.

In many cases, accurate information on Australia's unconventional gas reserves is unavailable due to insufficient exploration and data.

For many years, Geoscience Australia has been reporting estimated reserves, resources and production of Australia's unconventional petroleum to the Council of Australian Governments. The most recent report shows the following 2P reserves, resources and prospective resources:

Table 1: Coal Seam, Shale and Tight Gas Reserves and Resources[8]

State	2P Reserves (PJ)	2P Contingent Resources (PJ)	3P Prospective Resources (PJ)
Queensland	42,434	24,841	174,719
New South Wales	3,082	10,656	
Victoria		755	452
Tasmania			
South Australia		8,034	123,034
Western Australia	37	2,358	146,400
Northern Territory			257,276
Total	**45,553**	**46,644**	**701,881**

Table 2 aggregates total reserves and resources.

Table 2: Coal Seam, Shale and Tight Gas in Australia Resource Assessment[9]

TOTAL PETROLEUM INITIALLY-IN-PLACE (PIIP)	**DISCOVERED PIIP**	**COMMERCIAL**	**PRODUCTION: 343 PJ in 2014**		
			RESERVES 1P: 371 PJ	**RESERVES** **2P: 45,553 PJ**	RESERVES 3P: 3,331 PJ
		SUB-COMMERCIAL	CONTINGENT RESOURCES 1C: 7,132 PJ	**CONTINGENT RESOURCES** **2C: 46,644 PJ**	CONTINGENT RESOURCES 3C: 49,286 PJ
	UNDISCOVERED PIIP		PROSPECTIVE RESOURCES Low Estimate: 60,000 PJ	**PROSPECTIVE RESOURCES** **Best Estimate: 702,000 PJ**	PROSPECTIVE RESOURCES High Estimate: 281,000 PJ

NOTE: Not all jurisdictions have reported volumes for each category, so totals will not be indicative of the distribution of resources across each category. Some data has been rounded.

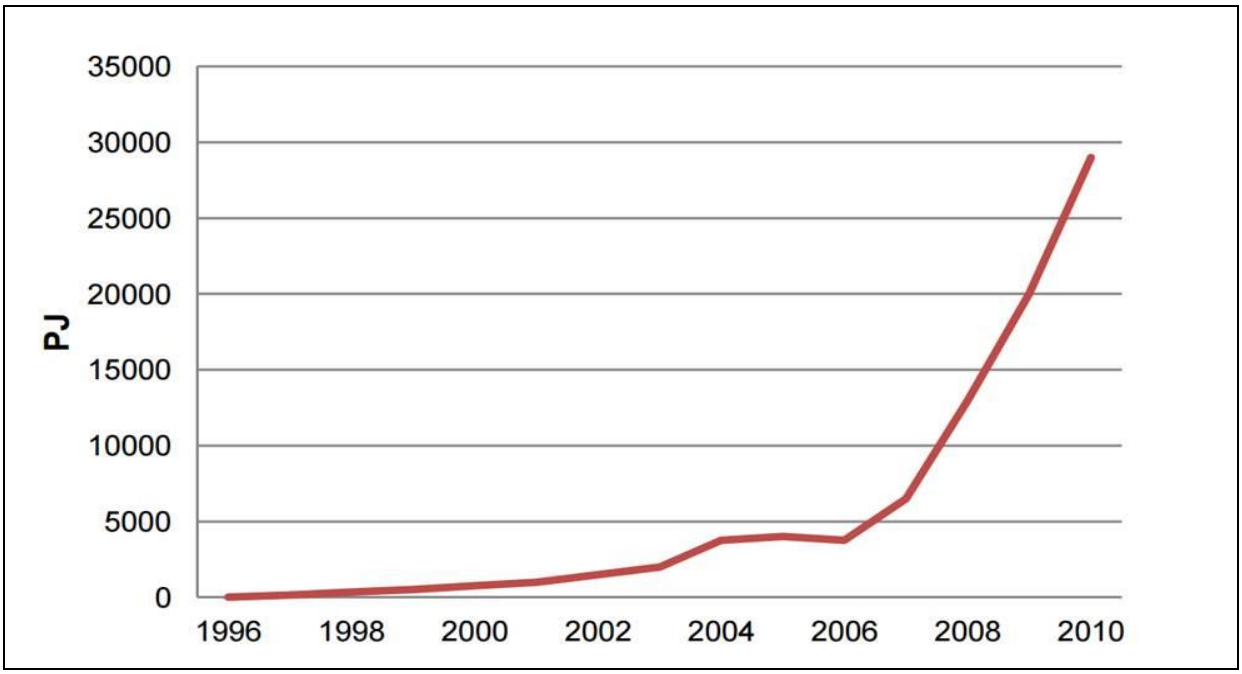
The level of reported 2P coal seam gas reserves for the period 1996 to 2010 is outlined in Chart 1. The rapid growth recorded in the years 2007 to 2010 corresponded with a period when project proponents were assessing options to develop the resource base through gas exports.

[8] Geoscience Australia, 'Upstream Petroleum and Offshore Minerals Working Group Inaugural Report to the Standing Council on Energy and Resources on Unconventional Reserves, Resources, Production, Forecasts and Drilling Rates' https://scer.govspace.gov.au/files/2013/12/Gas-Reserves-Resources-Production-Reporting.docx

[9] ibid

This supports the proposition that the extensive exploration effort required to prove up the new reserves would not have occurred without the prospect of LNG exports.

Chart 1: Coal Seam Gas 2P Reserves: 1996 to 2010



Source: Australian Energy Resource Assessment

While we have a detailed understanding of Queensland's gas resources and reserves, much more exploration is required in other Australian jurisdictions to achieve comparable knowledge.

While the resource potential of New South Wales and onshore Victoria is difficult to predict due to sparse exploration data, it is clear that eastern Australia's reserves are overwhelmingly unconventional. In Victoria, the onshore portions of both the Gippsland and Otway Basins have been identified as regions where unconventional gas may be found. In 2015, Geoscience Australia estimated Victoria's unconventional resource potential could be 755 PJ (2C) with prospective resources of 1,212 PJ.[10] New South Wales has 2P reserves of over 3,000 PJ, with contingent reserves up to 16,913 PJ.

Australia's Gas Markets

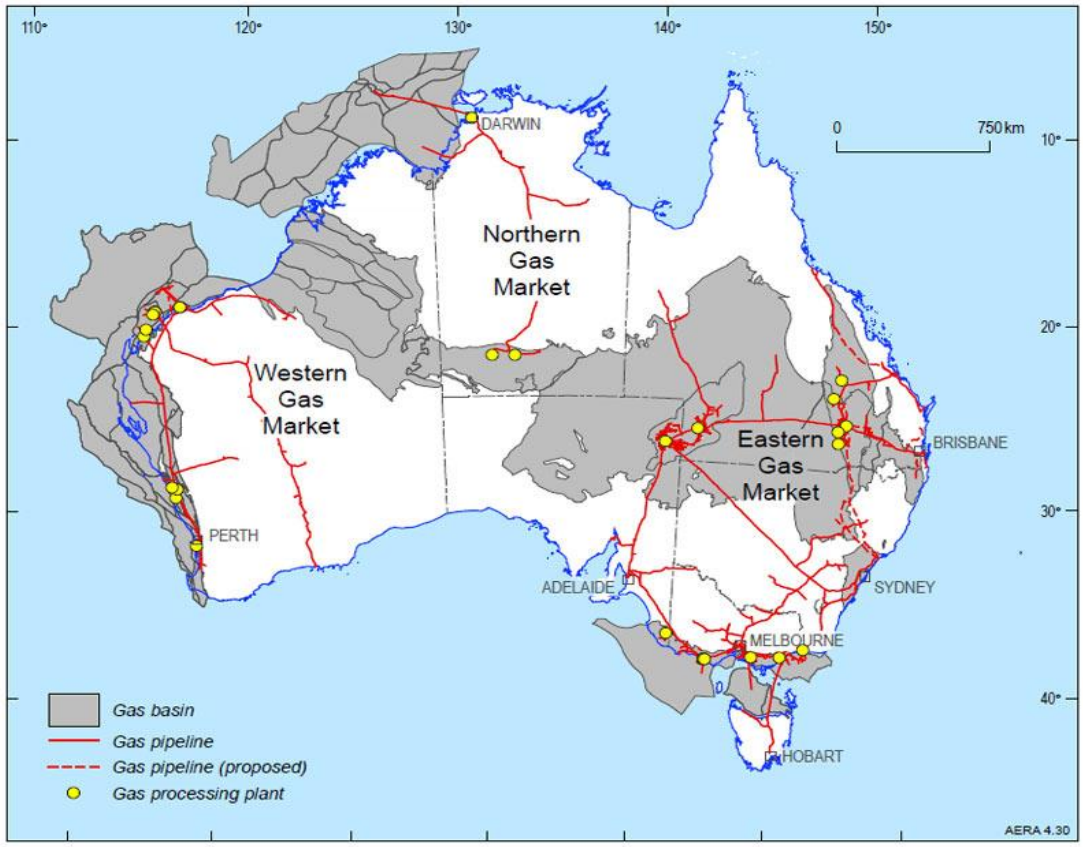
Australia's domestic gas market has three distinct regions, separated by distance and the gas basins and pipelines that supply them:

1. **The Eastern Gas Market**
   The Eastern Gas Market is the largest domestic market. It connects Australia's eastern seaboard states and territories, plus South Australia.
2. **The Northern Gas Market**
   The Northern Gas Market is Australia's smallest producer. It provides gas for export and also for domestic consumption in the Northern Territory.

[10] Geoscience Australia, Coal Seam, Shale and Tight Gas in Australia: Resources Assessment and Operation Overview 2015 http://www.scer.govspace.gov.au/files/2015/11/UPR-Unconventional-Resources-Report-2015-Final.pdf

3. **The Western Gas Market**
The gas basins of the Western Gas Market contain more than half of Australia's gas reserves. This market is heavily focused on exports but also supplies domestic gas.

Figure 2: Australia's Gas Markets and Infrastructure[11]

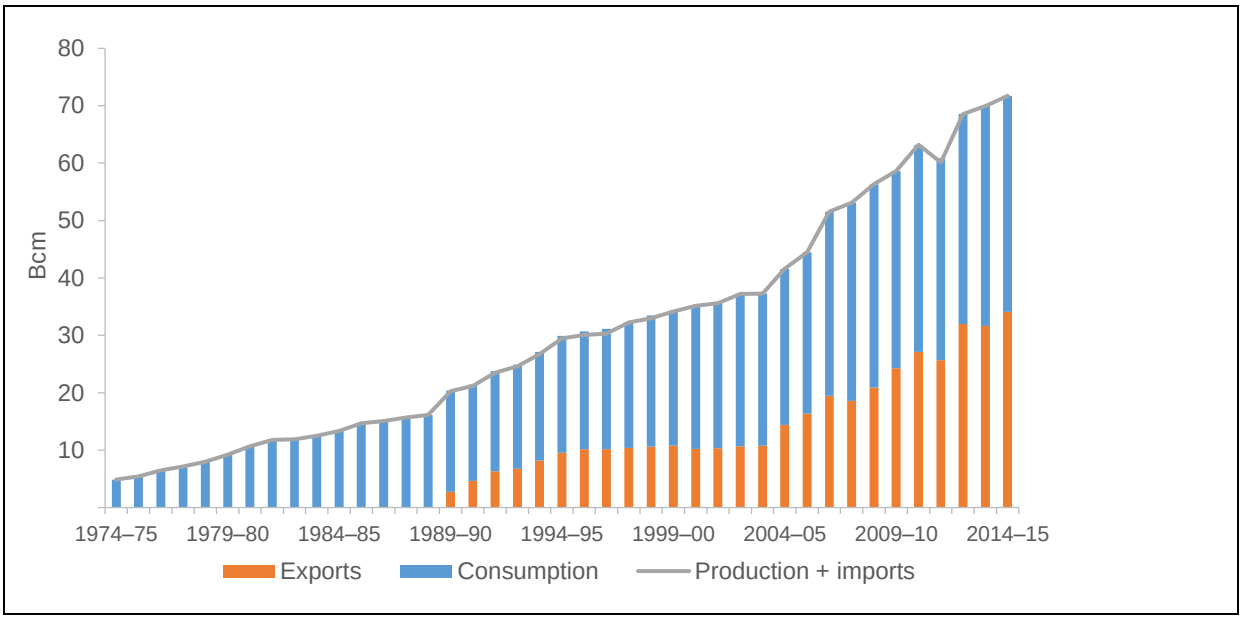


Natural Gas Production and Consumption

Natural gas production in Australia has risen steadily over the last four decades. Chart 2 outlines domestic consumption of natural gas and volumes exported as liquefied natural gas (LNG). Exports of gas started in 1989 with the opening of the gas export facilities at the North West Shelf Project. Additional production units (or 'trains') at the North West Shelf, and the start-ups of the Darwin LNG (2005) and Pluto (2012) projects saw LNG exports rise substantially. Four new LNG projects (including three Queensland CSG-to-LNG projects) have also begun production since 2015.

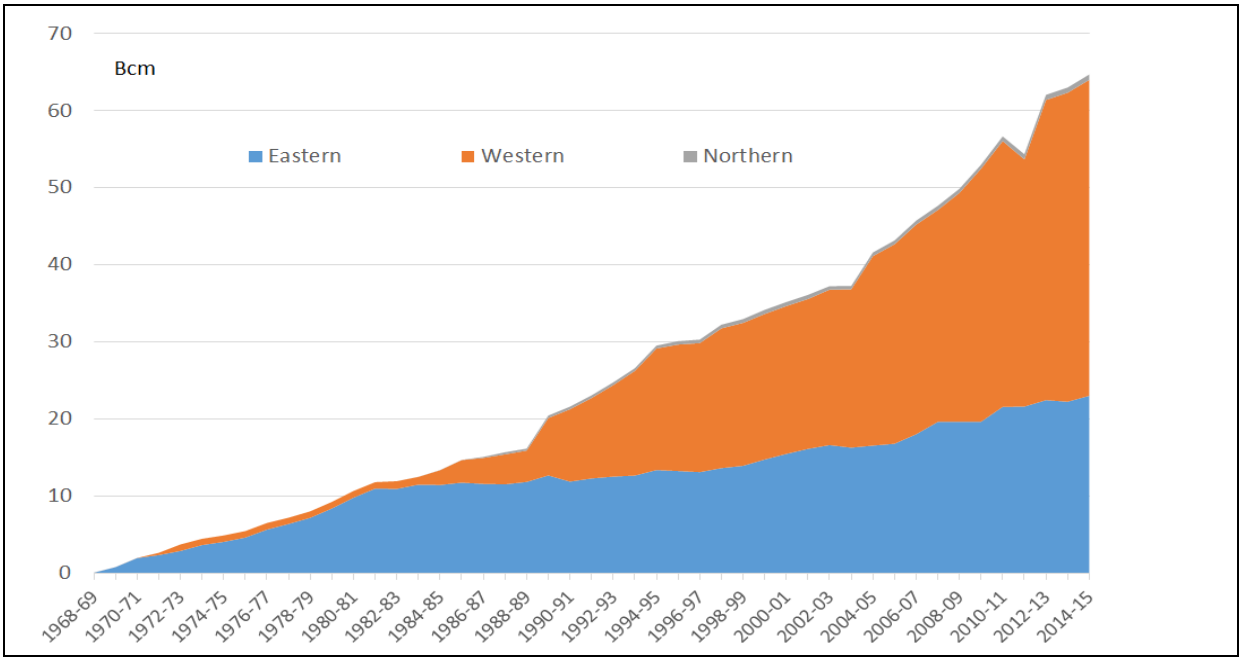
[11] Geoscience Australia, http://www.ga.gov.au/__data/assets/image/0005/12767/GA18782.jpg

Chart 2: Natural Gas Production and Consumption



Source: Department of Industry, Innovation and Science, Office of the Chief Economist

Chart 3: Australia Gas Production, by Region



Source: Department of Industry, Innovation and Science, Office of the Chief Economist

Chart 3 outlines Australian gas production by geographic region. Much of the growth over the last two decades has occurred in the western region. With exports beginning from the three LNG facilities in Queensland, production is quickly rising in the eastern region.

The Western and Northern gas markets are mainly supplied from conventional sources. In the Western market, consumption of natural gas was about 533 PJ in 2013-14, accounting for 38 per cent of all domestic gas consumption in Australia. Growth is expected to increase slowly due to a

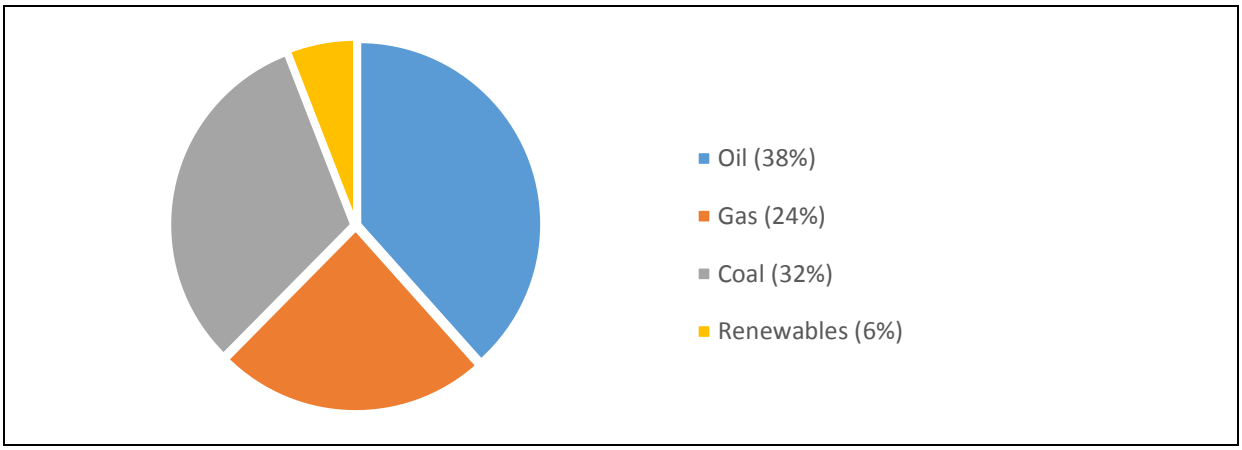
forecast decrease in gas-fired electricity generation in the South West Interconnected System (SWIS).[12]

Domestic gas demand in the Northern Territory (NT) for 2012-13 was about 25 PJ. Gas is used primarily for gas-fired power generation in the Alice Springs, Tennant Creek and Darwin-Katherine electricity networks. Domestic gas demand in the Northern Territory is forecast to grow steadily at about 2 per cent per annum.[13]

More generally, natural gas is widely used throughout the Australian economy – it accounted for 24 per cent of Australia's final energy consumption in 2013-14. This share has grown steadily over the last four decades and is expected to increase over the coming decades. Gas will continue to be essential to Australia for many reasons, including:

- electricity generation;
- heating, cooking and other household uses;
- as an industrial feedstock for the manufacture of essential products such as fertilisers, glass and bricks;
- for specialist uses such as high temperature incineration of hospital waste; and
- as a feedstock for liquefied natural gas exports.

Chart 4: Australia Final Energy Consumption: 2013-14

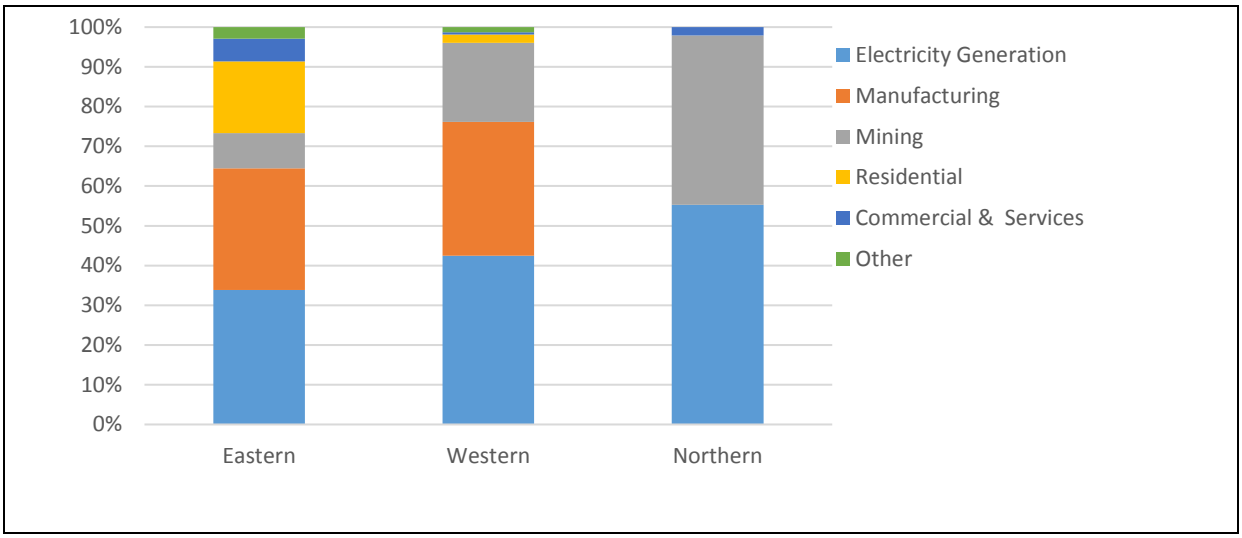


Source: Australian Energy Statistics[14]

Chart 5 segments gas consumption by gas market and sector. The use of gas varies considerably across regions. Gas is the main fuel for electricity generation in Western Australia and the Northern Territory. In the eastern States, especially Victoria and New South Wales, gas is widely used for residential heating and cooking. In Victoria, Western Australia and New South Wales, gas is also a major input for the manufacturing sector.

[12] Western Australia Gas Statement of Opportunities (2015) http://wa.aemo.com.au/docs/default-source/Reserve-Capacity/november-2015-gas-statement-of-opportunities_v28968963f29c46dc8b2c9ff0000bd36b5.pdf?sfvrsn=0
[13] Department of Industry, Innovation and Science, Gas Price Trends (2016) http://www.industry.gov.au/Energy/Energy-information/Documents/Gas-Price-Trends-Report.pdf
[14] Australian Government, Energy Statistics. (2016) www.industry.gov.au/Office-of-the-Chief-Economist/Publications/Pages/Australian-energy-statistics.aspx

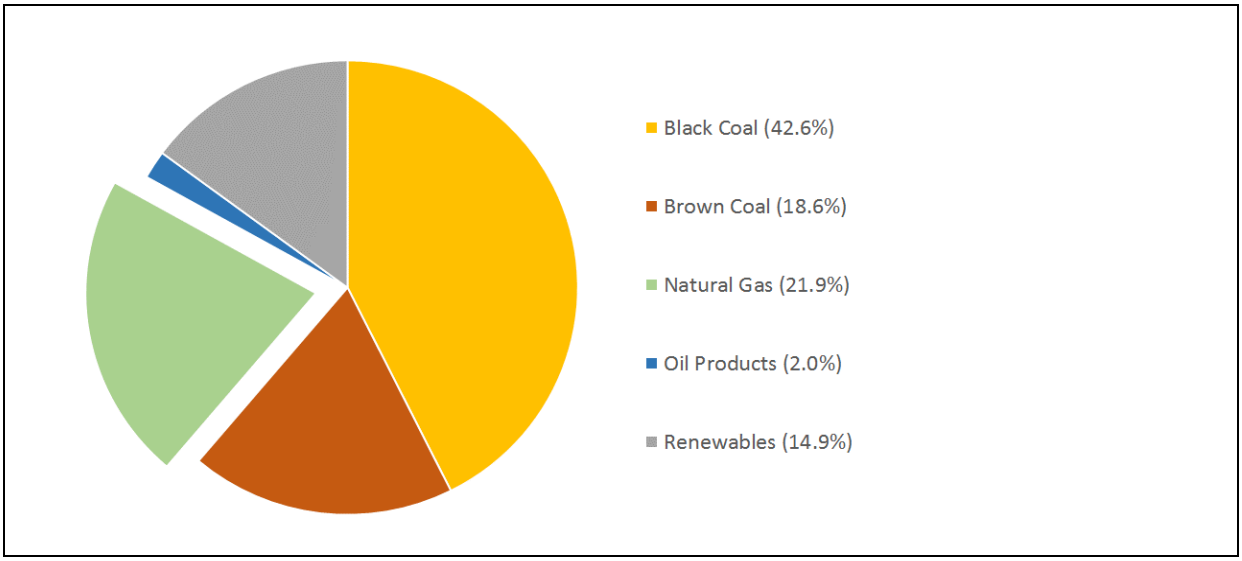
Chart 5: Australia Use of Gas in Australian Domestic Markets: 2013-14



Source: Australian Energy Statistics[15]

The use of gas varies across the three gas markets and within the eastern market. As noted above, gas is the main fuel for electricity generation in Western Australia and the Northern Territory. In the eastern states, gas is used less widely but has a vital role in meeting daily and seasonal peak demand. This balancing role is increasingly important as the market introduces an increasing proportion of intermittent renewable energy. Gas now accounts for about 22 per cent of electricity generation across Australia.

Chart 6: Australian Electricity Generation, By Fuel Type: 2013–14



Source: Australian Energy Statistics[16]

[15] ibid
[16] ibid

Gas Supply Outlook

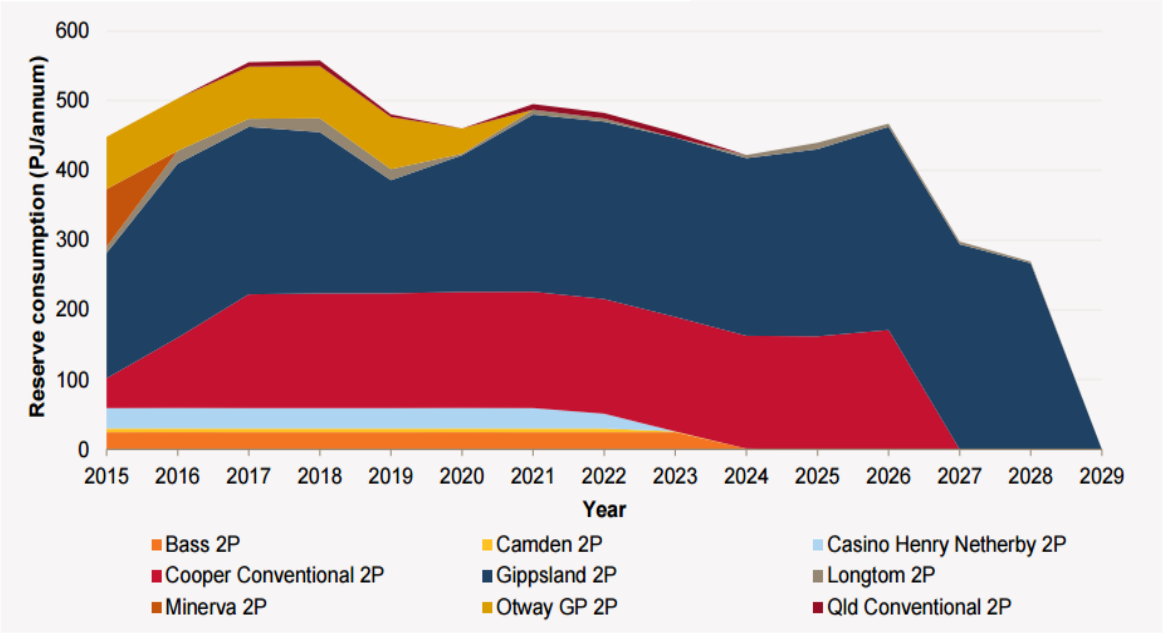
The Australian Energy Market Operator's (AEMO) five-year outlook for natural gas in eastern Australia forecasts continuing strong demand for gas, which will require further investment in exploration and development.

Gas production in the eastern market is forecast to be sufficient to meet domestic demand and existing LNG export commitments in the short term. However, AEMO and EnergyQuest warn that the industry must now begin developing new gas reserves to ensure adequate supply from 2019 onwards.

The Australian Competition and Consumer Commission (ACCC) made similar comments in its recent report into the east coast gas market[17]. Both AEMO and the ACCC recognise that depressed market conditions are inhibiting investment in upstream exploration and development – and this makes a future supply shortfall increasingly possible.

Whether or not new supply is provided, AEMO reports that significant 'demand destruction' is already occurring as constrained supply pushes up prices and leads industrial customers to reduce output. The ACCC has pointed out how tight supply reduces competition, especially outside Queensland, and generally puts upward pressure on prices.

Chart 7: Depletion of Proven and Probable Conventional Gas Reserves – Eastern Australia[18]

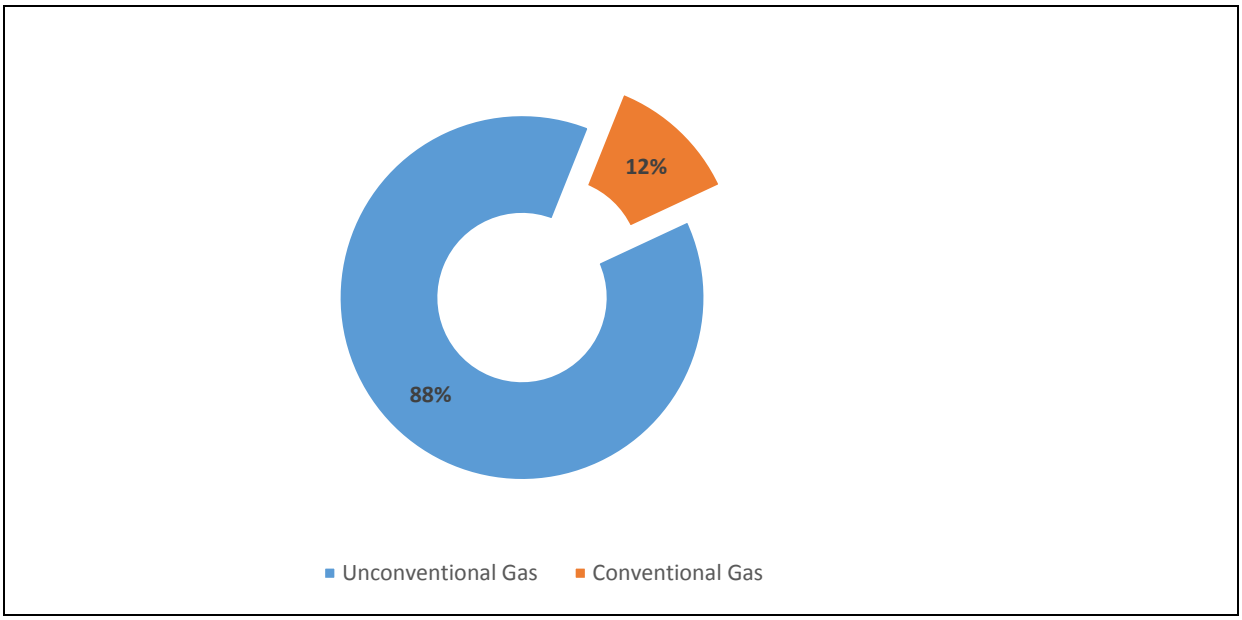


Source: AEMO

Unconventional gas accounts for 88 per cent of east coast gas reserves (See Chart 8). The clear implication is that, unless a major commercial discovery of conventional gas is made, the future of the industry will rely on unconventional reservoirs.

[17] ACCC East coast gas market. www.accc.gov.au/regulated-infrastructure/energy/east-coast-gas-inquiry-2015
[18] http://www.aemo.com.au/Gas/Planning/Gas-Statement-of-Opportunities/Previous-GSOO-reports/2015-Gas-Statement-of-Opportunities

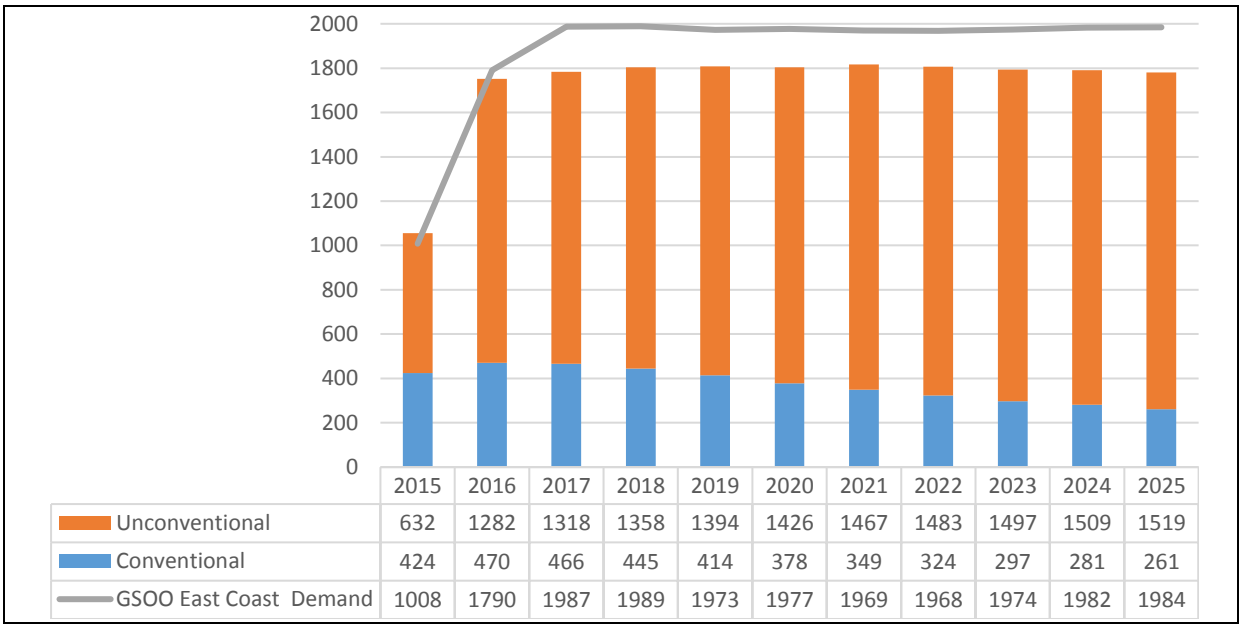
Chart 8: Eastern and South Australia 2P Reserves by Gas Source (PJ)



Source: Core Energy Group[19]

Over time, production must increasingly come from unconventional sources. Output from the established conventional gas fields in eastern Australia is expected to decline from 2017. See Chart 9 below.

Chart 9: Projected East Coast Gas Supply/Demand 2016-25 (PJ/pa)



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Unconventional	632	1282	1318	1358	1394	1426	1467	1483	1497	1509	1519
Conventional	424	470	466	445	414	378	349	324	297	281	261
GSOO East Coast Demand	1008	1790	1987	1989	1973	1977	1969	1968	1974	1982	1984

Sources: AEMO (Gas Statement of Opportunities 2015) and EnergyQuest

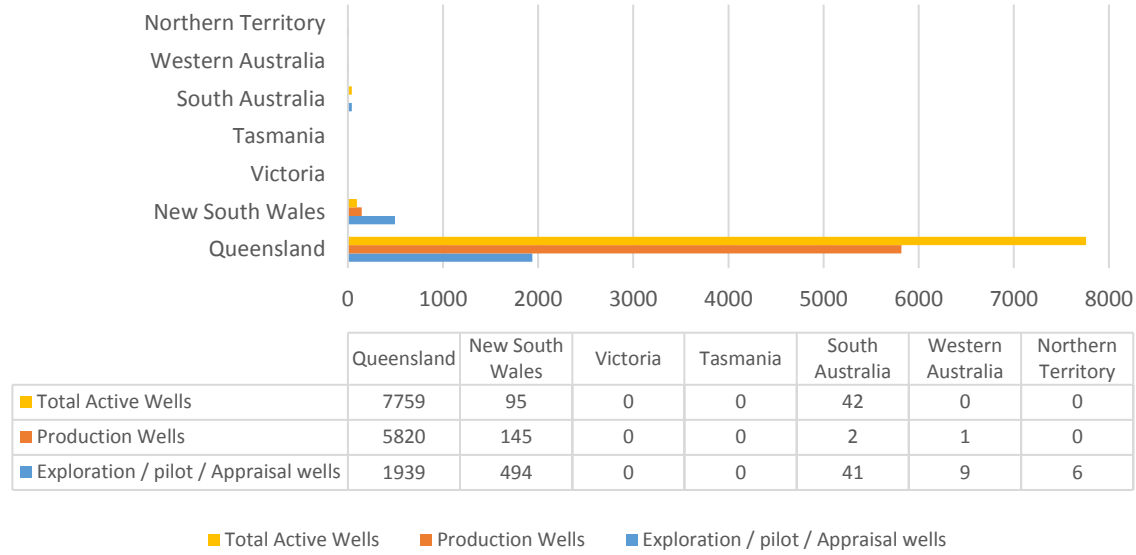
In these circumstances, the eastern market needs greater development of unconventional gas reserves as soon as possible. In the absence of a major commercial discovery of conventional gas, eastern Australia's future supply will depend on new unconventional projects.

[19] Gas Reserves and Resources Eastern and South Eastern Australia – Core Energy Group 2015.

Unconventional Gas Activity

Table 3 below captures the available data on key industry indicators across Australia. With the exception of Queensland, there is relatively little unconventional gas activity. Outside Queensland and New South Wales, there are only three wells producing unconventional gas. Exploration is modest – in 2015 only 50 wells were added. There is limited data in some areas.

Chart 10: Total Reported Gas Wells (Cumulative)

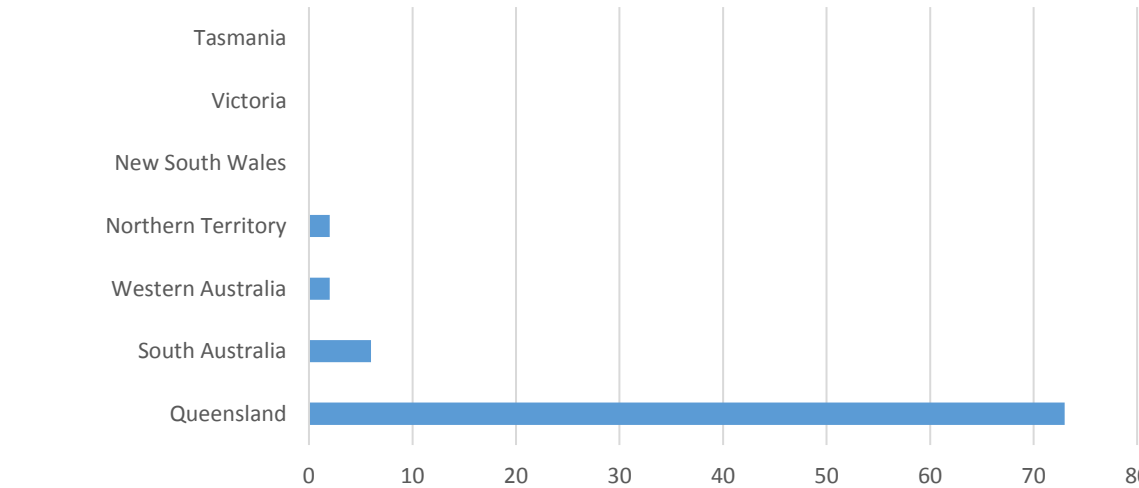


	Queensland	New South Wales	Victoria	Tasmania	South Australia	Western Australia	Northern Territory
Total Active Wells	7759	95	0	0	42	0	0
Production Wells	5820	145	0	0	2	1	0
Exploration / pilot / Appraisal wells	1939	494	0	0	41	9	6

(Note: In Queensland the total number of active wells includes exploration, appraisal, and development wells which are suspended or producing but not abandoned.)

Source: Various (collated by APPEA)

Chart 11: Fracture Stimulations - 2015



	Queensland	South Australia	Western Australia	Northern Territory	New South Wales	Victoria	Tasmania
Number of Fracture Stimulations	73	6	2	2	0	0	0

Table 3: 2015 Unconventional Gas Activity in Australia

	Queensland		New South Wales		Victoria		Tasmania		South Australia		Western Australia		Northern Territory	
	No. Added 2015	Total at end of 2015	No. Added in 2015	Total at end of 2015	No. Added in 2015	Total at end of 2015	No. Added in 2015	Total at end of 2015	No. Added in 2015	Total at end of 2015	No. Added in 2015	Total at end of 2015	No. Added in 2015	Total at end of 2015
Well activities														
Exploration / pilot / Appraisal wells	36	1939	0	494	0	NS	0	0	5	41	3	9	6	6
Production Wells	603	5820	0	145	0	NS	0	0	0	2	0	1	0	0
Abandoned Wells (completed)	118	NS		NA	0	NS	0	0	1	NS	3	6	0	NS
Total Active Wells	639	7759	0	95	0	NS	0	0	NS	42	3	0	NS	0
Number of Fracture Stimulations	73	463	0	168	0	23	0	0	6	34	2	8	2	2
Water management														
Co-produced Water (GL)	59 GL(a)	148.8 GL(a)		NA	0	NA	NA	NA	NA	NA	NA	NA	NA	NA
Monitoring Bores	NA	1,705 (a)		NA	0	NA	NA	NA	NS	NS	NS	NS	NS	NS
Land access														
Signed Access Agreements	288 (a)	5,184 (a)		NA	0	NA	NA	NA	0	28	NS	NS	5	5
Formal Disputes of Access	0	1 (a)		NA	0	NA	NA	NA	0	0	NS	NS	0	0

NS = Not Supplied; NA = Not Applicable

Note: Where not stated otherwise, information has been provided by the relevant State / Territory Government.
(a) Data collated by APPEA.

Hydraulic fracturing

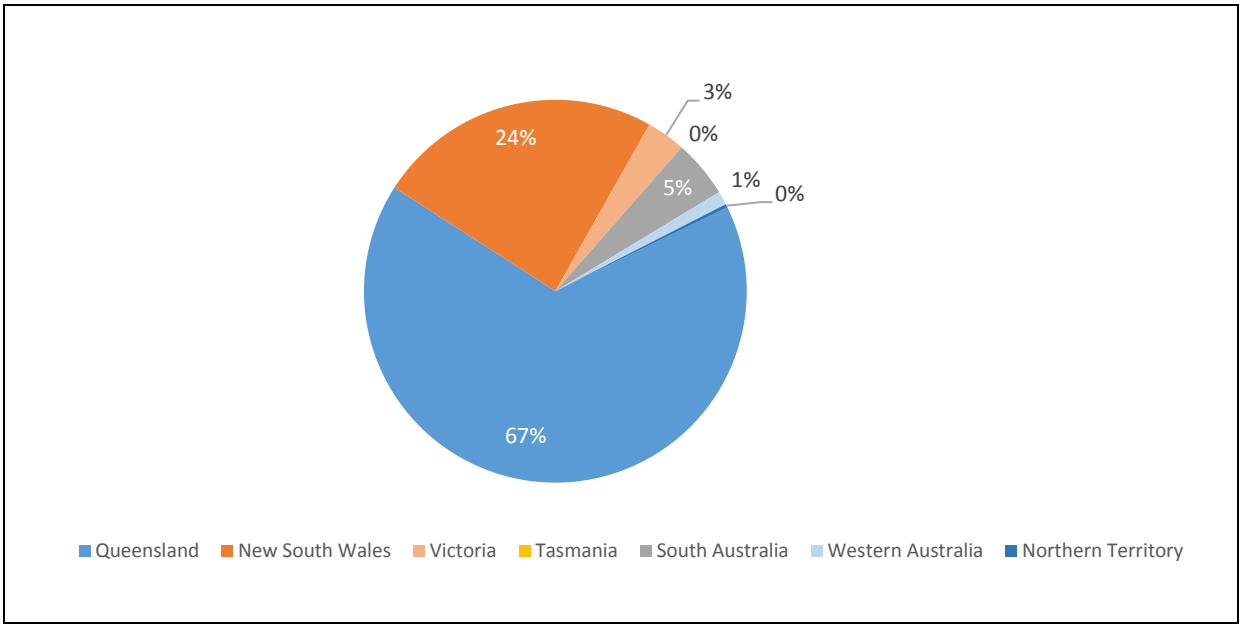
Hydraulic fracturing involves injecting water-based fluids at high pressure into rock formations deep underground to create tiny fractures that enhance the flow of oil and gas. This process requires detailed engineering, design and monitoring.

The process is well-understood and thoroughly researched. Hydraulic fracturing has been continuously improved since its first application in 1949.

Since the 1990s, hydraulic fracturing has been used mostly in New South Wales and Queensland. In the Cooper Basin in South Australia, about 70 wells have been hydraulically fractured. Of the 50 or so more recent wells drilled specifically for shale or tight gas in the Copper Basin, hydraulic fracturing has been used in about 15 wells[20]. Hydraulic fracturing in the Cooper Basin has occurred without incident.

In Western Australia, hydraulic fracturing has been used extensively to assist with the recovery of oil and gas from conventional resources – an estimated 800 wells have been hydraulically fractured since 1958[21]. Hydraulic fracturing operations have been undertaken in that State for the past 50 years without incident.

Chart 12: Total Unconventional Fracture Stimulations in Australia



Source: APPEA

[20] Cook, P., Beck, V., Brereton, D., Clark, R., Fisher, B., Kentish, S., Toomey, J. and Williams, J. (2013), *Engineering Energy: Unconventional Gas Production: A Study of Shale Gas in Australia,* Australian Council of Learned Academies

[21] Department of Mines and Petroleum, *Gas Fact Sheet: Hydraulic Fracture Simulation,* Government of Western Australia

Water and Coal Seam Gas

All coals contain some natural gas. In the early days of coal mining, removing gas from mines was a major safety challenge. In modern times, the gas in coal can be tapped as a valuable energy resource.

Natural gas is trapped on the surface of the coal – it is said to be 'adsorbed' onto the coal, and held there by pressure from the groundwater in the coal beds. To release the gas from the coal, the pressure must be decreased so that it no longer holds the gas on the coal. Pumping water from the coals decreases the pressure and frees up the gas. A well will produce most of its water at the start of the pumping phase. As the water is pumped from the coal formation, the pressure in the seam drops, and the gas begins to flow. Water production and gas production are inversely proportional – as water production declines, gas production increases.

The water pumping phase is unique to CSG. But the drilling techniques, surface equipment and gas compositions are not materially different from conventional gas production, which has been going on for decades in Australia.

Not all coals are suitable for CSG production. Commercial viability depends on the gas content, the permeability of the coal (its ability to flow gas) the costs of drilling, and the proximity to infrastructure and customers. Coal is naturally fractured. Cracks in the coal seam are referred to as 'cleats'. Water and natural gas are trapped in these cleats. Coals with more cleats are more permeable, which enhances the rate at which the water and gas can move through the coal's structure.

Coals with lower permeability do not require as much water to be pumped to reduce the pressure on the coal. This is why some CSG operations – for example in NSW and Queensland's Bowen Basin – produce lower volumes of water. Areas with higher permeability generally produce higher volumes of water.

Concerns have been raised that the CSG industry could impair the availability of groundwater for domestic, agriculture and commercial uses. The Underground Water Impact Report (UWIR) by the Office of Groundwater Impact Assessment indicates that water production by the CSG industry is expected to have a minimal impact on existing private water bores in Queensland. Under Queensland law, if the impact on a landholder bore's capacity meets the regulatory threshold, then the relevant company must enter an agreement with the landholder to make good the impact. The UWIR is a baseline study that was in place 2 ½ years before the start of LNG exports.

The Great Artesian Basin (GAB) contains 65 million Gigalitres (GL) of water.[22,23] Over the proposed life of the current projects (1995 to 2070), the CSG industry will produce 3,570 GL of water from the coal seams, or less than 0.005 per cent (5 parts per 100,000) of the GAB's water.

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[22] Great Artesian Basin Coordinating Committee (2014) *Great Artesian Basin Strategic Management Plan - Progress & Achievements to 2008* - www.gabcc.org.au/images/DL_684_.pdf

[23] CSIRO, 2008. *Background report on the Great Artesian Basin. A report to the Australian Government from the CSIRO Murray-Darling Basin Sustainable Yields Project.* Contributing author Herczeg, A.L. www.clw.csiro.au/publications/waterforahealthycountry/mdbsy/technical/S-GreatArtesianBasin.pdf

Recent studies by the Queensland Government's Office of Groundwater Impact Assessment, have found Surat Basin CSG operations' water production will average 70 GL a year. By comparison, in Queensland, 452 GL pa is used for agriculture, industry, urban, stock and domestic purposes.[24]

Table 4: Water Use by Industry/User in Queensland (compared to CSG volumes)

Purpose	Queensland (GL/year)
Stock and domestic (pastoral)	302
Stock and domestic wastage	54
Total Stock & Domestic	**356**
Irrigation and intensive livestock industries	39
Town water use	32
Industrial, mining, commercial and other urban uses	24
Total non-S&D sum	**96**
Total Annual Water (Use)	**452**
CSG Annual Total Production	70
CSG Production against Queensland GAB Production	15 per cent

Water produced from the coal seams is mildly salty (brackish). It comes from deeper geological layers and is generally not suitable for agricultural purposes without desalination or blending with fresher (less saline) water.

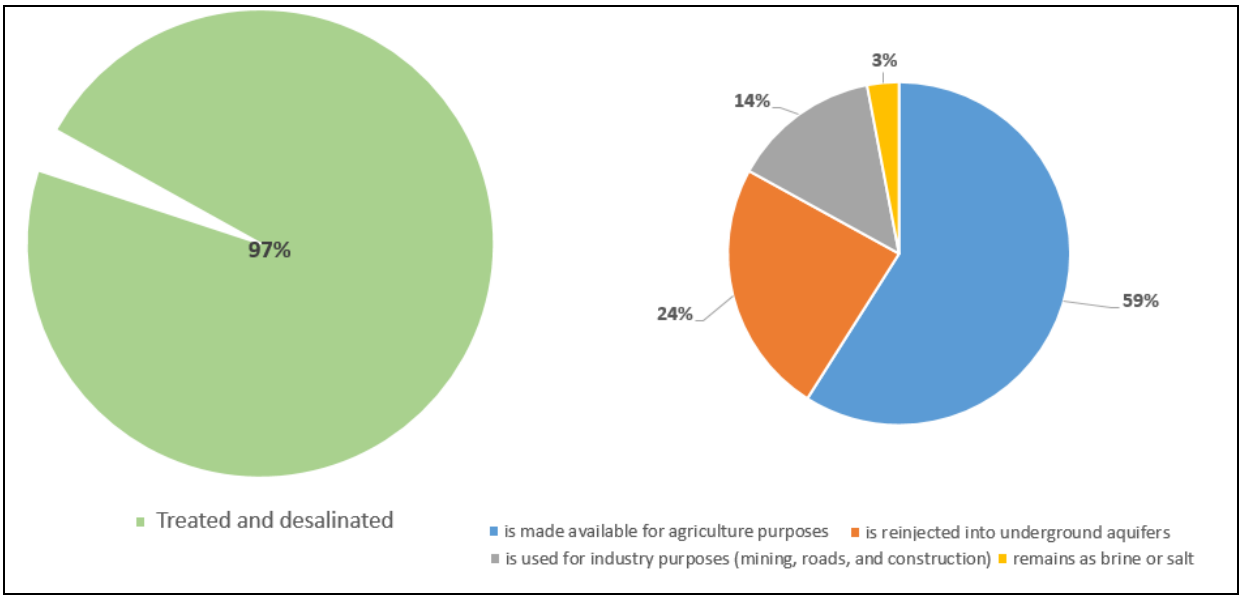
Importantly, of the CSG water produced annually in Queensland:

- 97 per cent is treated and desalinated
- 59 per cent is made available for agricultural purposes
- 24 per cent is reinjected into underground aquifers
- 14 per cent is used for industrial purposes such as mining, roads and construction
- 3 per cent remains as brine or salt.[25]

When treated and beneficially used, CSG production water can be an alternative supply to the water that is taken from the shallower, less saline aquifers of the GAB. This in itself will help recharge these shallow aquifers over time.

[24] Great Artesian Basin Coordinating Committee (2010) Great Artesian Basin Resource Study Update, 2010
[25] Department of Trade and Investment Queensland, 2014. *Queensland Resources Under Construction: Queensland LNG*

Chart 13: Coal Seam Gas Produced Water - Queensland



Source: Department of Trade and Investment Queensland

Petroleum Exploration

Exploration is the first step in developing gas reserves. It is a costly, high risk activity with no guarantee of commercial success.

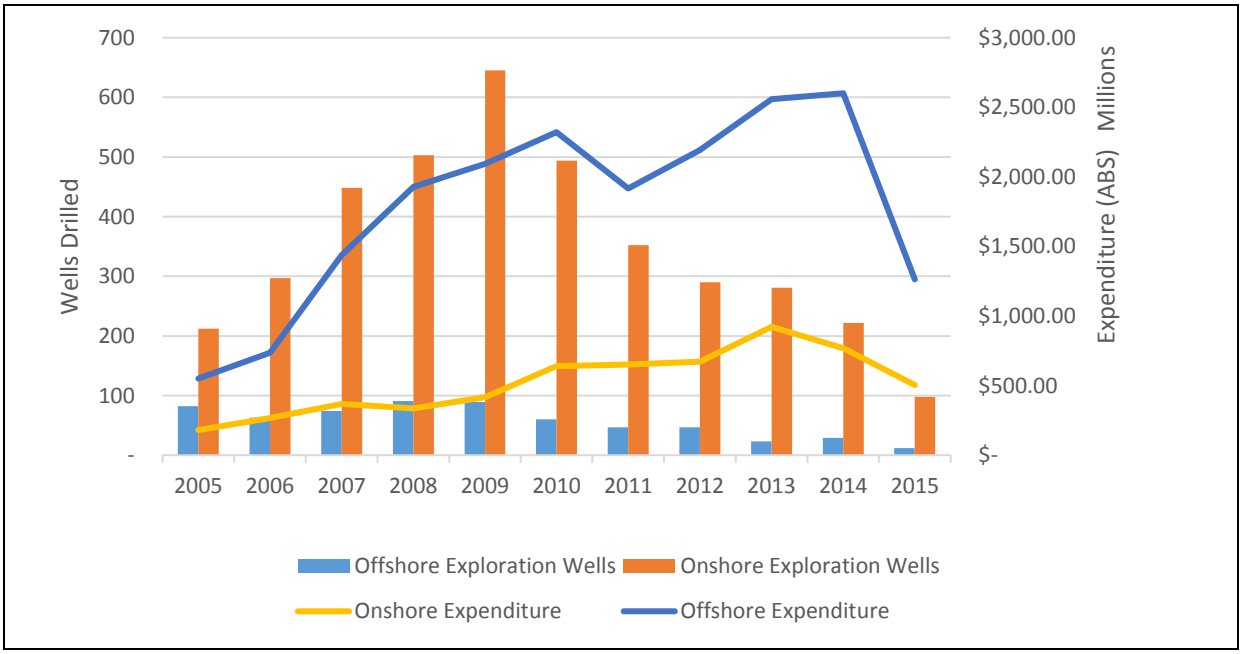
Whether the search is for unconventional or conventional resources, exploration typically involves four stages:

- A regional geological assessment to determine the resources' potential and which exploration permits should be acquired.
- Competitive bidding on areas. Generally the government will release exploration blocks and companies will bid an indicative work program to secure a particular block, although some areas are subject to cash bidding arrangements.
- If a company is awarded an exploration permit over an area, it will then conduct activities (e.g. seismic surveys and coreholes) to determine the likely location of hydrocarbon resources.
- Drilling only occurs once a suitable target has been identified. More often than not, exploration wells are not successful.

Following discovery of an oil or gas deposit, the resource will be assessed for its potential for commercial development.

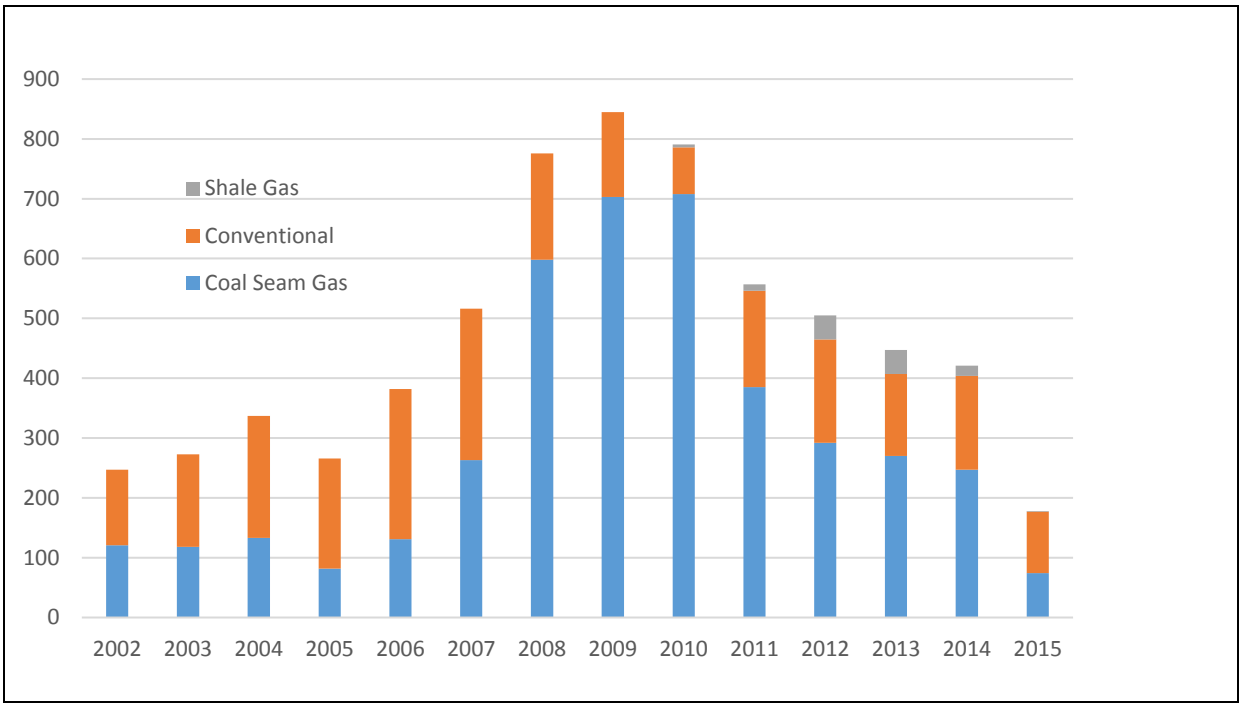
Petroleum exploration in Australia has been declining for many years. Chart 14 outlines the number of exploration wells drilled and exploration expenditure over the last decade. It should be noted that higher exploration costs leads to higher overall expenditure – and this can create the misleading impression of increased exploration activity. Recent bidding for acreage and commitments made by companies as part of their respective work programs indicate further falls in exploration activity.

Chart 14: Exploration Wells Drilled: Onshore and Offshore



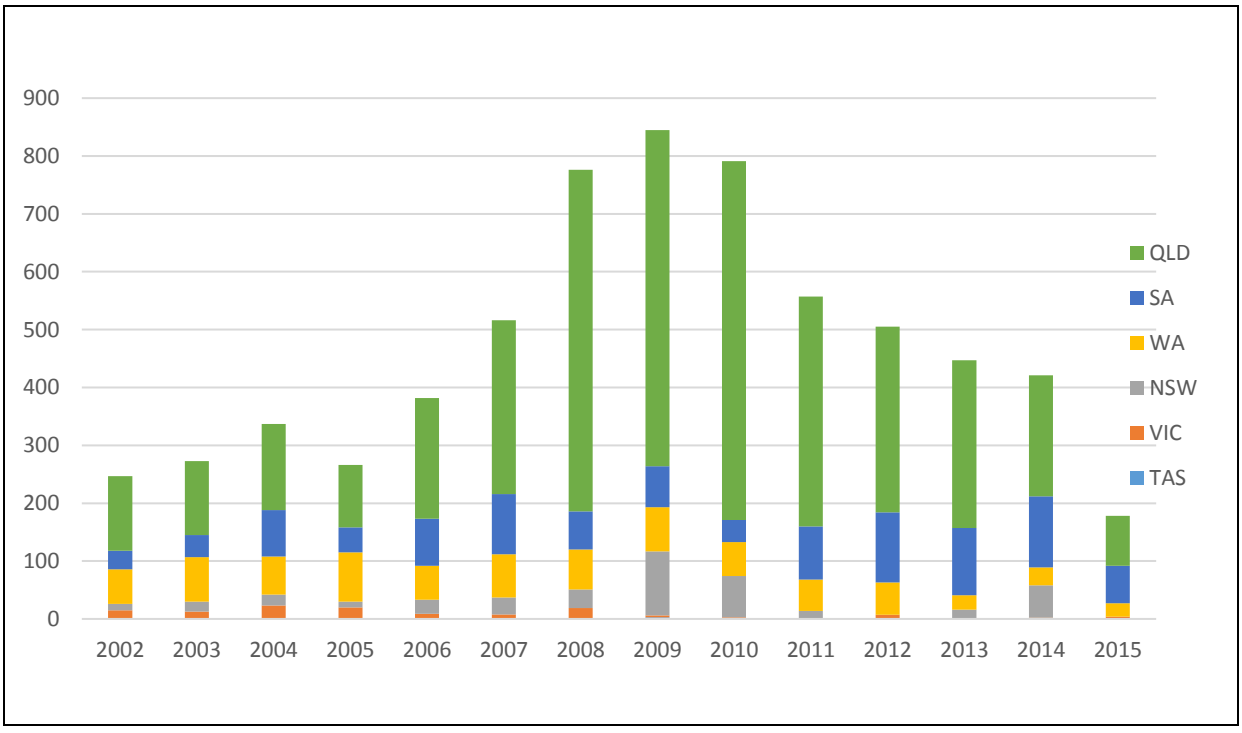
Source: ABS, APPEA

Chart 15: Exploration and Appraisal Wells (Onshore)



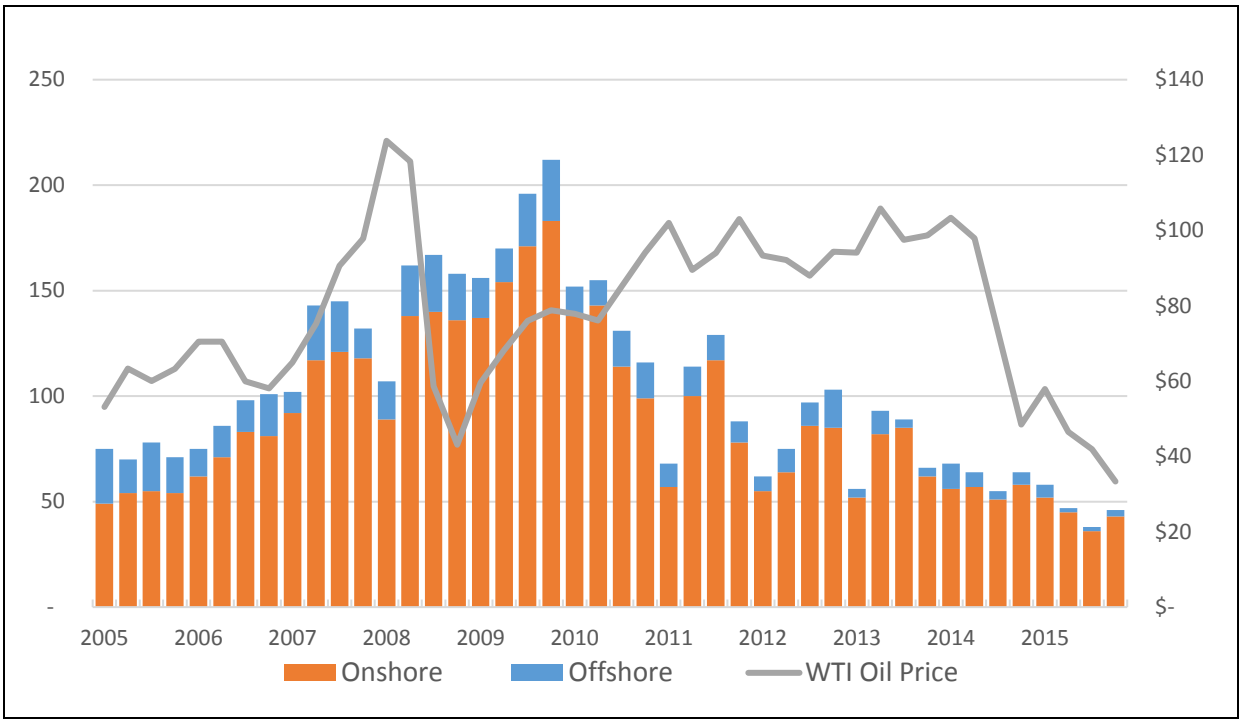
Source: APPEA

Chart 16: Exploration and Appraisal Wells – By Jurisdiction



Source: APPEA

Chart 17: Australian Exploration Wells Drilled and WTI Crude Oil Price



Source: APPEA, Reserve Bank of St. Louis

Industry Contribution

Economic Benefits

Several studies and reports published over the last five years have confirmed that the unconventional gas sector can contribute significantly to prosperity of the nation as a whole and specific regions in particular.

Economic Impact of Shale and Tight Gas Development in the NT (Deloitte Access Economics, 2015)

In 2015, Deloitte Access Economics (DAE) undertook a comprehensive analysis of the potential economic impact of the development of shale and tight gas resources in the Northern Territory. This report found that onshore shale and tight gas production has the potential to drive significant economic growth and provide substantial benefits to the NT economy.

DAE estimated that from 2020 to 2040, the net present value of additional capital expenditure in the Territory from developing shale and tight gas resources would be $10.1 billion under the 'Success' scenario, with a peak annual estimate of $3.3 billion invested in 2027. Operational expenditure for shale and tight gas development is projected to peak at $900 million under the Success scenario – this includes two production trains at existing NT LNG projects and the construction of new pipelines.

Estimates of the incremental effects of shale and tight gas development on output and jobs were compared against levels likely under a base case of no such development. The analysis showed that developing shale and tight gas will have significant effects on the NT's output and employment. By 2040, again under the Success scenario, NT gross state product (GSP) is projected to be almost $5.1 billion higher than the base case in real terms. This represents an increase of more than 26 per cent on current GSP estimates for the NT ($19.9 billion in 2012-13). In NPV terms (2015 dollars) over the entire period to 2040, the increase in GSP under the Success scenario is cumulatively $17.2 billion.

Developing these gas resources is also expected to significantly increase employment in the NT. Under the Success scenario, job creation is estimated to increase by nearly 4,200 full time equivalents (FTEs) by 2040. Developing this sector is projected to add $200 million to NT Government revenues. From 2020 to 2040, this increase is cumulatively (in NPV terms) almost $700 million.

Around half of the NT is covered by the Aboriginal Lands Right Act (ALRA). Some gas developments can be expected to take place on ALRA land. The Commonwealth makes matching payments to the Land Councils equal to the value of royalties paid by resource companies to the NT Government. The Land Councils distribute these funds to communities.

See APPEA's website for more details.

Queensland's Coal Seam Gas (CSG) Industry Snapshot 2010-2015: (GasFields Commission of Queensland, December 2015)

The GasFields Commission of Queensland is an independent statutory body formed to manage and improve sustainable coexistence between rural and regional communities and the State's onshore gas industry.

The Commission recently released a report on the CSG industry's impact from 2010 to 2015. As well as containing a broad range of operational data, the report presented significant economic and regional impacts, which include:

- More than $230 million paid in compensation to landowners up to June 2015.
- Significant other 'in-kind' benefits provided to landowners, including new fencing, roads, gravel and the supply of water.
- $10.6 billion in direct spending in Queensland in 2014-15 alone, benefiting more than 3,500 businesses state wide.
- Major contributions (exceeding 10 per cent contribution to Gross Regional Product in 2014-15) in the Brisbane, Darling Downs and South West regions.
- Employment (direct and contractors) of more than 22,000 as at June 2015.
- Provision of $360 million to road infrastructure in the State, including $275 million on local roads.

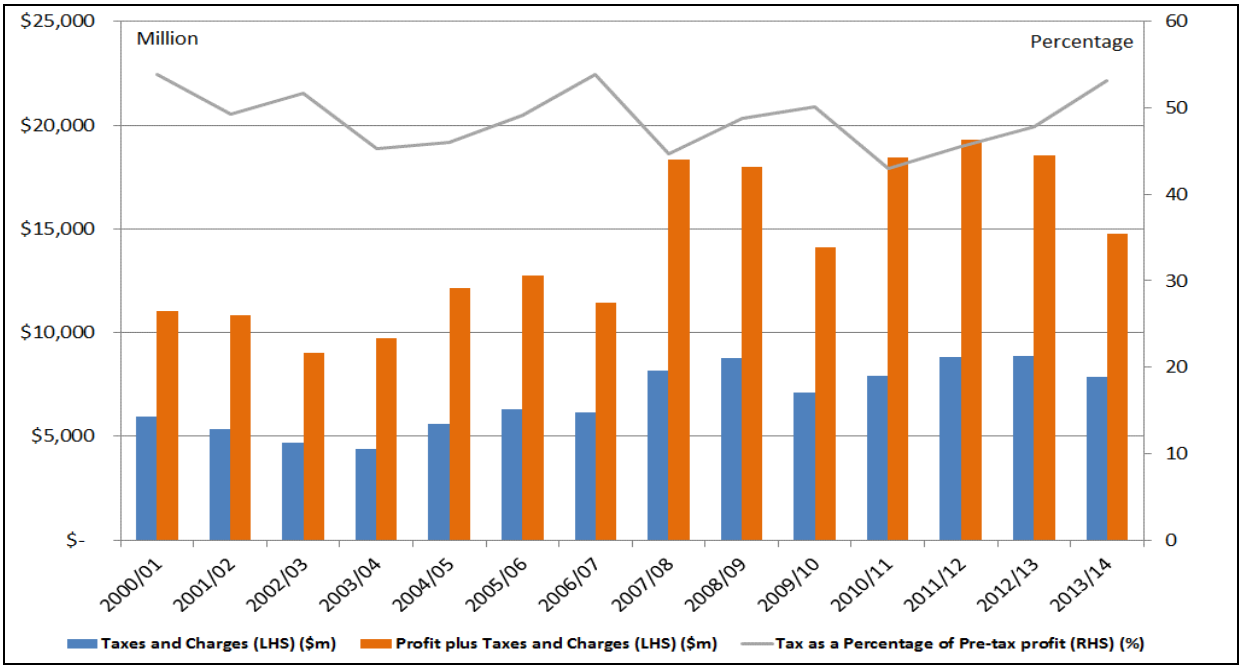
See http://www.gasfieldscommissionqld.org.au/resources/gasfields/combined-snapshot-report.pdf for more information.

Fiscal Contribution

All oil and gas production in Australia (conventional and unconventional) is subject to company tax, GST and many other taxes and charges (both at a federal and state/territory level). The industry is also subject to royalties and the petroleum resource rent tax (PRRT). No other competing fuels are subject to an impost similar to the PRRT.

Data compiled by APPEA indicates that, on average, taxes and resource charges account for around half of the oil and gas industry's overall level of pre-tax profit. Total industry tax payments have averaged between $7 and $8 billion per year over the last five years. Subject to movements in commodity prices and project costs, total payments could be expected to increase in the coming years as new projects reach peak production.

Chart 18: Industry Taxation Contribution: 2000-01 to 2013-14



Source: APPEA Financial Survey

Company tax is levied at a corporate level, while resource taxes are generally applied at a project level. In terms of resource taxation:

- State/territory royalties apply to onshore production (both from conventional and unconventional sources) and offshore production in state/territory waters. The royalty provisions for each jurisdiction are broadly similar (see below).
- Commonwealth crude oil and condensate production excise and Commonwealth petroleum royalty apply to production sourced from licences derived from Offshore Exploration Permits WA-1-P and WA-28-P (including the North West Project).
- Commonwealth crude oil and condensate production excise applies to crude oil and condensate production from areas under state and territory jurisdiction.
- PRRT applies to production (conventional and unconventional) from all projects.

Petroleum Royalties

Each state and territory applies royalties on the production of petroleum (from conventional and unconventional sources) under their respective jurisdictions.

Royalties are generally assessed as a percentage of the wellhead value of oil and gas production. The wellhead value is calculated by subtracting the cost of transportation and processing involved in bringing the raw products from the wellhead to a point at which marketable products are sold from the sales value of all petroleum products sourced from a licence area.

Allowable deductions when determining the wellhead value include a variety of post-wellhead production costs, including certain treatment, transportation and storage expenses and eligible depreciation and operating expenses. Most jurisdictions levy royalties at a rate of 10 per cent of the wellhead value of production.

The petroleum royalty payable by individual projects depends on a range of factors, including costs and the level of production. As the sales price is critical to the wellhead value, movements in oil and gas prices will significantly affect the forecast level of royalty payments. The Queensland Government has forecast petroleum royalty collections of $197m by the year 2018-19 (see Table 5 below).

Petroleum Resource Rent Tax

The petroleum resource rent tax (PRRT) is a profits-based resource tax that applies to all oil and gas projects in Australia. It is levied by the Commonwealth Government under the provisions of the *Petroleum Resource Rent Tax Assessment Act 1987*. A liability to pay PRRT arises after a project has recovered all eligible outlays associated with the project (including after deducting eligible exploration expenditure transferred from other projects), plus a threshold (or risk-adjusted) rate of return.

PRRT was first introduced in the mid-1980s for new offshore projects. In the early 1990s the regime was expanded to cover Bass Strait production. From 1 July 2012, the PRRT was further extended to apply to all onshore petroleum production, including unconventional gas. For onshore oil and gas projects (those captured by the 2012 extension of the PRRT regime), the then existing resource taxes and charges that applied at the time of the extension have been fully retained.

PRRT is a profits-based tax with the following basic features:

- It is assessed on an individual project basis. A project may comprise one or more petroleum production licences.

- It is levied at a rate of 40 per cent.
- A liability is incurred when all allowable expenditures (including compounding) have been deducted from assessable receipts.
- Assessable receipts include the amounts received from the sale of all petroleum (based on the concept of a 'marketable petroleum commodity').
- Deductions include capital and operating costs relating to the petroleum project. These are deductible in the year they are incurred. Deductible expenditures include those related to exploration (including eligible exploration costs incurred by a taxpayer in other areas), development, operating and closing down activities.
- Costs associated with the liquefaction of gas and storing and shipping LNG are generally outside the regime's scope, as a 'marketable petroleum commodity' exists before these processes occur.
- Undeducted expenditures are compounded forward at a variety of set rates depending on the nature of those expenditures and when they are incurred for a production licence.

Other resource taxes and charges (including production excise and royalties) incurred in relation to a project are rebateable against a project's PRRT liability. This avoids imposing double taxation on projects.

Like other resource charges, PRRT is deductible in determining a taxpayer's income tax liability.

The level of PRRT a company pays is determined by several factors:

- A tax liability under the PRRT regime is incurred only once a threshold return has been generated. As such, PRRT is unlikely to be paid from a project until a number of years of production.
- Other resource taxes and charges from a project (such as state and federal royalties and production excise) are rebateable against a PRRT liability from the same project. This avoids double resource taxation for the same project.
- As PRRT is a profits-based tax, a tax liability depends on factors such as commodity prices, exchange rates and project costs. This is a deliberate design feature of the regime.

Unconventional Gas Taxation Estimated Contribution

As the unconventional gas industry is at a relatively early stage of its development, its level of taxation paid to date (via resource and company taxes) is modest.

As company tax is calculated on an entity's overall activity base (not a project level), it is not possible to estimate the amount of company tax that is attributable to unconventional gas production. At this stage of the development cycle, taxation directly attributable to unconventional gas production is likely to be relatively low, particularly in an environment of low gas prices and high capital costs.

Most of Australia's unconventional gas production is sourced from Queensland. The petroleum royalty data presented below is derived from the 2016-17 Queensland Government Budget Papers and most of that State's petroleum royalty payable is associated with coal seam gas production. A small amount of royalty is also payable on New South Wales coal seam gas production, but separate data is not published.

The PRRT regime was extended to cover onshore petroleum production from 1 July 2012. The combination of relatively low levels of production, high levels of deductible expenditure in the early lives of projects, low prices and the payment of petroleum royalties rebateable against a project's PRRT liability, means that PRRT liabilities are not expected to be incurred for a number of years. This was understood when the regime was extended onshore in 2012.

In addition to the above, the industry also pays significant amounts of both group (personal income tax) and payroll tax.

Table 5: Unconventional Gas Production – Estimated Taxation Payments

	2016-17	2017-18	2018-19
Company Tax (1)	na	na	na
Petroleum Royalties (2)	68	135	197
PRRT (3)	0	0	0

Source: Queensland Budget Papers/APPEA

Notes:
na – not available
(1) Company tax is paid at a corporate level, data at a project or commodity level is not available. The amounts payable are expected to increase significantly over time.
(2) Petroleum royalties are sourced from 2016-17 Queensland Budget information, and includes royalties from conventional petroleum sources. Royalty payments from NSW are not included - APPEA estimates that such amounts are likely to be relatively small based on the level of production in that State.
(3) APPEA estimate.

Petroleum Industry Employment – Fragmentation of Reporting

Direct employment generated by gas operations is a key measure of the economic contribution of the natural gas industry (including the unconventional gas sector). Unfortunately, the collection of data by the Australian Bureau of Statistics (ABS) is not only fragmented – it also groups the industry's activities with other sectors of the economy. The Australian and New Zealand Standard Industrial Classification 2006 record direct employment in the gas industry under a variety of divisions. Various gas industry employment categories are grouped together with mining, manufacturing or electricity and waste categories.

Oil and gas extraction is only one component of the industry. ABS data does not directly count service and support activities, petroleum refining, LNG manufacturing, construction, gas services or distribution and gas supply. Nor does it count the many manufacturing plants that rely on petroleum products as a feedstock.

For example, the gas supply industry in Australia employs 20,700 people in Australia, but industry critics generally do not include this in the industry's employment numbers.

As such, APPEA recommends caution in quoting ABS data associated with gas industry employment as there is a strong likelihood that reported information will significantly underestimate the industry's employment contribution.

Australian and New Zealand Standard Industrial Classification 2006 ANZSIC [26]

- Division B – Mining.
  - 0700 Oil and Gas Extraction
    - Gas, natural, extraction, Natural gas extraction, Oil shale mining, Petroleum gas extraction
  - 1120 Service activities incidental to oil and gas extraction excluding surveying
  - 1011 Petroleum Exploration

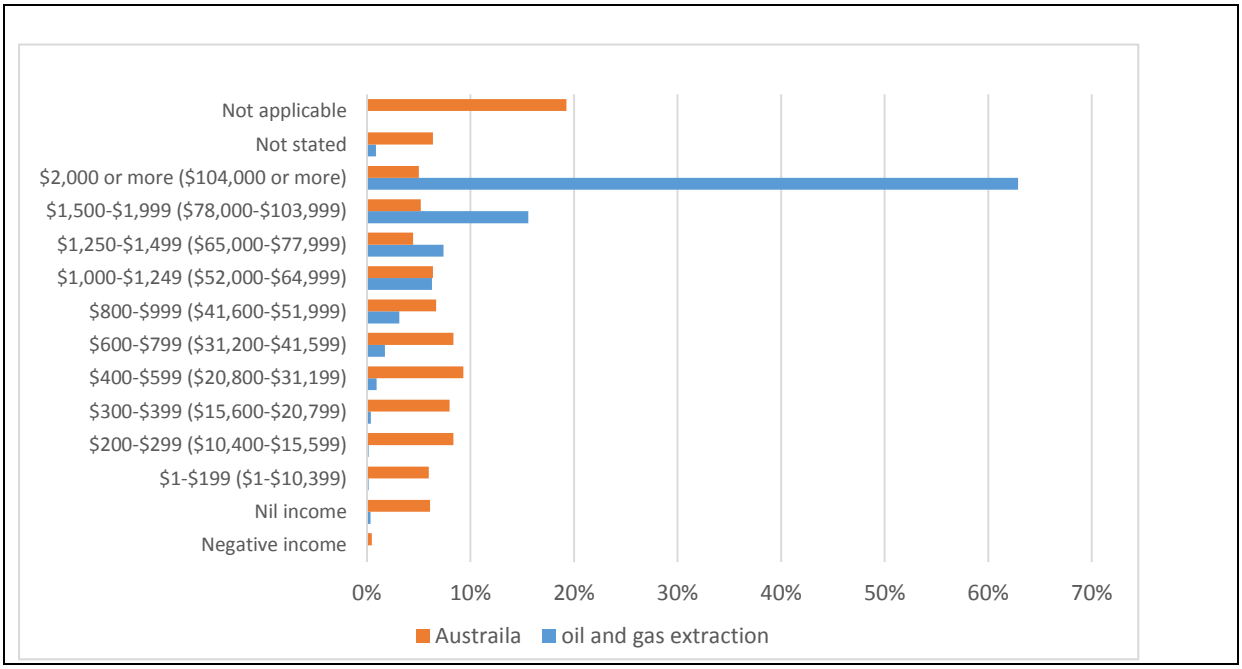
[26] Australian Bureau of Statistics2011 Census data, working population profile.

        - Natural gas exploration, Petroleum exploration
    - 1090 Other Mining Support Services
        - Cementing oil and gas well castings, Directional drilling and redrilling, Mining draining and pumping service, Oil and gas field support services
- Division C- Manufacturing.
    - 1701. Petroleum Refining and Petroleum Fuel Manufacturing. Includes refining, diesel, jet fuel, etc.
    - 1709 Other Petroleum and Coal Product Manufacturing
    - 1811. Basic Chemical and Chemical Product Manufacturing (LNG) Industrial Gas Manufacturing. LNG
- Division D – Electricity, gas and Waste
    - 2700. Gas Supply. Primarily distribution - incudes domestic CSG, LPG, natural gas.

Petroleum Industry Employment – High paying and highly skilled

It is important to note that the people employed by the oil and gas *extraction* industry are highly qualified and in high paying, value adding jobs. According to the ABS 2011 census, most (64 per cent) people employed by the oil and gas extraction industry earn more than $100,000 per year. This is significantly higher than the Australian average of 5 per cent.

Chart 19: Average Weekly Income for oil and gas and Australian Average



Source: Australian Bureau of Statistics

Regulatory Overview

The natural gas industry is regulated by many agencies – Commonwealth, State and Territory. Most Australian jurisdictions have significantly changed gas industry regulation to accommodate unconventional gas operations. In many cases, these reforms have been informed by reviews conducted by independent experts or parliamentary committees (examples are provided in Table 6). Many of these regulatory changes have built upon or been grafted onto existing provisions for conventional petroleum operations.

The main regulatory instruments are identified in Table 7 below. The industry complies with industry-specific requirements (e.g. environmental, safety and public health, land use, planning) as well as generic resource or business regulation. The regulatory arrangements are complex and often involve considerable, costly duplication.

Governments have sometimes rejected reform recommendations on flimsy grounds. For example, while the Tasmanian review of hydraulic fracturing found that "the risks associated with this technology [hydraulic fracturing] are seen as low and manageable by industry", the Tasmanian Government took the view that "Fracking may not be compatible with the Tasmanian community's aspirations for our rural communities and regional landscapes."

Table 6: Independent Assessments of Unconventional Gas Frameworks in Australia

Primary Finding	Source
"This Inquiry's major recommendation, consistent with other Australian and International reviews, is that the environmental risks associated with hydraulic fracturing can be managed effectively subject to the creation of a robust regulatory regime."	Allan Hawke AC, *Report of the Independent Inquiry into Hydraulic Fracturing in the Northern Territory*, 2014, Executive Summary, page x.
"The Committee finds that many of the concerns expressed by the community in relation to the impact of hydraulic fracturing for unconventional gas can be addressed through robust regulation and ongoing monitoring."	WA Legislative Council Environment and Public Affairs Committee, *Inquiry into Hydraulic Fracturing for Unconventional Gas,* 2015.
"The evidence suggests that, provided appropriate monitoring programs are undertaken and a robust and transparent regulatory regime put in place (and enforced), there will be a low risk that shale gas production will result in contamination of aquifers, surface waters or the air, or that damaging induced seismicity will occur."	The Australian Council of Learned Academies, *Engineering Energy: Unconventional Gas Production – A study of shale gas in Australia,* 2013, p177.
"There is a perception in some parts of the community that CSG extraction is potentially more damaging and dangerous than other extractive industries. This perception was heightened following the release of the American movie Gasland in 2010. The Review examined this issue in detail and concluded that, while the CSG industry has several aspects that need careful attention, as do almost all industries, it is not significantly more likely to be more damaging or dangerous than other extractive industries."	Mary O'Kane, NSW Chief Scientist and Engineer, *Final Report of the Independent Review of Coal Seam Gas Activities in NSW,* 2014, p7.
"Provided best practice is followed, including ensuring that there is comprehensive knowledge of the sub-surface, hydraulic fracturing is most unlikely to cause damaging induced seismic events or result in widespread, systemic impacts on drinking water resources – of which there is no evidence from hydraulic fracturing of shales in the US."	Australian Academy of Technology and Engineering *Media Release – Best practice and community support are keys to unconventional gas*, 3 December 2015.

Land Access

Land access for unconventional gas exploration and development is primarily regulated by state and territory governments. State and territory governments own mineral resources. They determine which resources are made available for exploration and production, and they set the conditions for development. Companies bid for development rights and, when producing, they pay royalties and other taxes to governments.

Access to land for petroleum exploration and development is comparable to other public purposes such as construction of roads, rail, power lines, pipelines and irrigation infrastructure. There is obvious potential for conflict between the community's interest in seeing resources developed and private landowners' concerns about developments occurring on their land.

The Commonwealth's Multiple Land Use Framework (MLUF), endorsed by the COAG Energy Council, recognises this potential for conflict:

> "*… rights of all land users and the potential of all regulated land uses should be acknowledged and respected, while ensuring that regulated land is not restricted to a sole use without considering the implications or consequences for other potential land uses, and the broader benefits to all Australians.*"[27]

The Australian oil and gas industry strongly supports policies that balance these competing interests and promote co-operation and co-existence. Gas developments have a relatively modest 'footprint' and can be conducted alongside traditional rural industries. There are significant benefits for regional communities from industry investment in infrastructure. Gas production can offer new, reliable supplies of water for agriculture.

Land access regulation varies between jurisdictions. However, there are some common requirements:

- notifying the landholder before starting operations;
- negotiating an access agreement with the landholder which determines the terms and conditions of access before any significant activities are undertaken;
- compensating the landholder for any loss arising from industry activities; and
- arbitration where landholders and companies cannot agree on land access and, failing that, recourse through the relevant court or tribunal.[28]

Companies have successfully negotiated thousands of land access agreements and compensation arrangements with farmers. Over 5,000 landholder access agreements have been negotiated in Queensland. Queensland landowners received $238 million in compensation in the five years to June 2015.

Table 7: Regulation of Unconventional Gas in Australia

Jurisdiction	Review(s)	Current status	Principal regulation
National	Australian Council of Learned Academies, 'Securing	The Commonwealth Government is working with States/Territories to negotiate assessment and approval bilateral agreements under the Environment	• Environment Protection and Biodiversity Conservation Act 1999 • Water Act 2007 • Native Title Act 1993

[27] www.scer.gov.au/publications/multiple-land-use-framework-december-2013.
[28] Productivity Commission Mineral and Energy Resource Exploration http://www.pc.gov.au/inquiries/completed/resource-exploration/report/resource-exploration.pdf

Jurisdiction	Review(s)	Current status	Principal regulation
	Australia's Future – Engineering Energy: Unconventional gas production'	Protection and Biodiversity Conservation Act 1999.	• Industrial Chemicals (Notification and Assessment) Act 1989 • Corporations Act 2001 and Australian Securities and Investments Commission Act 2001 • Fair Work Act 2009 • Petroleum Resource Rent Tax Assessment Act 1987 • Income Tax Assessment Act (various years) • Excise Tariff Act 1921
Queensland		Coal seam gas exploration and production is widely undertaken in Queensland. Significant environment and land access reforms have been implemented previously. An independent review of the GasFields Commission is underway, with a final report and recommendations due to the Minister for State Development in mid-2016.	• State Development and Public Works Organisation Act 1973 • Environmental Protection Act 1994 • Environmental Protection Regulation 2008 • Fisheries Act 1994 • Forestry Act 1959 • Nature Conservation Act 1992 • Regional Planning Interests Act 2014 • Petroleum and Gas (Production and Safety) Act 2004 • Waste Reduction and Recycling Act 2011 • Water Act 2000 • Aboriginal Cultural Heritage Act 2003 • Queensland Heritage Act 1992 • Public Health Act 2005 • Transport Operations (Road Use Management) Act 1995 • Queensland Industrial Relations Act 1999 • Sustainable Planning Act 2009 • Petroleum and Gas (Production and Safety) Act 2004 (and Petroleum Act 1923)
NSW	NSW Chief Scientist & Engineer, *Independent Review of Coal Seam Gas Activities in NSW.*	Following an extensive independent review of the NSW regulatory framework and how it manages CSG activities, conducted by Professor Mary O'Kane AC, the NSW Government responded with the NSW Gas Plan. Under the Plan, the Government will: • Make better science and information available to decision-makers and the community;	• Environmental and Planning Assessment Act 1979 • Heritage Act 1977 • National Parks and Wildlife Act 1974 • Petroleum (Onshore) Act 1991 • Protection of the Environment Operations Act 1997 • Water Management Act 2000 • Dangerous Goods (Road and Rail Transport) Act 2008 • Environmentally Hazardous Chemicals Act 1985

Jurisdiction	Review(s)	Current status	Principal regulation
		• Take a more strategic approach to issuing petroleum exploration titles; • Introduce strong and certain regulation with a lead regulator responsible for compliance and enforcing conditions of approval for gas activities in NSW; • Share the benefits of gas development with landholders and local communities; and • Secure gas supplies by exploring all supply options.	• NSW Work Health and Safety (Mines and Petroleum Sites) Act 2013 • Public Health Act 2010 • Industrial Relations Act 1996
Victoria	Victorian Auditor-General's Report, *Unconventional Gas: Managing Risks and Impacts*. Legislative Council Inquiry into Unconventional Gas in Victoria.	Following two reviews of unconventional gas in Victoria, a moratorium remains in place.	• Petroleum Act 1998 • Petroleum Regulations 2011 • Mineral Resources (Sustainable Development) Act (MRSDA) 1990. • Planning and Environment Act 1987. • Environment Effects Act 1978 • Water Act 1989 • Environment Protection Act 1970 • Mineral Resources (Sustainable Development) Act (MRSDA) 1990 • Occupational Health and Safety Act 2004 and the Dangerous Goods Act 1985
SA	Parliament of South Australia, Natural Resources Committee, Inquiry into Unconventional Gas. [Ongoing].	The Cooper Basin is the only area where unconventional gas exploration and development has been undertaken. The Roundtable for Unconventional Gas has provided a forum for consideration of improvements to the existing regulatory framework.	• Petroleum and Geothermal Energy Act 2000 • Development Act 1993 • Environment Protection Act 1993 • Native Vegetation Act 1991 • Natural Resources Management Act 2004—Far North Water Allocation Plan • Aboriginal Heritage Act 1988 • Heritage Places Act 1993 • Work Health and Safety Act 2012
WA	Dr Tina Hunter, *Regulation of Shale, Coal Seam and Tight Gas Activities in Western Australia.* Parliament of Western Australia, Legislative Council, Inquiry into Hydraulic Fracturing for	There have been two tranches of regulatory reforms in Western Australia. In response to the 2011 review by Dr Tina Hunter, the WA Government developed and introduced new environment and resource management regulations which captured issues associated with unconventional gas. Following the WA Parliament Legislative Council Environment and Public Affairs Committee's Inquiry into Hydraulic Fracturing, a further round of reforms has	• Conservation and Land Management Act 1984 • Environmental Protection Act 1986 • Wildlife Conservation Act 1950 • Environment Protection Act 1986 • Rights in Water and Irrigation Act 1914 • Planning Authority Act 1972 • Aboriginal Heritage Act 1972 • Petroleum and Geothermal Energy Resources Act 1967 • Petroleum and Geothermal Energy Resources (Environment) Regulations 2012

Jurisdiction	Review(s)	Current status	Principal regulation
	Unconventional Gas.	been agreed to by the WA Government and is expected to be progressed through 2016.	• Contaminated Sites Act 2003 • Health Act 1911 • Occupational Safety and Health Act 1984 • Petroleum and Geothermal Energy Resources (Occupational Safety and Health) Regulations 2010 • Petroleum and Geothermal Energy Resources (Management of Safety) Regulations 2010
NT	Dr Allan Hawke AC, *Report of the Inquiry into Hydraulic Fracturing in the Northern Territory.*	An independent review of the regulatory framework for unconventional gas in the Northern Territory has identified improvements to the existing regulatory framework which would further refine the Territory's ability to manage unconventional gas. In August 2015, the Territory introduced 'Onshore Oil and Gas Guiding Principles' as an interim measure while key recommendations from the Hawke Review are being progressed.	• Environmental Assessment Act 1982 • Territory Parks and Wildlife Act 2006 • Waste Management and Pollution Control Act 1997 • Water Act 1992 • Petroleum Act 1984 • Northern Territory Aboriginal Sacred Sites Act 1989 • Dangerous Goods Act 1998 • Petroleum Act 1984—Schedule of Onshore Petroleum Exploration and Production Requirements • Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act 2010 • Work Health and Safety (National Uniform Legislation) Act 2011
Tasmania	Department of Primary Industries, Parks, Water and Environment, *Review of Hydraulic Fracturing in Tasmania.*	Following a review of hydraulic fracturing by the Tasmanian Government, a moratorium remains in place until March 2020. Exploration, including for unconventional gas, is still permitted. However hydraulic fracturing is forbidden.	• Mineral Resources Development Act 1995; • Environmental Management and Pollution Control Act 1994; • Land Use Planning and Approvals Act 1993

Industry/Local Community Collaboration

Outlined below are several examples of the industry working collaboratively with stakeholders and local communities.

Queensland CSG Landholder Support Project

For many years, the industry has co-funded a landholder support program delivered by AgForce – the peak body for Queensland's beef, sheep, and grain producers. The program is a practical example of the gas and agricultural industries working together. A range of free services are provided to landholders, including advice on negotiating access with the industry.

The CSG Information Sessions assist landholders who are not yet at the negotiation stage, covering:

- An explanation of groundwater impacts and landholder rights
- Development plans in a given region
- Regulatory changes and new or updated legislation
- What landholders can expect when they enter into negotiations, including initial stages right through to negotiating rehabilitation.

The Advanced CSG Negotiation Support workshops are designed for people who:

- Are negotiating a land access agreement; or
- Have negotiated and settled a land access agreement; or
- Are renegotiating their existing land access agreement; or
- Are negotiating a Make Good agreement.

The CSG Digital Mapping Workshops provide practical computer training to help landholders develop a computer map to plan for potential CSG impacts on their land. The workshops cover:

- Skills and technology to develop a computer property map and plan, with property infrastructure and points of interest recorded, to help demonstrate to a resource company where and when it can conduct activities
- A given property's latest digital data and a mapping software demonstration program.

A Joint Farming-Petroleum Approach to Land Access in Western Australia

Between 2013 and 2015, APPEA, the WA Farmers Federation, the WA Pastoralists and Graziers Association and Vegetables WA developed Australia's first voluntary standard land access agreement. This standard agreement makes it easier for landholders and petroleum companies to negotiate a mutually beneficial arrangement. The agreement ensures that companies pay the landowner's costs for negotiating an agreement; provides a practical way to resolve disputes; and sets clear expectations for open and up-front communication.

A summary of the Farmer's Guide to Land Access, jointly prepared by the various representative bodies, is attached.

Long-term Community Investments in Queensland

Between 2011 and 2014, QGC delivered one of the most substantial private investment programs in Queensland's history through its Social Impact Management Plan (SIMP).

QGC has delivered on the 94 commitments made under the SIMP in six areas:

- Employment and economic development
- Community safety, health and social infrastructure
- Housing
- Road and marine traffic management
- Indigenous participation
- Land use management.

Implementing the programs involved investments totalling about $1 billion. Most funding was committed to roads and workforce accommodation. QGC also invested $150 million in community projects, helping about 500 community-based, not-for-profit organisations. These funds include:

- $3.5 million for the Gladstone Hospital, enabling thousands of treatments annually in a new renal dialysis centre and improved operating theatre resources.
- $1.3 million to the Chinchilla Connexions Centre for social service delivery.
- More than $600,000 to Queensland Fire and Emergency Services for infrastructure, equipment and other resources for rural fire brigades in the Western Downs region.
- Upgrades to airport infrastructure and safety in Chinchilla ($4.7 million) and Gladstone ($3.5 million).
- $150 million for upgrading, maintaining or repairing public roads in the Western Downs and Gladstone.

WA Mid-West Community Reference Group (CRG)

The Drover-1 exploration well is about 220km north of Perth on private agricultural land in the Shire of Coorow, adjacent to the Lesueur National Park and near the Mount Peron Water Reserve. It is operated by AWE Limited, which has been active in Western Australia's Mid-West region for many years.

After all necessary approvals for the project, an independent community reference group (CRG) was established in late 2014. The main issues identified by the community were drinking water protection, the approvals process and potential lifestyle changes.

The CRG placed local community members at the centre of the consultation process, providing a clear line of communication between AWE and other stakeholders. The CRG was designed to help establish trust and respect between community, industry and government. All interested community members living and/or working or with other interests in the Shire of Coorow were

welcome to attend meetings. This included Traditional Owners or their representatives with a current and/or historical connection to land in the Shire of Coorow. Meeting venues were shared between coastal towns within the Shire of Coorow at Green Head and Leeman.

Although independently facilitated, the CRG was governed by a community-selected steering group that included: local community and business owners (mainly from Green Head and Leeman), Traditional Owners (the Yued people), the Shire of Coorow (staff and council) and NGO groups.

The CRG funding was provided by AWE but not tied in any way to outcomes.

(Drover-1 Community Reference Group) – Photo Supplied by AWE

Once established, the CRG was open to invite input from external organisations as relevant. This included AWE; the Conservation Council of WA; state government agencies such as the Department of Mines and Petroleum, the Department of Water, the Water Corporation, the Department of Parks and Wildlife, the Department of Health; and academics and third-party consultants to address technical or specialist questions.

Although uncommercial results from the exploration program led to AWE decommissioning the site, post-CRG interviews with participants indicated that the CRG process had been an overwhelming success that created real value for the community.

Engagement with Indigenous Communities in WA's Kimberley Region

Buru Energy is an ASX-listed oil and gas exploration and production company, focused on the Canning Basin in Western Australia's Kimberley region. In 2015, Buru Energy undertook a tight gas appraisal project on and near Noonkanbah Station (Yungngora community).

Buru's work with Traditional Owners includes:

- Delivering cultural inductions to all Buru Energy staff and contractors who worked on site during the tight gas project.
- Supporting independent specialist reviews for hydraulic fracturing.
- Partnering with Kimberley Training Institute (KTI) to train environmental cadets to undertake groundwater monitoring at well sites.

- Partnering with KTI to train personnel in security and operating excavators, water carts, dump trucks, front-end loaders and bobcats.
- Employing more than 30 Traditional Owners.
- A stimulation program with more than 13,500 hours of paid employment undertaken by community members.

Provided below is a Yungngora Community Statement, released in September 2015, regarding Buru Energy's activities.

11 September 2015

The following is a joint statement released today by Yungngora Chairwoman, Caroline Mulligan and Koolkarriya Committee Chairman, Ronnie Lormada.

We the Yungngora People are the recognized Native Title holders for Noonkanbah Station. Our lands around Noonkanbah have been our traditional lands for many thousands of years.

Buru Energy has recently completed their fraccing operation on our country. We allowed this to happen after speaking to many experts about the effect of this activity on our country and the environment. Our experts looked at Buru's plans and let us know this is a safe activity if it is done properly. We trust Buru to do this properly.

"My hope and dream for the community and for the people as well is mainly getting young people involved in the workforce, getting them involved in looking after their country and with Buru it has been a really strong start with us and for the future."

"It has been great to see our young people work closely with Buru and we have that connection."

The following is a statement from Thomas Skinner, Chairman of the Yungngora native title corporation.

We are the new generation of Aboriginal owners that speak for our country and have the support of our old people. We have set up Koolkarriya as a business council that represents the seven clan groups of our Traditional Lands. The council really connects with Buru Energy so that we can have future work and opportunity for our young people.

The reason we selected the people on the business council is so that they can feed back to their own people that they can have their own business going as well. If Buru Energy get cranked up, that is really good for us.

We really want to keep this place going. We want to keep our young people safe from alcohol and the new drugs coming into the Kimberley. This is what is killing our people. Mining is giving us job opportunities to work on our own land. We need training and job opportunities for our kids future.

A mining company like Buru Energy come in here, they give opportunity and work. We want this.

Alcohol and drugs is killing our people – not mining or oil and gas.

WE NEED THESE NEW OPPORTUNITIES.

We welcome Buru.

Yungngora
ASSOCIATION INC

Noonkanbah Station Rd
PMB 400
Via Fitzroy Crossing
Western Australia 6765

Tel: (08) 9191 4691
Fax: (08) 91914689
Email: yungngora@bigpond.com

Selection Terms Used in this Report[29]

Term	Definition
1P	Proved reserves
2P	The sum of proved and probable reserves
3P	The sum of proved, probable and possible reserves.
2C	Best estimate of contingent resources.
3C	High estimate of contingent resources.
Abandoned/Decommissioned Wells	Where the reservoir and high pressure zones in a well are sealed with cement so that no fluids or gasses can escape after the drilling rig leaves the location.
AEMO	Australian Energy Market Operator.
APPEA	Australian Petroleum Production and Exploration Association.
BCM	Billion Cubic Metres (of gas).
Co-produced water	Produced water (also known as coal seam gas water or associated water) is the combination of hydraulic fracturing fluid (if hydraulic fracturing has occurred) and formation water, which is water that is already present in the coal seam. The gas and produced water are separated at the surface.
Conventional gas	Conventional gas reservoirs largely consist of porous sandstone formations capped by impermeable rock, with the gas stored at high pressure.
CSG	Coal seam gas is trapped in coal seams by water pressure. To extract CSG, water already in the coal seam must be pumped out to release the gas.
Exploration well	A well drilled to establish the existence of a possible petroleum deposit or to acquire information to delimit an established deposit. Exploration wells include wildcat and appraisal wells.
Formal dispute of access	An access dispute referred to a body (e.g. a Magistrate's Court) for arbitration.
Fracture stimulation/hydraulic fracturing.	Hydraulic fracturing, also commonly referred to as fracking, is a method used by the oil and gas industry since the late 1940s to increase oil and gas extraction from reservoirs. It has been used in Western Australia and South Australia since the 1960s and in Queensland since the 1990s.
GISERA	Gas Industry Social and Environmental Research Alliance.
LNG	Liquefied natural gas.
Land access agreement	Agreement between a landholder and petroleum operator. Typically details the terms of access.

[29] Note: some of these definitions have been adopted from the CSIRO's "What is Unconventional Gas" Page: www.csiro.au/en/Research/Energy/Hydraulic-fracturing/What-is-unconventional-gas

Monitoring bores	A well used for monitoring, typically for changes to water or atmospheric composition.
MTPA	Million tonnes per annum.
Pilot and appraisal wells	Exploration well drilled to establish the extent and size of a petroleum deposit that has already been discovered by a wildcat well.
PJ	Petajoule.
Production wells	A development well used for production of petroleum or of water for injection purposes.
PRMS	Petroleum resource management system.
PRRT	Petroleum Resource Rent Tax.
Shale gas	Shale gas occurs in rock formations under high pressure but having extremely low porosity making it difficult for gas to flow to wells.
SIMP	Social Impact Management Plan
Syngas	Abbreviation for 'synthesis gas'. A fuel gas mixture consisting primarily of hydrogen, carbon monoxide and carbon dioxide. The result of UCG.
Tcf	Trillion cubic feet (of gas). One TCF is enough gas to power a city the size of Perth for 10 years.
Tight gas	Tight gas is the term commonly used to refer to low permeability reservoirs that produce mainly dry natural gas. Many of the low permeability reservoirs that have been developed in the past are sandstone.
Total (active) wells	Total wells currently operating.
UCG	Underground coal gasification. This is not a form of unconventional gas production. It is a process of producing synthetic gas by partially burning coal seams in situ and then extracting the "syngas" produced.
Unconventional gas	Typically refers to gas found in coal seam, shale rocks or tight reservoirs (typically limestone and sandstone).

Attachment

A FARMER'S GUIDE TO LAND ACCESS

FOR PETROLEUM EXPLORATION ACTIVITIES UNDER THE *PETROLEUM AND GEOTHERMAL ENERGY RESOURCES ACT 1967*

THE PURPOSE OF THIS GUIDE

Western Australia's farming and petroleum industry leaders have been working together to produce an information package to help rural land owners negotiate fair and equitable agreements for exploration on private land. The project fills the need for a balanced and easy-to-understand guide to the rights and responsibilities of the parties to an agreement.

To produce this guide we have involved experienced farmers, petroleum operators, government representatives and legal advisers. The contents are based on input from the Australian Petroleum Production and Exploration Association, WAFarmers, WA Pastoralists and Graziers' Association, vegetablesWA and the Department of Mines and Petroleum.

The guide is part of a package of information designed to make negotiations easier and co-existence simpler. This supporting information makes it easier for farmers to be directly involved in the negotiating process - but it isn't a replacement for specialist advice on legal, financial and agricultural matters.

The guide is part of a package of information designed to make negotiations easier and co-existence simpler

The package includes:

- An agreement template which can be used as a model for individual agreements between property owners and oil and gas companies;
- A summary of key laws and regulations covering exploration;
- A checklist of some of the issues the land holder needs to know – and questions which need to be asked;
- A brief introduction to typical exploration programs; and
- Contacts for more information.

The guide deals specifically with the exploration phase of petroleum development. Proposals for field development and commercial production would need to be the subject of a separate agreement.

WHAT TO SAY AND WHAT TO ASK

The most important priority in dealing with petroleum companies is to get a clear idea of the exploration program envisaged.

So the first question when the explorer comes knocking is: What are your plans and when do you think work will start?

Other points the farmers should consider are listed below.

CHOOSE THE RIGHT TIME

Don't try to manage the negotiation around seeding, planting, harvesting, lambing or other priorities. Talk to the petroleum company about scheduling discussions during a time which suits the farming activities.

WORK ON A COOPERATIVE PROGRAM

Make sure you know what's planned and when. At the same time ensure the petroleum operator understands your farm programs and how to minimise the impacts of exploration.

TALK TO NEIGHBOURS INVOLVED IN THE SAME EXPLORATION PROJECT

Share ideas and knowledge about potential impacts and appropriate compensation.

The first question to ask is 'What are your plans and when do you think work will start?'

GET INDEPENDENT ADVICE

Use advisers of your choice, and see assistance from the operator to pay for such advice. These costs should be discussed and agreed up front.

CONSIDER HOW THE EXPLORATION ACTIVITIES CAN PROVIDE LASTING IMPROVEMENTS FOR THE FARM

The exploration activities might involve infrastructure like roads, water bores, fencing and power supply. In some cases, these infrastructures can be retained and subsequently used by the farmer. In a similar context, the operator might hire the farmer to carry out rehabilitation work – providing this meets with the approval of the regulators.

GET YOUR FARM PLANNING UP TO DATE BEFORE YOU NEGOTIATE A DEAL

You need to make sure that future activities are not compromised by exploration impacts.

FIND OUT ABOUT ENVIRONMENTAL MONITORING AND REGULATION

It will help to know how and where to get information about environmental management requirements - and who to talk to if you need to have the information interpreted. You are entitled to be consulted about the rehabilitation plans – and to monitor the way these programs are implemented. In a similar context, you can get detailed and comprehensive information about the requirements for construction, well integrity and safety.

TALK TO THE COMPANY DECISION-MAKERS

Each oil and gas project has a designated "responsible person" to liaise with land holders and other stakeholders. Make sure you have all the necessary contact details and a clear understanding of how the relationship will work.

WHAT THE LAW SAYS

Petroleum activities in Western Australia are governed by the *Petroleum and Geothermal Energy Resource Act 1967*. This Act and the associated regulations and guidelines were updated in 2013. Copies are available online from the State Law Publisher (www.slp.wa.gov.au).

Some of the key provisions are listed below:

GAINING ACCESS TO PRIVATE LAND

- Prior to accessing private land, an Operator must first obtain consent in writing and negotiate a compensation package, if any, with the private Land Holder.

- Operations cannot commence on private land until any compensation is paid to the owner and occupier of the land or agreement has been reached as to the payment of compensation.

CAN ACCESS TO LAND BE DENIED TO A PETROLEUM TITLE HOLDERS?

- Access can be denied where the land is: private land less than 2000 m^2 (one fifth of a hectare); land used as a cemetery or burial place; or land within 150 m laterally from such cemetery, burial place, reservoir or any substantial improvement.
- In this context a reservoir is defined as any natural storage or accumulation of water, spring, dam, bore or artesian well. The Minister is responsible for determining whether an improvement is substantial.
- It is at the discretion of the Land Holder as to whether access would be granted to a property that meets these criteria.

COMPENSATION TO BE NEGOTIATED WITH PRIVATE LAND HOLDER/OCCUPIER

- Operations cannot be commenced on private land unless agreement on compensation (if any) has been reached with the Land Holder.
- Compensation should cover the Land Holder being deprived of the land and for damage to the land and / or improvements.
- Compensation cannot include payment for the value of petroleum resources on or under the land as the law recognises that these belong to all Western Australians.

IF COMPENSATION CANNOT BE AGREED

- If compensation cannot be agreed after three months (from the date the Operator approached the Land Holder with a notice of intent to commence operations) either party may apply to the Magistrates Court to fix the amount of compensation.

IDENTIFYING THE ISSUES FOR NEGOTIATION

One of the most important elements of a successful agreement is the identification of the key issues, potential impacts and compensation costs in the early stages of the negotiation process. Some of the priorities include:

THE EXPLORATION PROGRAM

The operator needs to provide the farmer with a clear outline of the activities and likely time frames for exploration.

THE FARMING PROGRAM

In a similar context, the farmer should provide the exploration company with the following information:

- the annual farm program;
- potential impacts of exploration from the land holders' perspective; and
- any future plans for the property.

COMPENSATION AND FARM MANAGEMENT PROTOCOLS

The agreements between farmers and petroleum explorers will include provision for compensation for any losses, damage or other impacts from petroleum exploration. Where appropriate, the agreement will also outline protocols for stock movement, fencing, gates, biosecurity, fire risk management and a range of additional farming priorities

RECOMPENSE FOR "REASONABLE COSTS"

The operator will pay the land holder's agreed costs to secure legal, financial or technical advice. Both parties are expected to identify and agree to these costs before advice is sought.

REHABILITATION

Under law, the Operator is required to rehabilitate the land to pre-disturbance conditions. The Operator will consult with the Land Holder, as well as regulatory authorities, on appropriate rehabilitation strategies before the exploration program begins. The Land Holder should identify any infrastructure installed by the Operator, such as water wells, that the Land Holder intends to utilise into the future and which would not be included in the rehabilitation program. The resulting operational plan will be provided to the Land Holder and used as a reference for subsequent remedial work.

COMMUNICATION PROTOCOLS

This covers regular meetings, notice periods, contact information and access to the operators' designated representatives who are expected to keep the land holders fully informed about company activities. The representatives are available to address any issues raised by the land holder.

NEGOTIATING A FAIR AGREEMENT

A model agreement has been developed by farming and petroleum industry peak bodies to help the negotiation process. The model agreement can be obtained by contacting one of the representatives listed at the end of this document.

This model agreement aims to deliver fairness and equity to all parties in negotiations for access and compensation agreements. At the same time, the conditions in the agreement should help to protect the long term productivity and amenity of farmland.

Some of the most important elements of the model agreement include:

- Requirements for the operator (exploration company) to minimise any disturbance to farming assets and operations;
- Requirements for the land owner to allow the exploration to go ahead without unnecessary disruption once an agreement has been reached;
- Advance communication on operational activities, locations, equipment use, fire management and other relevant information;
- The operator's obligations to cover reasonable costs, including proposals for:
    - Legal and financial advice;
    - Other costs directly related to preparing the agreement; and
    - Technical advice on the impacts of petroleum exploration.

COMPENSATION

Each agreement will include a provision for compensation payments, specific to each project and land holder. Recognising that each property and farming enterprise is unique, the model agreement does not attempt a prescriptive formula for compensation on private land. However, the agreement is based on a set of overarching principles:

1. The Land Holder should not be financially disadvantaged by the exploration activity.
2. The Land Holder will be compensated for any loss of income, damage, inconvenience or loss of amenity.
3. The Operator will pay reasonable costs incurred by the Land Holder in seeking professional advice or information. These costs should be considered in the initial negotiations and incorporated in the agreement.
4. Provision for compensation should consider potential long term losses as well as immediate impacts.
5. Compensation – or an agreed portion of the compensation – will be paid before the start of any exploration activity.
6. Apart from the specifics listed below, Operators agree to compensate farmers for any losses which are shown to be attributable to exploration activity.

Impacts to be considered in a compensation package for exploration include:

- The cost of securing independent expert advice on legal, financial and technical matters (outlined in Item 3 in this section)
- Loss of income from cropping, grazing, horticulture or other agricultural activity
- Disruptions to farm management, including stock movement, fencing changes, livestock breeding, transport and other disturbances
- The cost of rehabilitation and biosecurity measures such as weed control (additional to conditions imposed by Government regulators)
- Seasonal restrictions on vehicle movements
- Soil compaction and other ground disturbance
- Potential agistment costs
- Reduced efficiency in disturbed paddocks
- Cropping delays
- Access to water
- Management of fire risks
- Monitoring and assessment of rehabilitation and other remedial work
- Temporary disturbance during drilling, well construction and hydraulic fracturing
- Land use for flaring and management of hydraulic fracture fluid or produced water.
- Vehicle movement and storage areas
- Devaluation of land as a consequences of the Operator's activities.

If the exploration is successful and the operators seeks approval for commercial production the potential impacts would be the subject of separate negotiations.

The model agreement makes it clear that statutory laws and regulations would take precedence over the contents of any agreement between land holders and exploration companies.

IF YOU CAN'T REACH AGREEMENT

Most agreements for exploration on private farmland in Western Australia have been reached without any form of formal intervention or determination. The processes developed by farming and petroleum industry peak bodies have recognised the critical importance of participants negotiating in good faith and acting on the basis of goodwill.

Occasionally, the parties will not be able to agree on specific issues. In these cases, the Agreement encourages the Parties to pursue mediation, rather than recourse to litigation. The following outlines the steps to initiating mediation:

- The disputing Party should give notice to the other Party setting out the nature of the dispute.
- Both Parties are encouraged to try to resolve the dispute between themselves in the first instance. Both Parties should retain records detailing the original dispute and efforts to resolve the matter, including details of any meetings held.
- If the dispute has not been resolved in 30 days, the matter can be referred to mediation.
- Mediation will be facilitated by a three-person panel, including an independent chairperson, a petroleum representative and a farming representative.
- The disputing Party should contact their representative body (listed at the end of this document). In the course of mediation, the disputing party should be prepared to forward any details of the dispute and efforts to resolve it. The other Party will also be requested for their records.
- The panel will schedule a date for the matter to be discussed between both Parties. Any mediation will be conducted in line with the rules of the Institute for Arbitrators and Mediators Australia, which can be downloaded from www.iama.org.au.
- The cost of mediation should be shared by the Parties in equal shares unless the panel advises otherwise or the Parties agree otherwise.
- If either Party is not satisfied with the outcome of mediation, they may refer the matter to the Magistrate's Court for determination. Information relating to the Magistrate's Court is available at www.magistratescourt.wa.gov.au.

EXPLORING FOR ONSHORE OIL AND GAS – POTENTIAL ACTIVITIES

Oil and gas exploration programs involve a range of technologies and strategies to find new resources – and meet the expectations and communities and regulators. These include:

ENVIRONMENTAL AND HERITAGE STUDIES

Before any exploration work can begin, the petroleum operator must conduct environmental, heritage and engineering studies to secure approval from State and Federal regulatory authorities.

NEGOTIATIONS WITH THE LAND HOLDER

The company must negotiate a land access and compensation agreement with the land holder ahead of any petroleum exploration or development.

AERIAL SURVEYS AND DATA REVIEWS

Most petroleum exploration programs begin with data from past exploration programs Follow-up magnetic and radiometric surveys of the sub-surface geology often use fixed wing aircraft flying 300 metres above the ground.

SEISMIC STUDIES

One of the key exploration tools - seismic surveys - use trucks with vibrator pads to send sound and energy waves deep below the ground Recordings are digitally enhanced to create three-dimensional pictures of the geological structures.

Where possible, the exploration crews use existing tracks for seismic studies, but sometimes they need to clear survey lines to get an accurate picture of the sub-surface geology. These tracks are rehabilitated once the survey work is finished

EXPLORATION DRILLING

Oil and gas exploration wells help to determine the quantity and viability of petroleum discoveries.

HYDRAULIC FRACTURING

If the first stages of exploration identify a promising shale or tight gas prospect the operator will consider hydraulic fracturing to test the potential for commercial production. In this process, exploration teams pump a fluid of water, sand and diluted chemical additives down the well at high pressure. The fluid opens up narrow fractures in the rock and the sand helps to keep the fissures open - allowing trapped natural gas to flow into the well. The water which flows back to the surface is either recycled or stored in sealed evaporation ponds.

REHABILITATION

When the work is complete, wells are capped for possible use in future production and the company works with the land owner to restore any disturbed areas.

CONTACTS FOR MORE INFORMATION

Organisation	Email	Phone
WAFarmers Federation	reception@wafarmers.org.au	(08) 9486 2100
WA Pastoralists and Grazier's Association	pga@pgaofwa.org.au	(08) 9212 6900
vegetablesWA	office@vegetableswa.com.au	(08) 9481 0834
APPEA	perth@appea.com.au	(08) 9426 7208
Department of Mines and Petroleum	Petroleum.Land.Access@dmp.wa.gov.au	(08) 9222 3133

DISCLAIMER

This document has been prepared to provide a guide for farmers, graziers and petroleum companies for land access negotiations.

The content of this template document is intended only to provide generic terms for an agreement. It does not constitute legal advice. The reader should seek legal or other professional advice before acting or relying on any of the content

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