



Inquiry into

Unconventional Gas (Fracking)

in the South East of South Australia

Final Report

ONE HUNDRED NINETEENTH REPORT

of the

NATURAL RESOURCES COMMITTEE

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Tabled in the House of Assembly and ordered to be published 29 November 2016

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Second Session, Fifty-Third Parliament

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## **2 Inquiry into Unconventional Gas (Fracking) in the South East of South Australia**

### **2.1 Establishment of the inquiry**

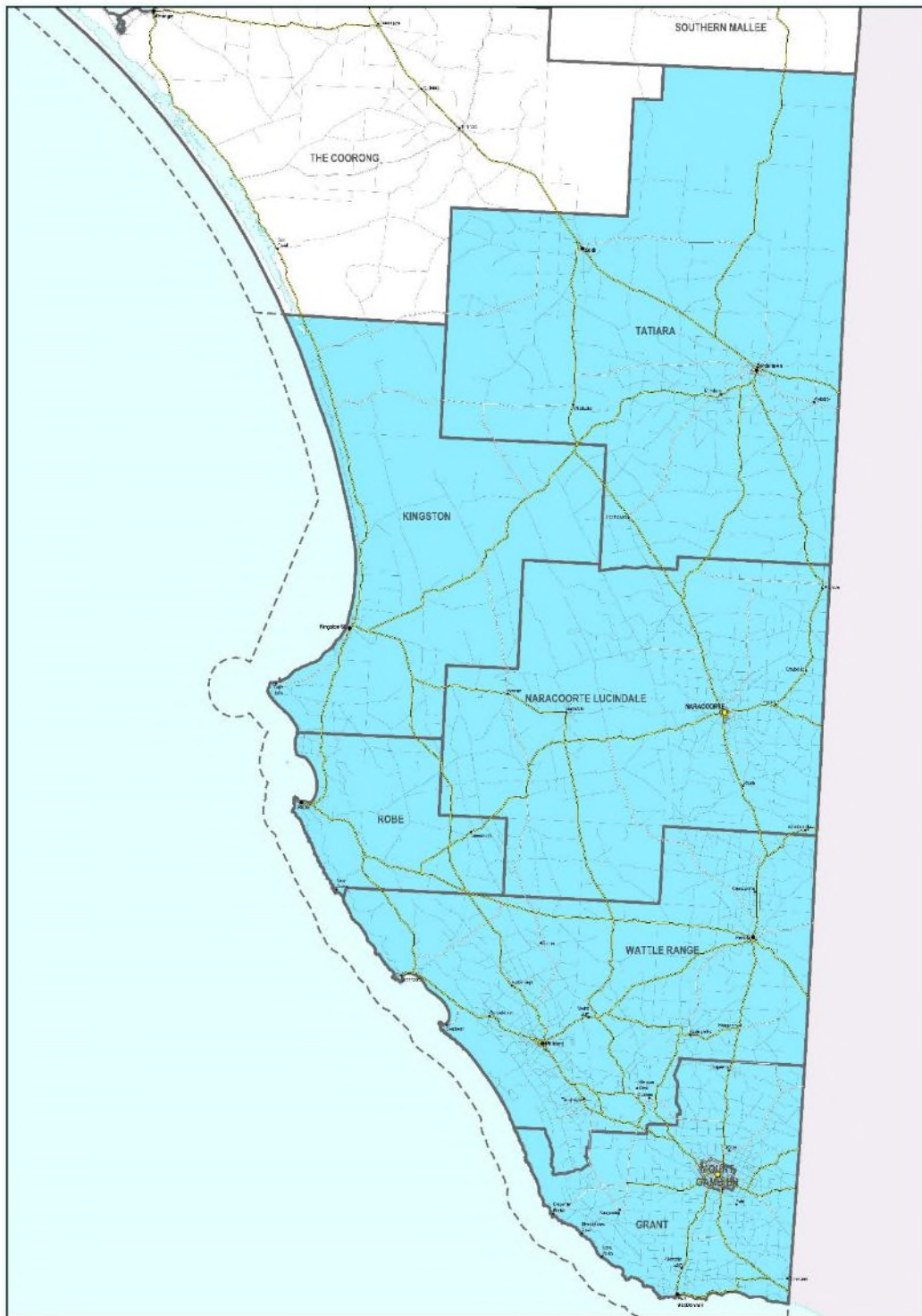
The Natural Resources Committee's Inquiry into Unconventional Gas (Fracking) was referred by the Legislative Council to the committee on 19 November 2014, on the motion of Hon MC Parnell MLC, as amended by Hon TA Franks MLC.

### **2.2 Terms of Reference**

Pursuant to section 16(1)(a) of the *Parliamentary Committees Act 1991*, the committee is inquiring into potential risks and impacts in the use of hydraulic fracture stimulation (fracking) to produce gas in the South East of South Australia and in particular:

1. The risks of groundwater contamination;
2. The impacts upon landscape;
3. The effectiveness of existing legislation and regulation; and
4. The potential net economic outcomes to the region and the rest of the state.

### 3 Map of the South East of South Australia



The South East region of South Australia comprises the seven constituent councils of the Limestone Coast Local Government Association (LCLGA, formerly SELGA, the South East Local Government Association): Tatiara District Council, Kingston District Council, Naracoorte Lucindale Council, District Council of Robe, Wattle Range Council, City of Mount Gambier and District Council of Grant. (Image source: Government of South Australia.)

## 4 Presiding Member's Foreword

The Natural Resources Committee's Inquiry into Unconventional Gas (Fracking) in the South East of South Australia was referred by the Legislative Council to the committee on 19 November 2014, on the motion of Hon Mark Parnell MLC, as amended by Hon Tammy Franks MLC.

Pursuant to section 16(1)(a) of the *Parliamentary Committees Act 1991*, the committee has inquired into potential risks and impacts in the use of hydraulic fracture stimulation (fracking) to produce gas in the South East of South Australia and in particular:

1. The risks of groundwater contamination;
2. The impacts upon landscape;
3. The effectiveness of existing legislation and regulation; and
4. The potential net economic outcomes to the region and the rest of the state.

The committee's inquiry into unconventional gas has taken almost two years to complete. After the public call for submissions we received 178 written responses. The inquiry has attracted a high level of community interest since it began in December 2014, an interest that has remained high throughout, with frequent emails, calls and mail received from the public, community groups and industry.

We also heard from 66 witnesses including a large contingent of local South East residents and business people, South East local government representatives, and members of Parliament including the Member for Mount Gambier Mr Troy Bell MP, the Member for Hammond Mr Adrian Pederick MP and Hon Mark Parnell MLC.

The committee heard from Santos and Beach Energy, the Department of State Development (DSD), South Australian Chamber of Mines and Energy (SACOME), petroleum industry lobbyists APPEA and a wide range of expert witnesses from Australia and overseas. The committee also conducted additional research including reviewing relevant reports, papers and media articles, and published an interim report a little more than a year ago, on 17 November 2015.

The committee undertook four fact-finding visits comprising two visits to the South East, one visit to Queensland and one visit to the Moomba gas fields in the Cooper Basin in SA. The South East visits were to take evidence from local residents and businesses and to visit gas industry sites. The extended visit to Queensland included the towns of Roma, Chinchilla, Dalby and Miles as the committee sought to gain an appreciation of how unconventional gas industry and agriculture might coexist and what community impacts might be expected.

The Moomba visit was undertaken by a subset of the committee in order to view an unconventional gas well in development and to witness an actual "frack", although disappointingly the latter was not seen by the members. I also met with representatives from the UK House of Commons Environmental Audit Committee in April 2015 when I was in the UK after their recently completed inquiry into fracking.

The body of evidence the committee was considering increased exponentially throughout the inquiry as the unconventional gas industry in Australia and worldwide is being studied and reported on regularly. Adding further complexity, there is major change underway within global energy markets. This change has been and will continue to be spurred on by the rapidly falling cost of renewables (especially solar and wind) and as the effects of climate change become more apparent and nations work towards decarbonising the global energy system. These changes have important implications for the economics of unconventional gas in Australia and it would have been remiss of the committee to ignore the broader international context of transitioning energy markets.

To illustrate my point I provide a list of just a few energy-related events from the last 12 months:

1. Leigh Creek coal mine closed down in November 2015.
2. Domestic gas prices have more than doubled since the completion of gas hubs at Gladstone, linking Australia to world-market prices.
3. March and April of this year saw the most widespread-ever coral bleaching event on the Great Barrier Reef as a result of sea-surface warming induced by climate change.
4. In May, the Port Augusta coal-fired power station shut down.
5. BP announced on October 10th it was withdrawing its plans for exploration drilling in the Great Australian Bight.
6. Global renewable energy capacity overtook coal on October 25th 2016.
7. Victoria banned onshore unconventional gas development in October.
8. Earlier this month, the Hazelwood coal-fired power station in Victoria was scheduled for closure in March 2017.
9. Just a few weeks ago, on November 10th, Australia ratified the Paris Agreement of the UN framework convention on climate change, working towards keeping global temperature rises under 2 degrees Celsius.

The committee heard during this inquiry that to meet the Paris climate agreement targets, 80 to 90 per cent of existing coal, oil and gas deposits must remain in the ground.

All this is just in the last 12 months, and according to a range of expert witnesses we have heard from, change to the energy market is considered permanent, not cyclical. Even the International Energy Agency, recognised among global energy analysis agencies as being relatively conservative, described 2015 as a year of remarkable growth in renewables and provided two quite graphic statistics:

- About half a million solar panels were installed every day around the world last year, and
- In China, which accounted for about half the year's wind additions and 40% of all renewable capacity increases, two wind turbines were installed every hour in 2015.

All of this helps to create a picture of the context in which the inquiry has been conducted. It was difficult for this committee to grapple with the enormity of such changes, even in an inquiry which has stretched over two years, but it is clear that all of these events are related to the likelihood of developing unconventional gas resources in the South East of South Australia.

As important as these developments are, however, what the committee has repeatedly come back to is the community at the centre of this inquiry and thus to the question of social licence, namely: does the social licence to operate exist that would allow the development of an unconventional gas industry in the SE of South Australia?

Social license was invoked in many submissions to the inquiry and by a number of witnesses appearing before the committee. The member for Mount Gambier, Mr Troy Bell MP, summed up social license in his evidence to the committee, which I will now quote from:

The term "social licence", or "social licence to operate", generally refers to a local community's acceptance or approval of a project or a company's ongoing presence. It is usually informal and intangible, and is granted by a community based on the opinions and views of stakeholders, including local populations, aboriginal groups, and other interested parties. Due to this intangibility, it can be difficult to determine when social licence has been achieved for a project. Social licence may manifest in a variety of ways, ranging from absence of opposition to vocal

support or even advocacy, and these various levels of social licence (as well as, of course, the absence of social licence) may occur at the same time among different interested parties.

Under this definition, a social licence is given by local community and other stakeholders when a project has broad ongoing social acceptance. Without proper community engagement, industry may find that obtaining social licence to operate may prove more difficult than obtaining a legal licence to operate.

After considering all the evidence available to it, particularly the definition of social licence provided by the Member for Mount Gambier, the committee has reached the position that social licence does not yet exist for the development of an unconventional gas industry in the South East. This has been made starkly apparent by widespread opposition from the local community. This is not vehement or violent opposition; it is peaceful and determined opposition, and it is occurring in spite of there having previously been a conventional gas industry in the South East which has undoubtedly provided significant benefits including employment to the local community.

The vast majority of the submissions and representations the committee received were anti fracking in the South East. Essentially the only submissions in favour of unconventional gas development were from companies and lobbyists engaged by or heavily involved with the oil and gas industry.

None of the pro fracking representations, written or verbal, came from representatives of the South East. The committee made an effort to understand from the perspective of local people and businesses what the economic benefits may be, but despite repeated invitations and approaches to bodies we felt might represent this aspect of the debate, there were no witnesses forthcoming. The committee was actually somewhat surprised that no regional residents or businesses approached us, even in confidence, to express support for the development of an unconventional gas industry in the region.

The committee acknowledges the possibility that regional support may exist but that supporters may not feel comfortable expressing their opinion. If so, it is the committee's belief that community engagement, properly and diligently conducted, will allow such support to be voiced.

At the beginning of this inquiry, the NRC saw its responsibility as recommending whether to frack or not to frack but by the end, although members have their views on the subject, the committee felt that ultimate responsibility rests not with the committee but with industry, government and community, to decide in concert. This inquiry has provided a forum for the issue to be discussed and the NRC has encouraged all stakeholders to have their say.

I wish to thank all those who gave their time to assist the committee with this endeavour. I commend the current members of the committee, Hon Robert Brokenshire MLC, Hon John Dawkins MLC, Mr Jon Gee MP, Hon Gerry Kandelaars MLC, and Mr Peter Treloar MP, as well as past members Mr Chris Pictou MP and Mrs Annabel Digance MP, for their contributions to this inquiry. All members have worked cooperatively on this report.

I also extend thanks to Mr Troy Bell MP, Hon John Darley MLC, Hon Mark Parnell MLC, Mr Adrian Pederick MP and Mr Mitch Williams MP for their assistance with and interest in the inquiry. Finally, I thank the committee staff for their assistance.

  
Hon Steph Key MP  
Presiding Member  
29 November 2016





## 5 Executive Summary

The Natural Resources Committee's Inquiry into Unconventional Gas (Fracking), relative to the South East of South Australia, was referred by the Legislative Council to the committee on 19 November 2014, on the motion of Hon MC Parnell MLC, as amended by Hon TA Franks MLC.

Pursuant to section 16(1)(a) of the *Parliamentary Committees Act 1991*, the committee has inquired into potential risks and impacts in the use of hydraulic fracture stimulation (fracking) to produce gas in the South-East of South Australia and in particular:

1. The risks of groundwater contamination;
2. The impacts upon landscape;
3. The effectiveness of existing legislation and regulation; and
4. The potential net economic outcomes to the region and the rest of the state.

The inquiry, one of many conducted among Australian jurisdictions in recent years, has attracted a high level of community interest since the committee began hearing evidence in December 2014. This interest has remained high throughout the two years of the inquiry, with frequent emails, calls and postal mail received from members of the public, community groups and industry representatives.

An interim report was tabled in the House of Assembly and published on 17 November 2015. That report summarised progress to that point and importantly set out clear definitions for the terms of this inquiry in order to facilitate continued useful discussion among all stakeholders. In the interest of clarity, an abbreviated version of this material is reprinted in Appendix D: Definitions.

The committee has heard evidence from 66 witnesses, 18 of whom have appeared before the committee since the production of the interim report presenting an overview of evidence received and the work of the committee during the first year of the inquiry. Three witnesses spoke to the committee on the subject prior to the official commencement of the inquiry; their evidence has been included and considered.

There were 178 submissions received, along with addenda to many submissions received since the interim report, and these have been considered.

The committee has heard evidence from proponents that possible benefits of developing unconventional gas resources in the South East of South Australia may include:

- Increasing energy security for Australia, particularly South Australia
- Attracting investment to South Australia
- Building export potential to meet demand
- Increasing employment in gas development regions
- Fossil-fuel emissions may be lower when compared to coal
- Using gas as a "bridging" fuel to renewable energy

The committee also received and heard evidence questioning these benefits, with a majority of written submissions expressing a lack of support for unconventional gas exploration and development in the South East, which comprises the seven constituent councils of the Limestone Coast Local Government Association. None of the supporting evidence received emanated from that region.

Throughout the inquiry, all of the evidence the committee has heard, both for and against development, has been in the context of myriad external forces including climate change considerations, production and export price, export demand, technological advances, renewable

energy growth, and very notably, public opinion. Other things affecting the inquiry are legislative changes such as new bans and moratoriums enacted in some jurisdictions while others have moved to ease some restrictions. Change has been a consistent and therefore challenging feature of this inquiry.

The NRC members have worked to keep up with these changes relative to potential development in the South East of South Australia as they have given consideration to the evidence received and information gathered since December 2014 when the inquiry commenced. Notably, one thing that does not appear to have changed since that time is the general public opinion of unconventional gas development in the South East of South Australia.

Recognising that this may have discouraged any potential local supporters from coming forward, the NRC members made attempts to seek other local people and organisations to understand what potential benefits may exist, but no such witnesses were forthcoming.

While some submissions and witnesses indicated they may consider unconventional gas development, it was reluctant and strictly conditional support which hinged on social licence and often considerable legislative review.

This report summarises the NRC's work on the inquiry and, with consideration to the complexity of the subject, the enormous amount of evidence received, and the limitations of committee time and resourcing, represents the members' understanding of unconventional gas development as it relates to the South East of South Australia. The report presents findings as well as the overarching recommendation that the unconventional gas industry, if it is to proceed with new exploration and development in the South East, must do so only with a social licence to operate.

## 6 Recommendations

The Natural Resources Committee recommends that:

1. Without social licence, unconventional gas exploration/development should not proceed in the South East of South Australia. The committee found that social licence to explore/develop unconventional gas does not yet exist in the South East of South Australia.
2. While the specific process of hydraulic fracturing or “fracking” in deep shale, properly managed and regulated, is unlikely to pose significant risks to groundwater, other processes associated with unconventional gas extraction, including mid to long-term well integrity and surface spills, present risks that need to be properly considered and managed. Furthermore, groundwater use in any unconventional gas extraction processes in the South East should be considered in relation to the existing Limestone Coast Prescribed Wells Area Water Allocation Plan (WAP) and other relevant regional WAPs.
3. A review of the Petroleum and Geothermal Energy Act 2000 and relevant regulations would be appropriate, with particular consideration given to:
  - defining terms such as “consultation processes” and “risk” to provide more clarity to the public and other stakeholders in relation to regulated activities;
  - the development and integration of formal guidelines for community engagement and consultation to assist with negotiation processes and achievement of social licence;
  - the perception of a conflicted regulator/promoter, and hence the role that other state agencies and departments, such as the Department of Environment, Water and Natural Resources, the Environment Protection Agency and Primary Industries and Regions SA, might fulfil in managing aspects of exploration and development such as water use, community consultation, landowner rights and ongoing monitoring.
4. The potential for disruption to landscape and local community in exploration, construction and production phases of unconventional gas development should be addressed in agreements with landholders, state and local government prior to any significant works occurring.
5. A definitive proposal for unconventional gas development in the South East of South Australia should be produced before any further consideration can be given to potential economic benefits. This would enable social, economic and environmental impact studies to be undertaken to collect baseline data and inform consultation and community engagement processes. It was not possible for the committee to conduct or commission any economic analysis of prospects for an unconventional gas industry in the South East of South Australia without a definitive proposal but based on expert evidence received on recent developments in the global energy markets, the committee concluded that the window of opportunity for a South East South Australian unconventional gas industry may already be closed. This may change, depending on future events in the international market.

## 6.1 Findings

1. The natural gas industry does not currently have social licence to operate in the South East, and in the committee's opinion unconventional gas exploration and development should not proceed without it. This is not to say unconventional gas exploration and development should never occur in the region, but that in the committee's view, obtaining social licence is a necessary precondition to such development occurring.
2. Major changes underway within global energy markets will continue as cost of renewables (especially solar and wind) falls and as the effects of climate change become more apparent and nations work towards decarbonising the global energy system.
3. Domestic gas prices are now linked to the international market and are not expected to return to previously low price levels.
4. Social impacts resulting from an unconventional gas construction boom in the South East would likely be considerable, with a mixture of positive and negative impacts on local communities.
5. Firm infrastructure agreements with local and state government regarding new road construction to support gas development would be needed in advance of any development occurring.
6. Landowners would need support in negotiations with gas development companies to ensure that Conduct and Compensation Agreements (CCAs) were developed in a consistent way that would be mutually beneficial.
6. The specific process of hydraulic fracturing or "fracking" in deep shale, properly managed and regulated, is unlikely to pose significant risks to groundwater, but other processes associated with unconventional gas extraction, including mid to long-term well bore integrity, surface spills, and waste and chemical transport, present risks that need to be properly considered and managed.
7. Impacts on landscape are difficult to quantify in the absence of a defined development proposal but impacts of an unconventional gas boom similar to that experienced in parts of Queensland would be expected to be significant and could include visual impacts, odour and noise impacts from infrastructure, and increased industrial traffic. Visual impacts of deeper shale-based drilling, especially when multiple wellheads are combined onto a single well pad, are likely to be less than that that seen for coal seam gas.
8. Gas well site location needs appropriate management to minimise impacts on landscape and local business; for example, native vegetation clearing should be minimised and wells should not be placed in the middle of productive farmland paddocks.
9. There exists a perception in the community of a potential conflict of interest regarding the dual roles of the Department of State Development as both promoter and also regulator of mining and gas extraction activities.
10. Potential net economic outcomes from gas-development work and any related construction are impossible to quantify in the absence of a firm proposal for the South East. Based on viewing the impacts of the unconventional gas boom in Queensland, the committee found that individual benefit varied, dependent on a range of factors including socioeconomic status, home ownership and negotiation skills of individual landholders; community benefit depended on the methods of engagement chosen by different companies and the preparedness of community leaders to negotiate on behalf of a community. Potential net economic outcomes are also intrinsically tied to changes and trends in global energy markets.

## 6.2 Explanation

The overarching finding of this report is that the natural gas industry does not currently have social licence to operate in the South East, and that unconventional gas exploration and development should not proceed without it. To be clear, this is not to say unconventional gas exploration and development should never occur in the region, but that before it does, social licence must be achieved. To this end, the establishment of formal guidelines for community engagement would be of great assistance.

Upon review of evidence received over the past two years, the committee was struck by the expression early in the inquiry, on both sides of this debate, of a desire for the exchange of factual information. This is perhaps best summed up by evidence from the Limestone Coast Local Government Association (LCLGA, formerly the South East Local Government Association) and from the Department of State Development. A representative of LCLGA told the committee that the South-East community was “starving” for information but—

the communication with the community when the exploration of gas happened around Penola was really very poor, and that really led to a lot of fear and reactions in the community. If that communication had been done better, then that may not have led to that. It is really sending a strong message to the regulator and to the proponents that the community needs to have surety of what is going to happen in our whole region. It is sending a message to “take us with you, please.”<sup>1</sup>

The committee heard a similar expression from the Department of State Development:

I just wish there was a way that people and enterprises who are relatively unfamiliar with oil and gas operations could be instantly informed so they could separate fact from fiction....I just wish there was a way that we could better communicate that to communities sooner and so I am glad that this inquiry will assist in that, maybe even lead.”<sup>2</sup>

There is a way to improve communication and to assist with social licence, and that is community engagement. It is not an instant solution, however; it will require the industry to budget both time and money.

The International Energy Agency’s publication *Golden Rules for a Golden Age of Gas* states:

A range of factors will affect the pace of development of this relatively new industry over the coming decades. In our judgement, a key constraint is that unconventional gas does not yet enjoy, in most places, the degree of societal acceptance that it will require in order to flourish. Without a general, sustained and successful effort from both governments and operators to address the environmental and social concerns that have arisen, it may be impossible to convince the public that, despite the undoubted potential benefits, the impact and risks of unconventional gas development are acceptably small.<sup>3</sup>

If prospects for gas extraction in the region are good, then industry expenditure on community engagement that allows consultation to be conducted properly should represent a good investment. All stakeholders can then benefit, in accordance with South Australia’s state priorities.

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<sup>1</sup> (Vickery, 2015)

<sup>2</sup> (Goldstein, Fracking, 2015, p. 20)

<sup>3</sup> (International Energy Agency, 2012)

## **7 Natural Resources Committee**

The Natural Resources Committee was established pursuant to the *Parliamentary Committees Act 1991* on 3 December 2003.

### **7.1 Membership and staff**

#### ***Current members***

Hon Steph Key MP, Presiding Member

Hon Robert Brokenshire MLC

Hon John Dawkins MLC

Mr Jon Gee MP

Hon Gerry Kandelaars MLC

Mr Peter Treloar MP

#### ***Members during inquiry***

Mr Chris Picton MP

Mrs Annabel Digance MP

#### ***Staff***

Mr Patrick Dupont, Executive Officer

Ms Barbara Coddington, Research Officer

### **7.2 Functions of the Committee**

Pursuant to section 15L of the *Parliamentary Committees Act 1991*:

(1) The functions of the Committee are—

(a) to take an interest in and keep under review—

- (i) the protection, improvement and enhancement of the natural resources of the State; and
- (ii) the extent to which it is possible to adopt an integrated approach to the use and management of the natural resources of the State that accords with principles of ecologically sustainable use, development and protection; and
- (iii) the operation of any Act that is relevant to the use, protection, management or enhancement of the natural resources of the State; and

- (iv) without limiting the operation of a preceding subparagraph—the extent to which the objects of the *Natural Resources Management Act 2004* are being achieved; and
- (b) without limiting the operation of paragraph (a), with respect to the River Murray—
  - (i) to consider the extent to which the Objectives for a Healthy River Murray are being achieved under the *River Murray Act 2003*; and
  - (ii) to consider and report on each review of the *River Murray Act 2003* undertaken under section 11 of that Act by the Minister to whom the administration of that Act has been committed; and
  - (iii) to consider the interaction between the *River Murray Act 2003* and other Acts and, in particular, to consider the report in each annual report under that Act on the referral of matters under related operational Acts to the Minister under that Act; and
  - (iv) at the end of the second year of operation of the *River Murray Act 2003*, to inquire into and report on—
    - (A) the operation of subsection (5) of section 22 of that Act, insofar as it has applied with respect to any Development Plan Amendment under the *Development Act 1993* referred to the Governor under that subsection; and
    - (B) the operation of section 24(3) of the *Development Act 1993*; and
- (c) to perform such other functions as are imposed on the Committee under this or any other Act or by resolution of both Houses.
- (2) In this section—

‘natural resources’ includes—

  - (a) soil;
  - (b) water resources;
  - (c) geological features and landscapes;
  - (d) native vegetation, native animals and other native organisms;
  - (e) ecosystems.

### 7.3 Referral process

Pursuant to section 16(1) of the Act, any matter that is relevant to the functions of the Committee may be referred to it in the following ways:

- (a) by resolution of the Committee’s appointing House or Houses, or either of the Committee’s appointing Houses;
  - (b) by the Governor, or by notice published in the Gazette;
- or
- (c) of the Committee’s own motion.



## 8 Overview of evidence

### 8.1 Public submissions

The committee placed an advertisement in the *Advertiser* on 26 November 2014 and distributed via email lists a call for interested persons to provide submissions to the inquiry or to register an interest in appearing before the Natural Resources Committee. The committee received a total of 178 written submission, all of which may be found on the Parliament of South Australia website. See Appendix A: List of Submissions for more information.

The submissions received varied in length from very short emails to extensive, multi-part reports running to the hundreds of pages. Approximately 40 submissions were form letters, 26 of which were in support of a lengthy report co-written by several members of a community group.

Seventy-four percent of submissions to the inquiry explicitly stated they did not support hydraulic fracturing in the South East of South Australia. Of these submissions, many called directly for the process to be banned statewide, while a small number of these submissions considered allowing its use to continue elsewhere in the state. There were many reasons stated for desiring that unconventional gas exploration/production be excluded from the South East (if not the state); some of these reasons were related to the terms of reference and some were presented that fell outside the terms.

Seven submissions were received from gas industry proponents—companies or entities either directly engaged in gas exploration and production or directly linked to it: the South Australian Chamber of Mines and Energy, Cooper Energy, Halliburton, Beach Energy, Santos, the Australian Petroleum Production and Energy Association, and The Norwood Resource. These comprised 4 per cent of the total. This group of submissions offered a great deal of background information and, indicating existing awareness of public criticisms levelled at the unconventional gas sector, provided evidence to counter some of the more prevalent concerns.

A submission providing an overview of gas industry activity in South Australia and related issues was received from the Department of State Development, with input from the Department of Environment, Water and Natural Resources, the Environment Protection Authority, Primary Industries and Regions SA, SA Health, and SafeWork SA, which the committee heard also “have a key regulatory role in managing the potential impacts from fracture stimulation” activities.<sup>4</sup>

A third group of submissions to the inquiry (17 per cent) came from private individuals, businesses including wine and forestry, and organisations with no direct ties to the energy industry. All of these submissions, some of which were not overtly opposed to gas exploration and development and some of which were, raised matters which may need to be addressed before the gas industry should progress with unconventional gas development or further exploration in the South East.

Such matters included industry obtaining social licence, security of regional water assets (in terms of potential contamination as well as proposed water usage in relation to the region’s water allocation plan), whether there may be a need for a division between agencies promoting and regulating the gas industry, and limiting fugitive/migratory methane emissions.

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<sup>4</sup> (Department of State Development, 2015a, p. 3)

In this group of submissions, an emphasis was made on:

- securing of social licence by industry;
- diligent community engagement;
- thorough, independent and objective risk analysis;
- the gathering of wide-ranging baseline data specific to the region in areas including hydrogeology, property values, soil and air quality, and mapping of existing bores;
- reviewing and, if necessary amending or adding to the existing legislation to empower landholders and separate regulation and promotion of petroleum industry, among other aims;
- inclusion of any future gas exploration/production in local water allocation plans; and
- ensuring policy and decision-making are informed by independent research.

A fourth group of submissions representing 4 per cent of the total did not explicitly state a position on unconventional gas in the South East of SA.

Over the course of the inquiry, via submissions, meetings and fact-finding visits, the committee has amassed a great deal of evidence, some of it highly technical, some of it emotive, and a great deal of it apparently contradictory.

The first term of reference was a highly disputed topic, particularly the perception of threat to drinking water and water for agricultural purposes. The committee heard evidence that claimed hydraulic fracturing activity had never caused a single instance of contamination of groundwater, and evidence claiming it had. Also questioned was the age and use of hydraulic fracturing. The committee heard evidence that:

- Fracture stimulation has been done for 50 years in south Australia
- Fracking is a relatively new process begun in SA in 2012

While the committee does not dispute that hydraulic fracturing has been practiced in South Australia for many years, the records of Parliament show that the current form of unconventional gas development is said to have commenced in Moomba in 2012. On 29 November 2012, Premier Jay Weatherill said during Question Time:

Our energy industry is benefiting from the burgeoning growth in shale gas, and this year we have seen Santos launch the first unconventional gas well for commercial supply in Australia at Moomba.<sup>5</sup>

A number of such dichotomies recurred throughout the inquiry and some of these are addressed further later in this report. As information was gathered, a picture developed of a complex issue with many grey areas.

## 8.2 Meetings

As of 22 November 2016, the Natural Resources Committee had heard evidence from 66 witnesses over the course of 23 meetings relevant to its unconventional gas inquiry.

Twenty meetings were held in Adelaide at Parliament House, with 47 witnesses appearing. Nineteen witnesses appeared before the committee at three days of regional hearings in the South East—two

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<sup>5</sup> (Weatherill, 2012)

days at the Civic Centre in Millicent SA in February 2015, and one at the Council Chambers in Robe SA in September 2015.

Prior to the formal commencement of the inquiry, the committee also held two meetings in which evidence was heard from three witnesses, under the references “coal seam gas and unconventional gas exploration and extraction”, and “fracking”.

See Appendix B: Witnesses for a complete list of meeting dates, locations and witnesses appearing.

### **8.3 Fact-finding visits and study**

The Natural Resources Committee made the following fact-finding trips for the Inquiry into Unconventional Gas (Fracking).

1. Millicent, South Australia (South East), 17–19 February 2015
2. Surat Basin, Queensland, 24–27 August 2015
3. Robe, South Australia (South East), 14–15 September 2015
4. Moomba, South Australia, 23 November 2015

Travel to Millicent and Robe included public meetings in which evidence was received and recorded in Committee Hansard, transcripts of which have been published to the committee’s Parliamentary web portal.

The Presiding Member travelled to the UK in 2015 and while there, met with staff of the House of Commons Environmental Audit Committee, which had recently concluded an inquiry into risks from fracking operations.

The NRC considered a fifth trip, to Mount Gambier, but this did not eventuate as no new witnesses wished to present in the South East.

A number of witnesses made requests to present a second time; these were declined in favour of written evidence being supplied.

Following is a summary of the committee’s inquiry-related travel to Queensland and Moomba.

#### ***Queensland, 24–27 August 2015***

In August 2015, the Natural Resources Committee visited several communities in south-central Queensland, where coal seam gas production has risen dramatically over the last several years.

While in the region, the committee members met and spoke with a range of stakeholders including land owners, community residents, energy companies, small business owners and operators, legal and financial groups, Western Downs and Maranoa councils, and the local Member of the Queensland Parliament. This visit was summarised in the committee’s Interim Report; the following presents additional detail.

The committee saw first-hand that the community has experienced both advantages and disadvantages following the industry’s expansion, and that both were in some cases linked to which company was dealt with and the negotiation skills of individual landholders.

For example:

- Some landholders have, through dewatering of new unconventional gas wells, secured new sources of water for irrigation
- Regional employment in some areas has increased overall
- Construction related to gas development brought with it a population surge of thousands of workers (from nearby towns, Brisbane, other parts of Australia and, to a lesser degree, overseas)
- Communities were unprepared in terms of basic services such as housing, road infrastructure (including parking), supplies, medical care and police availability.

The committee heard that the region was finally coming to terms with industry growth and working to ensure growth is sustainable and disruption is minimised. The committee was very impressed with the openness with which Queensland stakeholders who met with the committee were prepared to offer experience-based practical advice.

### **Western Downs Regional Council (24 August)**

The committee travelled to Brisbane early on Monday, 24 August, and after driving out west, conducted several meetings in the Western Downs Regional Council area.

After a late morning briefing by Western Downs Regional Council Mayor Ray Brown, council elected members, and staff, along with Scott Bird, representing Origin Energy, the committee went on a bus tour around the Dalby area. According to Mayor Brown, who spoke to the committee on the bus, approximately 6,000 wells were drilled in the Western Downs area in the 10 years up to August 2015, with construction “really ramped up” in the last four to five of those years.

Mayor Brown said local schools were at capacity and business owners were concerned with an industry downturn beginning to take hold of the area, particularly hoteliers who bought businesses “at the peak” of the boom. A problem for other local business owners was not being quick enough off the mark to capitalise on the boom, the committee heard. Machinery businesses from Western Australia entered the region with owners who had experienced that state’s boom; so, some interstate operators who were prepared to capitalise, Mayor Brown said, were thus able to maximise opportunities, in some cases by undercutting local businesses which were just getting started.

The local boom in mining-related construction had had an impact on tourism, with hotel and motel costs going up sharply and many tourists, particularly “grey nomads” preferring to avoid the area during the construction phase, Mayor Brown said.

An ongoing issue with coal seam gas was what to do with salt accumulated from the dewatering of wells. At the time of the committee’s visit, excess salt was being stockpiled in lined pits and monitored. “The last thing we want is more salt in the system,” said Mayor Brown. Ideally, he said, it would be stored in one deposit with monitoring ongoing, with the thought that in the future it could be used for soda ash or caustic soda, which was currently cheaper when imported from overseas producers.

Members heard that groundwater monitoring was taking place to measure aquifer recharge, with a legislated trigger in place to stop activity if the aquifer dropped below a sustainable level. Mayor Brown said interaquifer leakage had been detected as coming from some of the many artesian bores in the region. He estimated there were more than 16,000 such bores in the Western Downs Regional Council. All wells built since 1997, said Mayor Brown, were required to meet stricter well integrity standards to prevent leakage issues.

Mayor Brown admitted that mistakes had been made during gas industry development but said South Australia would be able to learn from these. The committee visited several well sites and viewed placement of wellheads and other infrastructure, some of which was well-screened from view by trees and scrub. Other sites were, he said, eyesores. Mayor Brown advised to “(s)tart with marginal country first. Don’t put wells in the middle of paddocks.” This was not to denigrate marginal country, he said, merely to work towards appropriate location of infrastructure, and to manage vegetation on all lands appropriately. “We don’t want them to clear it all. It has a purpose,” he said.

Social impacts were a mixture of positive and negative, said Mayor Brown. He mentioned jet skis, jewellery and hair salons as some of the new goods and services businesses coming into town, which improved social amenity. Some of the more challenging changes included a topless bar, increased prostitution and some related health concerns; there was also a need for more police as population grew.

The committee was interested to learn about some additional benefits to industry, such as a rural network of mobile towers and broadband built by industry. These were used for security webcams at well sites but could also provide internet and phone access to community members. Gas companies expressed willingness to assist landholders with matters such as wild dog control and reporting issues with cattle and gates on large properties. The committee also heard that gas company presence on land had the potential to create problems such as gates left open, creation of dust, and security issues.

New roads, Mayor Brown told the committee, were potentially very beneficial but could also have a potentially enormous negative impact on the area. He encouraged working closely with the gas companies to ensure firm infrastructure agreements were in place prior to building to ensure any new roads were properly planned, funded, constructed, maintained, and used. “You guys are in a position to make some hard rules,” Mayor Brown said. “Infrastructure agreements show how industry impacts the roads. If they become major arteries, they get upgraded.” After the industry usage had quieted down, council could then assume ongoing responsibility to road maintenance, thereby avoiding the initial expense of building the roads.

Consultation with community in the early days of industry expansion, he said, was “shocking.” He noted that it differed widely between companies, with some effectively adjusting their outreach skills to increase mutual benefit. One company was able to complete 80% of its Conduct and Compensation Agreements (CCAs) without lawyers, he said, while another wound up with 95 per cent of its CCAs having lawyers involved.

There were many points he said that needed consideration in landowner agreements, such as well placement; use of “new” water from dewatering CSG wells; setback of infrastructure from homes and towns; special consideration given to organic production; procedures for returning soil from excavation into beds in the proper order to minimise disruption; dust control from industry traffic; excessive land clearing (Mayor Brown discussed one farmer who had cleaned up what he considered “rubbishy stuff” which turned out to be native understory, leaving only ironbark trees and a landscape that “looks empty”); and minimising trafficking of weeds and pests (Mother of Millions became a declared weed following industry activity), as pest plants can rapidly colonise disturbed land.

Mayor Brown also stated the importance of acknowledging and dealing with community emotion around development. “Facts, facts, facts,” he said. “Stick to them, and hold industry responsible.”

### **Basin Sustainability Alliance, Dalby (24 August)**

In the late afternoon, the committee met in Dalby with members of the Basin Sustainability Alliance, a landholder group that works with industry and government to ensure protection of resources such as groundwater, lifestyle and food/fibre production, and to assist with legal issues and succession planning.

In attendance were BSA Chair Lyn Nicholson, a landholder/grazier and retired solicitor; BSA Secretary Neil Cameron, a farmer/grazier; accountant Peter Shannon; and Rory Ross, solicitor with Shine Lawyers.

BSA encouraged the committee to ensure that any gas development in the South East of South Australia be overseen by agencies that were appropriately funded and resourced to carry out all tasks, particularly risk analysis and baseline modelling, properly. Mr Ross addressed appropriate division of interests, saying, “Departments that are duty-bound to promote cannot be duty-bound to protect.”

The committee heard that benefits in communities, particularly financial benefits, were not experienced across the board, and this was due in large part to differences in negotiation skill levels. “Some people have done well, but at the expense of others,” said Mr Cameron. “Some people are better negotiators, and not everyone employs a lawyer.”

There is currently no legal way to stop a company from entering a property, which immediately put landowners at a disadvantage in negotiations, said Mr Cameron. “You can go to the Land Court if you are not happy with the way negotiations are going but they can only deliberate on the quantum of compensation and not rule to stop the access by a mining company. You risk being out of pocket by a large amount in legal fees if you go down this track.”<sup>6</sup>

BSA therefore suggested that companies should bear all necessary and reasonable legal fees to ensure CCAs were sound and fair. The committee heard that the three main energy companies operating in the region were considered to have very different negotiation practices and this also contributed to uneven distribution of benefits. When liaison officers were well funded and well trained, the committee heard, robust negotiations were the result and the CCAs were much better for it. “There is an enormous difference,” said Mr Ross.

The committee also heard that taxation aspects of CCAs should be given greater consideration. Compensation payments may be treated as capital, said Mr Cameron, but this was dependent on how the CCA was worded and what work was being done (e.g., pipeline easement, well installation, payments for water).

“Even when payments are treated as capital,” said Mr Cameron, “this still reduces the cost base of post-GST land with the result that a larger capital gain may be made on the subsequent sale of the land.” He added that the presence of CSG mining activity on a property may also be viewed as negative to some buyers.

A lack of a single authority landholders felt they could trust for help could be contributing in some instances to unwillingness to negotiate, the committee heard. In the absence of such a trusted liaison, BSA speculated that many could and would turn to associations such as Lock the Gate, potentially making future agreements between community and industry more difficult.

The committee heard that there was confusion in the community as to where best to house workers. Rents were up, and work camps had been established for FIFO workers, leaving motels empty. This

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<sup>6</sup> (Cameron, 2015)

contrasted with the boom period, Mr Ross said, when he could not find a single hotel room along the road from Toowoomba to Dalby when interviewing for his role with BSA.

Mr Cameron, like Mayor Brown, encouraged fact-based dealings to defuse emotion-based issues. He gave a short talk on the issues and impacts of mining company access to private properties, discussing:

- Time spent on negotiations: while industry has representatives paid to do this, it represents loss of time for farmers
- The need to monitor vehicle entrance and movements—are they authorised?
- Further possible impacts of industry vehicles: dust, noise, spread of noxious weeds, livestock safety, proper gate closure
- Strangers on property may create unknown risks to property residents
- Visual and aesthetic impacts on landscape: wells, vents, tracks, etc
- Psychological impacts of loss of autonomy over property
- CCAs may set guidelines for company conduct but who monitors and enforces them?

Other issues raised in the meeting included:

- Increased municipal waste
- Handling and disposing of salt waste from CSG processing
- Potential for intersection of drilling with unmapped abandoned mines or wells
- Onselling of wells from “blue chip” companies to “second and third tier operators” who may not have been involved in initial negotiations

Suggestions included establishing:

- A mandatory code of industry conduct
- An ombudsman
- An industry-funded legal aid program to assist negotiations

### **Chinchilla (25 August)**

After an early meeting of the committee, the members travelled west from Dalby towards Roma, stopping in Chinchilla (Western Downs Regional Council) for an informal talk with local resident Karen Auty, who had made a written submission to the inquiry outlining her experience and requesting to speak with members. Ms Auty said she offered the perspective of a community member in a region subject to much local coal seam gas development.

Ms Auty told the committee of a “divided” town and addressed what she viewed as several critical changes within the real estate market. One of these was relative to rural properties. At the time of the meeting, she said, approximately 40 properties were on the market, but no properties with gas infrastructure, to the best of her knowledge, had “been sold as a working property” in recent times. Farmers with gas infrastructure on their own properties were purchasing properties for development purposes, she said, rather than for farming.

Another change, the committee heard, was in rental prices and patterns. Long-term rentals, which she called “common in country towns” were disappearing as pensioners were priced out of the market.

She outlined the population changes to the region, estimating a population of about 4,000 people in Chinchilla (including outlying properties) in 2007; in 2012 this grew to about 7,000 people plus an additional 10,000 people in camps, held stable at that level in 2013, and then began to contract.

Ms Auty suggested some of the industry's success was due to its timing: she believed property owners "stretched by drought" were perhaps more keen to sign on to gas projects than they would have been otherwise. She also spoke in terms of "bullying" by industry liaisons, with particular concern for older residents who she said were often unable to negotiate effectively and for whom Land Court costs could be financially devastating.

While Ms Auty acknowledged that some people had likely made money, she estimated the number of beneficiaries to be very low. She also expressed grave concerns over the safety of the town's drinking water and felt overall the town had experienced "pain, for little or no long-term gain." Looking back, she said, she would have preferred better consultation and preparatory town planning in advance of a boom. "You need accurate estimates of industry plans to be ready for this kind of thing."

#### **Maranoa Council, Roma, (25 August)**

- Briefing with Andrew Snars, Maranoa Regional Manager, Santos shop front, and other staff
- Site visit to Roma gas hub/control centre and irrigation project with Santos representatives
- Evening meeting with Ms Ann Leahy MP (Warrego, Qld); mayor; council elected members; council staff

At the Santos "storefront" shop in Roma, which was established in 2014 as an information centre for the public, the committee saw video presentations on CSG production, and an interactive display on Santos facilities around Roma, and a mixed-use property used to develop a best practice approach for using treated coal seam water for irrigating fodder crops.

The storefront was one of the initiative set up by Santos to help residents understand what to expect as the gas industry grew in the town, the committee heard. Others were:

- Public meetings
- Small stakeholder talk groups
- Tours conducted up until 2014
- Social media campaigns
- A 1800 information line and a public feedback line for driving comments and complaints
- Sponsorship of social and education opportunities such as:
  - "F1 in Schools" engineering program with Roma College
  - Regular "shed meetings" with landholders to encouraging continuity in community engagement
  - Youth first aid program Rescue Roos

The committee heard that flood events that struck the town in 2010, 2011 and 2012 coincided with a huge increase in incoming workers (at one point 3,000 were living just outside town) which the committee heard called "a perfect storm" of problems. The town lost 500 houses in the floods; along with displaced locals, insurance adjusters needed houses, and the Fairview gas hub had not been built to house workers.

Prior to this situation, local authorities had wanted to ensure new workers were based in the town, but the committee heard that "the floods reinforced that offsite was the best decision—not just for Santos but for related industrial businesses too, like Halliburton and Schlumberger".

The boom was weathered and, the committee heard, has left the town with a permanent population increase of about 800 families.



The committee also heard about training and employment opportunities supported by Santos in town, including:

- A Certificate II in plant operations (through the local TAFE)
- Youth skills training
- School training for apprentices in non-petroleum industries such as water quality monitoring, cooking

A bus tour took the committee from Roma to the Roma Gas Hub 2, one of three Santos sites processing gas prior to piping it 420 kilometres to its liquefaction facility on Curtis Island, Gladstone. Along the route the committee viewed other gas industry infrastructure including workers' camps, such as the one outside Roma which had at peak housed about 1,000 people and at the time of the trip housed about 300 temporary workers and was sometimes used as a private facility for hire. The members also saw wells/wellpads such as Roma-08-11, which had four wells located on one pad with pipeline deviated over an area of approximately 70m<sup>2</sup>.

On the way to the gas hub, the committee heard that about 100 movements of large industry-related trucks occurred in and around Roma per day over the three years 2011–14. To ensure drivers met strict speed and safety regulations, in-vehicle monitoring systems (IVMS) were used in all company vehicles to keep records of driving movements.

At Roma Gas Hub 2, the committee toured the facility by foot, visiting control rooms and viewing workers' accommodation. The members heard that once a CSG well is running, it continues to run as it cannot be shut down; gas must be used, stored, or flared off. Some flaring was under way during the committee's visit. Members heard that excess gas that was not burned off was pumped into a decommissioned conventional reservoir underground where it could be stored for a short time.

According to the DSD, venting is not permitted "other than in the case of an emergency or in a controlled operational situation (for example, during maintenance of a high pressure gas pipeline) the venting of natural gas (or any petroleum). It has always been a requirement that natural gas be flared where it could not be either used for fuel, injection or directed into a flow line. The USA, through the adoption of this rule in August 2012, have brought themselves into line with what we in South Australia always considered to be a minimum requirement."<sup>7</sup>

The committee heard that the 80-room worker accommodation facility was a "dry camp" envisioned to provide housing over a 30-year operations period. Approximately \$240,000 was spent per room to build, which included soundproofing against the noise of the gas hub.

Later that evening, in Roma, the committee held an informal meeting with members of local government. Traffic and roads were brought up at this meeting as a persistent and difficult issue. The members heard advice corroborating that of the Western Downs Regional Council members: to ensure firm agreements are in place regarding the building, upgrading and maintenance of roads.

The Maranoa Regional Councillors also urged the committee to consider the need for the collection of baseline data in many areas, such as groundwater, land and air quality, sewer and rubbish/waste needs, health services, and policing.

During the meeting, the members heard from a councillor who had 190 wells on their property but was also critical of Origin and Santos regarding such issues as failing to prepare or support the

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<sup>7</sup> (DSD-ERD, 2015)

community in such areas as medical services. The mayor, acknowledging that conflicts of interest were a potential issue, said that councillors who had direct personal and/or business dealings with gas companies were required to exempt themselves from negotiations involving energy companies.

The new Roma airport capacity was built to service 90,000 people, the committee heard, but wound up servicing more than four times that many at peak; it was now receiving about 48 flights per week.

The committee also heard that there was some concern that council's regular industry contacts who were very skilful were deployed to other areas of the country, and that while companies were good at public relations they were not always delivering on promises.

#### **CSG Research Forum: Agriculture and Coal Seam Gas, Roma (26 August)**

The next morning, after a meeting of the committee, the NRC members attended several research presentations at the CSG Research Forum: Agriculture and Coal Seam Gas, hosted by Agforce, with presentations by representatives of the University of Queensland, CSIRO (GISERA), and the Department of Agriculture and Forestry.

The forum included brief presentations on:

- CSG and agricultural production and profitability (The University of Queensland)
- Groundwater research (The University of Queensland)
- Gas infrastructure on agricultural land—managing soil compaction and preserving agricultural productivity (GISERA)
- CSG Projects (AgForce)

Following the forum, the NRC members attended a short meeting and a presentation on roads and infrastructure with Maranoa Council staff.

The trip to Queensland concluded with a talk by the Queensland GasFields Commission. The committee returned to Adelaide on the night of 26 August 2015.

#### ***ICE WaRM 6<sup>th</sup> Groundwater Essentials 7–8 September 2015, Adelaide***

To help the committee gain a better understanding of the potential impacts of unconventional gas development on groundwater, two committee members and two committee staff attended a two-day course, Groundwater Essentials, run by the International Centre for Excellence in Groundwater Management, in Adelaide in September 2015. The course covered the following topics:

- Global and local water balances
- Introduction to hydrogeology and aquifers
- Resource assessment: accessing groundwater (investigation, drilling, bore construction), storage, movement, aquifer testing and estimation using pumping tests
- Monitoring groundwater
- Groundwater—surface water interactions
- Groundwater chemistry and water quality
- Pollution and remediation of groundwater
- Managing and protecting groundwater
- Unconventional gas extraction and water management (including regulation, water quality, transport and storage)

***Moomba, South Australia, 23 November 2015***

Natural Resources Committee members Mr Jon Gee MP, Mr Chris Picton MP and Mr Peter Treloar MP, along with the two committee staff, departed Adelaide early on the morning of Monday, 23 November, to travel to Moomba in the South Australian Cooper Basin and tour the plant, associated infrastructure, and operational unconventional gas fields.

They were met at Adelaide airport and accompanied to Moomba by Santos staff Tom Baddeley, Manager Government & Community Relations; Matt Doman, Manager Public Affairs Eastern Australia<sup>8</sup>; Greg Harrison, General Manager Operations; and Angelo Russo, Public Affairs Adviser, Eastern Australia. At Moomba airport they were met by additional Santos staff including Fracture Stimulation Team Leader Steve Roberts and Principal Operations Advisor Eastern Australia Nick Lagonik.

Before the members departed Moomba airport to begin their tour, a short discussion was held in which Mr Harrison explained that the well that the members would see later in the morning, Tirrawarra-86, would eventually go through “eight different horizons”, or stages. He said that four had been completed so far, with one completed just that morning and one or possibly two more to occur later in the day, and three to four days of work remaining to complete the stages.

The members heard that each stage includes:

- perforation of the well using a special casing segment and explosive charges
- the actual hydraulic fracture (or “frack”)
- insertion of a plug (known as “dropping the ball”).

After a short meeting for introductions, the group boarded a bus to travel to the Tirrawarra-86 “frack spread”, or well pad and drilling/fracking infrastructure.

On the drive there, Mr Lagonik spoke generally about the first unconventional gas well at Moomba (Moomba-191). He has worked for many years at Moomba and has a broad knowledge of the area, though he reminded the members that his expertise is in plant operations. “Moomba-191 is about 5 kilometres east of Moomba,” he said. “Three years on, it’s still producing, though I’m not sure at what rate. Typically a well will halve in production about 18–24 months in. They might re-frack a well when it slows down, but I’m not sure about the plan for 191.”

On the way to the Tirrawarra-86 well, the bus passed a large containment pond, which somewhat resembled a reinforced above-ground swimming pool in its construction. The members heard that this pond would be used for Tirrawarra-87, a new well with its pad still under construction at the time of the committee visit. A similar pond was viewed later at the Tirrawarra-86 well and the members heard these raised holding ponds are now the norm for operations in the Cooper Basin. Among other benefits, they increase the ability to monitor for problems and reduce risks of spills and leakage.

At Tirrawarra North Operations Camp, the hub for northern works occurring in the Cooper Basin, members disembarked from the bus into an increasingly hot day and entered a compound of low temporary buildings including the “Tirrawarra Toolbox” building, for a safety induction and plant overview. Mr Russo and Mr Doman also took the opportunity to give presentations on Santos’ involvement in gas in the Cooper Basin, including some information on the world energy outlook.

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<sup>8</sup> Note: In January 2016, Mr Doman took up the role of Director South Australia and Northern Territory with APPEA.

Mr Lagonik also spoke again, though briefly, about Moomba itself: its size, general operations, and population. There are 600 people working in the Basin at any given time, with about 70 workers at this northern camp, Mr Lagonik said, though he added it can hold more, and for big campaigns, a mobile camp will be brought in.

The drive to Tirrawarra-86 resumed. Ten minutes or so out of the Tirrawarra camp, the road crossed an ephemeral swamp, which is currently filled with dry grey scrub, the remnant of an explosion of plant growth that followed massive floods in 2009–10. The committee heard that big rains in Queensland bring big floods to this region, and this explained why gas infrastructure over the next 15kms (including a facility for injecting corrosion inhibitor into the pipeline) had been built above ground level. The Tirrawarra-86 camp is also built on high ground; Mr Lagonik said that during the last floods, people were able to come and go from it in flat-bottomed boats.

Arriving at Tirrawarra-86 just before noon, the members could see about 20–24 assorted trucks, tankers and trailers, as well as other small vehicles such as utes and 4WDs. This array included nine large, signature red Halliburton trucks carrying diesel engines; each one, the members heard, was capable of generating a pressure of 900 pounds per square inch (PSI). Santos staff estimated a total capability of 19,000 hydraulic horsepower (HP). The committee heard that, using a rule of thumb (for every 1HP, 1 gallon per minute can be produced at 1,500PSI), over an average 45-minute frack treatment, more than half a million litres of fluid could be pumped into a well.

The site office, a small portable building about 200 metres from the well head, displayed a red banner declaring a Red Alert Day, meaning temperatures were expected to be over 40°C. Inside the building, members met site staff, including Jeff Dzeryk, a Canadian engineer working in completions/fracturing for Santos, and Esma Bereksi, a fracturing engineer for Halliburton. Also present was Frack Team Leader Steve Roberts, who had met the members earlier at the airport.

All visitors were signed in and received magnetic name tapes to be left on the office muster board in case of emergency. Members heard another safety talk specific to the well site, outlining the areas where the visitors could go, and only under escort. “We have pressure on the well,” Mr Dzeryk explained, “so we will need to keep you well away from that.” The members heard that the sixth stage of Tirrawarra-86 had been completed not long before their arrival at the well pad, and that perforation for the seventh stage would begin shortly.

The group of visitors split into two. While one group was led on a walking tour of the area, the other group remained in the site office for a demonstration and talk about fracking fluid, given by Ms Bereksi.

Ms Bereksi explained the low toxicity of the main components other than water: plant-based guar gum, which is a thickener to enable the liquid to carry proppant material (sand or ceramic particles), and crosslinker, a chemical compound (in this case, a borate) used to join molecules in a stable bond.

Ms Bereksi mixed a sample of fracking fluid from these components for the members to see. In use in fracturing, the gel would also contain a proportionally small amount of other chemicals including surfactants, biocides and tracers. The mixture formed a thixotropic solution—one that has characteristics of both fluid and solid and can alter in its viscosity—which could be handled with bare hands, as some of the group members chose to do.

The members on the site walking tour heard that Tirrawarra-86 is a deviated well targeting a shale gas zone about 2,750m below the surface (and more than 2,300m below the aquifer zone). Out around the well pad, members saw tanks containing water, guar gum and ceramic proppants for the frack,

along with other chemical tanks and crates. One crate indicated the presence of radioactive material (Sb-124) on site; members heard that radioactive materials with low toxicity and rapid decay rates are routinely used for various purposes in gas production wells, including evaluating formations and tracing fluid movement through fractures. The members were also able to view fracking “guns”, which are casings used to hold explosive charges; multiple nitrocellulose-based charges, each about the size of a golf ball, are used to deploy what is essentially a rocket propellant that perforates the wellbore in the target layer.

One visitor group of one staff member and one committee member was able to be outside on site during the successful perforation of the well. The perforation guns were fired remotely via an electrical charge, deploying the explosives in the target zone, with one engineer keeping a hand on a line (the “e-line”) which jumps visibly upon successful deployment. A slight percussive sound could also be heard as the charges were deployed, perforating the well. No hearing protection was required at a safe viewing distance 100–150m from the well.

After about two hours on-site, the group departed the Tirrawarra-86 well for a short lunch break. Having decided to forego planned tours of the Ensign 971 drilling rig and the Moomba plant itself in order to see further stages of the well development, including fracking, the group returned to Tirrawarra-86. Unfortunately the members had missed the frack treatment itself but took the opportunity to have further discussions with well site staff and view logging operations. In the end, members were required to return to Moomba and then to Adelaide without having seen the hydraulic fracture treatment occurring.

The trip overall was of great value to the committee. During the day, many conversations were held that contributed to the committee’s understanding of unconventional gas production, and seeing the infrastructure and heavy equipment used in unconventional gas production was useful and informative. However, the committee members were disappointed not to have witnessed the actual practice of hydraulic fracturing. This would have been invaluable in terms of understanding some of the possible impacts, such as noise and vibration, raised as concerns by some residents of the South-East.

## 9 Potential risks and impacts

As noted in Section 2.2, the inquiry's terms include the phrase "the committee is inquiring into potential risks and impacts in the use of hydraulic fracture stimulation (fracking) to produce gas in the South East of South Australia" before setting out four specific terms of reference.

The inquiry's interim report, published in November 2015, explains that the term "fracking" is often used colloquially to mean unconventional gas development more broadly. The committee has considered the broader definition of the term "fracking" as well as hydraulic fracturing specifically. See Appendix D: Definitions for further clarification of terminology.

Legislation of gas exploration and production activities in South Australia, which is covered in greater detail in Section 9.5, takes place in three stages:

1. Licensing
2. Environmental assessment and approval of environmental objectives
3. Activity notification and approval

Environmental impacts and risks are assessed and addressed in the latter two stages, in part through community consultation. The committee heard evidence from the Department of State Development (DSD) that:

Stage 3 is about all the detailed activity notification that companies are required to submit to DSD, as the regulator, to ensure that what they are about to undertake on the ground achieves the objectives that are developed through community consultation and meets community expectations.<sup>9</sup>

The submission from DSD also states that "If a company proposes to undertake fracture stimulation, under the PGE Act, a comprehensive and extensive public consultation process is required to be undertaken, demonstrating how all potential risks to social, natural and economic environments can be managed to meet community expectations for net outcomes."<sup>10</sup>

The committee heard evidence relating to determination of community expectation and what determines acceptable levels of risk.

### 9.1 Acceptable levels of risk

An aim of the PGE Act, the committee has heard, is to "build public trust in industry and industry performance", and to ensure that "regulation of that industry reduces risks to ALARP [as low as reasonably practicable] and acceptable to community".<sup>11</sup>

However, *risk* and *risk management* are not defined in the PGE Act or its regulations. According to a literature review published by the Gas Industry Social & Environmental Research Alliance, industry tends to use a working definition of *risk* linked to a management concept of social licence: "...the risk-

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<sup>9</sup> (Malavazos, 2015)

<sup>10</sup> (Department of State Development, 2015a, pp. 28-9)

<sup>11</sup> (Department of State Development, 2015b)

management perspective fostered an audit approach and framed community stakeholders as a 'risk' needing to be managed."<sup>12</sup>

Various public submissions to the committee ask questions with regard to the definition of risk. Dr Geoffrey Wells, in a submission to the committee, wrote about risk as covered by Regulation 10 of the *Petroleum and Geothermal Energy Regulations 2013*. (Please see Appendix E: Regulation 10 (PGE Regulations 2013)).

Dr Wells states that, "in summary, the regulation relevant to hydraulic fracturing proposals requires"<sup>13</sup>:

- Identification of risks across the entire life cycle of the operation.
- The quantification of these risks in frequencies.
- An account of the method by which these frequencies have been estimated.
- Full identification of all the impacts of these events on the environment.
- Quantification of the potential duration, size, scope and cumulative impact of these events.
- An account of the potential risks posed by the interaction of these events with other activities on the land occupied by the project.
- An account of the technical methods by which these quantitative estimates have been made.
- A quantitative analysis of the uncertainty associated with these data.
- A sensitivity analysis on variations of these data.

Dr Wells' submission argues that recent Environmental Impact Reports (EIRs) included in current hydraulic fracturing projects in South Australia have not met the requirements of Regulation 10 and that his survey of some recent proposals indicates to him that:

Risks are typically described in crude terms, such as 'possible', 'unlikely', or 'remote'. This is presented as a subjective judgement, with no information provided on how these descriptive assessments were arrived at. No quantitative estimates are provided of the predicted frequencies of these risks, nor of the basis on which those quantitative estimates should be made, as required by the Regulation.

Community member Anne Daw, in a presentation to the committee, commented on the *Environment Protection Act (SA) 2003*, which she quotes as saying "A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm." She went on to comment:

The word 'minimise' is not good enough. Both the mining and petroleum industries are not in any position to give a 100 per cent guarantee that nothing will go wrong with wells in the next 100 years. There is no clear definition of 'minimise', and I find this term objectionable when it means risking our sustainable food and water.<sup>14</sup>

The wording of the Act as quoted by Ms Daw is similar to that of the Precautionary Principle, which was raised in multiple submissions as well as in evidence. A number of submissions have called for the use of the Precautionary Principle, taking it to mean that because there are risks involved in unconventional gas development, gas development should therefore be avoided.

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<sup>12</sup> (Williams & Walton, 2013, p. 2)

<sup>13</sup> (Wells, 2015)

<sup>14</sup> (Daw A. , 2015b, p. 105)

The Precautionary Principle has been defined by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and reads in part: “When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm.”<sup>15</sup>

In a presentation to the committee, James Baulderstone, Eastern Vice President for Santos, addressed this issue:

The precautionary principle is used by these anti-fossil fuel groups basically to have study after study after study after study. They are looking for a zero harm, zero risk position which, as I said, if you applied that to any industry or applied that to anything that we do in public life, nothing would ever happen.

What has been often put forward for the natural gas industry is some sort of risk-free position, which is clearly not acceptable for mining, sheep farming, cotton farming, airplane travel or car travel. Of course, there are risks in everything we do.<sup>16</sup>

Barry Goldstein, Executive Director of the Department of State Development’s Energy Resources Division, told the committee:

The community accepts intuitively that there is a controlled risk with seatbelts, speed limits and brakes, and there is a residual risk that somebody will get maimed, and that is accepted by the community. ...It is fundamental not just to the petroleum and gas industry but to any industry. So when we talk about avoiding risks, we are avoiding risks with speed limits and safety belts, but the community accepts the risk of getting in a car. ...we are requiring these companies undertaking these operations to take precautions to reduce risks to a level that is acceptable to community.<sup>17</sup>

It was not clear to the committee how DSD might understand the community’s definition of risk or what level of risk a community might find acceptable but Mr Goldstein linked risk reduction to community acceptance and potential benefit:

We have two criteria for what is acceptable. First, [risk] has to be reduced to as low as reasonably practicable...based on the technologies and methods available and, secondly, if the communities in aggregate say that some activity should not happen here, then this activity should not happen here. But, when we talk about net benefit to communities, are we talking about one individual landowner or the entire state?<sup>18</sup>

## 9.2 Community engagement and social licence

The committee has noted that the community may not have a means of communicating “in aggregate” to the industry and that methods of engagement by petroleum companies have had a direct impact on community acceptance of unconventional gas development.

Community acceptance is a precondition to obtaining social licence to operate, a concept raised repeatedly in submissions and evidence presented to the committee. In recent years social licence has

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<sup>15</sup> (Wells, 2015)

<sup>16</sup> (Baulderstone, 2015, p. 10)

<sup>17</sup> (Goldstein, Fracking, 2015, pp. 23-4)

<sup>18</sup> (Goldstein, Fracking, 2015, p. 24)



come to be seen as a requirement for industry, particularly mining and petroleum industries, to proceed with development in or near communities. However, the procedure by which it is gained is not set out in legislation or regulation and thus it may well prove more difficult to achieve than regulated licenses.

One way to consider the nature of social licence vs legal licence is in how each is “issued” and for how long. Dr Justine Lacey, a senior research scientist with the CSIRO’s Land and Water Division, wrote:

Legal and social licences ... vary in their temporal nature with the environmental licence being issued by government and enduring as long as a company complies with the relevant conditions of the licence whereas a social licence is constantly being renewed and negotiated; reflecting the natural fluctuations in the status and quality of a relationship between a company and a community.<sup>19</sup>

The International Energy Agency’s 2012 publication *Golden Rules for a Golden Age of Gas* raises the issue of a general lack of social licence to operate, attributed in part to the relatively new process of unconventional gas development:

A range of factors will affect the pace of development of this relatively new industry over the coming decades. In our judgement, a key constraint is that unconventional gas does not yet enjoy, in most places, the degree of societal acceptance that it will require in order to flourish. Without a general, sustained and successful effort from both governments and operators to address the environmental and social concerns that have arisen, it may be impossible to convince the public that, despite the undoubted potential benefits, the impact and risks of unconventional gas development are acceptably small.<sup>20</sup>

The IEA acknowledges that community engagement necessarily increases “the overall financial cost of development a typical shale-gas well by an estimated 7%” but notes that the cost would likely be lower when applied across a larger, multi-well development.

A set of mining authorisation guidelines published by Primary Industries and Regions SA (PIRSA), an agency which the committee has heard helps to oversee resource development in the state, describe engagement as “good business sense”, note that inadequate engagement may wind up creating higher than normal costs, and state that good engagement “is now considered best practice”.

The industry as a whole, and at a local level for individual projects, needs to secure broad community support and acceptance in order to protect its ‘social licence to operate’. Failure to achieve this may lead to delays in approving the project, or result in expensive conditions, or outright rejection of the proposal. Even if the proposal proceeds, failure to adequately engage the community may lead to the need for higher than normal resources to be expended by the company on reacting to community complaints and concerns.<sup>21</sup>

The South Australian Department of State Development’s guidelines for landowners and petroleum explorers (2014) “promote communication to establish good working relationships between landowners who have surface rights, and explorers who are authorised under the PGE Act to enter the land to search for and extract oil, gas and geothermal energy”.<sup>22</sup>

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<sup>19</sup> (Lacey, 2013)

<sup>20</sup> (International Energy Agency, 2012)

<sup>21</sup> (PIRSA, 2009, p. 18)

<sup>22</sup> (Department of State Development)

The guidelines state that PGE Regulation 22 “lays down clear obligations to notify and consult with landowners and provide sufficient information to enable them to make an informed decision about the impact or potential impact of the proposed operation on the land” which include contact details, descriptions of proposed activities, timing of events, information on landowner rights of objection and to compensation, among other things. A section entitled “Establishing good relations with landowners” sets out points for consultation with landowners during the planning phase:

- exchange of information
- identification and resolution of potential concerns and conflicts of interest
- arrangements regarding infrastructure (e.g. water sources, roads, tracks, fences, gates)
- meeting regulatory requirements
- development and maintenance of good working relationships
- negotiation of fair compensation (where appropriate).

This section concludes that “(s)uch consultation is seen by industry and the South Australian Government as good business practice”.

The guidelines contain a recommendation that an operator should “consult with traditional Aboriginal custodians of the land” but no mention is made of social licence or community engagement.

The committee has noted this approach is focused on presentation of information to landholders and instructing operators to develop “good working relationships” and maintain them without providing guidelines for how to do so.

### ***Community concern in the South-East***

The Limestone Coast Local Government Association (LCLGA, formerly the South East Local Government Association) provided in its submission to the inquiry that “(f)rom late 2013, [LCLGA] and the seven member councils began receiving correspondence from community members raising concerns regarding exploration activities for gas resources in the Penola area.”<sup>23</sup>

Ms Ann Aldersey, Executive Officer of LCLGA, and Ms Erika Vickery, President of LCLGA and Mayor of Naracoorte Lucindale Council presented to the committee at a regional meeting in Millicent in February 2015. (At the time of their presentation, the LCLGA was known as SELGA.<sup>24</sup>)

The committee heard that after Beach Energy commenced deep exploratory drilling in 2014 just outside Penola, in the South East of South Australia, LCLGA and member councils continued receiving correspondence from the public. Mayor Peter Riseley, of the District Council of Robe, told the committee that within a week of the drilling, Robe Council had received nearly 40 letters raising concerns.<sup>25</sup>

Ms Vickery said, “Based on this correspondence and media coverage, [LCLGA] was aware that there seemed to be a lack of accurate information regarding exploratory activity underway, and the decision-making and regulatory processes governing unconventional gas, and also the scientific facts regarding unconventional gas processes.”<sup>26</sup>

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<sup>23</sup> (South East Local Government Association, 2015)

<sup>24</sup> NB: SELGA has been changed to LCLGA even in quoted material to maintain consistency and clarity in this report.

<sup>25</sup> (Hill, 2014)

<sup>26</sup> (Vickery, 2015)

To help facilitate communication between community and industry, LCLGA convened two information sessions, one for local government elected members and staff, and a second for community members. A range of presenters spoke about legislation, regulation, and the scientific knowledge of unconventional gas, including fracking. More than 100 people attended the community session, said Ms Vickery, “so the community was starving for information.”

Ms Aldersey told the committee that industry was included in the sessions:

Early on in this process, in 2014, we were in contact with Beach Energy, the particular proponent of the exploration near Penola. They were included as part of our information sessions. They were asked to provide a presentation to both local government and the community on their practices in the South-East and their expectations for their future activities here.<sup>27</sup>

LCLGA called for a regional moratorium on fracking in its submission and explained in its presentation to the committee that this was based in part on lack of information at the time exploratory drilling began:

...the communication with the community when the exploration of gas happened around Penola was really very poor, and that really led to a lot of fear and reactions in the community. If that communication had been done better, then that may not have led to that. It is really sending a strong message to the regulator and to the proponents that the community needs to have surety of what is going to happen in our whole region. It is sending a message to “take us with you, please.”<sup>28</sup>

The committee took evidence from Mayor Riseley and others when the NRC travelled to Robe in September 2015 for a meeting. A peaceful gathering of approximately 100 protesters had assembled outside the council building, where the meeting took place. Inside, Mr Riseley told the committee:

We are only a small council, but we had in excess of 38 submissions pleading for us to look at this particular issue. There have never before been major marches and demonstrations across the South-East on such a front.

His presentation suggested the reasons for the protest include climate change, loss of agricultural land to industry, need for food security, and a perceived lack of baseline data for the area.

In July 2015, Beach Energy confirmed that water quality monitoring took place prior to and after exploratory drilling in the area and submitted as evidence to the inquiry a detailed independent scientific report on the subject.<sup>29</sup> In a covering letter to the report, Beach Energy Chief Operating Officer Neil Gibbins wrote:

In summary, the groundwater monitoring data over the duration of the project indicated that exploration drilling did not alter the groundwater in the tested aquifers, and had no impact on the existing or likely future beneficial uses of the local groundwater.<sup>30</sup>

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<sup>27</sup> (Aldersey, 2015)

<sup>28</sup> (Vickery, 2015)

<sup>29</sup> (John Leonard Consulting Services for Beach Energy, 2015)

<sup>30</sup> (Gibbins N. , 2015b)

It has been noted by the committee that although community members have requested this kind of independent analysis, the provision of such information does not appear to have greatly affected community opinion, if at all.

At his presentation, as evidence to the committee of a lack of social licence in the South East, Mayor Riseley displayed a bag of written “pledges from the community that actually say no to invasive gas mining”. He read aloud the text of one pledge, individual copies of which had been signed by many landholders whose properties are located along 76 rural roads in the South-East:

We the people of Engelhart Road declare that this road is gas field free, protected by the will of the community. This decision was made from community consultation and engagement. We recognise that our best defence is by standing together. If we detect any activity by gas or invasive mining companies here, we will raise an alert and ask their representative to leave. We are committed to stopping gas field industrialisation. In doing this we protect the water, soil and air. We will protect our community from the destructive impacts of the gas field industry.

Mayor Riseley explained that the gathering of these pledges was continuing through the area: “They are happening right across the whole of the South-East so the numbers are huge. There is a very big message to our elected representatives that this is a very important issue.”

Mr Troy Bell MP, the Member for Mount Gambier, appeared before the NRC in June 2016 to talk about community concerns around social licence. “This is a contentious issue,” he said. “Every week, there is either an article or an opinion piece, both for or against fracking in the South-East.” These articles were so numerous, Mr Bell noted the difficulty of keeping track of them: “The folder would be very thick if I put in every article that’s been written.”<sup>31</sup>

Mr Bell offered the committee a definition of the term social licence:

The term “social licence,” or “social licence to operate,” generally refers to a local community’s acceptance or approval of a project or a company’s ongoing presence. It is usually informal and intangible, and is granted by a community based on the opinions and views of stakeholders, including local populations, aboriginal groups, and other interested parties. Due to this intangibility, it can be difficult to determine when social licence has been achieved for a project. Social licence may manifest in a variety of ways, ranging from absence of opposition to vocal support or even advocacy, and these various levels of social licence (as well as, of course, the absence of social licence) may occur at the same time among different interested parties.<sup>32</sup>

This understanding of the concept is supported by a report by GISERA, a “collaborative vehicle established by CSIRO and Australia Pacific LNG to undertake publicly reported research addressing the socio-economic and environmental impacts of Australia’s natural gas industries”. In a 2013 literature review, GISERA reported:

The term “Social Licence to Operate” or “Social Licence” is gaining prominence in the resources sector as the industry increasingly focuses on recognising the interests of communities affected by mining activities. As originally conceived, the notion of a social licence to operate reflects the idea that society is able to grant or withhold support for a company and its operations; with the extent of support being dependent on how well a company meets societal expectations of its

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<sup>31</sup> (Bell, 2016, p. 363)

<sup>32</sup> (Yates & Horvath, 2013) in (Bell, 2016)

behaviour and impacts. A social licence is tacit, intangible and context specific. It needs to be earned and is dynamic, as people's experiences and perceptions of an operation shift over time.<sup>33</sup>

Mr Bell outlined for the committee the reasons social licence was important to both business and community, saying that it:

- provides a proponent with legitimacy for its presence and actions from a local community's perspective;
- provides regulators with a level of comfort that a proponent is acting responsibly;
- minimises the risk of costly delays in regulatory approvals due to opposition;

For communities, Mr Bell said, social licence—

- enhances trust by demonstrating to regulators and other stakeholders that the company is genuinely striving for good performance; and
- protects a company's reputation in times of crisis.<sup>34</sup>

The committee heard from a representative of Santos that being part of a community may lend an understanding of community as well as a desire to uphold its values:

One of the great things about our industry—we look at where we've had activity. So, we've been operating in South Australia for 40 years. We are very proud of our track record around both community engagement but also with environmental impact—very, very minimal environmental impact because we care. We're all South Australians, we're scientists, we're farmers' sons, we're a whole range of things. We care about the environment and what happens. If you went down to Santos today, that building is full of people like Matt [Doman] and I who are born and bred in the rural areas of South Australia. When I go home and see my parents they ask me these questions as well and I look them in the eye and say, 'I'm very proud of my industry, I'm very proud of Santos and I'm very proud of what we can do to benefit the state of South Australia.'<sup>35</sup>

Asked by the committee to outline Santos's engagement procedures, Matt Doman<sup>36</sup>, Manager Public Affairs Eastern Australia, responded:

We engage with government, local government; we hold public meetings where we respond to questions; we also engage with some of the groups opposed to our activity to counter false or exaggerated claims that are unfortunately frequently made.

In New South Wales and Queensland where we are operating in environments where the agricultural activity is more intense than we would find in the Cooper Basin or the Northern Territory, we put a strong emphasis on our landholder relations teams. We make sure that we have enough people and people who know both our story and the needs and requirements of agriculture, so there is a lot of one-on-one engagement with landholders in the areas in which we operate. Importantly, in the communities and towns in those areas, we establish a physical presence, open shopfronts in the town, contribute to local causes in the town and become part of the community and employ local people to make sure that, through the informal contact that those people have with their schools, sporting clubs and other activities in town, we become part

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<sup>33</sup> (Williams & Walton, 2013)

<sup>34</sup> (Yates & Horvath, 2013, p. 3)

<sup>35</sup> (Boulderstone, 2015, p. 107)

<sup>36</sup> Note: In January 2016, Mr Doman took up the role of Director South Australia and Northern Territory with APPEA.

of that community and that we are understood and accepted. We think that is the framework that enables us to succeed in building our business.

A representative of Halliburton linked community fears to inexperience dealing with industry:

If you are in a town that has lived and worked with the oil and gas industry, such as Roma or other different areas, you are very comfortable; you know that they are reputable companies, that they operate safely, that incidents don't occur that pollute. You have a better knowledge. But when you get further away into some of the city areas, for example, or into some of the other areas of New South Wales or the South East of South Australia that may not have ever seen any, or very little, activity; it is just the unknown. People listen to publicity they have seen and sensational movies and they get scared by it, because they haven't experienced it and they don't know that it is perfectly safe.<sup>37</sup>

Mr Chris McColl, of Kalangadoo Organic Orchards in the South East, told the committee in a presentation that Beach Energy had convened a roundtable in late 2014. Organised by an Adelaide group called OzTrain, with mediators David Waterford and Denise Picton, the roundtable included representatives from the potato, dairy, wine, fishing and livestock industries, as well as executives, directors and scientists from Rawson Resources, Cooper Energy and Beach Energy. The roundtable was apparently short-lived, however, as Mr McColl said it had not met since late 2014 and a February 2015 meeting had been postponed.

Mr McColl said it was difficult as a community member and business owner to get information. Two emails to the company, he said, had received no response. "That's what I'm concerned about, is that there's a real danger...and we can't get any written response from the mining companies. They just say, 'Everything's ok, there's nothing to worry about. We're using world's best practice...'"<sup>38</sup>

While visiting Queensland, members heard the Western Downs Regional Council Mayor Ray Brown describe industry consultation with community in the early days of industry expansion there as "shocking." He went on to say, however, that engagement differed widely between companies, with some quickly making adjustments to their outreach programs to successfully build levels of trust for mutual benefit.

A number of submissions to the inquiry raise the issue of lack of social licence:

The energy companies have no social licence here in the South East. Majority of people living in our region are against this, in fact I have not spoken to anyone that is for it. (Submission 37)

Does Beach Energy or any other prospective exploration company have a social licence, including overwhelming support of the local community, for their activities? No. (Submission 13)

It is essential that the companies engaged in fracking and unconventional gas secure a strong social licence to operate; a licence that currently does not exist in South Australia, particularly in the South East. (Submission 140)

In a submission written for a Western Australian inquiry into unconventional gas development, also submitted to the South Australian inquiry, the Conservation Council of WA considered lack of public knowledge about the subject of unconventional gas development and exploration a symptom of failed community engagement by proponents:

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<sup>37</sup> (Guglielmo, 2015, pp. 107-8)

<sup>38</sup> (McColl, 2015, pp. 38-9)

Most people have no idea what shale and tight gas fracking involves, what the risks are, and what experiences in other regions can tell us about whether it is an industry that we want to see imposed on iconic regions of Western Australia. Despite that lack of knowledge, and the failure of any social licence that it implies, the government is intent on pushing forward with development.<sup>39</sup>

The evidence provided to the committee indicates overall that while industry efforts have been made to engage with community and to acknowledge its needs and expectations, there appears a gap between what the community is saying and how industry responds. Also, notably, there do not appear to be any substantial guidelines as to how industry should conduct community engagement in the South East or how to ascertain if social licence has been granted. This represents a real problem both for industry and community.

Mr David Blowers, Energy Fellow at the Grattan Institute, presented evidence to the committee regarding economic opportunities lost due to poor engagement practices:

... I think both industry and government have let down the sector and let down the community particularly badly over unconventional gas. On the industry side, there were examples of some poor practice, particularly in New South Wales and Queensland, in terms of dealing with the community and dealing with the issue. From both government and industry sides—and this goes broader than unconventional gas; this goes to our entire approach to resources—there has been a failure to fundamentally argue the economic case of what the benefits of this are.

It is easy for me to sit here and talk about Queensland having \$63 billion of investment and 30,000 jobs, etc., but we have not been able to relate any of that to the people who are going to be affected on the ground in the communities. We also have to understand that what we have effectively lost is the social licence for a lot of this to operate.<sup>40</sup>

The Conservation Council of SA makes a direct link between lack of baseline data and lack of social licence, and addresses improved community engagement<sup>41</sup>:

Other states have allowed fracking to proceed in the absence of either baseline monitoring allowing its impacts to be quantified or regulatory regimes that provide protection and assurance to communities. The result has been strong community campaigns opposing unconventional gas developments, patchy and inconclusive science leaving decision makers in an information vacuum, and ongoing uncertainty and costs for gas project proponents. South Australia will do itself no favours if it does not learn from these experiences.

It is essential that the companies engaged in fracking and unconventional gas secure a strong social licence to operate; a licence that currently does not exist in South Australia, particularly in the South East.

In its submission to the inquiry, the Environmental Defenders Office (SA), discusses the provisions in the *Petroleum and Geothermal Energy Act 2000* for community engagement<sup>42</sup>:

One of the objectives of the Act is to “establish appropriate consultative processes involving people directly affected by regulated activities and the public generally” [S3(e) of the Act]. Giving

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<sup>39</sup> (Conservation Council of WA, 2015)

<sup>40</sup> (Blowers, 2016, p. 375)

<sup>41</sup> (Conservation Council of South Australia, 2015)

<sup>42</sup> (Environmental Defenders Office (SA), 2015)

affected members of the public meaningful rights recognises the often high level of impact that operations under the Act can have on a community's wellbeing.

Two common approaches to community engagement for the purpose of obtaining social licence to operate have been outlined in the CSIRO literature review noted earlier.<sup>43</sup> The committee suggests that new unconventional gas development in South Australia might be guided by these or similar principles.

1) The International Association for Public Participation (IAP2), an international member association which "seeks to promote and improve the practice of public participation or community engagement, incorporating individuals, governments, institutions and other entities that affect the public interest throughout the world" sets out five stages of engagement: inform, consult, involve, collaborate, empower. All five stages are ideally progressed through in community engagement to ultimately enable joint decision making between the public and a company.

2) The second sets out three strategies drawn from business literature: transactional engagement, transitional, and transformational. Each is used as an individual means of engaging with the public.

- Transactional strategies are "usually one-sided communications with the aim of reducing transaction costs associated with the company's activities. The company 'gives back' to the community in terms of information, time, effort and money" meaning things like volunteer time, building local infrastructure and donations.
- Transitional strategies "are more collaborative and involve two-way dialogue with shared involvement and consultation over company activities." This includes things like advisory boards, surveys, town hall or shed meetings, and focus groups.
- Transformational strategies "result in joint learning, with the integration of community into company decision making."

The first of these points describes the consultation style in use in many cases currently but the committee has noted this may not be adequate for meeting changing public needs, and a more collaborative approach may be required.

A report presented at the Pacific Energy Summit 2013 in Vancouver also offers material for consideration. It states that common aspects of successful acquisition of social licence include:

- early and substantial analysis of communities and stakeholders potentially affected by a project to understand local conditions, needs, and customs, including communication protocols and constraints
- early engagement and consultation with affected communities and stakeholders to identify issues and interests and establish dialogue
- action on areas of mutual interest and enhancement of benefits targeted at specific community needs
- sustained and transparent communication, particularly in the context of the growing role of social media in rapidly disseminating information about companies, technologies, and projects.<sup>44</sup>

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<sup>43</sup> (Williams & Walton, 2013)

<sup>44</sup> (Yates & Horvath, 2013, pp. 20-1)



These principles were supported by LCLGA's evidence to the committee. Ms Erika Vickery, President of LCLGA, said:<sup>45</sup>

In the future, consultation with regional communities needs to ensure a number of things, and they include:

- regional consultation starts very early, well in advance of any on-ground activity;
- community members, in particular, locals and landholders, are able to speak directly with the industry proponent prior to, during and following, any on-ground activity;
- community members have the opportunity to speak directly with the representatives of the state government agencies that are responsible for administering the legislation and the regulation;
- there is an easy access to technical and scientific information relating to any on-ground activity;
- information to be received via a number of forums and formats within the region; and
- community, landholders and local government are aware of all the avenues available to have input to the decision-making process.

In its submission to the inquiry, Primary Producers SA (PPSA) wrote:

Community engagement must be consistent with the following principles:

- Transparency and full disclosure;
- Early and ongoing collaboration;
- Inclusiveness;
- Ethical and responsible business practice;
- Integrity and appropriate behaviour;
- Capacity building; and
- Listening and responding to community concerns.

The key to productive relationships between agriculture and mineral and petroleum industries is relationships built on genuine trust and goodwill and appropriate community engagement.<sup>46</sup>

In her submission to the committee, Associate Professor of Environmental Law Karen Bubna-Litic stated that one of the objects of the PGE Act 2000 and the Petroleum and Geothermal Energy Regulations 2013 include the following:

- e) to establish appropriate consultative processes involving people directly affected by regulated activities and the public generally

She went on to recommend that "the Act be amended to define 'appropriate consultation processes', clarifying at which parts of the process consultation will take place."

### 9.3 The risks of groundwater contamination

Many submissions identified this first term of reference as a concern as well as set out many possible ways in which this could happen, such as during fracking, via fracture migration and existing faults, and through surface spills and waste management.

The region is dependent on groundwater for its drinking water and for irrigation, the latter of which is highly regulated through the Limestone Coast Prescribed Wells Area Water Allocation Plan (WAP),

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<sup>45</sup> (Vickery, 2015, p. 83)

<sup>46</sup> (Primary Producers South Australia)

administered by Natural Resources South East (DEWNR) and the South East Natural Resources Management Board. A number of submissions recommend that if unconventional gas production is to go ahead in the South East, it must be brought under the Limestone Coast Prescribed Wells Area WAP.

Mr Fraser Bell, legal adviser to Coonawarra Grape and Wine Incorporated, provided evidence in a public meeting at Millicent early in 2015. He told the committee that “the NRM Act, the parent of the water allocation plan...is inadequate” because it “is completely silent on fracking”.<sup>47</sup>

Groundwater is also linked in many submissions to the fourth term of reference (potential net economic outcomes to the state and region), as it supports the region’s agriculture, horticulture and livestock sectors, which as “premium food and wine” rank along the “mining boom” among the Government of South Australia’s state economic priorities.<sup>48</sup>

The committee has heard multiple statements from proponents that South Australian regulation and the precautions it requires have contributed to an industry with a good track record and no contamination. Other submissions question this claim and whether monitoring and regulation are sufficient to back it.

As set out in the first part of this section, the committee has considered hydraulic fracturing specifically as a procedure used in gas development as well as considered unconventional gas development more broadly.

Submission 49 demonstrates the potential for misunderstanding by clarifying the meaning in context: “I am referring to the entire process, not solely the activity of fracture stimulation”.

Some evidence the committee received focused narrowly on the procedure of hydraulic fracturing not having caused contamination of groundwater.

In its submission to the inquiry, SACOME quotes a 2014 Halliburton document which was submitted to a Western Australian Parliamentary inquiry:

...over 1 million wells have been hydraulically fractured (for conventional and unconventional gas) in the past 60 years, with no confirmed evidence of drinking water contamination from the fracking process<sup>49</sup>

Cooper Energy’s submission to the inquiry provides a slightly abbreviated quotation of the same Halliburton document:

“Internationally, over 1 million wells have been hydraulically fractured (for conventional and unconventional gas) in the past 60 years, with no confirmed evidence of drinking water contamination.

The same submission states, “It is highly improbable that hydraulic fracture stimulation (hydraulic fracturing) of the deep shales in the south east of South Australia would threaten contamination of the groundwater aquifer in the region” for the following reasons:<sup>50</sup>

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<sup>47</sup> (Bell F. , 2015)

<sup>48</sup> (Government of South Australia, n.d.)

<sup>49</sup> (South Australian Chamber of Mines and Energy, 2015, p. 6)

<sup>50</sup> (Cooper Energy, 2015)

- Remoteness from target zone and maximum extent of fractures
- Impermeable shales are barriers to fluid migration into aquifers
- Well design and construction (typically three layers) prevents egress from well bores

Providing evidence to the committee, South Australian Chamber of Mines and Energy Chief Executive Jason Kuchel spoke about the state's strong regulatory framework related to risk:

In South Australia our regulatory framework has existed for a long period of time and is administered by the state. It is a very well resourced department, with lots of experts in their particular field, and they have a very good track record of looking after this area. In much of the United States, for example, similar sorts of activities are actually regulated by local councils. In some cases, activity started when they had very little or no regulation. In many cases, they don't have the staff nor the experts to manage it properly.

If you like, it's almost like a frontier type of activity in much of the United States, whereas in South Australia it has been regulated for well over 50 years and hydraulic fracturing in particular has been regulated well for over 40 years in South Australia. There have been numerous inquiries across Australia and internationally into the use of hydraulic fracturing which have all concluded that there is low environmental risk provided best practice operations and a robust regulatory framework exists.<sup>51</sup>

The United States Environmental Protection Agency draft interim report on the effects of unconventional gas on drinking water (2015) presented preliminary findings regarding contamination. The report has been widely reported on and selectively quoted by media and agencies worldwide, as well as to the committee in evidence.

SACOME's slide presentation to the committee included a line from the US report: "we did not find that these mechanisms have led to widespread, systemic impacts, on drinking water in the USA".

On a separate occasion, APPEA Chief Operating Officer Stedman Ellis also spoke about this finding to the committee:

Can I also touch briefly on one of the other significant reports that has been released in the last couple of weeks by the US EPA. As the committee again would be aware, of the more than two million wells drilled and fracked internationally, more than a million have been hydraulically drilled and fractured in the United States—about 100,000 in the last 10 years and, in the last four years, about 25,000 to 30,000 wells. The US EPA has released a landmark study looking at this.

From the industry's view, I think it is a cautious green light for the development of the unconventional gas industry. It certainly is a significant rebut to the quite extremist claims that have been made by some people about the potential for hydraulic fracturing to contaminate water.<sup>52</sup>

In response to a question from the committee, Mr Stedman clarified his statement:

The finding was of isolated cases of contamination of groundwater caused not by hydraulic fracturing but caused by the surface handling of flow-back waters and other materials, and that is consistent with the findings of other studies and of the CSIRO, which has indicated the major risk

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<sup>51</sup> (Kuchel, 2015)

<sup>52</sup> (Ellis, 2015, p. 159)

in terms of contamination of near-surface aquifers used for drinking water is how chemicals and fluids are handled at surface.<sup>53</sup>

The quoted statement on page ES-6 of the US EPA report reads in full (*italics added*):

From our assessment, we conclude there are above and below ground mechanisms by which hydraulic fracturing activities have the potential to impact drinking water resources. These mechanisms include water withdrawals in times of, or in areas with, low water availability; spills of hydraulic fracturing fluids and produced water; fracturing directly into underground drinking water resources; below ground migration of liquids and gases; and inadequate treatment and discharge of wastewater.

We did not find evidence that these mechanisms have led to widespread, systemic impacts on drinking water resources in the United States. Of the potential mechanisms identified in this report, *we found specific instances where one or more mechanisms led to impacts on drinking water resources, including contamination of drinking water wells.* The number of identified cases, however, was small compared to the number of hydraulically fractured wells.<sup>54</sup>

The report considered possible reasons for the small number of contamination incidents:

This finding could reflect a rarity of effects on drinking water resources, but may also be due to other limiting factors. These factors include: insufficient pre- and post-fracturing data on the quality of drinking water resources; the paucity of long-term systematic studies; the presence of other sources of contamination precluding a definitive link between hydraulic fracturing activities and an impact; and the inaccessibility of some information on hydraulic fracturing activities and potential impacts.<sup>55</sup>

In a presentation to the committee, Professor Anthony Ingraffea, an engineering professor and teaching fellow at Cornell University, dismissed fracking itself as a likely risk to groundwater:

Fracking is not the issue with water contamination. Well bore integrity and surface spills are the issue so again, you are wise to make sure that your committee is investigating not just fracking but all aspects, including drilling, wellbore integrity, surface spills, transportation of chemicals, transportation of waste, and the impacts on the landscape.<sup>56</sup>

Professor Ingraffea recommended these be addressed in a legislative review.

Many submissions and some evidence raised concerns about risks of groundwater contamination. Some other main concerns are summarised below.

### ***Potential pathways for contamination***

The committee heard evidence from proponents acknowledging the risks to groundwater and how those risks are identified, classified and reduced to “as low as reasonably practicable” (ALARP). The main potential pathways for aquifer contamination are considered to be:<sup>57 58</sup>

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<sup>53</sup> (Ellis, 2015)

<sup>54</sup> (United States Environmental Protection Agency, 2015, pp. ES-6)

<sup>55</sup> (pp. ES-6)

<sup>56</sup> (Ingraffea, 2015, p. 291)

<sup>57</sup> (Cooper Energy, p. 10),

<sup>58</sup> (Santos 4, 2013, p. 7)

- drilling and production (including actual hydraulic fracturing)
- surface spills of hydraulic fracturing chemicals
- wastewater/stormwater spill or runoff
- migration of oil/gas up through cracks in rock (either natural or stimulated)
- well/casing integrity failure
- diffusion/natural migration of hydrocarbons

Risks related to these pathways can be controlled largely through best-practice regimes and the state's "robust" legislation, the committee has heard. APPEA, quoting the Australian Council of Learned Academies (ACOLA), wrote in its submission to the committee that:

The evidence suggests that, provided appropriate monitoring programs are undertaken and a robust and transparent regulatory regime put in place (and reinforced), 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.<sup>59</sup>

Quoting the South Australian EPA in its submission, APPEA wrote that previous incidents of groundwater contamination in the South East "are not associated with oil and gas wells" but with pre-existing industries including "dairying, timber mills, gasworks, cheese factories, abattoirs and septic disposal" and that other studies "focused on non oil and gas related industries as the key risk to be managed".<sup>60</sup>

Halliburton, in its submission to this inquiry, presented the following:

In over 60 years, in which more than 2.5 million wells have been hydraulically fractured internationally, there is no confirmed evidence that HF (hydraulic fracturing) fluids have ever contaminated groundwater as part of a HF process. Independent scientists such as those at CSIRO have repeatedly identified wellbore integrity as the critical factor in protecting ground water. (Halliburton, 2015, p. 2)

In its submission to the inquiry, DSD wrote: fracturing stimulation has been used in SA since 1969, in the Cooper Basin. Up to the end of August 2014, 716 wells had been fracture stimulated with no evidence of adverse impact on aquifers.<sup>61</sup>

An appendix to the Halliburton submission provided a range of statements and studies "from Australian authorities, US Federal offices, US state government agencies, and others to corroborate there is little or no risk of fracturing fluids contaminating groundwater."

Professor Anthony Ingraffea provided evidence to the committee regarding US investigations leading to the determination that well water had been contaminated by shale gas development in Northeastern Pennsylvania:

If someone complains that their water well is contaminated it doesn't mean it has been, so the Pennsylvania Department of Environmental Protection, as the regulatory body, is legally required to investigate each of these cases, so you can imagine the workload that that regulatory body has had in one state, having drilled 9,000 shale gas wells and received over 2,300 complaints.

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<sup>59</sup> (Australian Petroleum Production and Energy Association, 2015, p. 18)

<sup>60</sup> (Submission 74, pp. 22-3)

<sup>61</sup> (Department of State Development, 2015a, p. 3)

Of those 2,300 complaints, 260 of them have been determined by the state to be positive, that is, yes: your water well was contaminated by methane or another hydrocarbon from nearby shale gas development. That's a 10 per cent hit rate, so far. Over 1,000 of those complaints have not yet been investigated.<sup>62</sup>

### **Aquifer connectivity**

Dr Glenn Harrington, in a submission to the inquiry from Coonawarra Grape and Wine Inc., wrote:

...the literature indicates there is overwhelming evidence of vertical connectivity through the entire geological sequence within the Penola Trough. Whether or not these faults are conductive to fluid flow (i.e., whether they are open or closed) is dependent upon a number of factors, including their orientation relative to the contemporary stress field in the area.<sup>63</sup>

The submitter states that as analysis is yet to be conducted regarding how these faults may affect inter-aquifer connectivity, “the hydrogeological impacts of unconventional gas development in the Penola Trough are highly uncertain and unpredictable.”

### **Fracking fluid**

Fracking fluid itself, the committee has heard, is also not considered to be of great risk. In a presentation to the committee, James Baulderstone, Santos Eastern Vice President, explained the makeup of fracking fluid and purpose of the material added to water.

Among other things, he said, frack fluid contains guar gum (“what you see in ice cream and toothpaste”) to carry proppant. Mr Baulderstone said that it “is like a hair gel. It looks, feels, smells the same as hair gel...when you pump it with the water and the proppant sand into that fracture stimulation it will carry the sand further in. When you release the water pressure the pressure of the gas then pushes that fluid up the water bore and it cleans out. Guar gum carries proppant into the fractures and props them open.”

Biocide added to the fluid prevents introduction of bacteria to the well. Though he described it to the members as “the most dangerous part of frack fluid”, Santos Eastern Australian VP James Baulderstone said it “is the same biocide used in dairy farms where, at the end of a milk run you will pump your lines to clean them out.”<sup>64</sup>

The committee has heard that flowback fluids, which are fracking fluids plus any fluids that have been trapped in target layers returned to the surface, are held in appropriate tankage for containment and management<sup>65</sup>. (Beach Energy, 2015, p. 28) Further to this, committee members heard during their visit to gas wells at Moomba that fracturing fluids are recaptured and recycled for reuse in further frack stages whenever possible.

Concerns were raised in evidence about the intellectual property of chemicals used in fracking, and whether companies using chemicals were required to disclose the compounds in use. David Guglielmo, Country Manager, Production Enhancement, Halliburton, explained to the committee that

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<sup>62</sup> (Ingraffea, 2015)

<sup>63</sup> (Harrington G. , 2014, p. 3)

<sup>64</sup> (Baulderstone, 2015)

<sup>65</sup> (Beach Energy, 2015, p. 28)

South Australian regulation ensured transparency but also, unlike in other jurisdictions, afforded protection to operators for intellectual property:

We are happy to provide all the information that's available to a regulator and to disclose everything, and also we provide on our websites and other vehicles as much information as possible to the public. We outline all the chemical additives that we may use. There may be certain parts of scientific chemical formulas or chemical abstract numbers that really don't mean anything to a member of the public, and those are the fingerprints, if you will, of the actual formulation that we would not want to provide for a proprietary material, and so therefore that sort of material could not be used in a place like Queensland or New South Wales or Western Australia.<sup>66</sup>

### **Fracture propagation into aquifers/hydrocarbon migration**

Although many submissions have expressed concern over migration of fracking fluids during or after fracks, expert evidence to the committee is unequivocal: "Lateral migration of injected fluids away from the fracture treatment initiation point cannot occur."<sup>67</sup>

The committee heard this is because pressure within a well after fracking is completed ensures a flow path back towards the wellbore, and because the formations in which fracking takes place are low permeability<sup>68</sup> and further that:

The sheer weight of the overlying rock ("overburden") naturally limits fracture growth. [Stimulated fractures] are a few millimetres wide, about 30 metres high and extend anywhere from tens of metres to a few hundred metres from the well. The fractures will also vary in length due to the existence of natural faults, joints, or changes in rock type—these can either provide natural stopping points for a fracture or extend its reach."<sup>69</sup>

The committee has received evidence that "Fracture height growth into the Great Artesian Basin aquifers is not considered to be a credible risk"<sup>70</sup> and that "[m]igration of stimulation fluids to aquifers through the overlying strata is not considered to pose a credible risk."<sup>71</sup>

APPEA wrote to the committee that "extensive research has conclusively demonstrated that the fractures induced by the process are confined to the rocks close to the zone of interest".<sup>72</sup>

Santos has written in Part 2 of its submission to the NRC:

Conventional fracture stimulations in Cooper Basin gas targets are typically medium scale treatments, designed to achieve fracture heights in the order of 100 m.

An environmental impact report prepared by Santos for the Cooper Basin and provided as a submission to the inquiry states that the company identifies water within target formations and "if any risk of fracture propagation into these zones is present, these fracture targets will be avoided."

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<sup>66</sup> (Guglielmo, 2015)

<sup>67</sup> (Santos c, 2014, p. 49)

<sup>68</sup> (Santos 2, 2014, p. 78)

<sup>69</sup> (Santos 4, 2013, pp. 6-7)

<sup>70</sup> (Santos 2, 2014, p. 75)

<sup>71</sup> (Beach Energy, 2015, p. 33)

<sup>72</sup> (Australian Petroleum Production and Energy Association, 2015, p. 21)

Dr Michael Stephenson (2015) has written that gas is extremely unlikely to migrate into aquifers via fractures isolated by distances greater than the maximum documented vertical distance travelled by an induced fracture, or 588m. Furthermore, gas that is able to migrate via naturally occurring fractures would already have done so.

Dr Stephenson has written: “A more troubling possibility is that a fracture opens and unknown to the drillers it grows and meets a nearby old well.”<sup>73</sup> This concern has also been represented to the inquiry in multiple submissions from members of the public.

### **Wastewater handling**

In the period after fracking, the fluids flowing back from a deep unconventional (shale or tight) gas well are mostly fracturing liquids which, Beach Energy has told the committee, are directed to either a lined pond or tank. Additionally, substances which may have been present in the source rock, which can include naturally occurring heavy metals, benzene, toluene, and/or radioactive material, also flow from the well and must be handled and disposed of with caution. Some issues have also been identified around potential risks associated with wastewater and its disposal.

In a submission to the committee, Anne Daw wrote:

No one has answered the question on how disposal in the South East of SA, of shale gas produced water (concentrated brine, heavy metals, radionuclides, salt, etc. in the water left behind after water treatment) was going to be dealt with, as the result of exploration or during the process of hydraulic fracture stimulation.<sup>74</sup>

Tony Beck, a South East landholder presenting to the committee, questioned a wastewater holding pond for the Salamander-1 4000m deep geothermal well. Showing a photograph to the members on a screen, he said

This is the pond, and you can see, after four years, that the integrity of the plastic liner—the foxes have dug holes through the plastic liner and that water has been seeping into our underground aquifers for several years.<sup>75</sup>

A certain proportion of flowback water can be recovered. Beach Energy (citing King 2012) stated in its submission that US shale gas statistics indicate approximately 40 per cent to 50 per cent of injected fluid may be recovered. Dr Dennis Cooke, a researcher in the area of unconventional gas who addressed the committee, has also estimated fluid recovery of about one-third to one-half, noting the quality of water can vary considerably due to salinity as well as natural contaminants, so it is not always suitable for re-use, and production of recovered fracture fluid diminishes over the flowback period.<sup>76</sup>

A submission to the committee from a local resident who is a former researcher with the CSIRO suggests the South East region’s “shallow groundwater table and widespread seasonal wetlands make it particularly vulnerable” to contamination via the use of holding ponds.

In Penola, last year [2014] Beach Energy needed an emergency authorisation to move waste water from holding ponds to prevent flooding. Recent prediction by the CSIRO and Bureau of

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<sup>73</sup> (Stephenson, 2015, p. 79)

<sup>74</sup> (Daw, 2015a)

<sup>75</sup> (Beck, 2015, p. 37)

<sup>76</sup> (Cooke, 2014, p. 7)



Meteorology<sup>77</sup> conclude that “Even though mean annual rainfall is projected to decline, heavy rainfall intensity is projected to increase, with high confidence”<sup>78</sup>. This means increased likelihood of holding ponds flooding and will require that pond capacity will require to be significantly increased to prevent this likelihood.<sup>79</sup>

### **Well integrity/well failure**

Well integrity, i.e., the soundness of a wellbore, has arisen as one of the most important potential pathways for contamination.

Multiple submission from the public, many of them citing Professor Anthony Ingraffea, who provided evidence to the committee, raised concerns about well integrity and the potential for well failure:

Accidents occur within all industries that were not meant to happen. Despite the low risks quoted by the resources industry, increasing the magnitude of an operation significantly increases the proportionate risk of a well failure or accidents whereby risk becomes a reality. The risks associated with well leakage or failure are further magnified when the South Australia-Victoria Border zone groundwater investigation found that there is significant vertical movement of water between our aquifers demonstrating continual interconnectivity (S. Mustafa & J. Lawson, Department for Water 2011).<sup>80</sup>

According to a report commissioned for the Australian Council of Learned Academies (ACOLA) assessing the risks from shale gas extraction, the probability of ‘well failure’, and ‘over extraction from aquifer resulting in reduced water availability for the environment or other users/aquifer interference’ are both regarded as ‘likely’. This same study estimated there were already 3,446 shale gas wells in the Otway Basin, mainly on the South Australian side. The risks arising from potentially tens of thousands more wells across the South East are therefore deeply concerning.<sup>81</sup>

Professor Ingraffea talked to the committee about a peer-reviewed study into the percentage of shale gas wells in Pennsylvania which were found to be leaking within the first five years of their construction:

We compared that leak rate in the shale gas wells to the leak rate in the non-shale gas wells and we used the statistics provided to us by the Pennsylvania Department of Environmental Protection—that's the regulatory body in Pennsylvania—and their records show that shale gas wells were showing a leak rate of about 6.2 per cent in the first five years as compared to an overall failure rate in conventional wells of 1 per cent—one in 100 conventional wells and six in 100 shale gas wells.

In some regions of the state where drilling occurred very, very quickly, where operators were totally inexperienced, the failure rate in the wells was almost 10 per cent—one in 10—within the first five years, leaking. If you have leaking gas wells, you have a risk to groundwater contamination.<sup>82</sup>

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<sup>77</sup> (CSIRO, Bureau of Meteorology, 2016)

<sup>78</sup> (CSIRO, Bureau of Meteorology, p. 6)

<sup>79</sup> (Carlyle, 2015)

<sup>80</sup> (Livestock SA)

<sup>81</sup> (Conservation Council of South Australia, 2015)

<sup>82</sup> (Ingraffea, 2015, p. 289)

APPEA wrote in its submission to the inquiry that wells are constructed “to the highest standards to ensure gas is kept within the well and water is kept out. These wells are also maintained throughout their operational life to ensure that they remain safe and efficient.”<sup>83</sup>

Santos submitted to the committee that:

The design and quality of the well construction is of paramount importance in managing, and avoiding, any environmental risks associated with fracture stimulation. Santos applies best practice in its drilling techniques and related activities. Design and construction of wells is a critical process that needs to be both well regulated and well managed to ensure that groundwater and aquifer formations are protected and so the hydrocarbons can be produced safely throughout the life of the well.<sup>84</sup>

A representative of Halliburton provided evidence that:

Well integrity is a key part of the process to ensure that [fracking is] safe. ... barriers prevent any movement of fluids from the producing zone to the aquifers and completely seal off the intervals in between each other. So, that’s the key to protecting groundwater.<sup>85</sup>

The Department of State Development has stated that although cross-contamination of aquifers is considered a risk of hydraulic fracturing and associated procedures, the risk is related directly to inadequate well construction and does not differ from the risk associated with conventional gas production.

...based on current technology and unequivocal geological data (including thousands of metres of sealing rock between these aquifers and the potential petroleum reservoir fracture stimulation targets), the risk of fracture propagation at depths below 2,500 metres leading to fracture stimulation fluids contaminating shallow aquifers is unrealistic. (Department of State Development, 2015a, p. 16)

As part of its submission to the committee, Halliburton submitted a peer-reviewed paper from a Society of Petroleum Engineers journal addressing the relationship of well age to failure and resulting potential for methane leaks:

Although ageing is a significant issue, it must be remembered that failures of the past are what our knowledge of today is built upon, and as learnings progress, the failure rates of a later time should be lower than those of the era before it....A key issue with operators is how they capture and incorporate learnings into the next design.<sup>86</sup>

Inattention to older petroleum wells in the South-East also represents a concern in submissions to the inquiry. The Hon Mark Parnell, in the Legislative Council in July 2013, described hearing about leaking wells in the South East:

I have recently been contacted by concerned citizens in the South East regarding old mine drilling holes...on private property and were apparently drilled by Western Mining Corporation sometime

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<sup>83</sup> (Australian Petroleum Production and Energy Association, 2015, p. 23)

<sup>84</sup> (Santos 2, 2014)

<sup>85</sup> (Guglielmo, 2015, p. 104)

<sup>86</sup> King and King 2013, in (Halliburton, 2015)

between 1979 and 1982...Whilst it is quite likely that these drill holes were originally capped and sealed appropriately, they are now gaping holes in the ground.<sup>87</sup>

The committee heard from South East landholder Tony Beck:

...there is (an oil) well that was drilled in the '60s on my most northern boundary, within about 100 or 200 metres, and I can assure you that nobody from the department of DMITRE has ever been to that well to test its integrity. In fact, I doubt whether they could find it, but it's a well that went down quite a distance. Nobody knows what the conditions of the casings are like today...in 1960, they couldn't go very deep. It would have been less than 2,000 metres, I would imagine, but no-one has been back to check its integrity ...<sup>88</sup>

### Other risks to groundwater

Dr Glenn Harrington, a hydrogeologist presenting to the committee as a technical expert with Coonawarra Grape and Wine Incorporated, told the committee:

I think the potential risks can be broken into three simple categories: water quantity (or water availability); water quality (in other words, deterioration of the groundwater salinity through enhanced leakage through these low permeability layers); and, contamination. It's the third one that most people rely on for an argument about migration of fracking fluids and the potential threat that that poses. That is a potential risk, but I think we also need to be cognisant of the other two very general risks of decline in water quality and water quantity.<sup>89</sup>

## 9.4 Impacts upon landscape

It is important to note the difference between land and landscape. The committee has heard that the Department of State Development, the state's regulator for oil and gas development, considers "environment" broadly under the *Petroleum and Geothermal Energy Act*:

...when we talk about environment under the *Petroleum and Geothermal Energy Act*, we talk about all aspects of the environment: natural aspects like water and soil, plants and animals, but we also talk about the social, cultural and heritage features, visual amenity and other economic and other land uses. So, when we talk about addressing and managing environmental impact, we talk about it in a very broad context, so if you are having an impact on another land user or use that must be addressed.<sup>90</sup>

Therefore while *land* comprises the surface of the earth: ranges, forests, cities, towns, farms, watercourses, and air above it; *landscape* implies a human view and/or use of the land. This term of reference therefore deals with the impacts of unconventional gas exploration and production (and the use of hydraulic fracturing as part of those processes) upon the landscape as it is viewed and used by the people who live and work within that landscape.

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<sup>87</sup> (Parnell, 2013)

<sup>88</sup> (Beck, 2015, p. 39)

<sup>89</sup> (Harrington G. , 2015, pp. 39-40)

<sup>90</sup> (Malavazos, 2015, p. 22)

The committee considers that the important matter of social licence thus falls in part under this term of reference, with regard to use and enjoyment of the landscape, cultural/heritage amenity, visual and social amenity, and lifestyle.

Impacts on landscape also may potentially relate to nuisance law, which involves a substantial, unreasonable and repeated or ongoing interference with the use or enjoyment of a neighbour's land, such as smoke, smells or noise.

It is for the court to decide what is substantial and unreasonable and this will often depend on the nature of the local area. For example, noisy or smelly factories will not normally be regarded as causing a nuisance if they are sited in industrial areas. Nor will it be a nuisance if the occupier who suffers the damage has put up with it without complaint for a long time, or if the occupier suffered the damage because of an unusual sensitivity (for example, unusually delicate plants). Public authorities may sometimes be allowed to cause a nuisance in the course of necessary work they perform.<sup>91</sup>

The committee visited communities in south-central Queensland to better understand the effects of the gas development boom on the landscape there and met with experts who have studied the social impacts of the boom there.

Use and enjoyment of landscape includes the right of existing business to continue unimpeded. Associate Professor Will Rifkin provided evidence to the committee explaining the impact of coal seam gas and associated development on some Queensland farmers:

This sort of development is, basically, a construction project, it's like somebody doing renovations in your house, but you didn't ask for it. They leave a mess sometimes and that sort of thing, but you are getting compensated for it. They (farmers) felt they wanted to be told in advance. They wanted equal negotiating power when they go into a meeting with people from the company. They don't want them (a single farmer) facing three people from the company. They want some sort of balance. It's two businesses using the same landscape.

Submissions from the public and regional businesses express concern about the possible numbers of wells which have been proposed for the South East. Community members have written submissions expressing fear that the South East may become what was described to the committee in a written submission from a resident of Chinchilla, Queensland as "an industrialised landscape, the scale of which has never before seen in any residential and agricultural region of Queensland".

The NRC has heard the concern that unconventional gas infrastructure will have a negative impact on "visual amenity" as well as damage the region's tourism:

No one can give a guarantee that there won't eventually be 1000's of wells. The government commissioned document by Frogtech points out that there may be 3446 shale wells in the Otway Basin, mostly on the South Australian side. While Beach Energy Ltd. claim there won't be many wells, a truth yet to be proved, they may on sell their licence to the next petroleum company which intends to put in 100's or 1000's of gas wells.<sup>92</sup>

Neil Gibbins, Beach Energy's Chief Operating Officer, said specifically Beach would not create thousands of wells. He told the committee:

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<sup>91</sup> (Legal Services Commissions, 2014)

<sup>92</sup> (Limestone Coast Protection Alliance, p. 89)

Beach will not be drilling thousands of wells in the onshore Otway Basin—I repeat that: Beach will not be drilling thousands of wells in the onshore Otway Basin. ... Without core sample results to guide us, it is too early for us to specify how many wells may potentially be drilled on the South Australian side of the onshore Otway Basin for unconventional gas, if, in fact, any at all. However, we can rule out thousands, or even hundreds, of wells and say there could be five to 10 wells per year with one to two rigs operating at a time.<sup>93</sup>

The committee has heard on several occasions that deeper unconventional gas operations can have a lesser impact on landscape than coal seam gas operations:

There is a technology that mitigates this. It's called pad drilling...in the Cooper Basin right now the drillers and their companies are finding it very cost-effective to bring all the wellheads together and drill deviated wells. They spend a lot less money on pipelines, compressors, roads and moving drill rigs around, and it actually benefits the community considerably by lessening the footprint here.<sup>94</sup>

Public and proponent submissions also include concerns about potential impacts from increased industrial traffic/machinery as well as potential seismic risk.

### ***Seismic activity***

A large number of submissions raised concerns about unconventional gas activity inducing seismic activity in the South East.

Micro-seismic activity is a known factor in hydraulic fracturing and is carefully monitored.<sup>95, 96</sup>

The committee has received evidence that seismic events related to unconventional gas have been shown to be related mostly to wastewater disposal via injection well:

We have seen no seismic activities experienced. Where that comes from is a couple of occasions in the US where they have had water injection wells, particularly around the Californian fault seams, and you have seen some slippage, possibly due to injection of those water wells around there. I think, though, that the level of seismic activity is about the same amount as a truck driving by; it is almost impossible to actually feel the difference. So, no; we haven't had any seismic activity in the Cooper Basin, and any such event is very minor in nature.<sup>97</sup>

Tests on unconventional gas well casings that were done following an earthquake in Blackpool (UK) showed that the well casing had been deformed by the seismic activity. As the earthquake was small and the well casing damage at great depth, the study nonetheless showed that “earthquakes can increase the risk of leakage”.<sup>98</sup>

### ***Subsidence and sinkholes***

There is considerable concern indicated about gas development in the South East causing subsidence and sinkholes, particularly given the region's limestone geology, which are considered both a risk to

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<sup>93</sup> (Gibbins N. , 2015)

<sup>94</sup> (Cooke, 2014, p. 4)

<sup>95</sup> (Department of State Development, 2015a)

<sup>96</sup> (Baulderstone, 2015, p. 111)

<sup>97</sup> (Baulderstone, 2015, p. 111)

<sup>98</sup> (Stephenson, 2015, p. 97)

groundwater (contamination via both surface and subsurface) and significant damage to landscape. One submission to the committee stated:

Typical activities that can lead to sinkholes are:

- Decline of water levels—drought, groundwater pumping (wells, quarries, mines)
- Disturbance of the soil—digging through soil layers, soil removal, drilling
- Point-source of water—leaking water/sewer pipes, injection of water
- Concentration of water flow—storm water drains, swales, etc.
- Water impoundments—basins, ponds, dams
- Heavy loads on the surface—structures, equipment
- Vibration—traffic, blasting

All of these activities are part of the activities of hydraulic fracture stimulation, including wastewater holding ponds. A sinkhole is not a hole in the rock. Sinkholes that have collapsed and subsided that are seen on the ground surface are because of the hole in the rock below. Often, you can only see soil in the hole and not the actual hole in the rock itself because the rock is too far below.<sup>99</sup>

### ***Industrial vehicles, roads, and traffic***

Submission 133 cites a study from gas regions in Pennsylvania to suggest that unconventional gas development and increased traffic in heavy industrial vehicles is not appropriate for the South East and would lead to increases in road accidents, and therefore injuries and fatalities:

A recent study from Pennsylvania also reports that automobile and truck accident rates in 2010–2012 from counties with heavy [high volume hydraulic fracturing] HVHF activity were between 15% and 65% higher than accident rates in counties without HVHF. Rates of traffic fatalities and major injuries were higher in 2012 in heavy drilling counties in southwestern Pennsylvania compared to non-drilling counties. (Submission No. 133, citing Graham et al. 2015)<sup>100</sup> (*Graham et al. also concluded: “Vehicle accidents have measurably increased in conjunction with shale gas drilling.”*)

## **9.5 The effectiveness of existing legislation and regulation**

Gas production in South Australia takes place under a three-stage process regulated chiefly under the *Petroleum and Geothermal Energy Act 2000* (PGE Act), with any interaction between PGE Act and other South Australian Acts administered through arrangements with respective agencies.

Key objects of the PGE Act include:

- Protecting the public and the environment from risks inherent in activities regulated by the Act
- Establishing appropriate consultative processes, both with people directly affected by activities regulated under the Act, and the general public
- Ensuring appropriate levels of security of natural gas supply are provided for.<sup>101</sup>

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<sup>99</sup> (Daw, 2015a, pp. 48-9)

<sup>100</sup> <http://www.sciencedirect.com/science/article/pii/S000145751400325X?np=y>, accessed 17 Aug 2015. (Accident Analysis & Prevention, Volume 74, January 2015, Pages 203–209)

<sup>101</sup> (Resources and Energy Group, Department of State Development, 2016, p. 53)

The committee has heard evidence that potential impacts of unconventional gas development in the South East are managed under the *Petroleum and Geothermal Energy Act 2000* (PGE Act) and its regulations. Other relevant legislation and regulation can include:

- *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*
- *Natural Resources Management Act 2004*
- *Environment Protection Act 1993*
- *National Parks and Wildlife Act 1972*
- *Aboriginal Heritage Act 1988*
- *Development Act 1993*
- *Work, Health and Safety Act 2012*
- *Dangerous Substances Act 1979*
- *Dangerous Substances Regulations 2002*
- *Dangerous Substances (Dangerous Goods Transport) Regulations 2008*
- *Public and Environmental Health (Waste Control) Regulations 2010*

According to the submission from the Department of State Development (DSD):

This in turn creates additional layers of protection in addition to the best practice regulatory regime under the PGE Act. The PGE Act enables one window to government for industry whereby, through the SEO as a regulatory instrument under the Act, the requirements of other relevant pieces of legislation are incorporated into the Department of State Development's Energy Resources Division (DSD-ERD) approval and compliance monitoring processes.<sup>102</sup>

Licensing and approval for gas exploration and production activities in South Australia takes place in three stages:

1. Licensing
2. Environmental assessment and approval of environmental objectives
3. Activity notification and approval

Under Stage 1, the Department of State Development (DSD) handles applications for and grants petroleum exploration licenses (PELs).

Under Stage 2, the DSD assesses development proposals, including the licensee's environmental impact report (EIR), which 'is there to enable informed decisions to be made about the risks' by the community, the approving authority, and the minister.<sup>103</sup> Concurrent with the EIR, the licensee must submit a draft of a detailed activity proposal called the statement of environmental objectives (SEO).

Michael Malavazos, Director Engineering Operations, Energy Resources Division, Department of State Development, told the committee:

A key instrument under this bit of legislation is ... a statement of environmental objectives. This document, for all intents and purposes, is a form of regulation, but the beauty about this document is that the community have a say in what conditions and what objectives they want a company to meet to meet their expectations. It is something that I think has been missed somehow in all this debate. ... It sets the objectives that companies need to achieve and how those

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<sup>102</sup> (Department of State Development, 2015a, p. 29)

<sup>103</sup> (Malavazos, 2015, p. 22)

objectives will be measured. The more important thing about it is that the community have a say in what those objectives are. It is a very powerful instrument....

...the environmental impact report (EIR) and the statement of environmental objectives are developed in consultation with relevant stakeholders, landholders, the community, native title claimant groups, government agencies. All these approved documents are assessed by us as an agency.<sup>104</sup>

The committee heard that both the EIR and the SEO are developed in consultation with relevant stakeholders, which includes landholders, community, native title claimant groups, and government agencies, before they are assessed by the DSD.

“That assessment is not done in isolation by DSD,” said Mr Malavazos. “Through our administrative arrangements with the EPA, with DEWNR, with the Department of Health, we consult in reaching an understanding of what the level of the impact of that particular activity would be, whether it is low, medium or high.”

In Stage 3, the committee heard, the licensees must demonstrate how they will achieve the objectives set out in the SEO. “The community set the standard; we then, as the agent to the community, ensure that companies can demonstrate that they can meet those objectives,” said Mr Malavazos.<sup>105</sup>

While the PGE Act sets out compliance requirements, “[t]he key concept underlying the enforcement of the Act is that the basic responsibility for detecting and rectifying non-compliance lies with the licensee or individual, not the regulator.”<sup>106</sup>

Among the points of conflicting evidence received by the committee was one related to legislation, summarised as:

- South Australian legislation surrounding unconventional gas extraction is world’s best practice
- SA legislation surrounding unconventional gas in SA is unsuited to managing risks associated with fracking.

The concept of “best practice” was raised multiple times before the committee.

Mayor Peter Riseley of Robe Council spoke to the committee about “best practice” being a moving target:

DMITRE [DSD] claims best practice, but you can go back to Maralinga and that was quoted as being best practice as well. Best practice is based on knowledge in a timeline; and, as we move forward with new learnings, we know that, perhaps, what we considered best practice at a time is not necessarily best practice because it is only related to the information you have at a point in time.<sup>107</sup>

Mr Barry Goldstein, Executive Director, Energy Resources, from the Department of State Development (previously DMITRE) provided evidence along similar lines to the committee in 2013, prior to the inquiry’s commencement. In his view, continual improvement was a goal of best practice:

There is no such thing as best practice; best practice is just an aspiration, but you can actually be the leader of something for some ephemeral period. We are leading practice right now, and that

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<sup>104</sup> (Malavazos, 2015, pp. 22-3)

<sup>105</sup> (Malavazos, 2015, p. 23)

<sup>106</sup> (Department of State Development, n.d.)

<sup>107</sup> (Riseley, 2015, p. 208)



was through bipartisan support. This (the Petroleum and Geothermal Energy Act) is an Act that was brought in in 2000 and amended in 2009, and I am sure that once every five years or so we will find other things we will want to incrementally bring to parliament to make it better. Success is never done.<sup>108</sup>

### ***Potential conflict in regulation/promotion***

The committee has received evidence from witnesses and via many submissions which raise questions over the Department of State Development's dual role as promoter and regulator.

Primary Producers SA submitted a document "Mining and Gas Statement of Principles" which sets out general recommendations relating to the PGE Act and concludes:

In particular, we question the legislative framework in which the Minister for Mineral Resources and Energy is the key decision-maker for mining and gas proposals, rather than the relevant planning authority and despite the fact that important land use decisions are being made.

In her lengthy submission to the committee, community member Anne Daw notes "There is clearly a conflict of interest in regard to mineral and petroleum resources and agricultural land. The Department of State Development is the issuer of licences, the promoter of projects and the regulator."<sup>109</sup>

Associate Professor of Environmental Law Karen Bubna-Litic addressed the issue in her submission:

The expertise that exists within DSD in relation to unconventional gas exploration and production is well utilised in working with the licence proponents in developing and approving environmental management plans. However, the potential for a conflict of interest situation is too great if this relationship is extended into environmental assessment and monitoring. It is for this reason that I would recommend that the environmental assessment, monitoring of the plans and compliance and prosecution actions become the responsibility of the EPA.<sup>110</sup>

The multiple-party submission from the Limestone Coast Protection Alliance reiterates Ms Bubna-Litic's recommendation regarding the EPA and also states:

Further, a strong advisory board of independent scientific specialists should be created to provide an independent regulator to review all stages of the development, to consider and grant licences, assess environmental impacts, and to carry out monitoring and enforcement.<sup>111</sup>

Several other submissions also call for the formation of an independent scientific board and monitoring to be conducted by an agency other than the Department of State Development.

### ***Rights and protections for landowners and other businesses***

Teys Australia, Australia's second-largest beef processor and exporter, an employer of nearly 2,000 people in Naracoorte and 2,500 more across eastern Australia, supported the use of the Precautionary Principle in resources development. The company's submission also stated:

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<sup>108</sup> (Goldstein & Malvazos, 2013, p. 8)

<sup>109</sup> (Daw, 2015a)

<sup>110</sup> (Bubna-Litic, 2015)

<sup>111</sup> (Limestone Coast Protection Alliance, p. 188)

We note the clear need for land use policy settings and regulations which do not interfere with ongoing agricultural land use and community amenity, preserve the natural resources with which the region is endowed, and take into consideration the drivers of long-term economic growth in regional areas.<sup>112</sup>

A concern was raised from beef producers in particular about the need to fill out a national vendor declaration (NVD) and the potential for even minor gas industry compliance incidents to result in a residue result on mandatory tests.

In a presentation to the committee, South East producer Debbie Nulty asked, “What are the legal implications for the cattle producer, when standard tests later detect contaminants for which a producer has signed an NVD?”<sup>113</sup>

She told the committee that for farmers to move cattle off the property, whether for sale or production—

... we have to sign a national vendor declaration. It is a legal document. We can be held responsible for it. If I’ve got a coal mine at the back of my place and I have to say whether I’ve had chemical residue or anything else like that, I have to say yes, I don’t know. ... The onus is on me. The worst part is that, if I have mining come onto my place and I don’t want it there—when you send your cattle to market, they do checks every so often for chemical residue. If it comes back that we have a residue in our cattle or sheep, we have to prove that the mining company did it. We were fine before they got there, so why should all the onus be on us, why should the expense be on us, why should the worry be on us, why should the interruption to our business occur?<sup>114</sup>

A private submission from a landowner suggested that phrases used in various regulations and guidelines, such as “minimal impact” and “minor adverse effects” should be clearly defined.<sup>115</sup>

The committee has heard that landholders’ rights may not be adequately represented in the Act. In its submission to the inquiry, the Environmental Defenders Office (SA), discusses the rights of landholders as set out in the *Petroleum and Geothermal Energy Act 2000*<sup>116</sup>, expressing the concern that landholder rights of reply and veto are limited or absent:

The Act does not provide for public rights to appeal decisions made on proposals nor enforcement of project conditions. The type of projects assessed under the Act potentially pose grave risks to the environment and therefore it is in the public interest that there is full scrutiny of such proposals. Appeal rights enable the costs and benefits of proposed operations to be reviewed in a transparent manner in the State’s Environment, Resources and Development Court. With such appeals the rule that each party bears their own costs should apply.

Proponents are required to give landowners a notice of entry; landowners then have 14 days to object. Further disputes may be taken to mediation or court. A potential problem with this system, the EDO wrote—

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<sup>112</sup> (Tey Australian, 2015)

<sup>113</sup> (Nulty, 2015)

<sup>114</sup> (Nulty, 2015 b)

<sup>115</sup> (McAuliffe)

<sup>116</sup> (Environmental Defenders Office (SA), 2015)

is that once the 14 day period has expired, a land owner no longer has any say in the activities which are carried out on their land. More concerning is that if landowners have serious concerns about proposed activities they have no right of veto.

The EDO recommends “legislative amendment such that landholder consent via a land access agreement is a prerequisite for applying for both a license and carrying out activities” and further that “operators compensate landholders for reasonable legal costs incurred in negotiating a land access agreement.”<sup>117</sup>

### ***Risk and the Precautionary Principle***

A number of submissions raised the possibility of the use of the “Precautionary Principle” in licensing, exploration and development. Some submissions have presented an interpretation in which the Precautionary Principle is taken to mean that the presence of any risk means the activity should not be undertaken. The committee understands the principle to be more nuanced than this.

An “authoritative definition” of this principle is provided by one submission, which cites UNESCO’s World Commission on the Ethics of Scientific Knowledge and Technology, and reads in part:

“When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm.”<sup>118</sup>

It also states that “morally unacceptable harm” includes harm to both humans and the environment, is “serious and effectively irreversible”, or “imposed without adequate consideration of the human rights of those affected” and further that “plausibility should be grounded in scientific analysis” which should be “ongoing so that chosen actions are subject to review” and lastly that “(t)he choice of action should be the result of a participatory process.”<sup>119</sup>

The submission from Primary Producers SA advocates a simplified approach to the use of the Precautionary Principle, “whereby proposals are not approved where there are risks which cannot be managed to avoid any financial or other damage to existing land users in the region, or the water resources.”<sup>120</sup>

### ***Unconventional gas in the PGE Act***

In her submission to the committee, Associate Professor of Environmental Law Karen Bubna-Litic stated that the objects of the PGE Act 2000 and the Petroleum and Geothermal Energy Regulations 2013 include the following:

- e) to establish appropriate consultative processes involving people directly affected by regulated activities and the public generally

She went on to recommend that “the Act be amended to define ‘appropriate consultation processes’, clarifying at which parts of the process consultation will take place.”

Professor Anthony Ingraffea, from Cornell University’s College of Engineering, told the committee that he questioned whether the PGE Act is equipped to effectively regulate unconventional gas

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<sup>117</sup> (Environmental Defenders Office (SA), 2015, pp. 8-9)

<sup>118</sup> (Wells, 2015)

<sup>119</sup> (Wells, 2015)

<sup>120</sup> (Primary Producers South Australia)

development based on his finding that the Act had apparently not been updated to include language specific to the more recent development of unconventional gas in South Australia.

There are many examples in which your regulations are, in my opinion, laissez-faire. ... I mentioned previously that our state of Pennsylvania, which saw commercial shale gas development in 2007 has twice made major revisions to its regulations to account for the fact that the regulations that were in existence in 2007 were not appropriate for shale gas development.<sup>121</sup>

## 9.6 The potential net economic outcomes to the region and the rest of the state

It is important to note in discussing this term of reference that as yet, there is no proposal for unconventional gas development in the South East. The exploratory wells drilled in 2014 precipitated public concern but no further development has been discussed. Without a concrete proposal, it is difficult to quantify potential economic benefit.

The NRC heard conflicting evidence under this term of reference. In some instances the committee has seen evidence that both conditions may be true, as in the following:

- Unconventional gas extraction can create lots of jobs
- Unconventional gas extraction can result in the loss of lots of jobs.

The truth of this matter lies somewhere between the two; for instance in Queensland a temporary construction boom resulted in the creation of many short-term jobs. Many of these disappeared with the boom, although the result varied by locality.

Although the committee heard members of the public express concern that thousands of wells might be developed, Beach Energy was very clear that high numbers of wells were not in their plans at all:

...we can rule out thousands, or even hundreds, of wells and say there could be five to 10 wells per year with one to two rigs operating at a time.<sup>122</sup>

One of the more challenging points to consider came with two propositions:

- There is a shortage of gas which is the reason the price of electricity is so high.
- There is an excess of gas which is the reason the price of electricity is so high.

Other factors affecting potential economic benefits are the national and international gas market and the global energy market more generally. The committee recognised the importance of better understanding these factors and sought expert witnesses to provide evidence. This evidence is summarised below, in the section titled Energy market.

### ***Potential financial outcomes***

Cooper Energy wrote in its submission to the committee that the Otway Basin has the potential to yield 50–300 billion cubic feet (bcf) of natural gas. At the low end of the range, the following were forecast to occur over a 12-year period:<sup>123</sup>

- Capital expenditure of \$180 million

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<sup>121</sup> (Ingraffea, 2015)

<sup>122</sup> (Gibbins N., 2015)

<sup>123</sup> (Cooper Energy, 2015, p. 7)

- Gross revenue of \$320 million
- Royalty payments of \$18 million
- Income tax of \$25 million

At the higher end of the suggested yield, the following outcomes were forecast over 12 years:

- Capital expenditure of \$1,080 million
- Gross revenue of \$2 billion
- State royalty payments of \$156 million
- Income tax of \$175 million

### ***Outcomes for other local business***

The committee heard evidence about the potential impact on the region's agricultural production.

Mayor Peter Riseley told the committee he had met with Chinese delegations visiting the South-East with a view to sourcing high-quality food products:

Principally they are looking at clean, green, premium food, and their preference is that it be manufactured in our region because they know that Australia has standards that mean no contamination or less contamination than other areas.

They want the food at a standard similar to Australia. They don't want to actually do it in China and have adulteration or potentially problems. They are coming up to a standard of living where they want high value, high product and premium food like we have. So, they would prefer it was done in the South-East.

There is great investment opportunity within the South-East, but we have to protect and maintain those credentials and that image that it is an amazing food.<sup>124</sup>

Mayor Riseley acknowledged that agriculture also had potential impacts on the environment.

All I can outline are our concerns about the ongoing 150 years of agricultural production that is sustainable as a result of learning experiences through agriculture. Yes, there have been problems from agriculture where you can probably point the stick and identify, but agriculture moves on and it will be productive for another 150 years if it is carried out responsibly.<sup>125</sup>

### ***Effects of gas development on community economy and social capital***

As there exists no concrete proposal for unconventional gas development in the South East there is nothing to analyse in terms of quantifying actual costs and benefits. However, the committee has heard and seen for itself the effects of a gas-development construction boom in Queensland. Individual benefit varied, and was tied to a range of factors including socioeconomic status, home ownership rates and the negotiation skills of individual landholders; community benefit depended on the methods of engagement chosen by different companies and the preparedness of community leaders to negotiate on behalf of a community.

In Queensland the committee saw that a boom could work in favour of a community, economically speaking, but with risks to a community's social capital.

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<sup>124</sup> (Riseley, 2015)

<sup>125</sup> (Riseley, 2015)

Associate Professor Will Rifkin, University of Queensland, Centre for Social Responsibility in Mining and Centre for Coal Seam Gas, Sustainable Minerals Institute, spoke to the committee about the changes that typically occur in a region following the introduction of a new intensive activity. His research had looked at the construction period in Queensland that preceded unconventional gas development and how it affected the community's economy and social capital.

The big thing we saw is movement: movement of people within the region, into the region and out of the region. When the construction boom occurred, the price of houses went up. Older people who wanted to retire or wanted to sell their business sold and moved out; they moved to the coast. There were people who moved into the regions, let's say, to run a restaurant or build a hotel, who moved in from Brisbane, or people who were commuting into the region to do construction work, to be one of the tier 1, 2, 3, 4 or 5 contractors. You also had people moving within the region.

When the rents went up in a town, a small town like, let's say, Chinchilla or Miles, people might move out of the town into an area where the rents were cheaper, or they might move into Toowoomba. Then, when the rents dropped again, they would move back out. The evidence suggests there was a turnover in population in the region of 10 to 15 per cent a year on average. That went up to 15 to 20 per cent per year. Just looking at gross statistics like population doesn't tell you the turnover that's occurring.

What happens when you have that sort of movement is that it affects social ties and trust, which social scientists call 'social capital', and small business depends on that. They want to know their customers, they want to know their vendors, and they want to know their staff. This is an area with a lot of small businesses. The studies in North America suggest that, in these energy boom towns, it can take 15 to 20 years for that social coherence to recover. At the same time, you can build new social capital: people coming in from other regions with their own connections who can build new opportunities for businesses. So, you get winners and losers and much talk about a two-speed economy—those who were involved in CSG development and those who were not.<sup>126</sup>

Associate Professor Rifkin also said that social impacts to the Queensland gasfield communities included increases in alcohol-related violence, drug offences and theft, among other things.

With reported offences and good order offences, you had blokes from construction crews coming into the pubs, getting a bit rowdy and drinking too much. So the liquor accord was invoked as a Queensland law. Are you familiar with that? The pub owners, the police and the companies get together and put certain restrictions on drinking, hours and that sort of thing. (Rifkin, 2016, p. 315)

An increase in drug offences comes with increased income, but there's also an increase in drug offences nationally. All of the data we got we had to benchmark against Queensland and nationally to say: "Is this a CSG effect, or is this something happening in Queensland or across the country?"

Opportunistic theft—young blokes in the industry with fancy white utes with tools in it. People come in stealing driving lights, tools and that sort of thing.

Associate Professor Rifkin addressed the effects of fly-in/fly-out workers, saying that while they had an impact, it was not the same impact as an increase in local resident workers.

You have a town like Wandoan where QGC is now doing some development. Back in the early days, it had a very small population; subsequently, the number of nonresident workers living in a camp outside town was two or three times the population of the town. People wanted some of

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<sup>126</sup> (Rifkin, 2016, pp. 314-5)

the business, but they didn't want to look around to see that everybody was wearing a fluoro vest. There was a bit of a sense of alienation.

Mr Rifkin said that the female population of the community in Wandoan was worried about the possible increase of violence and assault. He said the assault rate did not rise, but the statistics alone did not explain the reason for this:

Women also were concerned because there were all of these men in town. The assault rate against women did not go up. So the police were happy, but they didn't realise the women were unhappy. The assault rate did not go up because the women didn't go to the pub and they didn't go jogging at night. Our researcher found this out, and we told the police. They said they would go and talk with the women about what measures they could use so that the women would feel safer.

### **Energy market**

The east coast gas market which South Australia is part of has been in a state of “unprecedented change” over the last four years as the Liquefied Natural Gas (LNG) industry has grown in Queensland,” said Australian Competition and Consumer Commission Chairman Rod Sims upon release of the ACCC’s *East Coast Gas Inquiry report into the increasingly complex and uncertain gas market* in April 2016. “These changes have created winners and losers, and industrial gas users in particular have been acutely affected by the transition,” said Mr Sims.<sup>127</sup>

A submission by the Australia Institute to the Inquiry into the supply and cost of gas and liquid fuels in New South Wales in December 2014<sup>128</sup> indicates some of the complexity of the issue:

Gas production in Eastern Australia is undergoing an unprecedented expansion, and is expected to triple within the space of just a few years. At the same time gas consumption in NSW is falling.

NSW faces a gas price shock not a shortage.

Mining more gas in NSW or elsewhere will have very little effect if any on the gas price, as any additional gas mined will still be linked to global gas prices. It could potentially raise gas prices in NSW further by requiring further otherwise unnecessary investment in gas network infrastructure.

The only way NSW policy makers could effectively reduce gas prices is through a gas reservation policy or restrictions on gas exports. Both of these would be very difficult to implement politically.

Overseas, rapid growth of the US shale gas industry, coupled with renewable energy targets related to climate change commitments (notably the Paris Agreement signed by 197 countries in December 2015 and ratified by 112 at the time of this report)<sup>129</sup>, are two major events shaping the market. Another important factor impacting the energy market is the growth of so called “disruptive technologies”, which include advances in renewable energy, battery storage, and increased energy efficiency gains which are reducing demand around the world.

The IEA’s outlook in *Golden Rules for a Golden Age of Gas* discussed a rise in domestic prices based on linking the east coast Australian gas market to the export market:

... east coast Australian domestic prices rise towards the export netback price (the delivered export price less liquefaction and transport costs) from their current very low levels. The high capital costs

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<sup>127</sup> (Australian Competition and Consumer Commission, 2016)

<sup>128</sup> (Grudnoff, Ogge, & Campbell, 2014)

<sup>129</sup> (United Nations, 2016)

of Australian LNG plants meaning that these netback levels are likely to be at least \$5 to \$6/MBtu [million British thermal units] below the price of LNG delivered to Asian markets.<sup>130</sup>

During the course of the inquiry, it became clear to the committee that any potential net economic outcomes to the region and state had to be considered in the context of the rapid change and complex issues as touched on above. To better understand the subject, the committee sought the advice of expert witnesses:

1. Kobad Bhavnagri, Head of Australia for Bloomberg New Energy Finance Bruce Robertson, Financial Analyst, Institute for Energy Economics and Financial Analysis
2. Tim Buckley, Director of Energy Resource Studies, Australasia, Institute for Energy Economics and Financial Analysis
3. Bruce Robertson, Financial Analyst, Institute for Energy Economics and Financial Analysis
4. Rod Campbell, Research Director, The Australia Institute
5. Mark Ogge, Researcher and Public Engagement Officer, The Australia Institute
6. David Blowers, Energy Fellow, The Grattan Institute

Summaries of the evidence provided follow.

**20 May 2016, Kobad Bhavnagri, Head of Australia for Bloomberg New Energy Finance<sup>131,132</sup>**

Key points from presentation:

- Australia's power capacity expected to increase 115% from 2014 to 2040, to 139 gigawatts from 65 gigawatts
- By 2040, more than 50 per cent of capacity will be "behind the meter", with 37GW of small scale PV and 33GWh of battery storage owned by households and businesses
- Demand for grid-supplied electricity will be weak in the above scenarios, +0.3% per annum nationally, and declining in some states
- New build almost exclusively renewable
- Almost 30GW of fossil fuel plants retired by 2040 though coal capacity will only close if refurbishment is impossible
- Sophisticated market mechanisms needed to enable energy system to make effective use of end-user storage
- Overall, power sector will not decarbonise substantially until 2036

Bloomberg New Energy Finance models the global power sector, with analysis focusing on economic and technological forces acting upon the energy market. Bloomberg projects the Australian energy market changing "substantially" by 2040, with the major changes occurring in the areas of end-user technology, decline of fossil fuel use (particularly coal).

The committee heard that a reorientation of the energy system is projected, moving from a centralised, fossil-fuel driven system to a decentralised system with a more varied mix of energy sources, particularly renewables.

Policy details cannot be factored into the analysis as changes will vary widely around the world depending on how different countries choose to regulate and administer their energy systems. Thus

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<sup>130</sup> (International Energy Agency, 2012, p. 135)

<sup>131</sup> (Bhavnagri, 2016a)

<sup>132</sup> (Bhavnagri, Outlook for Global Energy Markets, 2016b)



the report makes projections based on current policies worldwide. For example, Mr Bhavnagri said “coal capacity will gradually decline, although [it] will actually continue to be a significant feature of the energy system without policy to pave its exit.”

Mr Bhavnagri explained that the findings of Bloomberg’s research show the world is “obviously not on track to meet the emissions reductions that have been agreed to, so we can expect that this will change as further commitments are made, which appears likely, and also as the economics continue to evolve. These projections do tend to change year to year,” he said. Another factor influencing projections will be changes made in policy to broach the subject of energy commitments. (p. 326)

Mr Bhavnagri also said that “the historic error in energy forecasts has tended to underestimate the amount of renewable generation that is deployed and the pace of cost reduction.” He then presented a chart (see below) showing the revised forecasts of the International Energy Agency over time against the actual growth of renewable energy. “Their 2020 forecast has tended to be exceeded just in the next year and, each year, they have had to revise up their forecast to reflect the fact that these technologies have been deployed and their costs have fallen much faster than has been anticipated.” The chart showed that wind capacity forecasts had been consistently revised upwards five-fold since 2000 and solar capacity up 14-fold. (Bhavnagri b, 2016)

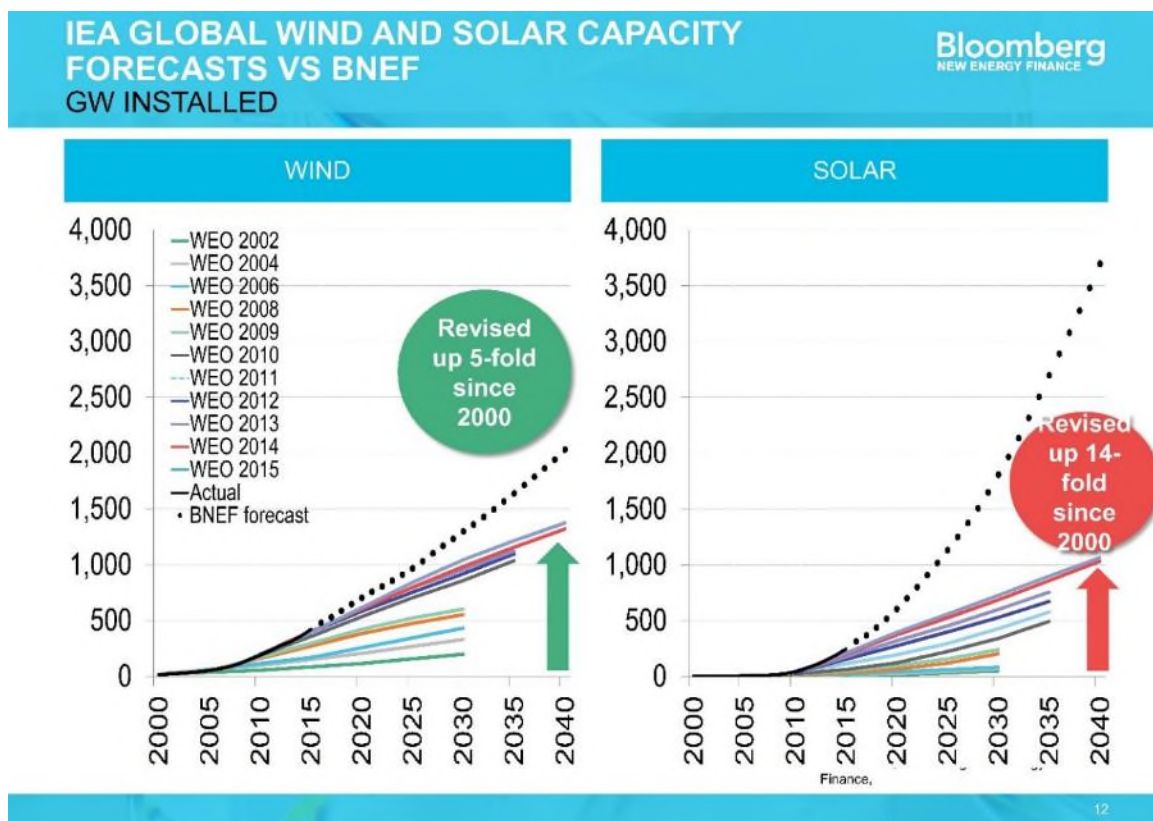
Overall, by 2040, Mr Bhavnagri said, renewable energy use is projected to increase in dominance as cost of fossil fuel generation rises and renewable generation costs decline.

Globally over the same time period, power generation from fossil fuels is predicted to remain relatively flat, said Mr Bhavnagri. Any growth in demand for gas and coal is projected to be most pronounced in the Asia-Pacific region (Bhavnagri b, 2016) , with gas use expected to increase and coal use expected to peak in the mid-2020s, after which growth will taper off and eventually become negative. (Bhavnagri, 2016a, p. 327)

“The growth in demand for electricity around the world, in an aggregated sense, is likely to be supplied mainly by renewables,” Mr Bhavnagri said, with most of this supply coming from a mixture of renewables, predominantly hydro, wind, and solar photo-voltaic (small and large scale) by the year 2040. (Outlook for Global Energy Markets, 2016)

Solar costs are very consistent, historically. “Since 1976 to the current day, we have seen than every time cumulative capacity of modules has doubled, the cost of models has fallen by about 24 per cent. Similarly with wind turbines, the cost has tended to decline about 19 per cent, and there is every reason to expect that this trend will continue,” said Mr Bhavnagri, noting that a natural deceleration is expected because a doubling of capacity is difficult to maintain ad infinitum.

Mr Bhavnagri said cost declines in solar, as with all new technologies, follow a “learning curve. What a learning curve shows you is that the more you produce of a particular good, the cheaper it tends to become. This is true for all sorts of goods, from microprocessors to steam turbines to internal combustion engines to refrigerators.”



IEA renewables forecast revision. (Source: Bloomberg New Energy Finance)

Likewise, he said, the energy community is finding ways in which to evolve and balance the system. "At present, it requires a certain amount of backup by fossil fuel technologies. However, one cannot draw the conclusion that that will always be the case, because technology continues to evolve." (p. 327)

Mr Bhavnagri indicated that relatively high energy prices in South Australia are likely due to lack of competition in a small market, rather than reliance on particular types of energy. "That said, it's important to point out that in this example I am talking about the cost of building a new energy generation technology."

**27 May 2016, Tim Buckley, Director of Energy Finance Studies, Australasia, Institute for Energy Economics and Financial Analysis**

IEEFA conducts financial analysis of global electricity markets. The organisation is independent and not funded by fossil fuel companies or renewable energy companies.

Mr Buckley told the committee change is already underway: "It is real and it is happening faster than anyone expects."

Some of the IEEFA's findings tend to agree with those presented to the committee by Bloomberg analyst Kobad Bhavnagri: that IEA has underestimated, even though IEA data still indicate massive change underway.

Mr Buckley's analysis indicates that this changes "is structural change, not a cyclical change...it is permanent. Even the IEA is seeing that. They are underestimating it but they acknowledge it." <sup>133</sup>

Mr Buckley said projections by the IEA and gas and coal companies for Australian exports of coal and gas had been revised downward, as it became clear that demand in China was shrinking. Meanwhile, India, which he said has been touted as a future market, was increasing its renewable energy use targets "fivefold in just seven years and, two years into that seven-year program, they are 100 per cent on track.

"Again, the International Energy Agency and a lot of gas and coal companies have projected that China's thermal fuel demand will grow dramatically. Now that they are recognising that China is not growing, they have changed the focus to India....I think the Indian energy minister has made it very clear, repeatedly in the last two years, that India will not be the source of thermal coal demand growth that Australia was expecting." <sup>134</sup>

In China, he said, there has been and will continue to be a "massive decoupling" of electricity demand from economic activity. China added 32GW new wind power and more than 15GW of solar power in 2015. So far in 2016, Mr Buckley said, gas and coal use in China is declining, and the country's imports of both are losing market share even faster. <sup>135</sup>

The US transforming "even faster" than China and India, but Mr Buckley said "gas has a unique role in America's electricity market transformation", with the country investing heavily on gas based on its shale gas development over the last decade-plus. But, he pointed out, this was underpinned by an acceleration of investment into wind and solar generation, as coal use was declining, ultimately "being absolutely replaced in America by a combination of energy efficiency, gas and, increasingly, wind and solar. The trends are accelerating." <sup>136</sup>

Japan is transforming and, as a top importer of both coal and LNG, it is a key market. While electricity demand has dropped by 12 per cent over the past five years due to efficiency increases, the whole market is shrinking. "The pie is getting smaller." To supply this decreasing demand, Japan is investing in 70–80GW solar and restarting nuclear to supply a bit more than half that, Mr Buckley said.

Germany is similar to South Australia, he said, in that the use of renewables is increasing. "It was 31 per cent of the entire electricity system in Germany in 2015" with a plan for rapid growth. "That will impact gas, nuclear and coal." He said electricity demand in Germany was "flat to declining" in the last eight years. "It is not a growth market." <sup>137</sup>

IEEFA analysis shows that both Origin and Santos have lost 60% of shareholder wealth in the last 10 years, along with experiencing "massive structural change that they did not anticipate". (p. 341)

One of the biggest factors that people have underestimated in this transformation is that renewable energy has been driven by technology change. The technology change is accelerating, and it is permanent. It is a bit like talking about the impact of the iPhone on fixed line carriers or

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<sup>133</sup> (Buckley, Fracking, 2016a, pp. 338-39)

<sup>134</sup> (Buckley, Fracking, 2016a, p. 339)

<sup>135</sup> (Buckley, State of International Electricity Markets and Stranded Asset Risk, 2016b)

<sup>136</sup> (Buckley, Fracking, 2016a, pp. 339-40)

<sup>137</sup> (Buckley, Fracking, 2016a, p. 340)

the car on the horse. It's structural changes, it's driven by technology, and the technology is getting better with every year. (p. 341)

Continuing decline of solar costs and increase in solar cell efficiency will place additional pressure on gas energy. "[Solar] changes the dynamics for gas dramatically, because gas was seen to be complementary to renewables, because you need gas peaking capacity, the theory goes, to offset the variability of wind and solar. Storage undermines that theory quite dramatically, and storage is getting dramatically cheaper with every month. (p. 341)

Mr Buckley said that in the context of a market that is changing technologically, there is a "very real" risk of stranded assets. (p. 342)

Ultimately, Mr Buckley said, a diverse grid supply—pumped hydro, batteries, and solar thermal and gas, with the latter two able to provide peaking capacity—would help South Australia to overcome the state's historically high gas prices. He said nuclear was not considered a viable option for Australia due mainly to the potential for building cost and schedule blowouts. (p. 345)

#### **10 June 2016, Bruce Robertson, Financial Analyst, Institute for Energy Economics and Financial Analysis**

IEEFA conducts financial analysis of global electricity markets. The organisation is independent and not funded by fossil fuel companies or renewable energy companies.<sup>138</sup>

Key points from presentation:

- The global gas market is in a state of long-term glut
- Majority of Eastern Australian gas supplies export market
- Demand has been historically overestimated
- Demand for gas is dropping due to solar demand and energy efficiency
- Competition is increasing (from US and Russia)
- More efficient competitors will supply dwindling demand
- The South Australian onshore gas industry is over capacity and travels over an expensive monopoly gas transmission network thus is not efficient
- In the global context, "it is highly unlikely that demand will recover to a level where we see the actual need to open up new gas provinces." (p. 355)
- SA risked being left with stranded assets, ie investment that was wasted due to energy market changes.

Mr Robertson urged the committee to recommend that the state look elsewhere for energy investment.

The committee heard there is a massive excess of supply at the moment in the global gas industry and there is faltering demand.<sup>139</sup> (p. 349)

"The global gas industry closed in 2015 in a glut with total liquefaction capacity of 308 million tonnes, outstripping import demand of 245 million tonnes by 26 per cent. By 2020, liquefaction capacity...will increase by a further 30 per cent."

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<sup>138</sup> (Buckley, Fracking, 2016a, p. 343)

<sup>139</sup> (Robertson a, 2016)

Like other witnesses, Mr Robertson said demand forecasts had been consistently overestimated, with the Australian Energy Market Operator (AEMO) consistently revising its predictions downward between 2011 and 2014. Demand for gas domestically had dropped 4 per cent in 2015, he said.

Several factors were contributing to this drop.

As costs of solar products dropped, gas demand was “crimped”. (p. 353) He acknowledged that “there are limitations to what solar and wind can do—it is intermittent and all those things—but it is crimping the demand. It means we are burning less gas.” (p. 356)

Also contributing to pressure reducing gas demand, he said, was energy efficiency, “a really big issue that people do not focus on”. This was occurring in a number of areas in the economy, from home and commercial lighting to taxi fleets, and as energy-savings measures increased in number and efficiency, the downward pressure on gas demand would also increase.

In addition, Mr Robertson said, conditions for a glut were encouraged by initial overinvestment in Gladstone and cost blowouts due to the boom caused by three major pipelines under construction at the same time. The three main energy companies “all tried to build plants at the same time, and obviously prices go up when there is limited capacity of engineers who can build those sorts of facilities.”

He quoted the International Energy Agency’s report of 9 June 2016 as showing the global gas industry’s growth at only 2.2 per cent per annum over the last 10 years, and only 1 per cent per annum since 2012, in contrast to the Office of the Chief Economist’s prediction of 5.9 per cent. “The IEA is forecasting demand to increase at an annual rate of 1.5 per cent out to 2020”, he said, noting that the IEA has “downgraded every year for the last four years”.

Looking at Australia’s key export market, Asia, Mr Robertson said that imports had dropped 4.7 per cent in 2015 and, with the country’s planned restart of nuclear, could be expected to continue to drop in the longer term, to 2030. Likewise the Korean market was down 9 per cent in 2015, expected to fall another 5 per cent.

Chinese gas demand was expected to grow, but Mr Robertson cautioned against conflating gas demand with LNG demand, particularly since China has access to inexpensive gas via pipelines from Russia. Other Asian nations, he said, were also expected to source more of their gas from Russia. He also said that China was “over-contracted for gas in the next 12 months” and that “demand simply has not come through, even in China, to anywhere near the extent they expected it would, even in one of the growth markets.” (p. 354)

Mr Robertson discussed Japan, the world’s largest buyer of LNG, and the energy mix it was using in its recovery from the Fukushima disaster. The country was simultaneously using more coal, increasing renewables, restarting nuclear, and reducing gas demand and increasing overall energy efficiency measures, he said.<sup>140</sup>

I do not think people quite understand the depths of despair Japan is in. [The earthquake] wiped out 8 per cent of their generating capacity in one hit [and] they had to shut down their nuclear power industry. ... and they are burning more coal. It may seem paradoxical to us, but the fact is, they have got the installed capacity in coal, and they need the power because 8 per cent of their generating capacity was taken out of the market with the close of the nuclear industry. Sendai, the nuclear reactor in Japan, has started up and they are looking at progressively starting up other

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<sup>140</sup> (Robertson b, 2016 p. 7)

nuclear reactors, but still, the country has had an energy crisis the likes of which we have never seen in our lifetime.” (p. 354-5)

Mr Robertson said, “I am not arguing for a total takeover in renewables tomorrow,” and emphasised that gas would be a necessary fuel “for a long time into the future”. However, he said, the efficient producers would be the ones to supply demand into the future, and in the global context, “East Coast Australian gas, onshore gas, is not low-cost, it is not an efficient producer and it will be one of the first casualties in the downturn. That is the essential point to make.” This was in comparison, he said, to “very efficient” producers elsewhere in the country, such as the north-west shelf and the Bass Strait. (p. 355)

The Australian gas industry’s prices were linked to the global market, which was under pressure to reduce prices. Mr Robertson said long-term contracts were in some cases subject to default while others were being renegotiated. For example, he said one Indian company had negotiated a 50% price cut in a 25-year contract with a Qatar-based company. Such changes had global ramifications, Mr Robertson said.<sup>141</sup>

Existing gas industry overseas was also expected to become more efficient, said Mr Robertson, to improve its use as an energy source in the transition to greener energy forms. “...what you are seeing in the US now is a move to actually incorporate into their decision-making process the fugitive emissions of gas. Gas, at every stage of the production process, does leak methane, at the wellhead and down the pipes. When you put it on ships you get leakage. At the moment, in terms of greenhouse gas emissions, that is not costed. The US is moving towards costing that.”

He asked the members to bear in mind that export made up two-thirds of the market that eastern Australian industry was looking to supply, and as other producers globally were better able to meet this demand, Australian suppliers would suffer.

**10 June 2016, Rod Campbell, Research Director, The Australia Institute**

**Mark Ogge, Researcher and Public Engagement Officer, The Australia Institute**

The Australia Institute is an independent research organisation based in Canberra conducting research into a range of issues, with a strong economic focus, looking particularly at areas where there are perceived to be widespread misperceptions. The organisation aims to communicate its findings in a “jargon-free and plain language type of way”.

Key points from presentation:

- There is a gas glut in Australia; production is about to rise higher than ever before
- Gas prices are now linked to the international market and are not expected ever to return to previous domestic price levels
- While normal economic theory suggests a glut would force prices down, due to linkage to international price, prices may drop, but not down to previous domestic price
- Evidence showed that once LNG exports from Gladstone began, all gas not already under contract would be linked to “oil-exposed prices” (i.e., the international gas price)
- Oil and gas sector in SA and across Australia employs a fraction of total workforce: 1 per cent of total. Agriculture employs 10 times as many, manufacturing 25 times and health care 40 times more.

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<sup>141</sup> (Robertson b, 2016 p. 12)

- Mining is an important contribution to the South Australian economy “but, in the scheme of things, a relatively small contribution compared to the overall gross value-added in the economy.”
- Large resource projects tend to have a “shock impact” on the economy because they ramp up quickly, requiring a great amount of “skilled labour, equipment, materials, services and other inputs very suddenly.”
- New jobs in new resources projects have a tendency to come at the expense of other industries because wages are generally high and specific skills are in demand
- Unconventional gas industry expansion has had a great impact on manufacturing via its impact on domestic gas prices.
- Percentage of income paid by oil and gas industry according to the ATO in 2014-15 was “very low”
- “If we fail to collect substantial tax from these companies, we are missing out on one of the key benefits.” (p. 353)
- Over the last 15 years, oil and gas production in Australia has increased but amount of tax paid by those industries has declined; this is thought to be largely due to exploration tax deductions.
- Resource royalties are an important source of income for the South Australian government but totalled about 3 per cent of state government revenue in 2014–15; about two-thirds of this amount is thought to be derived from the oil and gas industry
- Deloitte Access Economics report estimating impact of the linkage to global gas prices on various industries in Australia showed a \$118b impact on manufacturing
- “cheap gas” is the least expensive to extract; this is the first gas to be exported as it brings the highest profit. This leaves “the really expensive stuff which is like deep shale under the Coonawarra, or that kind of thing, or in the Bight, so it’s more expensive. We are exporting all the cheap stuff, and that’s why the price for gas in Australia won’t come down even when global prices come down because the stuff you’ve got left is just more expensive to extract.
- Further, because there is a glut, all the “cheap” gas cannot be sold, making “expensive” reservoirs unfeasible to extract at this time
- Industry-funded report by the Sustainable Minerals Institute at the University of Queensland surveyed stakeholder groups to determine whether these groups thought gas development had left different aspects of capital better or worse off.

Stakeholder groups	Financial	Human (skills)	Built (infrastructure)	Social (social cohesion)	Natural (environment)
Gas	Better	Better	Worse	Better	Better
Mining	Better	Better	Worse	Better	Better
Agriculture	Worse	Worse	Worse	Worse	Worse
Local business	Worse	Worse	Worse	Worse	Worse
Local government	Worse	Better	Worse	Same	Same
Community	Worse	Better	Worse	Worse	Worse
Advocacy	Worse	Worse	Worse	Worse	Worse

- Gas and mining stakeholders felt all aspects of capital to be better off, except built capital, which was felt by all groups to be worse off. Agriculture, local business and advocacy groups felt all areas of capital to be worse off. Community and local government felt human capital (skills) was better off, and local government felt social cohesion and natural capital to be the same.

- A study of people in the Darling Downs region of Queensland surveyed attitudes to unconventional gas development in the area and found 45.6% of people were “adapting to changes” while about 33.9% were “only just coping” with change. Smaller portions of participants felt that the community was “not coping” (8.5%) or “resisting change” (6.1%), while 5.9% of people felt their community was “changing to something different but better” (5.9%).

**8 July 2016, David Blowers, Energy Fellow, The Grattan Institute**

The Grattan Institute is an independent public policy think tank with a program on energy that has produced two reports in the last several years examining the Australian east coast gas market.

Key points from presentation:

- The ability to export gas from Australia to international markets has linked the domestic price to the international price.
- In the last few years there has been higher demand for gas in Asia (led partially by the tsunami which caused Japan’s nuclear shutdown) and this has contributed to the rise of unconventional gas in Australia.
- Rise in demand in Asia caused price rises in Australia  
So, instead of seeing international prices at around \$10 a barrel or a gigajoule of gas, we saw them rising up to \$15 to \$18 a gigajoule and that all of a sudden changed the game in Australia. Gas in Australia has always been about \$3 to \$4 a gigajoule and when you look at the price of transporting gas, which is about \$6, all of a sudden a \$10 international price doesn't really make sense...
- A large increase in price in Asia led to significant investment in Queensland in unconventional gas.  
To give you figures, we've seen, I think, more than \$63 billion, I believe, invested in LNG projects in Queensland. What that has meant—and these are estimates—but they estimate that about 30,000 jobs in construction will come with that, and from 2020 it was estimated that there would be about 17,000 ongoing jobs in that LNG progress throughout that period of time.
- Japan has now moved to restart its nuclear energy program, decreasing demand for gas in Japan
- International gas prices are linked to the oil price which has “plummeted” from somewhere around \$100 to under \$50 a barrel, significantly reducing the international price of gas.
- The potential gas reserves in South Australia are mainly shale gas, traditionally “more expensive gas”.
- The drop in international gas price will also mean a fall in domestic price, reducing the incentive for producers to go out and search for more expensive gas.
- The committee heard that gas price estimates next year could “rise as high in Adelaide, for example, to about \$9 a gigajoule, falling back to a long-run average of about \$8 from 2018–19 onwards.”
- Diminished future demand keeps prices low over the long term, in turn reducing incentive to extract “expensive” gas

...producers will foresee the fact that demand for gas will diminish in the future so they will look to supply more oil and gas now, and by supplying more oil and gas now that just diminishes the price and keeps the price at a low level for a long time—a low level until it finally draws out, and that does not provide the incentive for businesses to go and explore



and extract new gas resources, particularly those that are particularly difficult to get out and expensive to extract...

- Gas reservation is a counterproductive strategy.

We think that the evidence is that gas reservation policies end up being counterproductive. You've seen a gas reservation policy in place in Western Australia and what you've seen is gas prices growing higher than they have been in the East Coast of Australia.

- Stimulating supply may help reduce prices

... the way you stimulate supply is to stimulate that exploration in that activity—reducing barriers to entry into the market, making sure that people have a maximum amount of access.

- Reports from different jurisdictions indicate unconventional gas is safe with appropriate regulation but social license is essential.

Of the reports that have been done—and as I said, there have been three that I am aware of; there may have been more—there was the Reith report, and then the most recent report in Victoria ... and there was obviously the O'Kane report in New South Wales. Pretty much all of them, in terms of the function, said, 'You can do this as long as you have the right sets of regulation, etc., bearing in mind that regardless of what you put in place, you will never be able to provide that 100 per cent certainty that a lot of people are looking for.'

What I will add as well is that I think both industry and government have let down the sector and let down the community particularly badly over unconventional gas. On the industry side, there were examples of some poor practice, particularly in New South Wales and Queensland, in terms of dealing with the community and dealing with the issue. From both government and industry sides—and this goes broader than unconventional gas; this goes to be in our entire approach to resources—there has been a failure to fundamentally argue the economic case of what the benefits of this are.

It is easy for me to sit here and talk about Queensland having \$63 billion of investment and 30,000 jobs, etc., but we have not been able to relate any of that to the people who are going to be affected on the ground in the communities. We also have to understand that what we have effectively lost is the social licence for a lot of this to operate.

- US industry has found ways to achieve social license but it may be too late for Australia

In the US, the industry and environmental and community got together and came up with a set of regulations that everyone could agree with, and they made a standard for all the industry to obey when they went through. There has got to be a way of bringing people together to do this.

Unfortunately, we have left it quite a long time, and the tide of public opinion about this has become quite trenching in some circles, so I don't know whether there is the ability to turn that around.

- Delivery of economic benefits depends on optimising time frame, as in Queensland

Queensland is a good example to show how a state can have certain economic benefits delivered that are very specific to the time and the scenario which they are in. What is going to happen in the future with gas is very, very much unknown because there are a whole range of policy scenarios which are unknown. Regardless of a decision in South Australia about how you approach unconventional gas, or fracking, the future of that as an industry will be

determined by what happens on a national and international scale in terms of what the future demand for gas and the future price of gas is going to require.

- “...unless carbon tax from storage takes off, the role for gas in our future is increasingly limited.”

If—and this is a really big if—you were to meet the targets as set out in Paris, in terms of a two degree limit, you are looking at somewhere along the lines of the developed world reducing their emissions to zero by around 2050 and the non-developed world reducing those emissions by the end of the century. So unless carbon tax from storage takes off, the role for gas in our future is increasingly limited. There might still be some demand for gas because you might still need some to help control your electricity systems but that will be small and will have to be offset by carbon offsets effectively.

## 9.7 Major concerns outside terms of reference

Many submissions to the inquiry raised issues either tangential to or outside the terms of reference.

### *Industry concerns*

Petroleum companies and industry bodies mainly addressed the terms of reference but also raised concerns:

- Anti-industry sentiment
- Difficulty countering misinformation among members of public
- Unconventional gas is as safe as conventional gas
- More domestic gas supply required

The industry was notably concerned about the effects of a potential ban or moratorium. The Member for Mt Gambier, Mr Troy Bell MP, in response to the idea of a moratorium, said he felt it would only delay outcomes, and that social licence was key to avoiding such a situation.

What is the outcome of a moratorium? In my opinion, it's just a delaying strategy—to what end? I would much rather see action, one way or the other, to either gain that social licence, or ban it if it can't be achieved. ...I am an advocate of unconventional gas. I am not opposed to fracking in parts of South Australia—the Cooper Basin and all the rest of it. I know I will maybe cop some criticism for that, but there are areas of this state where I think it is quite appropriate, and there do not seem to have been any issues from information I have read.<sup>142</sup>

The committee heard evidence from several witnesses of the potential effects of a ban and, from a US landholder, evidence about living in rural New York State, where a ban was placed on unconventional gas development in mid-2015.

Jeff Heller, President of Steuben County (New York) Landowners Association, said the state's decision to ban fracking seemed to come from cities and not from the rural areas, where he said people “favour gas drilling overwhelmingly. Our organisation, the landowners coalition, is 75 per cent farmers, that is who we represent more than anything else. Many of those farmers are from family farms that have been in the same family for generations. This was their last hope.”<sup>143</sup>

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<sup>142</sup> (Bell, 2016)

<sup>143</sup> (Heller, 2016)

### **Baseline data collection**

Multiple submissions and witnesses raised the issue of collection of baseline data in the South East prior to any further unconventional gas works; the committee heard that should such development occur, baseline data was critical for the monitoring of impacts.

The committee heard that a range of data would need to be collected across all factors likely to be impacted by development. This includes not only those set out in terms of reference but others such as population, traffic movements, crime rates and community health.

In Queensland, the committee heard from the Basin Sustainability Alliance (BSA) in Dalby and from Maranoa Regional Councillors of the importance of the collection of baseline data prior to the commencement of unconventional gas development. Groundwater data was important, the members heard, but so were many other segments of the region, including land and air quality, sewerage and rubbish/waste collection and treatment, health services, and policing. BSA also encouraged the committee to ensure that agencies responsible for baseline modelling and risk analysis be appropriately funded and resourced to carry out all tasks properly.<sup>144</sup>

SACOME states in its submission to the inquiry that the Environmental Impact Report and Statement of Environmental Objectives required by the PGE Act “exhaustively address all social and environmental aspects of a proposed activity” including impacts on communities, well integrity and requirement for baseline analysis of aquifers prior to commencement of an activity.

Likewise the submission from the Department of State Development states:

Prior to any well operations being approved by government authorities, appropriate baseline studies are required in South Australia to be undertaken to determine the level of existing contaminants in the aquifers so that any contamination by the well operation can be detected.<sup>145</sup>

In 2014, Beach and Cooper drilled the deep exploration wells Jolly-1 and Bungaloo-1 (3km south-south-east and 10.5km west-north-west of Penola, respectively) intersecting shale and tight sandstone. In order to “establish baseline conditions, especially groundwater quality, prior to drilling the exploration wells and possible future gas regulated activities,”<sup>146</sup> Beach undertook a water quality monitoring program for both sites.

Neil Gibbins, Beach Energy’s Chief Operating Officer, told the committee in a meeting: “I can tell you, broadly speaking, that we saw no impact from the operations that we undertook. We didn’t see any change in the water.”<sup>147</sup> Groundwater reports from Bungaloo-1 and Jolly-1 were received by the committee in response to questions taken on notice by Mr Gibbins and have been appended to Beach Energy’s written submission to the inquiry.

Submissions to the committee also commented on baseline data collection:

- Mayor Peter Riseley
- Chinchilla, Queensland, resident Karen Auty wrote that in her community “(t)here has been no benchmark, baseline testing of waterways, noise, vibration, light, atmosphere or drinking water

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<sup>144</sup> (Natural Resources Committee, 2015)

<sup>145</sup> (Department of State Development, 2015a)

<sup>146</sup> (John Leonard Consulting Services for Beach Energy, 2015, p. 1)

<sup>147</sup> (Gibbins, 2015, p. 161)

tanks. The responsibility of testing has been left to individuals. The government has failed in its duty to maintain and monitor Public Health standards.”<sup>148</sup>

- Treasury Wine Estates called for “Baseline monitoring of target formations, key aquifers and ecological receptors for a range of physical, chemical and biological indicators” in the South East.<sup>149</sup>

### ***Climate change***

Although not set out specifically in the terms of reference, the degree to which new unconventional gas development might contribute to climate change was raised numerous times in submissions and evidence and must be considered among potential risks and impacts.

This point was also one on which the committee heard conflicting evidence:

- Gas is a good fuel for tackling climate change because it emits less carbon dioxide than coal when burned.
- Gas may be a worse fossil fuel than coal for climate change due to significant underestimation of “fugitive” / “migratory” emissions i.e. unburned gas released at various stages of production.

Fugitive emissions are examined below but a report by the Melbourne Energy Institute in October 2016 explained this dichotomy:

In some future energy scenarios, gas is considered to play a role in the transition to lower greenhouse-gas emitting energy sources. This is because burning gas results in 60% of the carbon dioxide emissions that occur when the same amount of energy is produced by burning coal. If Australia is to move away from coal and produce more gas (including LNG for export), in order to reduce carbon dioxide emissions and to meet its INDC (Intended Nationally Determined Contributions), it would be prudent to mitigate methane emissions at the same time: if the climate benefit of reducing carbon dioxide emissions comes with an overhand of direct methane emissions, any benefit will be smaller than expected because methane is also a potent greenhouse gas.

For these reasons, avoiding preventable methane emissions should be a standard practice and introduction of methane reduction policies in the near term would have the largest effect in light of the Paris Agreement.<sup>150</sup>

Australia officially ratified the Paris Agreement on 9 November 2016, following China, the US, India, Canada and the EU, among many others: as of 23 November 2016, 112 parties had ratified the agreement.

The treaty commits countries to keeping carbon emissions “well below 2 degrees C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 degrees C”, which will require leaving a significant proportion of fossil fuel reserves undeveloped.

Regarding this agreement, Professor Anthony Ingraffea told the committee:

...with the science acknowledging that we need to keep roughly three-quarters of all the undeveloped fossil fuels underground if we are going to meet our climate-change objectives, I’m

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<sup>148</sup> (Auty, 2015)

<sup>149</sup> (Treasury Wine Estates, 2015)

<sup>150</sup> (Lafleur, Forcey, Saddler, & Sandiford, 2016, pp. 15-6)

a little concerned that South Australia has already done its part to produce fossil fuels; you are producing oil and gas in the north-east.

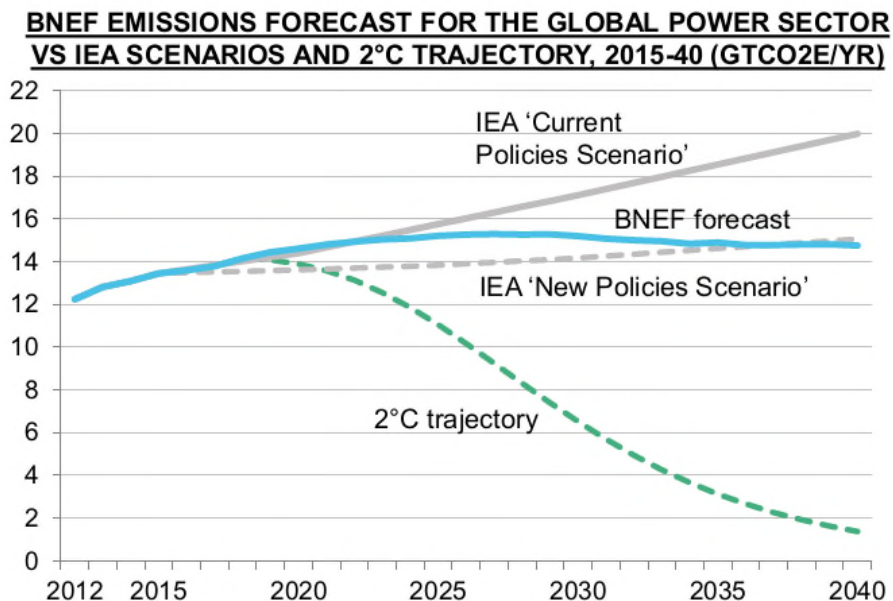
Various experts (e.g. Bhavnagri, Blowers, Ingraffea) point to the difficulty of decarbonising the economy as rapidly as will be needed to meet the ambitious but necessary 2°C and 1.5°C targets set out in the Paris agreement.

Significant change is already underway in the energy sector. The International Energy Agency (IEA) describes renewables and natural gas as the big winners in the race to meet energy demand growth to 2040. Renewables have recently overtaken coal as the world's largest source of power generation capacity and even the relatively conservative IEA forecasts that wind and solar will provide nearly 60% of global electricity by 2040.<sup>151</sup>

However, Bloomberg New Energy Finance witness Mr Kobad Bhavnagri presented evidence to the committee that while the current boom in renewables will undoubtedly cause power sector emissions to decline this won't be anywhere near enough to keep the world on a 2°C pathway.

Mr Bhavnagri estimated that to limit global warming to 2°C would require a doubling of investment in clean energy over the next 25 years and a reduction in all fossil fuel use from the BNEF base case forecast. The BNEF 2°C scenario compared with the base case forecast shows a reduction in gas from 17% of global power generation to 5%. The 2°C scenario also shows coal down from 25% to 1%. Hydroelectricity up from 14% to 23% and nuclear up from 9% to 16%.

This is just one possible pathway to limiting global warming to the agreed amount but it graphically illustrates the scale and rapidity of the transition to low carbon generation that will be required. Clearly if the world is to meet either of those goals then emissions will need to be reduced much more rapidly than current policies provide for.



<sup>151</sup> (International Energy Agency, 2016, p. 4)

### ***Fugitive/migratory emissions***

A recent report published by the Melbourne Energy Institute (MEI) states that:

Migratory emissions occur when methane migrates upward and laterally out of its original reservoir, eventually reaching the Earth's surface, and enters the atmosphere possibly at a considerable distance away from the site of original oil and gas drilling or other disturbance.<sup>152</sup>

Fugitive or migratory emissions have been raised during the inquiry by a number of submissions and in evidence. One submission<sup>153</sup> asserts that fugitive emissions have not been appropriately incorporated into government and agency reporting over a period of years despite this being set out among the aims of the National Greenhouse and Energy Reporting Framework.

According to the MEI report:

Currently the oil and gas industry reports methane emissions to the Australian Government using the National Greenhouse and Energy Reporting Scheme (NGERS). However, the emissions reported by the industry are generally estimates based on factors developed years ago by the United States oil and gas industry for estimating the amount of methane emitted using conventional production methods. ...

...there is significant uncertainty about methane-emission estimates reported by oil and gas producers to the Australian government, and by the Australian government to the United Nations. The United Nations has requested that Australia improve its methodologies.<sup>154</sup>

With a threefold increase in gas production forecast across eastern Australian between 2013 and 2017, which together with Western Australian export production is predicted to make Australia the world's largest exporter of natural gas, ahead of Qatar, migratory emissions represent "an opportunity cost in terms of lost gas sales and a liability to future carbon pricing" and mean that "Australia's oil and gas industry could also be among the world leaders in emitting methane to our Earth's atmosphere."

### ***Potential effects on health***

This point was another on which the committee heard conflicting evidence:

- Unconventional gas extraction doesn't create health issues for workers and local residents.
- Unconventional gas extraction can create health issues for workers and local residents.

This concern, expressed by many submissions to the inquiry and addressed in multiple presentations of evidence, warrants discussion in this report as it represents one of largest specific areas of concern outside the explicit terms of reference. Like contribution to climate change, it can clearly be considered an area of potential risk or impact.

Research into potential health impacts of unconventional gas development has grown along with the industry's expansion, and peer-reviewed scientific publications have found links between proximity to gas well development and health impacts.

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<sup>152</sup> (Lafleur, Forcey, Saddler, & Sandiford)

<sup>153</sup> (Kelly, January)

<sup>154</sup> (Lafleur, Forcey, Saddler, & Sandiford, 2016, p. 9)

Evidence presented by Hon Mark Parnell MLC as part of his travel report after visiting the US states of New York and Pennsylvania cites a recently published study (2016) of more than 10,000 infants in northern and central Pennsylvania:

In Pennsylvania the number of producing wells increased from zero in 2005 to 3689 in 2013. To our knowledge, no prior publications have focused on unconventional natural gas development and birth outcomes.

The findings of the study, controlled for link proximity to that:

There are multiple ways unconventional natural gas development activity could influence birth outcomes. Concerns include impacts on air quality, ground and surface water quality, and maternal psychosocial stress from noise, increased traffic volumes, and contextual exposures including social disruption and community liveability.<sup>155</sup>

"We don't know specifically why people in close proximity to these larger wells are more likely to be sick," says the study's senior author Brian S. Schwartz, MD, MS, a professor in the Department of Environmental Health Sciences at the Bloomberg School. "We need to find a way to better understand the correlation and, hopefully, do something to protect the health of these people."

Previous research conducted by Schwartz and colleagues has linked the fracking industry to increases in premature births, asthma attacks and indoor radon concentrations.

In the last month of the inquiry the committee received supplementary evidence from medical professionals associated with Doctors for the Environment including peer reviewed articles on potential health impacts associated with gas production. According to these articles unconventional natural gas production may be implicated in lower birth weight, preterm birth, increased hospitalisations, nasal sinus migraine, fatigue and asthma. A comprehensive review of this evidence has not been possible due to the need to finalise and report on the inquiry.

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<sup>155</sup> (Casey, et al., 2016)

## 10 Conclusion

Spanning two years, the Inquiry into Unconventional Gas (Fracking) in the South East of South Australia has represented a great challenge for the committee. The members endeavoured to ensure that all aspects of the debate were presented and that all terms of reference were considered thoroughly.

In the first year of the inquiry, the committee received a broad range of evidence from a wide variety of stakeholders, including the proponents of exploration and development in the South East as well as business owners, landholders, and individual community members as well as organisations representing South East community interests.

The NRC members also travelled to the South East twice and visited Moomba and Queensland to view active gas industry exploration and development to get a better understanding of what it might mean for unconventional gas to proceed in the South East of the state.

An interim report was published summarising the understandings gained in the first year.

In the second year, the committee consolidated its work and requested the expert advice of further witnesses, and gave consideration to all the information amassed over the two years of the inquiry. There were a number of findings but the one the committee returned to, in the end, was social licence: and the fact that it had clearly not been achieved in the South East.

The commencement of unconventional gas exploration in the South East apparently caught many community members by surprise. The committee heard that many people in the region felt they had been left behind from the very start.

The gas and oil industry clearly does possess a long history in the South East and a great deal of expertise and accumulated knowledge. The community's expectations of industry behaviour, however, have changed over time, and the industry has not kept up.

Upon review of the evidence presented during the inquiry, the committee was struck by the expression early on, on two sides of this debate, of a desire for the exchange of factual information. This was perhaps best summed up in two statements given to the committee in the first month of the inquiry.

A representative of LCLGA told the committee that the South-East community was "starving" for information but that communication from industry had been "very poor" which likely contributed to fear and negative feeling in the community.<sup>156</sup>

Earlier that same month, the committee had heard a similar expression from a representative of the Department of State Development who expressed the wish that "people and enterprises who are relatively unfamiliar with oil and gas operations could be instantly informed so they could separate fact from fiction".<sup>157</sup>

This evidence vividly illustrates the communication gap between the community and the gas industry that wishes to operate within it. The committee has heard a great deal more evidence besides that

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<sup>156</sup> (Vickery, 2015)

<sup>157</sup> (Goldstein, Fracking, 2015, p. 20)



indicates early, transparent communications from industry and related government agencies is critical to social licence, and social licence is critical to industry progress.

A report presented at the Pacific Energy Summit 2013 in Vancouver offers some material for consideration. It states that common aspects of successful acquisition of social licence include:

- early and substantial analysis of communities and stakeholders potentially affected by a project to understand local conditions, needs, and customs, including communication protocols and constraints
- early engagement and consultation with affected communities and stakeholders to identify issues and interests and establish dialogue
- action on areas of mutual interest and enhancement of benefits targeted at specific community needs
- sustained and transparent communication, particularly in the context of the growing role of social media in rapidly disseminating information about companies, technologies, and projects.<sup>158</sup>

These principles were supported by LCLGA's evidence to the committee. Ms Erika Vickery, President of LCLGA, said:<sup>159</sup>

In the future, consultation with regional communities needs to ensure a number of things, and they include:

- regional consultation starts very early, well in advance of any on-ground activity;
- community members, in particular, locals and landholders, are able to speak directly with the industry proponent prior to, during and following, any on-ground activity;
- community members have the opportunity to speak directly with the representatives of the state government agencies that are responsible for administering the legislation and the regulation;
- there is an easy access to technical and scientific information relating to any on-ground activity;
- information to be received via a number of forums and formats within the region; and
- community, landholders and local government are aware of all the avenues available to have input to the decision-making process.

Another submission to the inquiry, from Primary Producers SA (PPSA), states that "(t)he key to productive relationships between agriculture and mineral and petroleum industries is relationships built on genuine trust and goodwill and appropriate community engagement", and sets out the following measurements of successful community engagement:

- Transparency and full disclosure;
- Early and ongoing collaboration;
- Inclusiveness;
- Ethical and responsible business practice;
- Integrity and appropriate behaviour;
- Capacity building; and
- Listening and responding to community concerns.<sup>160</sup>

In summation, it became clear during the course of the inquiry that the natural gas industry does not currently have social licence to operate in the South East, and in the committee's opinion neither

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<sup>158</sup> (Yates & Horvath, 2013, pp. 20-1)

<sup>159</sup> (Vickery, 2015, p. 83)

<sup>160</sup> (Primary Producers South Australia)

unconventional gas exploration nor development should proceed without it. This is not to say such exploration and development should never occur in the region, but that in the committee's view, obtaining social licence is a necessary precondition to such development occurring.

The committee sincerely hopes that industry takes up its recommendation and reconsiders its approach to consultation and community engagement so that in the future, communities and industry may work together for mutually beneficial outcomes.

## 11 Abbreviations

ACOLA	Australian Council of Learned Academies
Bcm	billion cubic metres
BOM	Bureau of Meteorology
BSA	Basin Sustainability Alliance
BTEX	benzene, toluene, ethane, xylene
COAG	Council of Australian Governments
CBM	coalbed methane
CCA	conduct and compensation agreement
CH <sub>4</sub>	methane
CSG	coal seam gas (Australian usage; CBM used internationally)
DEWNR	Department for Environment, Water and Natural Resources
DMITRE	Department for Manufacturing, Innovation, Trade, Resources and Energy (now DSD)
DSD	Department of State Development (formerly DMITRE)
EIA	Energy Information Administration (US)
EIR	environmental impact report
EPA	Environment Protection Authority (South Australia)
FIFO	Fly-in/fly-out
GL	gigalitres
LCPA	Limestone Coast Protection Alliance
LNG	liquid natural gas
MBtu	million British thermal units
MJ	megajoule (1 joule x 10 <sup>6</sup> )
GJ	gigajoule (1 joule x 10 <sup>9</sup> )
LCLGA	Limestone Coast Local Government Association (formerly SELGA)
ML	megalitres
MLC	Member of the Legislative Council
MP	Member of Parliament
NRC	Natural Resources Committee
NRM	Natural Resources Management
NRM Act	Natural Resources Management Act 2004
NRM Board	Natural Resources Management Board
PEL	Petroleum Exploration License
PGE	Petroleum and Geothermal Energy (Act)
PJ	petajoules
SACOME	South Australian Chamber of Mines and Energy
SE	South East
SEA	South East Australia
SELGA	South-East Local Government Association (now LCLGA)
SEO	Statement of Environmental Objectives
SEPS	South East Pipeline Service
SESA	South East South Australia pipeline
UCG	underground coal-seam gasification ( <i>not</i> unconventional gas)
US EPA	Environmental Protection Agency (US)
WAP	Water Allocation Plan

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## **Appendix A: List of Submissions**

All written submissions received by the committee may be found on the Parliament of South Australia website at:

<http://www.parliament.sa.gov.au/Committees/Pages/Committees.aspx?CTId=5&CId=295>

No.	From
1	Jan Telford
2	Barney McCusker
3	Frances Winfield (Vic)
4	Vivonne Thwaites
5	Alison Hamilton
6	Colin Ball
7	Judy Rees
8	Sharon Holmes
9	David Clarke
10	Alan Richardson
11	Greg
12	Lois Doeven (Vic)
13	Chris Penfold
14	Joy Mayberry
15	Sophie Henke
16	Jonathan Peter & Josephine Prowse
17	Allie Pitman
18	Ralph Meznar
19	Rural Communities Australia Ltd
20	Burr Dodd
21	Justin
22	National Toxics Network (NTN)
23	Green Triangle Forest Products
24	SA Rock Lobster Advisory Council, SE Professional Fishermen's Assn, Southern Rocklobster Ltd
25	Peter (Huck) Shepherd
26	Mark Jones
27	Alison Nunan
28	No Fracking WAY
29	Margeaux Chandler
30	Jodie Wilson
31	Lucy Trethewey
32	Lisa Marcus
33	Heather Heggie
34	Robyn Russell
35	Tumby Bay Residents and Ratepayers Association Inc; Port Lincoln Residents and Ratepayers Association Inc
36	Joscelin Spurr
37	Gilda Mashado
38	M.R. Leach
39	Sustainable Communities SA Inc
40	Christine McCombe
41	Ash Dearman
42	Signature illegible
43	Patricia McAuliffe
44	Irene Yuill
No.	From
45	District Council of Robe
46	Limestone Coast Protection Alliance
47	Anne Rafferty
48	Donald Grey-Smith
49	Dr Clive Carlyle
50	Kathryn Wright

INQUIRY INTO UNCONVENTIONAL GAS (FRACKING)  
IN THE SOUTH EAST OF SOUTH AUSTRALIA

51	Tim Kelly
52	Ed Peucker
53	Brett Mashado
54	Helen & Steve Russell
55	Boudicca Cerese
56	Chloe Aldenhoven
57	Department of State Development
58	Jon Gray
59	Aaron Izzard
60	Karen Auty
61	Rosey Pounsett
62	Treasury Wine Estates
63	South Australian Wine Association Inc
64	South Australian Chamber of Mines and Energy
65	Heather Gibbons
66	Pauline Bosco
67	Pip Rasenberg
68	Tammy Parham
69	Julie Hart
70	Suzanne Moss
71	Doctors for the Environment Australia
72	Peter Clark
73	Gilbert John Daw
74	Australian Petroleum Production & Exploration Association Ltd
75	John Coverdale
76	South East Local Government Association
77	Cooper Energy
78	Halliburton
79	Teys Australia Pty Ltd
80	Marcia Lorenz
81	Angus Ralton
82	David Smith
83	Traudi Lepse
84	Kerry Picard-Arnott
85	Name withheld
86	LJ LaBarthe
87	Primary Producers SA
88	Mrs E Pauline Johnston
89	River Lakes and Coorong Action Group
90	Rod McArthur
91	Bill Doyle
92	Wayne Philp
93	Karen Bubna-Litic
94	Sandra Brown
95	Bronwen Hennessy
96	Kurt Florimond
97	Dorothy Scown
<b>No.</b>	<b>From</b>
98	Terry Allen
99	Stop Invasive Mining Group
100	Bronte Gregurke
101	Peter Couch
102	Friends of the Earth Adelaide
103	Kungari Aboriginal Heritage Association

104	Deiniol Griffith
105	James Panipucci
106	Melton Mowbray
107	Judith Ludwig
108	Jo-Anne Seater
109	Karen Wilson
110	Agravaine MacLachlan
111	Hayley Rundell
112	Jenny Allen
113	Tania Cudmore
114	Susan Chalcroft
115	Chantelle Roberts
116	Donella Peters
117	Natural Resources South East
118	Beach Energy Ltd
119	Sarah Dickins
120	John Berger
121	Winegrape Council SA
122	Limestone Grape and Wine Council
123	Tony Beck
124	Kathryn Bersee
125	Emery Rural
126	Sue Hill
127	Environmental Defenders Office (SA) Inc
128	Dr Michelle Sherriff
129	Livestock SA
130	Kalangadoo Organic
131	Brad Mann
132	Damian McMahon
133	Sue Westgarth
134	Anne Daw
135	Carol Bailey
136	Port MacDonnell Landcare Group
137	Shannon Pedler
138	The Norwood Resource
139	Woodsoak Wines
140	Conservation Council of South Australia
141	Merilyn Paxton and John Brook
142	Sonia Legoe
143	Bob Daly
144	Graeme & Joyce Douglas
145	Sandra Young
146	Michelle Berlin
147	Community Alliance
148	Brian Ling
149	Dr Catherine Pye
150	The Australia Institute
<b>No.</b>	<b>From</b>
151	Kalnya Micenko
152	Australian Lot Feeders' Association
153	Nature Glenelg Trust
154	Neville Moody
155	Coonawarra Grape and Wine Inc
156	Santos

157	Debbie Nulty
158	Mount Gambier Friends of Parks
159	John & Dee Hill
160	Gasfield Free Drumborg
161	Sally Watson
162	Mnemosyne Giles Round
163	Rivoli Bay Sailing Club Inc
164	Australian Wine Research Institute
165	Roy McLean
166	Will and Sonia Legoe
167	Will Legoe
168	Brett & Gilda Mashado
169	Nina Michielan
170	CSG Free Maffra and Districts
171	Claire Easterbrook
172	Sally Richards
173	James Smith
174	Jaye Seal
175	Rebecca Adams-Fulton
176	Alan Richardson
177	Thomas Giles
178	Sharyn Munro

## Appendix B: Witnesses

Friday, 5 December 2014—Balcony Room, Parliament House, Adelaide

1. Neil Power, Director, State Research Coordination, Department of Environment, Water and Natural Resources

Friday, 13 February 2015—Balcony Room, Parliament House, Adelaide

2. Barry Goldstein, Executive Director, Energy Resources Division, Department of State Development
3. Michael Malavazos, Director Engineering Operations, Energy Resources Division, Department of State Development

Tuesday, 17 February 2015—Millicent Civic and Arts Centre, Millicent

4. Chris McColl, Kalangadoo Organic Orchards
5. Tony Beck, prime lamb and beef producer
6. Peter Balnaves, Vice President, Coonawarra Grape and Wine Incorporated
7. Fraser Bell, Legal Adviser, Coonawarra Grape and Wine Incorporated
8. Glenn Harrington, Technical Expert, Coonawarra Grape and Wine Incorporated
9. Peter Bissell, Chair, Limestone Coast Grape and Wine Council
10. Stuart Sharman, Chairman, Unconventional Shale Gas Committee, Limestone Coast Grape and Wine Council
11. Allen Jenkins, Regional Vineyard Manager, Limestone Coast Treasury Wine Estates
12. Simon Marton, Chief Marketing Officer, Limestone Coast Treasury Wine Estates

Wednesday, 18 February 2015—Millicent Civic and Arts Centre, Millicent

13. Ann Aldersley, Executive Officer, South-East Local Government Association (now LCGLA)
14. Erika Vickery, President, South-East Local Government Association (now LCLGA), Mayor, Naracoorte Lucindale
15. Geoff Wells, Director, Rural Communities Australia

Friday, 27 March 2015—Balcony Room, Parliament House, Adelaide

16. Frank Brennan, Presiding Member, South East Natural Resources Management Board
17. Tim Collins, Regional Manager, Natural Resources South East (DEWNR)

Friday, 10 April 2015—Old Chamber, Old Parliament House, Adelaide

18. James Baulderstone, Vice President, Eastern Australia, Santos
19. Matthew Doman, Manager, Public Affairs, Eastern Australia, Santos
20. David Guglielmo, Country Manager—Production Enhancement, Halliburton Australia Pty Ltd
21. Anne Daw, Member, Roundtable for Unconventional Gas Projects in South Australia
22. Melissa Balantyne, coordinator/principal solicitor, Environmental Defenders Office
23. Karen Bubna-Litic, Professor of Law, University of South Australia; board member, Environmental Defenders Office

Friday, 8 May 2015—Balcony Room, Parliament House, Adelaide

24. Deb Nulty, South East landholder

Friday, 15 May 2015—Old Chamber, Old Parliament House, Adelaide

25. Kate Wheldrake, Member, Doctors for the Environment Australia, South Australia
26. John Willoughby, Secretary, Doctors for the Environment Australia, South Australia

Friday, 19 June 2015—Balcony Room, Parliament House, Adelaide

- 27. Stedman Ellis, Chief Operating Officer, Australian Petroleum Production and Exploration Association
- 28. Andrew Taylor, Senior Policy Adviser, Australian Petroleum Production and Exploration Association
- 29. Neil Gibbins, Chief Operating Officer, Beach Energy
- 30. Charles Hollingworth, Group Manager, Corporate Affairs and Environment, Teys Australia

Friday, 31 July 2015— Balcony Room, Parliament House, Adelaide

- 31. Heather Gibbons, Limestone Coast Protection Alliance
- 32. Peter (Huck) Shepard, Limestone Coast Protection Alliance

Friday, 11 September 2015—Balcony Room, Parliament House, Adelaide

- 33. Dayne Eckermann, Senior Policy Analyst, South Australian Chamber of Mines and Energy
- 34. Jason Kuchel, Chief Executive, South Australian Chamber of Mines and Energy
- 35. Nigel Long, Director, Policy and Community, South Australian Chamber of Mines and Energy

Wednesday, 16 September 2015—Robe Council Chambers, Robe, South Australia

- 36. Peter Riseley, Mayor of Robe
- 37. Marilyn Paxton, Mootatunga
- 38. John Brook, Mootatunga
- 39. David Smith, landholder
- 40. Dr Geoff Manefield, veterinarian
- 41. Dr Melissa Haswell, Associate Professor, Public Health, University of NSW
- 42. Angus Ralton, landholder/business owner

Friday, 16 October 2015—Balcony Room, Parliament House, Adelaide

- 43. Adrian Coulter, Senior Oenologist, the Australian Wine Research Institute
- 44. Mark Gishen, Project Manager, Environment and Technical, South Australian Wine Industry Association Incorporated
- 45. Peter Hackworth, Executive Officer, Wine Grape Council of South Australia
- 46. Jack England, Livestock South Australia
- 47. David Smith, Livestock South Australia

Friday, 30 October 2015—Balcony Room, Parliament House, Adelaide

- 48. Heather Heggie, South East landholder

Friday, 20 November 2015—Balcony Room, Parliament House, Adelaide

- 49. Dr Irene Watson, Chairperson, Kungari Aboriginal Heritage Association
- 50. Bruce Holland, Secretary, The Norwood Resource
- 51. John Hughes, Public Officer, The Norwood Resource

4 December 2015—Balcony Room, Parliament House, Adelaide

- 52. Professor Anthony Ingraffea, Dwight C. Baum Professor of Engineering Emeritus and Weiss Presidential Teaching Fellow at Cornell University
- 53. Hon Thomas George, Deputy Speaker Member for Lismore (NSW) – in camera



- 54. Craig Wilkins, Chief Executive, Conservation Council of South Australia
- 55. Julia Winefield, Research & Strategy, Conservation Council of South Australia

15 April 2016—Balcony Room, Parliament House, Adelaide

- 56. Associate Professor Will Rifkin, University of Queensland, Centre for Social Responsibility in Mining and Centre for Coal Seam Gas, Sustainable Minerals Institute

20 May 2016—Balcony Room, Parliament House, Adelaide

- 57. Kobad Bhavnagri, Head of Australia for Bloomberg New Energy Finance
- 58. Jeff Heller, president of Steuben County Land Owners' Coalition (via Skype)

27 May 2016—Balcony Room, Parliament House, Adelaide

- 59. Tim Buckley, Director of Energy Resource Studies, Australasia, Institute for Energy Economics and Financial Analysis (via Skype)

10 June 2016—Balcony Room, Parliament House, Adelaide

- 60. Bruce Robertson, Financial Analyst, Institute for Energy Economics and Financial Analysis (via Skype)
- 61. Rod Campbell, Research Director, The Australia Institute
- 62. Mark Ogge, Researcher and Public Engagement Officer, The Australia Institute (via Skype)

24 June 2016—Balcony Room, Parliament House, Adelaide

- 63. Mr Troy Bell, Member for Mount Gambier

Friday 8 July 2016—Balcony Room, Parliament House, Adelaide

- 64. David Blowers, Energy Fellow, The Grattan Institute (via Skype)
- 65. Hon Mark Parnell, Member of the Legislative Council

Friday, 21 October 2016—Balcony Room, Parliament House, Adelaide

- 66. Mr Adrian Pederick, Member for Hammond

The following witnesses appeared before the Natural Resources Committee in 2014, prior to formal commencement of inquiry, regarding unconventional gas development.

Friday, 26 July 2013—Balcony Room, Parliament House, Adelaide

Coal Seam Gas and Unconventional Gas Exploration and Extraction in South Australia

- 1. Barry Goldstein, Executive Director, Energy Resources Division, Department of State Development
- 2. Michael Malavazos, Director Engineering Operations, Energy Resources Division, Department of State Development

Friday, 8 August 2014—Balcony Room, Parliament House, Adelaide

Fracking

- 3. Dennis Cooke, Program Manager, Unconventional Resources, Australian School of Petroleum, University of Adelaide

## Appendix C: Figures

*Figure 1. Members of the committee taking evidence from a witness in a hearing at Millicent SE on 17 February 2015. Hansard travelled with the committee in order to record transcripts of the hearing.*



*Figure 2. Committee members with Beach Energy staff visiting Sawpit 2 rehabilitated conventional gas well in February 2015.*



*Figure 3. The committee hearing in Millicent was also attended by Hon Terry Stephens MLC, Hon Mark Parnell MLC, Mr Mitch Williams MP and Mr Troy Bell MP.*



*Figure 4. Committee members and the Member for Mount Gambier, Mr Troy Bell MP, visited Bungalow 1 with Beach Energy's Neil Gibbins (at left).*





*Figure 5. A display model of a triple-cased well design in cross section, viewed by the Natural Resources Committee at the Katnook Gas Plant, SA, February 2015. The centre (yellow) casing on this model is approximately 10cm across and each subsequent casing is surrounded by cement*



*Figure 6. An above ground holding pond used for unconventional gas extraction at Moomba in the Cooper Basin on 23 November 2015.*



*Figure 7. The Tirrawarra-86 well head prior to a perforation stage occurring.*



*Figure 8. A sample of fracking fluid was mixed in the site office so members could view and even handle it.*





*Figure 9. Sand and ceramic granules are used in fracking fluid as “proppant”, i.e., to prop open fractures, facilitating release of gas from deep shales.*



*Figure 10. Committee members Mr Chris Picton MP, Mr Peter Treloar MP and Mr Jon Gee MP at the Tirrawarra-86 site, with well head visible in the background.*



*Figure 11. Members Jon Gee MP and Peter Treloar MP observe fracking guns at Moomba.*



*Figure 12. Radioactive materials with low toxicity and rapid decay rates are sometimes used for various purposes in gas production wells, such as tracing fluid movement through fractures.*





*Figure 13. Gas infrastructure at Moomba in November 2015.*



*Figure 14. Halliburton vehicles in formation for a frack treatment. Moomba November 2015.*





*Figure 15. The Committee took evidence at the Robe Council Chambers on 16 September 2015. Witness pictured: Mayor Peter Riseley.*



*Figure 16. At Robe, the committee heard evidence from Angus Ralton, whose home is near the Jolly-1 well site.*





Figure 17. Witnesses David Smith (right) and Dr Geoff Manefield were among those presenting to the Fracking Inquiry at Robe Council Chambers.



Figure 18. Protesters left their signs outside the Robe Council Chambers while the fracking hearing was in session.





Figure 19. Members heard from witness Dr Melissa Haswell at the Robe meeting that there was a rapid rise in peer reviewed publications regarding health impacts of unconventional gas.

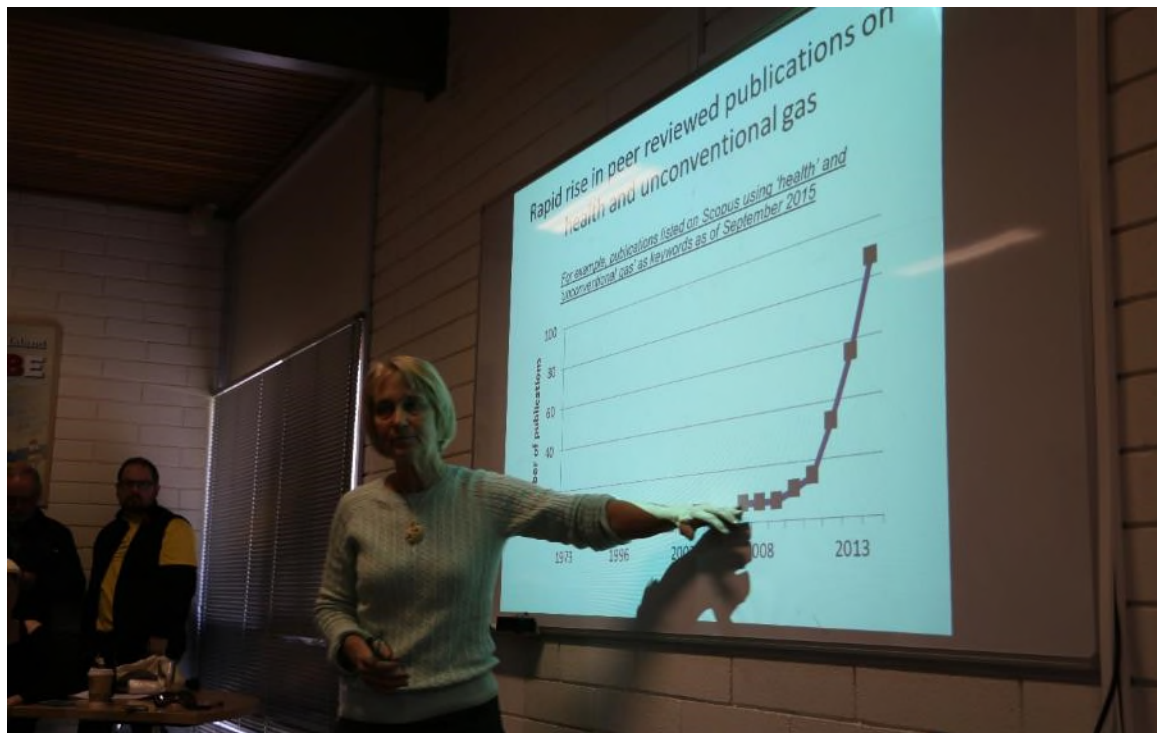


Figure 20. The Member for Hammond, Mr Adrian Pederick MP, was the last witness to present evidence to the Inquiry into Unconventional Gas.



## Appendix D: Definitions

One consistent issue throughout the inquiry has been clarity: some of the most frequently used terms and phrases associated with hydraulic fracture stimulation are often misunderstood, misused or misconstrued, leading to communication problems among stakeholders. Therefore the following working definitions for the central concepts and common terms of the inquiry have been used.

### ***Unconventional gas vs. conventional gas***

The use of the terminology 'unconventional' is misleading as there is nothing 'unconventional' about the gas; it is methane (CH<sub>4</sub>). It really refers to the geology from where the gas is extracted.<sup>161</sup>

In the US, where unconventional gas was first produced commercially, resources deemed too expensive or difficult to recover were considered 'unconventional', but in recent years as these formerly inaccessible sources have become economically viable resources, they are no longer referred to as unconventional.<sup>162</sup> In Australia, the term 'unconventional gas' usually refers to 1) a resource's geological location and 2) the fact that special (unconventional) means are required to extract it.

Conventional gas is trapped in porous and permeable rock such as sandstone or limestone, which will release the gas readily from the formations when a well is drilled. If a reservoir is not under sufficient pressure to force the gas into a well at a commercially viable rate, hydraulic fracture stimulation ('fracking') may be used to speed up the flow, as is the case in the South Australian Cooper Basin.<sup>163</sup> Therefore, use of fracking does not necessarily mean the gas is unconventional.<sup>164</sup> Conventional gas wells in the South Australian Cooper Basin have been fracked for several decades<sup>165</sup>, with unconventional shale gas production beginning only in 2012.<sup>166</sup> (See Section 4.1 of the Interim Report, Gas in South Australia, for more information on fracking in the Cooper Basin.)

Gas that is termed unconventional is trapped in low permeability rock requiring stimulation and/or directional drilling techniques to flow gas at commercial rates.

Unconventional gas is known by different names including shale gas, tight gas or coal seam gas (CSG), depending on its situation underground. All of these are mostly methane (natural gas), with varying degrees of other hydrocarbons (ethane, propane, butane, etc). Table 1 lists some of the main distinguishing characteristics.

As shown in Table 1, one feature of deeper gas resources, as opposed to shallower coal seam gas wells, is that fewer well pads are usually required. Multiple wells with horizontal segments may be drilled on one pad, which reduces the overall impact on landscape. The committee heard from Mr David Guglielmo, a representative of Halliburton, a company which describes itself as a leading provider of hydraulic fracturing services worldwide, that one well pad may feature four wells to 16 wells.<sup>167</sup>

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<sup>161</sup> (South Australian Chamber of Mines and Energy, 2015, p. 5)

<sup>162</sup> Law and Curtis 2002, in Submission 57 (Department of State Development)

<sup>163</sup> (Gibbins, 2015, p. 160)

<sup>164</sup> (Department of State Development Energy Resources Division, 2015)

<sup>165</sup> (Malavazos, 2015, p. 21)

<sup>166</sup> (Koutsantonis, 2012, p. 3514)

<sup>167</sup> (Guglielmo, 2015, p. 108)

*Table 1. Indicative table showing differences in ‘types’ of natural gas resources in Australia.*

Name	Shale gas	Tight gas	Coal seam gas	Conventional gas
Resource type	Natural gas	Natural gas	Natural gas	Natural gas
Depth below surface	2000–5000m	2000–5000m	300–1000m	1000–5000m
Rock type	Shale	Sandstone and limestone	Coal seams	Sandstone and limestone
Production well type	Vertical or horizontal	Vertical or horizontal	Vertical	Vertical and horizontal
Is hydraulic fracturing required?*	Always	Always	Occasionally	Rarely
Average number of wells per well pad	6	6	1	1
Average well pad density in producing field	1.5km apart	1 well pad per 2.5 km <sup>2</sup> (1.6km apart)	1 well pad per 0.25–1 km <sup>2</sup> (0.5–1km apart)	Varies

*Source: Government of Western Australia Department of Mines and Petroleum, Shale & Tight Gas Fact Sheet*

\*NB: While fracking is rarely required for a well that is considered conventional, it may be used for a variety of reasons without the well being considered unconventional.

### **Coal-seam gas (CSG)**

Coal seam gas (also known as CSG, or coalbed methane/CBM) is natural gas generated during the transformation of organic material to gas and trapped within coal, often with water, requiring wells to be dewatered before gas extraction. CSG targets in Australia are usually at depths of less than 1,000 m.<sup>168</sup>

The committee has received evidence from the South Australian Department of State Development that shallow coal seam gas is not a prospect anywhere in South Australia<sup>169</sup>, and coal seam gas at any depth is not a consideration for South East South Australia.<sup>170</sup>

### **Dewatering**

Dewatering is primarily associated with coal seam gas and occurs when gas is trapped in place by a water reservoir or trap, so that water must be pumped out before gas can be extracted from the well. The recovered water varies in quality and quantity but can be treated and reused for a variety of purposes. Water can be recovered from a coal seam gas well for periods of time ranging up to years.<sup>171</sup>

### **Fracturing fluid**

The composition of fracking fluid varies. The majority of the fluid is water, with proppants added to water to hold open the fractures created, and additional chemicals to carry the proppants as well as reduce friction, kill microbes, prevent scale/corrosion, and enhance surface tension, among other

<sup>168</sup> (South Australian Chamber of Mines and Energy, 2015)

<sup>169</sup> (Department of State Development, 2015a)

<sup>170</sup> (Malavazos, 2015, p. 21)

<sup>171</sup> (Cooke, 2014)

purposes.<sup>172</sup> Submissions to the inquiry indicate that the materials added to water are of great concern to many people.

When the pressure is released, the proppant remains behind, holding the fractures open, allowing oil and gas to move into the wellbore. Most of the fluids (along with any fluids which were already present in the source rock) also flow back out of the well, where they are captured and either recycled for use in further fracking stages or treated and disposed of. This mixture is known as ‘flowback’.

### ***Hydraulic fracturing (‘fracking’)***

Hydraulic fracturing (also known as ‘hydraulic fracture stimulation’, and colloquially as ‘frack(ing)’, sometimes spelled ‘frac(cing)’) is the process of injecting a mixture of mainly water, proppants (small particles, such as sand or ceramic) and chemicals (‘fracking fluid’) at very high pressure<sup>173</sup> to create small cracks through which hydrocarbons can to flow from a reservoir. For the sake of brevity, this report uses the colloquial word ‘fracking’ to mean ‘hydraulic fracturing’.

The terms ‘fracking’ and ‘unconventional gas’ are sometimes used interchangeably, but they are not equivalent terms. The former is a single (though complex) process; the latter is a broad descriptive phrase for a sector.

The committee has received evidence that Santos, as operator of the South Australian Cooper Basin Joint Venture, has undertaken more than 2,000 hydraulic fracture stimulation treatments in more than 900 conventional wells since 1967, with unconventional shale gas production commencing production in 2012.<sup>174</sup> No fracking has been conducted in wells in the South East, all of which have been conventional wells, nor are there any current proposals for operations involving fracking.<sup>175</sup>

### ***Shale gas***

Shale is a very common, fine-grained sedimentary rock which forms on the beds of large bodies of water over very long periods of time. Layers slowly build up, sometimes in great thicknesses, with organic matter which forms hydrocarbon deposits as it decomposes. If no fracturing (either natural or manmade) occurs, gas and oil can remain trapped in shale indefinitely.<sup>176</sup>

Because of the difficulty and expense in recovering gas trapped in impermeable shale, it has not been a focus for production until the last decade, when developments in hydraulic fracturing and drilling (such as horizontal or deviated vertical drilling) have made shale gas an economically attractive option.

Fracture stimulation is used to produce fissures in the thin layers of shale that trap gas, allowing it to flow through these induced pathways to the production well.<sup>177</sup>

Shale gas was produced in small quantities from shallow depths in the US since the 19<sup>th</sup> century; however, production there has boomed since 2009, when advances in technology allowed extraction from new reservoirs.

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<sup>172</sup> The additives create a slick texture, which is why fracking fluid is also sometimes known as slickwater and hydraulic fracturing sometimes called slickwater fracking.

<sup>173</sup> As high as 700 atmospheres (or about 70,000 kPa/10,000 psi) (Stephenson, 2015, p. 61)

<sup>174</sup> (Baulderstone, 2015, p. 104)

<sup>175</sup> (Gibbins, 2015, p. 160)

<sup>176</sup> (Stephenson, 2015, p. 25)

<sup>177</sup> (South Australian Chamber of Mines and Energy, 2015, p. 4)

In South Australia, primary unconventional targets are shale and deep coals. In the South East, the unconventional targets are between 3,000–4,000m below ground level and at least 2,500m below the aquifers.<sup>178</sup>

### ***Tight gas***

Tight gas is considered ‘not dissimilar to conventional gas in terms of geological setting’, but it is limited in its ability to migrate upward by low-permeability reservoir rock (such as sandstone or limestone) where it becomes trapped. It generally occurs at depths between 2000–5000m. Hydraulic fracturing is required to create commercial gas flows. Tight gas is in some instances considered conventional and has been produced in the Cooper Basin for ‘some decades through the use of hydraulic fracture stimulation’.<sup>179</sup>

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<sup>178</sup> (Ibid., p. 5)

<sup>179</sup> (Santos 4, 2013, p. 3)

## Appendix E: Regulation 10 (PGE Regulations 2013)

This section sets out Regulation 10 as raised in evidence.

### 10—Environmental impact report

- (1) For the purposes of any environmental impact report required under Part 12 of the Act, a licensee (or, in the case of a preliminary survey licence, pipeline licence, associated activities licence or special facilities licence, a person applying for a licence) must provide the following information or material:
  - (a) a description of the regulated activities to be carried out under the licence (including their location);
  - (b) —
    - (i) a description of the specific features of the environment that can reasonably be expected to be affected by the activities, with particular reference to the physical and biological aspects of the environment and existing land uses; and
    - (ii) an assessment of the cultural values of Aboriginal and other Australians which could reasonably be foreseen to be affected by the activities in the area of the licence, and the public health and safety risks inherent in those activities (insofar as these matters are relevant in the particular circumstances); and
    - (iii) if required by the Minister—a prudential assessment of the security of natural gas supply;
  - (c) a description of the reasonably foreseeable events associated with the activities that could pose a threat to the relevant environment, including—
    - (i) information on the following:
      - (A) events during the construction stage (if any), the operational stage and the abandonment stage;
      - (B) events due to atypical circumstances (including human error, equipment failure or emissions, or discharges above normal operating levels); and
    - (ii) information on the estimated frequency of these events; and
    - (iii) an explanation of the basis on which these events and frequencies have been predicted;
  - (d) an assessment of the potential consequences of these events on the environment, including—
    - (i) information on the following:
      - (A) the extent to which these consequences can be managed or addressed;
      - (B) the action proposed to be taken to manage or address these consequences;
      - (C) the anticipated duration of these consequences;
      - (D) the size and scope of these consequences;



- (E) the cumulative effects (if any) of these consequences when considered in conjunction with the consequences of other events that may occur on the relevant land (insofar as this is reasonably practicable); and
  - (ii) an explanation of the basis on which these consequences have been predicted;
  - (e) a list of all owners of the relevant land;
  - (f) information on any consultation that has occurred with the owner of the relevant land, any Aboriginal groups or representatives, any agency or instrumentality of the Crown, or any other interested person or parties, including specific details about relevant issues that have been raised and any response to those issues, but not including confidential information.
- (2) The Minister may require that a person provide further information or materials (verified, if the Minister so requires, in a manner determined by the Minister) to assist in assessing potential events and consequences that may arise from particular activities.
- (3) Information and material provided under subregulation (1) or (2) must—
  - (a) be balanced, objective and concise; and
  - (b) state any limitations that apply, or should apply, to the use of the information and material; and
  - (c) identify any matter in relation to which there is a significant lack of relevant information or a significant degree of uncertainty; and
  - (d) so far as is relevant, identify the sensitivity to change of any assumption that has been made and any significant risks that may arise if an assumption is later found to be incorrect; and
  - (e) so far as is reasonably practicable, be presented in a way that allows a person assessing the information or material to understand how conclusions have been reached and allows the information or material to be used to make an informed decision on the level of environmental impact of particular activities without the need to obtain additional technical advice.
- (4) Information or material provided under this regulation must be accompanied by a declaration signed or executed by a person (being either the licensee or applicant or a person authorised by the licensee or applicant) who has taken reasonable steps to review the information and material to ensure its accuracy.
- (5) Information and material provided under this regulation must be kept available for public inspection in accordance with directions of the Minister.

## Appendix F: Ministerial Correspondence

NATURAL RESOURCES



Parliament House

North Terrace

15 November 2016

Hon Tom Koutsantonis MP  
Minister for State Development  
Minister for Mineral Resources and Energy  
GPO Box 2832  
ADELAIDE SA 5001

Dear Minister, *Tom,*

As you are aware, the Natural Resources Committee's Inquiry into Unconventional Gas Development in the South East is underway. The committee is keen to finalise its inquiry as soon as possible and I am writing to seek your assistance.

One of the inquiry's terms of reference is the potential net economic outcomes to the region and the rest of the state as a result of unconventional gas development in the South East.

We are seeking information from the Department of State Development on the following matters:

- The committee has received evidence that with the connection of the east coast gas pipelines to the export facilities in Queensland, domestic gas prices in South Australia have increased towards price parity with the global gas market, resulting in permanently increased domestic gas prices and higher electricity prices domestically.
- The committee heard evidence of a gas glut globally, which together with depressed oil prices has resulted in low prices to producers and the likelihood that this trend will continue for some time.
- We note also that domestic energy prices (gas and electricity) in South Australia have risen considerably over recent years, with electricity pricing spiking to unprecedented levels in July 2016.

With these points in mind we ask the following questions:

1. How would increased gas production improve the state's energy security or reduce domestic electricity prices? Isn't it likely that any additional gas produced would be sold into the higher yielding export market?
2. Are there any policies under consideration to reserve any portion of future gas produced for the domestic market?
3. Is there a shortage of gas being produced in SA or too much gas available currently?

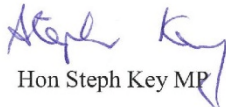
*Correspondence to GPO Box 572 Adelaide 5001 (DX 56506 North Terrace)  
Phone (61-8) 8237 9442 Fax (61-8) 8231 9130 E-mail [patrick.dupont@parliament.sa.gov.au](mailto:patrick.dupont@parliament.sa.gov.au)*

4. Given a lack of national carbon pricing structure and varied arrangements by state to ensure each state's own energy needs are met, what is the government doing to prevent/reduce further electricity price spikes such as the one that occurred in July 2016?
5. What changes to the NEM are required to address SA's energy security and to put a cap on future price spikes and rises? Is the government confident that these changes will be implemented?
6. At present when SA's electricity demand outstrips supply we rely on power from Victoria including from Hazelwood power station via the interconnector. When Hazelwood closes in March 2017 what steps will the government take to mitigate any impacts of this closure on South Australia's energy supplies?
7. How baseload and supply security will be assured and how energy will continue to be provided to South Australians reliably and affordably.
8. The committee would like to hear the government's perspective regarding future plans for energy supply in SA including how the transition to low emission technologies (renewables) will be managed?

A written response is requested by 25 November 2016 to allow the committee to finalise its inquiry and table its final report before the conclusion of the 2016 Parliamentary sitting schedule.

The Committee looks forward to your reply.

Yours sincerely



Hon Steph Key MP

**Presiding Member**

*Correspondence to GPO Box 572 Adelaide 5001 (DX 56506 North Terrace)  
Phone (61-8) 8237 9442 Fax (61-8) 8231 9130 E-mail [patrick.dupont@parliament.sa.gov.au](mailto:patrick.dupont@parliament.sa.gov.au)*

INQUIRY INTO UNCONVENTIONAL GAS (FRACKING)  
IN THE SOUTH EAST OF SOUTH AUSTRALIA

**The Hon Tom Koutsantonis MP**  
**Member for West Torrens**

MMRE16D01564

Hon Steph Key MP  
Presiding Member  
Natural Resources  
Parliament House  
GPO Box 572  
ADELAIDE SA 5001



**Government  
of South Australia**

Treasurer  
Minister for Finance  
Minister for State  
Development  
Minister for Mineral  
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Adelaide SA 5000  
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DX 56203 Victoria Square  
Tel 08 8226 1866  
Fax 08 8226 1896  
minister.koutsantonis@sa.gov.au

Dear Ms Key,

*Steph,*

Thank you for your letter dated 15 November 2016, requesting a response to the Natural Resources Committee's Inquiry into Unconventional Gas Development in the South East.

I trust that the attached responses to the Committee's questions assist the inquiry. Should you require any further information or have any questions, please contact Vince Duffy, Executive Director Energy Markets and Programs Division, Department of State Development, on (08) 8204 1724.

Yours sincerely

*Tom Koutsantonis*  
**Hon Tom Koutsantonis MP**  
Minister for Mineral Resources and Energy

*24<sup>th</sup>* November 2016

Attachments: Responses to Questions from the Natural Resources Committee's Inquiry into Unconventional Gas Development in the South East.



### **Inquiry into Unconventional Gas Development in the South East**

**1. How would increased gas production improve the state's energy security or reduce domestic electricity prices? Isn't it likely that any additional gas produced would be sold into the higher yielding export market?**

The South Australian Government supports development of gas supply and use of gas generation in South Australia's transition to a low carbon economy.

In September 2016, the Premier announced that the Government will commit \$24 million on a program to incentivise companies to extract more gas and supply it to the local market. This funding recognises the need for new gas supplies following predictions that the demand for gas in the eastern states will increase in the coming years.

Importantly, this program, known as the Plan for Accelerating Exploration (PACE) Gas fund, aims to increase the supply of gas to South Australian consumers, including local electricity generators, so as to put downward pressure on energy prices.

PACE projects must be developed within South Australia under current licenses and must be offered to the South Australian market first.

This program will complement the COAG Energy Council's gas market reform package which aims to provide better information for trading in the market, easier access to transport infrastructure, better pricing information and encouraging more gas supply and gas suppliers while taking into account each jurisdiction's circumstances.

**2. Are there any policies under consideration to reserve any portion of future gas produced for the domestic market?**

The gas market in eastern Australia has been and is currently going through significant change. The impacts of this change include tightening of the eastern Australian domestic gas market predominantly due to the introduction of an export market in Eastern Australia and decreasing domestic gas demand.

The expected tightening of the eastern Australian domestic gas market has resulted in concern amongst large industrial/manufacturing users and calls from those enterprises for government intervention to ensure domestic gas supplies. This has led to debate amongst Australian jurisdictions on whether adopting gas reservation for domestic markets would stem or prevent any such tightening.

The South Australian Government, consistent with the federal government's policy on this matter, is not intending to consider or develop a domestic gas reservation policy as such policies are likely to be ineffective in achieving their stated

objectives and can lead to unintended and perverse outcomes, as has been demonstrated in jurisdictions where such policies have been implemented.

While the development and expansion of Australia's LNG industry will lead to increased gas demand on the east coast gas market, this represents a very significant opportunity for the development of Australia's wealth. In South Australia, there has been significant investment in petroleum exploration and production as a direct result of increased gas demand driven by LNG development. Notwithstanding that with the drop in oil linked global LNG prices has resulted in a significant reduction in gas exploration and development activities over the last year.

It is worth noting that the Western Australian Government has had long running domestic gas reservation policies in place. Despite this, Western Australia sustained higher prices sooner than in Eastern Australia, which has been suggested as being primarily due to the lack of supply side competition. Gas reservation policies act to significantly discourage investment in otherwise profitable gas projects, restricting supply to both domestic and export markets. In the long run, supply restrictions will likely lead to further price increases. Pursuing a gas reservation policy in South Australia would be likely to exacerbate the expected tight gas supply outlook in the coming years associated with the various gas moratoria and land access impediments in other states.

Thus the South Australian Government considers that the best way to attain long term security of competitively priced domestic gas supply is through supporting supply side competition in gas exploration, production and storage. Furthermore, the overall economic gain from increased gas production will result in unequivocal gain to the overall economy through employment, jobs and consumption.

**3. Is there a shortage of gas being produced in SA or too much gas available currently?**

As referred in question 2, the gas market in eastern Australia has been and is currently going through significant change which include tightening of the eastern Australian domestic gas market predominantly due to the introduction of an export market in Eastern Australia and decreasing domestic gas demand.

The Australian Energy Market Operator's (AEMO) 2016 Gas Statement of Opportunities (GSOO) highlights that under a medium (considered most likely) scenario:

- Proved and probable gas reserves (considered the best estimate of commercially recoverable reserves) start to deplete from 2019.
- To maintain gas supply adequacy between 2019 and 2035, development will be required to ensure contingent and prospective resources and undeveloped reserves become commercially recoverable.

Gas supplies within South Australia come from multiple sources – through the Moomba to Adelaide Pipeline and the SEA Gas pipelines. This represents competition that is good for consumers. There is no contemplation of programs or

policies to reduce competition between gas suppliers for gas sales in South Australia.

Importantly, as highlighted in question 2, the observed reduction in gas exploration and development activities over the last year has the potential to tighten gas supply from South Australian gas fields in the near to medium term in the absence of material new gas exploitation initiatives.

To that end, the South Australian government is keen to expand environmentally sustainable gas exploration and development in the State through its recently announced PACE Gas initiative<sup>1</sup> for Accelerating gas Exploration (PACE) to increase the supply of affordable gas to local generators in order to put downward pressure on electricity prices for South Australian customers though seeking to:

- maximise competition between gas suppliers into the State;
- maximise investment and FTEs in the state;
- maximise royalties paid on petroleum produced in the state; and
- maximise the security of gas supplies.

**4. Given a lack of national carbon pricing structure and varied arrangements by state to ensure each state's own energy needs are met, what is the government doing to prevent/reduce further electricity price spikes such as the one that occurred in July 2016?**

The South Australian Government has been progressing with a number of measures to reduce wholesale electricity prices in South Australia.

In July 2016, the Government intervened in the market by requesting Engie to bring the Pelican Point Power Station back into service.

In September 2016, the Premier announced a number of measures that seek to increase competition in the energy market and thereby reduce wholesale electricity prices.

Firstly, the Government has launched a tender to procure 75 per cent of its long term electricity needs from generation which increases competition in the energy market. This measure builds on the government's previous announcement that we will source about 25 per cent of the government's electricity needs from dispatchable renewable energy providers that utilise technology such as battery storage and electricity generation from biomass. In total, the government uses up to 481 gigawatt hours of electricity per annum across all its sites. This means that we have significant purchasing power and through a measured procurement strategy we can effect change. The tender has been released on the State Procurement board website with the final date for submissions being 6 January 2017.

<sup>1</sup> <http://www.statedevelopment.sa.gov.au/news-releases/all-news-updates/applications-now-open-for-24-million-in-gas-extraction-grants>



Secondly, as outlined in questions 1 and 3, the Government has committed \$24 million to incentivise companies to extract and supply more gas to the local market including to the electricity generation market so as to reduce wholesale electricity prices. Applications for the grants are open until 4:00pm 16 December 2016.

Finally, the Government will explore an Emissions Intensity Scheme at the national level, which trades credits between energy companies. We have commissioned modelling of an Emissions Intensity Scheme as we believe that such a scheme will transform our electricity sector to a carbon constrained future with the lowest wholesale electricity price, lowest cost of abatement and lowest cost of building new capacity when compared with other potential policy mechanisms.

In addition, in October 2016, I introduced legislation changes that enable the Australian Energy Regulator to periodically and systematically monitor the performance of the electricity wholesale market.

**5. What changes to the NEM are required to address SA's energy security and to put a cap on future price spikes and rises? Is the government confident that these changes will be implemented?**

As South Australia transitions to a carbon constrained economy and old conventional generation in the National Electricity Market is withdrawn, maintaining the services that would normally be provided by traditional synchronous generators to ensure system security is becoming more complex. These technical challenges include: high rates of change of frequency; insufficient amount of frequency control ancillary services; and, performance issues with emergency under frequency control schemes.

To assist with these challenges the South Australian Government has pursued a number of measures ranging from short to medium and long term.

To address short term challenges, in October 2016, the Government made a new regulation which requires ElectraNet to provide information to Australian Energy Market Operator (AEMO) on the limitations of the Heywood Interconnector, in order to maintain the expected rate of change of frequency of the South Australian power system at, or below, 3 Hertz per second, in relation to the non-credible coincident trip of both circuits of the Heywood interconnector. AEMO will implement this advice, as required by the National Electricity Rules.

The South Australian government is also seeking to improve system security and competition in the wholesale electricity market through its own electricity procurement activities. These include:

- A tender to source about 25 per cent of government electricity needs (around 120GWh annually) from dispatchable renewable energy providers that utilise technology such as battery storage and electricity generation from biomass; and,
- A tender to procure 75 per cent of government electricity needs (around 360GWh annually) from a source that introduces new competition into the energy market



The tender for both has been released on the State Procurement board website with the final date for submissions being 6 January 2017.

In addition, the South Australian Government has been supporting the upgrade of the Heywood interconnector, which enables electricity to be either exported or imported between Victoria and South Australia. This will increase the interconnector's capacity from the current 460 MW to 650 MW with testing and commissioning due to be fully completed by March 2017.

In the medium term, the Government submitted a National Electricity Rule change proposal to the Australian Energy Market Commission (AEMC) that seeks to provide flexibility for the AEMO to manage security challenges. More specifically, the proposal seeks to amend the Rules, so that:

- The regulatory framework supports competitive and efficient provision of ancillary services necessary to manage emerging security challenges such as a high rate of change of frequency;
- The roles and responsibilities for managing system security challenges, including development of a framework for management of particular multiple contingency events by AEMO and network service providers are sufficiently clear; and
- The regulatory framework for the establishment of emergency frequency control schemes, such as automatic load and generation shedding schemes, associated settings and other emergency frequency control schemes are appropriate with the changing generation mix, including increased likelihood of low inertia conditions and further uptake of distributed generation.

The Rule change proposal was submitted on 12 July 2016, and will now be considered by the AEMC in accordance with its formal Rule change process. The AEMC is also undertaking a review on whether wholesale energy market frameworks are appropriate to complement increasing volumes of renewable energy and to maintain power system security as the industry transforms.

This review, called the System Security Market Frameworks Review, will address the need for possible changes to market arrangements that lead to more efficient outcomes for energy consumers while delivering a secure operating system. This review will provide recommendations to the COAG Energy Council with an interim report due by the end of 2016.

At the extraordinary COAG Energy Council meeting held on 7 October 2016, energy ministers agreed to a wider independent review to take stock of the current state of the security and reliability of the NEM and provide advice to governments on a coordinated, national reform blueprint. The review is being led by the Chief Scientist, Dr Alan Finkel. The reform blueprint will outline national policy, legislative and rule changes required to maintain the security, reliability and affordability of the NEM in light of the transition taking place. The Finkel Review will deliver a preliminary report to the COAG meeting on 9 December 2016.

The Essential Services Commission of South Australia (ESCOSA) is planning an inquiry into regulatory arrangements for wind and inverter-connected generator

licencing arrangements. Since 2005, the conditions ESCOSA imposes on South Australian wind generators have been more onerous than the requirements of the National Electricity Rules in order to ensure system security. ESCOSA plans to review existing licensing arrangements and assess whether there are risks posed by other generation technologies which warrant a regulatory response.

Over the long term the South Australian Government has recognised that stronger interconnection to either New South Wales or Victoria will improve wholesale electricity market competition and power system security for South Australia. Greater interconnection between the National Electricity Market regions will also facilitate further renewable energy development to help Australia achieve its emissions reduction target.

Accordingly, the Government has advocated for further interconnection and committed \$500,000 towards ElectraNet's assessment of a new high capacity interconnector to South Australia.

ElectraNet has commenced this assessment with the release of Project Specification Consultation Report on 7 November 2016 which represents the beginning of consultation in the regulatory process to explore options that can facilitate South Australia's energy market transition to a low carbon economy and which identifies four interconnector options. These options include an interconnector from central South Australia to Victoria, an interconnector from mid-north South Australia to NSW, an interconnector from northern South Australia to NSW and an interconnector from northern SA to Queensland.

The second phase of the RIT-T process will see ElectraNet release a Project Assessment Draft Report which will include a full quantitative assessment of the costs and benefits of each option. ElectraNet expect to publish this report in mid-2017.

In addition, the South Australian Government successfully advocated for a review of the regulatory investment test for transmission assets at the COAG Energy Council. This review considers whether the existing rules are effective in the current market environment with work to commence over the coming months.

**6. At present when SA's electricity demand outstrips supply we rely on power from Victoria including from Hazelwood power station via the interconnector. When Hazelwood closes in March 2017 what steps will the government take to mitigate any impacts of this closure on South Australia's energy supplies?**

AEMO provides critical planning, forecasting and power systems information to stakeholders. AEMO undertakes ongoing monitoring of the supply outlook in the market against minimum local generation and demand side capacity requirements in each region, with South Australia and Victoria able to share capacity via the Heywood and Murraylink interconnectors.

Under the National Electricity Rules, AEMO operates a number of reporting processes, over a range of time horizons, to inform the market of the current and projected levels of available reserves. Using its various market reports, AEMO will

continue to inform the market of forecast the demand/supply balance to assist generators to work out their market response. In addition, if the market does not respond with sufficient generation, AEMO has the ability to use the Reliability and Emergency Reserve Trader mechanism to call for offers for the provision of energy reserves from supply and demand-side facilities.

In addition to the work AEMO performs, the South Australian Government believes that the measures outlined in the responses to the previous questions will assist with mitigating any impacts of the Hazelwood closure. In particular, we believe that the Government's tender to procure 75 per cent of its long term electricity needs from generation which increases competition in the energy market, the government's funding of \$24 million to incentivise companies to extract and supply more gas to the local market and stronger interconnection are the most likely measures to assist South Australia.

**7. How baseload and supply security will be assured and how energy will continue to be provided to South Australians reliably and affordably.**

The package of measures outlined in the previous responses are all designed to address emerging challenges with South Australia's electricity system's as the state transitions to a carbon constrained future.

We believe that this comprehensive package, which includes work at both the State and national level, will ensure that South Australian consumers will continue to have secure, reliable and affordable electricity supply.

At the national level, through the COAG Energy Council, Energy Ministers recognise that there is a need to respond to the paradigm shift in energy markets arising from the significant transition to low-carbon emissions future. Energy Ministers agreed to take action to maintain an affordable and reliable supply of energy to consumers and manage these changes. The package of measures announced included a comprehensive suite of reforms to boost transparency in the gas market and to deliver better functioning and competitive energy markets.

Furthermore, Energy Ministers have agreed to a wider independent review to take stock of the current state of the security and reliability of the National Electricity Market and provide advice to governments on coordinated, national reform. The Review is being led by the Chief Scientist, Dr Alan Finkel AO.

**8. The committee would like to hear the government's perspective regarding future plans for energy supply in SA including how the transition to low emission technologies (renewables) will be managed?**

The South Australian Government is committed to transitioning our State to a low carbon economy. South Australia has the ability to produce almost all of our energy from clean and renewable sources and export this energy to the rest of Australia.

The Government's *Low Carbon Investment Plan for South Australia* has set a target of 50 per cent of our electricity production to be from renewable energy by

2025 and also outlines an approach to achieving \$10 billion of investment in low carbon energy generation by 2025. This Plan stands alongside *South Australia's Climate Change Strategy 2015-2050*, which outlines the State Government's aspirations for a low carbon, resilient economy. We recognise that transitioning the energy market in such a fundamental way presents challenges but the Government continues to work on strategies and policies to meet these challenges.

We believe that our comprehensive package of initiatives and policies outlined above, including our advocacy for a national Emissions Intensity Scheme, provides the appropriate mechanisms for South Australia's energy sector's transition.

