Inquiry into onshore unconventional gas in Victoria

Final Report
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This report is also available online at the Committee’s website.
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Chair’s foreword


This Inquiry likely received more submissions than any other Inquiry in recent Victorian Parliamentary history.

The Government, through the Legislative Council, referred this Inquiry to the Committee at the end of May 2015. Over the following six months we amassed a significant amount of evidence from submissions, hearings, site visits, correspondence and Reports. We heard perspectives from farmers and other landholders, environment and community groups, the gas industry, gas market analysts, hydrogeologists, manufacturers, tourism operators, local governments and the general public. We tabled an interim Report in September outlining the work done to that point.

From the evidence presented it appears likely that shale and tight gas is present in the Otway and Gippsland Basins. In part, the moratorium on unconventional gas has prevented exploration which would prove or disprove this. Exploration companies are adamant that the resource is there. Industrial gas users have signed contracts. In relation to coal seam gas, while it has captured the public’s attention, it is unlikely to be present in large commercial and extractable quantities in Victoria’s brown coal fields.

The Committee also considered the question of whether unconventional gas could be extracted safely – that is, in a manner that does not damage the environment, water resources or human health. Many in the community are alarmed at perceived risks. Of particular concern to many is the scenario of surface water and aquifers becoming contaminated. Farmers are also concerned about competition for scarce water resources and the potential for Victoria’s reputation as a ‘clean green’ producer to be compromised.

However, calls to completely avoid an industry or activity unless it is 100 percent safe are unrealistic. All human activities carry risk – the role of government, working with industry and the community is to design a regulatory framework to manage risk and mitigate it to an acceptable level. Inquiries and investigations in New South Wales, Western Australia and elsewhere have found that the risk is manageable with the right governance. Victoria’s current regulatory framework may or may not be suitable, however improvements can certainly be made to the regulatory framework. The Report discusses what work would need to be done to implement this, noting our inability to examine best practice in other jurisdictions with established unconventional gas production activities. We also found that gaps in the scientific knowledge base remain, particularly in regard to water.

An important associated question on which the Committee received considerable evidence was: what contribution might this potential resource make to the supply and cost of gas available to Victorian industry and consumers? Manufacturers who rely on gas as a feedstock need new and lower cost sources to ensure that they can remain competitive. From their standpoint, the uncertainty over the Government’s position on unconventional gas is frustrating. Equally, we received evidence of forecasting falling demand for gas in the eastern states gas market and the possibilities for some users to switch to other fuels or implement energy efficiency measures. More broadly, it is also clear that the gas market is highly complex with many players along the production and supply chain. It is pretty clear there will be a price challenge for gas in coming decades.
Chair's foreword

The Australian Competition and Consumer Commission (ACCC) is currently looking into the competitiveness of wholesale gas prices and the structure of the different segments of the gas industry. It is probable that the resolution of consumer and industry concerns through this ACCC process will be of far more import than any decision on unconventional gas in Victoria, especially noting that such an industry would take years to develop and have any impact on the market.

We received a considerable amount of evidence on the issue of land access. Currently, companies are required to negotiate access agreements and pay compensation where justified. There are many examples of mining companies successfully doing this. The Committee has taken the view that community concern on land access is best solved through a strengthening of the regulations around negotiating land access and compensation, rather than, as suggested by some, giving landholders a right of veto. Allowing landholders a right of veto is incompatible with the long established principle in Australia that the Crown owns the rights to minerals under the soil. To overturn this principle, while perhaps superficially attractive, would not be in the best interests of the Victorian community.

The community will wish to understand the Committee's overall view on the current moratorium on onshore gas. The Report and the Extracts of proceedings show that the Committee considered two positions in relation to this: either extending it for another five years or banning the unconventional gas industry altogether. The Committee was unable to reach a majority decision. However, our Terms of Reference require us to Report back to the House on a whole range of issues and we have done so with 15 agreed recommendations.

There is far more that the Committee could have seen to develop our understanding of this industry. The Committee could have travelled to Queensland, New South Wales and overseas jurisdictions where the industry is not merely theoretical. However, as stated in this Report, it is disappointing that the Government, through the Parliament, chose not to release the necessary funding and resources to allow this to occur and this has meant we were unable to do more than a cursory assessment of regulatory approaches elsewhere.

It is hard to believe the Government was serious about the Inquiry when they conspicuously failed to facilitate the support that was necessary to deliver an authoritative and complete Report.

The Committee sought additional scientific and administrative support, however what was provided in terms of a scientist was too late and too little. Additional administrative support was not forthcoming. Further, departmental precursor submissions have not been provided to the Inquiry, but in the Committee's view should be made public.

In my view, the decision of the Government to effectively block the appearance of the Minister for Energy and Resources, the Hon. Lily D'Ambrosio, at the Inquiry points to their lack of seriousness and lack of genuine support. This was a government-initiated reference after all and there is precedent for the appearance of Lower House Ministers at Upper House inquiries (eg. Minister Tony Robinson, 2007).

An initial request for additional support for the Committee Inquiry in the form of (1) scientific expertise, (2) researchers and (3) additional administrative help was sent to the Premier on 20 July 2015. A reply was received from the Premier on 27 August 2015 offering departmental support. A further letter from the Minister for Energy and Resources in late October again sent the Committee on a merry-go-round for additional resources. Any resources that may ultimately have been provided would have come too late to make
a material difference. Given the Committee was required to table an Interim Report on 1 September 2015 and a Final Report by 1 December 2015, it is hard to believe these letters were sincere.

The Committee was not in a position to point to satisfactory or otherwise regimes of regulation in other Australian jurisdictions, particularly Queensland and New South Wales. By contrast is the Inquiry of two years duration by the Western Australian Standing Committee on Environment and Public Affairs into Implications for Western Australia of Hydraulic Fracturing for Unconventional Gas.

The Committee’s Terms of Reference were to inquire into and consider a range of matters including the Victorian Auditor-General Office’s Report Unconventional Gas: Managing Risks and Impacts which was released during the period of the Inquiry. As a long-standing supporter of the Auditor-General’s Office and previous Auditors-General, it pains me to indicate that the then Auditor-General appeared to me to have a pre-determined outcome. It is my humble view that this particular Auditor’s Report cannot be relied upon in isolation.

A number of submitters pointed to the need for the Committee to look at best practice regulatory frameworks in Canada, the USA, Queensland and New South Wales. The inability of the Committee to collect evidence of the frameworks within these jurisdictions meant a recommendation of some cautious forward process on gas exploration and production within a world’s best practice framework was not open to the Committee. Victorians would surely want their Parliamentarians to propose the best and most rigorous regulatory framework available. This was not possible.

I thank all those 1942 people who provided evidence to the Committee either through written submissions or by appearing at the Committee’s public hearings. Thank you also to those who have assisted the Committee by hosting the regional hearings and site visits.

I would also like to thank my colleagues on the Committee. I would additionally like to thank the Committee staff for their work on this Inquiry and the production of this Report: from the Secretariat, Mr Keir Delaney, Secretary; Dr Catriona Ross, Inquiry Officer; Ms Annemarie Burt, Research Assistant; additional staff for this Inquiry Mr Ben Hall, School of Civil, Environmental and Chemical Engineering, RMIT University (Hydrogeology); and from the Council Committees office Ms Kim Martinow de Navarrete, Research Assistant; Ms Esma Poskovic, Research Assistant; and Mr Anthony Walsh, Research and Legislation Officer.

Hon David Davis MLC
Chair
The Committee considered two proposed recommendations: a ban on the unconventional gas industry in Victoria or a five year extension of the current moratorium. The Committee could not reach a majority decision. Notwithstanding this, and the content of any minority reports, the Committee must respond to its Terms of Reference and therefore makes the following recommendations relating to any future unconventional gas industry, were it to occur in Victoria.

**RECOMMENDATION 1:** That the precursor internal submissions from Victorian departments and agencies that informed the whole-of-government inter-departmental submission to this Inquiry into unconventional gas be made public to inform the community of the different positions of departments and agencies.

**RECOMMENDATION 2:** That the Chief Health Officer commissions a full review and report to the Victorian Government on the possible human health impacts of an unconventional gas industry.

**RECOMMENDATION 3:** That the Victorian Government undertake a significant program to collect baseline data prior to any unconventional gas industry going ahead, including:

(a) further sampling of groundwater monitoring bores
(b) locating groundwater monitoring bores in areas of potential gas extraction.

**RECOMMENDATION 4:** That the Victorian Government establishes an independent water science committee chaired by an eminent scientist to oversee a water science and monitoring program, and provide independent advice on water quality and other environmental issues.

**RECOMMENDATION 5:** That the Victorian Government:

(a) increase the resources available to monitor the integrity and condition of wells, and identify and decommission these where necessary
(b) clarify the roles and responsibilities of the Department of Environment, Land, Water and Planning, the Environment Protection Authority, water authorities and other agencies in regard to the decommissioning of wells.

**RECOMMENDATION 6:** That the Victorian Government provide easier online access to information about exploration licences targeting coal seam gas and petroleum exploration permits targeting tight and shale gas, and in particular:

(a) update and improve the relevant sections of the Department of Economic Development, Jobs, Transport and Resources website to reflect machinery of government changes to departments
(b) provide a simplified, more user-friendly interface and more effective search tools
(c) display the ‘Mining Licences Near Me Tool’ more prominently on the website.
RECOMMENDATION 7: That, noting that the Committee is not in a position to determine whether a single Act or improvements to the Mineral Resources (Sustainable Development) Act 1990 and the Petroleum Act 1998 would result in better regulation, the Victorian Government should look to individual improvements in both Acts and should ensure that:

(a) community consultation and effective dispute resolution processes are improved
(b) landholder rights are strengthened and an equitable balance and process between the rights of landholders and mining companies in relation to land access, compensation, and the rehabilitation of land is achieved, noting the Crown owns all mineral resources.

RECOMMENDATION 8: That mandatory environmental impact assessments be required for any coal seam gas, shale and tight gas projects.

RECOMMENDATION 9: That the Victorian Government examine improved consultation with relevant water authorities to enable a more comprehensive assessment of risk to water sources.

RECOMMENDATION 10: That the Victorian Government amend section 32 of the Sale of Land Act 1962 to ensure that when a person buys land they are made aware of any exploration licences or petroleum exploration permits or retention leases that the land is subject to, by having the licences, permits or leases listed in the section 32 document. Disclosure of any such licences, permits or leases should be accompanied by a plain English explanation.

RECOMMENDATION 11: That the Victorian Government, in consultation with stakeholders, develop an industry-wide code of practice for the exploration, production, and impact management of unconventional gas activities that specifically includes requirements for best practice in:

(a) well integrity
(b) hydraulic fracturing activities
(c) produced water
(d) fugitive emissions
(e) well decommissioning and rehabilitation obligations
(f) baseline and ongoing monitoring.

RECOMMENDATION 12: That in relation to chemicals and additives used in hydraulic fracturing, the Victorian Government should:

(a) commission research and advice on chemicals, including research to assess the impacts of chemical mixtures used in hydraulic fracturing
(b) require companies to seek approval for all chemicals proposed to be used
(c) require full, public disclosure of chemicals approved for use.

RECOMMENDATION 13: That the Victorian Government examine the Queensland GasFields Commission model and other independent bodies in other jurisdictions, to consider establishing a wholly independent, appropriately resourced statutory body that may facilitate information sharing and stronger relationships between landholders, local communities and industry.
RECOMMENDATION 14: That the Minister for Energy and Resources meet with Victorian manufacturers to understand their concerns regarding the supply and increasing cost of gas, and the impact on their businesses.

RECOMMENDATION 15: That the Victorian Government take note and consider the findings of the Australian Competition and Consumer Commission Inquiry into the East Coast Gas Market, which are due to be reported in April 2016.
1 Introduction and conduct of the Inquiry

1.1 Structure of the Report

This is the Final Report of the Environment and Planning Committee’s Inquiry into matters surrounding a potential onshore unconventional gas industry in Victoria. The Report consists of eight chapters. The first two chapters provide introductory and background information, and chapters three to eight are structured to correspond to the Terms of Reference for the Inquiry.

Chapter One

Chapter One provides a summary of the conduct of the Inquiry. It lists the Terms of Reference for the Inquiry and discusses the scope of the Report, the number of submissions received, and the hearings and site visits undertaken by the Committee. It also includes Committee comment on the resourcing of this Inquiry.

Chapter Two

Chapter Two presents background information on unconventional gas. It explains the difference between conventional and unconventional natural gas, and describes the geological characteristics of coal seam, shale and tight gas. It also provides a brief explanation of the identified potential risks posed by unconventional gas extraction, and how the industry is regulated. Chapter Two then provides a short summary of the history of unconventional gas activity in Victoria, and lists the key events in the regulation of unconventional gas at the Victorian state and Commonwealth levels.

Chapter Three

Chapter Three considers Victoria’s prospectivity for commercial sources of unconventional gas. It begins by providing some context to the discussion of prospectivity, by explaining how gas resources and reserves are classified and measured. It looks at Victoria’s conventional gas reserves, and unconventional gas reserves in other Australian jurisdictions.

Chapter Three then examines the geology of the two parts of Victoria that have been identified as the most prospective for unconventional gas: the Gippsland and Otway Basins. It provides a short history of exploration for unconventional gas in the Gippsland and Otway Basins and includes maps that show the historical and current exploration licences and permits over the regions. Chapter
Chapter 1: Introduction and conduct of the Inquiry

Three concludes with an overview of the evidence provided to the Committee by explorer companies that believe that there are commercially viable quantities of unconventional resources.

Chapter Four

Chapter Four examines the commonly identified risks posed by the extraction of unconventional gas, and outlines community and industry views on those potential risks. It begins by collating the identified risks, and provides information on: the importance of well integrity and potential impacts on water resources; the practice of hydraulic fracturing or ‘fracking’; chemical use in drilling and fracking fluids and the mobilisation of naturally occurring hazardous materials; issues to do with ‘produced’ and ‘flow back’ water; and fugitive methane emissions. It also looks at the potential impacts the industry’s surface level infrastructure can have on native vegetation and biodiversity. Chapter Four additionally examines the evidence presented to the Committee about potential impacts of unconventional gas extraction on human health.

Chapter Four then outlines the significant community concern expressed to the Committee regarding the potential risks posed by an unconventional gas industry, which raises the issue that the industry may not have ‘a social licence to operate’ in Victoria. Chapter Four concludes with an outline of the industry views expressed to the Committee, which state that the risks posed by unconventional gas extraction can be successfully mitigated by industry adherence to ‘best-practice’ regulations, and that the benefits the industry will bring to Victoria will outweigh the risks.

Chapter Five

Chapter Five examines issues relating to the potential co-existence of an unconventional gas industry in Victoria with other land uses such as agriculture and tourism, and with the rights of Traditional Owner groups.

Chapter Five firstly looks at agriculture. It outlines evidence received by the Committee in regards to potential impacts of the industry on farming operations; biosecurity; water resources; domestic and export markets including reputational risk; as well as land access laws, compensation agreements and property prices.

Chapter Five then considers potential issues relating to the co-existence of the tourism industry with unconventional gas development, and with the rights of Traditional Owner groups in areas under Native Title, or subject to agreements under Victoria’s Traditional Owners Settlement Act 2010. The Chapter concludes with a consideration of the potential implications of an unconventional gas industry for local and regional development, investment and jobs.
Chapter Six

Chapter Six considers the scientific knowledge requirements that would be necessary to enable the effective regulation of an unconventional gas industry in Victoria. It builds on the information provided in Chapter Four about identified risks potentially posed by an unconventional gas industry and discusses them in more technical detail in the specifically Victorian context.

Chapter Six focuses on the importance of understanding the hydrogeology of an area prior to unconventional gas development. It firstly explains why understanding hydrogeology is important in regards to risk management. It then provides an overview of the current knowledge of groundwater resources in the Gippsland and Otway Basins, including the Victorian Government’s recently completed water science studies, and the Bioregional Assessment of the Gippsland Basin which is expected to be completed in 2016.

In conclusion, Chapter Six identifies knowledge gaps that remain in the State’s understanding of the water resources in the two Basins, and the further work that needs to be done more broadly to inform the effective regulation of an unconventional gas industry.

Chapter Seven

Chapter Seven examines issues and evidence provided to the Committee surrounding the regulation of a potential unconventional gas industry in Victoria. It considers the evidence provided on the policy and regulatory safeguards that would be necessary to enable the exploration and development of unconventional gas, if it is determined that the industry should proceed in this State.

Chapter Seven firstly provides a summary of the State’s existing regulatory framework that applies to unconventional gas. It focuses on the two key pieces of legislation governing the industry: the Mineral Resources (Sustainable Development) Act 1990 (which regulates coal seam gas exploration and production) and the Petroleum Act 1998 (which regulates shale and tight gas exploration and production).

Secondly, it looks at ways the regulatory framework could be made more effective, and presents evidence submitted to the Committee, and findings from the Victorian Auditor-General’s report: Unconventional Gas: Managing Risks and Impacts. The evidence the Committee received suggested ways to increase the capacity of the regulatory framework to address risks associated with unconventional gas. The Chapter puts forward recommendations regarding the regulation of environmental protection; community consultation; health and safety; land owner rights; approval processes; and administration. The recommendations are not exhaustive but focus on key regulatory measures drawn from the evidence.

Chapter Seven concludes with a brief overview of how unconventional gas activities are regulated in the other Australian jurisdictions of Queensland, New South Wales, South Australia and Western Australia.
Chapter Eight

Chapter Eight, the final chapter of this Report, looks at unconventional gas and the domestic and international gas markets. It explores the evidence the Committee received about the impact developing unconventional gas could have on the domestic gas market, particularly in regards to the price and supply of gas in this State.

Chapter Eight begins with a short overview of the eastern Australian gas market, which includes Victoria, and current market dynamics. It explains that the eastern Australian gas market is in a state of transition since liquefied natural gas exports began from Queensland to Asia in January 2015, and that the Committee was informed that the price of gas has been rising and is impacting negatively on Victorian manufacturing businesses that rely on gas.

Chapter Eight considers the evidence the Committee received concerning supply and demand for gas, and the ability of unconventional gas to provide a competitive source of energy and non-energy inputs for manufacturing industries. Chapter Eight then looks at whether unconventional gas has the ability to provide an affordable source of energy for domestic consumers, and briefly presents evidence submitted to the Committee regarding the appropriateness of Victoria adopting a gas reservation policy.

1.2 Terms of Reference for the Inquiry

On 26 May 2015, the Leader of the Government in the Legislative Council, the Hon. Gavin Jennings, moved that the Environment and Planning Committee inquire into matters relating to a potential unconventional gas industry in Victoria. The Legislative Council agreed to the motion and adopted the following Terms of Reference for the Inquiry:

That pursuant to Sessional Order 6 this House requires the Environment and Planning Committee to inquire into and consider matters relating to the exploration, extraction, production and rehabilitation for onshore unconventional gas and present an interim report no later than 1 September 2015 and a final report no later than 1 December 2015 and, in particular, the inquiry should include, but not be limited to, the following —

(1) the prospectivity of Victoria’s geology for commercial sources of onshore unconventional gas;

(2) the environmental, land productivity and public health risks, risk mitigations and residual risks of onshore unconventional gas activities;

(3) the coexistence of onshore unconventional gas activities with existing land and water uses, including —

(a) agricultural production and domestic and export market requirements;

(b) the legal rights of property owners and the impact on property values; and

(c) any implications for local and regional development, investment and jobs;

Environment and Planning Committee
(4) the ability of potential onshore unconventional gas resources contributing to the State’s overall energy sources including —

(a) an ability to provide a competitive source of energy and non-energy inputs for Victorian industries;

(b) an affordable energy source for domestic consumers; and

(c) carbon dioxide emissions from these sources;

(5) the resource knowledge requirements and policy and regulatory safeguards that would be necessary to enable exploration and development of onshore unconventional gas resources, including —

(a) further scientific work to inform the effective regulation of an onshore unconventional gas industry, including the role of industry and government, particularly in relation to rigorous monitoring and enforcement, and the effectiveness of impact mitigation responses; and

(b) performance standards for managing environmental and health risks, including water quality, air quality, chemical use, waste disposal, land contamination and geotechnical stability;

(6) relevant domestic and international reviews and inquiries covering the management of risks for similar industries including, but not limited to, the Victorian Auditor-General Office’s report Unconventional Gas: Managing Risks and Impacts (contingent upon this report being presented to Parliament) and other reports generated by the Victorian community and stakeholder engagement programs.

1.3 Scope of the Report

The Report investigates all aspects of the extensive Terms of Reference. In submissions and at public hearings the Committee also received evidence on matters concerning the exploration, extraction, production and rehabilitation for conventional gas. Conventional onshore gas is also subject to the current Victorian moratorium under which the unconventional gas industry has been halted. This Report makes mention of the conventional gas industry, however, the Committee has determined that this topic falls largely outside the Terms of Reference.

The Committee has also been able to make only passing examination of regulatory approaches overseas and interstate, for reasons explained in section 1.8 (below).

1.4 Submissions

The Environment and Planning Committee invited submissions by placing an advertisement in the Herald Sun and The Age on 12 June 2015, and in The Weekly Times on 17 June 2015. The Committee’s call for submissions was also placed on
the Parliament of Victoria’s website and announced through the Parliament’s Twitter account. The Committee wrote to 172 stakeholders advising them of the Inquiry and seeking input.

The closing date for submissions was 10 July 2015. The Committee acknowledges the relatively short time frame of less than four weeks during which submissions could be received. The Committee considered and granted requests for extensions on a case by case basis.

The Committee has received and published 1862 submissions. This is likely to be the largest number of submissions ever received by a Victorian Parliamentary committee. The submissions came from a range of stakeholders including farmers, environmental and community groups, the gas industry, manufacturers, academics, small business owners, scientists, state and local governments, and the general public. The vast majority of the submissions expressed concerns that an unconventional gas industry in Victoria could pose risks to prime agricultural land and water supplies.

The Committee thanks each person or organisation that made a submission or provided evidence to the Inquiry. The submissions and evidence have been considered in their entirety, however, with such a large number of submissions and evidence received, it has not been possible to quote from each one. Lists of submitters and witnesses are provided in Appendices 1 and 2.

The Committee received a Victorian Government inter-departmental submission on 3 August 2015. Subsequent to a question taken on notice at a public hearing on 18 August 2015, the Acting Secretary of the Department of Economic Development, Jobs, Transport and Resources confirmed that the submission had been prepared pursuant to the Premier’s 2002 Guidelines for making such submissions. The Committee believes that as a rule, Government contributions to Parliamentary Inquiries should reflect the diversity of views across Government that have input into an inter-departmental submission.

RECOMMENDATION 1: That the precursor internal submissions from Victorian departments and agencies that informed the whole-of-government inter-departmental submission to this Inquiry into unconventional gas be made public to inform the community of the different positions of departments and agencies.

1.5 Pro forma submissions

The Committee received 13 different pro forma submissions. The largest of these, facilitated by the Australian Greens website, was sent in by 679 individuals. In 549 cases the submission was identical. The Committee has ascertained that individual contact details were provided for every pro forma submission received.
Chapter 1 Introduction and conduct of the Inquiry

1.6 **Hearings and briefings**

On 23 June 2015, the Committee received an initial briefing from the Department of Economic Development, Jobs, Transport and Resources.

The Committee held public hearings in Sale in Gippsland on 30 June and 1 July 2015, in Melbourne at Parliament House on 22 July, 5 August, 18 August, and 6 October 2015, in Torquay on the Surf Coast on 12 and 13 August 2015, and in Hamilton in Western Victoria on 23 September 2015.

The Committee heard valuable evidence from 125 individuals at public hearings and would like to thank all the witnesses who gave up their time to present to the Committee. A list of witnesses is provided in Appendix 2.

The Committee is of the view that it would have been beneficial to conduct further public hearings throughout regional Victoria had time and funding permitted.

1.7 **Site visits**

On 1 July 2015, following the conclusion of the public hearings in Sale, the Committee visited the Wombat Gasfield at Seaspray with Lakes Oil and then visited the neighbouring farm of Mr and Mrs Flint.

On 30 October 2015, the Committee toured Qenos, a polyethylene manufacturing facility in Altona that uses natural gas in its production processes.

1.8 **Committee resources**

As stated in the Interim Report, the Committee believes that the resources provided for this Inquiry were inadequate, given that the topic is highly contested, scientifically complex and the Terms of Reference are the most extensive of any parliamentary inquiry on this topic in Australia.

The Inquiry generated a huge level of public interest and the secretariat processed and considered an unprecedented volume of submissions, documents, reports and correspondence. The Committee made a number of requests to the Government for administrative and research assistance; these were not met. However, on 17 August 2015, the Committee received approval to engage a hydrogeologist to assist with understanding some of the scientific evidence received relating to water.

It is unfortunate and in fact a significant shortcoming of the Inquiry that funding was not released to enable the Committee to travel. In submissions and at public hearings, the Committee heard various claims and reports about the actual experience of unconventional gas mining in other parts of Australia and overseas. On both sides of the debate, Inquiry participants referenced these other jurisdictions to illustrate points about co-existence between mining and
agriculture, the potential health and environmental impacts and the effects of the mining industry on local economies. For example, Councillor Brian Crook of the Colac Otway Shire Council informed the Committee that:

...since this form of mining has been in place in Queensland and New South Wales we are seeing problems through lack of regulation whereby we have our agriculture and water basins, aquifers et cetera put at risk. In Queensland it seems that it was almost a free-for-all and now we are witnessing what happens when things go wrong.¹

Similarly, in relation to Queensland, Mr Paul Fennelly from the Australian Petroleum Production and Exploration Association stated at a public hearing:

...if the budget permits, I strongly recommend that the inquiry visit Queensland and talk to farmers. Talk to farmers, talk to the agricultural groups — AgForce. They indicated to me the other day they have more members in support of gas than those who are neutral or not interested. Gas is accepted by the farming communities up there. It is not war; it is a cooperation; it is a negotiation. They have provided legal advice, technical advice and water baseline studies. I encourage the committee to get into Queensland and talk to these people.²

Both the Victorian Auditor-General’s Office and Professor Peter Cook of the Australian Council of Learned Academies drew the Committee’s attention to the regulatory system in Canada. Professor Cook stated that:

I think there are lessons to be learnt there from their approach to onshore gas, particularly in Alberta. It is a very mature sort of area in terms of the industry, and I think there are lessons to be learned there.³

The Committee would have benefited from visiting operating unconventional gas fields in these other jurisdictions to see matters first hand and to hear directly from communities and industry.

2 Background – What is unconventional gas?

2.1 Chapter overview

Chapter Two presents background information on unconventional gas. It explains the difference between conventional and unconventional natural gas, and describes the geological characteristics of coal seam, shale and tight gas. It also provides a brief explanation of the identified potential risks posed by unconventional gas extraction and how the industry is regulated. It then provides a short summary of the history of unconventional gas activity in Victoria and lists key events in the regulation of unconventional gas both at the federal and the Victorian state levels.

2.2 The difference between conventional and unconventional gas

Coal seam gas, shale gas and tight gas are forms of unconventional natural gas. Natural gas is a fossil fuel that consists mostly of methane and can be found in a variety of geological settings. Natural gas is a major source of energy in Victoria and is used for home heating and cooking, manufacturing, and generating electricity. The term ‘unconventional gas’ refers to natural gas that is found in different geological settings from conventional gas, and is harder to extract from the ground than conventional natural gas.4

It is important to emphasise that it is the type of rock and the degree of difficulty involved in extracting the gas which define whether the gas is conventional or unconventional, and not the composition of the gas itself. All natural gas is composed predominantly of methane.5 As the Australian Petroleum Production & Exploration Association (APPEA) explains in their submission to the Committee, the key difference between conventional and unconventional natural gas is the ‘manner, ease and cost’ involved in extracting the gas.6

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5 Ibid.

2.3 Conventional gas

Conventional gas is natural gas that is easier to access and extract. Typically, conventional gas reservoirs are found in sandstones and limestones with high porosity and high permeability. The term ‘porosity’ refers to the spaces or ‘pores’ in the rock in which water or gas can be found. The higher the porosity, the greater the amount of water or gas that may be contained in the rock. The term ‘permeability’ refers to the level of interconnectivity between the pores in a rock (a characteristic that allows gas to flow through rock). Conventional gas found in these porous and permeable sedimentary rocks is trapped in place by layers of impermeable ‘seal’ rocks. When a well is drilled through the impermeable rock to reach the conventional gas reservoir, the gas is able to flow into the well relatively easily.

Victoria’s conventional natural gas is sourced from the offshore parts of the Gippsland and Otway Basins, and to a lesser extent from the Bass Basin which is located entirely offshore. Conventional gas was also sourced onshore in the Port Campbell Embayment (part of the Otway basin) from 1986 until 2006 when the discovered commercially viable natural gas was depleted. The history of conventional natural gas in Victoria is discussed in Chapter Three.

2.4 Unconventional gas

It is expected that reserves of conventional natural gas will run out in coming decades and this is in part driving the exploration for the more difficult to access, and costly to produce, ‘unconventional’ natural gas. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) explains that unconventional gas is ‘generally produced from complex geological systems that prevent or significantly limit the migration of gas and require innovative technological solutions for extraction’.

Advances in mining technology have aided the commercial viability of extracting unconventional gas. Horizontal drilling techniques developed in the United States since the mid-1980s have made it easier to reach unconventional deposits. The practice of hydraulic fracturing or ‘fracking’ (sometimes also called ‘fraccing’) has increased the productivity of unconventional wells. Fracking involves injecting fluid made of water, sand and chemicals down a well at high pressure to ‘fracture’ the rocks and allow the gas to flow more easily.

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Identified potential risks of the fracking process include increased connectivity between different geological layers, the contamination of water resources, and the risk of spills when fracking fluids flow back to the surface. Stakeholder groups have different views on whether these risks can be adequately managed. A significant amount of evidence received by the Committee focused on the potential risks of fracking — this is discussed in more detail in Chapter Four. It is important to emphasise that coal seam gas wells do not always require fracking. Shale gas and tight gas wells do often require fracking.

A summary of the different characteristics of coal seam gas, shale gas and tight gas is provided below, and a more technical description of the difference between conventional and unconventional gas and the use of hydraulic fracturing is provided in Appendix 3.

2.4.1 Coal seam gas

Coal seam gas (CSG) is natural gas found in coal seams at depths of approximately 300 to 1000 metres underground. The CSG is trapped underground by water pressure. To extract the CSG, a well is drilled into the coal seam and the water is pumped out to release the gas. This water — known as ‘produced water’ or ‘formation water’ — is then separated from the gas at the surface.

The produced water can be saline and contain chemicals from fracking fluids or naturally occurring hazardous materials mobilised by the extraction process (known as geogenic materials). The produced water generally requires treatment and extracted salt and/or chemicals and geogenic materials need to be disposed of. It is also important to note that the quantities of produced water can be very large.

Coal seams are less permeable than conventional gas systems and the gas does not flow as easily, which means that more wells are required to develop a CSG field than a conventional gas field. It is also often necessary to drill horizontal wells and, as stated above, in some instances to fracture the well to increase the flow of gas.

Coal seam gas is commercially produced in Queensland and New South Wales and is the most established kind of unconventional gas production in Australia. Significantly, Queensland and New South Wales have black coal deposits whereas Victoria has predominantly brown coal deposits. This matter is discussed in more detail in Chapter Three of this Report.

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Additionally, it is also important to note that because coal seam gas is the most established kind of unconventional gas production in Australia and hence the most well-known, it is common for people to talk just about ‘coal seam gas’. In Victoria, however, there is also potential for shale and tight gas.

2.4.2 Shale gas

Shale gas is found in shale rock layers at depths of about 1000 to 3000 metres. Shale rock has very low porosity and permeability. It is much harder and deeper underground than coal seams. Fracking is often used in shale gas wells to facilitate the flow of gas. Shale gas producers also usually employ horizontal drilling to gain maximum exposure to the deposit.

Notably, shale gas extraction requires larger quantities of water for fracking than CSG extraction does, but it does not create the large quantities of ‘produced water’. More wells are required to develop a shale gas resource than a conventional gas resource.

The United States has an established shale gas industry which has grown rapidly since the early 2000s. In Australia, the shale gas industry is in its infancy with the first shale gas well successfully producing gas in the Cooper Basin in South Australia in 2012. An Australian Council of Learned Academies study, chaired by Professor Peter Cook, who appeared as a witness for the Committee, suggests that shale gas may be present in large quantities in the Otway Basin but that it is not yet known if it will be commercially viable to extract it.

2.4.3 Tight gas

Tight gas is natural gas that is trapped in compacted sandstones or limestones that are relatively impermeable and non-porous (also known as ‘tight sand’). Tight gas occurs at depths greater than 1000 metres. It is called tight gas because it is tightly constrained within very hard rock formations.

The CSIRO explains that the pores in the rock that contain the tight gas are ‘miniscule’ and that ‘the interconnections between them are so limited that the gas can only migrate through it with great difficulty’. All methods to increase the productivity of tight gas deposits are usually employed, including fracking and horizontal drilling. Tight gas, like shale gas, requires relatively large amounts of
Chapter 2 Background – What is unconventional gas?

Gas from both conventional and unconventional sources is a naturally occurring hydrocarbon, mostly methane, but can also contain ethane, propane, butane and pentanes. Sulphur compounds, nitrogen, carbon dioxide, water and other substances may also be present, often in significant amounts.

Gas is found in conventional or unconventional reservoirs. Gas in unconventional reservoirs can be described as tight, shale or coal seam gas (Figure 1).

The majority of oil and gas produced across the globe comes from conventional reservoirs. This is also the case in Victoria, where all natural gas production to date is from conventional reservoirs. The majority of natural gas discovered and produced to date in Victoria has been from the offshore portion of the Gippsland Basin, with smaller but significant volumes from the offshore Otway Basin. Relatively smaller gas fields were discovered and produced between 1986 and 2006 in the onshore Otway Basin. Three discovered fields remain that have not been produced.

Figure 1 provides a diagram that illustrates the different geological settings of conventional and unconventional gas deposits:

Figure 2.1 Examples of conventional and unconventional gas deposits


2.5 Potential environmental impacts of unconventional gas extraction

The body of available literature on unconventional gas, government reviews, and evidence received by the Committee identify a number of potential risks posed by unconventional gas extraction. These risks centre on potential impacts on water resources which could affect agriculture and the environment more broadly, and potentially human health. Identified potential risks also include impacts to the surface environment from the industrial infrastructure associated with

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unconventional gas extraction such as clearing of bushland, fragmentation of native habitat, spread of weeds and increased risk of bushfires.\textsuperscript{31} Chapter Four of the report focuses on the risks potentially posed by the industry.

Government initiated reviews from some jurisdictions, and the report of the Gas Market Taskforce in Victoria, have concluded that these risks can be managed if regulatory frameworks for industry are improved, monitored and enforced.\textsuperscript{32} Two of these documents – the \textit{National Harmonised Regulatory Framework for Natural Gas from Coal Seams} and the Gas Market Taskforce report – are briefly discussed in the next sections of this Report, which provide a short overview of the regulation of unconventional gas extraction, the history of unconventional gas activity in Victoria, and the evolution of government policy.

\section*{2.6 Regulating unconventional gas extraction}

In Australia, it is the state and territory governments that have responsibility for the regulation of onshore mineral and petroleum resources, including unconventional gas. State and territory responsibilities include licensing mineral and petroleum exploration and development, setting conditions on licences, assessing environmental impacts and monitoring and enforcing industry adherence to regulation. The states and territories also collect royalties from mineral and petroleum production.\textsuperscript{33}

In Victoria, the licensing for exploration and production of CSG is regulated under the \textit{Mineral Resources Sustainable Development Act 1990} (the Minerals Act). Licensing for the exploration and production of shale and tight gas is regulated under the \textit{Petroleum Act 1998} (the Petroleum Act). Victoria is different to other states in that it regulates unconventional gas through two Acts. In other states CSG is regulated under petroleum legislation.\textsuperscript{34}

The Minister for Energy and Resources, through the Earth Resources Regulation Branch of the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) administers these Acts and their regulations. The regulation of unconventional gas in Victoria is discussed in detail in Chapter Seven of this Report.

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2.7 History of unconventional gas activity in Victoria and Government policy

As will be discussed in more detail in Chapter Three, activity relating to a potential unconventional gas industry in Victoria is at an early stage. It is not yet known whether there is unconventional gas in this state that would be commercially viable to produce. The highest potential for unconventional gas lies in the Gippsland and Otway Basins. From 2000 to the early 2010s, Victorian Governments issued companies with exploration licences to search for unconventional gas. Exploratory drilling and some hydraulic fracturing were undertaken.35

2.7.1 The National Harmonised Regulatory Framework

In late 2011, community concerns over the development of the CSG industry in Queensland and New South Wales – regarding potential environmental, health and social impacts – led to the then COAG Standing Council on Energy and Resources (SCER) determining to develop a regulatory framework for the industry.36

‘The National Harmonised Regulatory Framework for Natural Gas from Coal Seams’ was completed in May 2013.37 It identified 18 ‘leading practices’ that can be adopted by regulators to best manage the CSG industry, with particular focus on the ‘core areas’ of ‘well integrity, water management and monitoring, hydraulic fracturing and chemical use.’38 In regard to other forms of unconventional gas, the SCER stated that ‘some of the approaches to leading practice advocated in the Framework may have applicability to other oil and gas activities like shale and tight gas.’39 The Framework is of ongoing relevance because the 18 leading practices continue to be used to represent regulatory ‘best practice’ for the CSG industry and are referred to in reviews and reports.

However, two further points are worth noting. Firstly, as noted by the SCER, the practices relate to coal seam gas, so further work would be necessary to consider their applicability in the Victorian context, in which coal seam gas is unlikely to generate an industry in the short term. Secondly, the Committee believes that Victoria should strive for international best practice, rather than settling for practices determined at the COAG level.

38 ibid., pp. 7-8.
39 ibid., p. 9.
2.7.2 The National Partnership Agreement

The COAG ‘National Partnership Agreement on Coal Seam Gas and Large Coal Mining Development’ was made between the Commonwealth, New South Wales, Victorian, Queensland, South Australian and Northern Territory governments in 2012.\(^{40}\) The stated purpose of the National Partnership Agreement was to ‘strengthen the regulation of CSG and large coal mining development by ensuring that future decisions are informed by substantially improved science and independent expert advice’.\(^{41}\)

As part of the Agreement, the Commonwealth established the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Developments (the IESC) under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). The role of the IESC is to improve the science base and provide advice on the impact of coal seam gas and coal mining on water resources.\(^{42}\)

One of the tasks of the IESC is to facilitate ‘Bioregional Assessments’ of the groundwater and ecology in regions with potential for CSG or coal mining.\(^{43}\) Victoria, as a signatory to the Agreement, received funding to undertake a Bioregional Assessment of the Gippsland Basin (which is currently being conducted).\(^{44}\)

The funding received from the Commonwealth Government totalled $10.13 million. The Victorian Department of Economic Development, Jobs, Transport and Resources informed the Committee that as at 31 August 2015, $3.86 million remained taking account of actual and committed expenditure on projects.\(^{45}\) It is not clear to the Committee how the remaining funding is intended to be spent.

2.7.3 The Victorian moratorium

In August 2012, the Victorian Coalition Government announced a hold on approvals to undertake fracking as part of onshore gas exploration and on the issuing of new exploration licences for CSG, until the National Harmonised Regulatory Framework had been completed and considered.\(^{46}\) A ban on the use of BTEX compounds in hydraulic fracturing was also announced at this time, (discussed further in section 2.7.6) In the media release announcing the reforms, the then Minister for Energy and Resources, the Hon. Michael O’Brien, also stated

\(^{40}\) See: Council of Australian Governments (2012) *National Partnership Agreement on Coal Seam Gas and Large Coal Mining Development*.


\(^{42}\) ibid., pp. 13-15.

\(^{43}\) ibid., pp. 8, 13-14.


\(^{45}\) A. Harris, Acting Secretary, Department of Economic Development, Jobs, Transport and Resources, Answer to question taken on notice 18 August 2015, received 23 September 2015.

that work was underway to determine the Victorian based scientific studies to be funded by the National Partnership Agreement, in addition to the IESC’s Gippsland regional scale study.\(^{47}\) The continuation of the moratorium is detailed in sections 2.7.5 and 2.7.8.

### 2.7.4 The Gas Market Taskforce Report

In December 2012, the Victorian Government established the Gas Market Taskforce which was chaired by the former Federal Government Minister, the Hon. Peter Reith, and consisted of industry representatives. The Taskforce was asked ‘to provide policy options to the Victorian Government on improving the operation and efficiency of the eastern Australian gas market, suggesting ways of facilitating market transparency and transmission capability, and increasing gas supply to meet rising demand at competitive prices’.\(^{48}\)

In November 2013, the Taskforce presented its final report and recommendations – sometimes called the ‘Reith Report’ – and recommended that the Government proactively support the development of an onshore gas industry in Victoria and lift the holds on fracking and the approval of new CSG exploration licences. The report further recommended that the regulations underpinning onshore gas exploration and development be strengthened, particularly by the full implementation of the 18 leading practices outlined in the National Harmonised Regulatory Framework.\(^{49}\)

### 2.7.5 Continuation of moratorium, announcement of community consultation and water science studies

The then Premier of Victoria, the Hon. Denis Napthine, announced in late November 2013 that the Government would seek public feedback on the Gas Market Taskforce report, and conduct a formal community consultation process on issues surrounding onshore gas from April 2014 to July 2015, during which time the moratorium on hydraulic fracturing would remain in place.\(^{50}\)

The then Deputy Premier, the Hon. Peter Ryan, further explained that the moratorium would also extend to the issuing of new coal seam, shale and tight gas exploration licences until at least July 2015.\(^{51}\) Water science studies of both the Gippsland and Otway Basins were also announced at that time.\(^{52}\)

\(^{47}\) ibid.
\(^{49}\) ibid., pp. 1, 4-8.
In April 2014, the former Department of State Development, Business and Innovation engaged consulting firm ‘The Primary Agency’ to conduct the 12 month community and stakeholder engagement program.\textsuperscript{53}

\subsection*{2.7.6 Statutory ban of the use of BTEX compounds in hydraulic fracturing}

In September 2014, the Victorian Parliament passed the \textit{Resource Legislation Amendment (BTEX Prohibition and Other Matters) Act 2014}, which imposed a restriction on the use of BTEX compounds in hydraulic fracturing in Victoria. The acronym ‘BTEX’ refers to ‘benzene, toluene, ethylbenzene, and xylene’, which are compounds found in petroleum products that are known to be harmful to human health.\textsuperscript{54} The Victorian Government inter-departmental submission to the Inquiry notes that BTEX compounds can also ‘occur naturally within the vicinity of natural gas and petroleum deposits.’\textsuperscript{55} BTEX compounds are further discussed in section 4.2.3.

\subsection*{2.7.7 Publication of community consultation report}

In April 2015, The Primary Agency published its \textit{Report on Community and Stakeholder Attitudes to Onshore Natural Gas in Victoria}.\textsuperscript{56} The Primary Agency stated in the report that it had sought to capture the views of Victorians on issues surrounding an onshore natural gas industry in Victoria, and had engaged ‘with some 2000 community attendees at open days, key stakeholder meetings, discussion groups and community panels’, as well as undertaking a quantitative phone survey of a sample of 960 people from different parts of the state.\textsuperscript{57} The report divided the views of community members and stakeholders into three cohorts: those who do not support the industry, those who do, and those that are undecided, and outlined the typical reasoning behind each of the viewpoints.\textsuperscript{58}

\subsection*{2.7.8 Committee Inquiry and extension of moratorium}

The Victorian Labor Party went to the November 2014 state election with a policy to hold a Parliamentary Committee inquiry into unconventional gas.\textsuperscript{59} The Government also stated that the moratorium ‘will remain for all onshore gas activities including exploration, drilling and hydraulic fracturing’ until the Committee reports to Parliament in December 2015.\textsuperscript{60}

\textsuperscript{57} ibid., p. 1.
\textsuperscript{58} ibid.
\textsuperscript{60} ibid.
2.7.9 **Publication of water science studies**

In early August 2015, the Government released the completed water science studies of the Otway and Gippsland Basins, which are intended to ‘help provide a better understanding of the potential impacts of any onshore gas development on Victoria’s water resources’.

The water science studies were undertaken by the Department of Environment, Land, Water and Planning (DELWP) and the Geological Survey of Victoria (part of DEDJTR). They are distinct from the bioregional assessment of the Gippsland Basin that is being undertaken as part of the National Partnership Agreement by the IESC, which is due for completion in June 2016. However, the Victorian Government’s inter-departmental submission to the Committee states that the groundwater data from the Gippsland Basin bioregional assessment was used in the water science studies.

The Victorian Government’s inter-departmental submission also states that the water science studies provide an ‘initial screening analysis’ of potential impacts of unconventional gas extraction on water resources, and that ‘there are known gaps in the geological and hydrogeological data sets’. The water science studies and further knowledge requirements are discussed in detail in Chapter Six of this Report.

The Government additionally states that it is also undertaking geophysical studies of the Gippsland region to provide more information about underground rock layers. The results of seismic studies were not available to the Committee and are forthcoming in early 2016. A report on the Gippsland gravity survey was released with the water science studies in August 2015.

2.7.10 **VAGO Report – Unconventional Gas: Managing Risks and Impacts**

The Victorian Auditor-General’s Office (VAGO) report titled *Unconventional Gas: Managing Risks and Impacts* was tabled on 19 August 2015. The self-initiated report examines the State’s preparedness to effectively respond to potential impacts if an unconventional gas industry proceeds in Victoria.

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63 ibid.

64 ibid., p. 93.


67 See: Victorian Auditor-General’s Office (2015) Unconventional Gas: Managing Risks and Impacts. Note: references to the VAGO report on unconventional gas are stated as ‘VAGO (2015) op. cit.’ and the page number provided. References to the VAGO Transcript of Evidence provided to the Committee are identified as such.
VAGO reviewed the approaches of the relevant government departments – DEDJTR and DELWP – since 2000 to understand and manage unconventional gas. VAGO found that Victoria’s current regulatory system is ill-equipped to respond effectively to the specific risks arising from unconventional gas activities. The report states that other jurisdictions have amended their regulatory systems to address unconventional gas activities, but that this has not occurred in Victoria. 68

The VAGO report makes a number of recommendations on how to improve the regulatory system to better address the specific risks posed by unconventional gas activities, if the industry is to proceed in this State. The recommendations include the full implementation of the previously mentioned 18 leading practices of the National Harmonised Regulatory Framework. 69 The VAGO report and its recommendations are discussed in more detail in Chapter Seven of this Report.

The VAGO report is the most recent development in the timeline of events surrounding unconventional gas in Victoria, and concludes this short overview of the history of unconventional gas activity in the State and the evolution of government policy. The next chapter of this Report considers Victoria’s prospectivity for commercial sources of unconventional gas.

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69 ibid., pp. xvi - xviii.
Chapter Three considers matters relating to the prospectivity of Victoria’s geology for commercial sources of onshore unconventional gas. At present, exploration for unconventional gas in Victoria is at a very early stage. It is clear that there are deposits of unconventional gas, but it is not known whether the gas is commercially viable to extract.

The areas of Victoria where unconventional gas is most likely to be located are the Gippsland and Otway Basins. Most of the Gippsland and Otway Basins are located offshore in Bass Strait, with a smaller portion located onshore. It may be that unconventional gas could be located under the seabed, but at this point in time the technology does not exist that would make it commercially viable to locate and extract unconventional gas offshore.

From 2000 to 2014, prior to the extension of the moratorium, gas exploration companies (often called ‘explorer companies’) looked for unconventional gas onshore in the Gippsland and Otway Basins. The most significant outcome of this activity was the explorer company Lakes Oil’s discovery of tight gas in Gippsland in 2004. It is not known, however, whether the tight gas found by Lakes Oil can be commercially produced.

Chapter Three starts by providing some context to the discussion of prospectivity. It explains how gas resources and reserves are classified and measured. It looks at Victoria’s conventional gas reserves, and unconventional gas reserves in other Australian jurisdictions.

The Chapter then provides a short history of exploration for unconventional gas in the Gippsland and Otway Basins and includes maps that show the historical and current exploration licences and permits over the regions. The Chapter draws on the reports on the prospectivity for conventional and unconventional gas for both the Gippsland and Otway regions produced by DEDJTR and authored by geologist, Dr Louise Goldie Divko. These reports form part of the water science studies commissioned by the Victorian Government to better understand the potential impacts of an unconventional gas industry.

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Chapter Three concludes with a presentation of the views of stakeholders on the prospectivity for commercial quantities of unconventional gas in Victoria. It focuses on the views of Lakes Oil, Ignite Energy and Mecrus Resources, as they are the three explorer companies who state that they may have found commercially viable sources of unconventional gas.\(^7\)

**Figure 3.1 Areas of Victoria where unconventional gas may prospectively be located**

![Areas of Victoria where unconventional gas may prospectively be located](image)


### 3.2 Gas classification system

Petroleum resources and reserves – which include conventional and unconventional natural gas – are classified according to a system created by the Society of Petroleum Engineers.\(^7\) The classification system works on a continuum from an untested estimate toward commercial production. The Australian Council of Learned Academies (ACOLA) study of shale gas, chaired by Professor Peter Cook (henceforth referred to as ‘the ACOLA report’), provides a simplified explanation of the difference between ‘resources’ and ‘reserves’:

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71 Mecrus Resources is primarily targeting oil shale, but states that gas may also be present with the oil shale. See: Mecrus Resources (2015) *Transcript of Evidence*, 23 September, pp. 15-16.

If the quantity of gas in the field is poorly known, perhaps only in a very speculative way, then it is likely to be classed as a resource. If it is known with great confidence because it has been extensively drilled and tested and it is very likely to be economic to extract the gas, then the quantity of gas in the field is referred to as a reserve.73

Dr Goldie Divko, the author of DEDJTR’s prospectivity reviews, explains that there are two categories of resources. The lowest category is called a ‘prospective resource’ which means an estimate based on geological data but not yet actually discovered.74 The higher category is called a ‘contingent resource’ which is used when recoverable gas is actually discovered, and may be commercially viable to extract once certain contingences are satisfied (such as legal, logistical and technical issues).75

The highest category is then the ‘reserve’ which is used when the gas is shown to be commercially recoverable. Dr Goldie Divko summarises: ‘an undrilled prospect may be quantified with a prospective resource, if successful and whilst under evaluation it may contain a contingent resource, and once all the hurdles toward commercial production are cleared it may be considered a reserve.’76

The system of resources and reserves is often depicted as a triangle, with the base of the triangle representing the large untested gas resource which may not be commercially viable, and the apex representing the usually much smaller, but commercially significant reserve.77 Figure 3.2 provides an example of the triangle diagram showing the concept of resources and reserves:

**Figure 3.2** System of resources and reserves


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75 ibid.
76 ibid.
Dr Goldie Divko’s prospectivity reviews of the Gippsland and Otway regions state that, at present, Victoria has no reserves of unconventional gas.\(^{78}\) The Gas Market Taskforce report similarly communicated that:

Presently, all forms of unconventional natural gas (in shale, tight and coal seam formations) in Victoria are at an early stage of exploration and there is a lack of key information to estimate potential resource sizes. There is no production, commercial reserves or identified reserves of unconventional gas in Victoria.\(^{79}\)

Gas resources and reserves are measured in a number of ways including by energy (petajoules) and volume (cubic feet or metres). One petajoule equals \(10^{15}\) joules. Cubic feet and metres of gas are measured in the billions (‘bcf’ and ‘bcm’) and trillions (‘tcf’ and ‘tcm’).\(^{80}\)

Additionally, the terms economic demonstrated resource or ‘EDR’ and sub-economic demonstrated resource or ‘SDR’ are also sometimes used. EDR means the quantity of resources that is judged to be economically extractable under current market conditions with current technology. SDR are similar to EDR in terms of certainty of occurrence but are considered to be potentially economic only in the foreseeable future.\(^{81}\)

### 3.3 Victoria’s conventional gas reserves

Victoria has large conventional gas reserves located in Bass Strait, which were first discovered in 1965 through a joint venture between BHP and ESSO. In 1969, the first gas from Bass Strait was piped to Melbourne, via the Longford processing plant near Sale.\(^{82}\) Ray Proudley writes in his history of the gas industry in Victoria that during the 1970s ‘natural gas pipelines spread throughout the State, and town after town was incorporated into the transmission system supplied from the Bass Strait production platforms.’\(^{83}\) Further gas fields in Bass Strait were discovered over the following decades, and today, Victoria is the second largest producer of conventional gas after Western Australia.\(^{84}\) Australia’s conventional gas basins are shown in Figure 3.3 below. These significant offshore reserves mean that Victoria is a large consumer of gas and has well developed gas infrastructure.\(^{85}\)

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\(^{80}\) Ross & Darby (2013) op. cit., p. 9.


\(^{82}\) In the early 1960s, BHP secured acreage across much of the offshore Gippsland Basin and established a partnership with ESSO (later ExxonMobil) to search for oil and gas. In 1965, BHP and ESSO drilled the first well in Bass Strait and discovered the Barracouta gas field; further gas reservoirs were located in 1966 (and oil was discovered in 1967). In 1969, the first gas from Bass Strait was piped to Melbourne, via the Longford processing plant near Sale. See: BHP Billiton (2015) ‘Our History: Petroleum in the Bass Strait’, BHP Billiton website, p. 4; Gas Market Taskforce (2013) *Gas Market Taskforce: Supplementary Report*, op. cit., p. 6.


\(^{84}\) Ross & Darby (2013) op. cit., p. 6.

Most of Victoria’s conventional gas comes from the offshore Gippsland Basin, with some coming from the offshore Otway Basin, and a minor amount coming from the Bass Basin (which is located entirely offshore in Bass Strait). 86 The gas is extracted by major energy companies including BHP Billiton, ExxonMobil, Origin and Santos. The VAGO report on unconventional gas states that DEDJTR ‘has calculated that the production from offshore gas fields in Victoria is worth approximately $1.5 billion annually.’ 87

There has been significant exploration for onshore conventional gas reserves in Victoria since the 1950s. 88 No conventional gas has been found in the Gippsland region. In 1959, conventional gas was discovered near the Port Campbell township in the onshore Otway Basin. Dr Goldie Divko states that exploratory wells were then drilled across the onshore Otway Basin in the 1960s. From the late 1970s

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87 VAGO (2015) op. cit., p. 5.
until 2006 (particularly between 1986 and 2006) the Port Campbell Embayment was an active onshore gas producing region, until the discovered commercially viable gas was depleted.\textsuperscript{89} Notably, in 2014, Origin Energy drilled an exploration well called ‘Speculant-1’ onshore in Nirranda South (about 30 kilometres south-east of Warrnambool) targeting conventional gas reservoirs in the offshore Otway Basin. The well is using extended-reach horizontal drilling technology to access gas fields located approximately five kilometres offshore and up to 2000 metres under the sea floor.\textsuperscript{90} Stakeholders have differing views of whether the Minister’s approval for the project was appropriate given the moratorium on onshore gas exploration.\textsuperscript{91}

### 3.4 Unconventional gas in other Australian jurisdictions

In regard to unconventional gas in other Australian jurisdictions, coal seam gas is the only unconventional gas that is being commercially produced at this time. CSG has been commercially produced in Queensland since 1996 and in New South Wales since 2001. Exploration for CSG has occurred and continues in other states.

There is also exploration for shale and tight gas across Australia but no commercial production at the present time. There are no identified reserves of tight gas in Australia (Lakes Oil’s discovery of tight gas in Gippsland is classed as a prospective resource). Santos announced in 2012 that it had successfully extracted shale gas from a well in the Cooper Basin in South Australia.\textsuperscript{92} Geoscience Australia states that Santos ‘booked the first shale gas reserves’ of two to three petajoules on the results of production from that well.\textsuperscript{93}

Coal seam gas in Queensland and New South Wales is extracted from black coal formations. Geoscience Australia states that the majority of identified CSG reserves are in Queensland in the Surat and Bowen Basins, with smaller amounts in the Clarence-Moreton Basin on the border of Queensland and New South Wales, and in the Gunnedah, Gloucester, and Sydney Basins in New South Wales. These basins and identified gas reserves are depicted in Figure 3.4 below:

\textsuperscript{91} See for example: Lakes Oil (2015) \textit{Transcript of Evidence}, 6 October, p. 16. Mr O’Brien of Lakes Oil stated that: ‘Origin was allowed to drill their directional horizontal well from onshore to offshore, 12 kilometres down the road, but we were not allowed to drill ours. This inconsistency is giving a lot of uncertainty for the area. We have recently had some large industry conferences in town where people just cannot understand why one has been allowed and not the other. There is just no scientific reasoning for it.’
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Figure 3.4 Location of Australia’s coal seam gas reserves

- The commercial production of CSG in Queensland has grown significantly in recent years as shown in Table 3.1 below. Energy companies extracting CSG in Queensland include Santos, Origin and QGC (previously Queensland Gas Company), which is part of the BG Group (formerly British Gas). Growth in the Queensland CSG industry has led to the development of export facilities at the Port of Gladstone on the mid-Queensland Coast, so that CSG can be exported to lucrative overseas markets in the form of liquefied natural gas or ‘LNG’. This is an important development because it is affecting the operation of the eastern Australian gas market and is discussed in detail in Chapter Eight of this Report. Commercial production of CSG in New South Wales is on a smaller scale than in Queensland. Energy Companies involved in the CSG industry in New South Wales include AGL and Santos.

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### Table 3.1

<table>
<thead>
<tr>
<th>State</th>
<th>2010-11</th>
<th>2011-12</th>
<th>2012-13</th>
<th>2013-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>QLD Total</td>
<td>322</td>
<td>336</td>
<td>312</td>
<td>342</td>
</tr>
<tr>
<td>• Conventional</td>
<td>78</td>
<td>70</td>
<td>36</td>
<td>40</td>
</tr>
<tr>
<td>• Coal Seam Gas</td>
<td>244</td>
<td>266</td>
<td>276</td>
<td>302</td>
</tr>
<tr>
<td>NSW Coal Seam Gas</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>VIC Conventional</td>
<td>42</td>
<td>23</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>SA Conventional</td>
<td>54</td>
<td>59</td>
<td>76</td>
<td>66</td>
</tr>
<tr>
<td>WA Conventional</td>
<td>1280</td>
<td>1283</td>
<td>1558</td>
<td>1604</td>
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<tr>
<td>NT Conventional</td>
<td>24</td>
<td>27</td>
<td>26</td>
<td>27</td>
</tr>
<tr>
<td>Australia</td>
<td>2208</td>
<td>2112</td>
<td>2419</td>
<td>2456</td>
</tr>
</tbody>
</table>

*Source: Department of Industry and Science (August 2015) Australian Energy Statistics, Table R, Canberra.*

### 3.5 Unconventional gas in Victoria – Geology

In Victoria, the onshore portions of both the Gippsland and Otway Basins have been identified as regions where unconventional gas may prospectively be found. Notably, this does not guarantee that the unconventional gas is actually there, or if it is there, that it would be commercially viable to extract. Rather, it means that the geology of these areas is such that it is possible that unconventional gas may be there.

The different layers of rock in the onshore portions of the Gippsland and Otway Basins have geological names and the description of different geological layers is called ‘stratigraphy’. In both basins there are particular stratigraphic groups which are most likely to hold deposits of unconventional gas.

The Gippsland Basin extends along the southeast coast and offshore of Victoria and contains a thick sequence of Cretaceous and Tertiary age rocks. The three main stratigraphic groups, from oldest to youngest, are the Strzelecki, Latrobe and Seaspray Groups as described by Dr Goldie Divko as follows:

> ...three broad stratigraphic successions across Gippsland (based on lithological variations) are generally recognised. These stratigraphic groups comprise (a) the Strzelecki Group, a thick sequence of non-marine volcanoclastic rich sediments; (b) the Latrobe Group, a sequence of marine and non-marine siliciclastics that host all the known hydrocarbon occurrences in the offshore Gippsland Basin; and (c) the Seaspray Group, a carbonate-dominated succession that is the regional seal to the top Latrobe Group oil and gas accumulations.\(^\text{95}\)

Of these groups, the Strzelecki and Latrobe Groups are considered the most comparatively prospective for gas.\(^\text{96}\)

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\(^{96}\) ibid., p. 5.
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The Otway Basin extends for 500 kilometres along the south-west coast of Victoria, across into South Australia and offshore.\(^97\) Within the Otway Basin, six main stratigraphic groups have been identified, which include the: Otway, Sherbrook, Wangerrrip, Nirranda, Heytesbury and Bridgewater Bay Groups.\(^98\) Dr Goldie Divko states that within this regional stratigraphic sequence the Cretaceous and Jurassic aged Waarre Formation, Pretty Hill Formation, Eumeralla Formation, Casterton Formation and Killara coal measures have the most potential for gas.\(^99\)

### 3.5.1 Coal seam gas and brown coal

Significantly, as was mentioned in Chapter Two, Victoria has predominantly brown coal deposits, as opposed to the substantial black coal deposits in Queensland and New South Wales, and this may impact on the prospectivity of coal seam gas in this State. As the Victorian Parliamentary Library research paper on unconventional gas explains:

> In regard to Victoria’s potential coal seam gas resources, it is important to note that the production of CSG in Queensland and New South Wales is from black coal deposits (bituminous and sub-bituminous coals). The kind, or rank, of coal is an integral factor in determining the gas properties of coal seams. It may be that Victoria’s brown coal (lignite) deposits yield less coal seam gas than black coal deposits. It may also be the case that if there is coal seam gas in Victoria’s brown coal deposits it may be harder to extract and hence more costly to produce than CSG from black coal deposits.\(^100\)

The VAGO report on unconventional gas states that there is no commercial production of CSG from brown coal anywhere in the world.\(^101\) It was submitted to the Committee that CSG is commercially produced from brown coal in the Powder River Basin in the United States and that this could provide a model for Victoria.\(^102\) The Committee found, however, that there is insufficient evidence to confirm this and that it is unlikely to be the case. Research undertaken by the Committee suggests that the coal in the Powder River Basin is sub-bituminous (black) not lignite (brown).\(^103\) Mr Dane Stewart, a geologist from Ignite Energy Resources (the company targeting CSG in Gippsland’s brown coal), similarly stated to the Committee that the coal in the Powder River Basin is ‘sub-bituminous’ coal.\(^104\)

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98 ibid., p. 16.
99 ibid., p. 5.
102 Latrobe City Council (2015) Submission 354: Appendix 1: MWH (October 2012) *Report: Briefing Paper on Coal Seam Gas in the Latrobe Valley*, Prepared for Latrobe City Council, p. 12. The report states that: ‘In Australia, all CSG projects involve extraction of gas from black coal reserves and it has been assumed in this study that exploration in Latrobe City and vicinity is targeting CSG from brown coal reserves. It is less likely but possible that CSG could be extracted from brown coal, as there is at least one case where viable extraction of CSG from brown coal has been achieved on a large scale in the United States (Powder River Basin).’
103 Briefing provided by the Energy and Environment Research Center, University of North Dakota.
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A number of submissions to the Committee state that there is unlikely to be commercial quantities of CSG in Victoria. Mr Rob Annells, Chairman of Lakes Oil said that in his personal opinion he doubts whether there is any CSG in Victoria. Mr Tim O’Brien, of Lakes Oil, has similarly stated to the Committee that: ‘A lot of the focus has been on coal seam gas, which is probably the least likely resource to be produced in Victoria’. The VAGO report on unconventional gas states that ‘Greater possibilities appear to exist for tight and shale gas than CSG, which would make some of the risks and considerations, and even the footprint on the landscape, different from the experiences in Queensland and New South Wales.’

3.6 Unconventional gas in Victoria – History of exploration

Exploration for unconventional gas in Victoria was contemplated during the 1980s and 1990s but properly began around the year 2000. As stated earlier in this Report, licensing for the exploration of CSG is regulated under the Minerals Act and licensing for the exploration of tight and shale gas is regulated under the Petroleum Act.

The VAGO report states that between 2000 and 2014, at least 100 active licences allowed exploration for unconventional gas in Victoria, which often included multiple work plans under the one licence and a range of exploration activities including seismic surveys, drilling for rock cores and gas well drilling, testing, and some instances of fracking. These licences were issued by the departments which administered the Minerals and Petroleum Acts prior to DEDJTR: the Department of Natural Resources and Environment (1996-2002); the Department of Primary Industries (2002-13); and the Department of State Development, Business and Innovation (2013-14).

A key function of the Department which administers the Minerals and Petroleum Acts is to actively promote the development of the State’s earth resources by assigning rights to companies for exploration. As the Victorian Government inter-departmental submission to the Committee explains ‘The role of government has traditionally been to provide pre-competitive information and incentives for explorers to invest in a particular jurisdiction.’

Prior to the moratorium, the Department allocated exploration rights for CSG under the Minerals Act when a company made a direct application (subject to an approvals process), and through a competitive tender (acreage release) process for

109 ibid., p. 3.
110 See section 2.6 of this Report.
112 ibid., pp. 53, 55-56.
exploration rights under the Petroleum Act, which included the rights to explore for shale and tight gas (see Appendix 4 for details). The Victorian Government inter-departmental submission explains that pre-competitive geological data is included in the acreage release packages. It states that the package would include ‘A combination of regional data acquisition, such as geophysical surveys, new interpretations of geology and prospectivity, and open file company data collected in previous exploration attempts.’

3.6.1 Explorer companies

The Report of the Parliament of Victoria’s Economic Development and Infrastructure Committee’s 2012 Inquiry into Greenfields Mineral Exploration explains that it has become common in recent decades for junior explorer companies to prospect for new resources, rather than the big mining companies. If the explorer company is successful it may then sell its find to a larger mining company to produce the resource. Evidence to the Greenfields Mineral Exploration Inquiry from Mr Richard Schodde of MinEx Consulting suggested that:

... the junior sector has got a much shorter time frame to work on than the majors. At any one time a junior company, on average, has got two years with cash in the bank, so they have got to deliver results in the next two years otherwise they will not get funding in the future. They are always on a very short fuse.

The evidence of Mr Tim Goldsmith from PricewaterhouseCoopers to the Greenfields Mineral Exploration Inquiry, similarly stated that successful small companies ‘do not have a huge amount of funds and do not necessarily have huge amounts of technology to utilise but do have an awful lot more hunger and want to make sure that every dollar is used to its full potential.’

The companies with licences and permits which allow for the exploration of unconventional gas in Victoria are explorer companies, with the exception of Beach Energy Ltd, which is an explorer and a production company, but is presently focusing on South Australia.

The following exchange between Committee Member the Hon. Richard Dalla-Riva and Mr Barry Richards, Managing Director of the explorer company Mecrus Resources, provides an example of the relationship between junior explorer companies and larger production companies:

Mr DALLA-RIVA — ... From my understanding Mecrus is an exploration company ... Can I just get some clarification? Once Mecrus finds a site at which it can demonstrate there is a resource, do you then undertake the removal of the gas or oil, or do you then onsell the licence?

114 ibid., p. 8.
116 ibid., p. 11.
117 ibid., pp. 11-12.
118 Beach Energy (2015) Submission 478, p. 1. Beach holds permits in the Otway Basin across both Victoria and South Australia, and states that it has been focusing its exploration in South Australia (in the Otway and Cooper Basins) since the moratorium was imposed in Victoria. Beach did not give evidence at a Committee hearing.
Mr RICHARDS — That will be an economic decision at the time. This area is expensive. We are a small private company. That is the reality. We will need support in developing this. How do we go about achieving that? We have talked to other organisations about supporting us, but our overriding objective is to maintain control and benefit for our state and our country as far as we are concerned as a business. We would want to maintain influence over that. But financially this could well get to a stage where we will only be a bit player; that is the reality. It would be nice if the state government contributed to help us out, but I do not know where the funding will come from. We are not about exploring and just dropping it; we will stay involved in one form or another. To what percentage? Yet to be seen.  

### 3.6.2 Details of unconventional gas exploration licences and permits

The tables in the following sections of this Report list the unconventional gas exploration licences and permits issued by the Department to explorer companies from 2000 to 2014. Maps showing the areas that the exploration licences cover or did cover are also provided. Exploration licences for CSG issued under the Minerals Act are called ‘exploration licences’ and are commonly abbreviated to ‘EL’, whereas the Petroleum Act provides for the issuing of ‘exploration permits’ and ‘retention leases’ which are commonly abbreviated to ‘PEP’ and ‘PRL’. A petroleum retention lease or ‘PRL’ enables exploration permit holders to retain petroleum discoveries that are currently not commercially viable but may become so within 15 years. Licences and permits issued under the Minerals and Petroleum Acts are discussed in Chapter 7 of this Report and further details are provided in Appendix 4.

Some of the ELs and PEPs that were issued have now expired or were cancelled or surrendered, and some are still active (but not currently being pursued because of the moratorium). The tables and maps below list licences and permits according to the basin they are looking in (Gippsland or Otway), their target (CSG or shale and tight gas), and whether the licence or permit is still active or not.

### 3.6.3 Onshore Gippsland Region: Historical coal seam gas exploration licences

The first exploration licences for CSG in the Gippsland region were granted in August 2001 under the Minerals Act. Between 2001 and May 2012, 35 separate exploration licences were granted. Dr Goldie Divko explains that some companies had specifically targeted CSG, whereas others may have undertaken multi-commodity exploration that could include CSG.

Table A below lists the exploration licences for CSG in the Gippsland region that are no longer current because they expired or were cancelled or surrendered. Figure A then provides a map which depicts the areas where these licences were.

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120 Ross & Darby (2013) op. cit., p. 9.
Cancelled, surrendered and expired exploration licences that included CSG in the Gippsland region

<table>
<thead>
<tr>
<th>Company</th>
<th>Exploration Licence</th>
<th>Target/activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flatoak</td>
<td>4850</td>
<td>Cretaceous black coals in the Wonthaggi-Korumburra-Inverloch region; thin seams &lt;3m. No record of on-ground activities.</td>
</tr>
<tr>
<td>Greenpower Natural Gas</td>
<td>4619, 4620, 4803, 4804, 4805, 4806, 4807, 4808, 4809, 5228</td>
<td>Company annual reports indicate a focus on lignite resources for conventional mining and coal to liquids technology.</td>
</tr>
<tr>
<td>Karoon Gas</td>
<td>4537</td>
<td>Tested Strzelecki Group for CSG and conventional gas potential (latter under a PEP). Drilled two wells (Megascolides-1 and -2) in 2004 and 2007, respectively.</td>
</tr>
<tr>
<td>Leichhardt Resources</td>
<td>5081</td>
<td>Coals near Fish Creek targeted for CSG, coal mining and conversion to Syngas – desktop reviews and modelling carried out. No on-ground activities reported.</td>
</tr>
<tr>
<td>Monash Energy Coal</td>
<td>4681, 4682</td>
<td>No report available.</td>
</tr>
<tr>
<td>Mr Stanislaw Wassylyko</td>
<td>5229</td>
<td>No report available.</td>
</tr>
<tr>
<td>Sawells – Greenpower Energy</td>
<td>4858, 4860, 4861, 4862, 4859, 4902</td>
<td>Sub-bituminous to high volatile bituminous black coal seams of the Wonthaggi Formation, Strzelecki Group. Desktop studies and drill-hole location plans.</td>
</tr>
<tr>
<td>Seamair</td>
<td>5180</td>
<td>CSG in Strzelecki Group black coals near the Kongwak Monocline. Desktop studies only to plan drill holes. No on-ground activities.</td>
</tr>
</tbody>
</table>

3.6.4 Onshore Gippsland Region: Current coal seam gas exploration licences

There are 16 exploration licences that include CSG as a target resource that are current over the Gippsland region. Ignite Energy Resources holds the current exploration licence for the 3800 km² EL 4416, which is the largest exploration licence in Gippsland (discussed further in section 3.7.2 of this Report). Table B below lists the current exploration licences that include CSG in the Gippsland region. Figure B then provides a map which depicts the areas the licences cover.

3.6.5 Onshore Gippsland Region: Current petroleum exploration permits and retention leases

There are two petroleum exploration permits (PEPs) and two Petroleum Retention Leases (PRLs) in the onshore Gippsland Basin. Companies are not required to state what resource they are targeting under a PEP. The permits are held by Lakes Oil and Icon Energy. Both companies have said that they are targeting tight gas.\(^{122}\) The permits and retention leases are listed in Table C and Figure C provides a map which shows the areas the PEPs and PRLs cover. In regards to exploration for shale gas in the Gippsland region, Dr Goldie Divko states that no petroleum exploration permit holder has indicated that they are searching for shale gas in the Gippsland region.\(^{123}\) Lakes Oil has stated that it is interested in exploring and producing oil in PRL 3.\(^{124}\)

3.6.6 Onshore Otway Basin: Historical coal seam gas exploration licences

The first exploration licence for CSG in the Otway Basin was issued in 2000. Between the years 2000 and 2013, 22 exploration licences for CSG were granted or renewed. Most of these, however, had expired, been surrendered or cancelled by 2004.\(^{125}\) Dr Goldie Divko states that results from drilling programs targeting CSG by Purus Energy and Easter Star Gas were ‘disappointing’ and that exploration for CSG in the Otway Basin to date has been unsuccessful.\(^{126}\)

Table D below lists the exploration licences for CSG in the Otway Basin that are no longer current because they expired or were cancelled or surrendered. Figure D then provides a map which depicts the areas where these licences were.

---

124 ibid., p. 24.
126 ibid., pp. 6, 47.
### Current exploration licences that include CSG as a target in the Gippsland region

<table>
<thead>
<tr>
<th>Tenement</th>
<th>District</th>
<th>Municipality</th>
<th>Primary Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>EL4500</td>
<td>Gippsland</td>
<td>Cardinia Shire</td>
<td>Greenpower Natural Gas</td>
</tr>
<tr>
<td>EL4416</td>
<td>Gippsland</td>
<td>Wellington Shire</td>
<td>Ignite Energy Resources</td>
</tr>
<tr>
<td>EL4877</td>
<td>Gippsland</td>
<td>Baw Baw Shire</td>
<td>Sawells</td>
</tr>
<tr>
<td>EL5210</td>
<td>Gippsland</td>
<td>Baw Baw Shire</td>
<td>Resolve Geo</td>
</tr>
<tr>
<td>EL5212</td>
<td>Gippsland</td>
<td>South Gippsland Shire</td>
<td>Resolve Geo</td>
</tr>
<tr>
<td>EL5227</td>
<td>Gippsland</td>
<td>Baw Baw Shire</td>
<td>Greenpower Natural Gas</td>
</tr>
<tr>
<td>EL5270</td>
<td>Gippsland</td>
<td>South Gippsland Shire</td>
<td>Clean Global Energy</td>
</tr>
<tr>
<td>EL5276</td>
<td>Gippsland</td>
<td>South Gippsland Shire</td>
<td>ECI International</td>
</tr>
<tr>
<td>EL5320</td>
<td>Gippsland</td>
<td>Baw Baw Shire</td>
<td>ECI International</td>
</tr>
<tr>
<td>EL5321</td>
<td>Gippsland</td>
<td>Baw Baw Shire</td>
<td>ECI International</td>
</tr>
<tr>
<td>EL5337</td>
<td>Gippsland</td>
<td>Baw Baw Shire</td>
<td>Mantle Mining Corporation</td>
</tr>
<tr>
<td>EL5170</td>
<td>Gippsland</td>
<td>Wellington Shire</td>
<td>La Trobe Fuels</td>
</tr>
<tr>
<td>EL5274</td>
<td>Gippsland</td>
<td>South Gippsland Shire</td>
<td>ECI International</td>
</tr>
<tr>
<td>EL5275</td>
<td>Gippsland</td>
<td>Wellington Shire</td>
<td>ECI International</td>
</tr>
<tr>
<td>EL5322</td>
<td>Gippsland</td>
<td>South Gippsland Shire</td>
<td>ECI International</td>
</tr>
<tr>
<td>EL5416</td>
<td>Gippsland</td>
<td>South Gippsland Shire</td>
<td>Leichhardt Resources</td>
</tr>
</tbody>
</table>


---

### Figure B

Current petroleum exploration permits and retention leases in the Gippsland region

<table>
<thead>
<tr>
<th>Petroleum exploration permits (PEP) and Petroleum retention leases (PRL)</th>
<th>Primary Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEP 166</td>
<td>Lakes Oil</td>
</tr>
<tr>
<td>PEP 170</td>
<td>Icon Energy</td>
</tr>
<tr>
<td>PRL 2</td>
<td>Lakes Oil</td>
</tr>
<tr>
<td>PRL 3</td>
<td>Lakes Oil</td>
</tr>
</tbody>
</table>


Figure C

[Map showing current exploration permits, retention leases, gas field, oil field, marine national park, gas pipeline, and oil & other pipeline.]

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Cancelled, surrendered and expired exploration licences that included CSG in the Otway Basin

<table>
<thead>
<tr>
<th>Primary owner</th>
<th>Exploration Licence</th>
<th>Target/activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Star Gas</td>
<td>4507, 4510</td>
<td>Drilled four wells (one in the Bells Beach Syncline and three in the Parwan Trough); production testing at the ‘Oak Park pilot’ including high pressure water injection testing (fracturing).</td>
</tr>
<tr>
<td>ECI International</td>
<td>5277</td>
<td>Desktop reviews only</td>
</tr>
<tr>
<td>Greenpower Natural Gas</td>
<td>4811</td>
<td>Desktop reviews only</td>
</tr>
<tr>
<td>Ironbark Mineralsands</td>
<td>4540, 4498, 4755, 4756</td>
<td>A wholly owned subsidiary of Purus – formed in 2001 to explore for coal seam gas and mineral sands</td>
</tr>
<tr>
<td>Leichhardt Resources</td>
<td>5082</td>
<td>Desktop reviews only</td>
</tr>
<tr>
<td>Mantle Mining Corporation</td>
<td>5324, 5325</td>
<td>Desktop reviews; drilling to intersect the Maddingley coal seams in adjoining tenements</td>
</tr>
<tr>
<td>Purus Energy</td>
<td>4578, 4604, 4710, 4740, 4589, 4703, 4605, 4780, 4921, 4952</td>
<td>Targeted Early Cretaceous coals at the base of the Eumeralla Formation. Drilled seven wells over two project areas – Gordon and Hawkesdale – to test coal seam gas potential</td>
</tr>
<tr>
<td>Western Victoria Energy</td>
<td>4507</td>
<td>Took over lease from Eastern Star – not focused on CSG; potential for underground coal gasification and coal liquification investigated; water formation laboratory tests conducted.</td>
</tr>
</tbody>
</table>


Figure D

3.6.7 Onshore Otway Basin: Current exploration licences that include CSG as a target

In 2015, there are only two small exploration licences which include CSG in the Otway Basin remaining. Both licences are held by Mantle Mining who Dr Goldie Divko states is targeting the development of brown coal resources.127 The licences are listed in Table E below. Figure E provides a map showing the location of these two licences.

### Current exploration licences that include CSG as a target in the Otway Basin

<table>
<thead>
<tr>
<th>Exploration Licence</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>5294</td>
<td>Mantle Mining Corporation</td>
</tr>
<tr>
<td>5323</td>
<td>Mantle Mining Corporation</td>
</tr>
</tbody>
</table>


![Figure E](image-url)

3.6.8 Onshore Otway Basin: Current petroleum exploration permits

The Eumeralla Formation in the Otway Basin has been identified as prospective for tight gas. The Casterton Formation may be prospective for shale gas. Dr Goldie Divko states that the Casterton Formation is known to occur in the Penola Trough in Western Victoria near the South Australian border, and that this area may be the most prospective for shale gas. She adds, however, that this may be because there is more data available for that area than for other areas. Dr Goldie Divko states that most of the Otway Basin is covered by nine petroleum exploration permits held by four companies, which are listed in Table F below. Figure F shows the location of the nine permits.

Petroleum exploration permit holders in the Otway Basin

<table>
<thead>
<tr>
<th>Tenement</th>
<th>Operator</th>
<th>Tenement</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEP150</td>
<td>Mawson Petroleum [Beach Energy]</td>
<td>PEP169</td>
<td>Mirboo Ridge [Lakes Oil]</td>
</tr>
<tr>
<td>PEP151</td>
<td>Bridgeport Energy</td>
<td>PEP171</td>
<td>Beach Energy</td>
</tr>
<tr>
<td>PEP163</td>
<td>Mirboo Ridge [Lakes Oil]</td>
<td>PEP174</td>
<td>Mecrus Resources</td>
</tr>
<tr>
<td>PEP167</td>
<td>Mirboo Ridge [Lakes Oil]</td>
<td>PEP175</td>
<td>Mirboo Ridge [Lakes Oil]</td>
</tr>
<tr>
<td>PEP168</td>
<td>Beach Energy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Figure F


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128 ibid., pp. 58, 62.
129 ibid., pp. 59, 63.
130 ibid., p. 27.
**Chapter 3 Victoria’s prospectivity for commercial sources of unconventional gas**

### 3.7 Lakes Oil, Ignite Energy Resources and Mecrus Resources

This section provides information about the three explorer companies who stated to the Committee that they may have found commercially viable sources of unconventional gas in Victoria: Lakes Oil, Ignite Energy Resources and Mecrus Resources. Lakes Oil and Ignite Energy have published their estimates of onshore unconventional gas.\(^{131}\) Mecrus Resources is an unlisted private company and has not published its estimates but has submitted them to the Committee.\(^{132}\)

#### 3.7.1 Lakes Oil N.L.

Lakes Oil N.L. is an ASX listed oil and gas explorer company, formed in 1946 and named after Lakes Entrance in Gippsland.\(^{133}\) Its website states that ‘Lakes has also kept alive the pioneering spirit of a once larger band of optimistic junior explorers willing to tackle programs in which more cautious major companies have declined to take part.’\(^{134}\) Lakes Oil states in its submission to the Committee that its primary focus for the last 20 years has been exploring the onshore potential of the Gippsland and Otway Basins, on which it has spent in excess of $80 million over that time.\(^{135}\) Lakes Oil has determined on the basis of studying the information provided by previous exploration and on its own exploration, that ‘Victoria is very prospective for onshore unconventional and conventional gas of a significant enough volume to underpin Victoria’s domestic and industrial needs on a cost effective basis for decades to come.’\(^{136}\)

Lakes Oil states that it is focusing relatively deep underground on the Early Cretaceous Strzelecki and Tyers Groups in the Gippsland Basin, and on the Early Cretaceous Otway and Crayfish Groups in the Otway Basin.\(^{137}\) Lakes Oil states that the ‘prospective in-place onshore gas resources within these deeper formations rival those from any basin around the world with just further work required to prove that these resources can be recovered at commercial rates’.\(^{138}\)

As stated previously in this Report, Lakes Oil discovered tight gas near Seapray in Gippsland in 2004. Dr Goldie Divko explains that the Strzelecki Group has been a primary target for tight gas exploration since the late 1990s, and Lakes Oil’s discovery of tight gas there is, to date, Victoria’s only unconventional gas discovery.\(^{139}\)

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\(^{133}\) NL stands for ‘no liability’; Lakes Oil (2015) Submission 510, p. i.


\(^{136}\) ibid., p. 2.

\(^{137}\) ibid., p. 6.

\(^{138}\) ibid., p. 7.

Chapter 3 Victoria’s prospectivity for commercial sources of unconventional gas

Lakes Oil has defined three gas accumulations known as the Wombat, Trifon and Gangell fields, which cover a combined area of 27 km² in the Seaspray Depression. Lakes Oil has estimated that the fields host 1.7 trillion cubic feet of gas, but Dr Goldie Divko states that whether ‘gas is distributed throughout the Strzelecki Group in quantities that may prove to be commercial is unknown.’ Lakes Oil undertook hydraulic fracturing operations prior to the imposition of the moratorium in 2012.

Lakes Oil also submitted to the Committee its belief that – based on their studies of previous exploration in the Otway Basin – there are prospectively commercial amounts of tight gas in the Otway Basin. Lakes Oil wrote to the Committee seeking permission to drill two ‘proof of concept’ wells to test the productivity of its sites in the Otway Basin and provide information to assist the Committee’s understanding of Victoria’s prospectivity. The Committee determined that this is a matter for the Government to consider.

3.7.2 Ignite Energy Resources

Ignite Energy Resources, an unlisted company, holds the largest current exploration licence in Gippsland: EL 4416 which covers 3800 km². Ignite is targeting CSG from the brown coal (lignite) in the area. Ignite states that the brown coals prospectively host 3.7 trillion cubic feet of gas. The Victorian Government inter-departmental submission to the Committee states, however, that ‘To date there have been no direct measurements of the gas content of the coals and whether the gas could be extracted’ and that this prospective estimate, which is based on the assumed gas content, could be subject to change if it was found that the actual gas content or producibility was lower (or higher).

Ignite explained to the Committee that they are looking to exploit the biogenic gas in the deeper lignite seams in Gippsland. Dr John White from Ignite emphasised the difference between the geological and physical circumstances of thermogenic gas from older black coals and the biogenic gas from the much younger brown coals that Ignite is interested in. He stated that the water Ignite has ‘sampled from lignite seams around Burong is of agricultural quality’ and that it would be unlikely that the lignite would require fracking.

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141 ibid., pp. 5, 35.
142 ibid., p. 36.
144 Correspondence from Lakes Oil, Lakes Oil (2015) Submission 510, pp. i-ii.
146 ibid.
149 ibid., p. 4.
150 ibid., pp. 2-3.
Dr White and Mr Dane Stewart from Ignite both emphasised that the project is at a very early stage and the commercial viability of producing gas from the brown coals is not yet known, and has not been done anywhere else in the world. Mr Stewart stated that ‘There has not been a gas extraction operation that has used coal anywhere near as young as what we are proposing.’ Mr Stewart further explained to the Committee that:

> We are nowhere near the stage of an operation at the moment. We really are trying to figure out a ground truth this resource estimate that we have done and figure out the commerciality of the resource that is under there. We are a really long way away from understanding what an operation here might look like, so we will not know where any surface infrastructure would be or how many wells or even employees or anything like that. This is purely, as John said, research. There is potential for a commercial operation here, and we recognise that. That is why we are here. However, we are a long way away from being able to define exactly what this operation will look like. It is very much a preliminary assessment of our theory about the basin.

Notably, ExxonMobil formed a joint venture with Ignite in mid-2012 to explore for the CSG in the brown coals. However, in late 2014, ExxonMobil ended the joint venture with Ignite. Dr George Carman, a petroleum geologist who supports lifting the moratorium, said in his presentation to the Committee that Victoria’s brown coal does not present the same opportunities for gas as black coal, and that ExxonMobil may have withdrawn from the venture on that basis:

> ... the carbonaceous rocks in Victoria are more in the brown coal regime rather than black coal, and therefore we do not really have the same opportunities for a resource in that area. ExxonMobil had formed an alliance with Ignite petroleum, who thinks they have resources. They were allowed to speculate, and speculation does sometimes produce new results. But as I understand it, the ExxonMobil company has now withdrawn from that partnership, presumably on there not being a real resource there.

Dr Len Humphreys, the Chief Executive Officer of Ignite Energy, was reported as stating that ExxonMobil had provided limited information on why it had left the joint venture: ‘We’ve just been told every year they review what’s in their portfolio and based on what’s in their basket they make a decision on whether they want to continue or not … They have told us their view of the prospectivity of exploring for gas in onshore Victoria hasn’t changed.’

### 3.7.3 Mecrus Resources

Mecrus Resources is an unlisted company which holds a number of exploration licences over the onshore Otway Basin in Western Victoria. Mecrus states that it has invested significant money to date in detailed exploration and investigation and has identified ‘significant resources of Oil Shale and hydrocarbons within

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151 ibid., p. 6.
152 ibid., p. 4.
the Oil Shale’, particularly within its licences EL 5297 and EL 5298.\textsuperscript{156} Mecrus states in regard to gas that: ‘It should be noted that this oil contains gas in solution and accordingly any production of oil will result in production of gas as a by-product.’\textsuperscript{157}

It is important not to confuse ‘oil shale’ and ‘shale oil’ because they are two different things. The ACOLA report on shale gas explains that ‘oil shale’ – which is what Mecrus is targeting – is shallow shale rock containing oil which is mined and then retorted at high temperature at the surface to distil the oil. The oil shale can also be subjected to in situ thermal treatment, to release the oil.\textsuperscript{158} The ACOLA report explains that ‘shale oil’ is ‘the oil found at very deep levels underground in combination with shale gas.’\textsuperscript{159}

Mr Barry Richards from Mecrus stated to the Committee that Mecrus engaged consultancy firm RISC to undertake an independent review of the prospectivity of the oil shale.\textsuperscript{160} Dr Rodney Halyburton from Mecrus said that the review confirmed that: ‘potentially — I say potentially — there is a fairly large resource in Western Victoria, particularly in the two exploration licences, 5297 and 5298.’\textsuperscript{161}

Dr Rodney Halyburton from Mecrus stated that the consultants did not consider gas in their report but that ‘Gas will be produced along with the oils. RISC did not include the amount of gas or the value of the gas when they conducted all their studies. If oil is produced there, gas will also be produced and that will be the cream on top of the cake.’\textsuperscript{162} As stated earlier in this report, Mecrus has not published its estimates of prospective oil resources but has provided them to the Committee in confidence.\textsuperscript{163}

### 3.8 Findings

The onshore Gippsland and Otway Basins have geological formations which may be prospective for unconventional gas. This does not mean, however, that if the gas is there that it will be commercially viable to produce. Exploration for unconventional gas in Victoria started around the year 2000 and is at an early stage (and has been subject to the extended moratorium since November 2013).

Most of the exploration undertaken has focussed on searching for CSG. In the Otway Basin the exploration for CSG has been unsuccessful to date, and many of the exploration licences that nominated CSG as a target, expired, or were cancelled or surrendered prior to the imposition of the moratorium. In the Gippsland Region, of the 35 exploration licences issued which include CSG as

\textsuperscript{156} Mecrus Resources (2015) Submission 247, pp. 1, 3.
\textsuperscript{157} ibid., p. 2.
\textsuperscript{159} ibid., p. 33.
\textsuperscript{160} Mecrus Resources (2015) Transcript of Evidence, 23 September, p. 15.
\textsuperscript{161} Mecrus Resources (2015) Transcript of Evidence, 23 September, p. 16.
\textsuperscript{162} ibid.
\textsuperscript{163} Mecrus Resources (2015) Submission 247, p. 2.
a target, 16 remain current, the largest being held by Ignite Energy Resources. Ignite estimates that the brown coals within EL 4416 prospectively host 3.7 trillion cubic feet of gas. However, there has been no direct measurement of the gas, and it is not known whether the gas could be extracted, as CSG has not been produced from brown coal before and it would be a world first.

It appears that the geology of Victoria may be more prospective for tight and shale gas. Lakes Oil’s discovery of tight gas near Seaspray in Gippsland in 2004 is the only discovery of unconventional gas in Victoria so far. Lakes Oil estimates that it has located 1.7 trillion cubic feet of gas, but whether the gas is actually distributed through the formation in those quantities and whether the gas can be commercially extracted is unknown. Lakes Oil states that it believes that there are prospectively commercial amounts of tight gas in the Otway Basin, but that this cannot be confirmed without drilling wells to provide the necessary data.

There is little information in regard to exploration for shale gas. Under the Petroleum Act, companies do not have to specify in their applications for petroleum exploration permits which resource they are targeting. It appears that the geology of the Gippsland region may not be prospective for shale gas. The geology of the Otway Basin may be more prospective for shale gas, but the companies who hold the petroleum exploration permits in the onshore Otway Basin have not made any statements in regard to shale gas. Mecrus Resources is targeting ‘oil shale’ which it states will produce gas as a by-product. It appears that this is different to ‘shale gas’ which is found in deep shale deposits.
Chapter Four begins by collating the commonly identified risks posed by the extraction of unconventional gas. It provides information on the importance of well integrity and potential impacts on water resources; the practice of hydraulic fracturing or ‘fracking’; chemical use in drilling and fracking fluids and the mobilisation of naturally occurring hazardous materials; issues to do with ‘produced’ and ‘flow back’ water; and fugitive methane emissions. It also looks at the potential impacts the industry’s surface level infrastructure can have on native vegetation and biodiversity.

Chapter Four additionally examines the evidence presented to the Committee about potential impacts of unconventional gas extraction on human health. This evidence is inter-related with the identified environmental risks and centres on concerns regarding chemical use, and the mobilisation of harmful naturally occurring materials.

Chapter Four also outlines the significant community concern regarding the potential risks posed by the unconventional gas industry, and the prospect that the industry may not have ‘a social licence to operate’ in Victoria. It then concludes with an outline of the unconventional gas industry’s views that the risks posed by unconventional gas extraction can be mitigated by industry adherence to ‘best-practice’ regulations, and that the benefits the industry will bring to Victoria will outweigh the risks.

4.2 Identified potential risks of unconventional gas extraction

The body of available literature on unconventional gas extraction including scientific studies, government initiated reviews, and parliamentary inquiries commonly identify certain potential risks posed by the industry. As stated above, the main potential risks involve leakage from wells and impacts on groundwater resources; the practice of hydraulic fracturing or ‘fracking’; chemical use in drilling and fracking fluids and the mobilisation of naturally occurring hazardous materials; issues to do with ‘produced’ and ‘flow back’ water; and fugitive methane emissions. It also looks at the potential impacts the industry’s surface level infrastructure can have on native vegetation and biodiversity.

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use and the mobilisation of naturally occurring hazardous materials; issues to do with ‘produced’ and ‘flow back’ water which include induced seismicity and subsidence; fugitive methane emissions; and impacts on biodiversity. Each of these potential risks is discussed below.

It is important to note, as stated in Chapter Two of this Report, that Government initiated reviews from some jurisdictions, and the report of the Gas Market Taskforce in Victoria, have concluded that these risks can be satisfactorily managed if regulatory frameworks for industry are improved, monitored and enforced. Risk mitigation through regulation is discussed in Chapter Seven of this Report.

It is also important to note that potential impacts may differ across geographic areas due to differences in hydrogeology, geology, land use and other factors.

### 4.2.1 Wells and groundwater

To extract unconventional gas, wells are drilled deep underground through different geological layers including groundwater formations. Groundwater – water that is located under the ground – is stored in porous soils and rocks. The National Water Commission explains that these saturated soils and rocks are called aquifers and the top of the saturated portion of ground constitutes the water table. Groundwater is a valuable source of water in Victoria, and is used primarily for irrigation, dairy and stock farming, as well as for domestic purposes.

RMIT Lecturer in Hydrogeology, Dr Matthew Currell, states in his submission to the Committee that in both the Gippsland and Otway Basins, target rocks for unconventional gas development are underneath aquifers that supply important sources of water for agriculture and domestic use. The extraction of gas depressurises gas bearing geological formations and may cause groundwater levels to decline which can impact on water users. Groundwater level decline may also cause land subsidence. This is a greater potential risk with CSG development which requires groundwater extraction to depressurise the coal seam to allow the gas to flow.

The benefits of understanding Victorian groundwater formations prior to potentially proceeding with an unconventional gas industry are discussed further in Chapter Six. Figure 4.1 below provides a simplified diagram depicting unconventional gas wells passing through different geological layers including aquifers:

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165 ibid.
Figure 4.1  Schematic diagram of unconventional gas wells and aquifers

There is a risk when an unconventional gas well passes through different geological layers that gas or drilling and fracking fluids could leak out of the well and contaminate surrounding groundwater. The available literature emphasises that ‘well integrity’ which means making sure that wells are of high quality construction and do not leak is fundamentally important. Unconventional gas wells are, accordingly, constructed out of telescoping steel and cemented well casings to minimise the risk of leaks. Figure 4.2 shows a schematic diagram of a coal seam gas well passing through an aquifer.

Figure 4.2  Schematic diagram of a coal seam gas well


Risks of poor well integrity

The COAG Standing Council on Energy and Resources (SCER) emphasised that the design, construction, maintenance and decommissioning of a well needs to be done carefully at ‘best practice’ level.\(^{173}\) It stated that poor well integrity – ‘caused by ineffective cementing, the use of inappropriate materials, failed well casings or other well construction, operational or decommissioning shortcomings’ – could lead to the following potential impacts:

- Hydraulic connectivity between otherwise isolated aquifers with different water qualities causing contamination and potentially unwanted alterations to water flows
- Contamination of water at the surface and subsurface by drilling and hydraulic fracturing fluids and geogenic (naturally occurring) compounds
- Migration of gas into surrounding aquifers, wells and water bores, and the surface.\(^{174}\)

The SCER also stated that ‘Over-pressurisation of the well head due to poor operational practices or through encountering over-pressurised formations in the subsurface’ could potentially lead to ‘A blowout at the surface or in the subsurface’ which ‘may cause injury to the drilling crew and contamination by allowing the escape of drilling and hydraulic fracturing fluids and gas into groundwater or the surface’.\(^{175}\)

Number of wells

Unconventional gas extraction requires more wells than conventional gas extraction because the gas does not flow as easily through the rock to the well.\(^{176}\) The productive life of an unconventional gas well is also shorter than a conventional gas well which means that more wells need to be drilled to extract the resource. For example, a coal seam gas well is typically productive for 10 to 15 years, whereas a conventional gas well can be productive for up to 50 years.\(^{177}\) In regard to shale gas, the ACOLA report explains that:

...unlike the situation for conventional gas, where a gas field can be exploited by a few wells involving a one-off, up-front capital investment, exploitation of a shale gas field can require thousands of wells drilled over a continuing timescale due to the nature of the gas production decline curve for a single shale gas well.\(^{178}\)


\(^{174}\) ibid., p. 29; Ross & Darby (2013) op. cit., p. 18.

\(^{175}\) ibid.


**Decommissioning of wells**

When a well ceases producing economically viable amounts of gas it needs to be decommissioned because an abandoned well still has the potential to contaminate groundwater and leak gas into the air (fugitive emissions are discussed in section 4.2.5 of this Report). The decommissioning process generally entails that when a well ceases production, equipment is removed from the well, the well is plugged with cement, and cut and capped below the surface level. Surface equipment is then removed and the land should be rehabilitated.\(^{179}\)

**Monitoring of decommissioned wells**

The New South Wales Chief Scientist and Engineer, Professor Mary O’Kane (henceforth referred to as ‘the NSW Chief Scientist’), explains that active or temporarily suspended wells are typically subject to monitoring programs, ‘However, once a well is abandoned, monitoring generally ceases and the well must then stand the test of time.’\(^{180}\) She further states that ‘Despite the abundance of information and research on petroleum well integrity (including design and cements), very little data exists about the long-term (100-1000 years) durability of abandoned petroleum wells.’\(^{181}\)

The VAGO report on unconventional gas states that in Victoria, monitoring and integrity checks are required for up to three years after abandonment.\(^{182}\) Additionally, the VAGO report found that: ‘Rehabilitation and aftercare practices at unconventional gas well sites in Victoria – including the management of suspended and abandoned wells – has been poor. Better practice well approaches have not been required for these activities and DEDJTR has not effectively monitored them.’\(^{183}\)

4.2.2 **Hydraulic fracturing**

Hydraulic fracturing or ‘fracking’ (sometimes also called ‘fraccing’) is a method used by the oil and gas industry to increase the rate and amount of oil or gas extracted from wells. The fracturing process involves injecting fluid made up of water, sand and chemicals down a well at high pressure to fracture the rock to help the gas flow out of the rock and up the well.

Identified potential risks of the fracturing process include the fractures extending to connect with aquifers and contaminating water resources with methane, chemicals or geogenic compounds, and the risk of contaminating spills when

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\(^{179}\) NSW Chief Scientist & Engineer (2014) *Independent Review of Coal Seam Gas Activities in NSW Information Paper: Abandoned Wells*, op. cit., p. 1. Note: Wells have been dug by various industries in Australia over the decades, and historically may have been abandoned under less stringent conditions. These wells are called ‘legacy’ wells. See ibid., pp. 2, 12.

\(^{180}\) ibid., p. 3.

\(^{181}\) ibid., p. 5.

\(^{182}\) VAGO (2015) op. cit., p. 27.

\(^{183}\) ibid.
fluids flow back to the surface. Stakeholder groups have different views on whether these risks can be adequately managed. Submissions and evidence received by the Committee from industry groups and individuals who work in the oil and gas industry, state that the risks can be successfully minimised. The broader community, however, has expressed concerns to the Committee about the potential risks the practice could pose to the State’s groundwater resources.

The VAGO report on unconventional gas states that in Victoria, there were 11 fracking operations in tight gas wells between 2004 and 2009, and 12 fracking operations in coal seam gas wells between 2007 and 2008. The Victorian Government inter-departmental submission to the Committee similarly states that 23 fracking operations occurred in Victoria in the Seaspray area between 2004 and 2009, with 12 operations approved under the Minerals Act and 11 operations approved under the Petroleum Act.

The hydraulic fracturing process

As stated earlier, the hydraulic fracturing process involves injecting ‘fracking fluid’ which is made up of water, sand (or ceramic beads) and chemicals down a well at high pressure to fracture the rock. The sand acts as a ‘proppant’ to hold the fractures open. Water and gas then flow up the well and are separated at the surface. It is stated in the available literature that around 15 to 50 per cent of the fracking fluid is recovered (during flowback and as produced waters). The recovered fracking fluid needs to be stored for reuse or appropriately disposed of at an approved site. The unrecovered fracking fluid remains underground and could act as a potential groundwater contaminant if contact with an aquifer is made.

The fracking process requires a range of equipment and materials and is usually undertaken by specialised service companies such as Halliburton. The equipment includes fracking fluid storage tanks, sand storage units, chemical trucks, blending equipment and pumping equipment installed on a number of trucks, plus a data management van which controls the operation. Figure 4.3 below provides an image and list of hydraulic fracturing equipment from the
ACOLA shale gas report (sourced from Santos 2013). Figure 4.4 then provides a simplified diagram showing the underground view of a fracturing operation and water use.

**Figure 4.3** Well stimulation by hydraulic fracturing in Australia

**Figure 4.4** Diagram of hydraulic fracturing

It is important to emphasise that CSG wells do not always require fracking. Shale and tight gas wells do often require fracking (a summary of the different geological settings of coal seam, shale and tight gas is provided in sections 2.4.1 - 2.4.3 and Appendix 3 of this Report). The NSW Chief Scientist emphasises the greater scale of fracking that can be required for shale gas extraction in comparison to CSG extraction:

There is a major difference in the scale of operations in hydraulic fracturing between CSG and shale resources. Across the world, development of CSG resources have been in the depth range 200-1,000 metres (m) whereas shale resources are typically between 1,500 to 3,000m. The fracture stimulation pumping setup (frac spread) on the surface for CSG may run to 10,000 hydraulic horsepower with four to six high pressure pump units whereas for shale stimulation the power demand may be as high as 50,000 hydraulic horsepower and use 30 pump units.\(^\text{192}\)

The Committee also notes the evidence of Ignite Energy Resources which suggested that fracking the brown coal in the Gippsland region would likely be unfeasible because of the moisture content of the lignite. Dr White from Ignite stated that ‘We do not think we can frack, because lignite is rather wet. It would be like fracking a peat bog.’\(^\text{193}\)

**Water use in hydraulic fracturing**

The hydraulic fracturing of shale and tight rock formations requires more water than is needed to fracture coal seams. The NSW Chief Scientist states that in the United States, the quantity of water used for fracture stimulation for CSG has been estimated as being between 0.2 – 1 ML per well (a megalitre or ‘ML’ is one million litres). The water required for fracture stimulation for shale has been estimated as being between 15 – 25 ML per well. She further states that ‘stimulation of Cooper Basin shales (South Australia) has been as high as 45 ML per well (similar to parts of British Columbia), although the flowback water is good quality and can be recycled’.\(^\text{194}\)

However, Mr Tim O’Brien from Lakes Oil stated to the Committee that Lakes Oil has not used significant amounts of water in the fracking operations it has undertaken during exploration for tight gas in the Seaspray area, and suggests that less water would be required for a tight gas industry in Victoria than is required for agriculture:

The volumes that we would use, if we were to frack these rocks, is nothing near what is being portrayed out there as the 20 or 30 megalitres per frack. You would have to pump for three or four days to be able to do that, which we only pump for 60 minutes. The largest frack that has ever been done in Victoria was 0.2 of a megalitre, and that was in our Wombat-2 well. In the Trifon well, which has got five fracks in it, the largest we would have pumped I think is about 0.7 of a megalitre across five zones.


The volumes are not significant. If you think that agriculture in Victoria uses 2.5 million megalitres, even if we were to frack these wells and were doing 100 wells a year, it might be using 5 megalitres per well for multistage ones. The entire industry would be 500 megalitres rather than 2.5 [million] megalitres.\textsuperscript{195}

There is also the identified risk of spills when fluids flow back to the surface (this is discussed in section 4.2.4 on flowback and produced water). It is also suggested that hydraulic fracturing may lead to an increase in seismic activity although, the reinjection of flowback or produced water into aquifers may be more likely to induce seismic events than fracking (this is also discussed in section 4.2.4).\textsuperscript{196}

### 4.2.3 Chemicals

Chemicals are added to well drilling fluids and to hydraulic fracturing fluids to enhance the drilling and fracturing processes during unconventional gas extraction. The available literature states that this chemical use needs to be carefully managed to minimise environmental impacts.\textsuperscript{197}

### Drilling fluids

The SCER explained that drilling fluids, which are also known as ‘drilling muds’, are ‘used during the drilling of wells to reduce friction, stabilise formations, control pressures in the well bore and return drill cuttings to the surface.’\textsuperscript{198} The drilling fluids are most often water-based with clays and chemical additives included to ‘control and minimise fluid loss, density and viscosity.’\textsuperscript{199} The National Toxics Network states in its submission to the Committee that drilling fluid components include:

- Viscosifiers to increase viscosity of mud to suspend cuttings (eg bentonite, polyacrylamide);
- Weighting agent (eg barium sulphate);
- Bactericides/biocides to prevent biodegradation of organic additives (eg. glutaraldehyde);
- Corrosion inhibitors to prevent corrosion of drill string by acids and acid gases (eg zinc carbonate, sodium polyacrylate, ammonium bisulphate);
- Defoamers to reduce mud foaming (eg glycol blends, light aromatic and aliphatic oil, naptha);
- Emulsifiers and deemulsifiers to help the formation of stable dispersion of insoluble liquids in water phase of mud;
- Lubricants to reduce torque and drag on the drill string (eg. chlorinated paraffins);

\textsuperscript{195} Lakes Oil (2015) Transcript of Evidence, 6 October, p. 20.
\textsuperscript{198} ibid., p. 61.
\textsuperscript{199} ibid.
*Polymer stabilisers to prevent degradation of polymers to maintain fluid properties (e.g., sodium sulphite);*

*Breakers to reduce the viscosity of the drilling mud by breaking down long chain emulsifier molecules into shorter molecules (e.g., diammonium peroxydisulphate, hemicellulase enzyme);*

*Salts (e.g., potassium chloride, sodium chloride, calcium chloride);*

And in the case of drilling for shale gas:

*Shale control inhibitors to control hydration of shales that causes swelling and dispersion of shale, collapsing the wellbore wall (e.g., anionic polyacrylamide, acrylamide copolymer, petroleum distillates).*

The National Toxics Network also emphasises that drilling muds returned to the surface after the well has been drilled include contaminants that occur naturally underground but can be harmful to human health. It also asserts that because many new wells are required to be drilled to keep unconventional gas fields commercially viable, the impact of large amounts of drilling fluid components needs to be considered in assessments of unconventional gas industry impacts.

**Hydraulic fracturing fluids**

Chemical additives to hydraulic fracturing fluids vary depending on the geological setting, the operator, and in some cases the legislation and regulations of the area where the well is being fracked. The ACOLA report explains that a typical fracking fluid includes between three and twelve chemicals which, in general terms, are added to reduce fluid pumping friction, improve stimulation performance, and stop the formation of bacteria. The NSW Chief Scientist provides the following list of typical additives to CSG fracking fluids and the reasons why they are added:

Typical additives include acids and alkalis to control the pH balance of the fracture fluid (which affects the fluid viscosity); acids (to dissolve residual iron, cement, and rock particles from drilling operations and perforations, and calcium carbonate if present in the coals); bactericides to prevent bacterial growth (which could contaminate the formation and inhibit gas flow); gels including cross-linked gels to enhance proppant transport performance (addressing viscosity limits of water and improved functionality over less expensive linear gels); guar gum to create a gel (to transport the proppant); enzyme breakers to dissolve fracture gels (to aid fluid extraction and gas transmission); and friction reducers and surfactants such as emulsifiers and non-emulsifiers (to increase fluid recovery).

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201 ibid., p. 7.
202 ibid., p. 6.
The ACOLA report similarly provides the following list of chemicals, which it states are representative of the major compounds used in shale gas fracturing fluids:

### Table 4.1 Hydraulic fracturing fluid additives

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<thead>
<tr>
<th>Additive Type</th>
<th>Main Compound(s)</th>
<th>Purpose</th>
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<tbody>
<tr>
<td>Diluted acid (15%)</td>
<td>Hydrochloric acid or muriatic acid</td>
<td>Help dissolve minerals and initiate cracks in the rock</td>
</tr>
<tr>
<td>Biocide</td>
<td>Glutaraldehyde</td>
<td>Eliminates bacteria in the water that produce corrosive byproducts</td>
</tr>
<tr>
<td>Breaker</td>
<td>Ammonium persulfate</td>
<td>Allows delayed breakdown of the gel polymer chains</td>
</tr>
<tr>
<td>Corrosion inhibitor</td>
<td>N, n-dimethyl formamide</td>
<td>Prevents the corrosion of the pipe</td>
</tr>
<tr>
<td>Crosslinker</td>
<td>Borate salts</td>
<td>Maintains fluid viscosity as temperature increases</td>
</tr>
<tr>
<td>Friction reducer</td>
<td>Polyacrylamide, Mineral oil</td>
<td>Minimises friction between fluid and the pipe</td>
</tr>
<tr>
<td>Gel</td>
<td>Guar gum or hydroxyethyl</td>
<td>Thickens the water in order to suspend the sand</td>
</tr>
<tr>
<td>Iron control</td>
<td>Citric acid</td>
<td>Prevents precipitation of metal oxides</td>
</tr>
<tr>
<td>KCl</td>
<td>Potassium chloride</td>
<td>Creates a brine carrier fluid</td>
</tr>
<tr>
<td>Oxygen scavenger</td>
<td>Ammonium bisulfite</td>
<td>Removes oxygen from the water to protect the pipe from corrosion</td>
</tr>
<tr>
<td>pH adjusting agent</td>
<td>Sodium or potassium carbonate</td>
<td>Maintains the effectiveness of other components, such as crosslinkers</td>
</tr>
<tr>
<td>Scale inhibitor</td>
<td>Ethylene glycol</td>
<td>Prevents scale deposits in the pipe</td>
</tr>
<tr>
<td>Surfactant</td>
<td>Isopropanol</td>
<td>Used to increase the viscosity of the fracture fluid</td>
</tr>
</tbody>
</table>

Note: The original table includes proppant in the list of additives and an additional column which lists common uses of main compounds.


### Quantities of chemicals in hydraulic fracturing fluid

Estimates of the proportion of chemical additives in hydraulic fracturing fluid vary but are in general said to be between 0.1 – 2 per cent. The SCER states that in regard to CSG extraction, chemical additives typically make up 0.1 – 2 per cent of fracking fluid composition. The NSW Chief Scientist states that chemicals typically constitute about one per cent of CSG fracking fluids. The ACOLA report states that chemicals make up 0.1 – 0.5 per cent of fracking fluid for shale gas extraction.

Industry submissions to the Committee emphasise the low concentration of chemicals in fracking fluids and that the chemicals used are also found in familiar household products. The APPEA submission states that:

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Chapter 4 Risks of unconventional gas extraction and community and industry views

The hydraulic fracturing fluid used to improve gas and oil production is typically comprised of more than 99.5 per cent water and sand and 0.5 chemical additives. Many of the chemicals used are also found in common household and commercial applications. They include guar gum used in jelly sweets, salt, detergents and antiseptics – all of which are used in extremely low concentrations.209

Lakes Oil’s submission similarly said that: “The fluids used in drilling and hydraulic stimulation activities are generally non-toxic. Most of the additives are used in everyday household products but at lower concentrations”.210

The National Toxics Network states that while chemical additives make up less than two per cent of fracturing fluids, this nevertheless translates into large quantities of chemicals.211 The ACOLA report provides the following figures which it states provide a sense of scale of hydraulic fracturing, including chemical use:

... for a stimulation requiring ~15 million litres of water (roughly the average fresh water volume for fracturing per US shale well), the amount of chemicals required (using the high-end percentage of 0.5%) is ~75,000 litres (two road-tanker loads), and the amount of sand (proppant) required is of order 1 million kg (1000 tonne).212

Hence, according to the ACOLA report, the amount of chemicals required for the fracturing of a typical shale gas well in the United States, if the chemicals constitute 0.5 per cent of the fracking fluid, will be about 75,000 litres or ‘two road-tanker loads’.213

Non-disclosure of exact chemicals in hydraulic fracturing fluids

The exact chemicals used in hydraulic fracturing fluids can be classed as ‘commercial in confidence’ and not disclosed.214 The SCER stated that this is done to protect intellectual property rights and encourage growth in research, development and innovation.215 However, a significant number of submissions to the Committee argued that, from a risk management perspective, it is difficult for regulators to assess the risks posed by chemical additives if it is not known what those chemicals are.216 Professor Michael Ackland, Acting Chief Health Officer for the State of Victoria, said in his evidence to the Committee that in regard to hydraulic fracturing chemicals:

...perhaps one of the most alarming things for myself was that there are many, many chemicals that are proprietary chemicals and are essentially commercial-in-confidence and are therefore not able to be disclosed. Looking at the experience from the United States Environmental Protection Agency, there are

213 ibid.
around 1076 chemicals that have been compiled by the US EPA, and in only 42 per cent could the physicochemical properties of those chemicals be obtained, and in relation to levels that people could safely consume over a lifetime without health effects that information was only available in 90, or only 8 per cent, of that large list of chemicals. If that is not a large knowledge gap then I am not sure what is.217  

The VAGO report on unconventional gas states that in Victoria there is ‘no requirement to release information to the regulator or the community on the types, concentrations or toxicity of the chemicals used.’218 Additionally, the National Toxics Network states that proprietary data means that the disclosure of full formulations is usually not possible by those who use the products because the company that makes them does not identify exact ingredients.219  

Lakes Oil provided the Committee with a list of drilling fluid components used in an unconventional gas well in Victoria.220 The submissions from industry groups to the Committee provided information on fracking fluids in general terms.221  

It is worth noting the similar experience of the New South Wales Legislative Council inquiry into coal seam gas in 2012 which observed that ‘The Committee did not receive evidence that addressed the exact composition of fracking fluids and the Committee received broad information only on the quantities and names of chemicals used.’222  

The Committee also notes the introduction in New South Wales in 2012 of a 'Code of practice for coal seam gas fracture stimulation activities.'223 The code includes a mandatory requirement for a 'Fracture Stimulation Management Plan' to be in place prior to the commencement of a hydraulic fracturing activity.224 The code states that the management plan ‘must identify all chemicals to be injected as part of the fracture stimulation process’.225 The code additionally provides that the Chemical Abstract Service (CAS) registry number for those chemicals must be identified.226  

National assessment of chemicals associated with coal seam gas extraction in Australia  

In 2012, the Commonwealth Government, on advice from the IESC, commissioned a project to assess chemicals used in CSG extraction by the National Industrial Chemicals Notification and Assessment Scheme (NICNAS), CSIRO, Department of Environment, and Geoscience Australia. NICNAS explains that ‘The National CSG Chemicals Assessment project examines
human health and environmental risks from chemicals used in drilling and hydraulic fracturing for CSG extraction in Australia. It will inform the Australian Government, the IESC, industry and the public about the use and potential risks of these chemicals.\textsuperscript{227}

NICNAS further explains that it is ‘conducting a voluntary industry survey of companies involved in CSG extraction in Australia. The main aim of the survey is to identify the chemicals (and their functions) used in CSG extraction in Australia.’\textsuperscript{228}

NICNAS states that project examines surface and near surface water-related impacts of drilling and fracking chemicals, but does not examine impacts on deeper groundwater systems such as confined aquifers. It is also limited to consideration of CSG and states that shale and conventional oil and gas are outside its scope.\textsuperscript{229} NICNAS also states that the impact of mixtures of chemicals will not be considered.\textsuperscript{230} The project is expected to be completed in 2015-16.\textsuperscript{231}

**BTEX chemicals**

The acronym ‘BTEX’ stands for ‘benzene, toluene, ethylbenzene and xylene’. These chemicals are found in petroleum and petroleum products and can occur naturally in the vicinity of gas deposits.\textsuperscript{232} They are known to be harmful to human health and are highly volatile, which means that they can evaporate quickly into the air and dissolve in water.\textsuperscript{233} Benzene, the most toxic component of BTEX, is a well-established cause of cancer in humans.\textsuperscript{234}

In other jurisdictions, BTEX containing petroleum products – such as diesel – have been used as additives to hydraulic fracturing fluids (to thicken the fluid and improve the efficiency of the fracking process). Additionally, the fracking process can cause a link between naturally occurring BTEX in a geological formation and nearby groundwater.\textsuperscript{235}

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{232} State Government of Victoria (2015) Submission 658, p. 5.
\item \textsuperscript{235} Leusch & Bartkow, op. cit., p. 4.
\end{itemize}
\end{footnotesize}
In 2012, the Victorian Government announced a ban on the use of BTEX chemicals in hydraulic fracturing in Victoria. In late 2014, the Victorian Parliament passed the *Resources Legislation Amendment (BTEX Prohibition and Other Matters) Act 2014*, which implements a statutory condition restricting the use of BTEX chemicals in hydraulic fracturing in Victoria.\(^{236}\)

### 4.2.4 Flowback and produced water

Issues to do with ‘flowback’ and ‘produced’ water are commonly identified potential impacts of unconventional gas extraction. The definitions of the terms ‘flowback water’ and ‘produced water’ are not fixed, but in general ‘flowback water’ refers to fluid that predominantly consists of hydraulic fracturing fluid that returns from a well to the surface following a fracking operation. The term ‘produced water’ (sometimes called ‘formation water’) refers to water that flows from gas wells, and is much greater in volume in the case of CSG than in regard to shale or tight gas extraction. This is because, as was explained in Chapter Two, the process of CSG extraction requires water to be pumped out of coal seams in order to release the gas. Produced water can contain flowback water if the well was fracked, and the term ‘waste water’ is sometimes used to refer to both flowback and produced water.

Produced water from coal seam gas extraction can be high in salt and organic and hydrocarbon chemicals that were naturally occurring in the coal seam. The NSW Chief Scientist states that these can potentially include trace elements such as mercury, arsenic and lead, organic acids and polyaromatic hydrocarbons, BTEX chemicals, and naturally occurring radioactive materials (NORMS) such as radium, thorium and uranium.\(^{237}\)

In regard to flowback and produced water from shale and tight gas extraction, Dr Currell states in his submission to the Committee that:

> Contaminants typical in ‘flowback’ water produced by shale or tight gas hydraulic fracturing include salts, acids (hydrochloric and acetic acid) organic chemicals (biocides, gelling agents, surfactants and corrosion inhibitors), caustic soda and other additives used to control the density and viscosity of the fluid (e.g. Halliburton, 2015). Shale formations usually also contain saline formation water, which in some cases contains high levels of radionuclides such as radium and strontium...\(^{238}\)

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Inappropriate use and disposal of flowback and produced water, including through accidents and spills, can contaminate the surrounding environment including surface water, shallow groundwater and land.\textsuperscript{239} There have been a number of documented pollution incidents involving produced water in New South Wales.\textsuperscript{240}

**Volume of produced water from CSG extraction, groundwater depletion and subsidence**

The volume of produced water created by CSG extraction is large. The CSIRO states that the amount of water produced by CSG wells can vary but that in Queensland each well produces 20,000 litres on average per day.\textsuperscript{241} Dr Currell states in his submission to the Committee that: ‘Queensland Government statistics indicate that the total volume of produced water from CSG wells in the Bowen and Surat Basins in the 12 months from June 2013 to June 2014 was 26.7GL, a significant volume with major implications for wastewater treatment and disposal, and catchment salt balances’.\textsuperscript{242}

There is concern that the removal of large quantities of water may deplete groundwater and draw down the water table, which could impact on other water users such as farmers and the environment in general. The life-span of a CSG well and the dewatering process is approximately 15 years depending on the geological formation.\textsuperscript{243} It is also identified that the dewatering of coal seams could potentially lead to subsidence of the ground surface, which can affect surface-water systems, ecosystems, irrigation and grazing lands.\textsuperscript{244}

Notably, the extraction of shale and tight gas does not require the ‘dewatering’ process used to extract CSG. However, shale and tight gas extraction often requires fracking which can use significant amounts of water, whereas CSG extraction often does not require fracking. Mr Annells of Lakes Oil said to the Committee in regard to the dewatering of coal seams that:

> That is one issue where the aim with coal seam gas and tight gas is that the two really should be dealt with as separate resources. With the coal you do have to dewater the coal and produce water. We do not produce any water. Obviously we use water if we are to frack, to pump into it and we recover that, but the volumes you use in that are obviously much smaller than is ever flowed back to try to dewater coal.\textsuperscript{245}


\textsuperscript{244} Williams, J., T. Stubbs & A. Milligan (2012) op. cit., p. 53.

\textsuperscript{245} Lakes Oil (2015) *Transcript of Evidence*, 1 July, p. 5.
Treatment and disposal of produced water

Produced water generally requires treatment – such as reverse osmosis (desalination) – to purify it. The Queensland GasFields Commission states that CSG produced water that has been treated can be put to beneficial uses such as for irrigation, river discharge and the recharging of aquifers.246 The disposal of salt and associated chemicals from the treatment process, however, is an ongoing challenge. Dr Currell states in his submission that:

In Queensland and New South Wales there are some policy arrangements and infrastructure which have been developed in recent years in an attempt to manage the large volumes of produced water from CSG (e.g. Biggs, 2012), however there still exists a large gap between the ideal scenario – involving the safe storage and treatment of all production water to a high quality before selling water to nearby water users – and the reality of how this water is actually managed in practice, which often involves: - Extended periods of storage in dams, which can be subject to leaks, spills and overflows, that can contaminate groundwater (e.g. Khan and Kordek, 2014); and/or - Disposal into waterways or sewers, which occurs in contradiction to the wishes of environmental regulators such as EPAs (Hannam, 2015).247

One way of disposing of produced water is to reinject it into underground water systems. This reinjection can, however, potentially induce seismicity. It may be that the seismic activity is barely noticeable at surface level. The VAGO report on unconventional gas states that the reinjection of treated wastewater is routinely used in in many areas in the United States and is gaining more popularity in Queensland and New South Wales, and that ‘This activity has been linked to increased seismic activity in a number of states in America.’ In regard to Victoria, the VAGO report explains that:

Reinjection is prohibited in Victoria under state environment protection policies unless the water is treated to a high standard prior to injection. There are many knowledge and cost barriers to the use of this method in Victoria because not enough is known about the short- and long-term impacts of reinjection on groundwater systems and their dependent ecosystems.248

4.2.5 Fugitive emissions

Natural gas is often presented as a transitional fuel in the move to a lower carbon economy because it produces less carbon dioxide than burning coal for comparable electricity generation.249 There is debate, however, over whether methane leaks during natural gas extraction – called ‘fugitive emissions’ – could mean that natural gas has a greater greenhouse gas impact than was previously thought.250 The NSW Chief Scientist states that methane has a global warming...
potential, defined by the Intergovernmental Panel on Climate Change, as 21 times that of carbon dioxide.\textsuperscript{251} Fugitive emissions from unconventional gas extraction can also include other unintended gas or vapour emissions, but primarily refer to methane emissions.\textsuperscript{252}

As stated earlier, the SCER identified that poor well integrity can potentially lead to the migration of gas into surrounding aquifers, wells, waterbores and the surface.\textsuperscript{253} Fugitive methane emissions can also occur during other stages of gas production such as storage, piping and treatment.\textsuperscript{254} The New South Wales Legislative Council inquiry into coal seam gas and the NSW Chief Scientist and Engineer found that there is a significant level of uncertainty over the amount of fugitive emissions across the lifecycle of production and the accuracy with which they are measured.\textsuperscript{255}

The Victorian Government inter-departmental submission to the Committee provides an example of a gas leak incident in New South Wales from a CSG well, and states that “The NSW Environment Protection Authority has fined an energy company for a gas leak, which occurred from a gas well in Camden on 31 August 2014. The responsible entity acknowledged that 10,000 cubic feet of gas was released during the leakage.”\textsuperscript{256}

The APPEA and Minerals Council submissions to the Committee point to a study conducted by the CSIRO in 2014 for the Commonwealth Department of the Environment, which measured emissions from 43 CSG wells in Queensland and New South Wales, and found the emissions to be very low.\textsuperscript{257}

Industry groups also point out that methane leaks can occur naturally in the environment.\textsuperscript{258} The NSW Chief Scientist argues that this underlines the importance of obtaining baseline measurements prior to production, and conducting ongoing monitoring so as to be able to distinguish between natural sources of methane, methane being emitted through other bores, and fugitive emissions from industry.\textsuperscript{259}

The VAGO report on unconventional gas states that there is currently ‘no licence or regulatory requirement to assess and monitor fugitive emissions across the area and life cycle of unconventional gas activities in Victoria.’\textsuperscript{260}

\begin{itemize}
\item \textsuperscript{251} ibid., p. 91.
\item \textsuperscript{252} See ibid; M. Currell (2015) Submission 11, p. 4.
\item \textsuperscript{256} Government of Victoria (2015) Submission 658, p. 28.
\item \textsuperscript{258} APPEA (2015) Submission 364, p. 36.
\item \textsuperscript{260} VAGO (2015) op. cit., p. 29.
\end{itemize}
4.2.6 Impacts on native vegetation, biodiversity and threatened species

It is also commonly identified that unconventional gas exploration and production can impact on native vegetation, biodiversity and threatened species.\textsuperscript{261} Potential impacts of the infrastructure footprint of wells, roads, pipes and compressor stations, include the clearing of bushland, fragmentation of important remnant native vegetation, the spread of invasive species and the increased risk of bushfires.\textsuperscript{262} The Victorian Government inter-departmental submission to the Committee states that:

Loss of biodiversity and habitat fragmentation may result from land clearance for roads and other infrastructure, thereby reducing habitat. This is particularly relevant due to the higher number of wells typically required for unconventional gas production as compared to conventional gas production. Impacts on biodiversity are difficult to quantify without adequate baseline data on prevalence and vulnerability.\textsuperscript{263}

The Victorian Government inter-departmental submission also noted that loss of biodiversity may be caused indirectly through pollution or hydrological changes to ecosystems with a high dependence on groundwater, or through soil contamination caused by the increased mobility of water, gases and other chemicals through the strata.\textsuperscript{264} The submission states that there are 100 listed threatened species occurring in the parts of the Gippsland region prospective for unconventional gas, and 170 listed threatened species occurring in parts of the Otway region prospective for unconventional gas.\textsuperscript{265}

4.3 Potential human health impacts

The risk of unconventional gas activities impacting on human health was also brought to the attention of the Committee. A number of submissions and evidence of witnesses at hearings focussed on potential health risks posed by the industry.\textsuperscript{266}

The Acting Chief Health Officer, Professor Ackland, explained in his presentation to the Committee that public health risk assessment and management requires the identification of hazards of concern, and that there are a number of potential hazards associated with unconventional gas. He emphasised that the full range of hazards posed by the industry is currently unknown and that for the known

\textsuperscript{261} Williams et al. (2012) op. cit., p. 32.
\textsuperscript{262} ibid., p. 105. For further information see ibid., pp. 30-37, 105-106.
\textsuperscript{264} ibid., p. 27.
hazards, the scientific data is limited. He emphasised that further research is required to fully assess the potential risks, and that strong and effective regulatory oversight is a prerequisite for protecting public health.267

Professor Ackland said that key hazards of the industry include the chemicals used to extract the gas and the chemicals produced by extracting the gas. He said that the available evidence indicates that these may include the chemicals listed below, but that many chemicals remain unknown:

- Acids (e.g. hydrochloric acid, peroxydisulfuric acid)
- Alcohols (e.g. methanol, isopropanol, ethanol)
- Hydrocarbons (e.g. petroleum distillates, methane)
- Metals (e.g. arsenic, mercury, cadmium)
- Naturally occurring radioactive materials (e.g. radon)
- Polycyclic aromatic hydrocarbons (e.g. napthalene)
- Surfactants (e.g. 2-butoxyethanol)
- Volatile organic compounds (e.g. benzene, xylene, ethyl-benzene).268

Professor Ackland stated that the sort of health effects that can occur as a result of exposure to those chemicals, and importantly to mixtures of those chemicals, include ‘effects on the immune system, the nervous system, liver and kidney toxicity, reproductive issues, cancers, respiratory and cardiovascular illnesses and psychological effects’.269

He said that people may be exposed to these hazards through contaminated land (for example, from chemical spills or inappropriate disposal of wastes), through contaminated surface and groundwater supplies, or through pollutants in the air (for example, from fugitive emissions, dust from contaminated land and the operation of machinery).270

Professor Ackland stated that there are ‘a range of knowledge gaps’ regarding public health risks related to unconventional gas activities;271

Knowledge is lacking regarding potential hazards and their physical and chemical properties, how they move in the environment, associated health effects and the dose-response relationships. In those points I am suggesting that while on the one hand we may not actually know what the chemicals are, even if we did know some of the names of those chemicals it may still be unknown as to what the actual effects those chemicals would have on people who are exposed to them, so that is a significant knowledge gap.272

269 M. Ackland (2015) Transcript of Evidence, 1 September, p. 3.
271 M. Ackland (2015) Transcript of Evidence, 1 September, p. 3.
272 ibid.
He further said that these knowledge gaps prevent the carrying out of comprehensive risk assessments, and that there is a limited understanding of the health impacts from exposure to chemical mixtures. He additionally highlighted that health guideline values are not available for all known hazards, including those relevant to different exposure routes such as oral intake, inhalation or topical contact; that there is limited evidence regarding the long-term and short-term effects in relation to those exposures; and that there is no evidence to rule out such health effects. He advised the Committee that ‘a precautionary approach’ should be taken where there is scientific uncertainty, and provided the following quotation from the Public Health and Wellbeing Act 2008: ‘If a public health risk poses a serious threat, lack of full scientific certainty should not be used as a reason for postponing measures to prevent or control the public health risk.’

Other submissions to the Committee from medical professionals expressed similar concerns to the Acting Chief Health Officer. For example, the submission provided by Doctors for the Environment Australia (DEA) states that it is concerned that the rush to exploit this resource has outpaced regulation to protect public health and to adequately assess the health impacts, including exposures to industrial chemicals. The DEA further states that a cost-benefit-analysis of an unconventional gas industry in Victoria, should include the costs of air and water monitoring, health risk assessments, and potential adverse public health outcomes.

The Australian Medical Association – Victoria similarly recommends in its submission to the Committee that governments ensure that all future proposals for unconventional gas development are subject to ‘rigorous and independent health risk assessments, and take into account the potential for exposure to pollutants through air and groundwater and any likely associated health risks.’

The 13 paediatric doctors of the Barwon region said in their submission to the Committee that they are unanimously opposed to any form of unconventional gas mining proceeding in the Geelong/Surfcoast/Bellarine areas given the concerning emerging data related to environmental and associated health impacts. The Barwon paediatricians submission refers to research that is finding that the public health impacts of unconventional gas extraction remain undetermined and that more environmental and public health studies are needed.

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277 ibid.
280 For list of example studies see ibid., pp. 1-2.
Dr Mike Forrester, who gave evidence on behalf of the Barwon paediatricians drew the Committee’s attention to an editorial in the *British Medical Journal* which states that reports which find that problems with unconventional gas extraction are the result of poor regulation ‘ignores many of the inherent risks of the industry that no amount of regulation can sufficiently remedy, such as well casing cement failures and accidental spillage of wastewater or produced water.’

### 4.4 Community concern about potential risks of unconventional gas extraction

The vast majority of submissions to the Committee express concerns about the potential risks an unconventional gas industry could pose to the Victorian environment. The concerns mainly centre on potential risks to Victoria’s prime agricultural land and to the water resources that support agriculture, as well as to Victoria’s tourism industry (agriculture and tourism are discussed in more detail in Chapter 5 of this Report on the co-existence of the unconventional gas industry with other land users).

These concerns are widespread, and shared by a broad cross-section of the community including farmers and other landholders, environmental groups, landcare groups, medical professionals, hydrogeologists, tourism operators, small business owners, and local councils. The Committee has been informed that, while the designation does not have legal standing, since 2012 over 60 communities in Gippsland and Western Victoria have declared themselves ‘gas field free’ and formed local action groups.

For example, the submission from ‘Gas Field Free Seaspray’ states that: ‘Seaspray has two unconventional gas mining exploration licences covering the entire township and surrounds; Lakes Oil for tight gas and Ignite Energy for coal seam gas.’ The submission explains that following a community survey in which 98 per cent of those surveyed confirmed that they did not want gas fields in Seaspray or surrounding areas, the community declared itself ‘gas field free’ on 28 July 2013. The occasion was marked with the formation of a human sign, made up of 650 people, spelling out the words ‘No Gas Fields’. The Gas Field Free Seaspray submission also expresses the uncertainty the community feels about the development of an unconventional gas industry in their area:

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285 Ibid., p. 3.
We have an overwhelming grief in our community as generational farmers face the uncertainty of a future in an industrialised environment, their properties devalued and unable to develop their business plans for future expansion. The prospect of leaving a long held family farm and life’s work is heart wrenching and has led to extremes of depression and feelings of hopelessness.  

Similarly, ‘Gas Field Free South West’ describes itself as a group of farmers from the Byaduk, Byaduk North, Wallacedale and Branxholme area, south of Hamilton, which is covered by petroleum licence permit 150. Their submission states that: ‘On Sunday 3 May 2015, our community came together in order to officially declare ourselves ‘Gas Field Free’. Around 250 land holders took time out from their busy Autumn sowing season to bring their tractors to a help make a large sign saying ‘Food Not Gas’.’ The submission further states that:

Are we really prepared to risk a sustainable income from a product that all people need – food – and for which there is a growing demand for safe, clean and green food, for a short term (15-20 years) industry known to be damaging to human health and the environment...

Of the 17 local councils that have made submissions and/or presented at Committee hearings, most but not all were opposed to an unconventional gas industry proceeding in Victoria. As Councillor Neil Rankine from the Bass Coast Shire Council stated in his evidence to the Committee:

I would like to point out that Bass Coast Shire unanimously passed a motion — a number of motions in fact — of outright opposition to coal seam gas. Every councillor in our municipality has been told by our community that they do not want this industry. There is good reason for that. Our environment is our economy. Tourism is the industry in our municipality; agriculture and construction are the other two major industries.

The submission from the Colac Otway Shire Council is similarly representative of local government opposition to the industry. Their submission emphasises potential risks to agriculture and environmental-based tourism, and suggests that resources would be better directed into the renewable energy sector:

The literal footprint of the industry, the amounts of water it requires, and the potential for the processes involved to contaminate groundwater present an unacceptable risk to the agriculture industry and the region’s water catchments, especially in the face of climate change and dwindling water supplies. The potential impact on the unique environmental assets within our region, and subsequently the tourism industry, presents an unacceptable risk ... The resources and investment required to conduct appropriate research into these impacts, and to then develop and implement effective regulation of the industry, would be better directed to the renewable energy sector...

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286 ibid., p. 8.
288 ibid., p. 4.
Significantly, the level of community concern that has been expressed to the Committee suggests that the industry has not been granted a ‘social licence to operate’ in Victoria. The ACOLA report explains that the term ‘social licence to operate’ is widely used in resources industries and is based on the concept that ‘successful resource developments require not only the formal approval of government, but the broad acceptance of local communities and other key stakeholders’.

Mr David Arnault, of Mirboo North, wrote in his submission to the Committee that the people in Victorian regions prospective for unconventional gas, such as South Gippsland and Portland, have:

...made it clear that they don’t see gas companies as anything but a threat to their lives, to the commercial fishery and sport fishing, to the tourism industry and to the health of themselves and their neighbours. There is no social licence for gas extraction (or coal mines), but there is a quiet determination to protect the land they live in...

Gayle Margaret, Peter Ramon and Andrew and Linda Corcoran, residents and future residents of Mirboo North, similarly write in their submission to the Committee that ‘the government can be certain that there is no Social Licence for this industry to proceed in Victoria.’

### 4.5 Unconventional gas industry response to community concern

Industry proponents have submitted to the Committee that the risks posed by unconventional gas extraction are similar to the risks posed by other extractive industries, and that the risks can be successfully mitigated by adhering to regulations. They point to government initiated reviews from other jurisdictions that are recommending that the industry proceed, subject to ‘best practice’ regulations. Industry proponents additionally emphasise that the benefits of an unconventional gas industry to Victoria will outweigh the risks.

The APPEA states that the potential environmental and health risks involved in unconventional gas production can be safely managed and that ‘there is no sound basis for continuing to delay an industry that can provide substantial economic and community benefits to the State.’ The APPEA submission states that many of the risks found in the unconventional gas industry are also present in other industries, and that the CSG industry in Queensland provides an example how these risks can be successfully managed:

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Many of the activities – and associated risks – found in unconventional gas exploration and production are common in other industries. For example, drilling is undertaken in mining and agriculture. Hydraulic fracturing is used in geothermal energy production and to improve the flow of water bores. Pipelines are used to transport water and deliver gas to hundreds of thousands of households. The fact that these risks are manageable is clearly demonstrated by the Queensland coal seam gas industry, which coexists successfully with high-value agriculture and farming practices that are required to meet high standards, such as organic farming.\textsuperscript{297}

The APPEA submission highlights the reviews which are concluding that risks involved in unconventional gas production can be effectively managed with strict regulatory frameworks: ‘The findings of multiple Australian and international reviews and inquiries by eminent individuals and institutions are clear – the risks associated with unconventional gas can be managed effectively through the creation of a robust regulatory regime, underpinned by effective monitoring and compliance.’\textsuperscript{298}

The APPEA submission further states that: ‘Victoria is fortunate that there are a number of contemporary Australian examples of such regulatory regimes already in place’ and recommends the adoption of the SCER National Harmonised Regulatory Framework to underpin the regulation of unconventional gas in Victoria.\textsuperscript{299}

The Minerals Council submission to the Committee emphasises the findings of recent reviews in New South Wales and the Northern Territory into unconventional gas:

\begin{quote}
In September 2014, the NSW Chief Scientist’s Independent Review of Coal Seam Gas Activities concluded that the technical challenges and risks posed by the CSG industry can, in general, be managed though a clear legislative framework, high engineering standards and professionalism from the extraction companies. Also Alan Hawke, the commissioner presiding over the Hydraulic Fracturing Inquiry in the Northern Territory, said in his November 2014 report that the environmental risks associated with hydraulic fracturing could be managed effectively with a robust regulatory regime. These findings are consistent with other Australian and international inquiries...\textsuperscript{300}
\end{quote}

Dr Halyburton from Mecrus Resources stated to the Committee that there are risks involved in his company’s plan to extract oil shale and gas but that those risks can be mitigated by following good practice and well design:

\begin{quote}
There are a few perceived risks with hydrocarbon exploration and production, whether it is conventional or unconventional. Tongue-in-cheek I like to say what is unconventional today will be conventional tomorrow. There have been many things that have changed along the way. When the Wright brothers first flew their plane somebody said, ‘If God had wanted us to fly, he’d have given us wings’. Now we fly without second thoughts. But there are risks, and they can be mitigated. Groundwater
\end{quote}

\begin{footnotes}
\item[297] ibid., p. 11.
\item[298] ibid., p. 3.
\item[299] ibid., pp. 3-4.
\end{footnotes}
Chapter 4 Risks of unconventional gas extraction and community and industry views

and surface contamination: there are 2.5 kilometres of vertical separation between the aquifers near the surface and the oil. We will use good oilfield practice, including proper well design, to ensure that these risks are mitigated.301

Lakes Oil’s submission to the Committee emphasises that the benefits of an unconventional gas industry will outweigh the perceived risks, and that increasing the State’s gas resources will aid the manufacturing sector:

Lakes has been supportive of all the inquiries that have looked into this issue as it believes that once the facts are out there the local and wider community will see that the benefits of an onshore unconventional/conventional gas industry far outweigh the perceived risks. Victoria has been blessed with very significant natural resources which in the past have been exploited to make Victoria the manufacturing heartland of Australia. We believe that by exploiting these deeper, cleaner onshore gas resources we will help rejuvenate industry across the state...302

4.6 Findings and recommendation

The body of scientific studies, government initiated reviews and parliamentary inquiries into unconventional gas commonly identify a number of potential risks posed by the industry to water resources, the environment and human health. It is important to identify and understand these potential risks so that informed decisions can be made, and the Government can weigh these risks against the expected benefits of an unconventional gas industry, such as the provision of a potential source of energy, royalties paid to the state and employment opportunities.

If it is decided that the industry should proceed in Victoria, it is important to identify the risks posed by unconventional gas extraction so that governmental agencies can develop corresponding risk-based strategies to address and minimise the risks and ensure the industry is effectively regulated. It is also important that a risk-based regulatory framework is in place prior to the industry going ahead.

The Committee notes the emphasis placed by the VAGO report on unconventional gas on the importance of the Department of Economic Development, Jobs, Training and Resources and the Department of Environment, Land, Water and Planning developing risk-based strategies if it is determined that the industry should proceed.

RECOMMENDATION 2: That the Chief Health Officer commissions a full review and report to the Victorian Government on the possible human health impacts of an unconventional gas industry.

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5 Co-existence – Can the unconventional gas industry co-exist with other land uses?

5.1 Chapter overview

Chapter Five examines issues relating to the potential co-existence of an unconventional gas industry in Victoria with other land uses such as agriculture and tourism, and with the rights of Traditional Owner groups. In regards to agriculture, it considers matters relating to potential impacts on water resources, domestic and export market requirements including reputational risk, as well as the legal rights of property owners and compensation agreements.

Chapter Five then considers potential issues relating to the co-existence of the Tourism Industry with unconventional gas development, and with the rights of traditional owner groups in areas under Native Title or subject to agreements under Victoria’s *Traditional Owners Settlement Act 2010*. The Chapter concludes with a consideration of the potential implications of an unconventional gas industry for local and regional development, investment and jobs.

5.2 Agriculture

A key issue in the unconventional gas debate arises from the fact that gas deposits can be located under privately owned agricultural land. The following section provides a short overview of the evidence received by the Committee regarding the co-existence of the two industries, and then provides further details on evidence received by the Committee in regards to:

- the impact of gas industry infrastructure on farming
- biosecurity
- water resources and issues with chemicals and food safety accreditations
- reputational risk
- land access laws, compensation and property prices
- the multiple land use framework put forward by governments and industry to facilitate successful co-existence.

In very brief terms, under Victorian law, mining companies are required to negotiate access agreements with landholders and provide compensation for the disruption and impact on the property. In most cases, landholders and mining companies are able to reach an agreement. Ultimately, however, landholders
do not have the right to prevent the company from entering the property and exploring for and extracting the resource (land access laws and compensation is further discussed in section 5.2.5 of this Chapter and in Chapter 7 of this Report).

Farmers have expressed concerns to the Committee that unconventional gas extraction will pose risks to agricultural production. They emphasise the importance of agriculture to the Victorian economy and the state’s food security. They also point to the long-term economic value of agriculture as opposed to the short-term nature of the unconventional gas industry. The Victorian Government inter-departmental submission to the Committee states that the Victorian agricultural sector generated a gross value of food and fibre production of $12.68 billion in 2013-14 from approximately 12 million hectares of agricultural land across the whole State. This comprises approximately three per cent of Australia’s agricultural land and includes many of the nation’s most productive land areas.\(^{303}\) It is also notable, as the Inquiry into Greenfields Mineral Exploration pointed out, that Victoria is relatively densely populated in comparison to other Australian jurisdictions with 25 per cent of the national population occupying 2.6 per cent of the land mass.\(^{304}\)

The Victorian Farmers Federation (VFF) similarly states that ‘Despite farming on around three per cent of Australia’s available agricultural land, Victorians produce close to 30 per cent of the nation’s agricultural exports.’ The VFF further states that ‘The agricultural sector is a significant contributor to the Victorian economy, employing over 191,700 people, that is, one in six regional Victorians.’\(^{305}\)

The VFF stated to the Committee that there are significant concerns among its membership that an unconventional gas industry will affect agricultural production, particularly in regard to impacts on the quality and quantity of available water and the potential for contamination from the use of chemicals in hydraulic fracturing.\(^{306}\) The VFF additionally said that there is a lack of scientific information on the risks posed by unconventional gas activities to the Victorian environment and that ‘there are no guarantees from the Victorian Government or the gas industry that these risks can be managed.’\(^{307}\)

Significantly, the VFF calls for the moratorium on the unconventional gas industry in Victoria to be extended for another five years: ‘VFF members have responded to these uncertainties on the impacts of unconventional gas activities by calling for a moratorium on issuing licences for all types of unconventional gas exploration and mining until 2020.’\(^{308}\) The VFF states that it also supports the introduction of a farmer’s ‘right to veto’ unconventional gas exploration and production on their property.\(^{309}\)

\(^{304}\) Parliament of Victoria, Economic Development and Infrastructure Committee (2012) op. cit., p. 58.
\(^{306}\) ibid., pp. 6, 8.
\(^{307}\) ibid., p. 6.
\(^{308}\) ibid., p. 6.
\(^{309}\) ibid., pp. 2, 13.
The Committee also heard from farmers who called for an outright ban on the unconventional gas industry. For example, Mr Gary Everett, a lamb producer and fourth-generation farmer from Drumborg in Western Victoria, told the Committee that communities are overwhelmingly opposed to the industry and that: ‘We need a total ban on all unconventional gas exploration and extraction in Victoria so we can have closure and be more productive in our lives. We do not want law-abiding citizens, especially 70 and 80-year-olds, being arrested for protecting our farms and our environment for future generations.’

Conversely, Mr Alex Arbuthnot, a farmer from the Gippsland region who has been a member of VFF and mining committees and taskforces for many years, gave evidence to the Committee that it was his personal opinion that the two industries could successfully co-exist provided that the risks posed by unconventional gas extraction were managed by regulation. Mr Arbuthnot said that mining and agriculture already co-exist in Gippsland and that an unconventional gas industry could provide local businesses with better access to gas as an energy source and benefit the regional economy. Mr Arbuthnot also said, however, that he – like the VFF – supports the right of the farmer to say no to mining companies coming on to their land.

Industry bodies from the minerals and resources sector gave evidence to the Committee that the industry can successfully co-exist with agriculture, can be beneficial to farms, and have positive impacts on rural and regional communities. The submission from Lakes Oil to the Committee stated that: ‘Land is much more productive when gas activities and agriculture coexist and there is generally no drop in overall agricultural production.’ The APPEA stated to the Committee that:

Experience shows that petroleum companies have been able to successfully negotiate thousands of land access agreements and compensation arrangements with farmers. Over 4,700 landholder access agreements have been successfully negotiated in Queensland alone. Demonstrating that land access can be, and is being successfully managed. In many cases, the extra water and income provided to landholders has increased agricultural productivity. In Queensland the gas industry is also delivering infrastructure and investment to several rural and regional districts, providing new jobs and strengthening and diversifying regional economies.

The following sections of the Report discuss specific issues related to the co-existence of agriculture and the unconventional gas industry in more detail.
5.2.1 Impact of surface infrastructure

The Committee heard that landholders are concerned that companies accessing their land and building the surface infrastructure required to extract the gas, will negatively impact on the operation of the farm. As explained in Chapter Four, unconventional gas extraction typically requires more wells than conventional gas extraction, and these wells are connected by a network of roads, pipelines and compressor stations. The development phase when the wells are drilled can involve substantial intrusion on to a property (such as truck movements, light, erosion, noise and dust) and interruption to farming operations and domestic life.\(^{316}\) The ACOLA report provides the following description of shale gas well site construction:

Site construction involves the levelling of the site, structures for erosion control, excavation of fenced pits with special impervious liners to hold drilling fluids and cuttings, and access roads for the transportation of equipment to the site. Once the well (or multiple wells from the pad) is drilled, the drilling rig is removed and site prepared for well stimulation, by hydraulic fracturing.\(^{317}\)

The ACOLA report further states that shale gas well drilling and completion typically takes several weeks but that (as stated in Chapter Four) wells need to be drilled over a ‘continuing timescale due to the nature of the gas production decline curve for a single shale gas well.’\(^{318}\)

Mr Malcolm Rowe, a prime lamb and premium beef farmer from North Byaduk in Western Victoria, expressed concerns in his evidence to the Committee that gas industry infrastructure and associated vehicle movements would negatively impact on the management of his farm. Mr Rowe emphasised that farms in south-west Victoria are smaller and more densely settled than other areas of the country with unconventional gas industries, such as the Chinchilla/Roma area in Queensland.\(^{319}\) He said that in the Chinchilla/Roma area ‘farmers would be lucky to carry one sheep per hectare. We carry the equivalent of 15 to 20 sheep per hectare.’\(^{320}\) Mr Rowe further explained that farming those numbers of sheep on a relatively small farm requires careful management based on agricultural science, to ensure that the animals receive the energy intake they require:

In order to maximise production, we know that a sheep requires 12 megajoules of metabolisable energy. If she is pregnant, she needs 18; if she has twins, she needs 22. At 30 days of lactation, after she has had her lamb, it is in excess of 30 megajoules of metabolisable energy that she requires to get through that production system... For her to get 30 megajoules of metabolisable energy, she needs a paddock which has a minimum of 13 centimetres of grass, which might be the equivalent of 2500 kilograms of grass per hectare.

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\(^{317}\) Cook et al. (2013) *Engineering Energy*, op. cit., p. 53. See ibid and section 4.2.2 of this Report for a description of hydraulic fracturing equipment.


\(^{320}\) Ibid.
What I am trying to establish here is that it is a science that we are involved in here; it does not happen by accident. To do that we have small paddocks, connected by laneways, and we shift animals around the farm regularly, sometimes every two days, in order to ensure that in front of those animals, whether they be sheep or cattle, there is sufficient grass for them to receive the energy intake they require...

When I talk about these livestock rotations, imagine a coal seam gas industry established on our farm, where we have small paddocks with laneways, cattle movements happening, sheep movements happening every day or two, and then the whole scene of the gas industry coming in on top of that with vehicles and movements – all that sort of stuff. It will not work. It will not work on our farm.321

Ms Rebecca Reid, who lives on a wool farm in East Gippsland with her extended family, similarly expressed her opposition to unconventional mining on their property. She explained that one of the reasons is the potential impact of surface infrastructure and vehicle movements:

It would be a huge struggle to attempt to raise sheep with increased traffic and noise. Ewes can be quite skittish and can lose lambs when startled. It would be impossible to work around trucks, new roads, potentially polluted settling ponds, and noisy drills. Not only because of the pasture we would lose, but because of how disjointed our farm would become.322

Ms Claire Miller, from Dairy Australia who appeared before the Committee representing the Australian Dairy Industry Council, stated that dairy farms are ‘very intensive operations’ and ‘not like big broadacre farms where you could have wells out in the corner and you would never see them unless you flew over it. On a dairy farm the conduct of the contractors and the companies themselves has to be absolutely above reproach and very clearly set out beforehand.’323

From the unconventional gas industry perspective, the APPEA submission to the Committee stated that many of the impacts of site construction such as noise and movement of vehicles are of limited duration:

Many of the impacts such as noise are of short term duration while specific types of activities are being undertaken (such as drilling or hydraulic fracturing). Once a well enters production and is connected to an underground pipeline gas gathering network, many of the localised impacts such as noise and vehicular traffic are greatly reduced or eliminated entirely.324

The APPEA also said that mining companies will consult carefully with landholders in order to design their activities to minimise disruptions to farming:

Companies will design their activities to minimise the impact of their operations on land holders in areas such as biosecurity, use of roads, speed limits, impacts on stock, fencing, fire management, rubbish disposal, abandonment of water bores, gates, protection of trees and location of accommodation camps.325

321 ibid.
325 ibid.
Chapter 5 Co-existence – Can the unconventional gas industry co-exist with other land uses?

Lakes Oil similarly states in its submission to the Committee that: ‘All activities are scheduled to work in with the operations on the properties to minimise any disturbance’ and that farmers are provided with compensation and the benefits of upgraded access tracks, improved fencing and left over materials.\(^{326}\) Lakes Oil further states that:

The area around the wells is still available for general farming practices (e.g. grazing, cropping) and with the ability of directional drilling it is possible to position the wellsites so that the impact on the farmers day-to-day use of the land is minimised. Wellsites are usually positioned along fence lines and all access tracks run along the fence lines so as not to breakup the pastoral land. These access tracks are valuable assets for farmers as they provide all weather access to their properties. Petroleum and mining activities have co-existed with farming and other land uses across Victoria for well over one hundred years usually to the benefit of all parties concerned.\(^{327}\)

5.2.2 Biosecurity

Concerns were expressed to the Committee that the movement of people and equipment associated with the unconventional gas industry on privately owned farmland could pose biosecurity risks, though the inadvertent introduction of animal and plant diseases and invasive species. The VFF submission to the Committee stated that: ‘As mining and exploration activities often involve the movement of visitors on private land, from contractors to protestors and government agencies, there are biosecurity risks that need to be managed appropriately.’\(^{328}\) Mr Rowe also addressed the issue of biosecurity risks in his evidence to the Committee:

...we make a significant effort to manage biosecurity on our farm. We have a closed shop in terms of livestock coming in and going out. Any animal that comes in goes through a rigorous induction program to ensure that we do not import any diseases. Diseases can come in in a whole range of boots or tyre treads – those sorts of things – so if we had an intensive unconventional gas industry operating here, coming from known infected places in the district, how do we manage that? How do we get compensated for stuff that has been brought onto our farms by others, which may not manifest itself in the first year or the second year, but it may manifest itself in the 5\(^{th}\) or the 10\(^{th}\) year? It is not going to work for us, and it is not going to work for a significant proportion of people in this area.\(^{329}\)

5.2.3 Water resources, chemicals, and food safety accreditations

The Committee heard concerns from farmers that an unconventional gas industry could pose risks to Victorian water resources that are needed for agricultural production (water resources are further discussed in Chapter Six of this Report). The Committee also heard that the use of chemicals by the industry

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327 ibid., p. 14.
and the potential for industry activities to mobilise naturally occurring hazardous materials, were of concern to farmers (the potential risks of unconventional gas extraction are discussed in Chapter 4 of this Report). The risk of potential contamination interfering with food safety accreditations for agricultural produce was also brought to the Committee’s attention.

A number of submissions from farmers emphasised the importance of groundwater to their farms. For example, a submission from a merino farmer in Goon Nure in East Gippsland states that farming in the district is totally dependent on continued access to good quality groundwater, and that contamination of the groundwater would mean the end of farming in the area.\footnote{Name withheld (2015) Submission 945, p. 1.}

Mr Colin Frawley, from south-west Victoria, similarly stated to the Committee that ‘We see that the unconventional gas industry puts our farming operation at risk. In our particular situation, for our livestock we must have underground water. If that were to be contaminated or compromised, that totally compromises our business.’\footnote{C. Frawley (2015) Transcript of Evidence, 23 September, p. 56.}

Ms Alice Irving, from Darriman in Gippsland said in her submission that:

> Agriculture and an unconventional gas industry cannot co-exist safely. What Government in its right mind would risk the health and prosperity of such a productive area of Gippsland? The sustainability of beef, sheep, dairying and vegetable growing industries, as well as tourism, is so closely connected to the wellbeing of the Ramsar-listed Gippsland lakes, and directly threatened by the possible operation of an onshore gas industry.\footnote{A. Irving (2015) Submission 1059, p. 1.}

Mr Steven Ronaldson stated in his submission that: ‘I live on 200ha of Certified Biodynamic land near the Ninety Mile Beach. I rely on the ground water to farm and any use of chemicals on or near the property would severely jeopardise my business, certification and lifestyle. The risk to the water table by fracking is just too great.’\footnote{S. Ronaldson (2015) Submission 996, p. 1.}

Mr Trevor Flint and Mrs Diana Flint, who run a mixed farm which produces prime lamb, premium pork and beef in the Seaspray/Longford area of Gippsland, which was visited by the Committee, emphasised that contamination risks posed by unconventional gas extraction could prevent farmers from gaining food safety accreditation for their produce.\footnote{T. Flint & D. Flint (2015) Submission 1034, pp. 1-2.}

Mr and Mrs Flint drew the Committee’s attention to accreditation systems that require farmers to adhere to regulations and auditing processes to verify that the produce is free from contaminants. Examples of these accreditation systems include HACCP Australia (Hazard Analysis Critical Control Point) and Livestock Production Assurance (LPA) National Vendor Declarations (NVD). DEDJTR explains that:
The National Vendor Declaration (NVD) is the key tool underpinning Australia’s food safety reputation for livestock. Producers use the NVD to declare necessary and valuable information about the food safety status of the livestock being sold. Buyers rely on the NVD for accurate information on the livestock purchased and processors rely on the information to ensure only the safest food enters our food chain. 335

Mr and Mrs Flint’s submission to the Committee states that more attention needs to be paid to the risks an unconventional gas industry could pose to a farmer’s ability to gain these accreditations:

As ex dairy farmers, we are aware of regulated programs such as HACCP which get routinely audited for chemical and animal medicine use on the farm. Being meat and livestock producers we have been audited and know only too well the seriousness of the ‘LIVESTOCK PRODUCTION ASSURANCE NATIONAL VENDOR DECLARATION,’ (LPA/NVD). This underpins Australia’s meat and livestock FOOD SAFETY REPUTATION; (no contaminants get in the food chain).

As meat and livestock producers, our responsibility is to be accurate when answering all questions on the forms. Any false, misleading or UNVERIFIED statements may result in prosecution or civil action. These are legal documents we, as meat and livestock producers sign off on. The LPA/NVD is in place not only for traceability but to ensure all consumers; domestic and overseas, are guaranteed that no contaminants are in the food they consume. Agriculture and OUG [onshore unconventional gas] cannot co-exist due to the fact that whatever chemicals used or bought up to the surface, called ‘naturally occurring’ by the OUG [onshore unconventional gas] industry, cannot be guaranteed safe and has huge potential for entering the human food chain.

This is real, it is serious and it is underestimated. We ask you, what will the government do to protect all food producers and help them to continue to produce safe eating food for all? We cannot stress enough that this is extremely concerning for us. It is proven that some chemicals eg: arsenic, do accumulate over years in the soil. When livestock pick up some of that contaminated soil, the chemical hibernating in the soil becomes active again when it reacts with the animals stomach acid, therefore contaminating the food chain. 336

Mr Rowe also gave evidence to the Committee that he subscribes to quality assurance programs to accredit his prime lamb and premium beef for export markets. Mr Rowe similarly expressed concern that unconventional gas extraction could put the certification of his produce at risk: ‘If, for example, an unconventional gas industry come in and leaves stuff around and creates contamination in surface water supplies, we have to tick a box to say, “We think the cattle are contaminated”. Who in his right mind is going to do that? Who in his right mind would want to do that?’ 337

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5.2.4 Reputational risk

Related concerns regarding the risks an unconventional gas industry may pose to the ‘reputation’ of Victorian agricultural produce as ‘clean and green’ were also articulated to the Committee. The Committee heard that one of Victoria’s competitive advantages in international, particularly in Asian, markets is its reputation based on strong environmental protection and food safety. For example, the East Gippsland Food Cluster – a collaborative network of regional food and wine producers – states that:

The East Gippsland Food Cluster is particularly concerned about the potential impacts of Unconventional Gas in Eastern Gippsland. These threats are considered as both perceived (i.e. detract from the clean and green image of our region amongst consumers) and real (i.e. threats to land, soil and water).

Mr Frawley, who runs a farm between Hamilton and Branxholme, emphasised in his evidence to the Committee that agriculture is a long-term industry, whereas unconventional gas is a short-term industry that will put the clean, green image of the region at risk:

... we have the advantage at the moment of having a really clean, green image in our region, and we think that if industrial gas fields come to our region, that is immediately put at risk. We just think it is a marketing nightmare to promote your region if you have this overlay of a short-term unconventional gas industry.

The evidence provided by the Australian Dairy Industry Council emphasises the importance of protecting the reputation of the Victorian dairy industry in international markets. Mr Chris Griffin (a Gippsland dairy farmer and immediate past president of the Australian Dairy Farmers, who appeared before the Committee on behalf of the Australian Dairy Industry Council), highlights that Australia’s dairy industry is predominantly located in Victoria, and the importance of growing export markets to the industry:

We currently have around 6300 dairy farmers in Australia; 4268 of those are in Victoria. Some 9.2 billion litres of milk is produced in Australia annually; more than 6 billion litres of that is produced out of Victoria. Victorian dairy companies depend heavily on export markets for ongoing profitability and currently export around 60 per cent of the milk produced in Victoria. It goes out as milk powders, cheese, butter and other products. The dairy industry has potential to grow substantially over the next decade, and to meet growing domestic and international demand Victoria will certainly be a big part of this.

Mr Griffin continued on to state that remaining internationally competitive is dependent on two things that unconventional gas extraction could put at risk:

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342 ibid.
But to achieve that growth and remain internationally competitive we need two things that unconventional gas mining could put at risk. Firstly, the natural resources upon which the dairy industry relies must continue to be available without any negative impact, and our primary focus here is water. Secondly, the dairy industry’s reputation as a producer of high-quality, safe dairy products must be protected. Any possibility that unconventional gas mining could impact these two things, whether it is actual impact or the perception of our customers about impact, will need to be carefully managed to ensure all risks are addressed; for example, by having very robust legislative frameworks and limiting expansion of mining into new areas.\(^ {345}\)

Notably, Mr Griffin said that the co-existence of the dairy industry with unconventional gas in other jurisdictions was ‘quite minimal’ at this stage.\(^ {344}\) Ms Miller said that: ‘The coexistence at this stage is in Gloucester [NSW] near Barrington Tops. We have a couple of dairy farms up there that have trialwells on their properties with AGL, and we have one dairy farm there which has got trial fracking occurring as part of a more advanced exploration, and that is trial based.’\(^ {345}\) Ms Miller further stated that they were not aware of any international examples of the co-existence of dairy farming with the unconventional gas industry.\(^ {346}\)

### 5.2.5 Land access laws, compensation and property prices

The following section discusses issues relating to land access laws, compensation determinations and potential impacts on property prices by an unconventional gas industry. Further details are provided on land access and compensation arrangements in section 7.3.4 of this Report (Chapter Seven addresses the regulation of a potential unconventional gas industry).

#### Land access

In Victoria, as in the rest of Australia, the Crown owns the mineral and petroleum resources – such as unconventional gas – that are located under privately owned land. The State Government, on behalf of the Crown, licences companies to explore for and extract the unconventional gas. According to Victorian law, as stated earlier in this Chapter, mining companies are required to negotiate access agreements with landholders and provide compensation for the disruption and impact on the property. If, however, the landholder does not give their consent for the company to access the land, the company can obtain a compensation determination from the Victorian Civil and Administrative Appeals Tribunal (VCAT) which allows the company to access the land even though the landholder has not consented.\(^ {347}\) The Victorian Government inter-departmental submission to the Committee explains that VCAT’s primary role is to determine the amount of compensation provided and does not have the right to determine that access

\(^ {343}\) ibid.
\(^ {344}\) ibid., p. 3.
\(^ {346}\) ibid.
should be refused.\textsuperscript{348} The VAGO report on unconventional gas states that in practice, however, land access disputes have historically been settled in Victoria though the Victorian Mining Warden, rather than VCAT.\textsuperscript{349}

The Committee heard from industry proponents that thousands of land access agreements have been successfully negotiated between farmers and gas companies in Queensland.\textsuperscript{350} The Committee also received evidence and many submissions stating that the land access system in Victoria is unbalanced and favours the industry proponent over the landholder. The VFF submission to the Committee states that the ‘existing legislation does not provide a level playing field’ between landholders and companies ‘in negotiating access agreements for the use of agricultural land.’\textsuperscript{351} It further states that:

VFF members often report that they feel compromised in the negotiation process for exploration and mining activities. That is, if a landholder disagrees with aspects of the activities proposed, they lose the power to negotiate on outcomes once a matter progresses to the dispute resolutions stage over compensation agreements.\textsuperscript{352}

The VFF advocates that more support and certainty for landholders is built into the negotiation process so as to improve landholders’ legal rights and ‘create a more equal playing field’ with the mining companies.\textsuperscript{353} The VFF, as was mentioned earlier in this Chapter, proposes that landholders be given ‘a right of veto’ over mining activities on their land.\textsuperscript{354} The VFF states that:

We consider landholders have a right to determine what their land is used for, and this right should be enshrined in legislation. While the Crown undoubtedly owns the minerals, the land (including the top 15 metres of soil) is often privately owned. In most cases modern mining requires the removal of this soil to access the minerals, which landholders should have the power to stop.\textsuperscript{355}

The Committee also heard evidence that the existing land access system is a source of significant anxiety for landholders whose properties are subject to unconventional gas exploration licences and permits. As the VAGO report on unconventional gas explains: ‘The existing system creates uncertainty for the landowner given their land may be subject to an exploration or development permit at any time.’\textsuperscript{356}

Ms Aggie Stevenson, an agricultural scientist and farmer in south-west Victoria, gave evidence to the Committee about the stress and anxiety she and her community have experienced:

\begin{itemize}
  \item \textsuperscript{348} Government of Victoria (2015) Submission 658, p. 38.
  \item \textsuperscript{349} VAGO (2015) op. cit., p. 61
  \item \textsuperscript{351} VFF (2015) Submission 471, p. 2.
  \item \textsuperscript{352} ibid., p. 13.
  \item \textsuperscript{353} ibid.
  \item \textsuperscript{354} ibid., p. 16.
  \item \textsuperscript{355} ibid.
  \item \textsuperscript{356} VAGO (2015) op. cit., p. 61
\end{itemize}
My family has cared for this land for decades, and the thought that a faceless corporation could destroy that is devastating for me and my family. The anxiety I have experienced over the last 18 months has been like nothing I have ever been through before. To think that that land that made my parents so proud could be taken away from us is unbearable.

I have spent the last 18 months trying to work out how anyone can possibly think that they can walk onto someone else’s land and say, ‘There’s gas here, we’re going to drill for it. You need to sign this access agreement’.

The feeling of landholders and citizens of being powerless to prevent the imposition of this industry is a telling psychological burden. People in agriculture have enough trouble coping with the usual pressures they face, and the added stress and anxiety caused by fighting this industry is taking its toll on the entire community.  

Mr and Mrs Flint similarly emphasised to the Committee the impacts, including health impacts, of ‘the enormous stress’ and ‘anxiety’ that the industry is causing to individuals, families and communities. Mr Rowe emphasised that the time that he and others have spent on the issue of unconventional gas, has taken time away from farm work and family life:

Running the operation as I do does not leave you much time at the end of the day to do other things. Gas has been night-time work. I have youngish children, and they say, ‘What are you doing today, Dad?’ I say, ‘It’s another gas meeting’. ‘Ah’, they say. If there is one thing I would like from this — it has been hugely distracting for me in my work; I have a couple of young dogs that need training and I have not been able to spend time on them — I think all of us would like from this, I speak collectively, would be for this distraction to stop. One thing we do not want to be is back here in five years time going through it all again. It is just so exhausting.

Compensation

The Committee heard different views on the adequacy of compensation provided to landholders whose properties are accessed by unconventional gas companies. The issue of compensation requirements under Victorian law, and stakeholder suggestions for ways it could be improved, are discussed in detail in Chapter Seven of this Report.

The VAGO report on unconventional gas states that the ‘current access and compensation arrangements for landowners are often criticised for not being fair or just. There is an imbalance between the bargaining positions of the landowners and industry, and the legislation unfairly limits possible compensation to those directly affected.’

The VFF submission to the Committee states that: ‘VFF members often feel that compensation will not provide a reasonable return to a farmer for use of their land and their time. The VFF believes that there are opportunities to provide commercial payment arrangements to account for the

full impact of a mining activity on a farming enterprise.’\textsuperscript{361} The VFF further states that when ‘land is rehabilitated following a mining development, there can be on-going issues that need to be addressed’ and proposes that the time period in which landholders can make claims, which is currently three years, should be extended to five years.\textsuperscript{362}

Conversely, Lakes Oil gave evidence to the Committee that the current system of compensation works well and that their relationship with landholders is very positive.\textsuperscript{363} Lakes Oil’s submission to the Committee stated that:

"Petroleum and mining activities have co-existed with farming and other land uses across Victoria for well over one hundred years usually to the benefit of all parties concerned. The compensation paid to the landowner for the use of the surface to access the resources below is far in excess of what the landowner would earn from their normal use of the land. If the wells are unsuccessful then they are totally rehabilitated to the landowner’s satisfaction and returned to normal farming practices."\textsuperscript{364}

Mr Tim O’Brien of Lakes Oil, further stated to the Committee that: ‘Yesterday the landowner at North Seaspray, when I caught up with him, had great pleasure in showing me his new workshop that has been done and has been helped in some way by the compensation he has been receiving from us. He generates more income from that part of his land than any other part. It is a win-win for both of us.’\textsuperscript{365}

Lakes Oil also provided the Committee with a copy of a letter written by a farmer, on whose property Lakes Oil had conducted exploration work in 2012 using conventional drilling methods, that was published in \textit{The Weekly Times} newspaper in July 2015.\textsuperscript{366} The farmer, Mr Simon Gleeson from Brucknell in south-west Victoria, stated that it was a positive experience: ‘Our farm hasn’t shown any effects. In fact, we ended up with better access points, improved tracks and fencing. The trees next to the site are still alive, my adjacent pasture still produces its tonnage.’\textsuperscript{367}

\textbf{Property values}

The Committee also heard differing evidence on the issue of whether unconventional gas exploration and development would negatively impact on property prices. The VFF submission to the Committee states that the survey it undertook of members views on unconventional gas found that: ‘There is the perception amongst the VFF membership that unconventional gas activities would undermine the value of a farm. VFF members feel that land values would

\begin{itemize}
\item \textsuperscript{361} VFF (2015) Submission 471, p. 17.
\item \textsuperscript{362} ibid.
\item \textsuperscript{365} T. O’Brien, Lakes Oil (2015) \textit{Transcript of Evidence}, 6 October, p. 19.
\item \textsuperscript{367} S. Gleeson (2015) op. cit.
\end{itemize}
be impacted because of the unknown risks. In contrast, Lakes Oil states that property prices in areas of Queensland where gas activities are occurring have not been adversely affected, and that the income earned from gas activities adds value to properties:

The myth of the negative impact on property values is exaggerated. This is highlighted by properties in Queensland, on which gas activities are occurring, advertising the off-farm income achieved from these activities as a selling point when marketing their properties for sale. The income earned from these gas activities is significant and, as mentioned above, far exceeds the usual income that would be earned by farming the affected land. The income earned from these activities is also secured and is not affected by the normal natural and market forces which affect primary producers so has been described as “drought proofing” farms and providing them some protection from the usual fluctuations which occur across the industry.

The New South Wales Valuer General’s 2014 Study on the Impact of the Coal Seam Gas Industry on Land Values in NSW found that there has been little research to date on the impact of the CSG industry on land values and there was little guidance available overseas. The report further noted that other Australian jurisdictions, including Queensland where the industry is much further advanced, also did not provide definitive evidence about the impact of CSG operations on land values. In regards to New South Wales, the report concluded that:

The limited market evidence available for this study indicated no clear impact of the CSG industry on land values in NSW. However, a major limitation of these findings is the low number of sales that are available to analyse. The co-existence and impact of mining activity also limited the ability of the study to investigate some locations with CSG developments... Anecdotal evidence indicated that the presence of the CSG industry in an area may potentially cause a reduction to the number of potential purchasers and an increase to the time taken to sell a property...

Some of the features that are likely to be factors in the CSG industry’s impact on land values include the positioning of wells, well design, compensation provided to landholders, surrounding land uses, effect on the environment and community perceptions.

5.2.6 Multiple land use framework

The SCER (now the COAG Energy Council) which produced the National Harmonised Regulatory Framework (see section 2.7.1 of this Report) was also tasked with producing a ’Multiple Land Use Framework’ or ’MLUF’. The MLUF was completed in 2013 and is intended to provide a nationally consistent methodology to enable states to improve the management of potential land use conflicts with regard to the minerals and petroleum sector.
Chapter 5 Co-existence – Can the unconventional gas industry co-exist with other land uses?

The submission from the APPEA states that it strongly supports the adoption of the guiding principles set out in the MLUF as way to foster successful co-existence. The APPEA said that: ‘working together to establish a framework that supports ongoing development in both the agriculture and resources sectors, and of education and mutual understanding of the needs of all parties, has proven successful and will continue to be the most effective way to manage land access in Australia.’ The APPEA advocates that the MLUF ‘should be pursued across government to deliver shared benefits to all stakeholders’ and ‘integrated into planning documents and strategic frameworks relating to the further development of the onshore gas industry in Victoria.’

The Minerals Councils submission to the Committee similarly emphasises that ‘land can be used for different purposes at the same time (multiple) and for different purposes after a land use has finished (sequential).’ The Minerals Council states that ‘Exploration for and development of unconventional gas fields are activities that complement multiple land use as the physical footprint of a production well is relatively small. It allows the existing land users to continue to utilise the land.’ Land use planning is further discussed in section 7.3.4 of this Report.

5.3 Tourism

The Committee received evidence about the potential impact an unconventional gas industry may have on Victoria’s tourism industry. The Committee heard that tourism in areas of the state prospective for unconventional gas contributes a significant amount to both local and state economies. Councillor Brian Crook from Colac Otway Shire advised the Committee that tourism was worth $133 million, and agriculture a further $160 million per year in that shire alone. Councillor Margot Smith from the Surf Coast Shire advised that there are around two million visitors to the shire annually, accounting for over half a billion dollars of spending, and providing full-time employment for approximately 1100 people.

Mr Michael Greenham, a farmer from Dartmoor in Western Victoria which is an area in which Mecrus Resources is permitted to explore, suggested to the Committee that the tourism and agriculture industries provide more money to the economy than a potential unconventional gas industry would:

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374 ibid., pp. 15-16.
376 ibid.
Mecrus, which own the exploration licence over our farms at Dartmoor, said they have about a $6 billion goldmine they are sitting on there. I have figures from Tourism Victoria and the Department of Agriculture that say that in one year, tourism in this south-west area would match that, and that farming would match it over four years. Yet they have $6 billion that they want to spread out over 40 years.\footnote{M. Greenham (2015) \textit{Transcript of Evidence}, 23 September, p. 58. Note: Mecrus states in its submission to the Committee that, based on an independent assessment, royalties to the State would ‘exceed $600 million’ over the 40 year period. See Mecrus (2015) Submission 247, p. 3.}

A significant number of witnesses opposed the creation of an unconventional gas industry on the basis that it would damage the environment and pose a risk to the tourism industry.\footnote{See for example: T. Dennis (2015) \textit{Transcript of Evidence}, 12 August, p. 34; K. Kline (2015) \textit{Transcript of Evidence}, 12 August, p. 35; U. Alquier, Lock the Gate (2015) Submission 353, p. 22; M. Smith (2015) \textit{Transcript of Evidence}, 12 August, p. 2.}

Councillor Crook emphasised the growth of ecotourism in the Otways following the cessation of hardwood logging in 2008, and the successful co-existence of new small tourism businesses with agriculture.\footnote{B. Crook (2015) \textit{Transcript of Evidence}, 12 August, p. 3.}

Councillor Neil Rankine from the Bass Coast Shire Council stated that tourism is a major industry in that municipality, and that: “The tourists who come to our municipality want to see cows in the paddock; they do not want to see an industrialised landscape. So it is absolutely essential to our economy that we maintain the viability of that industry without something that is going to industrialise that landscape.”\footnote{N. Rankine (2015) \textit{Transcript of Evidence}, 30 June, p. 2.}

Mr Damien Marchant, of Frack Free Moriac, stated to the Committee that:

People have declared they do not want this industry in Victoria. What is at stake? Why did so many wish to be gas field free? The Surf Coast area, as you have heard today, is not only a top Victorian tourist area but boasts the best fertile agricultural land. In the heart of PEP 163, we have wineries, dairy farms, cattle studs, farmers cropping, horse studs, ecotourism accommodation and award-winning restaurants, all at the entrance of the Great Ocean Road.\footnote{D. Marchant, Frack Free Moriac (2015) \textit{Transcript of Evidence}, 12 August, p. 19.}

However, it was also suggested to the Committee that an unconventional gas industry may boost employment and tourism in these areas rather than reduce tourist numbers. Ms Megan Davison from the Minerals Council suggested that:

I think the assumption of a negative impact discounts the positive impacts also. Impact can be positive or negative. One of the benefits of any mineral development to any community in any region is that a company becomes an anchor tenant for upgrades of infrastructure and increased capacity in utilities, because it is an anchor contractor. It contracts a certain amount, and therefore the communities can benefit, so there is that benefit with regard to tourism. You might be surprised to know that mining tourism occurs as well. Certainly the Pilbara sees a very high proportion of travellers going on mining tourism.\footnote{M. Davison, Minerals Council (2015) \textit{Transcript of Evidence}, 22 July, p. 8.}
Dr George Carman, a petroleum geologist, suggested to the Committee that the two industries could co-exist, and gave the example of the Isle of Purbeck and the Solent in the United Kingdom. He said that: ‘Over 100 wells have been drilled horizontally out underneath this very prestigious sailing area, from a national park... All of these wells are drilling out up to 12 kilometres reach from the pads, and they are barely detectable to tourists’.\textsuperscript{385} Closer to home, the Committee notes that Corangamite Shire has both a tourist industry and a conventional gas industry operating in close proximity to each other:

\begin{quote}
[Corangamite Shire] has an important tourism industry with 2.5 odd million visitors annually to the Twelve Apostles, with Port Campbell as a key tourism hub. Corangamite Shire also has an important gas industry within the shire located in close proximity to Port Campbell. There are three large gas processing facilities within the shire that receive and process gas extracted from offshore fields in Bass Strait. The gas plants provide important direct employment opportunities for members of the community. They also contribute to the broader economy of the shire...\textsuperscript{386}
\end{quote}

\section{Traditional Owner groups}

The Committee recognises the significance of country to Victoria's Traditional Owners, and the importance of considering issues relating to unconventional gas activity on land subject to native title or agreements under Victoria's \textit{Traditional Owner Settlement Act 2010}. The Victorian Government inter-departmental submission to the Committee explains that ‘Traditional owners have a responsibility under their traditional law and custom to care for their country, which they see as inextricably linked to their identity, culture and wellbeing.’\textsuperscript{387} The Victorian Government inter-departmental submission further explains that the Commonwealth \textit{Native Title Act 1993} provides ‘a process through which Aboriginal people can make a claim for a Federal Court determination that recognises their native title rights and interests in their land and waters.’\textsuperscript{388}

The Native Title Act provides that native title is deemed to be extinguished if the land is under freehold title but can be claimed over vacant Crown land, other public land such as forests, lakes and reserves, and over some types of leases (such as pastoral leases).\textsuperscript{389} The Victorian Government inter-departmental submission states that there have been four positive native title determinations in Victoria to date.\textsuperscript{390}

\begin{footnotes}
\item[386] D. Rae, Corangamite Shire Council (2015) \textit{Transcript of Evidence}, 23 September, p. 3.
\item[388] ibid.
\end{footnotes}
The ACOLA report explains that native title does not provide Traditional Owners with the right to veto exploration or development activities on the land, but it does provide the right to negotiate over future uses of that land (termed ‘future acts’ in the legislation):

Native title gives only limited rights to traditional owners. In particular, native title holders do not own the subsurface rights, do not have a right of exclusive use and have no right of veto over development. They do, however, have a legally recognised right to negotiate over future uses of that land. If the parties cannot reach agreement, the matter can be referred to a court for final resolution, but in practice the great majority of claims involving resource projects are settled by negotiation. The main reason for this is that the alternative – seeking a court determination – is slow, costly and uncertain for all parties. 391

Mr Damein Bell, a Gunditjmara person, and the Chief Executive Officer of the Gunditj Mirring Traditional Owners Aboriginal Corporation, presented evidence to the Committee explaining that:

Under the Native Title Act 1993 and through the consent determinations by the Federal Court of Australia in 2007 and 2011 the state of Victoria and the commonwealth of Australia recognised a set of native title rights and interests in relation to Gunditjmara people. They include the right of access to lands and waters, the right to camp, the right to use and enjoy lands and waters, the right to take resources of the lands and waters, the right to protect places and areas of importance on the lands and waters, and the right to take water from the waterways, which is limited to domestic and ordinary use. The native title rights and interests are recognised over 143 000 hectares of vacant Crown land. 392

Mr Bell further explained to the Committee that petroleum exploration permits which allow for exploration for unconventional gas have been granted over Gunditjmara country. He said that that the Gunditjmara people, through Gunditj Mirring, have responded through the Native Title Act future acts notification process that triggers the right to negotiate. He said that ‘the Gunditjmara had successfully negotiated several Indigenous Land Use Agreements (ILUAs) with several companies, which allowed them to progress their exploration activities as prescribed in their respective exploration licences.’ Mr Bell further said that:

In early 2014 Gunditj Mirring became aware that one of the companies we had signed an ILUA with was including the practice of fracturing to extract unconventional gas if they were granted a production licence. Through several full-group meetings in 2014 our members discussed the previous negotiations with the company and whether the process of fracturing had been raised as a potential production method. At the same time Gunditj Mirring and our legal representatives, Native Title Services Victoria, reviewed our documents and the documents provided by the company for any reference to the fracturing method. We had found that while the earlier documents, the Indigenous land use agreement documents, that we had signed did not contain any mention of the fracturing method, we did find the term fracturing mentioned once in the actual exploration licence. 393

393 ibid., p. 33.
Mr Bell stated that the Gunditj Mirring determined that the prospect of the hydraulic fracturing had not been brought to their attention and that now that they are aware of it, further information gathering and negotiation with the company will be required.\(^{394}\)

In Victoria, the rights of Traditional Owners can also be recognised under the Traditional Owners Settlement Act. This Act is intended to provide a state-based means of settling native title claims and act as an alternative to the litigious processes provided by the Native Title Act. It allows for Victorian Traditional Owner groups to enter into ‘recognition and settlement agreements directly with the state government’.\(^{395}\)

The Victorian Government inter-departmental submission to the Committee states that agreements under the Traditional Owners Settlement Act provide a right to negotiate for mining licences, and a fast-tracked approval process for exploration licences.\(^{396}\) The Victorian Government inter-departmental submission further states that some Traditional Owners have expressed concerns about not having the right to negotiate approvals for exploration licences in the context of a heightened awareness of the risks of hydraulic fracturing:

Due to concerns about hydraulic fracturing, some traditional owners have expressed dissatisfaction with the standard conditions component of Victoria’s alternative settlement framework, requesting that all exploration or prospecting licence grants be subject to a right to negotiate.

A number of traditional owners perceive the right to negotiate under the Native Title Act provides them with a better means of carrying out their duty to care for country. Traditional owner groups may consider that the only way to oppose hydraulic fracturing under an exploration licence is to reject a settlement under the Traditional Owner Settlement Act. Groups may instead seek native title determinations through the Federal Court.\(^{397}\)

\section{5.5 Local and regional development, investment and jobs}

The Committee heard a range of evidence on the potential effects of an unconventional gas industry on local and regional development, investment and jobs. The submission to the Committee from the Minerals Council states that:

The development of an onshore gas industry has the potential to bring a great deal of wealth to the state and to the people of Victoria. It also has the potential to support regional economies and provide high-paying jobs to people who want to live in the regions.\(^{398}\)

\begin{flushright}
\begin{footnotesize}
\begin{itemize}
\item \(^{394}\) ibid., p. 35. Mr Bell stated that Gunditj Mirring ‘determined to raise the issue of fracturing with the company through the dispute clause in the ILUA’, p. 33.
\item \(^{397}\) ibid.
\end{itemize}
\end{footnotesize}
\end{flushright}
Chapter 5 Co-existence – Can the unconventional gas industry co-exist with other land uses?

Lakes Oil’s submission to the Committee similarly emphasised that new energy sources such as unconventional gas will ‘provide the ability for new industry to be developed to use them’ and that:

As the developments associated with the new energy sources are generally located in regional areas they can provide huge benefits to the local and wider regional areas. Youth unemployment in regional Victoria is one of the biggest issues facing the State and it is getting more and more difficult to attract significant industrial investment into regional areas to help combat this problem as the energy sources and infrastructure are not present. As Australia is a safe place to do business large multinational companies are prepared to invest into regional Victoria and can accept the high labour costs as long as their energy costs are manageable. Victoria’s onshore gas resources can offer them this energy cost security.399

Additionally, APPEA cited a 2013 study by KPMG of ‘Australia’s nine main resources regions’ which found that, in the five years to 2011, the number of people employed in the resources sector across the sampled regions grew by 13,810 or 50 per cent, whereas the number employed in all industries – including resources – grew by just 14 per cent.400

Research by the Gas Industry Social & Environmental Research Alliance in Queensland has found that for each gas industry job created there were two additional jobs created in related construction and professional services. Conversely, for each new gas job there was a reduction of 1.7 jobs from the agricultural sector.401

However, submissions from the Australia Institute and others have queried the long-term sustainability of the employment that might be provided by an unconventional gas industry in Victoria. The Australia Institute states that workers are likely to be sourced from interstate on a ‘fly in fly out’ basis, with minimal impact on local unemployment rates.402

Ms Ursula Alquier, of Lock the Gate Victoria, highlighted the potentially short-term nature of jobs provided by an unconventional gas industry in contrast to the ongoing employment provided by existing industries. She stated that: ‘these jobs are short-lived. A boost in employment may last two or three years during the construction phase of a gas project, but many communities are beginning to find out that after the boom, there is a bust.’403 Ms Alquier further stated that:

Even during the construction boom, an increase in the number of gas-industry related jobs does not paint the whole picture. Increases in rent, the price of labour and increases in the demand on contractors can drive up prices for agriculture, manufacturing, tourism and other parts of the economy that could be devastating for farmers and small business.404

404 ibid.
It is clear from media reports that the development of coal seam gas in south-east Queensland has resulted in considerable social and economic change in rural agricultural areas. The Committee notes the importance of Victoria taking account of the experiences of other jurisdictions in which the unconventional gas industry is more established.

5.6 Findings

The Committee notes that Victoria is a relatively small and densely populated state of Australia with agriculture forming a key component of the economy. The Committee also notes the economic importance of tourism to the State. The smaller size and more intensive land use in Victoria, in comparison to other Australian jurisdictions, is an important factor in the consideration of whether an unconventional gas industry should proceed in this State, and if so, how multiple land uses will be managed. The density of settlement and importance of agriculture in Victoria mean that there is potential for challenges in regard to co-existence with an unconventional gas industry.

The Committee also acknowledges the importance of country to Traditional Owner groups. It notes the importance of increasing awareness around the implications of unconventional gas exploration and development for Traditional Owners, and potential issues surrounding native title and agreements under the Traditional Owners Settlement Act.

The Committee also notes the evidence it received that the co-existence of the dairy industry with the unconventional gas industry in other jurisdictions is at a very early stage, with only one example of trial situations in New South Wales being provided to the Committee. Given the particular importance of the dairy industry to Victoria, it will be important to monitor the outcomes of the co-existence of dairy farming with unconventional gas production in other jurisdictions.

The Committee notes the findings of a number of reviews predating this current Inquiry which have found that there is an imbalance in the Victorian land access and compensation arrangements under the Minerals and Petroleum Acts, which favours the industry proponent over the landholder. The Committee concurs with the findings of those previous reports that the system needs to be reviewed.

The Committee acknowledges the VFF’s call for landholders to be given the right to veto mining activities on their land, however it notes the difficulty of this proposition given that the resources below the ground belong to the Crown, and a granting of a right to veto effectively transfers ownership of these resources to the landholder.

Chapter Six considers the science knowledge requirements that would be necessary to enable a potential unconventional gas industry, including the further scientific work required to inform the effective regulation of the industry. The compilation of scientific data is important because it enables a more informed understanding of the potential risks and impacts posed by the exploration and development of unconventional gas. This knowledge can then be used to formulate targeted risk-mitigation strategies, appropriate regulation, and to help determine areas where it would or would not be appropriate for an unconventional gas industry to proceed.

At present, there is an incomplete understanding of the prospectivity for unconventional gas in the geological formations of the Gippsland and Otway Basins, which was discussed in Chapter Three of this Report. Chapter Four outlined the commonly identified risks posed by the unconventional gas industry and highlighted potential impact on water resources as a major concern. Unconventional gas developments have the potential to impact water resources, and groundwater in particular, through a range of activities, such as drilling through aquifers, the use of various chemicals in drilling and hydraulic fracturing and by depressurisation of coal seams or reservoirs.

Chapter Six accordingly focuses on the importance of understanding the hydrogeology of an area prior to unconventional gas development. It firstly explains why understanding hydrogeology is important in regards to risk management. It then provides an overview of the current knowledge of groundwater resources in the Gippsland and Otway Basins, including the Victorian Government’s recently completed water science studies, and the IESC’s Bioregional Assessment of the Gippsland Basin which is expected to be completed in 2016. Finally, the Chapter identifies knowledge gaps that remain in the State’s understanding of the water resources in the two Basins, and the further work that needs to be done more broadly to inform the effective regulation of an unconventional gas industry, if it is determined that it should proceed.

Why understanding hydrogeology is important to risk management

Hydrogeology is the study of groundwater, the rock layers in which the groundwater is contained and the interaction of groundwater with surface water. There is an extensive body of literature emphasising the need to understand the
hydrogeology of areas earmarked for unconventional gas development in order to identify and assess risks.\textsuperscript{406} The key hydrogeological information required includes geological structure, hydrogeological properties (hydraulic conductivity, storativity and porosity), baseline groundwater levels and groundwater quality (including natural variability in these), and connectivity between groundwater in different aquifers and surface water bodies.

This information is necessary for several reasons. Firstly, it is needed to identify the groundwater and surface water assets that are present and require protection, including their function and value to the community or environment. It is important to have a benchmark of existing groundwater levels and quality so that any changes or adverse impacts that might be caused by unconventional gas developments can be identified. Box 6.1 below provides an example of a baseline study for the CSG industry in New South Wales.

**BOX 6.1: Baseline water study**

In October 2015, researchers from Southern Cross University completed baseline studies of the Richmond River catchment in New South Wales, an area with the potential for CSG development. The studies looked for the presence of methane within the aquifers. The researchers found that there was no evidence of methane moving from coal seams into the underground water. The studies therefore provide a baseline of what is ‘normal’ for the catchment and will allow the impact of any future CSG operations to be assessed in terms of the movement of methane into aquifers.

*Note: this example is provided as an illustrative case study of a baseline study.*

Secondly, hydrogeological information is required to predict the type, scale and likelihood of impacts that may occur from unconventional gas development. A knowledge of aquifer extent, structure, interconnectedness, water balance (inflows and outflows), hydraulic properties and water chemistry are all required. This allows a decision to be made on where and how these risks can be mitigated.

For example, this information will allow decisions to be made on the amount and quality of water required to be extracted (for CSG), likely water requirements for hydraulic fracturing (for shale and tight gas), the potential fracture propagation distances if hydraulic fracturing is used, the extent of depressurisation likely to occur in response to water extraction, and the extent to which any spills of wastewater or other contaminants would be able to migrate into groundwater and surface water if they were to occur at the surface.

Finally, key hydrogeological information allows the establishment of appropriate safeguards and monitoring criteria during unconventional gas development in an area. For example, hydrogeological knowledge is required to decide if enough groundwater monitoring bores exist and are in the right locations in a particular area and what parameters are monitored.

6.3 Current knowledge of groundwater resources

Overall, the understanding of the hydrogeology of the Gippsland and Otway Basins is reasonably strong. However, more is known about shallow parts of the basin (<500 m) and areas which have already undergone groundwater development, that is, within the Quaternary and Tertiary geological units where most accessible groundwater resources reside. Data gaps still exist in such areas of knowledge as surface water-groundwater interaction, consolidation and subsidence, aquifer and aquitard properties (particularly at greater depths), groundwater chemistry and spatial coverage (good data exists for some but not all of these areas).

There is a long history of geological investigations carried out in both basins associated for geological mapping and hydrocarbon exploration. The Geological Survey of Victoria/Department of Mines produced geological maps and survey reports based on drilling and hydrogeological investigations in the both basins, mostly conducted between the 1970s and 1990s. At a statewide level, the Victorian Aquifer Framework divides and names aquifers (water bearing geological units) and aquitards (water restricting geological units) in a consistent manner across the State. Each particular aquifer or aquitard in turn consists of a geological unit specific to various locations across the State. These layers have then been mapped in three-dimensions, with the degree of certainty or accuracy largely dependent on the amount of drilling that has occurred in any particular area.

Several numerical models of groundwater resources have been developed in the past decade, particularly in the Gippsland region. In 2010 ecoMarkets (a branch of DELWP) commissioned groundwater models for each of Victoria’s ten catchment management areas including the Glenelg-Hopkins and Corangamite Catchments.

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410 ibid.
Groundwater resource appraisals (which assess how much water could reasonably be extracted from a particular groundwater area) have been completed in recent years for the Hawkesdale Water Supply Protection Area, Lower Tertiary Aquifer in the Otway region, and the Moe Groundwater Catchment in the Gippsland region. Other appraisals were completed over much of the Gippsland and Otway regions in the late 1990s but were preliminary in nature and require improvement.

Research in the Gippsland and Otway regions is ongoing. More recent research has focused on specific issues such as surface water–groundwater interaction, or the potential storage of carbon dioxide.

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418 M. Reid (2004) Audit of permissible annual volumes for 35 Victorian groundwater management areas, Department of Primary Industries.
Box 6.2: Existing impacts on groundwater from coal mining and oil and gas extraction in the Gippsland Basin

Development of coal (onshore) and oil and gas (offshore) resources in the Gippsland Basin has had significant impacts on groundwater levels across the region. Approximately 180,000 ML of groundwater is extracted each year in the Gippsland Basin of which approximately 100,000 ML is by oil and gas operations and approximately 25,000 ML extracted by the Latrobe Valley coal mines.

Groundwater levels have declined by around 40 m in the Yarram region since the 1980s and continue to fall by around 1 m per year. This has largely been attributed to the oil and gas extraction from Bass Strait. This has resulted in the need for drilling replacement bores, lowering pumps or additional water pumping costs for which the Victorian and Commonwealth Governments have previously provided financial assistance.

In the Latrobe Valley, the large volumes of groundwater extracted for dewatering and production water purposes from brown coal mines have resulted in large groundwater level declines in the surrounding aquifers and extensive land subsidence of up to 2 m near the mines themselves. Settlement to date has been relatively even such that structural damage has been minimal, but stability issues near the mines remain ongoing.

Little is known about the impacts of groundwater quality from existing developments. Further research is required to understand groundwater geochemistry and water-rock interactions, sources of solutes that may be used as signatures of water sources, and effective monitoring technologies.

Note: this is an illustrative example of the potential impacts of mining on groundwater.

6.4 Recently completed work

The following sections provide information on the Victorian Government’s water science studies and the Bioregional Assessment of the Gippsland Basin.

6.4.1 Water science studies

In June 2015, during the course of this Inquiry, the Victorian Government completed water science studies, which it described as ‘an initial screening analysis of the potential impacts of possible onshore gas exploration and development on water users and ecosystems.’ The water science studies were produced by DELWP in collaboration with the Geological Survey of Victoria (part of DEDJTR). The key reports were reviewed by independent experts including Professor Rae Mackay, Professor Dayanthi Nugegoda and Professor Craig Simmons.

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The water science studies are outlined in summary reports for both the Gippsland and Otway areas supported by eight technical reports.\textsuperscript{422} The technical reports cover impact assessments, gas prospectivity and groundwater sampling for both areas,\textsuperscript{423} with two additional reports covering groundwater modelling and gravity survey results for the Gippsland area only.\textsuperscript{424}

### 6.4.2 The relationship between the water science studies and bioregional assessments

The IESC has developed a comprehensive methodology for conducting bioregional assessments for regional sedimentary basins in Australia that are currently or potentially the subject of large scale coal seam gas development (see section 2.7.2 of this Report).\textsuperscript{425} The bioregional assessment program currently includes six areas in Australia with only one of those areas – Gippsland – located in Victoria.

Bioregional assessments are ‘a scientific analysis, providing a baseline level of information on the ecology, hydrology, geology and hydrogeology of a bioregion with explicit assessment of the potential direct, indirect and cumulative impacts of CSG and coal mining development on water resources.’\textsuperscript{426} While this system was set up specifically for CSG and coal mining developments, the risk assessment process is equally valid for unconventional gas developments more generally. The components of bioregional assessments include:

- Contextual information: context and background against which qualitative and quantitative assessments of impact and risk of are generated
- Model-data analysis evaluates and synthesises information from data and models to develop a quantitative description of the hydrologic relationship between depressurisation and dewatering and associated impacts on receptors
- Impact analysis reports and records the direct, indirect and cumulative impacts and associated uncertainties of impacts of development on specified receptors
- Risk analysis provides a scientific assessment of the likelihood of impacts on receptors
- Outcome synthesis is a synthesis of outcomes used by the IESC to support scientific advice on impacts and risk of development on water resources.\textsuperscript{427}


\textsuperscript{426} ibid., p. ii.

\textsuperscript{427} ibid.
The Victorian Government’s water science studies constituted a subset of studies that will ultimately form the suite of studies required for the bioregional assessment of Gippsland. While a full bioregional assessment is required for the Gippsland area only at this stage, the water science studies completed for the Otway area are consistent with bioregional assessment requirements. The water science studies have been completed in collaboration with the IESC and the water science reports were peer reviewed by Professor Craig Simmons, a member of the IESC.

However, not all of the work completed for the bioregional assessments is currently available, such as the water asset registry (a key part of the ‘Contextual Information’). Furthermore, the impact and risk analysis completed were based on hypothetical development scenarios which may or may not be the same as actual future development of unconventional gas. The expected completion date for the Gippsland bioregional assessment is the first half of 2016.

6.4.3 Impact assessment reports

The water science studies impact assessments estimated the potential impacts to aquifers, rivers and water bodies from theoretical development scenarios of unconventional gas resources. The impact assessments considered four hazards: aquifer depressurisation, chemical contamination of groundwater from hydraulic fracturing fluids, induced seismicity and land subsidence. A ‘causal pathway approach, describing where natural gas might be, where water resources are, and the physical connections between the gas and water resources’ was used to complete qualitative risk assessments for each hazard as insufficient data was available for quantitative risk assessments.

The key findings of the impact assessment reports are:

- In Gippsland the risk posed by tight and shale gas development is low while the risk posed by CSG development is medium (for land subsidence) to high (for impact to groundwater users and the environment from depressurisation)
- In the Otway region the risks posed by tight, shale and CSG development are low
- The difference in risk profile between the two regions is the vertical separation of potential zones of gas development from overlying aquifers in all scenarios considered for the Otway region while the development of gas from within the Latrobe Group, which is also an aquifer, was considered in the Gippsland Region.

These findings were qualified in the report by noting some limitations of the studies (discussed further below).

6.4.4 *Groundwater sampling reports*

Groundwater sampling was conducted in the Gippsland and Otway regions to characterise the groundwater chemistry (particularly to confirm the presence or absence of hydrocarbons including methane) and provide baseline data. Groundwater samples were collected and analysed from 29 existing monitoring bores in the Gippsland region and 30 existing monitoring bores in the Otway region. Bores were selected on the basis that they were:

known or suspected of having hydrocarbon concentrations...and/or within or near high value groundwater or surface water assets. Priority was given to nested sites which provide vertical information on variations in groundwater chemistry and sites with known construction details.\textsuperscript{430}

Three rounds of sampling on different dates were conducted in the Gippsland region and one in the Otway region, although only the results from the first sampling round have been published to date.

The key findings of the groundwater sampling reports are:

- In Gippsland, major ion analysis indicated that groundwater is sodium chloride type and that lateral, not vertical, groundwater flow dominates
- Dissolved methane concentrations tend to be highest in the coal bearing units of the Lower Tertiary Aquifer and Upper-Mid Tertiary Aquifers. Methane was low or absent in shallow groundwater
- Ethene, Butane, Butene, Propane and Propene were not found in any samples
- Total Petroleum Hydrocarbons (TPH) and naturally occurring Benzene, Toluene, Ethylbenzene and Xylene (BTEX) compounds were only found in the coal bearing units of the Lower Tertiary Aquifer or Upper-mid Tertiary Aquifers
- The results are consistent with the idea that the Upper Mid-Tertiary Aquitard (Lakes Entrance Formation) acts as a seal on top of the Lower Tertiary Aquifer, although the presence of low concentrations of methane in shallow groundwater suggests that upwards seepage is possible and that the seal is imperfect
- In the Otway region, dissolved methane was typically found in low concentrations
- Only minor amounts of Total Petroleum Hydrocarbons were found while BTEX compounds were typically absent
- In the Otway region, it was tentatively concluded that there is limited upward migration of hydrocarbons from deep to shallow formations.\textsuperscript{431}


6.4.5 **Additional reports**

A groundwater modelling technical report for the Gippsland Basin was also produced. It describes how existing models of the hydrogeology of Gippsland were assessed, reviewed, adapted and used in impact assessment modelling under future potential gas development scenarios.\(^{432}\) As no numerical groundwater model currently exists for the Otway Basin, this was only conducted for Gippsland. The Gippsland model predicted the most substantial impacts on the shallow watertable are associated with CSG development (a watertable decline of 10 m over a 193,000 hectare area), whereas tight and shale gas developments were predicted to have a negligible impact.

A gravity survey was conducted in Gippsland to improve understanding of the regional geological structure, particularly of the Cretaceous Strzelecki Group and the underlying Palaeozoic basement. The report outlines the data collection and processing and presents the final data but does not provide geological interpretation.

In addition to these reports, a GIS-based (geographical information system) database of water ‘assets’ in the two areas was also developed – for example, high value surface water and groundwater dependent ecosystems; high value water supply aquifers. As yet this database is not available to view by the general public. The database for Gippsland will form part of the Bioregional Assessments program outputs for the Gippsland Region.\(^{433}\)

The gaps and limitations of the water science studies are outlined in the next section.

6.5 **Current knowledge gaps and uncertainties**

While the water science reports provide a comprehensive ‘initial screening analysis’ there were a number of limitations in the scope of the projects, some data gaps and/or degrees of uncertainty identified by the reports. These would need to be addressed to inform the effective regulation of an unconventional gas industry.

Matters outside of scope of the water science reports include:

- Produced water management including reinjection
- Use of water for hydraulic fracturing
- Hazards associated with bore integrity (closure, decommissioning and well abandonment)
- Handling and storage of chemical additives

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• Environmental issues not related to water resources such as amenity, air quality, fugitive gas emissions.\textsuperscript{434}

The water sciences reports acknowledge a number of data gaps and uncertainty including:

• Permeability of seal rocks
• Compaction and consolidation parameters
• Definition of potential gas sources
• Connection of ecosystems to groundwater
• Drawdown estimates
• Relationship between drawdown and river flows.\textsuperscript{435}

Additional gaps in the water science reports to date include:

• The lack of a numerical model to assess drawdown impacts in the Otway region
• The number of bores used in baseline assessment (and the number of bores currently available to adequately monitor potential gas developments)
• Ongoing maintenance of gas wells (that is, post installation and abandonment)
• The risk posed by existing or abandoned bores/wells that have not been sealed or decommissioned adequately.

It is noted that based on a review of international literature, and submissions to this Inquiry, these gaps relate to some of the most significant potential risks associated with unconventional gas activity (Chapter Four of this Report provides an overview of potential risks posed by the industry).\textsuperscript{436} The issues above can to some degree be informed by experiences in other jurisdictions, and in most cases are issues which are addressed to a degree in Victorian and Australian environmental policies and guidelines. Some of these key issues are discussed below.

\textsuperscript{435} ibid., p. 111
6.5.1 Production, treatment and disposal of produced water

Produced water management was the subject of a report completed for the NSW Chief Scientist by Professor Stuart Khan.\(^{437}\) It has also been studied extensively as part of the ‘Healthy Headwaters’ program of scientific studies in Queensland, associated with the recent expansion of the CSG industry there.\(^{438}\)

This issue is one which would largely fall within the jurisdiction of the Victorian Environment Protection Authority (EPA), who regulate the management, disposal and (if necessary) clean-up of any wastes and/or pollution. The New South Wales EPA has established a dedicated team working on issues associated with management, monitoring and compliance of CSG activity in the state, and a significant part of their work involves assessing and managing current and future impacts of produced water. The team has undergone significant training in the area of monitoring and mitigation strategies for CSG produced water and, as pointed out in the Victorian EPA’s submission, CSG exploration and production activities require an EPA licence.\(^{439}\)

If an unconventional gas industry were to proceed in Victoria, site-specific information would be required to allow effective monitoring and regulation. This would firstly include information on the volumes of water likely to be extracted, either to allow gas flow from CSG wells, or to conduct successful hydraulic fracturing for shale and tight gas deposits in Victoria’s geology. Secondly this would include information on the chemistry and quality of produced water or ‘flow back’ water associated with the particular conditions encountered with Victoria’s gas deposits. These will both vary depending on local geology and industry practices adopted (e.g. choice of fluids used for hydraulic fracturing). Hence a program of water sampling and detailed chemical analysis of any such fluids would be required for the specific setting in question.

6.5.2 On site/surface management of chemicals

The issue of risks associated with on-site chemical management was one focus area in the United States EPA’s forthcoming five-year study on impacts of hydraulic fracturing on drinking water.\(^{440}\) Their draft report, which has been released for public comment, identifies this issue as being one of the four major regulatory challenges associated with unconventional gas in the United States. The draft report provides data from Colorado, which shows that surface spills of hydraulic fracturing chemicals during preparation at the well-site and/or ‘flow

\(^{437}\) Khan & Kordek (2014) op. cit.
\(^{440}\) US EPA (2015) op. cit.
Chapter 6 Science knowledge requirements – Hydrogeology

back’ from the well have occurred in between one and ten percent of wells. Hence a strict set of guidelines and monitoring and compliance regimes covering this impact is a priority area.

As with produced water, this issue could be largely regulated by Victorian EPA, who oversee the assessment, management and regulation of wastes and pollution under the Environment Protection Act 1970. It is noted that unconventional gas prospects in Victoria are predominantly shale and tight gas, which in contrast to CSG (more common in Queensland) nearly always requires hydraulic fracturing.\(^{441}\)

### 6.5.3 Bore integrity

There is a consensus within the international research literature that the major pathway by which cross-aquifer contamination of groundwater, due to unconventional gas, occurs is through problems with gas and/or water bore integrity.\(^{442}\) This is particularly the case for cross-contamination of aquifers with fugitive methane, but can also apply to other components (for example, abandoned or poorly sealed wells providing a conduit for downward leakage of surface contaminants).

Most documented cases of contamination of groundwater with fugitive methane in the United States are attributed to either abandoned or poorly sealed active wells.\(^ {443}\) This is therefore a critical issue that requires effective regulation and oversight if an unconventional gas industry is to have minimal impacts on groundwater.

Victoria currently has a water bore construction and licencing system administered by Rural Water Corporations with standards set by the Minimum Construction Standards for Water Bores in Australia.\(^ {444}\) The task of keeping accurate records of every bore and ensuring their long-term integrity, is a time and resource intensive task. For example, records show that between 500,000 and one million bores of some kind (for example, water supply, monitoring, oil and gas, geotechnical) have been drilled in Victoria since the 1970s.\(^ {445}\) In cases where the bores are ageing and/or abandoned, decommissioning by way of cementing the bore is typically the recommended action, so that the bore cannot provide a contamination pathway in the future. A significant increase in the resources available to monitor the integrity and condition of wells, and identify and decommission these where necessary, would likely be required to ensure this pathway is minimised if an unconventional gas industry were to proceed.

\(^{441}\) Cook et al. (2013) op. cit. p. 65.
\(^{442}\) ibid.; Darrah et al. (2014) op. cit.; Vengosh et al. (2014) op. cit.; IESC (2014) Bore Integrity, Background Review, Commonwealth of Australia.
\(^{443}\) Darrah et al. (2014) op. cit.; Vengosh et al. (2014) op. cit.
6.5.4 Groundwater monitoring bore locations and baseline sampling

Only a limited number of groundwater monitoring bores were considered appropriate (in terms of location, depth and condition) for sampling in the baseline groundwater sampling program. The Gippsland groundwater sampling report shows a map with regions of gas prospectivity, and locations of the monitoring bores sampled in the program. There are areas near gas deposits where no monitoring bores were available for sampling.\(^{446}\)

The Gippsland groundwater sampling report also shows where groundwater monitoring bores would be desirable but do not exist at present. These areas include the Strzelecki group within the Seaspray depression, near the Lake Bunga 1 historic oil production bore near Lakes Entrance, near the interpreted hydrocarbon seeps to the north and southeast of Sale, within the Balook Formation near Rosedale, covering the Cretaceous and Lower Tertiary aquifers in all prospective areas near the Wombat, Trifon, Gangell, Echidna, Steele and Carrs Creek gas exploration fields.

A number of bores which have previously showed occurrences of hydrocarbons were also not sampled due to issues with poor bore condition. Only four sites in Gippsland were available where nested monitoring bores occurred, allowing assessment of the vertical connection between the aquifers.

Similarly, the groundwater sampling report for the Otway Basin stated: ‘It should be noted that whilst the primary prospective formations for potential oil and gas deposits reside in the deep Eumeralla Formation, Waarre Formation and Casterton Formation, only one groundwater bore was available for sampling these units and it was located away from likely prospective areas and was quite shallow’.\(^{447}\)

In both the Gippsland and Otway regions there is a lack of groundwater monitoring bores in the deeper Cretaceous geological layers (which are potential gas development targets). This means that as well as a lack of baseline water quality data, there is insufficient data to assess the vertical connectivity between the upper Cretaceous rocks (targets for gas) and overlying water supply aquifers in the lower tertiary (lower Tertiary aquifer) in both basins. Pumping tests are generally conducted in order to assess hydraulic parameters such as transmissivity, storativity and to determine if water extractions in one layer have a noticeable effect on water levels in overlying or underlying geological layers. Such data is also required to properly calibrate groundwater models, which require the user to estimate properties such as the vertical hydraulic conductivity of the various hydrogeological layers.\(^{448}\)

In Gippsland, areas highlighted as potentially important regions to target with additional monitoring wells are the upper portion (for example, upper ~100m) of the Cretaceous Strzelecki Group,


where tight and shale gas occurs, and the Lower Tertiary Aquifer in which CSG occurs, largely in the Seaspray area.\footnote{449} In the Otway Basin, this would include the Eumeralla formation/Killara Coals, and other Cretaceous aged shales and sandstones in the Portland/Glenelg area.

The baseline groundwater sampling in the water science studies were conducted over a relatively short time period. In Gippsland, three rounds of sampling were completed over approximately six months (December 2014 to June 2015), and at the time this Report was prepared, the results from rounds two and three have not been published. Regardless of the number of sampling rounds, a period of six months is generally not considered adequate to determine a full baseline of the degree of variability of groundwater methane and other quality indicators (a period of approximately two years is often used as a baseline monitoring period in resources/mining projects). In the Otway Basin, only one round of baseline sampling was completed, providing a single snapshot in time of the water quality in this Basin.

The water science groundwater sampling programs characterised groundwater quality largely from the point of view of hydrocarbons (including methane), as well as major ion compositions. It is likely that these constituents are the most important aspects of water quality that may be impacted by unconventional gas development. However, additional analytes and/or chemical data could also be included in order to have a more complete baseline assessment, in particular, an analysis of compounds commonly used in hydraulic fracturing fluids. Some common compounds not covered in the water science studies sampling include a range of ammonium based compounds, scale inhibitors (ethylene glycol), borate salts, biocides, gels (for example, hydroxyethyl) and other organic compounds not covered in standard assessments of hydrocarbons.

More detailed characterisation of the dissolved gas compositions in groundwater could also be conducted. The water science studies looked at the concentrations of methane and other hydrocarbon gases in groundwater at current (baseline) conditions. In Gippsland, significant existing concentrations of methane were discovered in groundwater from many areas. Isotopic characterisation of the methane in groundwater, as well as in the prospective gas deposits, has proved effective in the United States for identifying gas present in groundwater resulting from unconventional gas activity (as opposed to naturally occurring hydrocarbon gases).\footnote{450} Data on the carbon and hydrogen isotope composition of gases produced in gas wells in current areas of production (e.g. offshore in Gippsland or in the exploration wells drilled in the Wombat and other onshore gas bores) would be of value in this sense, allowing fingerprinting of these sources of gas as distinct from naturally occurring methane. The Committee notes that DELWP has commissioned a PhD study at RMIT to look at concentrations and isotope compositions of methane in groundwater from the Gippsland and Otway Basins, however this does not include sampling of gas production wells, and DELWP are yet to release the data publicly.\footnote{451}

\footnote{Jacobs Pty Ltd (2015) \textit{Gippsland Region Synthesis Report}, op. cit., p. 29.}
\footnote{Darrah et al. (2014) op. cit.}
6.5.5 Delineation of gas deposits

A more precise knowledge of the locations and depths of prospective gas deposits is required to inform a proper understanding of the risks to water resources. While prospective locations have been mapped as part of the water science studies, it is acknowledged that there is uncertainty as to the precise depths and areas where prospective gas deposits may exist. A more precise knowledge of the extent and distribution of the gas deposits would allow targeted groundwater monitoring wells to be installed at appropriate depths and spacings around these areas. At least one monitoring bore in the gas bearing unit and each shallow aquifer above a prospective gas deposit at any potential drilling location would be needed in order to assess impacts of drilling, hydraulic fracturing and gas production at a given location. Ideally, sets of monitoring bores at regular spacings would be installed above prospective gas deposits.

6.6 Findings and recommendations

The Committee finds that gaps remain in terms of the geological and hydrogeological science which should underpin a possible unconventional gas industry in Victoria. Further scientific work would be necessary to enable informed decisions on risk mitigation, regulation and whether and where the industry should proceed in this State.

The Committee notes the substantial amount of work undertaken by the New South Wales Chief Scientist and Engineer on coal seam gas in New South Wales. To date there is no comparable suite of scientific (and social) research papers for Victoria, noting that Victorian prospectivity, geology and land use context are quite different. In light of this, the Victorian Government should assess Victoria’s capacity to undertake a similar project.

RECOMMENDATION 3: That the Victorian Government undertake a significant program to collect baseline data prior to any unconventional gas industry going ahead, including:

(a) further sampling of groundwater monitoring bores
(b) locating groundwater monitoring bores in areas of potential gas extraction.

RECOMMENDATION 4: That the Victorian Government establishes an independent water science committee chaired by an eminent scientist to oversee a water science and monitoring program, and provide independent advice on water quality and other environmental issues.

RECOMMENDATION 5: That the Victorian Government:

(a) increase the resources available to monitor the integrity and condition of wells, and identify and decommission these where necessary
(b) clarify the roles and responsibilities of the Department of Environment, Land, Water and Planning, the Environment Protection Authority, water authorities and other agencies in regard to the decommissioning of wells.
7 Regulation of an unconventional gas industry

7.1 Chapter overview

Chapter Seven examines issues surrounding the regulation of a potential unconventional gas industry in Victoria. It examines the policy and regulatory safeguards that would be necessary to enable the exploration and development of unconventional gas, if it is determined that the industry should proceed in this State.

Chapter Seven firstly provides a brief summary of the State’s existing regulatory framework that applies to unconventional gas with further details provided in Appendix 4. Secondly, it looks at ways the regulatory framework could be made more effective, and presents recommendations made by stakeholders and the Victorian Auditor-General’s August 2015 report, Unconventional Gas: Managing Risks and Impacts. Thirdly, the Chapter provides a brief overview of how unconventional gas activities are regulated in Queensland, New South Wales, South Australia and Western Australia. The Chapter provides a number of recommendations, which are not intended to be exhaustive, but to suggest key directions for regulatory reform.

7.2 Current regulatory framework

This section provides a short summary of Victoria’s existing regulatory framework for unconventional gas. Further details are provided in Appendix 4.

The Minister for Energy and Resources, through DEDJTR, administers and manages the legislation that regulates unconventional gas in Victoria. Victoria differs from other Australian states in that it regulates unconventional gas through two separate Acts, in conjunction with associated regulations and guidelines. These are the:

- Mineral Resources (Sustainable Development) Act 1990 (Minerals Act) for CSG
- Petroleum Act 1998 (Petroleum Act) for shale and tight gas.

A number of other Acts and related legislation also contribute to the regulation of unconventional gas in Victoria. The most significant of these are listed in Appendix 4.
7.2.1 Mineral Resources (Sustainable Development) Act 1990

The Minerals Act provides a legislative framework for development and regulation of CSG. The Act and associated regulations cover licensing and approval requirements, as well as issues surrounding landowner compensation, mine site rehabilitation and royalties payable to the state.

The four types of licences granted under the Minerals Act are:

- **Exploration licences** which authorise low impact exploration activities for minerals in the area to determine whether the resource is commercially viable
- **Mining licences** which allow the holder to carry out mining, exploration, construction and any other activities incidental to mining on the land
- **Prospecting licences** which enable the holder to prospect or explore for minerals
- **Retention licences** which allow the holder to retain the rights to a mineral resource in the land covered by the licence that is not currently economically viable to mine, but may be in the future.\(^{452}\)

Exploration requires an approved work plan, consent or a compensation agreement with the owner of any private land affected and payment of a rehabilitation bond.\(^{453}\) Mining requires a work plan which contains additional details than those required for exploration, an approved planning permit or environment effects statement (EES), a compensation agreement, a rehabilitation plan, including payment of a rehabilitation bond and an approved work authority.\(^ {454}\) Details of the requirements for exploration and mining licences are contained in Appendix 4.

7.2.2 Petroleum Act 1998

The Petroleum Act provides a legislative framework for the development and regulation of shale and tight gas, including licensing and approvals and other matters such as consultation, compensation, rehabilitation and royalties. The Petroleum Act provides for the issuing of:

- **Exploration permits** which enable the holder to explore for petroleum within the permitted area
- **Retention leases** which enable the holder of an exploration permit to retain certain rights to a petroleum discovery that is not currently commercially viable, but might become viable to develop within 15 years
- **Production licences** which allow for the production and exploration of petroleum.\(^ {455}\)

\(^{452}\) Mineral Resources (Sustainable Development) Act 1990 ss 13, 14, 14B and 14C.
\(^{453}\) ibid., ss 40, 43(e), 78 & 80.
\(^{454}\) ibid., ss 40, 42(6)-(7) & 78-80.
\(^{455}\) Petroleum Act 1998 ss 18, 36 & 46.
Petroleum tenements are released by the Minister under acreage releases and companies are invited to tender.\textsuperscript{456} Tenders are assessed on their proposed work program and their technical and financial capability.\textsuperscript{457} Work under an exploration permit requires an approved operation plan, consent or a compensation agreement, where the affected land is private land, and a rehabilitation bond.\textsuperscript{458} Work under a production licence requires an approved operation plan and consent, compensation and rehabilitation commitments, as well as a production development plan and planning approval.\textsuperscript{459} Details of the requirements for exploration permits and production licences are contained in Appendix 4.

### 7.3 Review of regulatory framework

The current Victorian regulatory framework was established to primarily manage conventional oil and offshore petroleum resources.\textsuperscript{460} It is clear to the Committee from the evidence received that if an unconventional gas industry is to proceed, changes to the framework may be required to specifically address the risks associated with the industry. Parts of the regulatory framework that need to be considered include: environmental protection, community consultation, health and safety, land owners compensation rights and technical regulation. In their evidence to the Committee, Victoria’s Environment Protection Authority (EPA) suggested key areas to be addressed in Victoria’s regulatory framework:

...some aspects that would be relevant from the EPA’s perspective include clear roles and responsibilities, so integration across the different life cycles stages, environment and community; a risk-based, industry-wide and cumulative impacts approach; design for post-closure, so setting clear standards at the beginning; operations as a first step of site rehabilitation, so clear and transparent compliance and enforcement; and finally, independent verification and increased governance.\textsuperscript{461}

The recent VAGO report, \textit{Unconventional Gas: Managing Risks and Impacts}, made a number of regulatory framework recommendations for an unconventional gas industry in Victoria. The Committee received evidence from other key stakeholders including Professor Samantha Hepburn, from the School of Law at Deakin University; Environmental Justice Australia (EJA), an independent, not-for-profit, community legal service, specialising in public interest environmental law; and the Victorian EPA.\textsuperscript{462} The Victorian Government inter-departmental submission also addresses regulation. The Committee also notes that the Gas Market Taskforce report made a number of recommendations

\begin{itemize}
  \item \textsuperscript{456} Ibid., Part 3, Division 2.
  \item \textsuperscript{457} Ibid., ss 20-1.
  \item \textsuperscript{458} Ibid., ss 161, 128 & 173.
  \item \textsuperscript{459} Ibid., ss 161, 63 & 119-120.
  \item \textsuperscript{460} VAGO (2015) \textit{Unconventional Gas: Managing Risks and Impacts}, op. cit., p. 33. Note: references to the VAGO report on unconventional gas are stated as ‘VAGO (2015) op. cit.’ and the page number provided. References to the VAGO Transcript of Evidence provided to the Committee are identified as such.
  \item \textsuperscript{461} EPA (2015) \textit{Transcript of Evidence}, 15 September, p. 11.
  \item \textsuperscript{462} The EPA sits under DELWP and reports to the Minister for Environment, Climate Change and Water.
\end{itemize}
regarding the regulation of an unconventional gas industry. Recommendations made by these stakeholders for changes to the regulatory framework are outlined in this section.

### 7.3.1 A single Act?

The Committee heard evidence criticising Victorian legislation for having two different Acts that essentially regulate the same activity.\(^{463}\) The VAGO report states that there are over 50 Acts, plus associated regulations, policies and administrative arrangements relating to unconventional gas operations, and suggests that there is a large degree of overlap and inconsistency between the Minerals and Petroleum Acts.\(^{464}\) In their evidence to the Committee, VAGO stated that: ‘Our current framework is complex and fragmented, does not address all unconventional gas risks and the roles and responsibilities of regulators overlap and duplicate.’\(^{465}\)

The Victorian Government inter-departmental submission concedes improvements in consistency of regulation across unconventional gas types are necessary.\(^{466}\) Similarly, in 2012, the Victorian Parliament’s Economic Development and Infrastructure Committee recommended the amalgamation of the six earth resources Acts into one Act.\(^{467}\) VAGO also recommend consolidating legislative provisions for the regulation of CSG and shale and tight gas into one resource management Act to reduce the complexity and overlap of the roles and responsibilities of regulators and improve transparency.\(^{468}\) In their submission to the Committee, the Victorian EPA recommend the introduction of a new environmental framework which consolidates all environmental regulatory functions into a single regulator.\(^{469}\)

### 7.3.2 Environmental assessment

Chapter Four discussed the risks of unconventional gas industries, highlighting concerns relating to environmental impacts, including issues surrounding hydraulic fracturing, water management and groundwater and land contamination. The Committee has found that the current requirements for environmental assessment are inadequate for ensuring that environmental impacts and risks are considered at all stages of the approval.
process. The Committee received evidence that unlike in other jurisdictions, there is no distinct approval stage that requires definitive consideration of the environment. 470

The Petroleum Act requires an environmental management plan, but does not identify the specifics that the plan must include. 471 Exploration can involve drilling of wells and hydraulic fracturing, however, the Minerals Act does not require an approved environmental management plan for this work. 472

The Committee received evidence from Professor Hepburn and EJA which recommend a robust and detailed environmental assessment regime that gives regard to the impact that unconventional gas activities may have on the ecosystem, agriculture, climate change and water resources. 473 The submission provided by the Victorian EPA recommends an integrated framework that consolidates the assessment of risks, including cumulative impacts to air, surface water and groundwater into a single approval at every stage of project development. 474

**Environmental impact assessment**

The Committee received a large number of submissions that highlighted the widespread community concern surrounding the environmental impact of an unconventional gas industry. Currently, assessment of the environmental impact of unconventional gas is covered under the Environment Effects Act 1978. 475 This legislation requires an EES be prepared, only if requested by the Minister. In relation to the Environment Effects Act, Professor Hepburn argues that: ‘It is discretionary, non-binding, has an infrequent application to petroleum projects, and the approval process can often contain little more than bare environmental evaluation.’ 476

An environmental impact assessment (EIA) can influence the approval decision in a project, and therefore is a stronger protector of the environment than an environmental management plan. 477 There is currently no regulatory mandate for a comprehensive EIA. 478 ‘The Minister may require an EIA be prepared under the Minerals Act, however no comparable requirement exists under the Petroleum Act.’ 479 VAGO contends there are no transparent criteria or guidelines for when the Minister should apply this discretionary power and to date this provision has not been invoked. 480

472 ibid.
479 Mineral Resources (Sustainable Development) Act 1990 s 41A.
Professor Hepburn and other stakeholders recommended to the Committee that a detailed, scientifically driven EIA process that focusses on the key risks associated with unconventional gas activities and is proportionate to the scale and dimension of the proposed project be introduced for all stages of work.\footnote{S. Hepburn (2015) Submission 1072, p. 49; VAGO (2015) op. cit., p. 38; Environmental Justice Australia (2015) Submission 837, p. 24.} Professor Hepburn provided evidence to the Committee that: ‘It is very important to implement mandatory environment impact assessment for all CSG, shale and tight gas projects, which takes account of principles of ecologically sustainable development.’\footnote{S. Hepburn (2015) \textit{Transcript of Evidence}, 13 August, p. 27.}

In their submission EJA stipulates that the EIA process should be triggered by consistently applied, clear legislative criteria and should result in a legally binding decision to refuse, approve or conditionally approve the proposal, based on whether or not it is ecologically sustainable.\footnote{Environmental Justice Australia (2015) Submission 837, p. 24.} The Committee received further advice from EJA that the EIA framework should incorporate community involvement, including the opportunity for the public to make submissions and review and dispute decisions made.\footnote{ibid., p. 24.} EJA recommends these environmental controls should be introduced during the application process for an exploration licence to ensure work does not commence where the proposals are clearly unacceptable.\footnote{ibid., p. 28.}

In EJA’s submission to the Committee they state that they support the recommendations of the Environment and Natural Resources Committee in their \textit{Inquiry into the Environment Effects Statement Process in Victoria}, September 2011, which proposed:

- any project which is likely to have a significant impact on the environment must undergo some degree of environmental impact assessment
- there are three tiers of assessment that a project can go through, depending on the likely severity of the projected environmental impacts
- the Minister makes a legally binding decision to approve/reject the proposal on conditions, based on whether or not those environmental impacts are ecologically sustainable.\footnote{ibid., p. 29; Parliament of Victoria, Environment and Natural Resources Committee (2011) \textit{Inquiry into the Environment Effects Statement Process in Victoria}.}

**Water management and monitoring**

The Committee received extensive evidence relating to CSG and produced water.\footnote{Produced and flowback water are discussed in Chapter Four of this Report.} VAGO contends that the impacts and challenges to groundwater and surface water supplies that an unconventional gas industry would raise are inadequately regulated under the \textit{Water Act 1989}.\footnote{VAGO (2015) op. cit., p. 40.} The current framework
is unclear regarding licencing of activities that extract water from coal seams and there is uncertainty surrounding future water use requirements.\textsuperscript{489} Given the concerns and uncertainty surrounding unconventional gas and water management, the Committee acknowledge the framework regulating and monitoring water must be strengthened.

VAGO recommends the implementation of baseline studies and ongoing monitoring for vulnerable water resources, as well as the development of guidelines to develop a water management strategy for the life cycle of an unconventional gas operation.\textsuperscript{490} The Gas Market Taskforce report recommends the establishment of an independent water science committee which would oversee the water science and monitoring program and provide independent advice to the Minister on water issues relevant to the gas industry.\textsuperscript{491} The Taskforce proposed that where aquifers are connected, all users must hold a water licence and be subject to coordinated management under the Water Act.\textsuperscript{492}

In her submission to the Committee, Professor Hepburn asserts that shale and tight gas projects are not evaluated under the \textit{Environment Protection and Biodiversity Conservation Act 1999 (Cth)} (EPBC Act) as it only regulates water resources impacted by CSG development.\textsuperscript{493} Professor Hepburn advocates for the expansion of the EPBC Act to cover both CSG and shale gas impacts on water resources.\textsuperscript{494}

VAGO states that Victoria’s water resources are currently managed in an allocation framework, with allocations capped for sustainable management.\textsuperscript{495} Under this framework existing users have a licence to take and use water and any proposal for new uses requires a licence and may be subject to the predetermined cap of the resource.\textsuperscript{496} VAGO recommends a new system for water allocation rights which is transparent and evidence-based and assesses water licences based on the region’s economic, environmental and social priorities.\textsuperscript{497}

\textbf{Well integrity}

Chapters Four and Six identified the integrity of gas wells as critical in the protection of water resources. Victoria currently has no code of practice or guidelines for well integrity and there are no explicit requirements surrounding

\begin{itemize}
\item \textsuperscript{489} ibid.
\item \textsuperscript{490} ibid., p. 71.
\item \textsuperscript{492} ibid.
\item \textsuperscript{493} \textit{Environmental Protection Biodiversity Conservation Act 1999 (Cth)}, s 24D; S. Hepburn (2015) Submission 1072, p.55.
\item \textsuperscript{494} S. Hepburn (2015) Submission 1072, pp. 54-5.
\item \textsuperscript{495} VAGO (2015) op. cit., p. 40.
\item \textsuperscript{496} ibid.
\item \textsuperscript{497} ibid.
\end{itemize}
supervision of well construction. \(^{498}\) DEDJTR gave evidence to the Committee that: ‘Well integrity and aquifer protection is quite critical to the safeguards that need to be put in place to extract gas out of the ground.’ \(^{499}\)

VAGO recommends the introduction of a Code of Practice, similar to those in Queensland and New South Wales, that details the design, construction, operation, maintenance and decommissioning of wells and includes the requirement for independent supervision of well construction. \(^{500}\) The Gas Market Taskforce report highlighted the need to ensure a high level of competency in the workers performing any drilling, thus recommends the imposition of accreditation, qualification and experience standards. \(^{501}\)

**Independent oversight**

The Committee notes that there is no requirement for independent oversight of any unconventional gas activities under the existing framework. \(^{502}\) VAGO states that requiring licensees to seek third party oversight and auditing for key elements of their environmental performance would strengthen environmental regulation, thus increasing transparency and improving public perception and confidence in the process. \(^{503}\) The Gas Market Taskforce report recommends the introduction of an independent gas commissioner, similar to that established in Queensland, to provide third party oversight (see Box 7.1 in Section 7.4). \(^{504}\) The Taskforce reasoned that an independent commissioner would improve community engagement. \(^{505}\) VAGO agrees the introduction of a gas commissioner or, alternatively, the expansion of the existing role of the Mining Warden would be of benefit to the regulatory framework. \(^{506}\)

### 7.3.3 Health and safety

The Committee received a number of submissions and evidence from witnesses at Committee hearings that raised concerns about the health impacts of an unconventional gas industry (which were discussed in Chapter Four).

The Committee heard evidence that under the existing framework there is no explicit requirement to consider the health and safety of individuals impacted by an unconventional gas industry. EJA’s submission recommends strong protection, by way of robust risk management strategies that are enforceable through law and include recognition of the potential for unconventional gas activities to contaminate drinking water and food supplies. \(^{507}\) EJA proposes a

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\(^{498}\) ibid., pp. 41, 71.

\(^{499}\) DELWP and DEDJTR (2015) Transcript of Evidence, 18 August, p. 3.

\(^{500}\) VAGO (2015) op. cit., pp. 41 & 71.


\(^{503}\) ibid., pp. 39 & 49.


\(^{505}\) ibid.


framework to the Committee, similar to that in New South Wales, which includes a buffer zone prohibiting unconventional gas within two kilometres of existing residential zones and future residential growth areas in parts of Sydney.\textsuperscript{508}

The Victorian Government inter-departmental submission recommends appropriate health guidelines that would support effective oversight of an unconventional gas industry.\textsuperscript{509} Their submission outlined additional safeguards for human health that could include:

- full disclosure of chemicals used in natural gas production to support comprehensive health risk assessments
- mechanisms to ensure that funds are available for necessary remediation, health risk assessment and management works that might be required to address public health risks during and beyond the life of a project
- revised community consultation requirements that licensees be responsive in considering mitigation options raised by residents.\textsuperscript{510}

7.3.4 Community involvement and land owner consent and compensation rights

As discussed in Chapter Five, the Committee received a very strong response from the community regarding community involvement and land owner rights. The Committee received evidence that currently there is no compulsory legislative pre-requisite for payment of compensation to landowners to be agreed upon prior to a licence being granted under legislation.\textsuperscript{511} The Committee recognises the importance of improving community engagement, including informing, involving and compensating individual land owners and communities and rectifying land use conflicts. These issues and recommendations for improvements are explored below.

**Land access and compensation**

Chapter Five highlighted issues surrounding land access and compensation rights of landowners. These were consistently raised in submissions and in Committee hearings. At the current time these issues are also being debated federally.

In their submission, EJA outline that a licence holder is required to seek the consent of the owner or occupier of private land, however, there is no requirement that they must actually obtain that consent, as VCAT allows applicants to circumvent any opposition with a compensation determination.\textsuperscript{512} VAGO contends that giving such power to VCAT dramatically reduces the bargaining power of landowners.\textsuperscript{513}

\begin{itemize}
  \item \textsuperscript{508} ibid., p. 8.
  \item \textsuperscript{509} Government of Victoria (2015) Submission 658, p. 63.
  \item \textsuperscript{510} ibid., p. 62.
  \item \textsuperscript{511} S. Hepburn (2015) Submission 1072, p. 38.
  \item \textsuperscript{512} Environmental Justice Australia (2015) Submission 837, p. 13.
  \item \textsuperscript{513} VAGO (2015) op. cit., p. 61.
\end{itemize}
Queensland regulates land access through its *Land Access Policy Framework* and a Land Access Code of practice, which mandates access and compensation agreements.\(^{514}\) The policy framework includes compliance and enforcement provisions for breaches of the Code.\(^{515}\) VAGO and Professor Hepburn both recommend Victoria consider a model similar to Queensland’s Land Access Code.\(^{516}\) The Code provides a simple structure which provides ‘best practice’ guidelines to establish a good relationship between parties and imposes mandatory conditions on the conduct of authorised activities on private land.\(^{517}\) The Code includes:

- notice requirements
- induction training requirements for any person working on the land under the licence
- guidelines for access points, roads and tracks
- livestock and property considerations
- obligations to prevent the spread of declared pests
- guidelines for items which may be brought onto the land and conditions of use for gates, grids and fences.\(^{518}\)

VAGO’s review of the current framework for compensation in Victoria found it was inadequate and limited in a number of respects, including:

- compensation may be claimed for damages or loss suffered as a ‘direct, natural and reasonable consequence’ of the approval of a work plan, thus compensation is only available for above ground impacts and underground impacts are not applicable
- compensation is restricted to private land owners only, thus local communities are ineligible for any compensation
- a compensation agreement is an implied form of consent by the landowner to access their land
- time limits apply for requesting compensation, however the impacts from unconventional gas activities may not be evident for a number of years.\(^{519}\)

Professor Hepburn’s submission argues that compensation frameworks which require parties to agree to a conduct and compensation agreement prior to work commencing do help in reducing conflict and ensuring satisfaction of landowners.\(^{520}\) She recommends this change to the Committee because: ‘You

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\(^{514}\) ibid.


\(^{519}\) VAGO (2015) op. cit., p. 61.

are not saying that one party has a greater right than the other, because you are actually trying to achieve a reconciliation between those two effectively conflicting ownership rights.\textsuperscript{521}

Professor Hepburn recommends that a compensation agreement should be a mandatory component prior to the issuance of a production licence.\textsuperscript{522} She recommends existing compensation provisions should be broadened to include:

- loss of amenity incurred as a result of a disturbance to a landholder’s quiet enjoyment
- loss suffered to a surface activity, including depletion of groundwater aquifers and future losses connected with these environmental impacts
- legal and financial costs reasonably incurred by landowners in negotiating a compensation agreement.\textsuperscript{523}

In her evidence to the Committee, Professor Hepburn argues that the current three-year time limit for compensation claims must be revised.\textsuperscript{524} She advocates for flexibility to ensure the amount and type of compensation recoverable by landholders is not limited in all cases to loss or damages contained within a compensation agreement.\textsuperscript{525} In her submission, Professor Hepburn states that: ‘Damage to the subsurface from unconventional gas extraction may not be evident until many years following the commencement of mining activities. This is particularly relevant for adjoining landholders who are not directly affected by the mining activities.’\textsuperscript{526} Therefore, it is essential that options for recovering compensation for future, unpredictable damages is accessible.

Finally, VAGO highlights that Victoria has no regulatory mechanism to compensate local communities who may be indirectly impacted by unconventional gas activities.\textsuperscript{527} Professor Hepburn also raised this issue in her evidence to the Committee, stating: ‘it is very important to distinguish between private compensation, which is based legally upon the impact a project will have on the ownership entitlement, and community.’\textsuperscript{528} Both VAGO and Professor Hepburn recommend the establishment of a transparent royalty program, similar to those in Western Australia and Queensland, which promote the redistribution of profits back into the community.\textsuperscript{529}

\begin{footnotes}
\item[523] ibid., pp. 47-8.
\item[524] ibid., p. 48
\item[525] ibid.
\item[526] ibid.
\item[527] VAGO (2015) op. cit., p. 62.
\end{footnotes}
Community engagement

The Minerals Act requires consultation with the community prior to a mining licence being granted, however, the Petroleum Act does not have comparable provisions.\(^{530}\) The Petroleum Act contains no provisions for objections, while the Minerals Act contains the right to object but does not set out grounds on which an objection may be made or the significance the Minister must place on the consideration of these objections.\(^{531}\)

EJA, along with other stakeholders, made a number of recommendations to the Committee relating to community engagement, including:

- stronger laws relating to disclosure and community consultation
- public input on work plans and development plans
- amendments to current laws to enable greater weight to be given to community concerns in decisions about whether to grant licences
- the requirement that all licence applications should be required to notify the local council, and owners and occupiers of land within two kilometres of the licence area, in writing
- the provision that any person should have the right to apply to VCAT to enforce a breach of the Minerals and Petroleum Acts.\(^{532}\)

VAGO outlines that community consultation should occur prior to decisions relating to mining being made to allow for individuals to comment and influence the decision, and once a project has commenced community engagement should be undertaken.\(^{533}\) VAGO provided evidence to the Committee that: ‘Community consultation should provide the opportunity to comment on and influence decisions across the life cycle of a project and, if a project goes ahead, should enable those affected to understand the issues and risks and how these are to be managed.’\(^{534}\)

VAGO recommends the community engagement process should be separated from the staged licencing and approval process.\(^{535}\) Furthermore, VAGO recommends an effective dispute resolution process be initiated to complement the community engagement element of mining projects.\(^{536}\)

State-wide planning

Chapter Five discusses the co-existence of an unconventional gas industry with other land users, which is an area the Committee recognises must be regulated. VAGO, in their evidence given to the Committee state: ‘There is currently no
land use planning to determine whether extracting gas in a particular location will sustainably meet community needs and safeguard the priority economic, environmental and social values.\textsuperscript{537}

VAGO recommends the introduction of a strategic resource assessment in Victoria to identify areas that offer the highest potential for the occurrence of unconventional gas.\textsuperscript{538} They suggest this assessment should consider issues relating to land use and land values, water resources, landscape values and regionally significant environment, social and economic values that require protection.\textsuperscript{539} VAGO recommends that a land-use plan should be required for any region identified through a resource assessment as a potential unconventional gas resource, prior to production approval.\textsuperscript{540} They propose that any land-use planning exercise should incorporate the guiding principles including best use of resources, co-existence, strategic planning, tailored participation of communities and landowners and accessible relevant information.\textsuperscript{541}

### 7.3.5 Hydraulic fracturing and chemical bans

Chapter Four discussed the potential environmental implications of hydraulic fracturing, including the concerns surrounding chemical use. The Committee notes that there are currently no specific requirements or guidance relating to hydraulic fracturing in the Victorian framework.\textsuperscript{542} In New South Wales and Queensland operators must submit a list of all fracking chemicals, including their volumes, concentrations and potential toxicity, to state regulators prior to approval for hydraulic fracturing.\textsuperscript{543}

EPA’s submission to the Committee recommends the development of a code of practice for hydraulic fracturing, chemical use and water re-injection.\textsuperscript{544} The Gas Market Taskforce report recommends that the National Harmonised Regulatory Framework, produced by the former Standing Council on Energy and Resources (see section 2.7.1 of this report), be introduced as a minimum standard in relation to hydraulic fracturing operations, which includes:

- Developing new legislation, regulations and supporting guidelines that clearly set out the requirements for hydraulic fracturing operations
- Requiring public disclosure of all chemicals used in hydraulic fracturing operations
- Requiring demonstration of the effects of proposed chemical mixes, prior to those chemicals being approved for use in operations

\textsuperscript{537} VAGO (2015) Transcript of Evidence, 6 October, p. 3.
\textsuperscript{538} VAGO (2015) op. cit., p. 53.
\textsuperscript{539} ibid.
\textsuperscript{540} ibid., p. 54.
\textsuperscript{541} ibid., p. 55; These principles were outlined in the COAG Energy Council’s 2013 Multiple Land Use Framework.
\textsuperscript{543} VAGO (2015) op. cit., p. 63.
\textsuperscript{544} EPA (2015) Submission 841, p. 4.
• Encouraging the use of environmentally benign chemicals in hydraulic fracturing operations
• Independent monitoring of impacts and seeking independent expert advice on best-practice hydraulic fracturing to inform legislative and regulatory amendments.545

7.3.6 Approval process

VAGO criticised the current regulatory system for containing a number of ministerial discretionary powers, including: exempting land from earth resources activities; determining the requirement for an EIA; granting, approving and imposing conditions on licences and work and operation plans; and determining the cost of rehabilitation bonds.546 In their evidence to the Committee, VAGO stated that: ‘the earth resources regulation group within the department had not effectively overseen the industry’s compliance with the regulatory requirements.’547

VAGO contends that the criteria for licences, permits, work plans, operation plans and other approval decisions are inadequate and insufficient.548 VAGO recommends clearer guidelines, with more definitive criteria for decisions, less ambiguous wording and firmer time lines.549 Furthermore, VAGO recommends decision-makers must be required to communicate their reasons for decisions, which should be made public and opportunities for review of these decisions should be implemented.550

7.3.7 Compliance and administration

Given the community concerns presented to the Committee and the identified potential risks of an unconventional gas industry (discussed in Chapter Four), the Committee acknowledge that if the industry were to proceed, Victoria must develop a strong compliance and administration framework. Currently, DEDJTR manages compliance with legislation by performing inspections and audits and applying sanctions where breaches have occurred via the issuance of notices or prohibitions.551 VAGO is critical of this process and states that it is not effective or comprehensive, particularly in relation to unconventional gas risks.552 VAGO recommends a strategic, risk-based approach to compliance, with a specific focus on unconventional gas activities.553

547 VAGO (2015) Transcript of Evidence, 6 October, p. 3.
549 ibid., p. 45.
550 ibid.
551 ibid., p. 45.
552 ibid.
553 ibid., p. 47.
To improve transparency, EJA, in their submission to the Committee cite an independent review of the efficacy of the Mining Warden conducted by the State Services Authority in 2009, which recommended that licence decisions should be made by the Secretary of the Department, rather than the Minister.\textsuperscript{554} They further recommended that these decisions should be open to review by the Department and by VCAT.\textsuperscript{555} In their submission, the EPA recommends that an agency that is equipped and resourced to effectively undertake a clear, transparent and risk-based assessment should be created to regulate compliance and enforcement.\textsuperscript{556} Furthermore, the EPA stipulates the agency responsible for overseeing compliance and enforcement must ensure the provision for long term liabilities from operators, as well as enforce post-closure management arrangements.\textsuperscript{557}

With regard to administration of earth resources legislation and associated regulations, VAGO recommends improvements should be made to meet best practices in the areas of role clarity, accountability and transparency, risk-based strategies, and compliance assistance and advice.\textsuperscript{558} VAGO suggests a ‘more reflective, adaptive and systematic approach’ should be implemented by DEDJTR so it can respond to emerging issues in the unconventional gas industry effectively, and implement best practice regulation.\textsuperscript{559}

### 7.3.8 New earth resources activities and emerging risks

VAGO asserts that as the current regulatory framework was developed when the industry’s focus was on conventional gas activities, it is inadequate to handle the risks associated with unconventional gas.\textsuperscript{560} In their submission to the Committee, the EPA advocates that emerging risks must be considered in a regulatory framework: ‘It is a developing area so the technologies, both the chemicals and the understanding of the chemicals, used in the drilling and the safeguards around the wells and failures, are all developing as time goes on.’\textsuperscript{561}

Professor Hepburn’s submission recommends a monitoring system that is capable of responding to new technological advancements, such as hydraulic fracturing and horizontal drilling for the successful development of an unconventional gas industry.\textsuperscript{562} Furthermore, VAGO suggests that the development of a code of practice that specifies mandatory technical and operational requirements for unconventional gas activities would provide greater clarity on the rights and responsibilities of industry personnel.\textsuperscript{563}

\begin{itemize}
  \item \textsuperscript{554} Environmental Justice Australia (2015) Submission 837, p. 50; State Services Authority (2009) \textit{Review of the Mining Warden: Objectives, functions and alternatives}.
  \item \textsuperscript{555} Environmental Justice Australia (2015) Submission 837, p. 50; State Services Authority (2009) op. cit.
  \item \textsuperscript{556} EPA (2015) Submission 841, p. 4.
  \item \textsuperscript{557} ibid.
  \item \textsuperscript{558} VAGO (2015) op. cit., p. 48.
  \item \textsuperscript{559} ibid., p. 49.
  \item \textsuperscript{560} ibid., p. 33.
  \item \textsuperscript{561} EPA (2015) \textit{Transcript of Evidence}, 15 September, p. 18.
  \item \textsuperscript{562} S. Hepburn (2015) Submission 1072, p. 4.
  \item \textsuperscript{563} VAGO (2015) op. cit., pp. 41-2.
\end{itemize}
7.4 Key features of regulatory frameworks in other jurisdictions

The Committee heard that the regulatory frameworks in the other jurisdictions are significantly more developed than the regulatory framework for unconventional gas in Victoria. In their evidence to the Committee, the EPA asserts that: ‘if the state government decides to permit these activities, then obviously the lessons learnt by other jurisdictions are very relevant in the context of Victoria.’

Coal seam gas has been in commercial production in Queensland since 1996 and New South Wales since 2001; regulatory frameworks have developed in these states over time to manage their specific requirements. For example, New South Wales and Queensland have two separate agencies to deal with the two functions of promoting and developing earth resources and regulating the environmental, economic and social impacts of exploration and production activities. Whereas, in Victoria, DEDJTR has two separate divisions to perform these functions, but both are still within the one department.

Queensland, New South Wales, South Australia and Western Australia have developed individual frameworks to manage unconventional gas and a summary of each is provided below. It is important to note, however, that due to resourcing constraints the Committee has not been able to fully explore the different elements and the pros and cons of these regulatory frameworks.

7.4.1 Queensland

The Department of Natural Resources and Mines (DNRM) manages compliance relating to CSG, with a focus on groundwater resources. The Department of Environment and Heritage Protection (DEHP) manages environmental impact assessments and issues Environmental Authorities and water permits. These two departments combine to manage compliance. The Victorian EPA presented to the Committee that the Queensland Competition Authority performed an independent CSG review in January 2014, with most findings involving simplifying and clarifying the roles and responsibilities of the departments.
Queensland’s regulatory framework contains comprehensive codes of practice for hydraulic fracturing and environmental risk assessment. Legislation protects land with high agricultural value and manages impacts on natural systems, groundwater and the environment and mandates licence approvals throughout all stages of the work process.

Queensland’s former ‘Royalties for Regions’ scheme has been replaced with a ‘Building our Regions’ program, which compensates local communities who may be impacted by an unconventional gas industry by redistributing some profits back into the community. The program has provided support for infrastructure projects that addressed identified local needs.

The Committee heard evidence that a GasFields Commission (see Box 7.1 for details), which manages the interface between rural landholders, regional communities and the CSG industry, similar to that established in Queensland in 2013, should be introduced in Victoria. In their submission to the Committee, APPEA stated:

In Queensland the establishment of a GasFields Commission has significantly improved the level of community engagement and the dialogue between government, industry, and landholders. The Commission also assists in de-politicising the regulation of the industry as it is independent of the Minister and relevant government departments.

The Office of Groundwater Impact Assessment (OGIA) is responsible for assessing and managing the impacts of water extraction that occurs as part of the petroleum and gas industry. Queensland’s Land Access Code establishes a code of practice guiding communication between operators and landholders in relation to land access and mandates negotiation of a conduct and compensation agreement prior to accessing private land.

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573 Gas Market Taskforce (2013) Gas Market Taskforce: Supplementary Report, op. cit., p. 50; Petroleum and Gas (Production and Safety) Act 2004 (Qld); Water Act 2000 (Qld); Environment Protection Act 2014 (Qld).


575 ibid.


BOX 7.1: GasFields Commission

The Gasfields Commission Act 2013 (Qld) established the GasFields Commission in 2013. It is an independent statutory body comprised of seven Commissioners appointed for their skills and expertise in their respective fields. The Commission is designed to facilitate stronger relationships between landholders, regional communities and the onshore gas industry.

The powers and functions of the Gas Fields Commission include:

- reviewing the effectiveness of legislation and regulation
- obtaining and publishing factual information
- identifying and advising on coexistence issues
- convening parties for the purpose of resolving issues
- promoting scientific research to address knowledge gaps
- making recommendations to government and industry.

The Commission has the power to compel landholders and gas operators to provide relevant information or documents that they require to carry out their functions. This information goes towards creating Conduct and Compensation Agreements. The Commission produces publications to assist landowners and industry officials, manages enquiries and facilitates community engagement via site visits, meetings and workshops.

Source: GasFields Commission Queensland.

7.4.2 New South Wales

The Victorian EPA presented evidence to the Committee that the New South Wales regulatory framework was updated in July 2015 and is still evolving.\(^{580}\) The New South Wales EPA is the lead regulator of the health and environmental impacts of CSG. The NSW EPA issues licences and undertakes compliance and enforcement on all approvals.\(^{581}\) The Department of Industry’s Resources and Energy Division are responsible for administering petroleum titles and for granting approval for exploration and do this through the Office of Coal Seam Gas, which was established in 2013.\(^{582}\) The Department of Planning and Environment assess and grant approval for production.\(^{583}\) All CSG operators must hold an environmental protection licence issued by the NSW EPA for exploration, assessment and production activities.\(^{584}\)

New South Wales has implemented a range of regulatory safeguards for the CSG industry, including:

- a Land and Water Commissioner who oversees mining and CSG activity and provides independent advice to landholders, resource companies, the community and government;
- an Aquifer Interference Policy which sets out the requirements for assessing the impacts of aquifer interference activities on water resources;
- a ‘Gateway process’ which requires that a proponent obtain a certificate for the project from a panel of independent experts prior to lodgement of their application;
- a Strategic Regional Land Use Policy, which requires the preparation of an Agricultural Impact Statement;
- mandatory Codes of Practice for well integrity and hydraulic fracturing.

The New South Wales Gas Plan, released in November 2014, established a one-off buy-back of petroleum exploration licences (PELs) for titleholders which allowed holders of PELs to surrender their titles in exchange for limited compensation. On 11 December 2014, the buy-back program commenced, with an expiry date of 30 July 2015, which was extended to 30 September 2015. To date 17 PELs have been bought back by the New South Wales Government.

### 7.4.3 South Australia

In South Australia, the environmental elements of unconventional gas are regulated through the Department of State Development and management of water resources is regulated by the Department of Environment, Water and Natural Resources. The South Australian EPA is a mandatory referral agency and has a role in advising the Department of State Development in relation to environmental impacts. Public consultation to demonstrate potential risks and how they can be managed is required for any proposed hydraulic fracturing.
The South Australian Government developed a 'Roadmap' in 2012 which considered how unconventional gas projects could best progress.\textsuperscript{596} The Roadmap provided information to people, communities and markets about the potential risks and rewards of an unconventional gas industry.\textsuperscript{597} From this, a Roundtable working group, consisting of companies, peak representative bodies for industries, the environment and indigenous people, universities, media, individuals and key government agencies, was established to develop plans to implement the 125 recommendations made in the Roadmap.\textsuperscript{598}

The South Australian Legislative Council’s Natural Resources Committee began an inquiry into unconventional gas with a focus on fracking on 19 November 2014. The Committee tabled its interim report on 17 November 2015, and will table its final report in 2016.\textsuperscript{599}

\textbf{7.4.4 Western Australia}

Western Australia has a whole-of-government regulatory approach to unconventional gas, with an inter-agency working group established in 2011. This group includes the Departments of Mines and Petroleum, Agriculture and Food, Environment Regulation, Health, Parks and Wildlife, State Development, Water, and the Office of the Environmental Protection Authority.\textsuperscript{600}

The Department of Mines and Petroleum is responsible for regulating petroleum which includes assessing environmental plans, works programs, well management plans, safety management systems, safety cases, native vegetation clearing and permit applications.\textsuperscript{601} The Department of Environment Regulation is responsible for assessing emissions and discharges, issuing works approvals and licences and managing contaminated sites.\textsuperscript{602} The Department of Water regulates the management of water resources, including the assessment of proposed water wells, taking water licence applications and managing the safe guarding of public drinking water sources.\textsuperscript{603} Western Australia’s EPA performs environmental impact assessments for proposals that are likely to have significant environmental impacts.\textsuperscript{604}

\textbf{References}

\textsuperscript{596} Gas Market Taskforce (2013) Gas Market Taskforce: Supplementary Report, op. cit., p. 49; South Australia DMITRE (2012) op. cit.
\textsuperscript{597} South Australia DMITRE (2012) op. cit.
\textsuperscript{598} ibid., p. 7.
\textsuperscript{599} Natural Resources Standing Committee (2015) Inquiry into Unconventional Gas (Fracking) Interim Report, Parliament of South Australia.
\textsuperscript{600} Western Australia Department of Mines and Petroleum (2014) Natural Gas from Shale and Tight Rocks: An overview of Western Australia’s regulatory framework, p. 11.
\textsuperscript{602} ibid.
\textsuperscript{603} ibid.
\textsuperscript{604} EPA (2015) Presentation, 15 September; Western Australia Department of Mines and Petroleum (2014) op. cit., p. 10.
The Western Australian Legislative Council’s Environment and Public Affairs Committee began an inquiry on 7 August 2013 into hydraulic fracturing for unconventional gas. The Committee tabled its final report on 17 November 2015.605

7.5 Findings and recommendations

The Committee was unable to reach definitive conclusions about whether or not an industry could or should proceed at this time. A contributing factor was that the Committee was not provided with the full range of support that was necessary to fully examine every aspect of the Terms of Reference.

Given the large number of submissions, the complexity of the material, and the range of detailed scientific studies, the Committee sought additional support of an administrative and scientific nature. Late in the process some scientific support was provided, but this was not sufficient to examine and fully test all aspects of the evidence submitted. The Committee was also not able to travel nationally or internationally which particularly impacted on the ability to examine regulatory systems and take evidence from other jurisdictions. In the case of New South Wales and Queensland, it is clear that significant regulatory learnings are available of which the Committee was not able to avail itself fully. The Committee’s key finding is that while there are clearly improvements that can be made in Victoria’s regulatory system, the Committee is not in a position to point definitively to jurisdictions with better regulation. It is clear further work will have to be done by the Victorian Government.

The Committee finds that the Victorian regulatory system is not currently in a position to effectively manage the potential risks associated with an unconventional gas industry. The Committee supports the conclusions of recent reports, and the views of key stakeholders, that if an industry is to proceed, changes would need to be made to the regulatory framework, particularly with regard to environmental protection, community consultation, health and safety, land access, compensation and land rehabilitation.

To the extent that resources have permitted, the Committee has reviewed the regulatory frameworks in other Australian jurisdictions, specifically the codes of practice pertaining to the industry and suggests that Victoria also formulate codes specific to the industry, if it is determined that it proceed in this state. As stated at the beginning of this Chapter, the following recommendations are not intended to be exhaustive, but to suggest key directions for regulatory reform.

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The Committee considered two proposed recommendations: a ban on the unconventional gas industry in Victoria or a five year extension of the current moratorium. The Committee could not reach a majority decision. Notwithstanding this, and the content of any minority reports, the Committee must respond to its terms of reference and therefore makes the following recommendations relating to any future unconventional gas industry, were it to occur in Victoria.

**RECOMMENDATION 6:** That the Victorian Government provide easier online access to information about exploration licences targeting coal seam gas and petroleum exploration permits targeting tight and shale gas, and in particular:

(a) update and improve the relevant sections of the Department of Economic Development, Jobs, Transport and Resources website to reflect machinery of government changes to departments

(b) provide a simplified, more user-friendly interface and more effective search tools

(c) display the ‘Mining Licences Near Me Tool’ more prominently on the website.

**RECOMMENDATION 7:** That, noting that the Committee is not in a position to determine whether a single Act or improvements to the Mineral Resources (Sustainable Development) Act 1990 and the Petroleum Act 1998 would result in better regulation, the Victorian Government should look to individual improvements in both Acts and should ensure that:

(a) community consultation and effective dispute resolution processes are improved

(b) landholder rights are strengthened and an equitable balance and process between the rights of landholders and mining companies in relation to land access, compensation, and the rehabilitation of land is achieved, noting the Crown owns all mineral resources.

**RECOMMENDATION 8:** That mandatory environmental impact assessments be required for any coal seam gas, shale and tight gas projects.

**RECOMMENDATION 9:** That the Victorian Government examine improved consultation with relevant water authorities to enable a more comprehensive assessment of risk to water sources.

**RECOMMENDATION 10:** That the Victorian Government amend section 32 of the Sale of Land Act 1962 to ensure that when a person buys land they are made aware of any exploration licences or petroleum exploration permits or retention leases that the land is subject to, by having the licences, permits or leases listed in the section 32 document. Disclosure of any such licences, permits or leases should be accompanied by a plain English explanation.
RECOMMENDATION 11: That the Victorian Government, in consultation with stakeholders, develop an industry-wide code of practice for the exploration, production, and impact management of unconventional gas activities that specifically includes requirements for best practice in:

(a) well integrity
(b) hydraulic fracturing activities
(c) produced water
(d) fugitive emissions
(e) well decommissioning and rehabilitation obligations
(f) baseline and ongoing monitoring.

RECOMMENDATION 12: That in relation to chemicals and additives used in hydraulic fracturing, the Victorian Government should:

(a) commission research and advice on chemicals, including research to assess the impacts of chemical mixtures used in hydraulic fracturing
(b) require companies to seek approval for all chemicals proposed to be used
(c) require full, public disclosure of chemicals approved for use.

RECOMMENDATION 13: That the Victorian Government examine the Queensland GasFields Commission model and other independent bodies in other jurisdictions, to consider establishing a wholly independent, appropriately resourced statutory body that may facilitate information sharing and stronger relationships between landholders, local communities and industry.
8 Unconventional gas and the gas market

8.1 Chapter overview

Chapter Eight, briefly explores the evidence the Committee received about the potential development of an unconventional gas industry in Victoria and its possible impact on the gas market, particularly in relation to the price and supply of gas in this state.

The Chapter begins with a short overview of the eastern Australian gas market, of which Victoria is a part, and current market dynamics. It then considers the ability of unconventional gas to provide a competitive source of energy and non-energy inputs for Victorian industries, in particular for the manufacturing industry. Following the consideration of industry concerns, the Chapter looks at whether unconventional gas has the ability to provide an affordable energy source for domestic consumers.

8.2 Victoria and the eastern Australian gas market

The development of Victoria’s large offshore conventional gas reserves (as discussed in Chapter Three) has led to the state being a relatively large user of gas in comparison to other Australian jurisdictions. Gas in Victoria is primarily used for manufacturing and other industrial uses, for home heating and cooking, and for electricity generation in gas-fired power stations. Victoria also has a relatively well-developed network of gas transmission pipelines.

Victoria is connected by gas pipelines to New South Wales, Queensland, South Australia and Tasmania, and together they form the eastern Australian gas market. In addition to the eastern gas market, there is also the western gas market and the northern gas market. At present, these markets are not connected and are geographically and economically isolated from one another. The three different Australian gas markets, major pipelines, and gas basins are depicted in Figure 8.1. An enlarged image of the eastern Australian gas market and pipelines is depicted in Figure 8.2.

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607 ibid.
Chapter 8 Unconventional gas and the gas market

Figure 8.1  Australia’s gas markets and key pipelines

![Map of Australian gas fields and key pipelines](source)


Figure 8.2  Major pipelines and gas fields in eastern Australia

![Map of major pipelines and gas fields in eastern Australia](source)

Until recently, the eastern Australian gas market was purely a domestic market and did not export gas overseas. The price of gas in the eastern Australian market was insulated from international prices and has been comparatively low, and also comparatively stable because of the use of long-term contracts. As Mr Tony Wood, the Energy Program Director at the Grattan Institute, explained to the Committee:

The east coast of Australia has historically had a balanced gas market. The production of conventional gas from the Gippsland and Cooper Basins has been more than sufficient to meet domestic demand. It has been relatively low cost to develop these resources for a relatively small domestic market. This led to stable wholesale prices of between $3 and $4 per gigajoule over several decades.

Eastern Australian gas prices have, however, been increasing over the past few years, which Geoscience Australia and the Bureau of Resources and Energy Economics state is because of a number of factors, including but not limited to the expiration of mature long-term contracts, and increasing network charges to ‘reflect rising capital and operating costs of pipeline transmission and distribution.’ The most significant occurrence affecting the eastern Australian gas market is the recent commencement of exports from Queensland to Asia.

8.2.1 Liquefied natural gas exports from Queensland

The growth of the CSG industry in Queensland has enabled the export of gas overseas in the form of liquefied natural gas or ‘LNG’. The APPEA explains that when natural gas is chilled to minus 161 degrees Celsius, it becomes a liquid which takes up much less space than methane in its gaseous form, and can be exported in purpose built tanker ships. The LNG is created by moving gas through a system called an ‘LNG train’ which cools and compresses the gas, and then loads it onto the ship for export. Gas companies have invested over $63 billion in constructing the necessary infrastructure to export LNG from the Port of Gladstone in Queensland. The first LNG tanker departed Gladstone Harbour for Asia in January 2015.

8.2.2 Gas price rise

The opening of the eastern Australian domestic market to the Asia-Pacific market is putting upward pressure on domestic prices. The price paid for gas in the Asia-Pacific market is mainly linked (within contracts) to the oil price and is significantly higher than in the eastern Australian gas market. It

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610 Geoscience Australia & BREE (2014) op. cit., p. 106.
is expected that domestic prices will continue to rise to meet the ‘netback’ or ‘parity’ price of LNG, which refers to the export price received for LNG without the transport and liquefaction costs.\textsuperscript{616} The Productivity Commission states that the extraction of CSG and the linkage of the eastern Australian gas market to the Asia-Pacific market is driving significant and rapid change, with adjustments in prices occurring alongside growth in gas production.\textsuperscript{617} Mr Wood informed the Committee that the price of gas in international markets has been as high as $15-20 per gigajoule, and that:

\begin{quote}
Linking the Australian gas market to the international market means that domestic gas consumers must now compete with international buyers. If a gas supplier can get $8-10 per gigajoule (before liquefaction and transport) from an international consumer, why would they choose to supply domestic consumers at $4 per gigajoule?\textsuperscript{618}
\end{quote}

The Committee notes the difficulty in obtaining clear information about price movements in the eastern Australian gas market. The Australian Energy Market Operator (AEMO) acknowledges that obtaining credible data is an issue in the changing east coast gas market, thus making forecast modelling difficult,\textsuperscript{619} and the Australian Competition and Consumer Commission (ACCC) notes that the lack of price information adds to the level of risk and uncertainty felt by industrial gas users.\textsuperscript{620} AEMO have stated that they are committed to working with industry to improve data quality and transparency.\textsuperscript{621}

While acknowledging that forecasting future gas prices is difficult, Mr Wood cited Deloitte Access Economics figures forecasting that domestic wholesale gas prices will peak at around $9 a gigajoule in 2016 and then fall back to about $7.50 to $8 from 2019.\textsuperscript{622} He said that ‘there appears to be one thing on which all commentators agree: domestic prices will rise.’\textsuperscript{623}

\section*{8.2.3 Impact of gas price rise}

The Committee heard that the increase in the price of gas will impact significantly on Victorian businesses and households that rely on gas.\textsuperscript{624} The Committee received submissions and heard evidence from a number of manufacturing companies and representative bodies that expressed serious concerns about the implications of the gas price rise. These concerns are discussed below in

\begin{flushleft}
\textsuperscript{616} ibid.  \\
\textsuperscript{617} Productivity Commission (2015) \textit{Examining Barriers to More Efficient Gas Markets}, p. 43.  \\
\textsuperscript{618} T. Wood, Grattan Institute (2015) Submission 984, p. 2.  \\
\textsuperscript{619} Australian Energy Market Operator (2015) \textit{Gas Statement of Opportunities for Eastern and South-Eastern Australia}, April, p. 3.  \\
\textsuperscript{620} ACCC (2015) \textit{East Coast Gas Inquiry: Issues Paper}, op. cit., p. 15.  \\
\textsuperscript{621} AEMO (2015) op. cit., p. 3.  \\
\textsuperscript{622} T. Wood (2015) Submission 984, p. 2.  \\
\textsuperscript{623} ibid.  \\
\end{flushleft}
section 8.3. Victorian households use more gas than other Australian states and are particularly reliant on gas for heating. Household gas bills are expected to markedly increase and this is discussed in section 8.4 of this Report.

8.2.4 Supply and demand

The Committee acknowledges that there are different views as to whether there will be a shortage of gas in eastern Australian now that gas has started being exported to Asia. Mr Wood stated that there is no shortage of gas, as 'Australia has more than enough natural gas reserves to supply both the domestic and export markets for many years.' 625 The manufacturing company CSR submitted to the Committee that gas prices for Australian businesses will more than double from 2015 and there may be critical gas shortages and outages of 10 or more days. 626 Mr Mark Ogge, from the Australia Institute, submitted to the Committee that AEMO has never suggested that there is any risk of a gas shortfall in Victoria over their forecast period. He states that gas will be available but that it will be at the global linked prices. 627

The Committee notes that AEMO reported that Victorian gas consumption declined from 217.8 petajoules to 214.9 petajoules between 2010 and 2013. 628 AEMO predicted a decrease at an average annual rate of 1.7 per cent for total gas consumption in their short-term forecast (2014-19). 629 This is depicted in Figure 8.3 below:

Figure 8.3 Comparison of 2013 (actual) and 2019 (forecast) annual gas consumption


629 ibid.
The AEMO *Gas Statement of Opportunities for Eastern and South-Eastern Australia* (April 2015) provides forecasts of gas supply gaps over a 20-year period and includes a comparison to gaps forecast in the 2013 and 2014 Gas Statement of Opportunity Reports.\(^{630}\) This is depicted in Figure 8.4 below. AEMO forecast a short, medium and possible long-term supply gap in Queensland, but no other supply gaps in eastern and south-eastern gas markets by the end of 2019.\(^{631}\) AEMO concludes that there are sufficient commercially viable reserves and resources available to provide supply for the projected gas demand in the next 20 years.\(^{632}\)

![Figure 8.4: Total forecast supply gaps](source.png)

**8.2.5 Will developing unconventional gas influence prices?**

The Committee heard differing evidence on whether the development of an unconventional gas industry in Victoria would be able to positively impact on the price of gas now that the state is linked to international markets. CSR stated in its submission to the Committee that: "The development of further gas resources in Victoria will have a highly material and favourable impact on the availability and price of gas, and therefore on the viability of many of our businesses."\(^{633}\) The APPEA submission cited the Gas Market Taskforce report’s conclusion that:

Victorians should be under no illusions. Rising gas prices will have a negative impact on Victoria’s manufacturing base. Jobs and investment are at risk. Costs of living will rise... the only sensible course of action is for the Victorian Government and other eastern states to promote production of additional gas supply.\(^{634}\)

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631 ibid., p. 6.
632 ibid., p. 7.
The APPEA submission argued that the link between more Victorian gas and cheaper prices was a straightforward one: ‘Simple economics dictates that the best way to address these pressures is to bring more gas to market.’ Mr Annells, of Lakes Oil, similarly stated to the Committee that ‘There is talk about more gas making things more expensive, but that is economics 101: you increase supply and the price comes down.

However, the Victorian Government inter-departmental submission to the Committee stated that the linkage to international markets means that if Victoria increases the supply of gas it may not lower prices, because it would not be of a sufficient quantity to impact on the international market:

As a general economic principle, increasing supply of a good into a market is expected to create downward pressure on its price. With the start of LNG exports from Queensland, Victorian gas is now part of an international market and increases in Victorian supply would not be expected to have much impact on world supply; the price of gas in Victoria is instead being driven by the international LNG price.

Mr Mark Feather, the Executive Director of the Energy Sector Development Branch of DEDJTR, gave evidence to the Committee that: ‘For a Victorian gas find to have an impact on those LNG prices, you would have to find a lot of gas, because Victoria is only a very small component in what is an international market.’ Mr Feather also pointed out, however, that there is work going on more broadly through the COAG Energy Council, within the Government, and the ACCC, in understanding barriers to competition in the eastern gas market.

The Committee notes that the ACCC is currently conducting an inquiry into the competitiveness and structure of the eastern Australian gas market, and suggests in its issues paper that there may be a number of possible factors influencing the price of gas. The ACCC states that these factors could include exposure of domestic gas users to international prices; insufficient competition in the supply of gas in eastern Australia; rising costs of exploration, development and production; as well as uncertainty about LNG export volumes and long-term prices. The ACCC also states that ‘Some market participants consider that a move to spot price indexation in long-term gas supply agreements is desirable to ensure a competitive and efficient market for supply of gas.’

The ACCC further suggests that the historic reliance on long-term, confidential bilateral gas supply agreements in the eastern Australian gas market, has contributed to a lack of transparency in the market and made it difficult to access information.

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635 ibid., p. 18.
639 ibid.
641 ibid., p. 13.
642 ibid.
643 ibid., p. 15.
the efficiency of the eastern Australian gas market, similarly states that these long-term bilateral contracts between gas producers and gas users are often subject to commercial confidentiality clauses, which makes pricing opaque to third parties. The ACCC suggests that market reforms could provide for greater information transparency and trading liquidity in the eastern gas market.

8.3 Victorian industries and the gas market

The Committee received evidence from Victorian manufacturing businesses that changes in the eastern gas market, such as rising prices and the difficulties experienced by gas users in securing contracts, are of major concern. Australian Paper (AP), which employs approximately 1200 people at its manufacturing facilities in the Latrobe Valley and Preston, and head office in Mount Waverley, stated to the Committee that:

> All of AP’s investment and contribution to Victoria is currently at risk due to the failure of the gas markets to provide long-term competitively priced gas to manufacturers and industry. Historically, AP has, along with other major industrial customers, been able to rely upon competitive long-term gas supply contracts to underpin its business and business investment. Such supply contracts are no longer available in the current gas market. Competition to supply AP’s gas does not exist and a one-year or two-year supply contract is the best outcome if you can get an offer at all.

CSR, which states that it has seven large manufacturing facilities in Victoria and employs over 1000 people and an additional 200 contractors, explained to the Committee that their manufacturing processes are dependent on gas. CSR stated that ‘ensuring adequate gas supplies are available’ will ‘be critical to the ongoing competitiveness of manufacturing in the state.’ CSR said to the Committee that issues with gas may affect the continued operation of its Dandenong glass factory:

> The CSR Board will need to make a decision in the next two years to invest $80 million to re-furbish the Dandenong glass factory. The Board is following the issue of gas supply and demand closely and the outcome of this inquiry and the ACCC investigation together with action by Government will be a key input to their considerations. The alternative is to co-invest overseas in new manufacturing capacity or to develop long term supply agreements with overseas suppliers.

The packaging company Orora stated in its submission to the Committee that it had experienced recent increases in the cost of gas which had placed significant upward pressure on their costs. Orora stated that in order to ‘ameliorate rising gas prices’ it has entered into an agreement with an explorer company to supply

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645 ACCC (2015) op. cit., p. 15.
648 ibid., p. 2.
649 ibid., p. 3.
gas from a prospective CSG field in the southern Cooper Basin, and that the moratorium in Victoria had discouraged Orora from considering prospective gas suppliers in this State.  

The Committee notes that Lakes Oil stated that it has signed provisional agreements with two manufacturing companies – Simplot and Dow Chemical – to supply gas at below market prices. Mr O’Brien of Lakes Oil gave evidence to the Committee that:

...we have signed provisional gas sales agreements with Simplot and Dow to supply gas at less than the market price, because we know we can do it cheaper than everyone else can... They are provisional gas sales agreements, on the provision that we can drill the wells and get the gas to the surface. We have said, ‘As long as we can show that we will sell what we have got to you cheaper than what the market price is’, because they cannot secure those contracts through Esso or other traditional suppliers at the moment. We want to be given the opportunity to prove it. That is what we ask for.

8.3.1 Gas as feedstock for manufacturing

The Committee was also informed of the importance to some businesses of using gas as a feedstock in manufacturing. The Committee heard evidence that gas is used as feedstock in the manufacturing of a range of products, such as plastics and polymers, textiles, pharmaceuticals, paints, dyes, cosmetics, pesticides, fertilisers and explosives, and in mineral and metals processing. The Plastics & Chemicals Industries Association (PACIA) stated in their submission to the Committee that 37 per cent of Victorian industrial gas is consumed for chemical feedstock purposes. In their evidence to the Committee, PACIA outlined the diverse variety of uses of gas as a feedstock, including for the production of:

‘fertilisers to increase our agricultural yields; treatments to make our water safe to drink; pipes to transport water and gas and for other reticulation purposes used in agriculture and mining and for residential use; and... advanced packaging products that protect and preserve our food.’

During the Inquiry, the Committee was pleased to have the opportunity to visit Qenos polyethylene plant in Altona to discuss the use of gas as a feedstock first hand.

The Committee heard evidence that for some such manufacturers, there are no alternatives to gas. PACIA stated to the Committee that ethane and methane are essential feedstock molecules found in natural gas that allow the advanced

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655 ibid., pp. 4-5.
chemistry to occur that is required for the production of a variety of materials and products.\textsuperscript{656} They further stated that these feedstock molecules cannot be substituted in the manufacturing process.\textsuperscript{657}

### 8.4 Victorian domestic consumers and the gas market

The Victorian Government inter-departmental submission to the Committee emphasised the importance of gas to Victorian households. It explains that: ‘Victoria has the largest residential gas demand of any Australian state, equivalent to two-thirds of all residential gas consumption in Australia.’\textsuperscript{658} The Victorian Government inter-departmental submission also provides data from the Essential Services Commission, which states that:

... 77 per cent of Victorian households receive gas via the pipeline distribution network and many other households use bottled gas where mains gas is unavailable, or to supplement the mains gas supply. The main household uses of gas are in cooking appliances (ovens, cooktops and barbecues), gas heaters, ducted heating units and hot water systems.\textsuperscript{659}

However, Mr Tim Forcey, Energy Adviser at the University of Melbourne Energy Institute, stated to the Committee that research undertaken by the Institute has found that domestic gas use in eastern Australia peaked in 2012 and is now declining. He emphasised that the economics of gas have changed and that it is now cheaper for Victorian households to disconnect from gas and use electricity instead (which is termed ‘fuel switching’). Mr Forcey stated that:

The Australian Energy Market Operator is only starting to study gas to electric fuel switching in homes and businesses. Fuel switching has the potential to be a significant phenomenon. Some people can save hundreds of dollars per year by heating their homes with their electric reverse cycle air conditioner instead of using gas. Reverse cycle air conditioners, hot water heat pumps and the induction cooktop are the big three that lead to the all-electric Australian home.

With the wide availability of these efficient electric appliances, there is no longer any economic reason to connect gas to new Australian homes and suburbs. As consumers economically disconnect from the gas grid, those that remain must pay the cost of operating that grid. This leads to what is known as the gas grid death spiral, where fixed charges go up, then some people leave the gas grid, and fixed charges go up again to cover that and so forth.\textsuperscript{660}

The submission to the Committee from the Australian Workers’ Union (AWU) emphasises the hardship experienced by some Victorian households as a result of increasing gas prices. The AWU stated that: ‘Already there have been

\begin{itemize}
\item \textsuperscript{656} ibid., p. 2.
\item \textsuperscript{657} ibid.
\item \textsuperscript{658} Government of Victoria (2015) Submission 658, p. 45.
\item \textsuperscript{659} ibid.
\end{itemize}
anecdotal reports of so called ‘energy poverty’ emerging in the state, with lower socio-economic households and pensioners unable to heat their homes during the winter due to escalating and prohibitive gas prices.661

8.5 A gas reservation policy?

Some submissions to the Committee suggested that Victoria should introduce a gas reservation policy to ensure that it retains a cost-effective and sufficient supply of gas.662 The submission by the AWU stated that increasing gas supply will not lower the price of gas now that eastern Australia is linked with the international market, and advocates that: ‘the Government adopt a regulatory approach that ensures Australia’s gas prices are not completely exposed to a distorted global price. This would be in the form of a gas reservation – or reservation like – policy.’663

The AWU propose that ‘gas exporters would still be permitted to sell Australian gas to foreign nationals at the high global price – but on the condition that a percentage of the gas extracted would have to be reserved for sale at an affordable domestic price.’664

The opposing perspective was put to the Committee by Mr Wood who, while expressing sympathy for businesses affected by the rising cost of gas, stated that domestic reservation policies do not prove to be effective in the long term:

... there are a lot of small businesses and small manufacturers in Melbourne and regional Victoria that are seriously being affected by gas price increases. I have enormous sympathy for their situation, but I fail to see that providing a subsidy to domestic gas consumers is necessarily by any means in the interests of the Australian economy. Fundamentally it is just another form of protectionism, and our history suggests that most of the time protectionism does not work. All it does, eventually, as domestic gas reservation policies tend to do, is put up prices and reduce supply in the long term.665

8.6 Findings and recommendations

At present, gas is an important energy source for Victorian businesses and households. The eastern Australian gas market, which includes Victoria, is in a state of transition now that exports of LNG have begun to overseas markets. The domestic price of gas is increasing and is impacting on Victorian manufacturers. It is unclear if the development of unconventional gas in Victoria could influence the price of gas in this state, given that there are no identified reserves of

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664 ibid., p. 24.
unconventional gas, the long lead-in time required to develop reserves once they have been identified, and the possibility that the amount of gas would be too low to influence the international price.

The Committee notes that there may be other factors involved in the current challenges facing the gas market. The Committee acknowledges the current ACCC inquiry into the competitiveness of wholesale gas prices and the structure of the gas industry in eastern Australia, and finds that it may have the potential to address some of the concerns expressed by Victorian manufacturers.

**RECOMMENDATION 14:** That the Minister for Energy and Resources meet with Victorian manufacturers to understand their concerns regarding the supply and increasing cost of gas, and the impact on their businesses.

**RECOMMENDATION 15:** That the Victorian Government take note and consider the findings of the Australian Competition and Consumer Commission Inquiry into the East Coast Gas Market, which are due to be reported in April 2016.

*Committee Room, 26 November 2015.*
Appendix 1
List of submitters

1. Kristin Bitmead
2. Diane Morris
3. Lynnette Alderson
4. Pam White
5. Lee Gladwell
6. Ray Gladwell
7. Rajeshkumar Patel
8. Alan Coleman
9. Stuart Daigleish
10. Neville Larson
11. Dr Matthew Currell
12. Vanessa Mullin
13. Lois Doeven
14. Daryl Hook
15. John King
16. Andrew Beale
17. Alexander Arbuthnot
18. Paul Calvert
19. Nikki Thompson and Rob Hann
20. Kenneth Reid
21. Wayne Somerville
22. Jenny Jeal
23. Robert McLean
24. Brian O’Sullivan
25. Michael McGarrigle
26. Craig Farmer
27. Wurdale Landcare
28. Greg Oates
29. Kim White
30. Robert Whitaker
31. Craig Lambie
32. Kylie Richter-Cools
33. **Pro forma F (see Appendix 1.1 for list of names)**
   34. Paul Alexander
   35. Stewart Guthrie
   36. Anne Mulvey
   37. Brian Bowtell
   38. Lorraine Bignoux
   39. Sunny Wilson
   40. Alison Marchant
34. **Pro forma H (see Appendix 1.2 for list of names)**
   42. Robyn McLachlan
   43. Tracey McGuinness
   44. Clive and Pamela Newman
45. Jonathan McCarthy
46. Philip Baker
47. Peter Gardner
48. Wendy Evans
49. Peter Roche
50. Monica Petterson
51. Brad Kijlstra-Shone
52. John Bowman
53. Stephen Issell
54. Jeremy Schrader
55. Elizabeth Ellen
56. Julie Francis
57. Gippsland Environment Group
58. Marg Desira
59. Graeme Stockton
60. Jane Gorman
61. Martha Hills
62. Barbara Young
63. Brian Steadman
64. Jo Southern
65. Australian Medical Association Victoria
66. Dr Janeen Samuel
67. Wendy Davis
68. Dr Fred de Munk
69. Dale Gibbs
70. Jackson Docherty
71. Patricia de Mouplied
72. Robin Friday
73. Lynley Manson
74. Ann Wingad
75. Sheridan Guiney
76. Warren Sanders
77. Ian and Marian Cooke
78. William Reid
79. Steve Winfield
80. **Pro forma C (see Appendix 1.3 for list of names)**
   81. Danielle Haywood
   82. Raymond Martin
   83. Gail Barton
   84. Kerry Woodward
   85. Stephen Koci
   86. Cathy Cheadle
   87. Angela Robinson
   88. Mordialloc Beaumaris Conservation League Inc
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Appendix 1 List of submitters

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197. Dr A Barrie Pittock
198. Liana Beavis
199. Elizabeth Banks
200. G. H Schorel-Blavka
201. Julie Agar
202. Gabriel Brennan
203. Heinz de Chelard
204. Kate Watchow
205. Ingrid de Neve and Mark Wallace
206. Gasfield Free Dean Marsh and Bambra Community Group
207. Anunaki Holmes
208. David Williams
209. Dr Angela Munro
210. Gasfield Free Southwest
211. Thomas Rees-Lightfoot
212. Georgette Courtney
213. Colinn and Jill Frawley
214. Jan Molloy
215. David Tomkins
216. Australian Landscape Trust
217. Bruce Hedditch
218. C and P Jones
219. CSG-Free Maffra and Districts
220. Danniell Bennett
221. Diane Lawton
222. E McKinnon
223. Hadyn Cain
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231. David Fenton and Caroline Coggins
232. Adam and Jennifer Boughton and family
233. Tamara Taylor
234. Dr Jeffrey Butler
235. Bass Coast Shire Council
236. Mark Freeman
237. Robert Taylor
238. Sharyn Munro
239. Michael Stanley
240. Frack Free Grovedale
241. Michael Scott
242. Jill Smith
243. Brian William McLure
244. Bairnsdale Gas Field Free Group - Meerlieu and District branch
245. Edward Stuckey
246. Margaret Murphy
247. Mecrus Resources
248. Andrew and Jill Milne
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270. Hannah Alquier
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272. John Knox
273. Pamela French
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275. Plastics and Chemicals Industries Association
276. Anne Simons
277. Lawrence Balshaw-Blake
278. Steven McGlashan
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281. Eve Stocker
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410. Bill Bennett
411. Julie Constable
412. Margaret Rolfe
413. Suzanne Giacometti-Kingston
414. CSG Free Bass Coast
415. Glenelg Shire Council
416. Doctors for the Environment Australia
417. Roosendaal Farm
418. Pamela Reeves
419. Absolution Ecology
420. Marie Gibson
421. Karen Fitzpatrick
422. Jane Brownrigg
423. Dr David Harding
424. Geraldine Bagwell
425. Victorian Trades Hall Council
426. Gasfield Free Seaspray
427. Daan Spijer

428. Pro forma D (see Appendix 1.8 for list of names)
429. Rod and Ann Ebbott
430. Thomas Clarke
431. Margaret Gaita
432. Julie and David Boulton
433. CSG Free Kongwak
434. Michael Howes
435. Anda Banikos
436. Jo Livermore
437. Gerry Dunlop
438. Louise Nicholas
439. Malcolm Hansford
440. Robert Packett
441. Paul Batey
442. Nick Brodribb
443. Daniel Smith and Susan Peel
444. Simon and Louise Manifold
445. Ute Mueller
446. Tim Frazer
447. Quoc An Bui
448. Janet Watson Kruse
449. B Phillips
450. Bessie Tyers
451. Australian Academy of Technological Sciences and Engineering
452. Debbie McIntyre
453. Dr Michelle Sherriff
454. Leon Furze
455. Linda O’Hara
456. Jan Cosser and Guy Gilbert
457. Robert Brown
458. Golden Plains Shire Council
459. Robin James
460. LIVE (Locals into Victoria’s Environment)
461. Larissa Gardiner
462. Michael Gooch
463. Danielle Wilson
464. Andrew Laird
465. Surf Coast Air Action Inc.
466. Friends of the Earth
467. Naomi Halpern
468. Karen Large
469. Denise Schimana
470. Pamela Fyfe
471. Victorian Farmers Federation
472. Port Phillip City Council
473. Northern Alliance for Greenhouse Action (NAGA)
474. Elke Nicholson
475. Dorelle Davidson
476. David Lamb
477. Damian Thrum
478. Beach Energy
479. Peter Foot
480. Barbara and Alistair Hopkins
481. The Australian Living Earth Centre
482. Debra Fowler
483. Chris Wilson
484. Surf Coast Shire Council
485. Jane Donaldson
486. Clara Davies
487. Elvyn Dear
488. Katharine Wheldrake
489. Lesley Goode
490. Elaine Jones
491. George Laird
492. Sue Stevens
493. Shiona Berry
494. Helen Hill
495. Baw Baw Sustainability Network
496. Dr Peter Laird
497. Janet Howie
498. Phil Langdon
499. Brendan Gray
500. Andrew Ellery
501. Petroleum Exploration Society of Australia Ltd (PESA)
502. Lynda Britten-Epworth
503. Andrew Harrison
504. Barwon Region Water Corporation
505. Moyne Shire Council
506. Angela Crunden
507. Michael Blackam
508. Debra King
509. Maggie Riddington
510. Lakes Oil N.L.
511. Neil Longmore
512. Regnan Governance Research and Engagement
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621. Suyn Anson
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623. John and Beryl Langer
624. Jan McCann
625. Dr Nancy McMurray
626. Robert Messenger
627. Janene Swalwell
628. Dr Katrina Swalwell
629. Ian and Gay Cornthwaite
630. Anne Young
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632. Ebony Yuill
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1062.  Damien Pitts
1063.  Pat Purcell
1064.  Prof. Andrew Garnett, University of Queensland, Centre for Coal Seam Gas
1065.  Jenny Stielow
1066.  Kate Lidgerwood
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1068.  Charlie Davey
1069.  T. Rawlings
1070.  Prof. Paul O’Brien
1071.  Johannes denToom
1072.  Prof. Samantha Hepburn
1073.  Garry Owers
1074.  Lyn Hovey
1075.  Annabelle Gumpold
1076.  Pro forma K (see Appendix 1.11 for list of names)
1077.  Elaine Furniss
1078.  Condah Groundwater Users Committee
1079.  Lorraine Watt
1080.  Wendy Klason
1081.  Chris McPherson
1082.  Jenny Jeal
1083.  John Graham
1084.  Maree Goodwin and Lorraine Halabarec
Appendix 1.1 Pro forma F Submitters
1085. Rhys Schulze
1086. Janna Everett
1087. Jared Anskaitis

Appendix 1.2 Pro forma H Submitters
1090. Biranna Stock
1091. John and Cynthia Lyons

Appendix 1.3 Pro forma C Submitters
1094. J Robinson
1095. Elizabeth Bates
1096. Peta Fisher
1097. J & P Fleming
1098. Angie Derham
1099. Geoffrey Bates
1100. Chris Stubbs
1101. David Bourke

Appendix 1.4 Pro forma J Submitters
1109. Geoffrey Pittaway
1110. Michael Smith
1111. Julia Smith
1112. Owen Casson
1113. Diane Beyer
1114. Carina Beyer

Appendix 1.5 Pro forma G Submitters
1120. Suzanne Bitmead
1121. Lisa Kirwan
1122. Jo Harrison

Appendix 1.6 Pro forma I Submitters
1125. David Yates
1126. CK Bond

Appendix 1.7 Pro forma B Submitters
1129. Claire Halliday
1130. Wendy Morris
1131. Paul Gadsby
1132. Phillip Waters
1133. Andrew McKinnon
1134. Sherridan McDonald
1135. Julie Stephens
1136. Lisa Minchin
1137. Anita Hanaford
1138. Sian Bloom
1139. Robin Massey
1140. Rick Shulver
1141. James Lockwood
1088. Peter Koster
1089. Andrew Fox
1092. Brendon Thomson
1093. Julian Cook
1102. Alan Broughton
1103. Ann Patterson
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1105. Debbie Jackson
1106. Andrew McArthur
1107. Louise McArthur
1108. Kaye and Robert Hoffman
1115. Pam Benjamin
1116. Peter Benjamin
1117. Suzanne Wightman
1118. Glenys Pentland
1119. Tracey Fraser
1123. Freya Morris
1124. Verity Tuck
1127. Lynnette Yates
1128. Susan Deery
1142. Caroline Clarke
1143. Janina King
1144. Kevin Harbison
1145. Kate Ferguson
1146. Helen Karpas
1147. Julie Gelman
1148. Kerry Bourke
1149. Maureen Pearl
1150. Owen Smith
1151. Peter Margrie
1152. Rachel Diffey
1153. Jacqueline Berry
1154. Darian Zan
Appendix 1 List of submitters

Appendix 1.8 Pro forma D Submitters
1162. S & L Souther
1163. Lesley Briggs
1164. Steven and Fiona Collins
1165. Ellen Burton

Appendix 1.9 Pro forma E Submitters
1169. A & M Lange
1170. B Hepburn
1171. Marissa Mahon
1172. Jim Cleary
1173. Will Wolseley
1174. Ken Stevenson

Appendix 1.10 Pro forma A Submitters
1180. Abdul Baig
1181. Adam Quennell
1182. Adam Watson
1183. Adrian Francis
1184. Adrian Rachele
1185. Aidan Macdougall
1186. Aidan Matuschka
1187. Ailsa Jean
1188. Akarsini Ashman
1189. Alan Leenaerts
1190. Alex Breskin
1191. Alex Byrne
1192. Alex Delaney
1193. Alex Lindeman
1194. Alexandra Bhathal
1195. Alia Swift
1196. Alice Burns
1197. Alisa World
1198. Alison MacGregor
1199. Allison Harvey
1200. Amy Lampugnani
1201. Ana Gioino
1202. Andrea Frisby
1203. Andreas Katsineris-Paine
1204. Andrew Godall
1205. Andrew Nielsen
1206. Andrew Peploe
1207. Andrew Pollitt
1208. Andrew Steward
1209. Andy Shanahan
1210. Angela Smith
1211. Angela Watson

1155. Janet Burchill
1156. Louise Harvey
1157. Karen Coffield
1158. Ellen Fox
1159. Helen McKinnon
1160. Carol Dyer
1161. Bryan Baldwin
1162. Pauline Fry
1167. Hamish Southerland
1168. Helen Newman
1175. Julian Knox
1176. Lorelle Sunderland
1177. Maureen Shivel
1178. Barry Schulze
1179. L & J Grossman
1212. Ann Abrahmsen
1213. Ann McGovern
1214. Anna Haines
1215. Annabel Davy
1216. Annaisse Novak
1217. Anne Boyd
1218. Anne Caughey
1219. Annette Brooker
1220. Annette Herschtal
1221. Annie Crane
1222. Annie Leschen
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1225. Anthony Reid
1226. Anthony Williams
1227. Arisja Oberholzer
1228. Arnold Greiner
1229. Ashley Voigt
1230. Bartolomeo Verduci
1231. Basil Eliades
1232. Ben Cronly
1233. Ben Leunig
1234. Bernard Abadie
1235. Bernard Rowley
1236. Bernard Silvey
1237. Bethanni Taylor
1238. Bethany Ong
1239. Betty Breneieris
1240. Bev Cowan
1241. Bev Isaac
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Appendix 1 List of submitters

1568. Nicola Carlile
1569. Nicola Coles
1570. Nicole Alexander
1571. Nicole Merzliakov
1572. Nicole Robinson
1573. Nigel D’Souza
1574. Nina Earl
1575. Nina Hagan
1576. Olga Morris
1577. Olivia Hartigan
1578. Pam Talbot
1579. Pat Allan
1580. Patricia Hubbard
1581. Patricia McGann
1582. Patrick Alilovic
1583. Patrick Hearps
1584. Paul Bennet
1585. Paul Pocock
1586. Paul Riddle
1587. Paul Williamson
1588. Pauline McCracken
1589. Peta Malins
1590. Peter Carroll
1591. Peter Hassold
1592. Peter Krause
1593. Philip Cahn
1594. Philip Horbury
1595. Philip Riley
1596. Philip Payne
1597. Pia Arrien
1598. Rachel Laws
1599. Ray Connor
1600. Ray Heathcote
1601. Rebecca Cameron
1602. Rebecca Edwards
1603. Rebecca Lloyd
1604. Rebecca McGhee
1605. Rebecca Rose
1606. Renea Johnson
1607. Renee Huish
1608. Richard Lane
1609. Riley AcAuliffe
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1616. Robert Krones
1617. Robert Krones
1618. Robert McKeilvey
1619. Robert Stephen
1620. Robin de Garis
1621. Robyn Aldrick
1622. Robyn Hoe
1623. Robyn Smith
1624. Rod May
1625. Roderick Anderson
1626. Rodolfo Garcia-Flores
1627. Roger Putnam
1628. Rosalind Jones
1629. Rosemary Brooks
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1632. Rupert Steiner
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1634. Sahar Naghshian
1635. Sally Dawe
1636. Sally Goullet
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1649. Sarah Griffiths
1650. Sarah Jones-Hill
1651. Scott Daniel
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1655. Sean Weatherly
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1659. Sheryl Gay
1660. Silvia Gonzalez
1661. Simon Conlon
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1664. Sonia Dioguardi
1665. Sonia Holt
1666. Sonja van Dort
1667. Sophia Rutter
1668. Stanislaw Pelczynski
1669. Stephen Swan
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1671. Stuart Kelly
1672. Sue Davis
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**Appendix 1.11 Pro forma K Submitters**

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<td>Mark Reeves</td>
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Appendix 2
Public hearings and site visits

Public Hearing – Tuesday 30 June 2015 – Gippsland Regional Sports Complex, Sale, Victoria

Wellington Shire
John Websdale, General Manager, Development

South Gippsland Shire
Tim Tamlin, Chief Executive Officer
Cr Don Hill

Baw Baw Shire
Cr Murray Cook
Phil Cantillon, Director, Community Assets

Latrobe Shire
Sara Rhodes Ward, General Manager, Community Livability

Bass Coast Shire
Cr Neil Rankine
Deirdre Griepsma, Environment Manager, Sustainable Environment

Alex Arbuthnot

Lock the Gate Alliance
Chloe Aldenhoven, Community Campaigner, Friends of the Earth
Ursula Alquier, Victorian Coordinator, Lock the Gate Alliance

Ross Scott

Committee for Gippsland
Mary Aldred, Chief Executive Officer

Margaret Williamson

Rodger Davis

Ronald Wangman

Elizabeth Balderstone

Lorraine Halabarec

Andrew Harrison

Marg Thomas

Maureen Versteden
Glen Maher
Kerrin Schelfhout
Rosemary Maher

Public Hearing – Wednesday 1 July 2015 – Gippsland Regional Sports Complex, Sale, Victoria

Dr Jo McCubbin

Australian Dairy Industry Council
Claire Miller, Manager, Policy Strategy, Dairy Australia
Chris Griffin, Member, Natural Resources Management Policy Advisory Group
Irene Clarke, Senior Policy Manager, Australian Dairy Farmers

Lakes Oil NL.
Robert Annells, Executive Chairman
Tim O’Brien, Operations Manager

Ignite Energy Resources
Dane Stewart, Manager, Resource Development
Dr John White, Government and Community Liaison


Melbourne Energy Institute, University Of Melbourne
Timothy Forcey, Energy Adviser

Australian Academy of Technological Sciences and Engineering
Professor Peter Cook

Department of Environment, Land, Water and Planning
Dr Sharon Davis, Executive Director, Water Resources
Kate Houghton, Deputy Secretary, Water and Catchments
Chris McAuley, Director, Water Entitlements and Markets

Victorian Farmers Federation
Gerald Leach, Chair, Land Management Committee
Melanie Brown, Policy Manager
Emily Waters, Policy Adviser, Land Management

Australian Petroleum Production and Exploration Association (APPEA)
Paul Fennelly, Chief Operating Officer, Eastern Australia
Damien Dwyer, Director, Economics
Matthew Paul, Policy Director, Queensland

Dr Matthew Currell, RMIT University, Hydrogeology And Environmental Engineering

Minerals Council of Australia
Megan Davison, Executive Director, Victorian Division
Public Hearing – Wednesday 5 August 2015 – Legislative Council Committee Room, Parliament House

Environment Victoria
Dr Nick Aberle, Safe Climate Campaign Manager
Anne Martinelli, One Million Homes Energy Efficiency Campaigner

Grattan Institute
Tony Wood, Energy Program Director
David Blowers, Energy Fellow

Public Hearing – Wednesday 12 August 2015 – Surf Coast Shire Council, Torquay

Surf Coast Shire Council
Keith Baillie, Chief Executive Officer
Cr Margot Smith, Mayor
Kate Sullivan, General Manager, Environment and Development
Rowan Mackenzie, Manager, Environment and Community Safety

Colac Otway Shire Council
Cr Brian Crook, Deputy Mayor
Stewart Anderson, Manager Environment and Community Safety

Barwon Water
Carl Bicknell, General Manager Strategy and Planning
Steven Reddington, Senior Environmental Planner

Frack Free Moriac
Alison Marchant
Damien Marchant

Dr Mike Forrester

G21 Agribusiness
Russell Coad

Otway Harvest Trail
Tom Dennis, President
Kit-E Kline, Vice-President

Ian Clarke

Wendy Klason

Darren Noyes-Brown

Alan Manson

Suzanne Yandle

Chris Johnson

Kristin Bitmead
Public Hearing – Thursday 13 August 2015 – Surf Coast Shire Council, Torquay

3228 Residents Association
Sid Pope, President

Friends of the Earth
Cam (Campbell John) Walker, Campaign Coordinator

Dr George Carman

Professor Samantha Hepburn, Research Director, Deakin University Law School

Michael Blackam, Coffey

Frack Free Geelong
Anthony Gleeson, Frack Free Geelong
Elizabeth Packett, Gasfield Free Torquay

Wurdale Landcare Group
Peter McGregor
Carole McGregor
Joan Lindros

Environmental Justice Australia
Ariane Wilkinson, lawyer

Public Hearing – Tuesday 18 August 2015 – Legislative Council Committee Room, Parliament House

Department of Environment, Land, Water and Planning
John Ginivan, Executive Director, Planning and Building Systems
Lee Miezis, Acting Executive Director, Environmental Policy
Dr Sharon Davis, Executive Director, Water Resources

Department of Economic Development, Jobs, Transport and Resources
Paul McDonald, Director, Geological Survey of Victoria, Ross McGowan, Executive Director, Earth Resources Regulation Branch
Mark Feather, Executive Director, Energy Sector Development Branch
Anthony Hurst, Executive Director, Earth Resources Development Branch

Public Hearing – Tuesday 1 September 2015 – Legislative Council Committee Room, Parliament House

Department of Health and Human Services
Professor Michael Ackland, Acting Chief Health Officer

Doctors for the Environment Australia
Dr John Iser, Committee Member
Dr Liz Bashford, Committee Member
Appendix 2 Public hearings and site visits

Public Hearing – Wednesday 2 September 2015 – Legislative Council Committee Room, Parliament House

**Plastics and Chemicals Industries Association**
Samantha Read, Chief Executive Officer
Peter Bury, Director, Strategy, Innovation and Research

**CSR Limited**
Martin Jones, General Manager, Government Relations

Public Hearing – Tuesday 15 September 2015 – Legislative Council Committee Room, Parliament House

**Energy Users Association of Australia**
Peter Dobney, Board Member

**Environment Protection Authority Victoria**
Tony Robinson, Manager, Major Projects
Dr Cathy Wilkinson, Executive Director Knowledge, Standards and Assessments

Public Hearing – Wednesday 23 September 2015 – Regional Hearing – Hamilton Performing Arts Centre, Hamilton

**Glenelg Shire Council**
Greg Burgoyne, Chief Executive Officer

**Moyne Shire Council**
David Madden, Chief Executive Officer

**Corangamite Shire Council**
David Rae, Acting Chief Executive Officer
Cr Chris O’Connor, Mayor

**Southern Grampians Shire Council**
Cr Peter Dark, Mayor

**Mecrus**
Barry Richards, Managing Director
Dr Rodney Halyburton, Senior Petroleum Consultant

**Mr Darrell Morrison**

**Gunditj Mirring Traditional Owners Aboriginal Corporation**
Damein Bell, Chief Executive Officer

**Wannon Water**
Peter Wilson, Branch Manager, Asset Planning

**Protect the West Alliance**
Bernadette Tapscott
Bob Hodgets
John Coverdale
Pat Nesbitt
Kevin Cotter
Branxholme, Byaduk and Wallacedale farmers
Malcolm Rowe
Colin Frawley
Michael Greenham
Aggie Stevenson
Gary Everett

John Graham
Hayley Rundell
Helen Henry
David Smith
Andrew Pettingill

Public Hearing – Tuesday 6 October 2015 – Legislative Council Committee Room, Parliament House

Victorian Auditor General’s Office
Steve Vlahos, Assistant Auditor-General
Dallas Mischkulnig, Sector Director, Performance Audit
Maree Bethel, Manager, Performance Audit

Lakes Oil
Robert Annells, Executive Chairman
Timothy O’Brien, Operations Manager

Site Visit – Wednesday 1 July 2015 – Seaspray, Victoria

Wombat Gasfields
Lakes Oil

Flints Farm
Trevor and Di Flint

Site Visit – Friday 30 October 2015 – Altona, Victoria

Qenos
Appendix 3

The difference between conventional and unconventional gas

The following extract provides a detailed explanation of the difference between conventional and unconventional gas and the use of hydraulic fracturing. It is extracted from Dr Louise Goldie Divko’s reviews of the gas prospectivity for the Otway and Gippsland regions, produced as part of water science studies undertaken by the Department of Economic Development, Jobs, Transport and Resources.666

Conventional gas reservoirs are commonly porous and permeable rocks such as sandstones or limestones. Impermeable rocks such as claystones lie directly above the reservoirs and are known as a seal or cap-rocks. The gas is trapped in the reservoir and under the seal in geological structures. Geological structures are like an inverted dish, with the gas held underneath. A gas well drilled into the geological structure will intersect the porous gas reservoir and, when present, gas will flow into the well.

Tight, shale and coal seam gas are termed unconventional gas types. These differ from conventional gas in that the gas is trapped at or near the source, which may also act as the gas reservoir. In the case of tight gas, the gas is produced from relatively low permeability and low porosity sedimentary reservoirs. The lack of permeability in the rock prevents gas from migrating, and so it is trapped in the tight rock formation. A similar principle applies to shale gas where the gas is sourced from and trapped in fine-grained sedimentary rocks that have low porosity and permeability, and are organic-rich. The gas is held on organic matter in the rock, in tiny pores between grains, and in any fractures present in the rock. In the case of coal seam gas (also known as coal bed methane), naturally occurring methane in the coal seams is held on the coal surfaces by water pressure and may also exist in the gaps and cracks in the coal seams.

Shale gas in the US has been produced since 1820 (e.g. Martin et al., 2010) and coal seam gas production in Queensland has grown from the first small scale commercial production 18 years ago at Moura (Slater & Baker, 2012). In the case of US shale gas, it is only in the last few years that decades of experience and knowledge gained from the development of individual shale gas plays, and advancements in well completion technologies, have led to the growth of the industry. The rising price of the commodity has also contributed to the commercial viability of gas development projects that would not have been possible in the past.

The difference between conventional gas production and the unconventional gas types (tight, shale and coal seam gas) is that for most conventional wells, gas will flow from the reservoir into the well and to the surface infrastructure without assistance, whereas for the other gas types, additional technologies are required to release the gas. For instance, gas may not flow unless the rocks are fractured to create artificial permeability in the formation to release the trapped gas. For coal seam gas, water must be drawn away from the coal seam by depressurising the coal to release the gas into the well.

Not all unconventional gas types require fracturing or are suitable for fracturing, and some conventional gas reservoirs are artificially fractured to maintain or enhance production. For instance, more than 700 conventional wells have been fracture stimulated to enhance hydrocarbon recovery in South Australia since 1969 (Goldstein et al., 2012).
Appendix 4
Regulatory framework

Victoria predominately regulates onshore unconventional gas activities through two earth resources Acts, administered by the Minister for Energy and Resources through DEDJTR. These Acts are:

- the Mineral Resources (Sustainable Development) Act 1990 (Minerals Act) for CSG

The four other earth resources Acts in Victoria are:

- the Greenhouse Gas Geological Sequestration Act 2008
- the Geothermal Energy Resources Act 2005
- the Pipelines Act 2005

A number of other Acts and related legislation also contribute to the regulation of unconventional gas, including:

- the Native Title Act 1993 (Commonwealth)
- the Planning and Environment Act 1987
- the Water Act 1989.
- All petroleum exploration and recovery in Victoria is prohibited unless authorisation is granted.\textsuperscript{667} The Minister may grant rights for specified areas via a licence under both the Petroleum and Minerals Acts. The Minister may also exempt land from the application of the Acts.\textsuperscript{668}

\textbf{Mineral Resources (Sustainable Development) Act 1990}

The Minerals Act provides a legislative framework for development and regulation of CSG. The Act and associated regulations cover licensing and approval requirements, as well as issues surrounding compensation, rehabilitation and royalties.

\textsuperscript{667} Petroleum Act 1998 s 15; Mineral Resources (Sustainable Development) Act 1990 s 8.
\textsuperscript{668} Petroleum Act 1998 s 12; Mineral Resources (Sustainable Development) Act 1990 s 7.
The Minerals Act applies to ‘minerals’ as defined as any substance which occurs naturally as part of the earth’s crust, excluding petroleum. This definition means CSG is defined as a ‘mineral’ rather than as ‘petroleum’ and therefore, is regulated by the Minerals Act.

The four types of licences granted under the Minerals Act are:

- **Exploration licences** which authorise low impact exploration activities for minerals in the area to determine whether the resource is commercially viable
- **Mining licences** which allow the holder to carry out mining, exploration, construction and any other activities incidental to mining on the land
- **Prospecting licences** which enable the holder to prospect or explore for minerals
- **Retention licences** which allow the holder to retain the rights to a mineral resource in the land covered by the licence that is not currently economically viable to mine, but may be in the future.

Exploration and mining licences are the two most common and details of the application process for each are provided below.

**Exploration**

Minerals exploration requires an exploration licence granted under the Minerals Act. Exploration licences authorise low impact exploration activities for minerals in the area, to determine whether the resource is commercially viable. To obtain an exploration licence, an applicant must advertise their application, and satisfy the Minister that they:

- are a fit and proper person to hold the licence
- intend to comply with the Act
- genuinely intend to do work
- have an appropriate program of work
- are able to finance the proposed work and rehabilitation of the land.

All exploration applications are subject to an objection process and any objections must be considered.

A licence holder must lodge and obtain approval of a work plan before any exploration activities may commence. It must:

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670 ibid., ss 13, 14, 14B & 14C.
671 ibid., s 13.
672 ibid., s 15(5).
673 ibid., s 15(6).
674 ibid., ss 24 & 25.
675 ibid., s 40.
Appendix 4 Regulatory framework

- describe the proposed work, including details of potential environmental impacts and the measures proposed for their control or mitigation, as well as the proposed methods of monitoring, auditing and reporting those impacts
- include a description of the proposed rehabilitation of areas subject to surface disturbance, maps depicting sites identified for drilling or other earthworks and the proposed arrangements for consultation with landowners
- be prepared in consultation with DEDJTR and other relevant agencies, and
- include an environment impact assessment, where required by the Minister.  

A cultural heritage management plan may also be required for ground disturbing works in areas of cultural heritage sensitivity and must be prepared prior to the approval of the work plan.

As discussed in Chapter 5 of this Report, which looked at the co-existence of agriculture and unconventional gas mining, if the land affected is private land, compensation must be determined prior to a licensee commencing work under an exploration licence. The licensee must either:

- obtain the consent of the owners of the land affected
- make and register a compensation agreement with those owners and occupiers
- obtain a compensation determination from VCAT, or
- purchase the land.

Further restrictions apply to land which is on restricted Crown land, water supply catchments or on land with a public highway, road or street on it.

A licensee has a duty to consult with the community throughout the period of the licence, by sharing information about activities authorised by the licence, and giving them a reasonable opportunity to voice their concerns. The licence holder must give owners and occupiers of the affected land at least seven days notice prior to work commencing and is not permitted to do any work within 100 metres of a home without the owner’s consent.

In accordance with the conditions of their licence, the licensee is obliged to rehabilitate the land they have worked on. Before work commences, the licensee must pay a rehabilitation bond, which will only be repaid if the licensee rehabilitates the required land to the satisfaction of the Minister.

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676 Mineral Resources Development Regulations 2002 r 25, Schedule 12 and Mineral Resources (Sustainable Development) Act 1990 ss 177E and 41A.
677 Mineral Resources (Sustainable Development) Act 1990 s 41AD.
678 ibid., s 43(1)(e).
679 ibid., ss 44(1) & 44(2).
680 ibid., s 39A.
681 ibid., ss 43(1)(d) & 45.
682 ibid., s 78(1).
683 ibid., s 80.
Mining production and extraction

Before any mining, as defined in the Minerals Act as ‘extracting minerals for the purpose of producing them commercially’, can begin, a separate mining licence must be obtained. Mining licences allow the holder to carry out mining, exploration, construction and any other activities incidental to mining on the land. The applicant for a mining licence must satisfy the Minister that there is a reasonable prospect that the mineral resource will be economically viable. A mining licence requires an approved work plan which must include more detail than that required for exploration, including maps and plans of proposed work, a rehabilitation plan, an environmental management plan and a community engagement plan. A work plan, prepared in consultation with DEDJTR will be lodged in draft form where it then must receive a ‘statutory endorsement’ within the timeframe required by the licence. Once endorsed, the draft works plan will be submitted with the application for planning approval, unless an environmental effects statement (EES) has been required.

Unlike exploration work, which is exempt from the requirements of planning approval, mining requires either a planning permit or an EES. A mining application requires a planning permit from the responsible authority, under the Planning and Environment Act 1987 (PE Act), as specified by the Victoria Planning Provisions (VPPs). However, if the Minister for Planning decides the project could have a significant effect on the environment, they may insist an EES is prepared under the Environment Effects Act 1978 (EE Act), which overrules the planning permit requirement.

Similar to exploration licences, objections may be made to the grant of a mining licence which the Minister must consider. The PE and EE Acts outline the process for objection and appeals against mining projects. Under the PE Act, an individual may object to an application for a planning permit, and any one of those objectors may appeal to VCAT if the permit is granted. The EES process involves public submissions and hearings which act as an individual’s means to object to the mining proposal.

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684 ibid., s 14.
685 ibid., s 15(6B).
686 ibid., s 15(5); Mineral Resources Development Regulations 2002 r 16(2).
688 Mineral Resources (Sustainable Development) Act 1990 Part 6B.
689 ibid., s 43(3).
690 Victoria Planning Provisions cl 52.08.
691 Mineral Resources (Sustainable Development) Act 1990 s 25(2).
692 Planning and Environment Act 1987 ss 57 & 87.
A licensee must establish a rehabilitation plan and pay a rehabilitation bond, which is set in consultation with the owner of the land and the local council.\textsuperscript{693} Finally, an approved work authority must be obtained, which certifies that all other approvals and requirements have been met.\textsuperscript{694}

The provisions and arrangements relating to compensation, duty to consult, notice of intention to commence work, the 100 metre buffer zone and consent requirements for specific land apply the same way to mining as they do for exploration work.

\textit{Petroleum Act 1998}

The Petroleum Act provides a legislative framework for the development and regulation of shale and tight gas, including licensing, approvals and issues including consultation, compensation, rehabilitation and royalties. The Petroleum Act provides for the issuing of:

- \textbf{Exploration permits} which enable the holder to explore for petroleum within the permitted area

- \textbf{Retention leases} which enable the holder of an exploration permit to retain certain rights to a petroleum discovery that is not currently commercially viable, but might become viable to develop within 15 years, and

- \textbf{Production licences} which allow for the production and exploration of petroleum.\textsuperscript{695}

Exploration permits and production licences are the focus of the description below.

\textbf{Exploration}

Petroleum exploration requires a petroleum exploration permit (PEP). Petroleum tenements are released by the Minister under acreage releases and companies are invited to tender.\textsuperscript{696} Tenders are assessed on their proposed work program and their technical and financial capability.\textsuperscript{697} When granting a permit, the Minister must ensure the area to which the permit applies is smaller than 12,500 square kilometres and forms a continuous parcel of land and that no part of the area is already the subject of an exploration permit.\textsuperscript{698}

\begin{flushright}
\textsuperscript{693} \textit{Mineral Resources (Sustainable Development) Act 1990} ss 79 and 80(2).
\textsuperscript{694} ibid., s 39(3).
\textsuperscript{695} \textit{Petroleum Act 1998} ss 18, 36 & 46.
\textsuperscript{696} ibid., Part 3, Division 2.
\textsuperscript{697} ibid., ss 20 & 21.
\textsuperscript{698} ibid., s 25.
\end{flushright}
Once the Minister has granted the PEP, the holder must prepare and have approved an operations plan prior to any exploration work commencing.699 This plan:

- must address the proposed activities, risk assessments and management commitments, well operations plans and environmental management plans that include consultation
- may be referred to other agencies for review
- may be subject to a cultural heritage management plan for any ground disturbing works in areas of cultural heritage sensitivity.700

No exploration (or production as described below) can be carried out on private land without:701

- obtaining consent of the owner and occupier, or
- a compensation agreement being entered into with the owner and occupier of the land, or
- VCAT determining the compensation payable to the owners and occupiers of the land, and
- the written consent of the Minister.702

- Petroleum exploration does not require a planning permit.703 A licensee must hold insurance and provide a rehabilitation bond.704 A licensee must provide the landowner or occupier with 21 days written notice of any operations taking place.705

Production and extraction

Petroleum production requires a petroleum production licence, which may only be applied for in respect of an area on which the holder has discovered petroleum or a reservoir.706 Similar to the process described above for exploration, petroleum production also requires an approved operation plan and in addition requires a production development plan, which must include a reservoir management plan.707 These plans must address all the issues relating to the proposed operation and must cover all the aspects prescribed in the Petroleum Regulations.708

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699 ibid., s 161.
702 ibid., ss 128 and 138.
705 ibid., s 145.
706 ibid., ss 46 & 47.
707 ibid., ss 63 & 64.
708 Petroleum Regulations 2011 r 16.
An applicant must obtain planning approval for petroleum production and development unless the project is assessed under the EE Act.\textsuperscript{709} The same requirements for exploration relating to consent, compensation, insurance and rehabilitation also apply to production.\textsuperscript{710}

The Crown owns all petroleum “on or below the surface of any land in Victoria that came to be on or below that surface without human assistance”.\textsuperscript{711} Therefore, no compensation is payable to landowners for petroleum that is extracted from their land.\textsuperscript{712} Compensation is payable for any loss or damage that has been, or will be, sustained in relation to the land as a direct, natural and reasonable consequence of the approval of any petroleum operation or the carrying out of any petroleum operation under the authority.\textsuperscript{713}

\begin{itemize}
\item \textsuperscript{709} Petroleum Act 1998 ss 119 & 120.
\item \textsuperscript{710} ibid., s 145.
\item \textsuperscript{711} ibid., s 13.
\item \textsuperscript{712} ibid., s 131.
\item \textsuperscript{713} ibid., s 129.
\end{itemize}
Legislative Council Standing Order 23.27(5) requires the Committee to include in its report all divisions on a question relating to the adoption of the draft report. All Members have a deliberative vote. In the event of an equality of votes, the Chair also has a casting vote.

The Committee divided on the following questions during consideration of this report. Questions agreed to without division are not recorded in these extracts.

25 November 2015

Key Recommendation A

That, in recognition of the Committee not receiving a body of indisputable evidence that convinced it that the current moratorium on an unconventional gas industry operating in Victoria should be lifted, and in recognition of the need to provide certainty on this issue, within the Terms of Reference for this Inquiry, the Victorian Government introduce a permanent ban on the exploration and extraction of unconventional gas.

Mr Leane moved, That Key Recommendation A stand part of the Report.

The Committee divided.

Ayes 4
Ms Dunn
Mr Leane
Ms Shing
Mr Young

Noes 4
Ms Bath
Mr Dalla-Riva
Mr Davis
Mr Somyurek

There being an equality of votes, the Chair gave his casting vote for the Noes.

Question negatived.
**Key Recommendation B**

That in these circumstances, the Committee supports a further five year moratorium on onshore gas exploration and production in Victoria.

The Chair moved, That Key Recommendation B stand part of the Report.

**The Committee divided.**

Ayes 3  
Ms Bath  
Mr Dalla-Riva  
Mr Davis  

Noes 5  
Ms Dunn  
Mr Leane  
Ms Shing  
Mr Somyurek  
Mr Young  

**Question negatived.**

**Recommendation 3**

That, noting that the Committee is not in a position to determine whether a single Act or improvements to the *Mineral Resources (Sustainable Development) Act 1990* and the *Petroleum Act 1998* would result in better regulation, the Victorian Government should look to individual improvements in both Acts and should ensure that:

- community consultation and effective dispute resolution processes are improved
- landholder rights are strengthened and an equitable balance and process between the rights of landholders and mining companies in relation to land access, compensation, and the rehabilitation of land is achieved, noting the Crown owns all mineral resources.

The Chair moved, That Recommendation 3 stand part of the Report.

**The Committee divided.**

Ayes 7  
Ms Bath  
Mr Dalla-Riva  
Mr Davis  
Mr Leane  
Ms Shing  
Mr Somyurek  
Mr Young  

Noes 1  
Ms Dunn

**Question agreed to.**
## Minority reports

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The Committee was not provided with the full range of support that was necessary to reach definitive conclusions given the large number (1987) of people who provided evidence to the Committee both through written submissions and by appearing at the Committee’s public hearings, the complexity of the material and the range of detailed scientific studies.

As the complexity and scope of the task at hand became apparent, the Committee sought additional support of an administrative and scientific nature. Late in the process some scientific support was provided and we note the important contribution made, but this was not sufficient to examine and fully test all aspects of the evidence submitted.

Such was the Government’s apparent disdain for the inquiry that in response to the Committee’s request to the Premier for additional support made on 20 July, it received a letter from the Minister for Energy and Resources in late October, having tabled its interim report on 1 September and rapidly approaching the 1 December deadline for its final report, that stated: “The Committee’s specific staffing requirements are yet to be determined”.

This disdain for the inquiry was also evidenced by the Minister for Energy and Resources failing to appear before the Committee, not once, when requested by the Committee, but also when requested to appear to give evidence before the Committee by the Legislative Council as a whole.

The Leader of the Government in the Legislative Council made clear the Government’s policy about the uses to which committee resources could be put when he said in the Parliament on 24 June 2015:

*It certainly has not stopped your members of committees, who complain bitterly about the number of references and the amount of resources available to support the research activities, being very adventurous in using that precious resource to underpin overseas trips. Whilst at the same time you are pushing for a multiplicity of references simultaneously*
and worrying about the amount of resources, you want to spend it on trips. I reckon as a matter of principle you might suggest that overseas trips in this climate are perhaps not a good idea.

The Committee was therefore not able to travel nationally or internationally with a particular impact on its inability to examine regulatory systems and take evidence from other jurisdictions. In the case of New South Wales, Queensland, Canada and the United States, which have established unconventional gas industries, it is clear that significant regulatory learnings are available of which the Committee was not able to avail itself fully.

The Committee repeatedly received evidence and direct advice that it should visit a series of other jurisdictions to view first-hand the strengths and weaknesses of the various regulatory approaches, for example the Gas Fields Commissioner model in Queensland. We were not permitted to do this and thereby test these regulatory approaches.

A key finding is that while there are clearly improvements that can be made in Victoria’s regulatory system the Committee is not in a position to point definitively to jurisdictions with better regulation.

It is clear further work will have to be done by the Victorian Government.

In these circumstances the Coalition members of the Committee proposed a further five year moratorium on onshore gas exploration and production in Victoria – a proposition that was rejected by the ALP members of the Committee.

The real reason for the apparent disdain in which the Government held the inquiry became apparent in the ALP members of the Committee’s counter proposal, which was to impose a complete ban on onshore gas exploration and production in Victoria.

It is also clear that to ensure the future of Victorian industry, including key manufacturers, issues of gas supply and price will have to be resolved. Long term more gas will have to be brought on stream to ensure reliable supply and reasonable pricing.
A further five year moratorium on onshore gas exploration and production would have permitted necessary further examination of other jurisdictions’ regulatory frameworks and the development of a world’s best practice regulatory environment for Victoria that might have permitted a timely resumption of onshore conventional gas exploration at the very least.

The Coalition members of the Committee recommend the Government extend the current moratorium for a further five years.

Signed

David Davis
Richard Dalla-Riva
Melina Bath
Simon Ramsay
Introduction

This minority report reflects my views in relation to submissions received by a broad range of community members, individual industries, environment groups, peak bodies and industry groups as part of the Inquiry into Onshore Unconventional Gas in Victoria. As detailed in the final report, the committee received 1,862 published submissions and participated in multiple public hearings across the state.

It must be noted that the recommendations contained in the final report are made without prejudice as part the work of the Environment and Planning Committee members in responding to the Inquiry and in my view should not be considered as a recommendation for this industry to proceed in Victoria.

The findings

It was disappointing that the committee could not reach a consensus, nor a majority decision, when considering either a permanent ban on unconventional gas exploration and extraction against a counter position of extending the current moratorium.

It is my view a permanent ban on unconventional gas exploration and extraction would ensure the protection of Victoria's environment, agriculture and water supply as well as public health.

Further it is my view that the only way to provide certainty across the range of stakeholders, including community, primary producers and industry, is to secure a permanent ban on the exploration and extraction of unconventional gas in Victoria.

It was unfortunate that the committee was not resourced to visit other states in Australia, it would have been useful to hear first hand the views of other communities who have already experienced the impact of unconventional gas activities.

The committee heard from concerned community members across the state, both at public hearings and via written submissions. At the time of writing this minority report, 69 towns across Victoria have declared themselves Gasfield Free. The public hearings revealed the enormous amount of stress communities were feeling at the prospect of an unconventional gas industry in their region. The depth of concern was profound and the amount of time community members have dedicated to the issue, being strong advocates for the protection of rural and regional Victoria, was immense.

The committee heard extensively from Victoria’s primary producers, agri-tourism and tourism sectors, both at public hearings and through written submissions. A consistent theme of their submissions was the risk to productive farmland and water supply, the impact of industrialised landscapes and reputational risk of Victoria as a clean and green primary producer. The final report elaborates on these submissions.

The committee heard substantial evidence on the energy market and Victoria’s energy future. Unconventional gas is not a renewable source of energy, it is polluting, contributes to climate change, and is not required as a fuel to transition between fossil fuels and renewables. Victoria doesn’t need an unconventional gas industry in Victoria to provide employment. Supporting and growing our renewables industry would provide more jobs that are future-proofed and lead to greater long-term employment growth in Victoria. A permanent ban on unconventional gas activities would also ensure that fugitive emissions would not be a contributor to greenhouse gas emissions.
The lack of scientific knowledge around the full extent of risk was alarming as were the ongoing gaps revealed when examining current regulatory frameworks. The hearings and submissions highlighted the need for much further work to properly understand all the risks associated with unconventional gas activities, whether that be around public health, environment, air, aquifers, water supply, soil, subsidence, economic impact, climate change, biodiversity, land productivity, agricultural industries, traditional owners and our communities.

It is my view that the risks posed by unconventional gas exploration or extraction are far too great to be managed by regulation and that those risks are far outweighed by any perceived or real benefits.

Conclusion

In conclusion, given the evidence presented to the Committee by the wide range of stakeholders, from farmer, to township group, to industry and advocacy groups alike, I am of the opinion that unconventional gas, including coal seam gas, tight gas and shale gas, poses an unacceptable threat to Victoria’s farmland and communities and that this threat cannot be mitigated through regulation.

I would like to thank the Chair and members of the committee for allowing me to be an active participant even if we weren’t able to come to a consensus position on the key recommendation. I would also like to thank my colleague, Ms Colleen Hartland MLC for her contribution as a participating member when I was absent. I would also like to thank the Committee Secretariat for their tireless efforts in supporting the Committee Inquiry and in preparing the Final Report in what has been an enormous task with few resources.

Samantha Dunn MLC
Member for Eastern Metropolitan Region
30 November 2015
OVERVIEW

There was unanimous agreement among members of the committee concerning appropriate legislative and regulatory safeguards to put in place should an unconventional gas industry commence in Victoria.

The Committee was not, however, able to reach an agreement on the principal recommendation of the inquiry. The two competing principal propositions considered by the committee were as follows:

- An outright ban on the unconventional gas industry in Victoria based on bringing about greater certainty
- A five-year extension of the current moratorium.

While I acknowledge the evidence received by the Committee [The Environment and Planning Committee] concerning the risk of unconventional gas extraction to human health and the environment was powerful, I do not believe that an outright ban is the right action to take. An outright ban on unconventional gas does not make allowances for future technological advances that may make unconventional gas more palatable in the future, so it could result in missed opportunities for the competitiveness of our economy and the living standards of Victorians.

On the other hand, I believe that a moratorium on unconventional gas should only be applied for another three years and not five, given the speed at which technological advances may take place.

I also rejected the recommendation of extending the current moratorium since a mere extension of the current moratorium as proposed by Coalition members would incorporate conventional gas.

The refusal of the Coalition members of the committee to decouple conventional and unconventional gas from their recommendation to extend the moratorium on onshore drilling when the committee’s terms of reference did not require the committee to investigate conventional gas is misleading because it creates the impression that the committee investigated the extraction of conventional gas.

I therefore believe the inclusion of conventional gas in the five-year moratorium as recommended by Coalition members is arbitrary—it is not based on any evidence received by this inquiry.

As a result of Coalition members recommending an extension to a moratorium on conventional gas as part of the moratorium on unconventional gas (and formulating a minority report on that basis), I will also incorporate recommendations concerning conventional gas into this report.

The committee heard significant evidence that pressure is mounting for domestic gas prices to rise to a level equivalent to the world price (before the cost of liquefaction and transport is added). This would result in a doubling of gas prices for the domestic market. Yet cheap gas is the backbone of much of Victoria’s manufacturing industry and is used extensively in domestic and commercial premises as both a feedstock and an energy source. It also has the potential to be an interim form of baseload energy as the state transitions from brown coal to renewables.
While the committee did emphasise the importance of maintaining a cheap ongoing supply of gas to Victoria, it did not make recommendations on the importance of implementing policy instruments to put downward pressure on gas prices.

Manufacturing renaissance: United States
The importance of proceeding with onshore gas production in the medium term cannot be overemphasised. In the United States rising shale gas production had an enormous impact in terms of jobs, increased manufacturing competitiveness and boosting the economy.

This is because, as in Australia, gas is an important component in manufacturing and industrial processes. And with cheaper locally available gas supplies the chemical, plastics, aluminium, iron and steel, rubber, coated motor vehicle and glass industries have been revitalised.

The United States went from being an importer of energy, mainly from the Middle East, to now being a net exporter. Shale gas production is a major contributor to the turnaround in the US economy.

The Australian Petroleum Production & Exploration Association (APPEA) has reported that US shale gas production is expected to create some 1.5 million jobs and is expected to continue to drive US economic growth and is projected to contribute $332 billion to US gross domestic product (GDP) by 2035.

Conventional gas: Moratorium
The proposed inclusion of conventional gas in the present moratorium on onshore gas exploration appears to be driven by political expediency rather than good public policy outcomes. The committee received very little evidence supporting the moratorium on conventional gas exploration.

A conventional non-fracking onshore gas industry should not be caught up in the net of maintaining a moratorium for whatever period on unconventional gas. A conventional gas industry is a critical element for the future industry because it will allow us to ascertain the size of the resource and potentially will provide significant new gas onshore without fracking.

A recommendation to continue the current moratorium without stating that it does not include conventional gas would capture conventional gas by default. This means that the committee is bound to express a view on onshore conventional non-fracking gas exploration and extraction. As the committee has not expressed a view on this issue, this report will argue strongly to allow conventional non-fracking gas exploration and production to proceed.

This minority report will address the negative impacts on the Victorian economy of not proceeding with gas exploration and extraction onshore within appropriate safety and regulatory arrangements. In particular, allowing conventional non-fracking gas exploration and extraction alongside of a reservation policy is crucial to maintaining low prices and saving and increasing jobs in Victoria.

RISING GAS PRICES – EFFECTS ON JOBS AND THE ECONOMY
There are two reasons for the projected increase in gas prices. First, the increased costs of production as new gas developments are no longer underpinned by oil production. This is highlighted by Esso/BHP’s new Kipper/Turrum development requiring a gas price of approx. $5.50/Gj to break even. Offshore developments are much more expensive than onshore (up to
ten times the cost) and therefore it is increasingly less likely that gas produced from offshore can be supplied at the traditionally low prices that the state has enjoyed for the past 50 years.

Second, there is increasing pressure to utilise existing gas resources for export LNG and to bring the price of domestic gas into line with international prices. Gas suppliers now have strong incentives to ‘reserve’ gas for the export market at the expense of domestic users.

In its submission to the enquiry the AWU emphasised the negative effects of rising gas prices:

“The AWU in 2014 commissioned BIS Shrapnel to consider the economic impacts of rising gas prices on the economy in general and the manufacturing sector in particular. The main conclusions from the study are:

- Economy-wide net losses of between $26.6 billion to $110 billion of the value of output, and associated job losses of between 56,500 and 235,800, once you add the net indirect flow on effects
- Negative impacts on households with annual gas bills rising $260 (26 per cent) over the next four years
- Higher greenhouse gas emissions in Australia as there is a switch to coal fired electricity generation and away from domestic gas usage.”

This point was also emphasised in the Reith Report:

“Victorians should be under no illusions. Rising gas prices will have a negative impact on Victoria’s manufacturing base. Jobs and investment are at risk. Costs of living will rise and could rise for longer if not addressed.”

– Gas Market Taskforce Chair The Hon. Peter Reith AM, October 2013

In this context it is not appropriate simply to lock up the massive potential of onshore gas reserves and not even allow conventional exploration and extraction. While the volume of the resource is not known and will not be fully established until at least conventional gas exploration commences, estimates indicate that put the volume is very significant.

A recent study by the Department of Economic Development, Jobs, Transport and Resources, Oil and Gas, for example, estimated that “1.8 to 3.7 Tcf of gas remains undiscovered. In the Gippsland Basin, it is likely that 0.6 to 2.0 Tcf of gas remains undiscovered with up to 600 million barrels of liquids.”

Victoria cannot afford to leave this resource in the ground and not allow any exploration including conventional gas extraction to take place. We need to learn from the US experience and do it better but also recognise that we must maintain our competitive advantage in lower energy prices through onshore gas production as the United States has done.

A WAY FORWARD – CONVENTIONAL GAS AND A RESERVATION POLICY

It is clear from submissions to the committee that natural gas is the only energy source that can underpin Victoria’s economy while also serving as a transitional fuel to a low-carbon economy.

If a non-fracking onshore conventional gas industry is allowed to proceed and it finds considerable onshore gas that can be extracted using conventional means, there are potentially massive benefits for the Victorian economy. Proposals to build a petrochemical plant, gas-fired power station and fertiliser plant in the Otways alone have been floated if a long-term low gas price can be negotiated.

The need to maintain cheap guaranteed supplies is evident from recent comments by the largest single user of gas, Australian Paper, which employs some 1300 people directly, that an
increase of the gas price of the scale anticipated will render their business uncompetitive. Other significant local employers, such as Qenos plastics facility, Simplot and Dow Chemicals are approaching potential conventional onshore gas exploration companies to offer contracts to buy gas at affordable prices in order to maintain or expand their operations.

None of this will occur unless two things happen as a matter of urgency:

- First, that alternative sources of gas onshore are identified and exploited using conventional non-fracking means to increase competitive pressure and hold down prices.
- Second, that all new (and perhaps ultimately also existing) sources of gas include a reservation arrangement so that a certain percentage of the gas is tagged for the local market with long term pricing guarantees at or below current domestic prices.

In addressing the first of these issues this minority report specifically endorses conventional non-fracking onshore gas in Victoria on the strict condition that any production licence will exclude fracking and will be subject to reservation conditions.

**SUPPORT FOR CONVENTIONAL GAS**

In its report the committee differentiated between conventional and unconventional gas noting that onshore conventional gas involves those reservoirs where the gas is trapped under pressure and where the gas will flow easily without fracking when a well is drilled.

The committee also identified a number of potential risks from unconventional, fracking-related gas extraction including risks of contamination of ground water, depletion of groundwater, increased seismicity and pollution. Uncertainty over the technical and regulatory management of these risks has generated considerable community concern and this is a reason to continue with a moratorium pending further technical and regulatory enquiries.

The committee has included in its recommendations an approach that would ultimately lead to a safe unconventional gas industry. This is despite significant disagreements as to timing. However, the committee also heard much evidence in relation to a conventional gas industry onshore with the vast majority of those providing evidence at hearings or in submissions favouring the immediate commencement of onshore conventional non-fracking gas activities. One example is the Corangamite Shire.

**Corangamite Shire – formal submission to the inquiry**

Conventional onshore gas. We understand that there are potentially reserves of gas located onshore, particularly in the Port Campbell area. It is likely that these gas reserves can be extracted without fracking. We believe this gas should be treated in a similar manner to the offshore gas reserves. The moratorium that prohibits exploratory drilling for conventional onshore gas should, therefore, be lifted as a matter of urgency. If exploratory works prove that the gas resource is available, extraction of these reserves is supported subject to the usual environmental approvals being obtained and that no fracking be used in the extraction processes.

Unconventional gas. We do not support the moratorium on exploration activities, including drilling, for unconventional gas. It is difficult to make informed decisions on the viability or potential economic significance of unconventional gas unless we actually know if the resource exists and the nature of that resource. Any exploration activities should be subject to high levels of environmental control and landowner consultation and compensation.
Corangamite Shire – transcripts of evidence

“Corangamite understands there are potential reserves of gas located onshore, particularly in the Port Campbell area, and it is likely that these gas reserves can be extracted without fracking. We believe this gas should be treated in a similar manner to offshore gas reserves, and the moratorium that currently prohibits exploratory drilling should therefore be lifted. If exploratory works prove that gas resources are available, extraction of these reserves is supported by Corangamite subject to the usual environmental approvals” and “We support the moratorium on fracking, but we would like to see the moratorium on exploration lifted to understand what reserves are actually in existence within the shire.”

– Mr David Rae, Acting Chief Executive Officer, Corangamite Shire Council.

Mr David Davis (Chair): Thank you for those submissions. I want to come to the Corangamite submission. Chris, there are a few points that Simon has partially fleshed out. I just want to get absolutely clear in my mind: you support conventional gas extraction from a capped well?

Cr Chris O’Connor, Mayor, Corangamite Shire Council: “Yes.

“Our actual conventional gas industry is being threatened to a degree by the current moratorium. We would like to see it taken out. That is our main concern: to have it taken out and allow further exploration for conventional gas, as we have always done.

“Conventional gas just does not happen under water; it is onshore as well. As I said before, conventional gas is also much cheaper to extract, so conventional onshore gas is much cheaper to extract than offshore.”

Moyne Shire Council – transcript of evidence

“Recently, even though there is a moratorium on drilling, we have had drilling at Nirranda, because it is actually offshore gas but it is drilled from onshore. That work has been really well accepted by the community. It has caused no fuss at all in the community”

– Mr David Madden, Chief Executive Officer, Moyne Shire Council.

Protect the West Alliance – transcript of evidence

Mr John Coverdale, who appeared with the Protect the West Alliance, seemed to have no difficulty with conventional gas.

Mr John Coverdale: I am not opposed to conventional gas whereby you drill straight down, find pockets of gas and extract it. It has been around in Timboon for quite a number of years. It is offshore in the Otway Basin.

Mr Daniel Young MP: Just as a last question then, you would support lifting the moratorium for conventional gas?

Mr Coverdale: Lifting for conventional gas? I personally would, yes. But they would have to guarantee themselves that it was going to be conventional gas, and be watched.

The Australian Workers Union – formal submission

“The AWU does not buy the argument which says that unfettered access to gas to supply LNG exports will assist to lower domestic gas prices. Nor does the AWU believe that gas should be locked away for all time simply because it raises (albeit) major challenges regarding its sustainable and responsible extraction on-shore.

The Government could consider ‘fast-tracking’ approvals for proponents contributing to the reserve for ‘best-practice’ projects.
**The Australian Workers Union – media comments**

AWU Secretary Ben Davis is also quoted in *The Weekly Times* of 30 September 2015 as saying: “A ban on any exploration for onshore gas and extraction of conventional onshore gas would be to the detriment of all Victorian households and businesses. There’s no reason we can’t have exploration for onshore gas that doesn’t have to include fracking.”

**A RESERVATION POLICY**

The AWU in its submission and in subsequent comments by its secretary Ben Davis called for a reservation policy that would reserve some gas for domestic use at an affordable price. It is important to stress the concept of an affordable price.

In Western Australia, the reservation policy of 15 per cent for local consumption resulted in the most expensive gas in the country for local consumption as there was no requirement to keep prices down. We don’t want this in Victoria.

Instead we should look at policies under which companies would agree to set aside a portion of the gas deposit (e.g. 20 per cent) to be sold on the domestic market at below the prevailing local price. In return their licence applications to operate may be fast-tracked. Of course they must also meet all applicable requirements under the *Mineral Resources (Sustainable Development) Act 1990* and the *Petroleum Act 1998* and operate under additional conditions aimed at maximising local content and jobs, and cooperation with the local community.

Companies would be expected to engage with local landowners and communities as legitimate stakeholders in the development and ongoing stewardship of the industry and explain to stakeholders and the broader community the reservation and pricing obligations they have agreed to for the benefit of Victorians.

Based on the analysis above, this Minority Report proposes the following recommendations:

**RECOMMENDATION 1**

Enact a moratorium on unconventional, fracking-related gas production for three years – and, in line with agreed recommendations of the committee, including:

- detailed scientific research be commissioned by the government on all health and environmental risks associated with onshore unconventional gas production and how they can be contained
- a parallel process of implementing best practice in regulation, and
- economic modelling to identify potential impact in terms of jobs, manufacturing and the economy of onshore gas production.

**RECOMMENDATION 2**

Immediately discontinue the moratorium on conventional gas wells on the basis that any proposal to drill a conventional well will include a number of commitments by the applicants including:

- that gas production will use only conventional non-fracking means
- full consultation with local communities and landowners
- a percentage of the resource will be reserved for local businesses or consumers at a price below the prevailing local price, and
- a commitment to abide by all best practices under the various Acts and Regulations.

By

Harriet Shing MLC (Deputy Chair) and
Shaun Leane MLC

“The question is not have we got gas, but, at what price?”
Tony Wood, Grattan Institute

Introduction

This Minority Report has been drafted by reference to the evidence presented to the Victorian Parliamentary Inquiry Into Onshore Unconventional Gas in Victoria (Inquiry) and to the oral and written submissions made to the Inquiry by individuals, organisations and peak body representatives referred to in the Inquiry’s Interim and Final Reports.

Between us, we attended every metropolitan and regional hearing, and we have each read and assessed every submission to the Inquiry, including those submissions made by way of oral evidence (which occurred at the end of witness evidence in a number of hearings).

To the extent of any inconsistency, the Recommendation made in this Minority Report is intended to override any recommendation made in the Main Report.

Scope

As the Terms of Reference for the Inquiry specifically relate to the exploration, extraction, production and rehabilitation for onshore unconventional gas, this Minority Report does not express a view on conventional gas.

Victoria’s unique regional profile and productivity

Evidence to the Inquiry clearly distinguished Victoria’s agricultural profile from other parts of Australia where onshore unconventional gas industries have proceeded. In this regard, we note that significant investment has been made over a long period of time to develop and maintain domestic and international market share in a highly competitive environment and to enhance the
reputation and desirability of our meat and livestock, dairy and horticultural products.

**Community engagement, education and consultation**

Evidence to the Inquiry indicated a lack of sustained investment and engagement by industry in community consultation, engagement or education in communities that might be affected by the development of an unconventional gas industry in Victoria.

This is despite evidence to the Inquiry from industry of the potentially lucrative returns that onshore unconventional gas might generate in Victoria if it were to go ahead, and the long history of commercial interest in developing and growing such an industry.

**Social Licence**

The Inquiry was presented with overwhelming evidence that Victoria’s regional communities, particularly those in the Otway and Gippsland Basins, have refused to grant any substantive form of “social licence” that might enable onshore unconventional gas exploration or extraction to take place.

It is clear that community opposition to any (further) onshore unconventional industry growth or development in Victoria has grown exponentially over time.

In fact, the evidence indicated that the actual and/or perceived risks of an unconventional gas exploration or extraction are, for an overwhelming majority of communities in regional Victoria, too great to enable exploration or extraction of onshore unconventional gas in the terms proposed by industry.

In this regard, it seems to us that the absence of scientific consensus on appropriate risk identification and management, mitigation, reparation and “best practice” within the industry as it operates elsewhere, regulatory shortcomings, and a lack of engagement between industry and communities has placed this issue well beyond the point at which an onshore unconventional industry could operate with the blessing of regional Victorians whose land, water sources and communities would or might be directly affected.

**Co-existence**
The Inquiry received a large volume of submissions raising a range of concerns about the impact that an onshore unconventional gas industry would have on existing industries and markets, from primary production to regional tourism.

The majority of evidence provided to the Inquiry on this issue submitted that co-existence was not possible given the actual and perceived risks that any potential unconventional industry would present.

Uncertainty for communities and industry

It was clear from evidence to the Inquiry that there is a high level of community distress and anxiety at the prospect of an onshore unconventional gas industry in Victoria. It was also evident that the prospect of any future onshore unconventional gas industry for the state is an ongoing source of uncertainty and worry – for families, farmers, and business operators in regional Victoria.

This was clearly articulated in both written submissions and at the regional hearings and not only centred around the potential environmental damage such as risk to essential water supplies but also related to Victoria’s ability to retain the current reputation as a clean food producing jurisdiction which has been a pivotal element to food safety accreditations and to maintaining and building success in agricultural export markets.

A number of industry and local government witnesses also indicated a clear preference for the Inquiry to determine the question of a potential onshore unconventional gas industry in Victoria as conclusively as possible.

Extension of the Moratorium

It is our view that to extend the current moratorium for onshore unconventional gas would simply delay the making of a further decision about the potential for an onshore unconventional gas industry, and enable these existing uncertainties to continue.

Alternative energy sources

Although an onshore unconventional gas industry in Victoria might provide improved supply and pricing for gas to meet domestic and industry demand,
is our view that the risks (including perceived risks), costs (including as they relate to potentially diminished international market demand for Victoria’s prestige meat, dairy and horticultural products) and uncertainties outweigh the benefits that any industry might bring.

In this regard, it is our view there are other energy sources available to put downward pressure on prices. Specifically, the Andrews Government’s commitments to new energy technology as part of the Future Industries Fund and renewable energy targets are illustrative of the increased policy and community appetite for energy supply that minimises the environmental, health and social impacts on affected communities.

The Final Report contains a number of Recommendations that could possibly facilitate a framework for the development of an unconventional coal seam gas industry coexisting with Victoria’s vital agricultural and tourism industries, however we note that evidence was also provided to the Inquiry that questioned whether this could occur even if these recommendations were accepted and the resources and funding were invested.

As the Final Report and accompanying (unanimous) Recommendations indicate, there is a significant volume of further work required, at significant cost, before any onshore unconventional gas industry could potentially commence in Victoria. The funding and resourcing requirements associated with properly completing this work would be the responsibility of government, and thus taxpayers to meet.

Even after the completion of such work and for reasons such as those detailed in this Minority Report and the Interim and Final Reports, there is nonetheless a significant chance that an onshore unconventional gas industry could or would not go ahead in any event.

On this basis, it is our view that funding and resources that might otherwise be allocated to undertaking this further work are more appropriately directed to investment in the certain, predictable and long-term benefits of renewable energy initiatives, a number of which are already the subject of investments by the Andrews Government.
Conclusion and Recommendation

For these reasons, we recommend that the Government consider the following Recommendation in responding to the Interim and Final Reports.

That, in light of the Committee not receiving a body of indisputable evidence that convinced it that the current moratorium on an unconventional gas industry operating in Victoria should be lifted, and in recognition of the need to provide certainty on this issue within the terms of reference for this Inquiry, the Victorian Government introduce a permanent ban on the exploration and extraction of unconventional gas.

Signed:

Harriet Shing MLC
Deputy Chair
Member for Eastern Victoria Region

Shaun Leane MLC
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