

Parliamentary Submission

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Coal Seam Gas, Shale and Tight Gas Extraction Methods:

An Analysis of Policy, Pollutants and Protests

Abstract

Australia is undoubtedly one of the most resourceful countries in the world. With such abundant planes of land stretching from the Coral Sea to the Indian Ocean, there is much to be discovered of Australia's potential to be a global leader in the production of energy.

But does this title come with a potentially devastating impact upon Australia's wellbeing?

With global energy demand expected to rise some 39% leading into 2030¹ and China scrambling to purchase a large portion of the gas - yet - to be extracted from coal seams and shale rock in Australia, the number of gas wells becoming operational around the country is increasing at an alarming rate.

With this economic opportunity in the wind, it is hard to shy away from the benefit it will bring to Australia over the energy sector's revolutionary years of transformation.

However, the growing concerns of the public in pursuing this "cash cow" are the methods used in gas extraction. Specifically, fracturing has been the centre of media attention and the cause of many protests around the country since the mid 1990's.²

The submission will attempt to address the most prevalent and damaging problems encountered during the extraction process of unconventional gas (UG). This will include an analysis of the policy, legislative framework and regulatory systems in place to protect Australia's biodiversity, water reserves and quality of life throughout this adjustment period.

It will address stakeholder interests, including environmental activist groups, farmers associations (including private landowners), industry investors and government panels.

Conclusively, the submission supports the transition of the energy market into more sustainable sources of energy production. However, this is only if such resources are extracted responsibly, captured adequately, stored and transported safely and sold in favour of the Australian economy. For this industry to function efficiently, the legislative and regulatory framework needs to strike a balance between stakeholder interests, environmental protection and economic wellbeing.

¹ John Williams and Jamie Pittock, 'Unconventional Gas Production and Water Resources' (2012) *Australian National University* 6.

² Queensland Competition Authority, 'Coal Seam Gas Review' (Report, Queensland Competition Authority), January 2014) 15.

Introduction

A moratorium on new onshore CSG was established in 2012 by the Victorian government due to the infamous risks associated with exploration, extraction and production methods. Although the current legislative framework addresses issues such as extraction methods, the use of toxic chemicals, private land ownership and water regulation the government's ban on CSG suggests a lack of stringency in its applicability, regulation and enforcement.

In 2013, it was estimated that Australia had approximately 624 trillion cubic metres (tcm) of shale gas with 133 tcm of that 'technically recoverable'³. This statistic arguably displays the inefficiencies prominent in the industry. This may have come as a result of the rapid pace at which this industry evolved in its infancy. The effect of which is currently causing a traffic-jam of moratoriums in Australia leading to financial burdens, policy reform, environmental concerns and a very disgruntled community. With the raft of international data available to the Australian government, it is a wonder how the regime for this industry has encountered almost every angle of disruption in its commercialisation.

If this resource is as integral to developmental Australia as portrayed by government officials and industry specialists, by improving the quality of Research & Development in the field, we should be able to maximise returns, prevent environmental degradation whilst building and maintaining community confidence.

The protests currently underway in Australia are largely due to the infringements of private land ownership rights in conjunction with the unrestricted use of chemicals causing the contamination of water systems leading to many health concerns and the depletion of the Great Artesian Basin (GAB). It is imperative that the Victorian government considers and implements a strategic regulatory and legislative regime satisfying all of the above-mentioned restrictors so as to allow for the efficient progression of this industry. Importantly, to avoid repeating this problem in the future, the Victorian inquiry should seriously consider the gas reserves and anticipate the next source of energy moving toward a carbon reduced future and how such a transition from natural gas may occur in order to support the growing energy demand.

³ Advanced Resources International. Inc., *EIA/ARI World Shale Gas and Shale Oil Resource Assessment* (2013) U.S. Energy Information Administration
<http://www.eia.gov/analysis/studies/worldshalegas/pdf/chapters_i_iii.pdf?zscb=44648513>.

Extraction

Because this paper focuses primarily on CSG, it is important to note that only 20-40% of CSG wells require fracc(k)ing due to the permeability of the rock.⁴

Chemicals

The use of toxic chemicals in the industry has been a central concern for the Australian public for nearly two decades.⁵ This comes as a result of the companies' lack of transparency in disclosing their trade recipes for riches⁶. To contextualise the secrecy involved, Queensland's Mines Minister, Steven Robertson, when interviewed by 60 minutes in 2010, openly admitted to being uninformed when asked what chemicals are being used in fracturing techniques.⁷ Isn't this something that should be regulated? It should at least be known or available to the very person granting production and exploration licenses (PEL).

In 2014, the Victorian Government banned the use of BTEX chemicals⁸ in order to avert the risk of a health crisis and the consequent burdens it would impose on the system. Benzene is notoriously known as a carcinogenic compound that is found in cigarette smoke, aircraft and motor vehicle fuels⁹. Notably, chemical additives are not only a crucial ingredient in fracturing fluids, but merely make up between 0.33% - 1.2% of the total injection.¹⁰ However, this figure can be somewhat misleading as radioactive compounds in tiny percentages can be deadly.¹¹ Although an exaggeration, the live issue here is the lack of transparency gas companies have displayed in divulging their cocktail of additives.

⁴ Commonwealth Scientific and Industrial Research Organization, *What is hydraulic fracturing?* (2012) CSIRO <<http://www.csiro.au/en/Research/Energy/Hydraulic-fracturing/a-What-is-hydraulic-fracturing>>.

⁵ John Williams and Jamie Pittock, 'Unconventional Gas Production and Water Resources' (2012) *Australian National University* 6.

⁶ Legislative Council General Purpose Standing Committee, Parliament of New South Wales, *Inquiry into Coal Seam Gas* (2012) 67-69.

⁷ Liz Hayes: do you know what's put down into those wells? Stephen Robertson: yes. Liz Hayes: do you know what chemicals are used. Stephen Robertson: not totally, no. Liz Hayes: shouldn't you? Shouldn't you know what chemicals they hydraulically ram down those wells? Stephen Robertson: well, what I'm assured about is that the processes that they employ are appropriate processes for the extraction of that coal seam gas.

Liz Hayes, Interview with Stephen Robertson, Australian politician and Former Member of the Legislative Assembly of Queensland (Television Interview, 14 May 2010) <<http://sixtyminutes.ninemsn.com.au/article.aspx?id=1052462>>.

⁸ Jenni Henderson, *Victorian Government Bans Fracking Chemical* (22 September 2014) ABC <<http://www.abc.net.au/local/stories/2014/09/22/4092151.htm>>.

⁹ Department of Environment and Heritage Protection, *BTEX Chemicals* 30 May 2012 Queensland Government <<https://www.ehp.qld.gov.au/management/non-mining/btex-chemicals.html>>.

¹⁰ Australia Pacific LNG, *Fracking* <<http://www.aplng.com.au/home/fracking>>.

¹¹ United States Geological Survey, *Radioactive Elements in Coal and Fly Ash: Abundance, Forms, and Environmental Significance* (9 January 2013) USGS <<http://pubs.usgs.gov/fs/1997/fs163-97/FS-163-97.html>>.

Whilst some reports have alluded to a potential list of the chemicals used,¹² gas companies still qualify the list of chemicals published on their websites with “may be used”.¹³ Whilst it may be true that the chemicals used in fracturing techniques are found in household items, could this act as a distraction for the undisclosed additives not scrutinised by the National Industrial Chemical Notification Assessment Scheme (NICNAS)?¹⁴ Furthermore, there exists no information addressing the reaction of such chemicals when mixed together. Rather, each chemical is taken individually and dismissed as non-harmful in such low concentrations. As such, the legislation addressing the above-mentioned needs tighter regulation and enforcement schemes.

Environmental Regulation

Victoria, like other States and Territories is accountable for the regulation of onshore mineral and petroleum resources. The *Mineral Resources Sustainable Development Act* (MRSD),¹⁵ currently regulates CSG production, while shale and tight gas is governed by the *Petroleum Act* (PA).¹⁶

Federal Level

The *Environment Protection and Biodiversity Conservation Act* (EPBC),¹⁷ fails to adopt a high calibre of protection, whereby exploration projects are required to undertake Environmental Impact Assessments (EIA) only if it is a ‘matter of national environmental significance’¹⁸. Although the *EPBC* outlines the ‘matters of national environmental significance’¹⁹ and a guide as to which factors should be considered, the discretionary powers of assessment provided to the Minister are broad and would not apply unless the action is deemed a ‘controlled action’²⁰ this signifies a lack of stringent regulation. The Environmental Defender’s Office (EDO) took a similar view suggesting the current EIA’s undertaken are not credible²¹ since the assessment does not highlight the importance of potential environmental implications such as ecological sustainability.²² This is parallel to the decision of Pain J, whom stated that the Ministerial function must be balanced with the notions of intergenerational equity as well as the precautionary principle.²³

¹² Keith Adam, ‘Health Effects of Coal Seam Gas – Tara’ (Report, University of Queensland, 19 February 2013) <<http://www.health.qld.gov.au/publications/csg/documents/appx2.pdf>>.

¹³ Australia Pacific LNG, *Fracking* <<http://www.aplng.com.au/home/fracking>>.

¹⁴ Mariann Lloyd-Smith and Rye Senjen, ‘Hydraulic Fracturing in Coal Seam Gas Mining: The Risks to our Health, Communities, Environment and Climate’ (Report, National Toxics network, 2011) 2 <<http://ntn.org.au/wp/wp-content/uploads/2012/04/NTN-CSG-Report-Sep-2011.pdf>>.

¹⁵ *Mineral Resources Sustainable Development Act 1990* (Vic).

¹⁶ *Petroleum Act 1998* (Vic).

¹⁷ *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

¹⁸ *Ibid* ss 12–25.

¹⁹ *Ibid*

²⁰ *Ibid* s 65(A).

²¹ Environment Defenders Office, *Reforming Mining Law in Victoria* (24 April 2012) Environmental Justice Australia, 24 <https://envirojustice.org.au/downloads/files/EDO_Reforming-Mining-Law-in-Victoria.pdf>.

²² *Ibid*.

²³ *Gray v Minister for Planning* (2006) 152 LGERA 258, 278.

State Level

The *Environment Effects Act*²⁴ imposes a less rigorous obligation, whereby companies are required to devise an Environmental Effects Statement (EES) for works with significant environmental effects, subject to the Minister's request.²⁵ Victoria's assessment process invoked substantial criticism since the EEA provides wide discretionary

Ministerial powers without setting out a decision-making framework.²⁶ During the period of 2009 – 2010 only three mining developments drafted an EES²⁷ with 72 PEL's granted.²⁸

Seemingly, the extraction processes are remote from being eco-friendly, impacting on water conservation, native flora & fauna, livestock, flowing of drains and soils²⁹ and endangering native species.³⁰ There is a continuum of other effects flowing from the mining tenements attached to land.³¹

One of the most notable environmental impacts is the release of greenhouse gases (GHG) that leak during different stages of the mining process.³² GHG emissions of CSG were compared to that of coal burning and even though there is no record as to the exact amount of gas leakage during the process³³, it was reported that its methane global warming footprint would possibly be 21 times that of CO₂.³⁴

²⁴ *Environment Effects Act 1978* (Vic).

²⁵ Victorian Government Department of Sustainability and Environment Melbourne, 'Ministerial guidelines for assessment of environmental effects under the Environment Effects Act 1978' (Report, Department of Sustainability and Environment, June 2006) 11.

²⁶ Samitha Rao, 'Reforming the Environment Assessment Process in Victoria' (2010) 34 *National Environmental Law Review*.

²⁷ Victorian Government Department of Sustainability and Environment Melbourne, 'Ministerial guidelines for assessment of environmental effects under the Environment Effects Act 1978' (Report, Department of Sustainability and Environment, June 2006) 24.

²⁸ *Ibid.*

²⁹ Senate Rural Affairs and Transport References Committee, Parliament of Australia, *Management of the Murray Darling Basin* (2011) 70.

³⁰ Catriona Ross and Paige Darby, 'Unconventional Gas: Coal Seam Gas, Shale Gas and Tight Gas' (Research Paper No 2, Parliamentary Library, Parliament of Victoria, 2013).

³¹ Peter Cook, Vaughan Beck, David Brereton, Robert Clark, Brian Fisher, Sandra Kentish, John Toomey and John Williams, 'Engineering Energy: Unconventional Gas Production' (Report, Australian Council of Learned Academies, May 2013) 100
<<http://www.acola.org.au/PDF/SAF06FINAL/Final%20Report%20Engineering%20Energy%20June%202013.pdf>>.

³² Doctors for the Environment Australia Inc., Submission No 412 to Parliament of New South Wales, *Coal Seam Gas Inquiry*, 15 September 2011, 4.

³³ Mary O'Kane, 'Independent Review of Coal Seam Gas Activities in NSW' (Initial Report, Chief Scientist & Engineer, 30 July 2013) 91–97
<http://www.chiefscientist.nsw.gov.au/_data/assets/pdf_file/0016/31246/130730_1046_CSE-CSG-July-report.pdf>.

³⁴ *Ibid* 91.

Nonetheless, the NSW legislative Council contested such observations and stated that ‘at worst the greenhouse gas emissions produced from CSG would be equal to those produced by coal.’³⁵

A contrary view in support of exploration and extraction processes was held by Australian petroleum Production & Exploration Association (APPEA), noting that:

‘The Australian oil and gas industry has proved time and again that it can operate in sensitive environments and co-exist with other land uses’.³⁶

It stated that the industry is well regulated by stringent guidelines regarding water and environmental management in addition to access to land.³⁷ This was further supported by studies in New Zealand, UK and the US, concluding that the processes of fracc(k)ing are in fact not dangerous to water resources since chemicals tend to be diluted before use.³⁸

While the ban on BTEX in Victoria is ongoing, the Resources Legislation Amendment intends to further regulate the chemicals used in hydraulic fracturing.³⁹ The proposal includes the prohibition of BTEX by amending both the MRSD.⁴⁰ In addition, the Bill proposes a condition that restricts the use of ‘hydraulic fracturing substances’,⁴¹ regarding the PA.⁴² Despite the Bill indicating progress, this is not well reflected in practice due to a lack of monitoring.

US & UK Comparison

The United States’ UG industry shares similarities with the Australian industry. While federal regulations exist in regard to UG, the industry is primarily regulated by individual states. A 2005 amendment to the US *Energy Policy Act*⁴³ - also amending the *Safe Water Drinking Water Act*⁴⁴ - saw the deregulation of “underground injection of fluids or propping agents pursuant to hydraulic fracturing operations”.⁴⁵ This ultimately removed the Environmental Protection Authority’s (EPA) regulatory oversight regarding fracturing operations,⁴⁶ meaning US companies are not obligated to reveal any chemicals used in their fracturing fluids.

³⁵ Legislative Council General Purpose Standing Committee, Parliament of New South Wales, *Inquiry into Coal Seam Gas* (2012) 203.

³⁶ Australian Petroleum Production & Exploration Association, *Environmental Management* (2013) <<http://www.appea.com.au/oil-gas-explained/operation/environmental-management>>.

³⁷ *Ibid.*

³⁸ Catriona Ross and Paige Darby, ‘Unconventional Gas: Coal Seam Gas, Shale Gas and Tight Gas’ (Research Paper No 2, Parliamentary Library, Parliament of Victoria, 2013).

³⁹ Resources Legislation Amendment (BTEX Prohibition and Other Matters) Bill 2014 (Vic).

⁴⁰ *Petroleum Act 1998* (Vic).

⁴¹ Resources Legislation Amendment (BTEX Prohibition and Other Matters) Bill 2014 (Vic) cl 69.

⁴² *Petroleum Act 1998* (Vic).

⁴³ *Energy Policy Act of 2005*, Pub L No 109-58, 119 Stat 594 (2005).

⁴⁴ *Safe Water Drinking Act*, Pub L No 93-523, 88 Stat 1660 (1974).

⁴⁵ *Energy Policy Act of 2005*, Pub L No 109-58, § 322, 119 Stat 594, 694 (2005).

⁴⁶ Catriona Ross and Paige Darby, ‘Unconventional Gas: Coal Seam Gas, Shale Gas and Tight Gas’ (Research Paper No 2, Parliamentary Library, Parliament of Victoria, 2013) 50.

Conversely, the United Kingdom has rigorously regulated their UG industry.⁴⁷ In addition to requiring a licence under the PA,⁴⁸ developments that involve hydraulic fracturing will need to acquire environmental permits⁴⁹ and notify the Environment Agency (EA) of their plans regarding to the *Water Resources Act*.⁵⁰ Pursuant to this Act⁵¹ the EA has the authority to “require full disclosure of chemicals used in hydraulic fracturing in England and Wales”.⁵²

The approach undertaken by the United Kingdom is very much bespoke. This is evident by the fact that the EA assesses chemicals on a “case by case basis for each well”,⁵³ and additionally anticipates the requirement for unique environmental permits for projects involving fracturing.⁵⁴ Notably though, there is a very low number of wells in operation in the UK and thus more easily regulated.⁵⁵

1. Chemical Recommendation

If state governments are trying to build confidence in the community, the secrecy and ambiguity of chemical additives and its effects on environmental and human health, are causing anything but. As a first step towards building community confidence, the issue must be addressed with action rather than reports.

Inherently, any reports published by industry members or governmental bodies will be discarded, largely due to the existence of Government royalties. Accordingly, as a matter of national interest, it is high time for states to introduce legislation with ‘teeth’, to structure;

- A comprehensive and uniform set of guidelines addressing with *absolute* (emphasis added) clarity; and
- The chemicals that can be utilised; and
- The quantities; and
- Stringent reporting requirements detailing all acceptable and unacceptable combinations of chemicals used in hydraulic fracturing; and
- Strict governmental monitoring for gas well maintenance; and
- Safety authority akin to NOPSEMA for onshore gas wells; and

⁴⁷ Ibid 52.

⁴⁸ *Petroleum Act 1998* (UK).

⁴⁹ *Environmental Permitting Regulations (England and Wales) 2010* SI 2010/675.

⁵⁰ *Water Resources Act 1991* (UK).

⁵¹ Ibid.

⁵² Department of Energy & Climate Change, *About shale gas and hydraulic fracturing (fracking)*, (2013) <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/268017/About_shale_gas_and_hydraulic_fracturing_Dec_2013.pdf>.

⁵³ Department of Energy & Climate Change, *Fracking UK shale: Water* (2013) <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/277211/Water.pdf>.

⁵⁴ Environment Agency, *Guidance Note: Regulation of exploratory shale gas operations* (2012) <http://www.groundwateruk.org/downloads/EA_ShaleGasRegulation.pdf>

⁵⁵ Adam Vaughan, ‘UK’s shale gas revolution falls flat with just 11 new wells planned for 2015’ *The Guardian* (UK) 19 January 2015.

→ Strict penalties for non-compliance

Currently, the legislative regimes in place attempting to address such issues are a flagrant disregard for advancing community concerns.

If state governments are unable to converge and find uniformity in the regulatory framework governing what is a vital organ of Australia's development, the Commonwealth Parliament should take up the matter in a Federal regime.

Water

Another topic that has been surfacing in the production of UG is water conservation and contamination. CSG requires large amounts of water to be pumped out of aquifers to lower pressure and allow the gas to move into the well. The National Water Commission stated that the CSG industry would use more than 300 gegalitres of water each year.⁵⁶ This dewatering process is a major concern due to the salinity levels and toxic chemicals present in 'produced water'. Billions of litres of agricultural water supplies such as the GAB could be at risk of depletion if this 'produced water' is not dealt with in the correct manner.

Although there have been suggestions on recycling this water, none have been researched extensively or shown enough promise to implement indefinitely.⁵⁷

While depletion of ground water is a growing concern, if chemicals used in extraction methods are strictly regulated, both health and environmental risks could be averted.

While the EPBC⁵⁸ amendment was passed in June 2013, the desired effect of the amendment was to establish a Matter of National Environmental Significance (MNES) in relation to protection of water resources from CSG and large coal mining developments.⁵⁹ This entails an assessment and federal approval of CSG developments, when they are deemed to have a significant effect on water supplies. Furthermore, states are to consider advice provided by the Independent Expert Science Committee (IESC), but are in no way obliged to accept or implement the committee's suggestions.⁶⁰

2. Water Recommendation

Despite the IESC's lack of authority, the amendment indicates a progressive and unified approach by state and federal governments. Water conservation is a fundamental part of Australia's future prosperity – devising ways in which to recycle the water extracted by or used in CSG production should be an *absolute* (emphasis added) priority in continuing to pursue this "gold mine".

⁵⁶ Coal Seam Gas News, CSG (2012) <<http://coalseamgasnews.org/opinion/>>.

⁵⁷ The Conversation, *Can Water from coal seam gas be re-injected into the ground* (2015) <<http://theconversation.com/can-water-from-coal-seam-gas-be-re-injected-into-the-ground-39647>>.

⁵⁸ *Environment Protection Biodiversity and Conservation Act 1999* (Cth).

⁵⁹ Explanatory Notes, Environment Protection and Biodiversity Conservation Amendment Bill 2013 (Cth) 1–1, 1.

⁶⁰ Commonwealth Department of Parliamentary Services, *Bills Digest*, No 9 of 2014–15, 3 July 2014, 16.

- Developing safe aquifer re-injection techniques; and
- Consider geological and hydrological information in locating suitable mining sites that do not compromise water reserves, landscapes or agricultural land; and
- Stringent chemical restrictions; and
- Cost and resource effective reverse osmosis and water purification; and
- Developing hydro and osmotic energy sources

Social Licencing

The Social Licence to Operate (SLO) has been engrained in the Resources and Energy vernacular for centuries. The idea of SLO's and its attached stigma of 'poor industry performance'⁶¹ suggests that economic stability is not the sole determinant in granting PEL.⁶²

Landownership & Compensation

A major concern prevalent in the domain of social acceptance is that of private landownership. The issuance of PEL's directly affects private landowners' proprietary rights fundamentally derived through historical doctrines of common law.

Compensation, in regard to coal seam gas, is regulated by the MRSD,⁶³ while shale and tight gas is regulated by the PA.⁶⁴ This framework sets out certain threshold requirements that must be met before accessing private land.⁶⁵

Before engaging in any production or exploration activity on private land, the operator *must* (emphasis added) acquire the consent of occupiers/owners of the land.⁶⁶ However, this idea of consent is far from reality in practice. If landowners do not agree to a compensation agreement, the matter is determined in the Victorian Civil and Administrative Tribunal (VCAT),⁶⁷ where VCAT realistically has next to no discretion in revoking entry.⁶⁸

Additionally the PA does not specify the maximum amount of compensation that VCAT may order,⁶⁹ while the MRSD restricts the amount to \$10,000.⁷⁰

⁶¹ John R. Owen and Deanna Kemp, *Social licence and mining: A critical perspective* Resources Policy (30 April 2012) Insitu Development Consulting <http://www.in-dev.org/docs/Owen_Kemp-Social-Licence-2012.pdf>.

⁶² Peter Cook, Vaughan Beck, David Brereton, Robert Clark, Brian Fisher, Sandra Kentish, John Toomey and John Williams, 'Engineering Energy: Unconventional Gas Production' (Report, Australian Council of Learned Academies, May 2013) <<http://www.acola.org.au/PDF/SAF06FINAL/Final%20Report%20Engineering%20Energy%20June%202013.pdf>>.

⁶³ *Mineral Resources Sustainable Development Act 1990* (Vic).

⁶⁴ *Petroleum Act 1998* (Vic).

⁶⁵ *Mineral Resources Sustainable Development Act 1990* (Vic) s 43.

⁶⁶ *Ibid* s 43(1)(e); *Petroleum Act 1998* (Vic) s 128(1)(a).

⁶⁷ *Petroleum Act 1998* (Vic) s 128(1)(a).

⁶⁸ Environment Defenders Office, *Reforming Mining Law in Victoria* (24 April 2012) Environmental Justice Australia 13 <https://envirojustice.org.au/downloads/files/EDO_Reforming-Mining-Law-in-Victoria.pdf>.

⁶⁹ *Petroleum Act 1998* (Vic).

⁷⁰ *Mineral Resources Sustainable Development Act 1990* (Vic) s 89(3).

There are growing concerns that compensation paid out will not be sufficient to rectify damage to the environment such as loss of water and/or contamination.⁷¹ If Victoria's industry reflects the trends evident in Queensland, recipients on average should receive \$2,500 per well.⁷² Nevertheless recipients of conduct and compensation agreements have received as little as \$250 per well, despite these wells generating monumental profits.⁷³

3. Landownership & Compensation Recommendation

The establishment of mining projects causes significant intrusion on private land use⁷⁴ consequently affecting food security.⁷⁵ Australia must observe the principle of intergenerational equity and ensure that food security and land fertility is not compromised by an underdeveloped economic manoeuvre.

- Balance the rights of private land-owners with those of the crown by observing common law doctrines; and
- PEL conditions include stringent reporting to government officials and private land-owners; and
- Improved government confidence in termination of PEL's; and
- Improved compensation schemes where state governments are liable to pay a percentage of compensation - thus stopping frivolous granting of PEL's and implementing a thorough assessment before grants; and
- EIA's not acting as mere managerial hurdles

Health and safety

Another concern is the safety and health of communities who reside within the vicinity of exploration and extraction projects.

Attention should be paid to the effects of CSG on the safety of farmers and their property sub-surface techniques -especially hydraulic fracturing - run the risk of seismic activity.⁷⁶

Additionally, reports have been made indicating numerous impacts on public health caused by UG extraction⁷⁷. Clean drinking water is fundamental to human health, and the significant volumes of water

⁷¹ Catriona Ross and Paige Darby, 'Unconventional Gas: Coal Seam Gas, Shale Gas and Tight Gas' (Research Paper No 2, Parliamentary Library, Parliament of Victoria, 2013).

⁷² Brian Bahnisch 'CSG and the land: straight from the farmers' mouths', *Crikey* (9 March 2012) <<http://www.crikey.com.au/2012/03/09/csg-and-the-land-straight-from-the-farmers-mouths/>>

⁷³ Matthew Carney, 'The Gas Rush' (21 February 2011) ABC <<http://www.abc.net.au/4corners/content/2011/s3141787.htm>>.

⁷⁴ D. Kerr, 'Australia's Unconventional Energy Options' (Report, Committee for the Economic Development of Australia, September 2012) 47 <<http://www.ceda.com.au/media/263565/cedaunconventionalenergyfinal.pdf>>.

⁷⁵ Catriona Ross and Paige Darby, 'Unconventional Gas: Coal Seam Gas, Shale Gas and Tight Gas' (Research Paper No 2, Parliamentary Library, Parliament of Victoria, 2013).

⁷⁶ Executive Committee of Stop Coal Seam Gas Illawarra, Submission No. 552 to Legislative Council General Purpose Standing Committee No. 5, Parliament of New South Wales, *Inquiry into Coal Seam Gas*, 7 September 2011, 44.

used in the extraction processes deplete and contaminate water levels such as the GAB and thus compete 'with human and agricultural needs'.⁷⁸

Further to this, health concerns caused by the release of volatile organic compounds (VOC) have been reported to have long-term harmful effects on human health. The senior advisor of National Toxics Network found that farmers exhibited 'respiratory problems and burning eyes' whom have been exposed to coal seam gas extractions.⁷⁹ It was established that the effect of

'the chemicals used for hydraulic fracturing as well as toxic substances produced through this process ... produce[d] short-term health effects and ... systemic illness and/or cancer many years later'.⁸⁰ The aforementioned impacts tend to develop 'poorer mental health, with increases in depression and anxiety'.⁸¹

NSW Chief Scientist & Engineer further noted that although methane does not affect the health of humans 'at low or normal environmental concentrations ... at mixtures between 5% (Lower Explosive Limit) and 15% (Upper Explosive Limit) in air, it is explosive and can pose a safety risk to people within the high concentration area.'⁸² Should the concentration of methane increase within the air, oxygen levels are depleted and therefore individuals are at risk of asphyxiation.⁸³

4. Health Recommendations

The health and safety of the Australian public (including industry employees) should be of fundamental concern. Human life depends on its environment and accordingly both need to be carefully looked after when undertaking risk prone energy production such as this.

- Regular monitoring of VOC's present in the air; and
- Regular water testing around UG sites; and
- Reports independent from industry and government on health concerns; and
- Total ban on the use of chemicals likely to harm human health

⁷⁷ Doctors for the Environment Australia Inc., Submission No 412 to Parliament of New South Wales, *Coal Seam Gas Inquiry*, 15 September 2011, 3.

⁷⁸ Ibid.

⁷⁹ Mariann Lloyd-Smith and Rye Senjen, 'Hydraulic Fracturing in Coal Seam Gas Mining: The Risks to our Health, Communities, Environment and Climate (Report, National Toxics network, 2011) 11 < <http://ntn.org.au/wp/wp-content/uploads/2012/04/NTN-CSG-Report-Sep-2011.pdf> >.

⁸⁰ Ibid.

⁸¹ Ibid.

⁸² Mary O'Kane, 'Independent Review of Coal Seam Gas Activities in NSW' (Initial Report, Chief Scientist & Engineer, 30 July 2013) 91.

⁸³ Ibid.

5. Overall Recommendation

In light of the above evidence and careful analysis, it is without speculation we conclude that the UG industry is far from being developed enough to become a puzzle piece fitting into the complex sets of organisms making up society today.

For this to occur, it is evident that governments (state and federal) must pay more attention to community concerns in what we call democracy.

While the CSG industry could create thousands of jobs and greatly contribute to the economy encouraging both domestic and international investment, it is clear that a balance must be struck between economic well being and environmental/human degradation, for the sake of present and future generations.

All the evidence points to a dollar dash before an anticipated energy revolution. With this in mind, it becomes clear that the overall response to this growing concern could be solved with a shift in focus from financial prosperity to true prosperity. The implementation of sound procedures for gas extraction, a focused and stringent legislative framework accounting for the environment as a primary and finite resource through scientific investment and a 'hard-line' approach in dealing with careless corporations is the cure for this crisis. We urge responsible governments to take their duty under the Constitution seriously and legislate for the peace, order and good governance of the Australian public, as this is clearly a matter of National Interest.