From: Daniel Leather
To: fracking inquiry
Subject: Fracking Submission: Daniel Leather, attached a copy of my Unconventional Gas Perception study
Date: Tuesday, 14 March 2017 3:04:16 PM
Attachments: D Leather unconventional Gas Perception article.docx

To the Chairperson & Panel Members

In 2013, For the purpose of my own Oil & Gas MBA studies, a project was completed presenting results gathered from a '*perception survey'* conducted in 2013. Investigating the interconnectivity of the pro and anti UGC stakeholders by raising a series of questions, gauging a wide sample to clearly quantify levels and aspects of concern. Identifying key hurdles affecting confidence, obstructing industry acceptance and what influences the populaces current perception.

I've attached my study, though not sure if it will have any relevance at this particular point of time. I haven't as yet published my findings of this particular study as attached.

Data was been analysed by use of quantitative techniques. Showing that the industry, regulators and governments suffer a '*negative perception'*, from those particularly in NSW who '*believe*' that they are correctly informed, contrasting with data indicating some of these '*perceptions*' are actually '*far from empirical fact'*.

My project shows a wide range of perception of the industry; particularly '*less negative*' in areas of established activities, but points to the wider public being uninformed of what is '*factual*'. Identifying those pro and anti '*protagonist*' messages are also recognized as being '*unreliable*', creating confusion due to the emotive nature of mixed messages emanating from competing interest groups.

Suggesting if the industry desires instead to be '*perceived as a positive'* contributor to Australian society and its future prosperity, it needs to acknowledge risk factors and concerns as raised by industry protagonists, though could benefit by letting parties whom are '*recognized as impartial'* deliver those '*facts*'. Serving to decrease UGI resistance, scrutiny, costs and increase participants reputations as the industry attempts to achieve and maintain social acceptance.

For the purpose of explaining my expertise in the subject matter, to date I have already had two peer reviewed and published industry related articles, (As lead author, can provide copies upon request)

Maintaining Momentum in Northern Australia's LNG Projects faces Formidable CSR Challenges

OGEL 3 (2012), *in* OGEL Ten Years Special Issue: Internationalization of Energy Law

http://www.ogel.org/article.asp?key=3275

A review of Australia's natural gas resources and their exploitation

Journal of Natural Gas Science and Engineering Volume 10, January 2013, Pages 68-88

http://www.sciencedirect.com/science/article/pii/S1875510012001011

Kind Regards

Daniel Leather

[redacted]

[redacted]

The Future of Unconventional Gases: Australia in focus, the challenges of public perception verses reality, as the industry attempts to achieve and maintain acceptance.

This Business Transformation Project is submitted as partial fulfilment for the award of

Masters of Business Administration in Oil and Gas by:

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Student No: M00384143

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Abstract

Natural gas versatility and its current state as the cleanest fossil fuel make it a strong contender for balancing the global energy mixes. There is an adversarial and growing community resentment in Australia, particularly from the eastern coast populous on the matter of CSG. The likelihood that the CSG debate, identified as a '*fracking argument*' could spillover, further impinging on future Australian UGI activities is a great possibility.

For the purpose of my own Oil & Gas MBA studies, a project was completed presenting results gathered from a '*perception survey'* conducted in 2013. Investigating the interconnectivity of the pro and anti UGC stakeholders by raising a series of questions, gauging a wide sample to clearly quantify levels and aspects of concern. Identifying key hurdles affecting confidence, obstructing industry acceptance and what influences the populaces current perception.

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Key Words: Coal Seam Gas, CSG, Australia, shale gas, tight gas, perception, NSW, New South Wales, Unconventional Gas Resources, Energy supply, Hydraulic fracturing, fracking, LNG, fracking argument.

Abbreviations

APPEA	Australian Petroleum Production & Exploration Association
BTEX	Benzene, toluene, ethyl benzene and xylene
BTP	Business Transformation Project
CAPEX	Capital Expenditure
COAG	Council of Australian Governments
CMM	Coal Mine Methane
CSG	Coal Seam Gas (Alternatively, Coal Bed Methane, CBM)
CSR	Corporate Social Responsibility
E&P	Explorations and Production
FPIC	Free Prior & Informed Consent
GAB	Great Artesian Basin
GHG	Green House Gases
GTL	Gas To Liquids
IOC	Independent Oil Companies
LNG	Liquefied Natural Gas
NOC	National Oil Companies
NGO	Non Government Organisation
NSW	New South Wales
NT	Northern Territory
O&G	Oil and Gas
OPEX	Operational Expenditure
QLD	Queensland
UCG	Unconventional Gas
UGI	Unconventional Gas Industry
US	United States of America
WA	Western Australia

For clarity, the project will use the Australian term of Coal Seam Gas (CSG) instead of the American term of Coalbed Methane (CBM) though in effect they are one and the same.

CHAPTER 1: INTRODUCTION

1.1 Background to the Study

Emotive issues such as children's vaccinations and nuclear power are a part of everyday life and as such people get to a point where they form a '*view*', '*belief*' or '*perception*' of what is going on, so their perception then drives reality.

Most people, though not all would be aware of *"fracking"* mixed with technologies of *"horizontal drilling"* due to the commentary from the world's media.

The project, utilising primary data obtained from survey analysis, assisting to identifying what some people '*know*', and what they '*perceive'* to be a *'truth*' and how they have come to now accept it as '*fact*'. The project was't aimed for the focused benefit of any specifically industry participant. Rathe serving a segment of the wider O&G industry which is presently evolving, facing challenges of '*perception*', causing it difficulties towards gaining public confidence. Does this perception matter? Perception, which is also creating influences upon government, who in turn have imposed, rushed measures of regulatory intervention particularly affecting NSW CSG, though may in turn affect other regions endowed with onshore UCG resources.

Findings reveal that many individuals are confused by UGI activities and do not know where to look for '*factually reliable'* information. Confusing differing aspects of the industry with each other or professing views that, from my perspective as an engineer, are highly improbable or plainly not possible by the realms of physics.

Having no association, nor first hand experience with the onshore O&G industry and have never been to a region of active UCG activities. Only since embarking on the Middlesex O&G MBA program, had I started to pay attention and become more aware of the debate primarily on the East Coast of Australia through mainstream sources of media, recognizing that it is increasingly becoming an aspect of every day discussion around the country.

1.2 Statement of the problem

On an international level, the recent confirmation that UK shale reserves are most likely larger than initially anticipated (BBC, 2013) prompted Mayor Boris Johnson to say he is willing to offer up the streets of London to companies hoping to solve Britain's energy crisis by drilling for shale gas (The Times, 2013). Indicating the UK UGI debate and community awareness is still embryonic, though the battle lines have indeed been drawn (Kavanagh, 2013). Other countries, or their regional governments, have enforced moratoriums or banned activities altogether, due to the uncertainties of potential affects of the associated technologies upon the environment and landscape (FOE Scotland, 2013). Countries such as Russia, who perceive UGC resources as a threat, due to competition upon gas exports, having a vested interest in undermining such activities, may now in fact also have to embrace them (AFP, 2013). Conversely UCG sources, particularly shale O&G, are transforming the US manufacturing economy and creating a situation of potential North American energy independence. It is apparent globally, where there are UCG resources, protestation, politics and debate will follow.

My project concentrates on aspects of gas reserves that are being developed in every Australian state, with estimates projecting up to 40,000 wells in QLD alone by 2030. A large industry, drawing in many billions of dollars, creating many jobs and swelling government coffers. In some regions public engagement is high, and it is further heightened by the contentious nature of the proposed resource extraction techniques (Lloyd *et al*,. 2013).

All the while, every Australian level of government is being viewed as guilty of '*knee jerk*' reactions. Driven by '*negative perception*' and public discontent as delivered and driven by activist NGO groups, who are vocal on the subject of UCG. Noting that many of these groups carry no legislative or representative authority and do not represent all stakeholders of the argument, leading to accusations stating that Australia is suffering from a perception of *"increasing sovereign risk"* (Tasker, 2012).

A situation that has influenced recent pronouncements by the NSW Energy Minister, stating

> *"It is up to the CSG Industry to earn the support of local communities for its operations"* (McDonald-Smith, 2013).

Which would then lead an '*uninformed spectator to perceive'* that UGC companies may indeed be at fault. Subsequent announcements, spurning regulatory certainty with companies having been granted authorisation to proceed with planned exploration-drilling campaigns (APP, 2013), means participants having to abandoned their NSW leases in some instances, post commencement of approved exploration drilling programmes. Sending mixed messages to stock markets, increasing risk exposure and in many cases large losses to shareholders (Stephens, 2013).

Believing that such confusion is leading people towards making uninformed assumptions - which can work to influence and assist the agendas of differing groups - whereby an '*untruthful*' message conveyed to the public is accepted as fact or '*perception*', having a wider implication. This affects the judgment of members of our society. As a democracy we have the right to be informed and know the facts, not a perception of someone else's truth.

The debate as recognised by this project covers a wide range of issues. From a '*positive perspective,'* it is seen as an opportunity to create wealth and obtain energy security. The '*negative perspective'* is that UGI participants are struggling in their efforts towards gaining and therefore maintaining social licence. This is due to front line social and environmental issues, influenced by groups who are vociferously opposed to UCG activities, a message which is gaining global momentum. An argument, which is exemplified in the manner of the bitter observation the first Sherlock Holmes novel: A Study in Scarlet,

> '*What you do in the world is a matter of no consequence. The question is what you can make people believe you have done*.' (Harris, 2013)

1.3 Objectives of the study

The main aim of the study was to compare the survey participants '*reality*' against '*perception*' of Australian UCG activities. This study is a measure of the disconnect between the negative or positive prospects for the industries ability to achieve and maintain "*Social License*" within the wider community.

Presently companies publicise their internal process as evidence of 'r*esponsibility*', widely perceived as '*propaganda while expecting praise*'. Is this so? To determine if benefits might very well be found if details remain behind closed doors, we need to measure whether participants in this case care for results alone, or the process, which is quantified against measured outcomes.

Reed (2008) argues that stakeholder participation must be underpinned by a philosophy that enables empowerment: equity, trust and learning to take place.

> '*To empower individuals and groups in the community, so that they can make informed choices, towards steering the governmental decision making process, the community has to be bought to science, and vice versa'* (Greenwood & Levin, 1998).

To determining the sample participants' trust and knowledge we must first gauges levels of sentiments of:

- Development, commercialization of any resource in general
- The O&G industry in general
- The unconventional gas industry
- Federal governments ability to regulate, control and influence
- State and territory governments ability to regulate, control and influence
- Government scientific authorities, ability to pass impartial advice
- Government scientific authorities, confidence of the wider community
- Regulatory, red & green tape and its duplication by the levels of government.
- Industry Associations. I.e. APPEA
- Farmers, Land-users & Landholder Associations, water dependent industries
- Community Groups against UCG activities, Lockthegate.com, etc.
- Of alternatives energy sources, being either renewable or fossil fuels

From the sample, determining if there are sample families who share common views and aspects of concern for identifying and then studying the impacts of

community engagement and communication, successes and failures. As Spears (2011) argues with '*social identity theory'*, individuals define themselves largely according to their group involvement and memberships. It is to be noted: "*you don't have to manage all your stakeholders equally, some people who think they are stakeholders might not be*." Browne & Nuttal (2013).

In social identity theory, sociologists explain levels of social analysis along an interpersonal to intergroup continuum, creating an important bridge between a concept of self, group membership and intergroup behavior (Spears, 2011), so we need to identify: Participants awareness of the industry, how and from where they have learnt about the industry and membership to the different stakeholder groups

Upon discovering the samples sentiments and identified sample families, the project measures the sample '*perception* or '*believe of a truth'* by the choice of subjective answers, thereby identifying '*associations*,' samples levels of '*understanding*' and if chosen answers are in fact close to a '*reality*' of the likely physical situation.

For the comparison, I then identify what is the most clear and concise scientific viewpoint, for this project in terms of '*reality*', in contrast to a quantified measure of '*perceived views'* by means investigating in a broad and holistic manner the interconnectivity of the stakeholders. Determining if there is any possibility for successful extraction of the UCG resources, taking into consideration all aspects of the debate in an inclusive manner, the companies need to develop methods of addressing concerns raised by dissenting voices without attempting or being seen to be ignoring inconvenient facts. There is a great deal of backlash here in Australia, with no industry nor protagonist confidence with present governmental structures as identified by this project.

1.4 Usefulness of the study

The primary concern of this particular project is with the perception of aspects of the Australian narrative, burgeoning and in its infancy compared to the USA UGI. It has been noted that aspects of the Australian UGI argument have been purposely adapted and in all likelihood misrepresented from the US narrative.

The study measures the possible disconnect from a sample population perception and points out gaps as to what is considered empirical knowledge.

Serving as gauge for who could be '*for*' or '*against*' the UGI activity, by identifying whether the '*negative*' or '*positive*' impinge on the opportunity for initiating a dialogue at a regional and national level. Developing a narrative for UCG, which goes beyond the economic contribution or energy security, towards how UGC might be utilised is essential to address other societal priorities as identified by Cook *et al*,. (2013). These priorities such as enhancing productivity of agricultural regions, enhancing manufacturing and resource extraction industries, enabling the development of remote regions of Australia while facilitating a transition to a low carbon economy.

Identifying '*what*' in this instance, serves to assist to overcome the levels of backlash within the Australian narrative, which might otherwise grow if industry and protagonist confidence cannot be gained. Identifying measures which might assist with gaining and then retaining '*social license to operate*', given that recent events have highlighted that the debate is not simply a '*local issue*' but one encompassing views of stakeholders across, local, regional, national and global levels, need to be taken into account.

Determining whether experiences with other resource projects elsewhere, which historically indicate that a '*one size fits all'* approach is feasible, or alternatively if different strategies need to be enacted for different groups and different concerns needs to be considered. All of which will require different levels of respectful engagement, communicating and collaborating in a transparent manner for effective engagement (Cook *et al*,. 2013) As the success of implementation, could serve to be cheaper than misunderstanding social issues as described by Browne & Nuttal (2013).

CHAPTER 2: LITERATURE REVIEW

2.1 The Unconventional Gas Industry

O&G industry participants in Australia have utilised historical data learning's from other regional operations where it is specifically applicable to aspects of subterranean areas which geoscientists have determined are likely to contain hydrocarbon reserves, a standard practice of O&G E&P in the global sphere of activities.

It is clear to state that UGI activities are already well underway in Australia, with many examples of early success in frontiers where there has been little

conventional gas activity. Additionally there has been a relatively small-recorded measure of adverse industry incidents, taking into account the levels of activities thus far. The argument is now well past the point of whether or not there will be an UGI in Australia. As much as some protagonists would like to see an end to it, but more of what form the industry should take. A full examination of the potential future size, the benefits, which might accompany the development and adverse impacts, which might arise, and how they might be balanced, mitigated or fully prevented (Cook *et al.,* 2013).

It was evident when I initially looked into the outline of my project, that it would not have been sufficient to look at CSG on its own. The waters of the debate have been stirred as the outlines of perception in Australia are already blurred by multiple aspects, which are both aiding as well as possibly negating facts as being presented by antagonists of either side of the debate. Many of the specialist studies into aspects of the subject are in fact limited by their specific scope being CSG, Shale or Tight gas, rather than combining aspects of all three unconventional types. It was obvious from the point of the Australian perspective for this project that all aspects of the industry would have to be looked at in their entirety to decipher if in reality there is overlap of key differences.

Due to air quality concerns, particularly in China, Australia is well positioned to increase its gas exports by supplying LNG to help fuel Asian economic growth. This will also assist in clearing the skies, rapidly expanding cities and assisting in their over all reduction of CO2 output. Coal has become a constraint on Australia's own efforts and stated goals of curbing CO2 emissions. LNG is playing a key role in de-leveraging Asian energy from a strong reliance on coal. Australia is presently ranked fourth amongst the world's LNG exporters. However, based on projects currently under construction both UGC and conventional sources, Australia is destined to become the second largest LNG exporter worldwide by 2015. Australia could rival Qatar for the position of the World's largest LNG exporter by 2018, but that depends if all of its planned projects are constructed and on evolution of the LNG market's in Asia (Leather *et al*,. 2013).

Bugala (2012) has identified that companies are increasingly adopting relationships with local communities according to a Free Prior & Informed

Consent (FPIC) process; though for effective implementation there must be a measure of skepticism when evaluating E&P portfolios. Otherwise it is difficult for company management to provide investors with accurate guidance on timelines, etc. When there is the possibility that a category of stakeholder, who has previously brought large projects to a halt, it needs to be considered whether they should be excluded from decisions that affect them or not. Investors can't be assured that conflict and the resultant delays which proved to be difficult to secure in the recent past, won't affect a new or expanded operation in a country or region where social licence to operate. The process is only achievable by implementation of established policies and procedures, materiality of which needs to be reflected in a transparent way. Disclosure of which is necessary to enable investors to substantiate strong long-term assumptions. The alternative is difficulty of attracting long-term investors

The spectacular increase in North American natural gas reserves by the development of shale gas makes its encroachment into the Asian market disruptive, as it threatens profitability and continued development of other existing fossil fuel sources (King, 2012) including Australia's existing and large coal export's and growing LNG exports. This same disruptive force is also creating an over all negating effect on more expensive renewable energy sources.

The arrival of the "*disruptive source*" in the Australian landscape, as described above, inevitably draws resistance on both monetary and political levels, to attack the disruptive source or its methods of enabling, such as '*hydraulic fracturing'* (King, 2012). Would this debate still be prevalent if the regions of development only contained conventional gas rather than unconventional sources?

The majority of international technical literatures concerning the UGI are extensive, clearly addressing most aspects of fracturing, horizontal well development and product water (waste water) disposal. All of which are central to key arguments being pointed to by protagonists of both sides of the debate. It is clear, through out all of the literature, that problem areas have been purposely identified, with out seeking to '*vilify or glorify'* (King, 2012). Instead, assisting practitioners and the wider public to understand the risks that can be taken to mitigate such risks, or if necessary highlight risks which may prove to

be insurmountable. This should, if the correct risk minimisation systems are in place, would then alert any industry participant or regulating authority.

The EPA (2010) 'Coalbed Methane Extraction: Detailed study report' is a key document of the experiences of the 15 US CSG basins, some of which have been producing since the early 1980's. The report by the EPA Office of Water mainly discusses the potential environmental impacts of CSG product water. At the time of the report approximately 45 percent of all product water was discharged into onshore waterways of the US, with concerns of various pollutants such as sodium, calcium, and magnesium. Increasing the levels of total suspended solids as well as prevalence of selenium and chromium.

The effects of surface discharge, which increases stream volume, also raised additional concerns, which could potentially exacerbate streambed erosion, adding suspend sediment and increase salinity, which is also alluded to by Williams *et al*, (2012) upon the Australian narrative. Surface impoundment and land application of product water has also impacted upon groundwater infiltration and the concentration and/or bioaccumulation of CSG associated pollutants. The EPA (2010) report also identified that headway has been made with advanced treatment options for removing and stabilising product water, with measures for dealing with solids by-product waste, which has also been the case in Australia. Depending on the well location, zero discharge options could be viable as could the beneficial use of treated product water for land application, irrigation, livestock and wildlife watering as well as industrial uses which would be site specific according to water rights, permitting legislation and associated cost for end user. The down turn of the US economy prior to the report of 2010, with the influx of Shale gas into the market had negatively affected the US CSG industry. It has been noted that US CSG projects often begin with high operating costs, tending to diminish over time, which is contrary to the operating costs for conventional O&G wells (EPA, 2010).

A key point as identified by an EPA (2010) report was the limitation of overall studies within the North American CSG basins due to a lack of baseline findings prior to UGI development and subsequent discharge of product water. Noting that it has been difficult to measure the degrees of aquatic impacts without baseline measurements, especially given the seasonal variability of rainfall and consequent waterways flow fluctuations mixed with the natural occurrence of

many contaminants of concern of product water (e.g., Chlorides and sodium).

It is clear that much of the concern and subsequent furore over fracturing and frack waste disposal was largely driven by a lack of chemical disclosure and the pre-2008 laws of some US mainland states. All activities, no matter what the industry, have levels of associated risk, which must clearly be identified and ranked, isolating any potential harm or giving rise to any detrimental event. Many of the US '*anti-frack*' charges in peer reviewed studies and media articles do have a basis of fact and require a case by case focused improvement of well design for the specifics of geophysics of the area in question with equal measures of oversight of well development. Though it is also clear that some articles do indicate intentional misrepresentations or a lack of fundamental understanding of the well development process. King (2012) alludes that in the case of the US industry this is an attack on the '*disruptive source*.'

Interest and investment have intensified; whereby 2019 Australia will in fact be the biggest exporter of CSG once it is converted to LNG (Leather *et al., 2013)*. Due to the relative infancy of the Australian UGI and with the apparent transformation of the North American market with the potential to affect global gas supplies.

The Australian governments, on both a state and federal level, have been commissioning independent reports by means of a plethora of governmental agencies as well as independently funded scientific bodies, seeking to identify key issues and regulations, which will soothe the way for electorate acceptance in areas of ongoing or potentially expanding activities. Bugala (2012) has identified that governments and regulators may come and go during the life cycle of an O&G project, though local communities will remain. He further maintains that transparency is the first step in establishing a significant goodwill necessary to encourage local communities, so that they embark and stay on the often-challenging journey that is the E&P and subsequent remediation of O&G projects.

Recently, geophysical records, which have long been archived are being retrieved across Australia as well as other international regions, due to advents of a culmination of new technical capabilities, give rise to previously unchartered and interesting situations, arising from implications of fiduciary

obligations. The party that might have been dealt with at one time or another in a specific example might not have been honest, or if as implied in one recent North American case, were not fully aware until the advent of recent technologies unlocking resources upon acreage tenements. These tenements previously thought to be uncommercial though are now viable creating multiple challenges upon aspects of '*fiduciary duty'* as stated by the Allen v. Devon Energy Holdings case where Allen, invested $700 and pledged a $34,300 certificate of deposit as collateral for a line of credit.

Ten years later, the managing member made pessimistic assessments, suggesting a negative impact to the venture. Despite this, $8 million was accepted with written disclaimers attesting Allen had undertaken independent investigation of the facts. Twenty months later, the majority shareholder sold his interest to Devon Energy for $2.6 billion, twenty times the value used to calculate Allen's redemption price. Comparing $8 million versus $160 million, Allen sued claiming, among other things, breach of fiduciary duty. The Texas Appellate Court permitted the claim to proceed to trial, ruling that the managing member had dominate control over the business and thus, possessed special knowledge, allegedly withheld from Allen, a formal fiduciary duty which existed in the context of redemption. The written disclaimers, according to the court, were not explicit enough to block Allen's case (Delman, 2013).

With millions perhaps, billions of dollars at stake, developers and their co-ventures could themselves be at each other throats when leaseholds thought dry turn out to hold vast reserves unlocked through technological advances in horizontal drilling and/or hydraulic fracturing, an ongoing debate of which is excluded from this particular project.

2.2 Concept of perception

Individual differences and their significance are extremely apparent when focussing on the process of perception. As humans, we all see things in different ways, having our own unique picture or vision of the '*real*' world; this is a complex and dynamic process. Individually we don't passively receive the world's information; instead we analyse and judge it. Disregarding some information as worthless, while placing significance upon other information we can be influenced by our expectations, to the effect that we '*see'* what we expect to see and '*hear*' what we expect to hear.

Perception *n. (from the Latin perceptio, percipio) perceiving, ability to perceive.* Definition being *apprehension, consciousness, grasp, realization, recognition, understanding, feeling, insight, intuition, sense, sensitivity* (Oxford, 1995)
Described by Schacter (2011) as the organization, identification, and interpretation of sensory information in order to represent and understand the environment.

Figure 1: Meaning, definition and description of perception

As individuals we are unique. There is only one of me as I write this report and as a reader only one of you. All having our own '*world*' with our own way of looking at, then understanding our environment and the people encompassed with in it. Situations can be the same but the subsequent interpretation of the situation can be totally different, as an example one person might be riveted by reading this project, though another might find it a boring and pointless chore. The physical properties can be identical, though perceived very differently as each individual has imposed upon the object/environment/person their own interpretations, their own judgement and subsequent evaluation (Mullins, 2010).

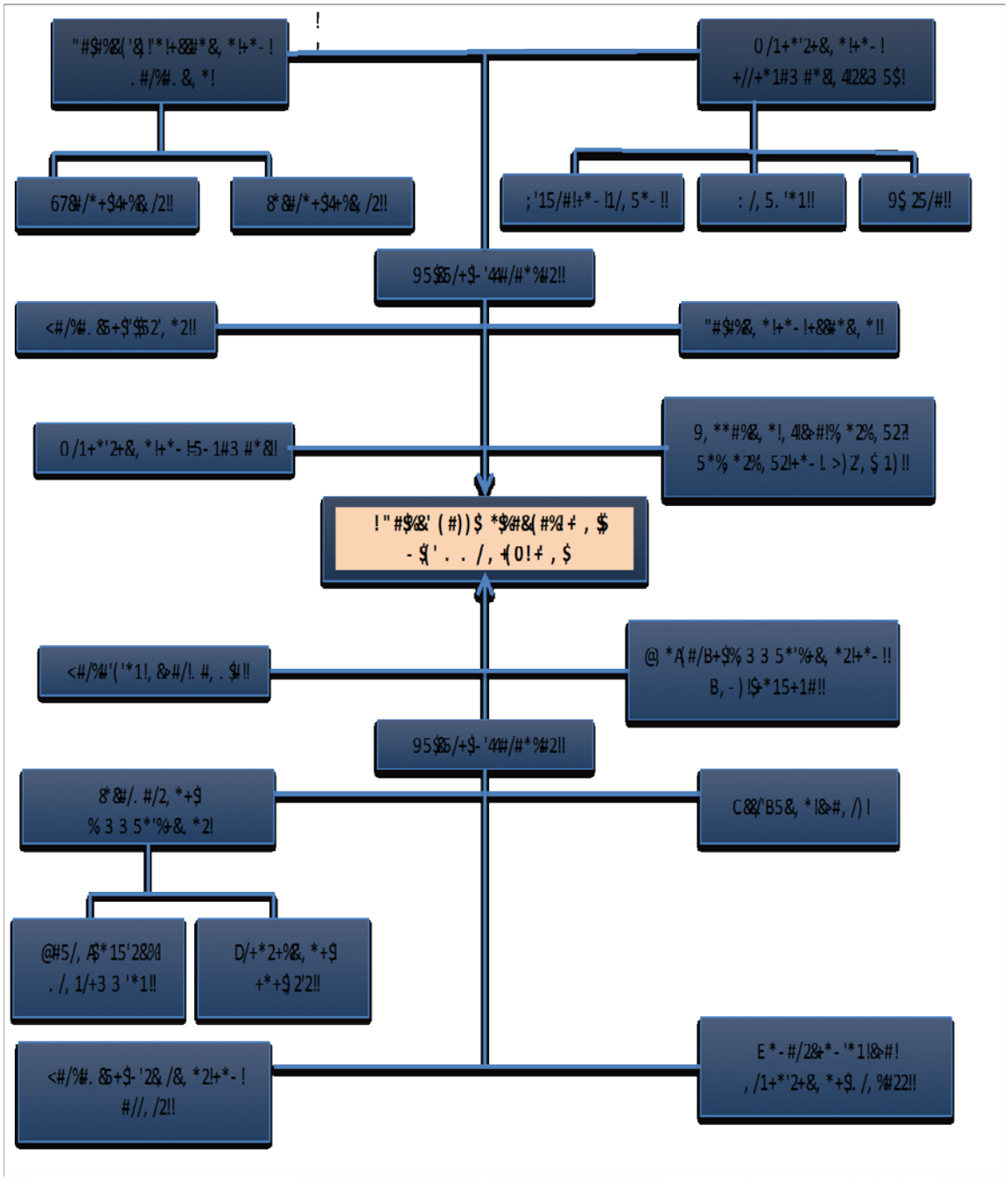


Figure 2: A framework of study for perception & communication (Mullins, 2010)

While this project will in no way attempt to explain concepts to a level of depth as a psychologist, it's simply not possible to understand perception with out considering sensory basis. Our sensory systems have limits, not being able to attend to everything within our environment. These limitations determine that we are selective in our attention and perspective. Pioneer works by psychologists give us a better understanding of universal laws that underpin the perceptual process, seemingly as humans learn, we continually search for meaning and subsequent understanding of our environment. Humans categorise, then organise sensory information dependant on a range of factors including present

situation, emotional state and any experiences of same or similar events (Mullins, 2010).

Mullins (2010) has inferred that we should all be aware of the assumptions made throughout the perceptual process, those below our conscious threshold. We take certain constraints in our environment for granted, predominantly assuming features of our world will stay the same and generally don't make any attempt to spend time seeing things afresh and anew. Making '*inferences*' throughout the entire '*perceptual process'*, serving to save us time and speed up the process, though these inferences can also result in '*distortions*' and '*inaccuracies*,' which serve to '*impinge*' on decisions we choose to make.

Information if considered highly important may result in immediate action or speech, while in other instances information might only be '*parked*' or '*assimilated*' with other idea's or thoughts, creating an obvious link between perception and memory processes as some of the '*parked*' material could be forgotten, or in fact changed and subsequently '*reconstructed'* over time (Bartlett, 1932).

2.3 Social Licence

There is no standard or generally accepted definition of '*social license*,' it is simply and commonly viewed as existing when a development activity has the ongoing acceptance by local communities. It is additional and different from the explicit requirements set by government or legally granted rights to operate, in that they are tacit, intangible and context specific (Franks *et al*,. 2010). A social license can't simply be issued, instead needs to be earned (Lacey, *et al*, 2012).

The conditions of a social licence change over time based upon people's ongoing experiences of an operation and shifts in their perceptions and opinions (Thomson & Boutilier, 2011), in the context of UGI activities dependant on how well a company meets societal expectations of its behaviours and impacts as demonstrated by Williams & Walton (2013). Therefore, it is not static, instead continually under negotiation and reflects the state of the relationship between a company and its stakeholders (Franks *et al*,. 2010)

Although social license suggests a positive relationship between a company and its neighbours, corporations when pressured would rarely or willingly equate social licence with community consent that is corporations aren't wiling to simply withdraw operations in locations where communities are opposed to their presence. This distinction between '*social license'* and '*consent*' is critical because accepting community consent as a basic operating standard sets a higher bar. If a community's actual consent is required before operations begin, then the companies will need to treat the company as more of a partner in project development. Implying that a company must engage more holistically with a community, providing members of the community access to critical information, while giving them adequate time to assess their own needs and interests, prior to making a decision to accept a companies presence (Voss & Greenspan, 2012)

At the same time, tensions are created over the extent as to '*which citizens'* are able to determine the '*appropriateness'* of resource extraction as a land use in a particular context, or the '*conditions*' under which it may proceed, and whose voices should count in '*providing or denying consent'* (Bridge, 2004). As Lloyd et al, (2013) in their research have identified a reoccurring message from affected CSG communities around '*perceived*' insufficient research and legislation for such rapid UGI expansion.

Williams and Walton (2013) have stated that community engagement literature indicates that collaborative forms of engagement, between Australian CSG companies and the affected communities lead to higher levels of trust, noting the time and effort which is required to develop trust based on personal relationships, while also noting that communities are '*diverse in their values, aspirations and expectations*', with some groups more marginalised than others, which needs to be taken into account when developing '*inclusive engagement strategies'*. The importance of understanding a community's values, aspirations and expectations is emphasised if the company understands the communities '*perceptions*' of its actions.

2.4 Protagonist debate for maintaining acceptance

After initial media statements by the NSW Premier Barry O'Farrell pledged to listen to '*community concerns'* or as I define them '*perceptions*' after a landslide 2013 election victory. He then immediately introduced tough new measures to further strengthen the regulation of the CSG industry in NSW and established the Environment Protection Authority as the '*cop on the beat'* to enforce environmental and health regulations, while implying that they were cleaning up the previous Labor governments mess (NSW Government, 2013). Around the same time, the Premier instructed that an independent review of CSG activities in NSW be conducted by the NSW Chief Scientist and Engineer Ms. Mary O'Kane. The initial report of the review, draws particular attention to concerns as raised by current activities drawing upon five months of information gathering, stakeholder meetings, interviews, community consultations, site visits, and technical paper preparation. The review sought the independent advice of several experts who were commissioned to provide reports on a range of topics relevant to CSG activities in NSW including water, geology, CSG operational processes, health and environmental impacts.

Additionally the review sought the views of the community-at-large through the offices of the NSW Land and Water Commissioner, via meetings with community representatives in Sydney and the wider NSW regions and with requests for public submissions, generating more than 230 responses to inform the review (O'Kane, 2013). The NSW Review makes a number of recommendations aimed at improving the information available to the community and for assisting the Government to build confidence that it has the intention and subsequent capacity to oversee a safe CSG industry, which the industry could build upon towards hinging individual companies efforts of '*social licence'*.

In addition, the NSW Review has identified areas around landowner compensation; company insurance and operator penalties, which could be strengthened, so have commissioned further legal work in such areas.

O’Kane (2013) has clearly identified that the issue of CSG in NSW is a very tough one with numerous complicated aspects, whereby a commitment to sound policy implementation based on highly developed data and further research to fill the knowledge gaps is essential for a complex and multi-layered issue. This has proven divisive, chiefly because of the emotive nature of community concerns, the competing interests of the players and a lack of publicly available ***factual*** information.

The debate has additionally been fuelled by unanswered concerns surrounding landholders’ legal rights, land access and use, human health, the environment, particularly relating to impacts on water, engineering and operational processes, and industry regulation and compliance. The review also highlights the considerable challenges faced by government and industry, requiring a commitment from all parties in an attempt to improve the existing situation and build trust with the community.

As O’Kane (2013) has concluded, from a technical and scientific standpoint, the highlighted challenges and risks associated with CSG are not dissimilar to those encountered in other energy and resource production, water extraction and treatment industries. Some challenges are well defined and can be effectively managed through high standards of engineering, rigorous monitoring and supervision of operations. Other challenges relating to long-term and cumulative environmental impacts are less obvious and require a commitment to significant and ongoing research, as well as a consequent evolution of engineering practice.

This initial report aims to explore the many issues of community concern drawing on material learned through listening to stakeholders and applying an evidence-based approach to problems. Based on the work done to date, recommendations have been made that the NSW Government commit to adopting a vigilant, transparent and effective regulatory and monitoring system ensuring the highest standards of compliance and performance by the CSG industry. Additionally, identifying that the Government needs to institute a strong and sophisticated policy for data collection and data handling, by establishing a whole-of-environment data repository, stating regulators should also implement stronger conditions around the training of CSG operators, and champion further research on unanswered questions around the science of CSG (O’Kane, 2013).

In addition to this, Williams *et al*, (2012) in their report prepared for the Australian Council of Environmental Deans and Directors point towards a '*whole of landscape*" analysis and cumulative risk assessment with two key recommendations.

1. *The approach used for assessing CSG developments (and for any other developments) should first be to understand the regional landscape capacity, and then to determine if there is capability for the development with out crossing landscape limits.*
2. *Current development approval processes should be updated to approve new developments only on the basis of landscape limits and the expected cumulative impacts of the existing and proposed developments.*

Expressing a view that opinions on a social and economic level it would be folly to secure one natural resource while putting at risk renewable long term resource use associated with water resources and aquatic ecosystems, agricultural land use with it's subsequent food, fibre production along with the biodiversity and landscape function and connectivity via vegetation of habitat management, though they re-iterate that.

> "*CSG development should be treated no differently from any other activity which creates wealth with subsequent impacts on the landscape with any potential to reduce it's function*".

Inferring and subsequently identifying further gaps in existing knowledge but imply that data sets

> '*Must be expanded upon not to an exhaustive level before it can in fact be used, as it is apparent that knowledge will increase with the continuation of time*'.

Additionally multiple documents make reference to Geoscience Australia's advice to the Australian Federal Government, which states that cumulative impacts assessments by project proponents are

> '*Unavoidably inadequate because of the inability of individual proponents to access commercial-in-confidence data from a number of resources*' (Habermehl, 2010).

Williams *et al* (2012), voice a main concern over the extreme nature of the present legislative framework, with multiple Acts operating at varying state levels and scales, with fears that increasing complexity, flags the potential for system abuse with a push to cut '*green tape'* and a possible outcome being the further compromise of landscape function. This complexity has the potential to distort the economics of different developments and result in perverse outcomes associated with effective use of resources (Williams *et al.*, 2012).

Australian CSG resources are geographically divided by state legislation, where there are cumulative fears for the Great Artesian Basin (GAB), which extends 2,400km from Cape York (QLD) in the north to Dubbo (NSW) in the south and 1,800km at its widest from the Darling Downs to the West of Coober Pedy, encompassing and area of 1,700,000 km2. The GAB, being the major and important water source which comprises of three major sedimentary basins: namely the Eromanga, the Surat, and the Carpentaria but also including parts of the Bowen and Galilee Basins (DEER, 2013), water resources including catchment which lay beneath the jurisdictions of the Northern Territory, Queensland, South Australia and New South Wales, underlies approximately one-fifth of the Australian landmass.

In agreement with the shortfalls, as detected by O'Kane (2013), Williams *et al* (2012) also highlighted legislative complexities having attempted to unravel the existing legislative processes related to CSG, though also determining that the subject requires comprehensive work to clearly identify overlaps and gaps in the present system. They point to the usefulness of developing a legislative framework based on a landscape-function approach, which would require innovative efforts with the potential for more efficient legislation, providing clarity for developers, ensuring that function is maintained and that measured limits aren't compromised while additionally pointing out that the QLD government presently has no mechanism for dealing with CSG at a landscape scale across all asset classes.

Australian State and Territory governments are primarily responsible for the regulation and licensing of the CSG and coal mining industries. The role of the Commonwealth Government in regulating CSG and coal mining proposals focuses on proposed projects, which could have a significant impact on matters protected by the *Environment Protection and Biodiversity Conservation Act*

1999. This includes matters of national environmental significance, actions involving the Commonwealth and actions on Commonwealth land (COAG, 2013).

In the context of growing CSG activity in QLD and exploration in NSW, concerns expressed by community's members to Federal ministers of parliament about potential environmental impacts of new developments, including over the volume of water produced as a by-product of CSG extraction and possible contamination of fresh water aquifers. The COAG Reform Council having been established by the Council of Australian Governments (COAG) as part of the arrangements for federal financial relations. The council is independent of individual governments and reports directly to COAG with a mission to assist COAG in strengthening the performance and public accountability of governments. The National Partnership aims 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'* (COAG, 2013).

The Australian Commonwealth Government has provided funds to establish an Independent Expert Scientific Committee towards funding scientific research on the potential water-related impacts of CSG and large coal mining activities, identifying three priority areas for strengthening decisions for objectives and outcomes (COAG, 2013).

- *More closely identifying potential and actual impacts on water resources, and supporting parties to avoid or minimise significant impacts through a transparent process that builds public confidence.*
- *Substantially improving governments' collective scientific understanding of the actual and potential effects of CSG and coal mining developments on water resources.*
- *Ensuring that the best scientific information and expertise underpins all relevant regulatory processes and decisions.*

The National Partnership shows a mutual interest by participating governments in the long-term health, quality and viability of Australia's water resources stating:

> '*Acknowledge public concerns about the actual and potential impacts of CSG and coal mining activities on water resources and agree there is a critical need to strengthen the science that underpins the regulation of these industries'* (COAG, 2013).

With time, I expect that some of the specific CSG learning's will also provide a structure for subsequent Australian shale and tight gas activities. This may assist in expanding upon the debate in a transparent manner, allaying '*perceived fears'*, increasing the amount of publically available factual information and assisting to increase the reliability of messages being driven by stakeholders toward the wider community from all sides of the debate. This will in turn enhance the abilities of industry participants to gain acceptance or desired '*social licence'.*

2.5 Satisfaction

The O'Kane (2013) report in itself has only outlined aspects in a preliminary manner. It is anticipated that the NSW Review will continue with an industry compliance study, identifying best practice in UCG extraction technologies and

regulation. Additionally commissioned studies on risk and on exposure pathways for chemicals and contaminants, the next phases of the NSW Review will address in more detail the principles that can underpin setbacks and exclusion zones, international best practice, risk characterisation and subsequent mitigation as well as the challenging matters yet to be completed, such as a comprehensive study of industry compliance. The next phase will not be concluded until 2014, post the due date of this particular project.

Key aspects of the Australian narrative will be dependent upon Australian State and Territory governments, with major political party conflicts of intent, dependent upon levels of co-operation, with the recently majority elected Abbott Liberal government, whom like its predecessor the Rudd Labor Government, stated as being pro-UGI activities. With such uncertainty at regulatory and governmental levels, it will take time before the affected communities will voice confidence in the described activities, let alone embrace the UGI and bestow '*social licence.'*

The subject is not presently a forefront debate issue, so it will take a short while to determine further clarity of the position of the incoming government. Expectations are that the newly elected government will herald an era of restored certainty setting out long term plans '*getting out of the way of business*' with accompanying fiscal and regulatory certainty. A message that has been conveyed by the Australian business community, whom desire a process whereby any regulation, is tested against the value that it creates. A situation whereby the goalposts are set, with out being moved on a whim, towards ongoing stability for continual confidence for future long term investment, efficiency gains and towards determined measures of enhanced productivity (White & Kitney, 2013). As it stands we still don't have a clear picture of the possible workings for the UGI to know the initial position of said goal posts.

Reviewing all literature, it is evident that any of the overall analysis can and will still be misinterpreted either by companies, protagonists or specific stakeholders who don't see their priorities or opinions reflected with in any consolidated results (ARPEL, 2012). Specific priorities can't simply be altered, though there can be an engagement towards providing guidance on socio-environmental sustainability issues that with co-operation will allow stakeholders to work together towards sustainable development.

It is also evident, that the importance of growing industry perception within any O&G industry participant's global business strategy needs to be addressed. Whereby the levels of commitment and leadership for strategic management of socio-environmental stability are maturing from a historical position of '*there are no implementation plans*' or guiding regulation towards '*total implementation with measureable and comparable results with continuous improvement'* (ARPEL, 2012).

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

The structure of this specific project arose after noticing a marked increase of discussion by mainstream Australian Media. This discussion from my own perspective, (through knowledge gained by recent studies) aided me in being able to closely look and critique the matter objectively. Having closely monitored associated topical subjective material, which in turn made me question why it is that people are thinking in the manner they do? Where do they obtain their information? And what amount of information is factually incorrect or possibly factually misleading?

3.2 General review of the research design

I created a questioning structure and utilised SurveyMonkey™, selected after investigating its analysis function for linking, comparing and filtering. Determining that it was suitable for the dissemination of a survey entitled: "*Unconventional Gas Perception Survey*" for the purpose of the project primary data. Primarily discussing CSG, though encompassing aspects of other unconventional gases, such Tight and Shale Gas, which can sometimes share aspects of how they are bought into production.

Given I knew the questions being asked by the public (as had been identified in reviewing material as detailed with in the literary review), the survey questioning was essentially reverse-engineered. This format was used to gather the pertinent data needed to support this study. The survey identified a baseline of what people think, of which has been measured against information considered to be science or empirical fact, towards trying to identify how participants might have come to such a conclusion.

3.3 Quantitative study

The research design is primarily quantitative, though data has been analysed by use of a combination of qualitative or quantitative techniques, dependant on the types of responses avaliable to some of the questions. Utilising filtering functions associated with the nature of the survey data, it's difficult to conclude the reliabiliy of the data, due the logistics involved and time avaliable I am unable to obtain qualitive data by means of follow up interviews. I therefore determined quantative research to be the most practical.

3.4 Survey

The anonymous survey, revolving around perception of the UGI, was open to participation from the 2nd of July 2013, until the 17th of September 2013. Questions could simply be skipped if participants were unsure of the answer as with testing it was discovered that some participants whom aren't familiar with some of the concepts were baffled, having no idea of what was being asked. Similarly the questioning still needed to cover all aspects to appeal and engage those participants whom were aware of the subject. Additionally as some aspects were Australia-specific, due to the viral nature of networking as the project encompassed international participation from 34 international participants from 17 countries in total, having been distributed widely, via a multitude of international contacts, not limited to Australia it wouldn't have been fair to expect those participants to simply guess.

3.5.1 Data collection

Entrusting the viral nature of global Internet communications, survey links have been propagated by a specifically created email address (Unconventional.gas.survey@gmail.com) as well as distributing widely by utilising social networking, Facebook™ postings and viral message dissemination, LinkedIn™ contact list distribution as well as postings of

discussions and links on group LinkedIn™ discussion pages.

The survey targeted a diverse audience, revolving around perception with no firm control over the nature of the participants, who may or may not have a real understanding of the industry. Not simply stakeholders, but also wives, partners, family, friends, colleagues, party members. Participants did not need to know anything about the subject, only what they might know and how they know it. This was not an exercise to measure right or wrong answers, nor to steer opinion but to gauge a mindset of our democratic public collective.

Additionally, requests for participation were emailed out to various stakeholder group representatives. This was done via publicly available points of contact, with a request for their participation and/or further dissemination of the survey link or by voluntary participation by members of their office staff, and/or associated organisations.

The survey was made available to anyone who wanted to participate and not merely for representatives of a given stakeholder group:

Organisations and stakeholder groups such as but not limited to

- Federal Government Ministers and respective departments of responsibility as applicable to the UGI
- State & Territory Government Ministers and respective departments of responsibility as applicable to UGI
- Federal Government regulatory departments
- State & Territory Government regulatory departments
- Government representative scientific authorities
- Industry Associations. APPEA, Australia Petroleum Production & Exploration Association, etc.
- Farmers, Land-users and Landholder Associations.
- Community Groups against identified as being anti-CSG. I.e Lockthegate
- Companies who advertised in the 2013 Gas Industry Directory (Published by Gas Today Australia)
- Community groups voicing concerns for water aquifers and the wider environment
- Companies and industry associations of water dependent industries
- Industry associations for specific groups. I.e. Viticulture and Horse Breeders

- Groups associated with investment, insurance and risk management of the industry

Additionally, I posted links and requests to multiple stakeholder websites via internal contact submission posting systems.

3.5.2 Measurement variables and issues

As the topic is emotive for many people, there were suspicions of my intentions and '*whom*' I might have been collecting data for. Accompanying emailed requests for participation, a PDF letter from Middlesex University stating that I was adhering to the institution's ethical requirements was provided. Additionally participants, primarily of groups associated with anti-CSG activities subsequently responded with a request for verification that Middlesex receives no funding from any group or association with in the O&G industry, which I was able to provide.

I had also received multiple accusatory emails of non-professionalism concerning grammatical aspects of the survey, which might have turned off participants when they began the exercise and may have added to the non-completion rate of the survey. Some of the emails were abusive and clearly from persons from the anti-CSG sample, though some after secondary exchanges were actually cordial, with an email from one anti-CSG stakeholder who to my surprise stated, from their perspective that the project was quite balanced and covered all the key concerns, so they were willing to assist dissemination of the project link.

Feedback was also given by persons not aware or associated with the debate that the survey was too long, conversely others responded that it was a positive experience as it made them think of more of the aspects associated with the debate that they were unfamiliar with.

Additionally, I encountered issues that highlighted a limitation due to dissemination of the survey by utilising links within Facebook™ and using personal contacts in regions of CSG activities, connections that had a wider association with persons having affiliations with anti-CSG groups.

Facebook™ limited my ability to include the PDF of my ethics letter, as I wasn't able to provide a connection or a link within SurveyMonkey™ to the Middlesex ethics adherence. Messages had been disseminated by anti-CSG proponents via Facebook™, stating that my study origins may be suspect, which may have served to reduce the anti CSG sample size.

3.5.3 Data analysis

The project primary data survey received 298 responses. The resulting data was analysed by utilising the functions available to SurveyMonkey™ subscribers, which has proven in itself to be quite a powerful tool.

For quantitative analysis of results, it was important to identify from the sampling frame the origins of the sample, clearly identifying the population subsets. Answers to selected questions were compared, split, filtered and linked serving to identify participants location, their levels of industry exposure, identifying if participants were associated with the UGI, affected particularly by CSG activities or purely spectators.

3.6 Secondary analysis

Having performed searches for applicable literature/data primarily utilising web search engines for the purpose of secondary data, as well as library books and stakeholder journals discussing aspects of the subject. Identifying companies and/or specific organisational groups, publicly stating a particular stance on the matter. Giving additional linkage to regulatory bodies and recognised empirical facts, some of which is provided by sources as listed and who were also subsequently contacted for the purpose of dissemination of the survey link.

Media outlets some of which are behind pay walls (subscription), industry journals, organisations and stakeholder groups such as but not limited to

- Oil & Gas Journal (Print Magazine & online) PennWell. Houston. USA
- Gas Today Australia (Print Magazine & online) Great Southern Press Pty Ltd. Melbourne, Australia. Whom provided an embedded link to my survey in their website with a brief outline of the project.
- Journal of Natural Gas Science & Engineering (Online) Elsevier B.V. Amsterdam, The Netherlands
- Oil Gas Energy Law & Intelligence (Online), Maris B.V. & Camko Ltd
- Australian Financial Review (Daily print & online newspaper) Fairfax Media Ltd, Australia
- The Australian (Daily print & online newspaper) News Ltd, Australia
- Local & regional newspapers in UCG affected areas.
- Australian Commonwealth Scientific & Industry Research Organisation (CSIRO): CSG and UCG papers

- International Energy Agency: Golden Rules of CSG & up dated review papers
- Australian Government and departmental policy papers, reviewing the chronological evolution of pronouncements.
- Australian State & Territory government and departmental policy papers

Research of Australian UGI IOC & Energy participant's websites and publicly available information from but not limited to: Santo's, AGL Energy, Dart Energy, Metagasco, Origin Energy, Beech Energy, BG, Arrow Energy and additional E&P majors supplying development/partnership funding to smaller E&P participants.

3.7 Reliability and validity

Having attempted to determine reliability, by posing similar types of questions which have subsequently identified trends as indicated through out the results and analysis. SurveyMonkey™ operates a security function utilising the sample participants IP address to eliminate the possibity of duplicate attempts.

A key validator for the project survey was discovered, whereby with a sample population of only <300 participants in comparison with a Vote Compass survey having garnered in >1.3 million responses by the conculsion of the 2013 Australian Federal election (7th of September 2013). Vote Compass respondents were asked for their view on this statement: "*There should be fewer restrictions on coal seam gas exploration*." With responses concluding that NSW is by far the state most concerned about CSG, with 61 percent of Vote Compass respondents in NSW saying restrictions on CSG companies should not be relaxed, which triangulates with Figure 74, which indicates the highest levels of participation coming from NSW, with 22 percent of whom, when filtered Figure 6, indicates that 62 percent of the projects NSW sample also being against the industry, in close correlation to the Vote Compass findings as discussed in length in the results and analysis section of this project.

3.8 Internal measurement issues

Additionally the SurveyMonkey™ results where extracted by means of an Excel™ worksheet, which allowed for refining of the results whereby some participants had identified their postcode though not their relevant state, or in some cases only their town.

Figure 74 (Q81) was skipped by 79 and answered by 218 participants, of whom 28 were international, indicating that 190 people identified their state. By means of the Excel sheet, I was able to make a secondary confirmation of the state of 187 participants and identify 34 international participants in total. Indicating 45 persons did not fully complete the survey to the final question, though there were answers that achieved participation rates over 97 percent.

3.9 Limitations of the study

By the nature of any project, it would be improbable to state that any results unearthed are conclusive, as it would have been preferable to conduct some on the ground investigations as well as perform face-to-face interviews, which would serve to allay suspicions, which are raised by Internet or blind contact introductions. Though this wasn't possible due to logistical limitations, and access to persons in regions of the activity. Never the less, it has served to confirm some of my suspicions especially when speaking to associates of the sample group after they had completed the survey that people are becoming aware of the conversation.

3.9.1 Sample population

The survey managed to cover quite a wide demographic of subsets with a 2.29 ratio of men to women (Figure 70), across defined age groups as identified in (Figure 75). 30% of respondents had no children, though 32% indicated that they have children less than 18 years of age, 42% had Children over 18 with another 16% identifying as having Grandchildren (Figure 80).

Participation of 6 Australian elected representatives and 15 participants identifying as senior level executives (Figure 77). Cumulatively 17 percent either in full or part time study (Figure 79) and 77 percent indicating that they utilise gas for domestic consumption (Figure 81) with a wide spread of education levels (Figure 76).

3.9.2 Time factors

This has been an intensive project whilst managing an offshore equal time leave schedule through the duration of the study period. Offshore Internet access hasn't always been reliable, impinging upon the ability for easily access of relevant and large source files. Aspects of the discussion have only evolved with the recent Australian federal election, called and concluded within the project duration. Additionally many relevant investigations and reviews in Australia are only at preliminary or recommendation level due to the embryonic nature of the industry, with subsequent findings due post submission of this project.

It must also be noted; to increase the sample size by means of viral networking, links had to be repeatedly sent out for requests or participation. Survey participation rates definitely decreased when efforts of dissemination was reduced or were in fact halted.

Chapter 4: RESULTS AND ANALYSIS

4.1 Introduction of the key issues

O&G company's core strategies are continually evolving; decisions of which segment of the industry to operate within, ratio's and balance of activities, areas of operation within a specific region or alternatively embarking on wider global activities when anticipating the next advantage opportunity. All major SPE O&G investments, such as refinery re-fit projects, new onshore/offshore drilling prospects being conventional or unconventional sources, or decisions to build a new facility such as an LNG facility are long-term investments, or even smaller regional production and O&G distribution networks considered "*a bet on the future*". Investors in Australian unconventional gas activities have recently been caught by an evolution of negative sentiment and nervous government, serving to influence measures of regulation. (Leather, 2013)

Investment activities revolve around central concepts of the key industry stakeholders and their strategies, i.e. IOC's, NOC's, NGO's, citizenry, National and Regional governments with future potential for International treaties enacting the mitigation of greenhouse gases or subsequent influence then adjustment of regulation. Activities and strategies which force change, action and subsequent reaction, while creating a diverse set of new opportunities, further pure and speculative risk for market sphere participants, all of which have to be factored while hopefully and successfully anticipating in all eventualities.

The search for new and subsequent delivery of O&G derived products, gives cause for the industry to go further, deeper and into more remote and geographically challenging frontiers of the world. Project scale and the CAPEX, ongoing OPEX required to fund such activities continues to grow, combined with increased technological risk, business risk and growing global & regional political interference, giving rise to multiple challenges. (Inkpen, 2011)

Natural gas is found overwhelmingly in sedimentary basins or geological settings and within various rock types. It is largely the rock type and the trapping mechanism that defines whether a gas is regarded as "*conventional*" or "*unconventional*" and not the composition of the gas. All natural gas is composed predominantly of methane (CH4), but sometimes contains minor

quantities of other hydrocarbons. Conventional natural gas (and oil) is trapped in porous and permeable reservoir rocks, such as sandstones.

To date, most of the gas produced globally has been conventional gas. Conventional gas and conventional oil underpinned twentieth century economic and social development. As easier-to-produce sources of O&G are exhausted, the industry is increasingly turning to a source that has always been there, which, until the advent of new technology was too difficult and expensive to recover; unconventional O&G, though as recognised by Lloyd *et al* (2013), the identified present source has been social disruptive.

A junction of capabilities i.e., '*fracking*' mixed with the technologies of '*horizontal drilling*', serve to release energy sources previously ignored as not being economically viable. Driving a transformation of O&G global markets a *'second global oil rush'* (Kohler, 2012) a narrative revolving upon gas. We've recently witnessed the decoupling of North American markets from the historical and viewed as shackling relationships (Middle East dependency), reducing a requirement for sending hard currency reserves overseas to power their own economy. A factor, previously only added to the present poor state of US fiscal reserves.

This evolution of global O&G markets and the development of primarily US onshore *Tight* and *Shale* gas reserves is aiding to decrease costs of business in the US. Reduced gas prices are displacing coal for power generation, with positive environmental aspects and additionally aiding manufacturing, as previously offshored arrangements return. Project CAPEX and OPEX are creating O&G industry employment, with subsequent stimulation of the wider economy. This new rush may be a catalyst, re-invigorating the US economy, job creation aiding investor confidence, assisting to pull the fiscal world out of it's morbid state, re-building economic confidence. The USA has identified a new advantage, as it edges towards energy independence for the first time since 1952 (Miller, 2012) and clearly intends to use it.

The growth of unconventional resources, primarily the coal seam gas (CSG) industry in Australia, has the potential to deliver similar significant economic benefits. Australia's relatively vast supplies of CSG resources are located in Queensland (QLD) and New South Wales (NSW), prompting large investment

on CSG for power generation and a burgeoning conversion to liquids (GTL) for low carbon transportation fuels. Recent and rapid expansion of the CSG industry in QLD including construction of the worlds first CSG to LNG export facilities and a corresponding increase in exploratory activity in NSW, so the industry has become the centre of considerable attention, criticism, protestation and debate (Lloyd *et al*,. 2013). Deeper Tight gas accumulations are located in onshore Western Australia and South Australia, while potential shale gas resources, which are also deeper than shallow CSG down to around 4000m (BREE, 2012) are located in the Northern Territory, Western Australia and South Australia. Separate to the recognised conventional gas resources developed offshore and out of sight from community scrutiny, aiding Australia's rise towards a status of the world's largest LNG exporter.

The cost of the different exploration components between unconventional and conventional well types, including seismic and drilling vary markedly depending primarily on the scope and location of the projects, which affects logistics as well as numerous other factors with the ability to tie into an existing sales network. It is often possible to drill multiple CSG wells for the cost of a single well in deep water. For example, an offshore well drilled to 3000-4000 m in water depths of 100-200 m will typically cost $30-50 Million, potentially equating to $1 million per day of drilling (BREE, 2012) though we must note that the majority of major offshore reserve discoveries are increasingly in deeper waters over 2000 m which markedly increases the cost of well development which is outside the scope of this report. Shallow CSG wells drilled to 200-1000 m for exploration and development typically cost around $300,000 to $1 million equating to around $1000 a meter or an average cost of around $500,000 per well (BREE, 2012)

4.1.1 Association of participants towards identification of influence upon opinion

Q9. How would you associate yourself with the Unconventional Gas Industry (Such as CSG or Shale Gas) (Answered 291, Skipped 2)

s

Figure 3: Q9 Participant's association with the Unconventional gas industry

For the project purposes, it was important to try and determine participant's association with the industry, then I seperated the key Australian naratives of the debate primarily revolving around QLD & NSW, though will subsequently expand into other regions of Australia, particularly as new domestic energy source for some of the more remote energy users (Cook et al., 2013).

Achieving a positive distinction between ones own group and another group leads to inter-group behaviours, where any perception, cognition or behaviour is influenced by an individual's recognition that they and others are members of a distinct social group (Turner, 1975)

With the sampling frame of QLD with 43 participants and an active CSG industry, as filtered indicated with 37 percent working in the UGI, 11 percent supporting activities, with 13 percent against, 11 percent not liking and 16 percent professing to be spectators alone. In contrast, NSW with a total of 49 participants and a minimal industry presence of only 10 percent of participants working in UGI, 4 percent supporting activities, a strong indication of 59 percent against the industry and another 10 percent who don't like the idea of the industry but aren't fully informed of the debate.

Q15. What is you knowledge of Coal Seam Gas (CSG) or Unconventional Gas? (Answered: 252, Skipped: 41)

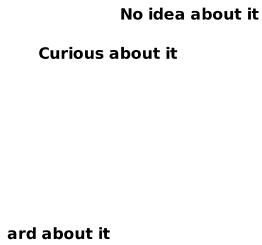


Figure 4: Q15 Participant's percieved levels of knowledge of the topic of UCG

Again by sampling Q15 it was determined that all participants in NSW & QLD at least had an idea about the subject. Firsthand: 35 & 33 percent NSW & QLD respectively. Know about it: 45 & 35 percent NSW & QLD. In NSW cumulatively heard or curious about it: 18 percent, while 21 percent in QLD have heard about it with another 9 percent curious about it. The contrast between the two states is interesting due to large extent of the industry in QLD, though it is obvioulsy not percevied to be such an issue across the whole state.

People like to assume that they are informed when they aren't exposed to the UGI in their immediate area, though as we are seeking to discover, are they receiving the correct information?

Q4. Concerning unconventional gas, do you identify yourself as any of the following? (Answered: 287 Skipped: 6)

Figure 5: Q4 Identifying participant's association with the UGI

Indicated as a percentage	NSW	QLD	Average
Working in the Industry	12	35	20
Concerned public	37	32	35
Primary producers	35	7	9

Table 1: NSW, QLD and Average participants association with the UGI

Table 1, serves to indicate that the project response wasn't swamped by proponents pro UGI activities, indicating that the levels of concern through sample where indicative of an wider average. QLD UGI activites are also occuring in key primary production / farming areas, though from the figures on hand, unable to determine the success of penetration for the QLD sampling frame.

Q16. What is your general opinion of Unconventional gases? (Answered: 249, Skipped: 44)

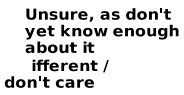


Figure 6: Q16 Participant's general opinion of UCG

It is difficult to determine a conclusive 'gauge of perception', due to the accessibility of the population from which the survey from (Sampling Frame). Results from my survey which indictes that 26 percent are totally against, with 22 percent yet to be convinced either way and 14 percent stating unsure as they don't yet know enough about it, cumulatively with 35 percent for or somewhat for.

According to Vote Compass an educational tool developed by a non-profit group of political scientists and hosted by the ABC having garnered in excess of 1.3 million responces by the conculsion of the 2013 Australian Federal election, whereby participants answer a short series of questions to discover how they fit in the Australian political landscape. Vote Compass respondents were asked for their view on this statement: '*There should be fewer restrictions on coal seam gas exploration*.' With responces concluding that New South Wales is by far the state most concerned about CSG, with 61 percent of Vote Compass respondents in NSW saying restrictions on mining companies should not be relaxed, where as Figure 74 of this study indictes a NSW participation rate of 22 percent of whom when filtered Figure 6, triangulates with an indication of 62 percent being against the industry, close correlation to the Vote Compass findings. Vote Compass indicates 55 per cent of Australians in general think

CSG miners should not get more leeway, with just 23 per cent support the easing of restrictions and believe that voters in rural and regional seats are indicating more of likeliness than urban respondents to back tighter restrictions on CSG (ABC Vote Compass, 2013).

This is in contrast to exit polling taken by APPEA the industries peak body, who have been pushing a strong pro-CSG campaign and believe that the CSG was a non-issue for the federal election having conducted polling in the seats whereby the standing whom subsequently received a swing againts them had billed the election as a 'referendum' on CSG Development. A poll of 400 people, spread evenly across 20 seats in area's of UGI, results which APPEA indicate natural gas was a non issue, scoring zero percent under questions of 'spontaneous' issues of concern when people leaving polling booths were prompted on an issue that determined their vote, with indication that their key issues were instead state of the economy, cost of living and immigration (Tasker, 2013).

Though it is likely that this type of survey would lack reliability as it isn't as engaging as taking actively taking part in a survey where you are being asked aspects of the topic, rather that the APPEA survey asked participants identify 'spontaneously' aspects of concern in many cases whereby persons might not even have any first hand experience, or exposure to UCG activities and in all likleyhood due to the combative election campaign, particiapant might have been suffering from 'issue fatigue' or 'psychic numbing', whereby people focus less on distant issues (Srivastava, 2013), added to the fact that those persons had already discharged their vote on the day.

The APPEA survey, additionally has been undone by members of key members of the UGC sector. Where 89 percent of executives in the O&G industry believe that 'worries' or 'issues', identified by the public are warrented and that the UGI itself has done a poor job in educating the public about the issues, with 69 percent stating that agreed that concern over ground water was valid. Industry respondants were also divided by the real reason of objections to CSG, with 47 percent believing that it was due to property rights more so than environmental issues (Kitney, 2013). Additionally a newspoll of 1100 people in the 'The Australians Path to Prosperity series', has also identified that 56 percent of

NSW and ACT participants were against CSG activities, compared to 30 percent in QLD.

4.1.2 Differentiation of the Unconventional gas types.

Q21. Shale Gas and Coal Seam Gas activities, how do you view them against each other? (Answered: 252, Skipped: 41)

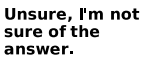


Figure 7: Q21 Participant's perception of similarities between Shale & CSG activities

Having detemined participants opinion of UGI activities, requiring to discuss participants understanding of the activities. Having seperated the aspects of the NSW & QLD narrative by filtering and including the survey average which indicates by a large margin, persons in NSW have incorrectly come to a conclusion that activities are one and the same.

Indicated as a percentage	NSW	QLD	Average
Same	54	14	25
Different	33	47	38
Unsure	12	38	36

Table 2: NSW, QLD and average perception of production of Shale against CSG

Conventional gas reserves are typically characterised by the accumulation of free gas occupying void spaces within a sedimentary reservoir rock and capped by an impervious rock that traps the gas in place. (Norton Rose, 2012).

In contrast, CSG of which we have identified as primarily methane, collects in underground coal seams by adhering to coal particles. The gases bond as a

thin layer of molecules to the surface of the coal (i.e. ‘adsorption’). Coal by nature is porous, the surface area of coal is much larger than first appears this ‘porosity’ (like the gaps in a sponge) being the space between the grains that make up a reservoir rock, in which fluids such as water or gas occur. The higher the porosity, the greater the quantity of a fluid, whether water or hydrocarbons, being potentially trapped within the rock.

Some methane occurs in the natural fractures of the coal, and some is dissolved in the waters in the coal seam, but the vast majority of the methane comes from the micropores. In order to release the adsorbed gases from the coal surface (i.e. the process of ‘desorption’), the pressure in the matrix of the coal needs to be reduced, which is performined by removing formation water from the coal fractures, which creates product water which often has a high saline content. The adsorbed gases are subsequently released and diffuse through the micropores into a fracture or cleat in the coal. Together with the remaining formation water, the gases then flow through a network of natural fractures and cleats ‘permeability’ to the low pressure area around the wellbore in the same manner they would in a conventional gas reservoir.

‘Permeability’ measures the level of interconnectivity between the pores or gaps and is an indication of the ease or difficulty encountered in extracting fluids from a source rock, higher the permeability the easier it is to produce gas or liquids from a rock. The described porosity of the coal bed and permeability of the natural cleat systems will inevitably vary from basin to basin, subsequent coal seam to coal seam and potentially even with in a seam. Permeability changes with time as the content of water in the flow path declines, making it quite difficult to confidently estimate the volume of recoverable reserves (Norton Rose, 2012).

The lower permeability the more difficult it becomes to produce and recover the gas, which is the differentiating factor for Shale and Tight gas reserves where it might be necessary to inject fluids into the rock an industry term ‘*Fracking*’, (discussed in other sections), creating pathways so that the gas or oil can migrate, volumes of fluids injected depend upon the tightness or ‘*low permeability’* which is also variable from basin to basin, shale seam to shale seam, etc.

On reflection, from looking at the NSW sample it would have been useful if the question were instead constructed, asking for the perspective including conventional gas.

Q45: Though they are both sources of gas, what do you understand to be the processes of production shale gas against CSG activities? (Answered: 225, Skipped: 68)

Figure 8: Q45 Perception of the difference between Shale Gas & CSG resources

Indicated as a percentage	Uses a lot of water	Produces a lot of water	Usually requires Fracking
Coal Seam Gas (NSW)	NO (14%)	YES (54%)	NO (6%)
Coal Seam Gas (QLD)	(20%)	(57%)	(36%)
Coal Seam Gas (Ave)	(29%)	(38%)	(17%)
Shale Gas (NSW)	YES (35%)	NO (33%)	YES (38%)
Shale Gas (QLD)	(24%)	(21%)	(46%)
Shale Gas (Ave)	(28%)	(9%)	(44%)

Table 3: The processes of production Shale against CSG

The process of CSG and Shale Gas are quite different, participants would have been correct in answering the sections highlighted green (YES) according to Table 2 above, where percentages indicates participants correctly identifying the stated answer, as the table serves to identify that only a small fraction of the sample recognise that no, CSG doesn't use a lot of water.

For the case of NSW and the present CSG debate it is important to point out that fracking of CSG creates additional risk for damaging the organic coal surface serving to potentially blocking gas flow to the wellbore due to the subsequent impedient of natural network fractures. Filtering Q45. identified that only 6 percent of answers from NSW identified that CSG doesn't require fracturing, while neither QLD or NSW clearly identified that Shale gas would require the use of a lot of water.

Cook et al. (2013) state;

> *"volume of water required to hydraulically fracture shale gas strata can be in an order of mangnitude larger than that of CSG depending on well depth and extent of horizontal drilling. Conversely, the total volume of produced water in shale gas operations is orders of magnitude less than the total ammount produced during CSG operations. Leading to a conclusion that while initial extraction of water for shale gas operations will be significant, shale gas operations will not be faced with the ongoing disposal and subsequent replacement of large volumes of produced water, which is the case for CSG operations."*

This statement in itself poses a few problems for the uninformed reader or for that matter the spectator due to word context. As it should point out that the 'extraction of water for shale gas operations' is not water removed from the UCG source, in a manner of produced water similar to CSG, but instead a seperate water source which will 'need to be consumed to stimulate the well' for gas production.

Q24. What percentage of Coal Seam Gas wells are hydraulically fractured? (Answered: 253, Skipped: 40)

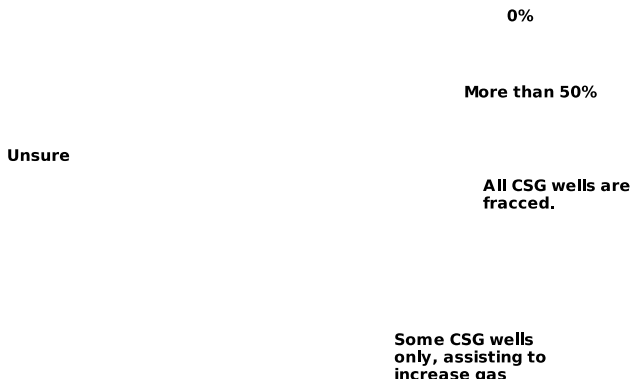


Figure 9: Q24 Participant's perception of percentage of CSG wells actually fractured

The correct answer choice would be 'Less than 10%', which was only selected by 6 percent of participants in contrast to facts identified in multiple references and pointed out by the NSW DPI (2013) website fact sheet, stating 'less than 5 percent of CSG wells are fracked and in all likelihood it is less than 10 percent ever will be'. Which or could be read as 'Some CSG wells only, assisting to increase gas production from a specific well'. Which was answered by 25 percent.

So it is odd that anti CSG proponents are agitated to the extent that they believe that the argument is a 'fracking argument' which is a narrative borrowed from films like Gasland (2010) which depicts aspects associated with shale gas, rather than CSG. This divide will be expanded upon further in Figures 19, 38 & 56.

Not all CSG wells require fracturing, if there is adequate natural permeability, or if it has been horizontally drilled, then it may not be necessary. Fracking is expensive, as a commercial consideration if it can be, it will be avoided (Cook et al,. 2013) Though as discussed by Rutovitz et al,. (2011) the AGL Camden gas project in NSW, during 2011 being the only one supplying the NSW

consumer market has ‘fracked’ 117 wells, with 15 percent done twice, all wells ‘fracked’ were vertical rather than horizontal due the basin characterstics.

Q27. What percentage of shale gas wells do you think are hydraulically fractured? (Answered: 254, Skipped: 39)

Figure 10: Q27 Participant’s perception of percentage of Shale wells actually fractured

The correct answer would be that ‘All, Shale gas wells are Fracked’. Which was only answered by 26 percent, with a lot of participants simply not aware of the actual case, as the main narrative in Australian debates revolves upon CSG.

Again it is important to point out, similar to all gases, shale gas is mostly composed of methane. Natural gas produced from shale like CSG is termed a UGC, is often by contrast to ‘conventional gas’ produced from other kinds of rock usually sandstones or limestone’s. Conventional Gas or oil is found in reservoirs in sandstone or limestone, where gas or oil has migrated up from source rocks, normally an underlying shale, where organic rock matter through the action of heat pressure over time becomes gas.

In contrast shale gas is produced directly from the source rock. The techniques used to extract either oil or gas are essentially the same, but shales have to be systematically ‘fractured’ to enable the gas to flow due to the lower permeability, as gas flows much less freely through shales than sandstones or limestone’s, so the techniques are applied in a different way (UK DECC, 2013).

Ongoing shale and tight gas development is dictated by the threshold price, which is a ratio of drilling and completion costs to initial gas production. Shale gas production differs from CSG, as shale suffers from a rapid production decline rate, meaning that capital expenditure needs to be maintained each year due to the need to drill and complete new wells to maintain field production (Cook et al,. 2013) which entails additional fracking. Whereas CSG costs decrease as the produced water decreases.

The cost of extraction is significantly higher in Australia than the USA, due to the lack of market networks connectivity, skills and equipment shortages. Though due to the abundance of prospective basins it is likley that resources will be developed in the northern, central and western Australia (Cook et al,. 2013).

Q19. So in general, simply from what you do hear about CSG of other unconventional gases, what do you think the general public opinion is? (Answered: 259, Skipped: 34)

Figure 11: Q19 Participant's belief of the wider communities opinion of UCG

	Average	NSW	QLD	VIC	NT	WA
Against %	47	65	46	46	45	35

Table 4: Participants perception of the publics opinion of UCG

This result especially of NSW at 65 percent as identified by Figure 6. Triangulates with findings of Vote Compass having a sample population of 1.3

million (Vote Compass, 2013) above 56 percent as discussed by Kitney (2013) in the Newspoll survey of 1100 people.

4.1.3 Perception of science and development activities impact

Q8. How well do you think the environment can recover on it's own from problems caused by humans? (Answered: 289, Skipped: 4)

Figure 12: Q8 Perception of environments ability to recover due to human interference

The Australian economy has a history embeded with aspects of the resource narrative so it was interesting to find the results as detailed below on Table 5. and Table 6. Especially due to the filtered response of Figure 12. Whereby none of the WA sample who mainly work in the fields of engineering and human resources, primarily in mining as well as O&G identified that they thought the environment lacked the ability to recover from human interferance. Moderate was the mean point of 'well' responses, which points to a more pragmatic attitude to the environment.

	NSW	QLD	WA	Average
Not well %	35	25	0	29
Moderately %	20	30	30	28

Table 5: Perception of the environments ability to recover from human interference

Q2. When people get involved in trying to solve environmental problems, how often do you think they make things better? (Answered: 288, Skipped: 5)

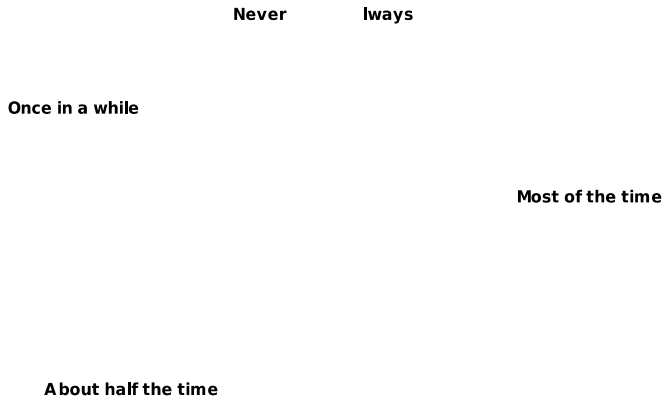


Figure 13: Q2 Ability of humans to assist in resolving environmental problems

	NSW	QLD	WA	Average
Never %	2	2	0	2
Most of the time %	41	39	60	41

Table 6: Perception of abilities of humans to assist in resolving environmental problems

'Most of the time' being the mean answer, Indicating that the sample are confident that we can assist in rectifying problems of our own making, with only an extremely low portion saying that 'never', which points to most participants being fairly pragmatic of our abilities to assist after we do make any mistakes.

Q5. What is your perception of the abilities of science? (Answered: 288, Skipped: 5)

Figure 14: Q5 Participant's perception of the abilities of science in general

	NSW	QLD	WA	Average
Possibly impartial %	50	42	55	43
Yes, politicised %	54	40	20	36
Yes, interest groups win %	46	30	50	35
Yes, science is acceptable %	45	51	60	56
Yes, do trust science %	31	40	45	43
Yes, for measured comparisons %	64	72	75	73

Table 7: Perception of abilities of science

It is apparent that the majority of participants agree with the requirements for measured before and after comparrisons which was highlighted by the O'Kane (2013) report. While this question identified that pragmatic WA sample (Figure 12) overall hasn't interpreted that science is politicised and has a stronger sense that it is if 100% proven acceptable (Note, 100% proven being debatable notion only) though interestingly still more inclined to think that bigger interest groups do win.

Cook et al,. (2013) have determined that building trust is key for securing social licence for any major resource project, requiring a transparent approach for the collection and dissemination of reliable data which is reinforced by Lloyd et al,. (2013). People are are likley to distrust information provided by industry or government as well as from research or academic bodies where there may be a perception of a close or dependant financial relationship with industry.

It is more likely that local communities are ready to accept information, which they deem to be credible if it comes from sources such as CSIRO or universities, then only if it satisfactorily determined that it is truly independent.

Cook et al,. (2013) have identified that there is an opportunity for stakeholders to increase trust by involving local people and landowners in the process of collecting and understanding environmental data.

Additionally, 44 percent of the submissions to the O'Kane (2013) report expressed concerns about the lack of data enabling a scientific understanding of the effects of CSG on the environment, human health and water. To be able to understand or build knowledge requires specific information or data from various sources, such as an activity in the system (including company reporting), specific monitoring programs and monitoring programs for cognate activities (e.g., water allocation or coal mining) and research projects. Without effective spatially enabled and open data repositories, the cumulative impacts of multiple activities (e.g., agriculture, mining, urban development) sharing the same space also won't be effectively analysed and monitored. The more extensive the data, the more sophisticated the capacity for modelling the likely impact of future activity proposals becomes.

The O'Kane (20130) review identified that monitoring, data management and data sharing are all key needs, noting not just an issue for CSG activities but for other major industries as well, such as mining and agriculture, whereby complex issues can be managed if high standards of operation and performance are in place; however, they need to be monitored effectively and the resulting data needs to be curated appropriately and be widely accessible.

Critics of any activities are right in pointing out that there are issues with identifying factual information, as the O'Kane (2013) expanded upon issues encountered by its own search for information, which is sought by other

agencies and the public. This usually exists in isolation within the specific area managing a component of the overall activity. Requests for information, both between agencies and from the public though, mean in many cases that portions of the data are provided in hardcopy or PDF form. Many government agencies have data available online but the data is generally dispersed over different departmental websites, often incompatible formats, making the data difficult to mine and manipulate. Increasing the difficult for various agencies, researchers and interested members of the community to extract useful knowledge from available data sources.

Advances in technology mean that governments increasingly have the ability to store and manage massive amounts of data through common data repositories and make all data in such repositories available easily and efficiently to groups that would benefit from access. Multiple data set access has many advantages for CSG, but also other areas of government, industry and research. Combining data from multiple sources enables fresh insights to be made allowing for research on major data fusion modeling, using heterogeneous data sources, which could be undertaken in critical areas such as the shallow-to-deep aquifer modeling to the for the benefit of UGC knowledge, an area of concern as identified by anti UCG proponents. (O'Kane, 2013)

Governments across the world are committing to guiding principles whereby it is in the public interests to generally disclose information '*open data'*, unless a string case to the contrary can be demonstrated. An idea that data and information should be open and accessible to the public, with any confidentiality and controls limited as much as possible, enabling source material for research, business and policy making, leading towards significant innovation and productivity benefits in the private, public and community sectors. The US has already set up data.gov, the UK data.gov.uk and Australia maintains data.gov.au (O'Kane, 2013)

Q14. What would be the reasoning of your opinion on Unconventional gases?
(Answered: 252, Skipped: 41)

Figure 15: Q14 Participant's reason for opinion of UCG

	NSW	QLD	WA	Average
Fact, based upon science / evidence %	66	61	55	50
Concern, in general for the environment %	22	11	16	23
Unsure, don't know a whole lot about it %	4	5	16	13
Discourse, have heard of protest %	0	9	5	6
Belief, certain that it is bad %	4	5	5	4
Perception, sounds and looks like %	2	3	0	6

Table 8: Participants ranked reasoning for opinion of UGC

As we have identified from examples being viewed throughout the particular project, measured a disconnect from empirical facts identifying that members of the public believe they are informed though as discussed through out this project in fact might not be.

Alternatively confessing in general to be concerned for the environment, a theme that ties in with Figure 11 where 47 percent inferred that the general consensus of UCG was negative, additionally believing that 35 percent are indifferent and 9 percent aren't concerned at all.

Q1. As humans do we have the capacity to overcome challenges and environmental risk in a sustained manner when extracting any type of mineral resource? (Answered: 288, Skipped: 5)

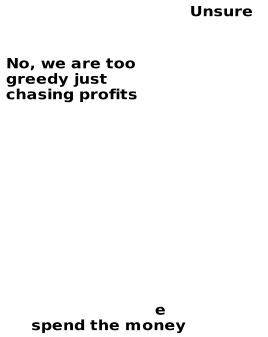


Figure 16: Q1 Abilities to overcome environmental risk when extracting mineral resources

Q13. As humans do we have the capacity to overcome challenges and environmental risks in a sustained manner when extracting any type of gas resource? (Answered: 249, Skipped: 44)

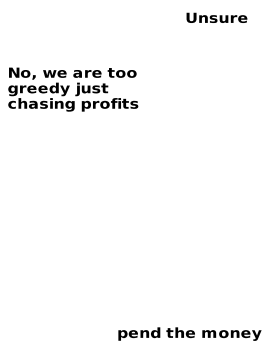


Figure 17: Q13 Ability to overcome environmental risk when extracting a gas resource

The question posed in Figure 16 mineral and Figure 17 gas, as aspects of the CSG narrative share a geographical proximity with area's of coal mining activities especially in the case of NSW, with an ongoing historical association with the coal industry, as participants where more likley to believe that we are more able to overcome environmental risk associated with mineral (35 percent) over gas (25 percent) resources. Most of the literature also links CSG with the Coal mining industry. Persons familiar with coal mining activities would know of Coal Mine Methane (CMM). A general term for all methane released mainly during and after mining operations. Methane captured prior to mining can also be considered associated to mining and is considered as coal mine methane, it can also be called CSG. CMM show's great variability in flow rate and composition, a typical gassy coal mine ventilation air may contain 0.1–1% methane, whereas gas drained from the seam before mining can contain 60% to more than 95% methane dependant on presence of other gasses in the coal seam. Gas drained from fractured formations above mined seams (gobs), may contain 30–95% methane depending on the locations of the boreholes and other operation and completion parameters (Karacan, 2009). Although ventilation air methane (VAM) from shafts of active mines contributes approximately 64% of worldwide methane emissions from underground coal mines, methane concentrations in the ventilation air are different for each mine. (Karacan et al,. 2011)

There are three primary incentives for recovering CMM. The foremost being improved safety of the mines (Ham & Kantzas, 2008). In recent years, with many fatalities in under-ground coal mine explosions whereby methane was a contributing factor. The second benefit, improved mine economics by reducing downtimes due to high methane levels. A third incentive is to reduce greenhouse gas emissions involving methane, being 21 times more potent than CO2. (Karacan *et al*,. 2011).

It is interesting to note that areas of extensive coal mining are seeing CSG protests by people long associated with coal mining, either open cut or underground. Both physically having the potential for more environmental issues than CSG extraction, an interesting comparison most likely due to the cumulative effects of infrastructure on agricultural land and its '*perceived*' ability to coincide with other activities, worth research of it's own outside the scope of

this project. Williams & Walton (2013) have pointed out that this co-existence important to the CSG industry as a whole for the purpose of supporting ongoing viability of the competing elements of the areas economy for maintaining social license.

Additionally, CSG production also requires continued pressure in the coal seam, meaning any proposed coal mining from the same seam must be delayed until abandonment of gas production (Norton Rose, 2012).

4.1.4

Q17 Focusing on the word 'Unconventional'. What immediately springs into your mind when you read it? (Answered: 250, Skipped: 43)

Figure 18: Q17 Word perception 'Unconventional'

'*Unconventional*' O&G is a dynamic concept, as by definition what constitutes unconventional will adjust as technologies render previously unconventional deposits more accessible. (Cull *et al.*, 2012)

'Perception barriers' can occur as individuals can view the same message or this case word in different ways. Factors, which can influence the perception, will include the person's level of education and region of experience. Perception problems can be minimised by using words that have precise meaning (Kerzner, 2013) Which leads us to question, has the O&G industry invited aspects of critical perception by using a word which essentially means different, fears of

the unknown? Reports of a leaked briefing note prepared for NSW energy and resources minister Chris Hartcher, recommends the phrase and its acronym CSG be replaced with the standard term '*natural gas from coal seams'*. Designed to '*improve clarity and consistency of the terms used to describe coal seam gas in departmental correspondence, communication and content*', stating that is simply an adoption of commonwealth terminology in an attempt of harmonisation, though slammed as '*Orwellian by terminology'* which won't demise concern as voiced by those against the activities (Nicholls, 2013).

Q3. Focusing on the word 'Fracking.' What immediately enters into your thoughts? (Answered: 285, Skipped: 8)

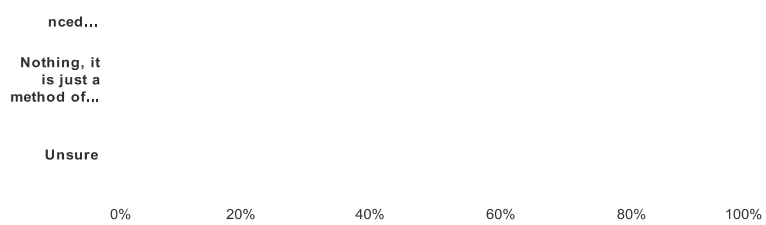


Figure 19: Q3 Word perception 'Fracking'

	NSW	QLD	WA	Average
Dangerous, convinced it is bad %	54	18	10	24
Nothing, method of breaking rock %	25	62	65	47

Table 9: NSW, QLD and average perception of Fracking

It was interesting to find that the NSW sample when asked to associate the word were convinced that it was bad. Which leads us back to the findings of Figure 9 which identified that we might be looking at concept of a 'fracking argument'.

Everley (2013) points to a strategy whereby he believes that critics are claiming that ‘fracking’ is just not the proccess of hydrualic fracturing, but instead the entire shale development process, including downstream proccessing including exports as identified. Such a statement has been attributed to Fox (2013) one of the key protagonist in the debate and director of ‘Gasland’ (2010).

Pyle (2013) argues that Fox’s redifinition is one of convenience, which allows him to used the word ‘fracking’ to indicate any part of O&G production, where as it is only simply one step, a well stimulation process in a wide process of developing many wells but not all wells, used to maximise the extraction of underground resources; including oil, natural gas, geothermal energy and in some places even water.

King (2010) also identified a concept of ‘bridging the language barrier’ where he explains that environmentalist critics insist that some ‘fracks’ have contaminated ground and surface waters while engineers insist that not one frack has ever contaminated ground waters; thus, a wide disparity in accuracy of the statements. King (2010) believes, surprisingly, both sides have valid arguments, but just a ‘mismatch of definitions’ with much of the turmoil concerning how each group defines fracturing.

In engineering terms, fracturing concerns a precise stimulation activity, limited to the fluid action in initiating and extending cracks in the rock; while, for many concerned citizens, bloggers and environmentalists, fracturing has come to represent nearly every phase of the well development cycle from drilling to production as expanded upon by Everely (2013).

Accuracy in any argument rests on defining the subject; in this case it is activities in gas or oil resource development. King (2010) has indicated that science behind well development activities, including fracturing, resides in about sixty thousand presented papers and peer-reviewed papers in the literature from a dozen or more engineering and geoscience societies, representing a hundred thousand engineers and scientists in the oil and gas industry, world-wide.

As stated by Miller (2013) whom comments on the US centric debate;

> *‘It’s one thing to grossly distort, exaggerate, or makeup data concerning oil & gas well development and facilities production performances in the*

name of an environmental cause, and it's another thing to claim that the vast majority of many State and Local Environmental Agencies and their staffs are apparently so grossly incompetent, failing to do their jobs to protect local environments and the general public. If I were a manager or representative of one of those State or Local Environmental Agencies I would be extremely disappointed and insulted by the exaggerated claims that up to half of all wells are grossly polluting the ground water, air or land for those operations my agency was responsible for. This includes not only developing and issuing the environmental operating permits, but also the responsibilities for inspecting and verifying that all the conditions of the permits environmental controls are being strictly adhered to'.

Everely (2013) has accused oponents of hydraulically fracturing to have taken a harsh sounding word 'fracking' and redefined it to mean what ever they want, which has created a situation whereby a perception is formed that 'fracking' causes water contamination, where as the actual truth is actually something completely different.

In reading the text of the ongoing Fox v. Pyle debate it was interesting to read Fox (2013) digress and point to the fault of contamination actually being due to the 'cement casing' associated with the wells over time, which he also defines as being a part of 'fracking'. Though he doesn't include in any of this texts any of the conventional O&G wells leaking in a similar manner, of which due to there overwhelming presence there should be reference material for him to back up his point, which isn't the case and a matter outside of the scope of this project.

Though we must be careful to cherry pick quotes from various conversations, as a single quote or statement can not capture the full context of a conversation, let alone explain the nuances of sciences, giving lead to the infamous saying attributed to Cardinal Richelieu when Cook (2013) was discussing the Climategate affair.

"give me six lines writtern by the most honest man in the world, and I will find enough in them to hang him"

4.1.5 History of the unconventional gas industry in Australia

Q46. At a guess, how long do you think the Coal Seam Gas Industry has already been operating for in Australia? (Answered: 228, Skipped: 65)

Figure 20: Q46 Participant's perception of the duration of CSG supply

The CSIRO (2012) fact sheest states that CSG has been in production in QLD from the Bowen basin since 1997 (10-15 years) and in the Surat Basin since 2005, which has correcty been identified by a greater margin of participants indicating that people don't belive that it is a totally new issue. In contract levels of concern and protestation have been accelerated by groups such as Lockthegate.org.au (2013) whom formed in 2010.

Perception of CSG duration in QLD	NSW	QLD	WA	Average
Identified 10-15 years %	45	37	21	31

Table 10: NSW, QLD and average perception of duration of CSG activities in QLD

Q47. At a guess, how long do you think Hydraulic Fracturing has been going on in Australia? (Answered: 228, Skipped: 65)

Figure 21: Q47 Participant's perception of the history of Fracking activities in Australia

Hydraulic 'fracking' has been used by the O&G industry since the late 1940's, to increase the rates and total amount of O&G extracted from reserves. It has been used to enhance CSG production since the 1970's in the US and used widely in Australia since 1990 (CSIRO, 2012) with in the Geothermal and gas industries primarily for the stimulation of conventional gas wells in SA and QLD, with CSG fracturing in NSW and QLD. The 23 year time frame hasn't been recognised by the sample population whom have indicated a perspective that it is a more recent activity.

For the perspective of Figure 20 & 21, the timing of information is critical to impressions we form. As an example, information heard first tends to be resistant to later contradictory information. As it is supported by Miller & Campbell's (1959) research, we are correct in assuming that 'first impressions count' it is referred to as the 'the primacy effect'. Additionally Hodge (1974) has shown that a negative first impression is more resistant to change than a positive one. However, upon a break of time a person is more likely to remember the most recent information termed the 'recency effect'.

Q48. At a guess, what percentage of total gas market would you think the CSG industry supplies in Queensland, Australia? (Answered: 231, Skipped: 62)

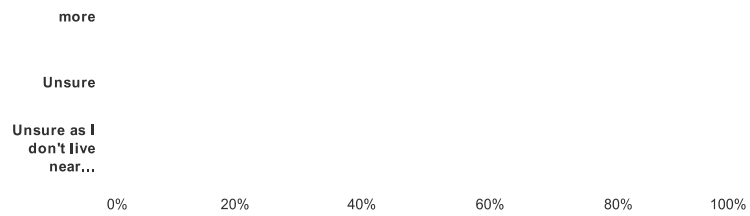


Figure 22: Q48 Participant's perception of levels of CSG supplies to QLD gas market supply.

The QLD DNRM (2013) Department of Natural Resources and Mines have indicated that QLD CSG annual production figures between 2011-2012 to be 254PJ. By comparison, QLD annual consumption is around 240PJ of gas for domestic and industrial use, including power generation (Arrow Energy, 2013). Queensland, CSG currently provides approximately 90 per cent of gas needs (Origin, 2013)

Perception of CSG supply to QLD	NSW	QLD	WA	Average
Identified 80 percent or more %	12	7	5	6
Identifed 20 percent or less %	24	30	31	27

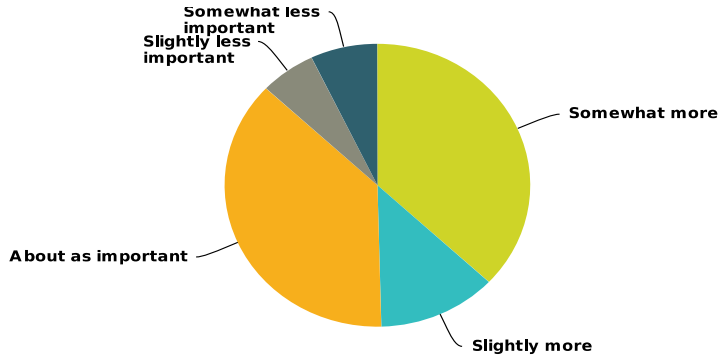
Table 11: Perception of CSG supplies to QLD gas market

The majority of the sample population seem to be totally unaware that CSG is already the dominant gas source for QLD gas markets, it was interesting to note that most participants by a wide margin had selected 20 percent or less which is a total contrast to the facts, especially in QLD where CSG unknowingly the key

supply.

4.1.6 Global warming and methods of mitigation

Q32. Is reducing global warming more important than improving the economy? (Answered: 254, Skipped: 39)



al 254

Figure 23: Q32 Participant's priority of global warming mitigation v. improving economy

Q25. Would using natural gas which could potentially reduce our CO2 emissions by say 40% instead of coal be acceptable? (Answered: 250, Skipped: 43)

Responses

Figure 24: Q25 Perception of reducing coal CO2 emissions by substitution with natural gas

The global warming debate is separate to this research, though the narrative is still a topic of discussion for all stakeholders as proponents point to an argument that UCG development can benefit the reduction of CO2 emmissions with in the global sphere.

Though we must be mindful that large LNG facilities are energy intensive for the purpose of reducing the gas volume by 1/600th prior to shipping as discussed in Figure 29, an aspect which isn't ignored or disputed by the governments or industry. The CSIRO (2012) have indicated that natural gas does have a role in supporting the journey towards lower or zero emission reneweable energy sources having a direct range of purposes for heating, and powering fast resopnce electricity generating turbines. The temporary transition as identified by 34 percent of the sample.

Q11. Do we utilise a resource of our own when it can benefit the wider world by contributing to the reduction of global CO2 emissions? (Answered: 248, Skipped: 45)

Figure 25: Q11 Using a resource in our area assisting reduction of global CO2 emissions

Resource use in our to reduce global CO2	NSW	QLD	WA	Average
Yes, part of the bigger picture %	31	82	88	60
No, CSG unacceptable at any cost %	57	12	5	23

Table 12: Perception of using a resource in our area to assist global CO2 reduction

It was interesting to note that a great deal of the NSW sample were against CSG at any cost, as possibly concerned by a perspective that CSG would be

too detrimental to their own local environment. When the question was filtered by Figure 5 (participant's association with the UGI) Only 23 percent (56 participants) of the sample identifying as concerned public, while 73 percent (26 participants) being primary producers were of the opinion of non CSG at any cost. Lloyd et al (2013) has identified that society faces many challenges for sustainability within a world in transition, which demands an urgent call for research and development towards mechanisms that allow science and society to address decision making and the needs of citizens at global, regional, national, and at local scales (Reid et al,. 2010)

Q56. What would you guess the percentage reduction of CO2 emissions when burning natural gas compared to coal. (Answered: 219, Skipped: 74)

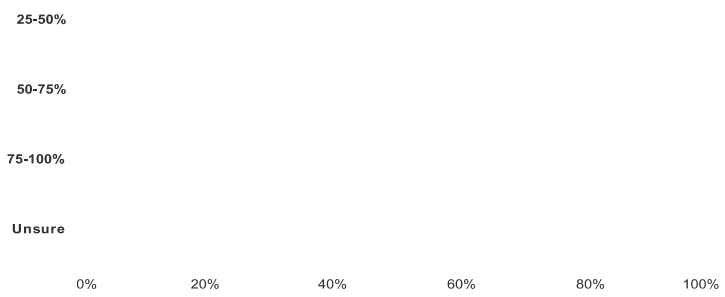


Figure 26: Q56 Participant's perception of CO2 emissions substitution of gas for coal

An ongoing debate, as the identified in Figure 24, the CSIRO (2014) have identified that natural gas burns more efficiently than coal or oil and can emit less greenhouse gases at the points of extraction and combustion, against which anti UCG proponets point to the fact that associated activities such as production, processing, transport and distribution adds to the total emissions. Cook et al (2013) point out that total lifecycle analysis (LCA) of emissions is very sensitive to substantial differences at well completion, which can be

mitigated at the well completion stage ‘green completions’ capturing the gas emissions or flaring rather than historical practices of venting.

A complicated aspect, as pointed out by Cook et al (2013) identifying that UGC emissions are clearly identified as being 20-30 percent higher than that of conventional gas, as presently installed though with the uptake of higher effiency gas generation plants combined cycle gas turbines (CCGT) will have up to 50 to 75 percent of the emissions of black coal as COSPP (2010) are indicating efficincies breaking once unheard of 60 percent efficiency barriers, which reduces the over all ammount of gas required for the same ammount of wattage output. Where was the older existing open cycle gas turbines produce 70 to 90 percent of black coal emissions. Presently Australia only generates around 15 percent of it’s electricity from gas (Leather et al,. 2013) but we could comfortably point to a figure of emissions reduction in a band between 25 -50 percent as identified by most of the sample. Australia could gain from efficiencies of gas alone, in an advantage for reducing emissons if such a transition occurs which is acknowledged by the sample in Figures 27, 28 and 29.

The same can be said from research by Lloyd et al,. (2013), having stated that improved scientific knowledge of the industry and it’s potential impacts, in the popular view, enable better comparison of power generation effiency with coal and renewable energy sources and better comprehension of the industry as a transition energy industry. As it will serve to enable elected representatives and policy makers to make more informed decisions while developing appropriate legislation to ensure a sustainable future.

Q53. Statement: “For the end user, Natural gas emits half as much carbon dioxide as coal when used to make electricity”. Do you think there would be an advantage in burning gas obtained from Coal Seam Gas (CSG), rather than going to all the effort of digging up and burning hard coal? (Answered: 216, Skipped: 77)

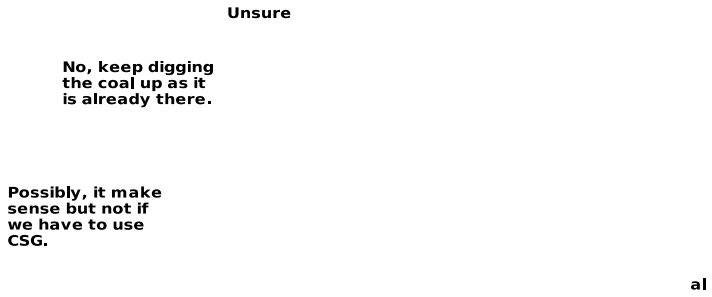


Figure 27: Q53 Participant’s perception of burning CSG rather than hard coal

Anti-UCG proponents and some of the published literature published within the debate of resource emissions often failed to compare the aspects associated activities such as production, processing, transport and distribution of coal with the multitudes of complicating variables adding to the total emissions due to relative calorific value by volume weight / density and differing grades of coal.

Q70. Read the following statement: ‘Unlike renewable energy, natural gas is reliable and flexible – unaffected by weather, night or day, serving to provide a constant source of power, with reduced emissions compared to coal and the benefits of easily been able to turn on and off to meet spikes in demand or to fill gaps in other forms of power production (Such as renewables)”. Would you agree with this statement. (Answered: 207, Skipped: 87)

Figure 28: Q70 Participant’s perception of flexibility whereby natural gas aids renewables

Q55. As acknowledged by government and industry, the production of LNG whereby freezing gas to 162 degree's centigrade, shrinking its size by 1/600th for subsequent shipping and transportation uses a great deal of energy. This energy will release CO2 emissions with in the regions where the gas is processed before it is shipped. Do you think this is acceptable when factoring into the overall global picture? As exported gas might serve to offset burning coal elsewhere in possible less developed countries. (Answered: 217, Skipped: 76)

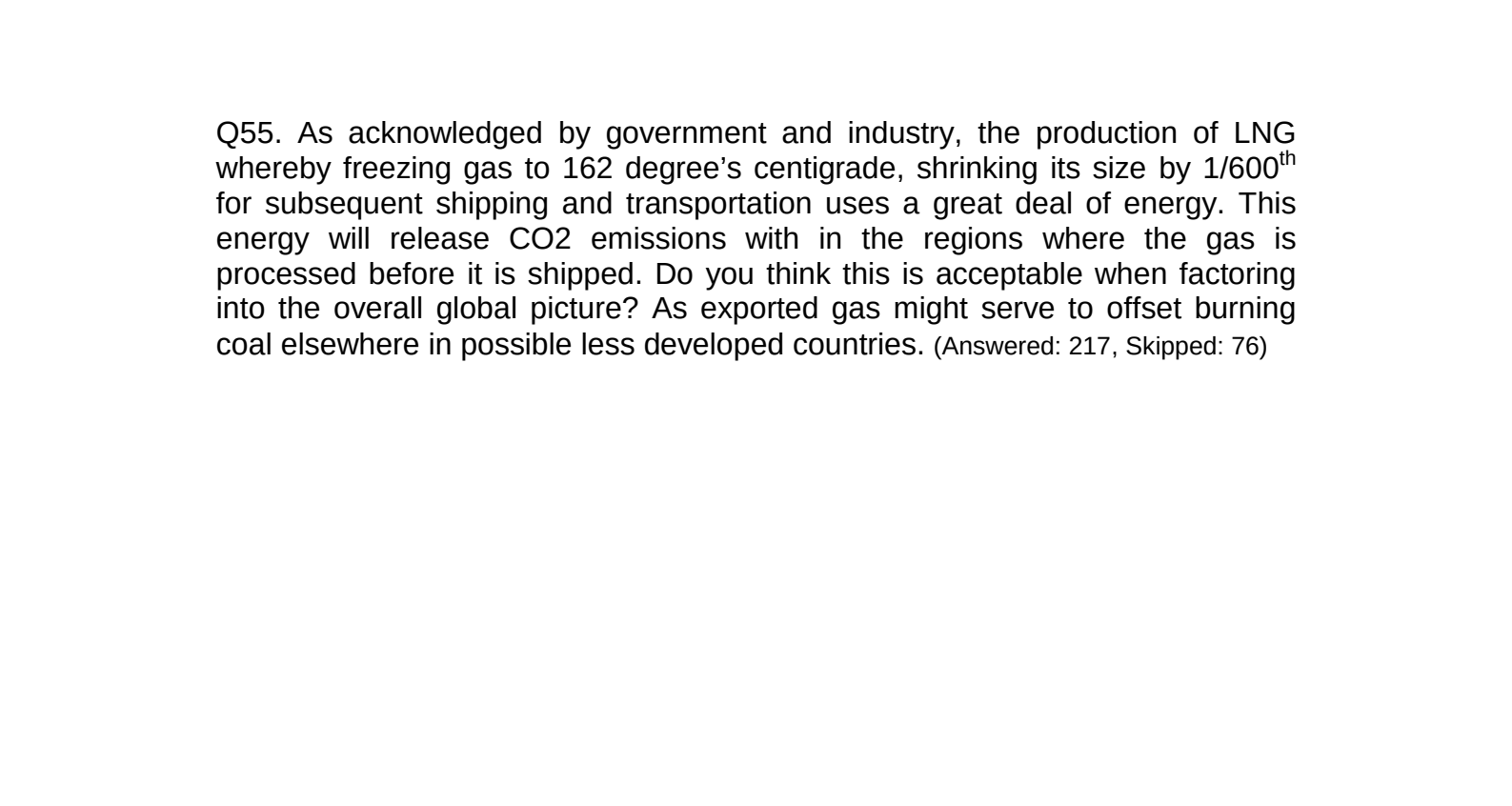


Figure 29: Q55 Participant's perception of the points of release of CO2 emissions

Llyod et al,. (2013) claim that this present decade is claimed to be the 'critical decade'. Whereby it is understood that 'human society' needs to be able to adapt quickly to rapidly changing global social and environmental conditions, and that any community that lacks adaptability to its changing environment can compromise it's own viable existence (Lebel et al,. 2010), of which the same can be said of any commercial enterprise involved in the UGI.

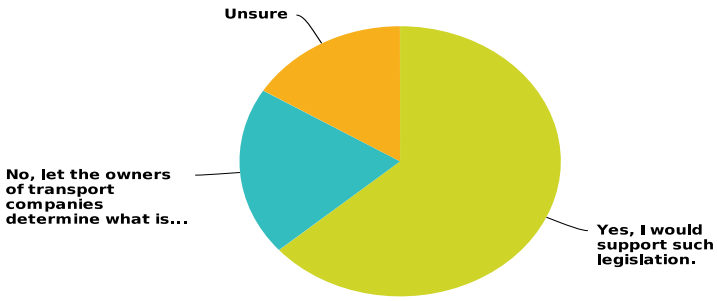
Figure 29 has served to identify that the majority of the sample are pragmatic and realised that globally we share the same atmosphere, while a portion of the sample state that it isn't acceptable to create more CO2 close to the source, we can identify through filtering of the survey that this result mainly correlates with those against CSG activities. Can we then declare, that there may be a price to pay for group cohesiveness, as individuals minimise there differences, while they seek to maintain there group identity, which can lead to development of stereotypical and conformist behaviours within a group, and to the stereotypical perceptions of other groups (Llyod et al,. 2013). For example, the acronym 'NIMBYism' – 'not in my back yard' - whereby persons would rather see a

specific activity somewhere and someone ‘else’, rather than it being ‘their’ problem.

Q54. Statement: “It’s widely acknowledged that USA carbon emissions have fallen by 12%, from a 2005 high back to levels used last in 1994 by the end of 2012. This has been attributed to a ‘downturn of the US economy’, ‘new fuel and economy and new motor vehicle standards’, ‘energy efficiencies’ as driven by businesses wanting to save costs, ‘energy conservation’ of homes and businesses. But it is widely recognised that the main factor is the uptake of ‘fuel switching’ whereby power stations are now burning and abundant US resource of Shale Gas, greatly reducing an historical reliance upon coal.” What is your impression of this statement? (Answered: 218, Skipped: 75)

Figure 30: Q54 The reinvention of the US energy landscape & reduction of CO2 emissions

Q41. Would you support government legislation, known as “Direct Action” whereby new heavy vehicles on our roads (Buses, Trucks, etc.) are required by law to operate on fuels such as LNG or other gases, which could serve to reduce our emission levels? (Answered: 228, Skipped: 65)



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Total 228

Figure 31: Q41 Policies of direct action for utilization of LNG for heavy road vehicles

Q42. Global warming reduction:
Carbon Tax is where big companies pay a set fee for carbon credits, to offset any pollution caused by their activities.
Direct action is where is where rules are put in place and enforced. I.e. Standards increasing the efficiency of vehicles, power stations, smarter technology or limits of allowable pollution.
Which government regulatory style do you think would work best towards reducing our CO2 footprint? (Answered: 228, Skipped: 65)

Figure 32: Q42 Carbon Tax verses Direct Action

Q50. Are you of the opinion that man-made activities DO have an impact upon global climate change? (Answered: 221, Skipped: 71)

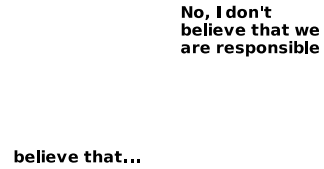


Figure 33: Q50 Participant's perception of mans activities affecting global climate change

Q22. Hypothetical Question: If we could NOT 100% utilize renewables in the future; rank what would be your preferred choice for producing electricity towards minimising CO2 emissions. Rank 1 as your first choice and Rank 6 as your last. (Answered: 249, Skipped: 44)

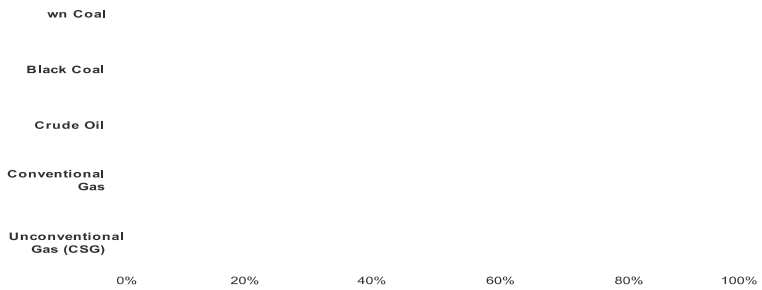
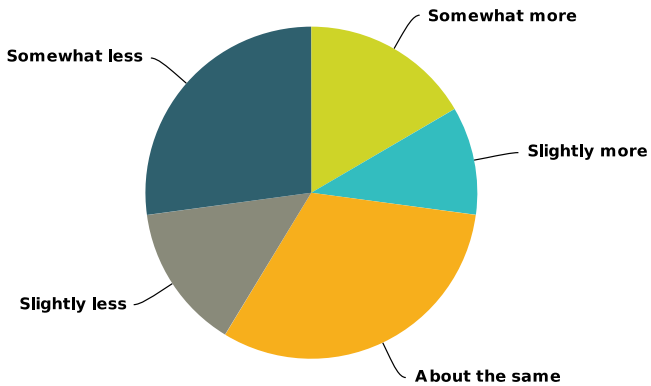


Figure 34: Q22 Participant's preference non-renewable resource if unable to use renewables

It seems that most of the sample were unaware of the present US narrative and reduction of US emissions as discussed in Figure 30 and the aspects of the associated fuel switching which most of the sample agreed with as suggested in Figure 31. The Australian carbon tax narrative, supported only by 20 percent is an emotive topic, at times descending into a debate of ideological concensus, rather than science and analytical method. The recently elected federal government ran a platform of abolishing the specific tax, which has co-incided with this project as the survey began before the election date was announced, though both the project and Vote Compass (2013) determining, most of the participants DO identify that man made activities affect global climate change. Nevertheless, the results of rankings for energy sources in Figure 34 were interesting. I was surprised by the high preference for Nuclear which the incoming government urging the resource industry to back nuclear (Barrett, 2013) and that UGC preferences ranked so low with in the mix, at times below coal.

Q12. Do you think unconventional onshore gas exploitation has a greater environmental impact than mining and burning coal? (Answered: 247, Skipped: 46)



Somewhat less

Total 247

Figure 35: Q12 Participant's perception of environmental impacts of UGI compared to coal

	NSW	QLD	WA	Average
Somewhat + Sightly more %	43	20	21	26
About the same %	36	20	22	31
Slightly + Somewhat less %	20	59	55	41

Table 13: Perception of environmental impacts of UGI compared to coal

Again, a narrative which was observed in Figure 16 & 17 whereby the sample in NSW are of the perception that UGI activity impacts are increasingly or having a similar detrimental affect upon the environment, above those of coal mining activities, even though coal mining has a greater footprint area of affect, creating dust and air pollution. The CSIRO (2012) have also identified that the surface footprint of CSG infrastructure is much less than that of mining. With 20 percent of the NSW sample group in the opposite effect of the other averages identify with coal being slightly or somewhat less detrimental.

4.1.7 Environmental concerns

Q51. A common list of concerns as identified by participants of the UCG debate, please identify if you think that they are a real and valid concern. (Answered: 218, Skipped: 75)

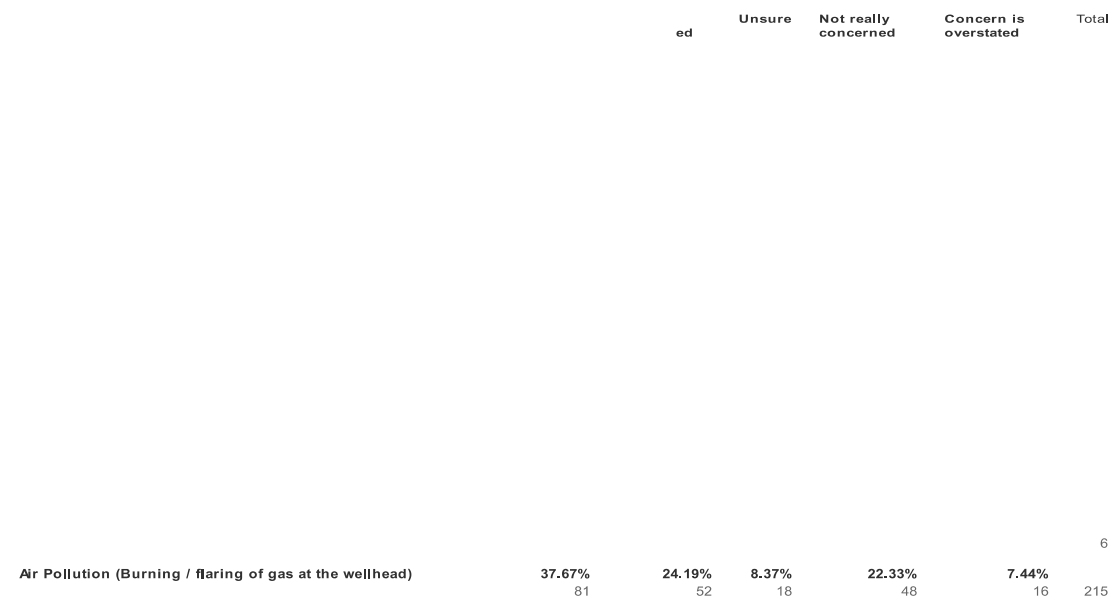


Figure 36: Q51 Participant's levels perception of UGI aspects of concern

There are various aspects of concern of which are fare too wide to elaborate upon the scope of this specific project. Though it is obvious that some people would only state a concern when prompted of the subject to do so, otherwise they in fact might be unaware of the issues, which might have been the case of missing validation of APPEA survey as discussed in Figure 6.

4.1.7.1 Flora and Fauna

Q62. Critics have highlighted impacts for local areas, as well as upon Flora and Fauna (Plant & Wildlife) as well as social aspects in areas which might initially have high levels of activities when UCG wells are first build and constructed. Please state your levels of concerns. (Answered: 219, Skipped: 74)

Figure 37: Q62 Participant's perceived of impacts upon areas of UCG activities

In accordance with results so far, I fully expected the sample frame would have some affinity with environmental aspects and would subsequently express levels of concern associated with the impacts of physical activities performed by the UGI. UGI have a stated goal or earning and maintaining social licence, which is entirely dependent on the minimisation of the risk of any potential impacts with careful management of the distribution of developments. These developments may fragment local habitate and agricultural landscapes and on a social level compromise the scenic and aural quality of the landscape (CSIRO, 2012).

The OECD/IEA (2012) '*Golden rules on Unconventional Gas'* point to companies drill '*watching where they drill'*, with well sites selected to minimise the impacts on the local community, heritage, existing land use, individual livelihoods and ecology.

Numerous aspects have been identified as per Figure 36, which have also been discussed in a book by Manning (2012), though many aspects of points raised have been collectively identified and again broadly defined as '*fracking*', in a similar manner to Figure 9 and 19. Again by reviewing reviews and the applicable literature, a large deal of the concerns have in fact been disproved.

With full disclosure as discussed within the literature review, transparent engagement with local representatives, residents and other stakeholders throughout all stages of development starting prior to exploration would serve to obtain '*social licence*.' Providing sufficient opportunity to comment on plans, operations and performance, full disclosure of data with adequate measures of associated aspects, listening to and not discounting concerns, responding appropriately and promptly. Aiding in the minimisation of disruption during operations with a broad view of social and environmental responsibities, ensuring that locals also gaining economic benefit rather than increasing a perception of being marginalised in their own communities OECD/IEA (2012) .

4.1.7.2 Ground and surface water

Q65. We are all aware that that at time Australia can be a dry and arid environment, whereby water is a precious commodity. Agriculture accounts for above 50% of all groundwater extracted from the Great Artesian Basin (A giant Australian underground supply of water, spread under large eastern parts of the country Unconventional gas production is said to account for 4% though companies are have stated a determination towards minimising impact. The Queensland Government Department of Environment and Heritage have recommended the beneficial uses of treated and cleaned product water from the production of CSG as listed bellow. What do you think of these ideas? (Answered: 206, Skipped: 87)

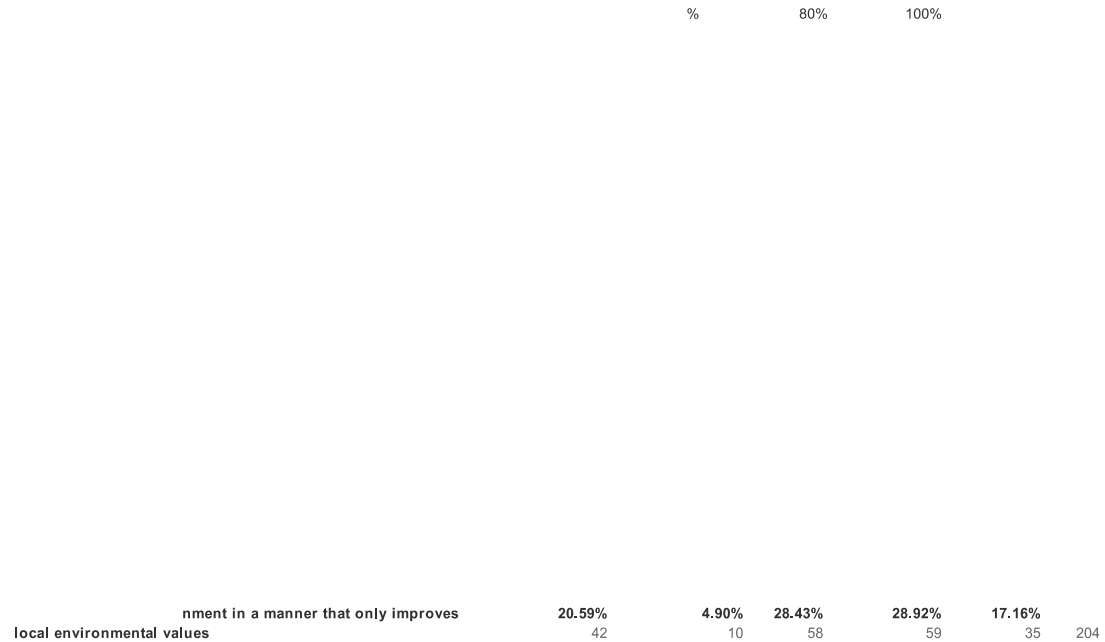


Figure 38: Q65 Participant's perceived of impacts of UCG treated product water

Australians realise that our continent is one of environmental contrast, with periods of drought as well as flood inundation which makes water management and control exceptionally difficult.

Most of the sample frame haven't indicated a great deal of familiarity with particular aspects of the industry and how it is conducted in other parts of the world which share a similar narrative, though movies and documentaries such as '*Gasland*' and '*Fracking Hell: The untold story'*, and other numerous efforts which can be viewed at http://frack-off.org.uk/fracking-hell/watch-the-film/ have served to paint an unpalatable perception of which no responsible person would want in their local environment, aspects which we have discussed in Figure 9 and 19.

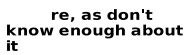
As we have identified in Figure 21 the differences of CSG and shale activities, whereby CSG wells will often produce volumes of product water, volumes and qualities which will differ from well to well. In QLD average wells have produced 20,000lts of water each day which will up and down scale over time. (CSIRO, 2012) The targeted CSG product water is not artesian water, it is actual water from the specific coal seam as described in Figure 7. The water is naturally brackish (1/6th the saltiness of sea water), containing dissolved sodium chloride, sodium bicarbonate and traces of other compounds though it can be treated for a variety of surface uses or alternatively for aquifier recharge, which can be an energy intensive process affecting the financial outcomes of the well and additionally produces a waste stream of super saline brine water which will have to be disposed of or treated to produce a commercially usable salt (CSIRO, 2012). Such water treatment facilities are factored into the cost and developments associated with CSG activities.

Once the salts are removed and the acidity is balanced, the CSIRO (2012) and the EPA (2010) are confident that the potential impacts of such water on agriculture production and the surrounding ecosystem function are in all likelihood managable via appropriate mechanisms for use or disposal and potentially used in a multitude of beneficial ways as alluded to by Williams et al,. (2012) in manners as outlined and recognised by respondants as noted in Figure 38.

Whereas the fracking process for shale and tight gas reserves requires a substantial supply of water, especially the slickwater fracturing process which appears more cost effective for high pressure formations giving rise to competition for water supplies. It is possible that some shale formations will produce water, in much the same way as occurs for coal seam gas wells. The

substantial quantities of saline fracking wastewater pumped back to the surface will typically contain a high level of total dissolved solids and contaminants and, together with any produced water volumes, will need to be treated and disposed of. As re-fracking the shale is often required over time to maximise recovery, water management will be an ongoing and expensive operation. These are emerging issues and the regulatory environment will constantly evolve (Cull et al., 2012).

Q26. Drilling a bore for either groundwater or gas, are the risks of dissecting different layers of geology causing contamination of artesian basins (underground water) the same? (Answered: 253, Skipped: 40)



Answer Choices	Responses

Figure 39: Q26 Perception of the difference of drilling risk fresh water v. UGC well bore

As discussed by Fox v. Pyle debate of Figure 19. Interestingly Fox (2013) digresses, pointing to the fault of contamination being due to the cement casing associated with the wells, which in my view raises concern with the activities of drilling in the regions of shallow and dispersed CSG reserves of both historical and new water bores. How stringent are the regulating standards for water bore construction, which could unintentionally extract water from a CSG seam? O'Kane (2013) has noted that NSW has a long history of drilling water wells across the state for different purposes, where it is also the case that the types of drilling muds (bentonite stabilisers) being used are also changing, but believed that the present codes for drilling and installation of wells / bores are well established.

Primary producers, and persons identifying as environmentally concerned, have drilled in areas which have long relied upon and supported the drilling of water bores all over the great artesian basin by means of a some would say Voodoo *'science of water divining' or 'dowsing'.* Whereby a revered community member, being the '*qualified person'* wanders around with a bent coat hanger or in some countries a branch determining the best position and likely depths, so a local land user can complement their surface activities by identifying a ready water resource. Is this method, long accepted by members of the community sufficient enough to warrant sanctioning as a valid scientific method? Unlikely, but still it persists. (USGS, 2013*).*

It is interesting to note, when filtering this question by Figure 5 using the feedback from primary producer sample that an increased amount of 46 percent identify the risks as being different and 25 percent unsure, which states that they are confident that these activities are different, a concept, which I believe warrants further investigation.

Q28. How concerned are you with detrimental effects upon artesian ground water, such as water level depletion and irreparable water contamination. (Answered: 254, Skipped: 39)

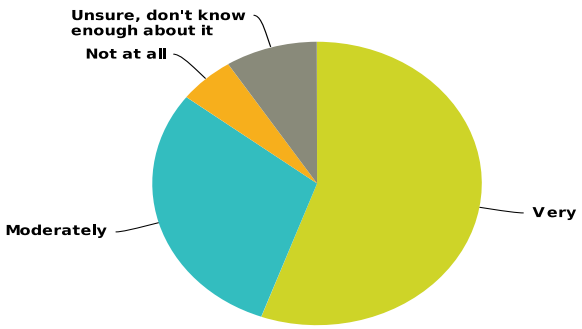


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Figure 40: Q28 Participant's concern of detrimental affects upon artesian ground water

Modelling large underground water systems such as the GAB, Surat and Bowen basins is challenging due the basin size and scarcity of groundwater data in sparcely populated regions. The CSIRO (2012) believe that the general principles of hydrology are well understood, gaining insights of groundwater behaviour by analysis of historic impacts upon the GAB.

Predictions of specific impacts of CSG will likely require ongoing research, as groundwater response might take decades or centuries to move slow velocity flow through aquifiers. In the case of cross contaminiation of aquifiers due to CSG water extraction, it is unlikely, as inter-aquifier transfer will be of a higher quality water, into neighbouring coal measures as water flows from high to low pressures (Habermehl, 2010). That may result in ground water depression and reduced volume in water aquifiers which can be monitored over the long term to help identify potential for well leakage into aquifiers (CSIRO, 2012).

In 2010 the National Water Commission (NWC, 2012) issued a position statement on CSG and water issues, driven by concerns, having additionally been reflected in this project by Figure 40, whereby cumulatively 85 percent of the sample was very or moderately concerned by detrimental effects of potential risks to water resources, particularly the cumulative effects of multiple projects and noting that objective information on CSG co-produced water volumes and management options wasn't readily available in the public domain.

The study performed by Lloyd *et al*,. (2013), indicated a recurring message from affected communities, with a common citizen demand being the cessation of the industry until there is better understanding of underground water system interconnectivity, along with methane extraction and processing lifecycle Thus making a distinction from the findings indicated by this project.

CSG development and regulatory responses have progressed rapidly, with substantial legislative, regulatory and organisational reforms occurring in Queensland and NSW. Federally, the Senate Rural Affairs and Transport References Committee released its interim report on CSG impacts, the Standing Council on Energy and Resources (SCER) agreed to the development of a national harmonised regulatory framework for the CSG industry, building scientific evidence with understanding of the impacts on water resources of extractive industry activities to underpin bio-regional assessments and improve the standards of regulation of these industries which has also been discussed in length by Williams *et al*,. (2012)

Due to intense public interest in CSG development, various estimates of co-produced water volumes have been published over the past year, based on different methods and available data. With a published estimate of 300GL/Yr

based on an assessment of average water production per energy unit in each production basin, for CSG reserves that will be, or potentially developed. This '*water to energy ratio'* method was chosen at the time, because energy information was widely and nationally available.

The Commission also encourages the industry to continually release actual co-produced water data in an accessible format over the entire CSG life cycle (exploration and testing, dewatering, production), along with other baseline ground water monitoring data, as an essential element for broader and more transparent reporting (NWC, 2012).

4.1.7.3 Fracking concerns upon health and pollution

Q57. Fracking Chemicals (Sometimes termed as Frack, Fracking, Fracturing) people are concerned by what they hear about "Fracking Fluids. Which us stated by gas companies to comprise of about 99% water and sand, is pumped down the well under pressure. The water in the fracking fluid forces the coal seams to open and the sand keeps the fractures open, providing a pathway for gas to flow more easily to the well (A pipe which brings the gas to the surface). The remaining one percent is made up of chemical additives, of "Fracking Chemicals". What are your thoughts on these chemicals? (Answered: 215, Skipped: 78)

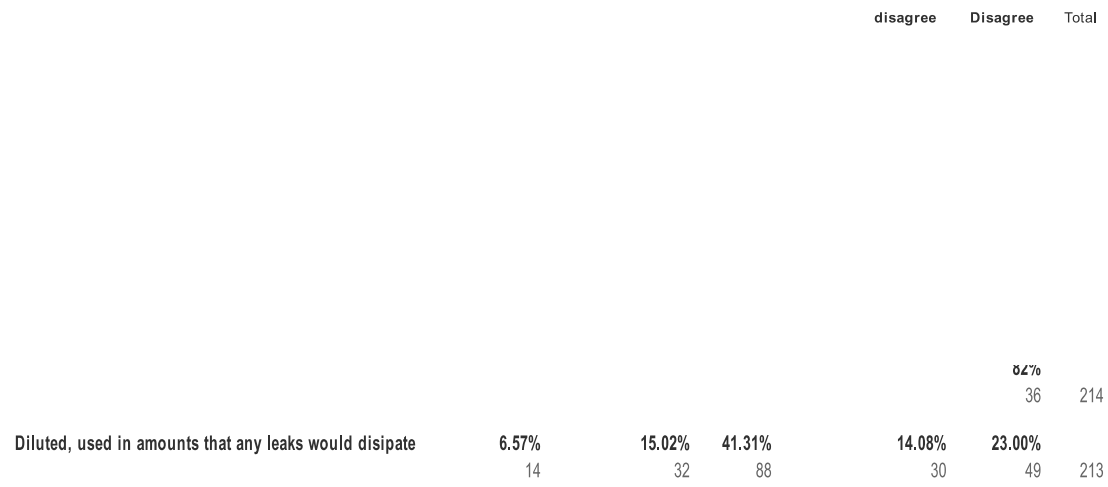

Figure 41: Q57 Participant's perception of Fracking Chemicals

The average samples result as indicated above doesn't particularly identify any overly concerning perceptions with the majority identifying as unsure. When the sample is filtered to identify primary producers, those most reliant on artesian waters, it was identified that over 60 percent believe that fracking chemicals are dangerous to the environment, unregulated, poisonous and in general unsafe. Additionally, 60 percent of the NSW sample believes that fracking is dangerous to the environment.

The discussion is a wide and contentious issue though leans back to the concept of the '*fracking argument'* whereby the community consensus is possibly maligned due to an ideology or specific values, rather than science and analytical method. Figure 41 is discussing the associated chemicals, rather than the complete process. Habermehl, (2010) has identified that the potential risks posed by fracking are low, discussing aspects of structural integrity of the targeted coal seam, other aquifers and aquitards though makes no mentioned of the chemicals used in his summary of impacts for CSG extraction.

It is fair to say as identified by King (2010), much of the concern and subsequent furore over fracking and frack waste disposal creating the '*fracking argument*', was largely driven by a lack of chemical disclosure and the pre-2008 laws of some US mainland states, which served to undermine any base of industry credibility before the UGI had identified that they had to '*gain and maintain a social licence to operate*', exacerbate suspicions of an already poorly perceived industry trying to deliver a message that changes have been made with efforts of re-assurance that chemicals aren't harmful, an issue that was helped since many regulators and governments were seen to be complicit whom were viewed as late in efforts of curtailing BTEX chemicals.

BTEX Chemicals as indicated by Leusch & Bratkow (2010) are natural occurring compounds in crude oil. Benzene for example is found at levels up to 4 g/L in crude petroleum, and can be found in seawater (0.8 ppb) in the vicinity of natural gas and petroleum deposits. Other natural sources of BTEX compounds include gas emissions from volcanoes and forest fires.

Once released in the environment, BTEX compounds usually evaporate quickly into the air and can also dissolve in water, being found in surface and groundwater at contaminated sites or in close vicinity to natural oil, coal and gas deposits. With the primary man- made sources of BTEX into the environment via emissions from motor vehicles and aircraft exhaust, losses during petrol marketing, spills and cigarette smoke. They are created and used during the processing of refined petroleum products, coal and during the production of chemical intermediates and consumer products such as paints and lacquers, thinners, rubber products, adhesives, inks, cosmetics and pharmaceutical products.

BTEX- containing petroleum products, such as diesel have been used as additives in stimulation fluids '*fracking fluids'*. Well stimulation is used to increase production in oil and gas wells by improving the flow of hydrocarbons into the oil well. Fracking fluid consists mostly of water and sand but small amounts of additives are used to thicken the fluid and improve the efficiency of the process, thus reducing the need for excess water use. The use of BTEX as an additive in fracking fluids has in the past been permitted in coal seam gas extraction, since 2003 the US industry has voluntarily agreed to discontinue using BTEX due to the availability of safer alternatives. In QLD, and the rest of Australia BTEX is already strictly regulated and must not be used in stimulation fluids in amounts greater than that provided by the legislation.

Use of BTEX in fracking fluids is out of favour due to the availability of safer alternatives. Though if BTEX were used, it is unlikely to significantly contribute to contamination of drinking water from groundwater sources. Groundwater in the vicinity of natural oil, gas and coal deposits may however contain elevated levels of naturally- occurring BTEX compounds. The local geomorphology and possibility of creating hydraulic connections between coal seam and nearby groundwater is taken into account prior to fracking. (Leusch & Bratkow, 2010).

We have already identified in Figure 9 concerning CSG, which the NSW DPI (2013) website fact sheet, stating '*less than 5 percent of CSG wells are fracked and in all likelihood it is less than 10 percent ever will be'.* Measures are taken to identify the numbers, concentration and volumes used for any well development, likely being Shale or Tight gas production, where they are used in development and NOT exploration wells, as well as the risks, likelihood and consequences of injected chemicals affecting the beneficial use class of the target aquifer or any other aquifer (O'Kane, 2013).

Workers handling such chemicals are aware of the Chemical Abstracts Service (CAS) unique international standard numbers, outlining potential human health risks arising from exposure of the individual components which, as well as the likelihood of surface spill which is more likely during transportation to the well location (King, 2010), as the chemicals formula is mixed as it is pumped into the well, at the '*fracking*' event. Companies and workers alike are risk adverse, which can be attributed to historical aspects of asbestos exposure and litigation, whereby people naturally will protect their own health above a job function.

4.1.7.4 Exclusion zones

Q60. The New South Wales (one of the eight states of territories of Australia) Government has recently called a moratorium, whereby drilling activities can't be performed with in a 2km radius of a residential area. Do you think this is acceptable or excessive? (Answered: 220 Skipped: 73)

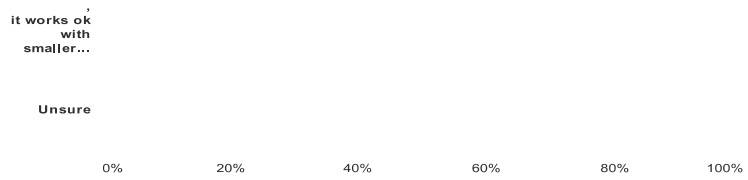

Figure 42: Q60 Participant's perception of exclusion zones for UGi activities

NSW Premier Barry O'Farrell who desires a sustainable CSG industry, declared country towns and suburbs across the state '*no go zones'* for CSG. Establishment of two-kilometre exclusion zone, imposed around residential zones and distinguishing Critical Industry Clusters, such as viticulture, equine industry, as well as lands identified for future residential growth. Applying to any CSG activity not yet approved under the EP&A Act or the Petroleum (Onshore) Act. Preventing new CSG exploration, assessment and production activities (surface and underground). In a move seen as populist, detaching from the former Labor Government's granting of CSG exploration licenses with no regulation over residential zones and scant regard for local residents or the environment (NSW Government, 2013) tying into the narrative described by OECD/IEA (2012)

	NSW	QLD	Ave	Primary producers
Should be larger %	60	30	37	67
About right %	20	32	30	17
Excessive %	14	30	16	7

Table 13: Perception of the 2km exclusion zone as mandated in NSW

Again, we can see NSW and primary producer samples still aren't satisfied.

4.1.7.5 Methane

Q33. Unconventional gases in their nature are made up of 95% of methane. So any leaks from wells, pipes and infrastructure are viewed to be adding to global warming. Though there are also other sources of escaping emissions. In your opinion what is the validity of concern for the following? (Answered 228, Skipped: 65)

Figure 43: Q33 Participant's perception of fugitive methane emissions sources

Q34. Fugitive emissions: Critics of the unconventional gas industry say companies are irresponsible and don't always repair their equipment properly. Companies say they are concerned by leaks of gas from their equipment, which are a loss of a product that they want to sell, stating of course they want to act towards stopping any leaks, as leaks reduce their profits. What is your opinion? (Answered: 231, Skipped: 52)

Figure 44: Q34 Participant's perception of fugitive methane leakages

Figures 43 & 44 serve to outline concerns over aspects of methane leaks, which have been identified by critics of the UGI, though a pragmatic perspective has been identified by the sample that companies do from an angle of safety and for profit preservation, plug and attend to leaks.

The University College of London and the University of Adelaide have recently prepared a joint proposal to develop cost-effective remote sensing and ground truth technologies to detect GHG emissions (Cook *et al*,. 2013) which could be mandated, then retro-fitted for monitoring of all wells for baseline data atmospheric GHG monitoring and subsequent measuring of fugitive methane emissions, performance data collection in conjunction for alerting owners of the specific wellheads of any adverse issues.

A recent study, by University of Texas where the authors state they had controlled how the research was done and how the wells were chosen has identified risk of '*fugitive emissions'* (from equipment, such as valves, flanges, compressors and other mechanical equipment associated with production) of methane are less than previously thought, a far more potent greenhouse gas than carbon dioxide, being one of the main objections raised by campaigners against UCG. Finding that, during the process of extracting natural gas from the ground, total leakage at the sites was 0.42 per cent of all the gas produced - slightly less than the 0.47 percent that the US Environmental Protection Agency suggested in 2011 was the national average. (Times, 2013)

The study reviewed 190 US gas production sites operated by nine of the biggest domestic gas producers. While the report found that emissions from pneumatic devices at well sites were at least 30% higher than EPA's estimates, and that pneumatics and equipment leaks account for roughly 40% of total US methane leaks from gas production, emissions from completions were mostly non-existent (Scheid, 2013).

The same study, seemingly refuting long-held anti-fracking arguments, was immediately picked apart by the author of another, relatively famous fracking study. Then that criticism got upended and torn apart by many others.

A co-author of a 2011 Cornell University fracking, Anthony Ingraffea, called the UT study '*fatally flawed'* and based on '*inadequate*' data. Criticised it for using a

small sample of roughly 8,000 wells fracked in 2012 and only testing sites at which production companies agreed to allow measurements.

Ingraffea and Robert Howarth, in 2011 released a study that said as much as 60% more methane is leaked from a fracked gas well than a conventional well, and that gas may be a greater contributor to climate change than coal, stating that:

> '*Methane contributes substantially to the greenhouse gas footprint of shale gas on shorter time scales, dominating it on a 20-year time horizon. The footprint for shale gas is greater than that for conventional gas or oil when viewed on any time horizon, but particularly so over 20 years. Compared to coal, the footprint of shale gas is at least 20% greater and perhaps more than twice as great on the 20-year horizon and is comparable when compared over 100 years*.'

UGI supporters, academics and even former US Energy Secretary Steven Chu, have refuted the findings of that Cornell study, which has been criticised for shaky science and inaccurate findings since it was released. In April 2012, EPA finalised a rule requiring the installation of green-completion equipment on all newly fracked wells by January 1, 2015. The University of Texas study found that about two-thirds of sites already have these technologies in place. (Scheid, 2013).

4.1.7.6 Land user rights and impacts

Q59. Land User Rights: There has been a concern voiced that gas companies can just barge onto some ones land, i.e. farm land and start their activities. Do you think this is the case? (Answered: 217, Skipped: 76)

Figure 45: Q59 Participant's perception of land users rights

Q66. Read the following statement: " Under Australian and State laws, minerals and resource property rights, including onshore unconventional gas or oil, are held by the state, not by landowners. Companies looking to access properties and/or locate infrastructure, are required to perform extensive consultation with farmers and landowners. Do you perceive that this is how things do actually work? (Answered: 206, Skipped: 87)

Figure 46: Q66 Participant's perception of the rights of landholders

Figure 45 & 46 serve to question the sample on the complex and interconnected issues associated with UCG activities, as most of the literature has identified land as a key issue and one that strikes an emotional chord due to the strong connection people have with their land and its central role in the livelihood of rural communities, keeping in mind that laws differ from state to state, though fundamentally with in the Australian Federal system they are similar.

To identify for the purpose of clarity in accordance with the Petroleum (Onshore) Act (NSW) 1991, section 6 states

(1) All petroleum, helium and carbon dioxide existing in a natural state on or below the surface of any land in the State is the property of the Crown, and is taken to have been so always. No compensation is payable by the Crown for any such petroleum, helium or carbon dioxide that was at any time vested in any person other than the Crown.

(2) All Crown grants and leases and every licence and other instrument of title or tenure under any Act relating to lands of the Crown whether granted before or after the commencement of this section, are to be regarded as containing a reservation to the Crown of all petroleum, helium and carbon dioxide existing in a natural state on or below the surface of the land comprised in the instrument concerned.

In a similar though simplified manner the Petroleum and Gas (Production and Safety) Act (QLD) 2004, Section 26 states:

(1) This section is subject to section 28 and chapter 2, part 6, division 3.

(2) All petroleum as follows is, and always has been, the property of the State

(a) Petroleum on the surface of land, if it was produced in the State;

(b) Petroleum in a natural underground reservoir in the State, other than petroleum in the reservoir produced outside the State and injected or re-injected into the reservoir.

(3) To remove any doubt, it is declared that—

(a) a person does not acquire any property in petroleum merely because the person discovers petroleum in a natural underground reservoir; and

(b) subsection (2)(a) applies whether or not the land is freehold or other

land; and (c) subsection (2)(b) applies whether or not the natural underground reservoir is in or under freehold or other land.

The property owner ultimately has no legal right to refuse access to their property and must negotiate a land access agreement. If an agreement cannot be reached through direct negotiation in specifically in the case of NSW, the matter then proceeds to arbitration and the final stage is the Land and Environment Court should the arbitration decision be appealed by the land-holder. The O'Kane (2013) review has been advised by the Office of CSG that to date arbitration has happened infrequently, with companies deciding to explore alternative arrangements such as other land sites or by using different drilling approaches, such as directional drilling.

Evidence submitted to the Legislative Council Inquiry into CSG demonstrates that affected landowners have been given limited guidance on this process and believe they have no bargaining power whatsoever, only being able to delay land access to the company for a period of time. O'Kane (2013) has highlighted that it is very clear that better processes around land access arrangements and information for landholders need to be put in place at every stage of the CSG process, which is the job of government, industry for concerned communities.

The response doesn't negate the fact that the NSW UCG is strongly oposed by green groups and farmers, whereby filtering of Figure 46 for NSW alone indicates that collectively 30 percent of the sample somewhat disagree and 30 percent strongly disagree. Indicating the likelihood of more argument ahead as the incoming Liberal National Coalition likely minister for the portfolio backs the development of NSW CSG (Tasker, 2013) in contrast to two incoming Nationals MP's (normal associated with landowners and rural communities) who form the Coalition have threatened to break ranks rather than acquiese to any Liberal Party policies of which they disagree, stating reservations of the CGI, believing that it shouldn't interfere with land or water and not be allowed onto prime agricultral land (Neales, 2013).

While issues relating to indigenous land were not directly raised with the O'Kane (2013) review, it is understood there are mixed views among indigenous communities about CSG in NSW, which in contrast to reports that the NSW Aboriginal Land Council has applied for permits to explore for gas

over two-thirds of the state in what they have expressed is an attempt to provide jobs and prosperity for aboriginal workers (Owens, 2013) while at the same time the NT Government has accused a coalition of UGI activist's attempt to link with Aboriginal groups of stirring up community anger in a bid to block development on remote Aboriginal lands (Aikman, 2013), a strategy which can work both ways depending on alignment as expanded upon by Leather & Wood (2012).

Answered as True	NSW	QLD	Ave	Primary producers
Right by law %	50	52	35	53
Negotiation %	66	79	68	64
Compensation %	58	80	63	42
Equal communication %	39	70	51	20

Table 14: Perception of land users rights.

Table 14 identifies the samples perception of the '*true*' rights, though strongly identified by the QLD sample as discussed in Figure 45. O'Kane (2013) has identified for a company to explore on privately owned or public property it must obtain a title and licence (PEL) granted by the Minister for Resources and Energy under the *Petroleum (Onshore) Act 1991*, sometimes also requiring development consent under the *Environmental Planning and Assessment Act 1979*, and must enter into a land access agreement with the landholder, though it was pointed out by the review that stakeholders expressed concerns over the level of land access agreements with subcontractors who are under contract from the petroleum titleholder or operators, and the question of who covers the damage if an accident occurs on their land.

In addition, options need to be explored to ensure that operating UGI companies have adequate financial cover for any impacts their operations have on the surface land of private property owners. This should include ensuring appropriate training and monitoring of sub-contractors working on private land, and establishing a robust insurance arrangement for the industry which would better protect the Government, landholders and the taxpayer (O'Kane, 2013)

As discussed in Figure 6, whereby research indicates that 89 percent of executives in the O&G industry believe that '*worries*' or '*issues*', identified by the public are warranted, with a key point that '*industry respondents'* were also divided by the real reason of objections to CSG, with 47 percent believing that it was due to property rights more so than environmental issues (Kitney, 2013).

Q67. Graziers, farmers and other landowners receive compensation from the resource developer for any loss of land or other impacts on their business operations. To date more than 3700 land access agreements have been signed between companies and landowners in NSW and Queensland. Would you believe this to be an honest assessment? (Answered: 206, Skipped: 87)

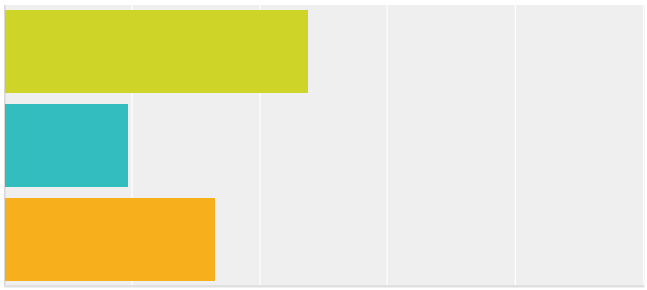

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Figure 47: Q67 Participant's perception of landholder agreements in QLD & NSW

APPEA latest industry data figures, first quarter of 2013 suggest that landholders have now signed 4,017 land access agreements with QLD based natural gas companies since 2011 (Gas Today, 2013), which has been acknowledged by the participants of Figure 47.

Figure 48 identified some of the aspects that can impinge and complement land use activities. CSG projects having a much larger footprint on the land than conventional gas production, due to the large number of wells, pipeline infrastructure and access requirements, causing tension with other surface land users (Norton Rose, 2012). An industry driven development for finding time and cost efficiencies has lead to the development of multiple horizontal wells from a single pad (Cook *et al*,. 2013) Rutovitz *et al*,. (2011) Explains the AGL Camden gas project in NSW, which utilises amongst vertical wells additional horizontal wells. It is important to identify that UCG horizontal wells require an in-situ stress regime that sustains vertical fracture planes at the many stages along the lateral length, as some Australian basins lead to fractures on the horizontal component, reducing the likely flow efficiency. Single pad well proposals, can only be determined on a basin to basin basis, with ongoing data collection to assist with clarification of the situation (Cook, *et al*,. 2013)

King (2010) has given numerical indications of the surface area and potential infrastructure savings obtainable by multiple pad facilities for a given shale play.

Participants of research performed by Lloyd *et al*,. (2013), had expressed shock when discovering what they '*perceived*' to be their total lack of rights to stop drilling on their land, identifying correctly that they '*only barely own the topsoil'.* With additional concerns by another informant, stating if they were to make capital investment on their own property, it would require planning consent and a process to consult and inform neighbours. Though in their experience and that of neighbors there was no requirement for CSG companies to notify occupants of neighbouring properties.

Lloyd *et al*,. (2013), have identified a focus of the issue, spanning the rights to land and water, an issue which they believe reaches from the heart of communities questioning the foundation and the present nature of the capitalist system. A focus which draws from other more tangible, directly relevant internal and external factors, such as social disadvantage of the region, tensions between what is acceptable resource use, land tenure access, environmental awareness and patterns in the region, equally attempting to factor in the dynamics between different local and regional social groups.

Q64. A list of impacts as identified by critics if a farmer or land user were to form an agreement for UGC activities on their property. What do you think of the points? (Answered: 208, Skipped: 85)

				8.29% 17	**16.10%** 33	205
Activities of fraccing would always poison bore water	**16.10%** 33	**16.59%** 34	**30.24%** 62	**19.02%** 39	**18.05%** 37	205

Figure 48: Q64 Participant's perception of potential UGI impacts upon landusers

The sample has agreed with many of the aspects as presented by Figure 48, aspects which as previously discussed by O'Kane (2013) need to be fully disclosed to any land owner or user.

4.1.8 Influence of media upon debate, determining the clarity of information

Q31. Accusations have been made that some environment activist aim to spread "fear and confusion' about the UGI rather than helping in the battle to improve regulation to protect the environment. How do you perceive the messages as given by some of the anti-CSG groups? (Answered: 256, Skipped: 37)

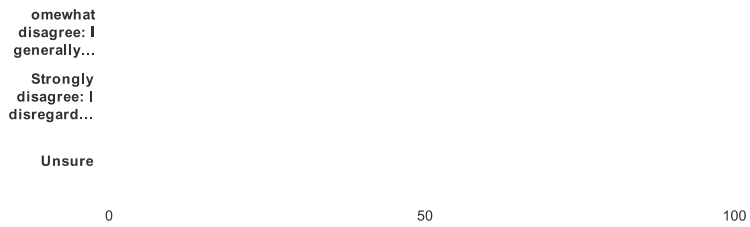


Figure 49: Q31 Participant's perception of message driven by groups opposing UCG

Cumulative responces	NSW	QLD	Ave	Primary producers
Strongly + Somewhat disagree %	48	22	28	67
Slighty agree + Confused + Slightly disgree %	22	21	36	13
Strongly + Somewhat agree %	17	57	34	17

Table 15: Perception of the fear and confusion driven by groups opposing UCG activities

Figure 49 has identified that the NSW and predominantly the primary producer sample is more likely receptive to messages driven by opponents concerns, while the sample average mean is in the middle being confused, where as the QLD sample are more likely to disregard activist messages.

Q63. We are continually bombarded by messages of different interest groups. As a government minister recently said "The anti-CSG sentiment is quite strong and it is fuelled not just by those who are concerned about it but by a hard core of people who are opposes to any used of fossil fuesl at all". He said "It doesn't matter what concessions are given to that group, it doesn't matter how you try to rationalise with that group, they will simply argue that fossil fuel needs to be eliminated." Do you think these groups could possibly overstate the facts in an attempt to create panic? (Answered: 220, Skipped: 73)

Figure 50: Q63 Participant's perception of sentiments as delivered by the anti-CSG lobby

'Attitudes, emotions, and prejudices' serve to warp our sense of interpretation. Individuals if fearful or having strong love or hate emotions, tend to protect him or herself by distorting communication processes, whereby these strong emotions can rob individuals of their ability to comprehend (Kerzner, 2013) in the example of Figure 50 and Table 16 where we have witnessed both extremes of responses.

Cumulative responces	NSW	QLD	Ave	Primary producers
Strongly + Somewhat agree %	35	72	60	32
Agree %	10	16	12	7
Strongly + Somewhat disagree %	64	11	27	60

Table 16: Perception of overstatement of messages of groups opposing UCG activities

Figure 50 has identified that the NSW and the primary producer sample don't identify the issue as simply being against fossil fuels, so likely receptive to messages driven by UCG opponents concerns, while the sample average mean and that of the QLD sample are more likely to disregard activist messages.

Q6. Thinking about what you do know about the subject of UGC, what sources influence your opinion? (Answered: 287, Skipped: 6)

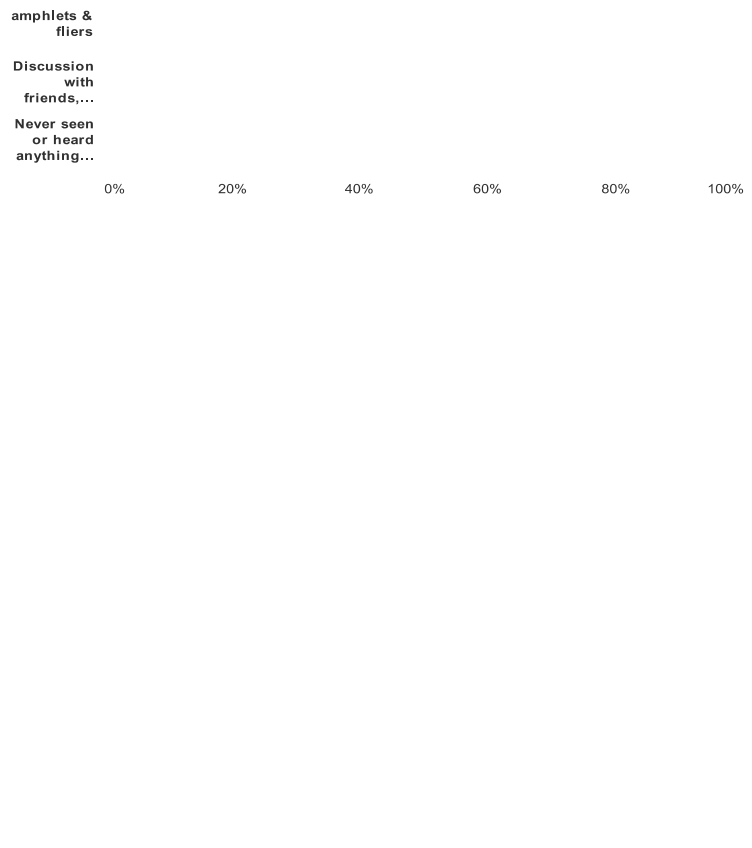


Figure 51: Q6 Participant's sources for formation of opinion on the topic of UCG

Figure 51 hasn't particularly identified any anomolies. The NSW and primary producer sample were utilising white papers accessed by websearch, influenced by discussions with friends and additionally more likely to be influenced by documentaries. The NSW sample, possibly due to proximity to supply were more likely to rely on news media.

Q20. When thinking about the future generation, what is more important in your mind for your grandkids? (Answered: 256, Skipped: 37)

Figure 52: Q20 Participant's aspiration for future generations

Q40. Which of the following energy sources do you think will be the MOST important in the next 10 years. (Answered: 229, Skipped: 64)

Figure 53: Q40 Participant's belief of dominant energy source with in the next 10 years

Figure 52 has clearly identified the sample aspires to maintain clear resources and realise that with a balanced society while Figure 53 identifies that half of the sample see a future predominantly powered by natural gas or alternatively solar additionally indicating a realisation that wind power popularity is possibly waning.

Q79. What do you think is the main source of energy used to generate the electricity at the power station nearest to your home? (Answered: 212, Skipped: 81)

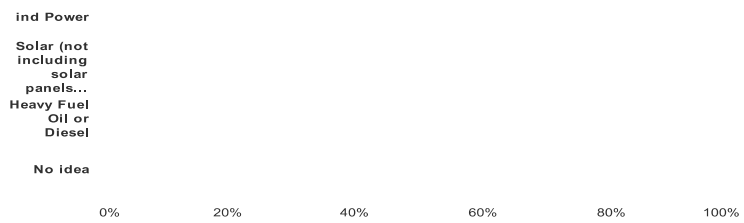


Figure 54: Q79 Participant's perception of main energy source nearest to their home

When filtered by Figure 9 The 60 – 70 percent of the sample for respective Australian state samples identified correctly what is the main energy source which provides power to their own home.

Q7. There is a movie / documentary called "Gasland" which discusses some aspect's and concerns of the experiences with in the US Shale Gas industry. Have you seen this movie? (Answered:289, Skipped:4)

Figure 55: Q7 Identifying if participant's have viewed the movie 'Gasland'

Q18. Regarding the movie / documentary "Gas Land" which discusses perspectives of US Shale Gas. Skip if you haven't seen the movie. (Answered: 110, Skipped: 183)

Figure 56: Q18 Impressions of 'Gasland' the movie

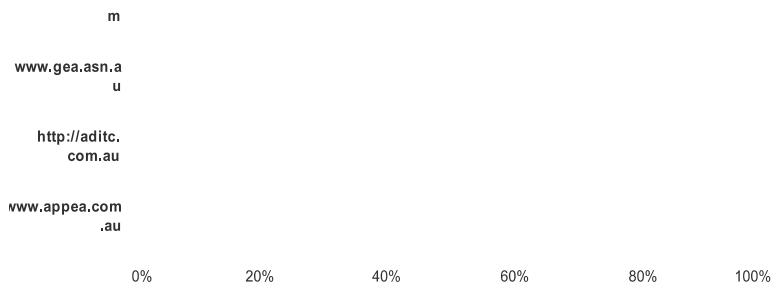
Figure 55 served to identify that 72 percent of the NSW and 67 percent of the primary producer sample had in fact seen the movie and more likley to agree with the validity of the concerns raised in Figure 56, where as the QLD and sample averages were both 37 percent.

Criticised as 'totemic movies of the anti-shale gas movement, Gasland and Gasland II, cinematically engaging but scientifically questionable' (Scheid, 2013). A websearch for '*Gasland screenings in Australia'* indicates free screenings. Predominantly, by groups considered '*hard core*' (Crowe, 2013), against-UCG activities as they are percieved in Figure 9, which points back to the '*fracking argument'* as discussed in Figure 19 and 38. Emphasising a need for '*fact checking',* of concepts being presented as fact. For some viewers such a screening, may be their only incoming avenue of information, causing immediate radicalisation for the impressionable.

Inferences as described by Mullins (2010), as not all viewers will properly judge reliability of messages or investigate alternate material from either side of the debate. A balance view is required, avoiding any inconvinent truths and single

sided messages, ensuring that all aspects are viewed in a pragmatic manner. Which in a short news cycle modern environment might very well be wishfull thinking.

Q49. Of the websites listed bellow, which do you belive deliver reliable and factually correct information? Simply scan the list and leave empty if you are not aware or don't recognise any of the specific websites. (Answered:163, Skipped: 130)



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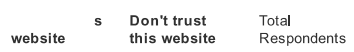

Figure 57: Q49 Participant's perception of levels reliability of prevalent Australian websites

'Personality and interests' such as the like or dislike of individuals or for the purpose of this exercise, associations for origin of information can affect communications. People will listen carefully to topics of interest or sources that they perceive to maintain a valid voice, but will tend to turn a deaf ear to unfamiliar or boring topics or unfamiliar sources of information. People investigating aspects of UGI will attempt to access information of their '*needs*' from their own '*frame of reference'*, determining the '*senders credibility*' upon their '*personality and interests'* which is dependant on the investigators '*interpersonal sensitivity'* (Kerzner, 2013).

There simply isn't enough space with in the scope of this project to identify and discuss aspects of which service providers deliver impartial information, maintaining factual content and editorial independence. Looking at Figure 57 we can see that a high portion of the average sample have viewed such

sources as the http://www.abc.net.au/news/specials/coal-seam-gas-by-the-numbers/ The website is the national broadcaster's first foray into '*data journalism*', where information sourced from industry, government and scientific sources is compiled and presented. Though APPEA has accused the Australian Broadcasting Corporation of using inaccurate information and emotive language on a website dedicated to CSG, whereby a formal complaint was lodged (McHugh. 2011), the display of the websites content has since been markedly changed, with an editors note acknowledging the changes. The special CSG site is no longer prominently linked with in the home and majority of the website portals interface pages (ABC, 2012).

APPEA (2013) have then applauded an recent CSG episode of ABC Channel 2's '*Shitsville Express'* (ABC 2, 2013), opinioned, for once a balanced piece of reporting on CSG where controversial Australian journalist Joe Hildebrand took four young aspiring politicians to northern NSW and southern QLD to meet and discuss aspects with a multitude of interviewees including; A pro-CSG farmer who complained of misleading media reporting and harassment by anti-CSG locals; Agricultural scientist Professor Stephen Raine discussing a belief CSG is about 50% cleaner than black coal, with exports CSG potentially a major contribution to fighting global warming and believes that 99.9% of gas wells do not cause any problems; Origin Energy Upstream Regional Manager Rob Hart discussing the industry's economic, regional development benefits, the large number of environmental conditions it faces and its strong safety record; Tara Estate anti-CSG activists, claiming their bore-water had become flammable but declined to light it for the camera; Hildebrandt and aspiring politicians visited a CSG water treatment plant, discovering the treated water tasted superior to standard tap water, water which is re-injected underground or used for irrigation (APPEA, 2013)

Though, the ABC in this instance have instead received criticism from persons in areas of CSG activities who have determined that Joe Hildebrand arrived with his own preset definitions, with accusations of ignoring farmers against CSG and avoidance of local scientists who have researched and are against the issue. Lismore Mayor Jenny Dowell said Hildebrand revealed a clear bias in favour of CSG, stating '*you wouldn't ever call it a piece of journalism*' (Broome, 2013).

4.1.9 Reservation policy

Q38. The present Australian government doesn't want to create a policy of reserving gas as a tool for keeping gas prices down or put more gas into the local market, they believe it would create uncertainty and deter investment in new gas supply. What do you think of such a comment? (Answered: 226, Skipped: 67)

Figure 58: Q38 Participant's views of gas government intervention with reservation policies

Q37. Some manufactures believe that government intervention is required to ensure competitive local gas supplies. In your opinion should a country reserve some of its gas for its own uses or home industries? (Answered: 228, Skipped: 65)

Figure 59: Q37 Participant's views of gas reservation for competitive local supply

Figures 58 and 59 indicate a desire for debate on the matter of preserving local interest, towards maintain a local advantage of costs at the region of supply.

Q69 Read the following statement: Australia has more than enough natural gas for both domestic and export markert's, with an estimated 819 trillion cubic feet (TCF) of gas reserves sufficiante for powering a city of 1 million people for 16,000 years. In 2010-11, the entire Australian economy consumed only 1.1 TCF, with a further 1 TCF exported. It is believed that more discoveries are likely. The country's gas supply is growing as new technology allows companies to produce gas from large coal seams. Would you agree with this statement? (Answered: 207, Skipped: 86)

Figure 60: Q69 Participant's perception of the expectations of scale of Australian reserves

Figure 60 identified, most of the sample agree Australia has sufficient gas supply for domestic and export consumption. The Australian CSG and conventional LNG narrative having developed due to massive investment by the US in Australian resource projects, assisting to foster a healthy relationship of mutual reliance towards developing a key relationship with China.

As pointed out by, departing American ambassador Jeffry Bleich, US companies are spending hundreds of billions of dollars building LNG facilities for Australia to benefit and gain royalties, becoming richer towards strengthening our economy by selling more gas to China and regional countries. Supplies which additionally assist China with it's tragetory of growth, whereby all three countries are dependant on each other, with a mutual desire to see each other succeed, as the world has more to loose by seeing China fail rather than suceed (Nicholson, 2013). It is doubtful the Australian narrative would have developed otherwise.

Q39. Andrew Liveris, the Australian-born CEO of giant US company Dow Chemical, has joined Manufactuting Australia in requesting that they federal government takes action to make gas more affordable for users. Liveris, a long-time cretic of the country's unfettered gas export situation, has writtern an opinion piece cliamining that investment in Australia is being discouraged and that, despite rich gas reserves, supply is shrinking because it is being sold as exports. "In turn, prices are shooting through the roof, causing Australian manufactures to close up shope or shift there investments to other places," he has writtern. "This does not make sense and should not be the case." Do you agree his opinion? (Answered: 225, Skipped: 68)

Figure 61: Q39 Participant's views of the views as voiced by Andrew Liveris

As identified by Figure 58, 59 & Figure 61 the sample have identified with the narrative of supporting local manufacturing, which may require capitalising on a natural advantage of an abundance of reserves.

Morphet (2013) has identified that much of Australia's manufacturing sector relies heavily on gas, either as a reliable, effective and affordable source of energy, or more directly as a feedstock Forming 15-40 per cent of the cost base of common products like alumina, cement, glass, bricks and roof tiles, and much more for fertilisers and other manufactured chemicals, stating an opinion that

> '*Experience tells us that, productive manufacturing flourishes in countries that identify and exploit their natural advantages. Alongside a highly skilled workforce, proximity to Asia and stable governance one of Australia's natural advantages is abundant energy and nowhere is this acutely evident than the gas crisis now facing manufacturing on Australia's East Coast*'.

Expanding to discuss the recent advent of large-scale export gas projects, development of the domestic pipeline infrastructure moving Australian gas into the international marketplace, in and of itself, this is not a problem as to the contrary opening up of exciting and valuable opportunities for the nation. Believing however, export licenses have been granted with little regard to ensuring domestic demand continues to be met and that no national interest tests were conducted before these licenses were granted in the manner of the US, Canada and Qatar or the quantity available for export agreed upon, tied into an argument that production yields of gas earmarked for export have been far lower than expected and now gas traditionally provided to domestic industry is expected to be exported (Morphet, 2013).

While such an argument is countered by Cleary (2013) who opines that a challenge Australia faces is that gas resources historically relatively cheap to develop are mostly gone as remaining gas resources are more expensive to produce. He believes the key to drive down cost, is to develop resources at scale with access to an export market, such as Asia provides today with ability to import gas as LNG, stating that this needs to be remembered amid rising calls for governments to intervene, forcing producers to reserve portions of their gas for domestic use.

Cleary (2013) has no doubt there will be tightness in the eastern Australian gas market. Arguing it isn't about having enough gas in the ground, particularly in NSW with proven large un-contracted UCG reserves onshore Australia, but of the ability to develop such resources, creating market supply, an ability hampered by policy uncertainty and increasing environmental activism.

He believes calls for a reservation policy is not about the availability of gas but for a request for the gas producers to subsidise others, and ideology which he doesn't believe is sensible nor the best approach to ensure either industry prospers in the long term, seeing it as a proxy for price control, which will not promote the development of new gas resources, but likely to stop investment and reduce supply, causing the market to tighten and prices to rise (Cleary, 2013)

4.1.10 Energy security

Q43. Energy Security: It has widely been claimed that in 2012, North America reached a point for the first time since the 1950's no longer reliant on imports of oil & gas, helping guarantee their energy independence, in simple terms meaning they have "Energy Security". So no longer rely upon what's viewed as risky global suppliers (i.e. Middle East). This is due to the development of their own UCG resources. How would you feel if this were also possible for your own country? (Answered: 227, Skipped: 66)

Figure 62: Q43 Participant's perception of North American energy independence

The sample have identified with the concept of energy independence, though again the NSW and primary producer groups have again indicated not at the cost of CSG in Australia.

With recent scenarios discussing O&G price volatility, possible diplomatic solutions to avert a U.S. military strike on Syria, which isn't a major oil producer, though investor concerns of conflict spreading to neighbouring countries an all out Mid Eastern war scenario, including the Persian Gulf, circumstances where the price of crude would become an obstruction, towards $150 a barrel.

Threats of fighting the Middle East brings up the memories like those of the 1970s, cars stretched around the block waiting for fuel. As the energy security situation has changed, no longer dependent on Middle Eastern, instead America is producing more O&G and using less, with today's imports accounting for 40 percent of US consumption, down from 60 percent in 2005. The top exporter to the U.S. is Canada. Canada is the largest exporter to the U.S. Saudi Arabia is number two, followed by Mexico, Venezuela and Russia (CNN, 2013).

Does the present status redefine global politics whereby America even though chemical weapons have been used doesn't feel so inclined to act, even with less pretense they had in Iraq upon a simply a suspicion that chemical weapons existed? A perception which some felt served as a prelude for intervention on grounds of securing O&G resource supply, though at this time war weary.

4.1.11 Regulation & reservation policy

Q36. Recently there have been regulatory changes, after companies have been granted authorisation to proceed with approved and planned drilling campaigns. Pronouncements by the NSW Energy Minister stating: "it is up to the CSG Industry to earn the support of local communities for its operations". Changes whereby industry participants are halting activities, post commencement of legally compliant drilling programs, sending mixed messages to stock markets, increasing risk exposure and in many cases large losses to shareholders. Is Australia suffering from a perception of 'increasing sovereign risk?" Being viewed as guilty of "knee jerk" reactions upon perception of public opinions as delivered / driven by activist groups who carry no legislative of representative authority? (Answered: 227, Skipped: 66)

			9%	4%	2.67%	
			20	9	6	225
Interest groups on any side shouldn't have a monopoly upon influence	67.40%	14.98%	9.69%	3.96%	3.96%	
	153	34	22	9	9	227

Figure 63: Q36 Participant's perception of aspects of governmental decision making

Cumulative responces of agree & slightly agree %	NSW	QLD	Ave	Primary producer
Agree with ministers statement	52	54	59	53
Agree government attempts to appease by short term idea's towards gaining popular support	88	94	87	74
Agree protest groups have excessive influence	37	66	54	27
Agree industry groups have excessive influence	92	73	82	99
Agree government should maintain investor stability	72	93	86	77
Agree interest groups shoudn't have a monopoly upon influence	73	82	82	64

Table 17: Perception of the minister's statement concerning UCG activities.

Figure 63 when filtered indicates a wide sample concurs with the question raised, we identified two normally unlikely bed-fellows greens and primary producers / farming groups have formed an alliance against the UGI.

The greens want a law to allow the federal government to do it's own scientific analysis on CSG of Coal Mining projects that could affect underwater reservoirs, with the previous Federal Energy Minister also expressing concerns about the anti-CSG lobby on the industry, with additional accusations of it *"spreading fear and confusion to achieve dramatic media driven objectives"* (Heath, 2013), additionally is had been the primary producers who have been spearheading protests (Benedek, 2012).

Whereas the governments independent think tank '*The Productivity Commission'* released in May 2013 stating that uncertainty on the environmental impact of CSG drilling could lead government agencies to make decisions that aren't fully based on the evidence, additionally which will have impacts for international firms as an investment destination, which might lead to the country being frozen out of a new wave of global energy investment. it was also highlighted that Commonwealth state and territory governments have overlapping and duplicative environmental and indigenous heritage regimes,

though still have it with in their power to agree on more efficient accreditation regimes (Heath, 2013).

Clearly both the green and primary producers view themselves as stewards of the environment, as they share an aligned goal of protecting the land. Though it is multi-dimensional and does depend on context as some green groups are also opposed to primary producer activities. For example farmers in the NSW Hunter Valley, quickly aligned with conservation movements to oppose CSG development and UGI expansion, while conversely farmers in QLD who identified as traditional farmers aligned with the traditional animosities in discourse between the old National Party of Bjelke-Petersen and the political left, reject collaboration in favour of direct lobbying of parliamentarians. So it is clearly a difficult concept for researchers and policy makers to determine or identify rural Australia (Lloyd *et al*,. 2013), or who clearly represents their views.

Q30. Who do you believe should be ultimately responsible for matters of regulation concerning CSG or Unconventional onshore gases? (Answered: 251, Skipped: 42)

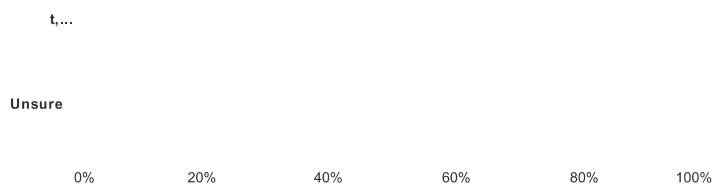

Figure 64: Q30 Participant's opinion of who should be responsible for UCG regulation

Few industries are subject to such a multitude of rules, laws, regulations and standards such as those placed upon the O&G industry. Standards are necessary for providing the common basis required for global commerce, with out such standards, product compatibility, resulting in end user satisfaction and production efficiencies can't be achieved. Recognising that quality doesn't magically appear over night, compliance standards will not be accomplished

instantaneously (Badiru, 2013) Processes are developed into regular procedures over a period of time, therefore defining critical elements which must be taken into consideration towards meeting all stakeholders expectations.

	Mean response type	%
NSW	Equal = Federal National Body / Two levels of Government	43 / 43
QLD	Two levels of government	51
Average	Two levels of government	44
Primary Producers	Two levels of government	62

Table 18: Preference for levels of regulation of UCG activities

Figure 64 has identified that the sample group don't support the independent states to monitor UCG affairs, which would possibly be linked to the aspects as discussed in Figure 40 of the issues associated with national aspects of the GAB and water resources. NSW participants have indicated that they are split between a '*single*' national Federal body, which would override present state jurisdiction and '*two levels of government'*. Though it would be interesting to ask this question factoring in the recent election of the federal Liberal national coalition government, which is viewed as more pro industry.

Where the power to legislate on certain topics is concurrently held by the Commonwealth and the State, methods exist in resolving conflicts between laws made by States and laws made by the Commonwealth. Section 109 of the Constitution achieves this by providing that laws of the Commonwealth shall prevail over those of the State to the extent of any inconsistency between them. In order for section 109 to apply, there must be a valid and operative State law and a valid and operative Commonwealth law. If either is invalid, no conflict of '*laws*' arises (Blackshield & Williams, 2010).

Under changes to the Environment Protection and Biodiversity Conservation Act, '*water*' will now act as a legal trigger. Any new CSG or large coal projects potentially linked to water reservoirs will need assessment by an expert committee before approval. Previously the Federal Government could only intervene on issues relating to water if a threatened species or RAMSAR wetland was involved. The Federal Environment Minister will have the power to consider cumulative impacts on water of CSG wells and coalmines, and impose

penalties for breaches (Russell & Perry, 2013)

Industry will clearly and actively lobby to resist increased levels of their perception of

> '*Policies that undermine the development of energy projects and curtail energy production impose real costs on the Australian community in the form of lost jobs, forgone economic opportunity, and higher energy bills. Green tape, regulatory and fiscal uncertainty, and threats of market intervention each compound to undermine the confidence required to deliver the next wave of Australia's resources boom*.' (APPEA, 2013)

Coal mining rights and CSG rights are often granted and administered by different authorities, potentially delaying and complicating the CSG approval process. (Norton Rose, 2012)

APPEA the peak national body representing Australia's oil and gas exploration and production industry, maintain a membership in excess of 80 full member and 250 associate member companies that provided a wide range of goods and services for O&G activities, members accounting for an estimated 98 per cent of the nation's petroleum production. APPEA desires a secure regulatory and commercial conditions that enable member companies to operate safely, sustainably, and profitably, developed with Australian governments to help promote the development of the nation's oil and gas resources in a manner that maximizes the return to the Australian industry and community, primarily as taxation revenue (APPEA, 2013).

They seek to increase community and government understanding of the upstream petroleum industry by publishing information about the sectors activities and economic importance. "*We support a science-based approach to the regulation of the CSG industry*," a spokesman said. "*However, we are increasingly concerned at the risk of duplication of oversight at the state and federal levels, and the unnecessary delays or costs that this may impose to current and future projects*". (Russell & Perry, 2013).

Conversely, the research by Lloyd *et al*, (2013) points to people's fears of not having access to clean drinking waters now and in the future, as they perceive that corporations and governments to be making decisions that can affect

Australia's water supplies indefinitely. For this reason, a wide range of participants and separate groups are uniting on this issue.

Q29. Are the authorities that regulate and monitor CSG companies sufficiently independent and capable of delivering correct and balanced decisions for the wider community? (Answered: 255, Skipped: 38)

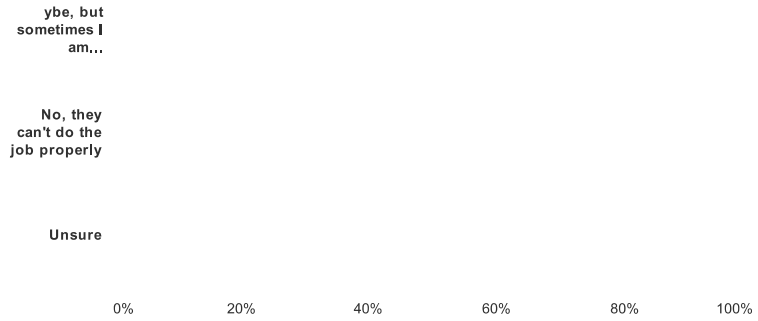

Figure 65: Q29 Participant's perception of reliability of authorities regulating UCG activities

Governments and industry have no option but to work together in a form or risk-mitigation partnership, rather than an adversarial 'lording' relationship. The community understands that no O&G activities are risk-free. Many of the more recent O&G E&P industry accidents have clearly involved human elements, such as errors, incompetence, negligence, etc. Is there any way to prevent negligence? We can encourage compliant behaviour as an incentive for perfect records, though humans will still be humans whenever an adverse occurance happens. (Badiru, 2013) Operators and regulators can only build upon experiences towards reducing risk of activities, as they develop regulation.

	Mean response type to questioning the independence and capabilities to regulate matters assocaited with UCG	%
NSW	No	66
QLD	Maybe / No	30/30
Average	Maybe	36
Primary Producers	No	71

Table 19: Perception of the abilities of regulatory bodies for UCG activities

Figure 65 when filters and applied to Table 19 indicates a lack of confidence of independents, capabilities for delivering balanced decisions for the wider community, which is quite a damning indictment of the perception of the present industry with '*yes*' being selected the minimal amount of times across the sample group often well behind '*unsure*'. Though this could be tempered when Vote Compass has also indicated that not one of Australia's key political leaders rate any higher than 4 out of 10 on matters of trust and competence (Liddy, 2013).

UGI activities are characterised by huge levels of investment, large interfaces and often complex engineering endeavours. Protagonists on either of the debate are questioning the layers of division of activities, pointedly who is regulating what, levels of oversight and the possibilities of the overall complexity that aspects might be missed. Checks and balances, towards ensuring a holistic view of activities needs to be maintained, especially as artesian water sources run under multiple state & territory jurisdictions as highlighted by Cook et al,. (2013)

Q52. Hypothetically, Would you be confident of any findings of a Government instigated Royal Commision on any subject, even if they were oposed to your own held belief's? (In Commonwealth Countruies, Royal Commisions are called to look into matters of great importance and usualy controversy. These can be matters such as government structure, the treatement of minorities, events of considerable public concerns or economic questions) (Answered: 220, Skipped: 73)

nses

Figure 66: Q52 Participant's perception of a Royal Commission

Figure 66 when filtered as indicated by Table 20 still identifies that the mean of the samples is uncertain of the reliability of commissions findings, with the portions of the NSW and primary producers indicating that they wouldn't be confident if it ruled '*against*' their held beliefs, which ties into the distrust as identified when discussing who should be responsible in Figure 64 and the perception of the reliability in the regulators involved Figure 65.

Mean response type, questioning if the sample would be confident of the results of a Royal Commision %				
Sample	NSW	QLD	Primary Producer	Ave
Yes, confident	37	49	35	42
Uncertain,	40	40	35	40
No, if against my beliefs	21	5	20	8

Table 20: Perception of reliability of findings a royal commission if against held beliefs

A simple websearch using ' Royal Commission into CSG' identifies a multitude of stakeholder and Anti-CSG groups who are calling for an inquiry, which may

infact placate the wider community, though in the manner of those '*against*' it is dependant on the investigators '*interpersonal sensitivity'* as previously discussed by Kerzner (2013).

4.1.12 Investment and trusting industry

Q44. Do you support balanced development of resources if all standards are met and the risk to the environment is minimal or at least repairable? (Answered: 226, Skipped: 67)

Figure 67: Q44 Participant's view of ballanced development

Q10. If a resource gives us a competitive advantage, when do we use it? (Answered: 249, Skipped: 44)

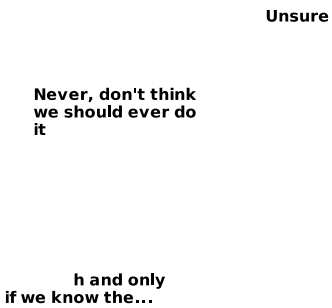

Figure 68: Q10 Participant's view of developing an advantageous resource

Q68. Read the following statement: Companies bid for the development rights and when producing resources pay royalties to the government which can be used to improve the economic wealth of the state and community living standards. Do you think the risks are worth what the county can earn in royalties? (Answered: 208, Skipped 85)

Figure 69: Q68 Participant's view of royalties v. risk

Figure 67 has identified that the majority of the sample do support balanced resource development, with Figure 68 identifying an a divided concensus between the pragmatic view of '*now*' using best practices and '*wait*', which reveals a perception that the sample would like to wait for conclusive analysis of the risks which isn't supported by Williams et al,. (2012) maintaining that knowledge is an ongoing process, while Figure 69 slightly higher portion of the sample agreeing that the benefits might outweigh the risks.

Q35. How do you think foreign and local investors view the risks of investing in the Australian CSG of Shale Gas industries as compared to natural gas opportunities elsewhere in the world? (Answered: 227, Skipped: 66)

Figure 70: Q35 Participant's view of UGI investment in Australian v. rest of the world

The project saw a higher mean of persons slightly agreeing that Australia had high levels of productivity, in contrast to industry debate, where projects are being affected by large cost over runs, due to a multitude of reasons. A point of debate when discussing the future of natural gas resources and their utilization in Australia (Leather *et al,.* 2013)

Breaking ranks with O&G industry perception, Gallagher, the Managing Director of contractor Clough and former head of a Woodside's LNG project, believes management has a bigger influence on Australia's productivity than policy. Disputing a perception Australia has a low productivity workforce culture, believing it is dependent upon competency of the leadership and management, for planning and managing well with competent people so objectives and targets are clearly communicated. Arguing that productivity issues are more about those kinds of issues than about politics (Burrell, 2013), management of which, also has a responsibility of engaging with dissenting stakeholders.

Q23. What is your sentiment of the big oil companies who are transforming from predominately oil related activities towards gas activities, which might assist with reducing global Carbon emissions? (Answered: 253, Skipped: 40)

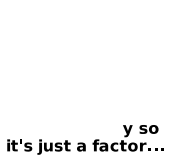

Figure 71: Q23 Participant's perception of oil companies evolution to gas activities

Q58. Through out history, all industries have made mistakes. If acknowledged rather than covered up, do you think that industries can progressively learn in an evolving manner? (Answered: 219, Skipped: 74)

Figure 72: Q58 Participant's perception of industries progressive evolution

Figure 71 indicates no matter how they try to market a perception of themselves, large NOC & IOC's will never win any popularity competition, though there is a pragmatic mean perception that industry can and does learn from mistakes.

It is fair to say as identified by King (2010), much of the concern and subsequent furore over fracking and frack waste disposal creating the '*fracking argument*', (Figure 9, 19, 38 & 56) was largely driven by a lack of chemical disclosure and the pre-2008 laws of some US mainland states, which served to undermine any base of industry credibility before the UGI had identified that they had to '*gain and maintain a social licence to operate*'.

Global incidents such as the Macondo well disaster, highlighted by the National Research Council (2011) only serve to exacerbate suspicions of an already poorly perceived industry trying to deliver a message that changes have been made with efforts of re-assurance that present methods aren't harmful, an issue that wasn't helped as many regulators and there governments were viewed as complicit with late in efforts for curtailing BTEX chemicals as discussed in Figure 41.

Q61. Do you believe that you will ever be able to trust Oil & Gas companies of the companies that provide them with services or supplies? (Answered: 221, Skipped: 72)

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Figure 73: Q61 Participant's perception of trust of O&G associated companies

This project doesn't have the scope to investigate trust metrics or how users feel about a particular company or industry over time.

Industry will clearly and actively lobby to resist increased levels of their perception of

> "*Policies that undermine the development of energy projects and curtail energy production impose real costs on the Australian community in the form of lost jobs, forgone economic opportunity, and higher energy bills. Green tape, regulatory and fiscal uncertainty, and threats of market intervention each compound to undermine the confidence required to deliver the next wave of Australia's resources boom*." (APPEA, 2013)

The organisation seeks to increase community and government understanding of the upstream petroleum industry by publishing information about the sector's activities and economic importance, as per the opinion of Gallagher, believing management has a bigger influence on Australia's productivity than policy. Arguing that productivity issues are more about those kinds of issues than about politics (Burrell, 2013), management of which, also has a responsibility of engaging with dissenting stakeholders as many residence in areas of activities have identified that the impacts and changes that they are currently experiencing are not associated with a particular company, but with all of the cumulative effects of all of the resource developments in the specific areas (Williams & Walton, 2013).

Though it has been noted that some CSG companies in particular have been identified as doing better than others, which industry bodies could learn from. Again it is important these experiences don't always reflect the totality of these individual experiences of the impacts of UGI activities, nor are they completely representative in the ways that other residents in the region experience the changes, which raises a question as to how meaningful it is to consider the idea of social licence in relation to an individual company (Chapel, 2012)

Franks et al. (2010) also suggest that a specific technology can require a social licence, and ideal which could be relevant to the CSG and wider UGI context.

Lloyd *et al*, (2013) in their study point to the fact that individuals and groups appear to be reflecting what should be a growing concern, whereby the public seems to be losing it's faith in governmental structure. They believe concerns broached, highlight questions of the principles, foundations and perceptions of science and research as it is applied to industrial extraction of any natural resource. Further illustrating the potential for independent community groups to

continue to question the role of scientific enquiry in a society where governmental decision-making seemingly leans towards economic outcomes (Klan, 2013). Whereby the CSG and the UGI is a obvious symptom of malaise which many people see in Australian society today, so that public concerns expressed in all forms of diversity, should reflect a health social response to any potentially damaging commercial activity (Lloyd *et al*,. 2013).

Chapter 5: CONCLUSIONS

5.1 Introduction

These conclusions do not seek to sanction or disapprove any geographical specific UGI activities, the scope the project was to clearly identify aspects of '*perception*' and the challenges faced by all pro and anti stakeholders having an interest in such activities. We live in an imperfect world where people will always continue to voice their opinions in the manner awarded by a free democracy.

It would be ambitious of proponents suggesting, measures, whereby prior to any drilling activities that we should have a clear and concise geophysical data set baseline prior to the commencement of any activities as identified in Figure 68 & 69. When drilling any type of well for hydrocarbons, minerals or water resources, prior research of the area is at best an assumption, which can only be proven by embarking upon an exploration-drilling program.

Only by analysis of return cuttings, core sampling, wireline, MWD (measurements while drilling) functions of down hole testing can science of any type then prove or disprove hypothesis. Those against any UCG activities can not simply demand a stop to all activities, as there needs to be a clear separation of the types of activities, untangling of the definitions being used in the debate, as the separate activities which as described do in fact add to the science data set.

To mandate that we require a concise understanding of all geology, artisanal flow is fanciful, as this is in fact the data, which is pursued by knowledge base industry such as O&G or mining. The data, which opponents have called for prior to being able to embark on activities, is what all O&G have in fact seeking to obtain by their own methods of E&P since the processes have become industrialised.

Persons who disapprove of all O&G conventional and unconventional activities must understand that it is only by encouraging exploration, which doesn't necessarily lead to production of any economical reserves, can still release a treasure trove of information, which could lead towards underpinnings of proof for further specific geophysical understanding.

This give us, as a community a better understanding of specific attributes of such an area of artisanal water flow, geology and the like. Towards determining which land use activities are safe and where, towards curtailing, abandoning activities or encouraging them where applicable.

In all likelihood, such understanding will clearly identify for O&G participants, regulatory bodies, members of the scientific community and in turn State and Federal Government, relevant information of comparable basins a more concise understanding of the wider picture of all aspects of the landscape and it's complete function.

Identification of the correct data, which can then be used to gain broad acceptance for all types of land use activities for the wider communities confidence which area's and resources which can safely be developed with minimal potential for adverse risk. This would serve to dispel any myths and decrease the incorrect '*perceptions*' as identified throughout this project, increasing the likelihood of greater acceptance and serving to re-align factors of the UGI activities in accordance with sentiments being expressed the general public, which this project may have served to identify.

It is important that all side of the debate, have the ability to being open about what is not known.

5.2 Discussion on relationship values

Results from the project have identified that particularly in areas of burgeoning CSG activities, primarily in NSW that there is clearly a factual disconnect, which will take a more concerted effort to overcome.

It has also become clear that there has been key communication failures between the UGI and the community, which has created the conditions for the identified '*fracking argument,'* to drive emotions and suffocate the wider debate.

Also we have identified from the data, an alignment of two normally disparate groups. Within the Australian narrative, it is very rare for two protagonist groups such as farmers/primary producers to be so aligned and receptive to messages as driven by green groups as has been the case of the Australian UGC narrative. Two separate audiences with ultimately different aspirations. One group who want to halt fossil fuel development, and the other who want to safeguard their own lands, common water supplies and livelihood, in stark contrast to the historical relationships of the two groups. There needs to be more study towards the point of convergence by these two groups which has been created due faults of the UGI.

APPEA's repeated efforts to gain and maintain public support for the industry in general haven't been effective. Continual rebranding of industry funded web portals, with efforts such as www.wewantcsg.com.au being converted to http://www.naturalcsg.com.au/ with accompanying publicity campaigns, bombardment of television and newsprint, using recognised celebrities and sports stars in an attempting to demonstrate the positives of the industry. Methods of packaging the '*benefits*' as applicable to Australia's '*prosperity*.' Rather than focusing upon regional issues, it has only served to erode measures of good will, hence '*perceived*' as desperate. As a layperson might deduce if '*they*', the UGI are going to so much effort, is there in fact, something suspicious going on? Those in the city are often a driving force in the debate, do this without realising the impact of their influence on the countryside and the community.

Poorly managed '*introduction to the industry'* portholes are costly to produce and heavily stage-managed. People have been noticing the continual changes, initially from a protagonist '*we want CSG'* stance, then a patronising and '*cartoonish*' effect, attempting to '*paint a positive picture'*. Aspects, which smack of desperation as they seesaw both extremes of the scale. Lacking any clear strategy or evidence of evolution of accepting community concerns or any ability to deliver any industry message effectively. The message can't simply be 'sold' by a marketing campaign. As the data has identified, people are pragmatic and primarily want the facts.

It is obvious, for those presently outside the debate, in a society with perceived reduced levels of trust in regulators, industry and governments together. That those in charge for the efforts of dissemination of the UGI message need instead pass the job of '*painting a balanced picture'*, to trusted and independent portals such as the CSIRO, etc. Bodies perceived to be impartial '*have always delivered a stable and maintained message,'* seen to be distanced from the funding from industry interests. With capabilities, ideas and knowledge sets for problem solving based on values, rather than ideology.

Painting this picture with aspects of both side of the argument including inconvenient truths and then identifying where there are recognised shortfalls in knowledge is important. This action will lead to the dissemination of a reliable source of information for suspicious lay members of the public, and for those not yet curious enough to learn the facts of the industry at the present time. It also serves to assist with alleviating some of the untruths which may be presented by anti-UCG protagonists.

As presently it is obvious that the tide of negativity is rising, if not halted will serve to add further layers of bureaucracy and oversight as MP's in affected areas will have no choice but to listen to concerns, be seen or '*perceived*' as being seen as looking after their electorates interests or be thrown out at the next election. Industry, regulators and governments of all levels have both failed in their responsibilities of maintaining and presenting any valid argument for gaining, let alone maintaining community consent, as the industry is viewed as potentially being worse than coal or even nuclear, a perception that should have been impossible.

5.3 Managerial implications

The results of the project and aspects identified, in conjunction with numerous studies point to the fact that the UGI has a long and complicated battle ahead for overcoming '*negative perceptions'*. This is particularly the case with those already ascribed as anti-CSG, for example in more populated and affected areas. But this will also spill over into regions yet to be fully be exposed to E&P activities. It is too simplistic to say that companies might have to walk away from CSG activities in NSW, as market demand will require an increased gas supply, which then may adjust consumers perception in the way that the Australian public's negative perception of the previous Labor governments '*carbon tax'*

inflationary effect day to day expenses, where peoples attention will fade with repeated message eroding goodwill, especially when it hits their hip pocket.

Efforts of the industry's management in many cases have obviously failed, with a need for stakeholders to '*swallow some bitter medicine.'* Identifying that they aren't going to be able to ride roughshod over community concerns no matter how annoying or seemingly inconsequential of persons in any specific region, mindful that it is simply not possible to keep everyone on side. Though will these additional activities inflate already expanding CAPEX? As companies redirect stretched resources for '*gaining and retaining community acceptance*,' towards '*social licence'.*

Chapter 6: RECOMMENDATIONS FOR FUTURE RESEARCH

Research, which follows this project will need to draw out the diverse values interests and aspirations which underpin community expectations (Lockie *et al*., 2008) towards assisting industry and government department representatives to understand community expectations through dialogue with stakeholder members.

Accessing and analysis of the date generated by the ABC Vote Compass exercise: An opportunity for researches to access a treasure trove of information, which has been obtained by the recent ABC Vote Compass exercise. Vote Compass is an independent entity from the ABC and the political scientists behind the project operate independently. Having been conducted in the lead up to the recent Australian Federal election. An independent, non-partisan network of political scientists developed Vote Compass, which has been used internationally. It is not affiliated with any political organisation or interest group. The Australian edition of Vote Compass has been developed in collaboration with a team of political scientists from the University of Melbourne and the University of Sydney http://australia.votecompass.com.

Based on the responses to a brief questionnaire, it generated an analysis of how samples views compare to the positions of the candidates in a given election. This analysis is restricted to the specific issues included in the Vote Compass questionnaire and not necessarily reflect perceived political affiliation or intended vote choice. Analysis generated contains several different outputs, including a two-dimensional plain and a bar graph. Each output measures something different and reflects a practical reality in which people think about politics in multiple ways, identifying that some think in terms of ideology and others in terms of public policy issues.

The process has generated a large amount data covering a multitude of subjects across Australia that will be available to aid researchers, towards creating further understandings of aspects, which will benefit protagonists on either side of the debate of topic encapsulated with in this specific project, towards fostering acceptance, data that by the due date of this project was unavailable as it is still being collated.

Unintentional contamination by means of a water bore drilled into a CSG seam disecting different geophysical strata: It has been identified that cement casing

is of paramount concern for CSG wells as discussed by Figure 39, in the prevention of groundwater contamination Discussion of the possibility of the unintentional contamination, what are the standards for water bore well structural integrity as the impacts on baseline assessments due to older and existing wells.

Coal mining participants CSG protestations: It was interesting to note in Figure 16, 17 and also Figure 35 areas of extensive coal mining are seeing protests by people long associated with coal mining, either open cut or underground. Both aspects have physical potential for environmental issues though people are associated with in the industry see CSG as being a much worse alternative in contrast to views raised by the CSIRO (2012) an interesting comparison, warranting further investigation.

Proponents now shifting the debate to cement casings of the wells, though they don't mention existing onshore conventional O&G wells: In reading the text of the ongoing Fox v. Pyle debate (Figure 19) it was interesting to read Fox (2013) digress and point to the fault of contamination actually being due to the cement casing associated with the wells. Though he doesn't mention or reference in any discussions any of the conventional O&G wells leaking in a similar manner, which is a matter outside of the scope of this project.

Alliance of the green and primary producer / Farmer groups: There needs to be more study towards the point of convergence by these two groups which has been created due to faults of the UGI. Is it sustainable, or will the aspirations of the two stakeholders dissolve in the manner affecting some of the indigenous and green allegiances?

Chapter 7:

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APPENDICES

(Answered: 195, Skipped: 103)

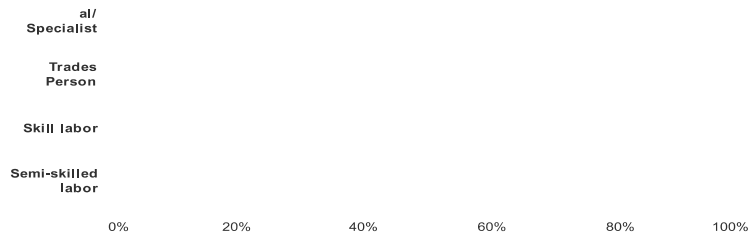

Figure 74: Description of participant's current position