Submission No 642

INQUIRY INTO COAL SEAM GAS

Organisation: New South Wales Government

Date received: 30/09/2011

NSW Legislative Council General Purpose Standing Committee No.5

Inquiry into Coal Seam Gas

NSW GOVERNMENT SUBMISSION

September 2011

1. EXECUTIVE SUMMARY

The NSW Government welcomes the General Purpose Standing Committee No.5 Inquiry into Coal Seam Gas (CSG) and is pleased to submit the following material for consideration by the Committee.

The NSW Government was elected on an ambitious platform of restoring strength in the State's economy. The Government's number one priority is to restore economic growth and establish NSW as the first place in Australia to do business. Our plans to deliver this economic growth include enhancing trade and export performance by targeting and attracting international investors into priority sectors, and growing the capability of NSW's export base.

The NSW Government is implementing its Jobs Action Plan to create an additional 100,000 jobs in NSW, including 40,000 in regional NSW. It is acknowledged that future economic growth in regional NSW will require balancing development with community interests and the sustainable management of natural resources. Growth needs to be better planned to give businesses and the community increased confidence about what the future holds.

For the past 30 years NSW has relied upon secure supplies of gas from South Australia and Victoria to support and grow our industries and businesses. Changes in the energy sector now mean gas will be of growing importance for the State. Gas will be increasingly used to generate electricity and consumers are increasingly seeking to use gas in their homes and businesses in order to reduce their overall energy costs and carbon emissions.

The NSW State Plan outlines the NSW Government's goal to increase the value of both primary industries and mining production by 30% by 2020. In the 2011/12 State Budget, the NSW Government extended the New Frontiers program to attract petroleum and mineral exploration investment in under-explored areas of NSW and to grow NSW minerals and petroleum production. Our commitment to grow the value of primary industry and resource production dictates a sophisticated approach to co-existence.

The NSW Government was elected on a commitment to introduce its *Strategic Regional Land Use Policy* which is built on the premise that mineral and petroleum resource industries can and do co-exist with agricultural production and environmental protection. The Policy acknowledges that some areas of regional

NSW are already experiencing significant growth in mining and petroleum projects, leading to increasing land use conflicts, particularly with agricultural industries.

The Policy is now being implemented and will allow the Government to work with regional communities to strike the right balance between resource development, continued agricultural production and environmental protection. With global food demand predicted to more than double by the middle of the century, the Government recognises that the strategic management of NSW's resources will be essential. To meet these challenges, the Government has committed to establish an Office of Food Security and Agricultural Sustainability as part of its *Strategic Regional Land Use Policy*.

In other jurisdictions, conflict has arisen in relation to land access arrangements between resources companies and individual landholders. In NSW, the rights of landholders have always been recognised. The *Petroleum (Onshore) Act 1991* (POA) provides that an exploration title holder cannot enter a landholder's property to carry out prospecting operations unless acting in accordance with an access arrangement. The POA contains detailed and stringent provisions covering land access and compensation, which aim to ensure that landholders are not adversely impacted by petroleum activities.

The experience of other jurisdictions with substantially more developed gas production industries has indicated that there are concerns that CSG activities may pose a threat to drinking water supplies and food production through competition for, and quality impacts on, surface and groundwater and agricultural land. Stakeholders have also raised issues in relation to the location and space consumed by CSG infrastructure, such as well heads, pipelines and roads.

The NSW Government believes that balanced co-existence of mining (including CSG) and agriculture is not only possible, it is essential. The Government recognises that such co-existence necessitates appropriate management and assessment requirements on CSG and mining activities. To this end, the NSW Government is implementing a ban on the use of BTEX chemicals in fracturing fluid additives, and has announced a moratorium on all new hydraulic fracturing ('fraccing') approvals while a detailed review of the approach is undertaken. The Government is working with key stakeholders to develop an *Aquifer Interference Policy* to ensure that impacts on groundwater and surface water systems are minimised. The interim obligation for CSG proponents to prepare Agricultural Impact Statements will also remain a requirement until detailed Regional Strategic Plans are in place.

The NSW Government has a clear vision of the economic future of this State that involves growing both agricultural and resources output while reducing greenhouse gas emissions. In order to restore strength and resilience in the NSW economy, co-existence is in the community's overall best interests, both at local levels and from a state wide perspective.

NSW gas consumption is projected to grow significantly from its current level of around 160 Petajoules (PJ) per annum to 550PJ pa in the next 20 years. Current possible NSW CSG reserves represent over 250 years of gas supply at that level. Increased use of natural gas, including CSG, to meet an increasing proportion of future energy needs is a key component of the strategy to restart economic growth in

NSW, minimise rising energy costs and the effects of climate change and facilitate the transition to a lower carbon economy.

In Part A of this submission, a brief description of the CSG industry in NSW is provided and the NSW Government's perspective on the role of CSG in the State's energy future is outlined. In Part B, the NSW Government's response to community feedback about the industry, principally the *Strategic Regional Land Use Policy* and *Aquifer Interference Policy*, are described and comments are made against each of the Inquiry Terms of Reference.

2. BACKGROUND

It is worth briefly considering the history of gas in NSW. The use of gas, initially for public lighting in Sydney, dates back to 1841. This pre-dates the use of electricity for the same purpose by more than 45 years – the first electric street lights were installed in Tamworth in 1888, and were not installed in Sydney until 1904.

The gas used from 1841 was town gas, which was produced from the distillation of coal. Natural gas from the Cooper Basin in South Australia began to be supplied from 1976, with the building of the Moomba to Sydney Pipeline, allowing the phasing out of town gas. The construction of this pipeline allowed gas to be supplied to new regional areas along its length to support industrial, commercial and agricultural development, as well as providing the fuel for heating and cooking in households.

Reticulated gas (gas transported via pipeline networks) is now supplied to over one million households in NSW, or around one-third of all households. Until the recent construction of new gas fired generators, around 70 per cent of the gas consumed in NSW was used by the manufacturing, industrial and agricultural industries, thereby supporting the economic development of the state.

NSW's reliance on coal as a primary fuel for electricity production – over 80 per cent of the electricity consumed in NSW is generated from coal – means that gas is a useful fuel source which will assist NSW to reduce the amount of coal fired electricity and therefore greenhouse gas emissions. In addition, gas, and in particular coal seam gas, may play an increasingly more important role in ensuring affordable energy supplies to the State.

The development of a coal seam gas industry in NSW resulting from technological innovation has created an opportunity for an abundant new cleaner energy resource which was largely unknown until recently. The coal seam gas industry has the potential to create thousands of regional jobs, and add billions of dollars to the State economy, reduce our dependence on imported petroleum for transport, and create new industries around the availability of gas as a feedstock. This can be achieved while reducing and diversifying away from our dependence on coal, resulting in a significant reduction in carbon emissions.

The NSW Government is committed to achieving the national renewable energy target of 20 per cent renewable energy by 2020, which is reflected in the recently released State Plan, by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources. A Joint Industry Government Taskforce has been established and is currently developing a Renewable Energy Action Plan for NSW to identify opportunities for investment in renewable energy sources. Increased renewable energy development is complementary to gas peaking generation as intermittent renewable energy sources such as wind and solar generation, require increased peaking generation capacity to meet demand when energy use is high.

In all the recent controversy surrounding mining and CSG, we should not lose sight of the fact that the use of gas for domestic cooking, heating, hot water, sophisticated manufacturing and a wide range of other uses is a day to day reality in NSW.

PART A

3. COAL SEAM GAS EXTRACTION

CSG largely consists of methane (CH_4) found in underground coal seams. Methane gas is soaked up by coal grain faces or micropores and water-generated pressure captures it within the seam.

Not all coal seams contain useful quantities of methane. In some cases, the coal gas may consist mainly of carbon dioxide (CO_2), or it may contain poisonous carbon monoxide (CO), or nitrogen (N_2) but this will vary from site to site and the scale of the resource. There may also be quantities of hydrocarbon gases other than methane (for example, ethane, propane and butane).

CSG is extracted by drilling a well to the coal seam. When water is pumped from the coal seam, the hydrostatic pressure is reduced and the gas is released with the water.

The CSG is separated from the water at the surface. The processing is undertaken close to the well head to remove carbon dioxide and water before injecting the gas into a pipeline for transportation and use.

Small, in-field screw type compressors are typically used to push produced gas to a central gas processing facility where it is dried and/or compressed as necessary for transportation along a high pressure transmission pipeline for delivery to energy markets.

In a minority of cases the CSG extraction process can be aided by fracturing the coal seam through application of hydraulic pressure to facilitate gas release, a process known as ‘fraccing’ (from hydraulic fracturing).

The objective of fraccing is to open up the methane-bearing coal formation in order to increase the surface area from which methane can be desorbed to increase the production of a gas well. Fraccing involves the pressurised injection of fluids (“fraccing fluids”) into the coal formation. These fluids generally consist of water, sand and a small percentage of chemical additives. The sand (or other material such as ceramic beads) prevents established fractures from closing once the hydraulic pressure ceases. Large volumes of fraccing fluids are pumped down the well and into the coal seam to stimulate fracturing of the seam and release of CSG up to several hundred metres from the well.

A number of chemicals may be used in the fraccing process, including sodium hypochlorite, hydrochloric acid, surfactants, cellulose, acetic acid and bactericides. These chemicals appear in varying concentrations in many every day products used by the community. Their primary purpose in the CSG setting is to assist the transport of sand into the fraccing zone. The chemical additives generally constitute less than 1% of the fraccing solution.

Newer technologies including horizontal well drilling have in many cases displaced the need to undertake fraccing and it is important to note that the geology of NSW

and gas exploration activities here differ from the USA, France and areas of Queensland.

Nevertheless, the NSW Government is implementing a ban on the use of fraccing fluids that include the organic compounds benzene, toluene, ethyl benzene and xylenes (BTEX) as additives. The Government will ensure that fraccing activities do not compromise beneficial uses of groundwater, surface waters or the environment through the use of BTEX.

CSG and "natural gas" (also methane) from traditional oil and gas fields are very similar, but CSG exploitation and use is a relatively new phenomenon. Until recently, the natural gas or methane used in Australia and elsewhere was nearly all supplied from reservoir gas - that is, 'conventional gas' that occurs in underground porous sedimentary rock reservoirs (gas fields) rather than in coal seams. Both are odourless natural gases suitable for domestic, commercial and industrial uses, including power generation. CSG may have slightly lower energy content than conventional gas in circumstances where the conventional gas also contains longer chain hydrocarbons (ethane, propane and butane). The absence of longer chain hydrocarbons results in CSG being a very clean, non-toxic gas compared to natural gas, which may contain higher hydrocarbons.

At the end use point there is no difference between CSG and natural gas and both have almost identical physical and chemical properties. The key differences are the location of the gas and the extraction methods used, though both require drilling into the ground beyond aquifers. Both natural gas and CSG, sourced from NSW and Queensland, are being used by domestic, commercial and industrial consumers in NSW today.

4. THE COAL SEAM GAS INDUSTRY IN NSW

Coal seam gas (CSG) exploration and production is an emerging industry in NSW, particularly when compared to Queensland. The majority of the focus for coal seam gas exploration is in the Hunter region, Gloucester Basin, Gunnedah Basin, Southern Coalfield (near Camden) and the Clarence Moreton Basin in north eastern NSW. While exploration is active in all these regions, to date only a limited number of CSG projects have been approved for production. These are:

Camden Gas Project (Stages 1 and 2)

The Camden Gas Project, southwest of Sydney, owned and operated by AGL Energy, is the largest producer, and the only CSG site in NSW approved and currently in production. Production at Camden is currently about 16 peta joules (PJ) per day, which can currently supply 6% of the State's current gas market. AGL is currently proposing a northern expansion of the Camden Gas Project ("Stage 3") which has the capacity to expand production to 38PJ per day, or 15% of the NSW gas market.

Casino Gas Project

In June 2010, Metgasco Limited received project approval for the Richmond Valley Power Station, a 30 megawatt gas-fired power station to be powered by

locally-sourced coal seam gas. The project included approval to develop between 30 and 45 coal seam gas production wells and to connect these wells via underground pipelines with the power station.

Gloucester Gas Project

In February 2011, the Planning Assessment Commission approved AGL's concept plan application for the Gloucester Gas Project (comprising the following five elements) and also granted project approval for elements two to five:

1. staged development of gas extraction wells and associated infrastructure within a 210 km^2 area of the Gloucester Shire and Great Lakes Shire Local Government Areas (LGAs);
2. construction and operation of up to 110 gas extraction wells and associated infrastructure in 50 km^2 of this area, in the Gloucester LGA;
3. construction and operation of a central processing facility to compress and process the gas ready for transport, at one of two potential sites in Gloucester Shire LGA;
4. construction and operation of a gas transmission pipeline to transport the gas from the central processing facility to the existing gas supply network at Hexham; and
5. construction and operation of a gas delivery station at Hexham in the Newcastle City LGA, to deliver the gas from the pipeline to the existing Sydney-Newcastle gas pipeline.

Gas Production in NSW

Currently, NSW only produces a very small percentage (approximately 6%) of its own gas demands and is heavily dependent on gas supplies from interstate, primarily from South Australia and Victoria. Evidence suggests that these sources may be depleting in the foreseeable future, therefore NSW needs to take action to maintain and increase the State's energy security whilst reducing greenhouse gas emissions.

There are two options available to reinforce energy security by ensuring suitable future gas supplies – development of domestic NSW production and processing capacity or the construction of further transmission pipelines to access other sources such as CSG from Queensland. Industry is likely to adopt a combination of the two options.

There are reasons to believe that CSG in NSW has a similar potential as identified in Queensland, where the industry could generate over 18,000 direct and indirect jobs, increase gross state product by over $3 billion and provide royalty returns of over $850 million per annum. In NSW, CSG production is currently valued at around $34.5 million per annum, but given the current estimates of potential NSW CSG reserves are larger than total natural gas reserves for Australia, there is potential for CSG production to exceed $1 billion per annum by 2025.

In areas such as Gunnedah and Narrabri, the existing investment in CSG activities has led to new jobs being established, population increases and boosted the local economy. These positive developments are already being seen from the current level of investment in the industry, and expansion is likely to see further development

of this nature in a range of regions and towns across the most prospective CSG areas in the State.

Gas, unlike most mining projects, has the potential to stimulate new industries in regional centres that could use gas as a feedstock or as a clean energy resource. These industries include fertiliser manufacturing, food processing, glass manufacturing, kiln firing and electricity generation. As a consequence, the development of a gas industry could have a much larger economic impact than the production of the gas itself.

The growing estimates of CSG reserves in NSW have also lead to investors in CSG exploration examining the feasibility of a liquefied natural gas export facility in NSW. There is a general expectation that gas production from NSW coal seams has the potential to support major investments beyond local gas production and consumption. As a consequence, there is an opportunity for LNG exports of large volumes of NSW gas driven by growing overseas demand for energy, including LNG and other cleaner energy resources.

5. ROLE OF COAL SEAM GAS IN MEETING THE FUTURE ENERGY NEEDS OF NSW

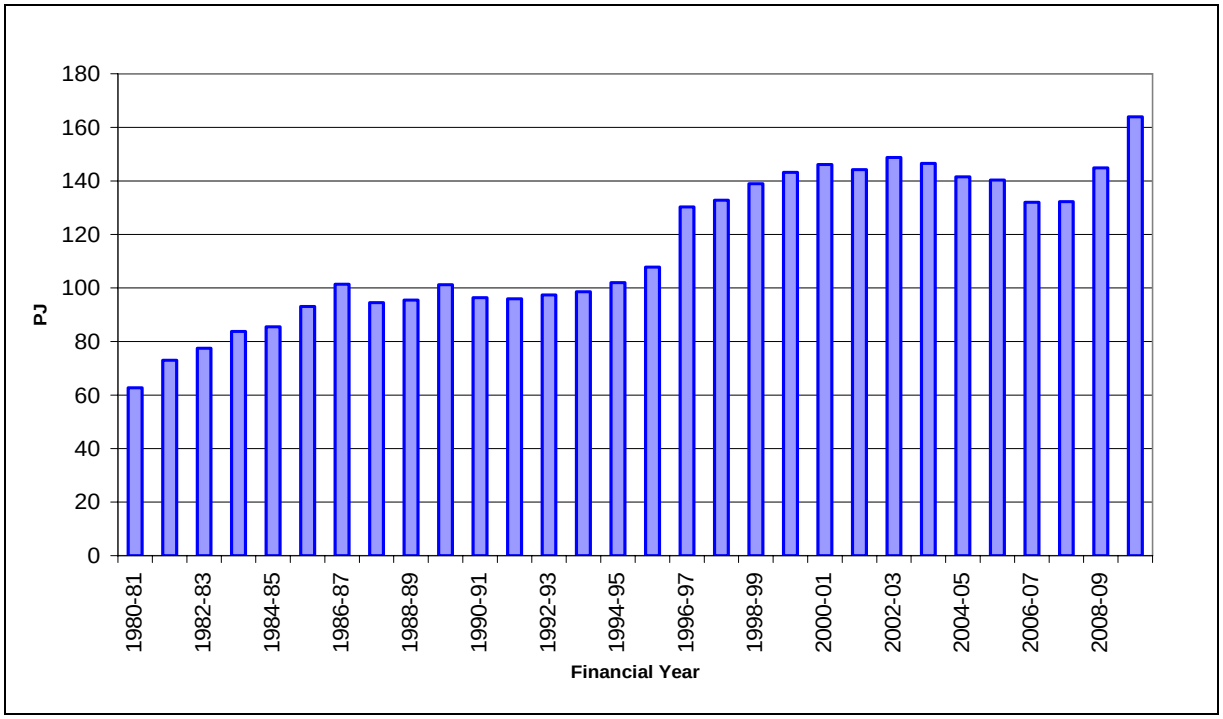
5.1 Gas Demand in NSW (Current and Forecast)

The total gas demand in all National Electricity Market (NEM) regions in 2010-11 was around 640PJ, of which NSW demand was around 25% or 160PJ[1]. Gas contributes 10% of the total primary energy use in NSW, with coal and oil contributing 48% and 38%, respectively.

Gas consumption in NSW has more than doubled since the mid-1980s, with the average annual increase being around 3.4%[2] (Figure 1). There has, however, been a steep increase in demand in the past two years, mainly due to the commissioning of three gas-fired power plants (Tallawarra, Uranquinty and Colongra) (Figure 2). Around half of the gas used in NSW is in industrial, manufacturing and agricultural industries, a quarter in electricity generation and the rest in the residential and commercial sectors, mainly for heating and cooking purposes (Figure 3).

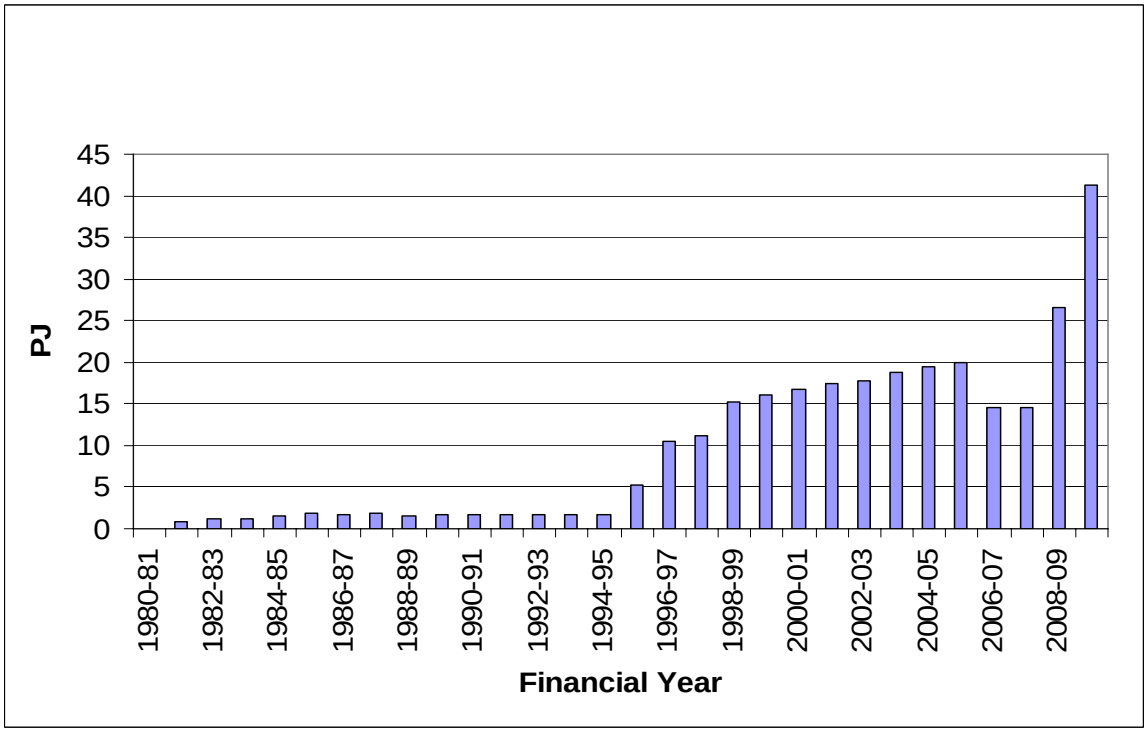
While on an annual average basis the share of gas used for power generation in NSW is around 25%, during periods of peak demand (e.g. cold winter nights) the proportion of gas used for power generation could go up to 45%, indicating the importance of gas as a fuel source to meet the State's electricity demands.

Figure 1: Natural Gas Consumption in NSW (PJ)



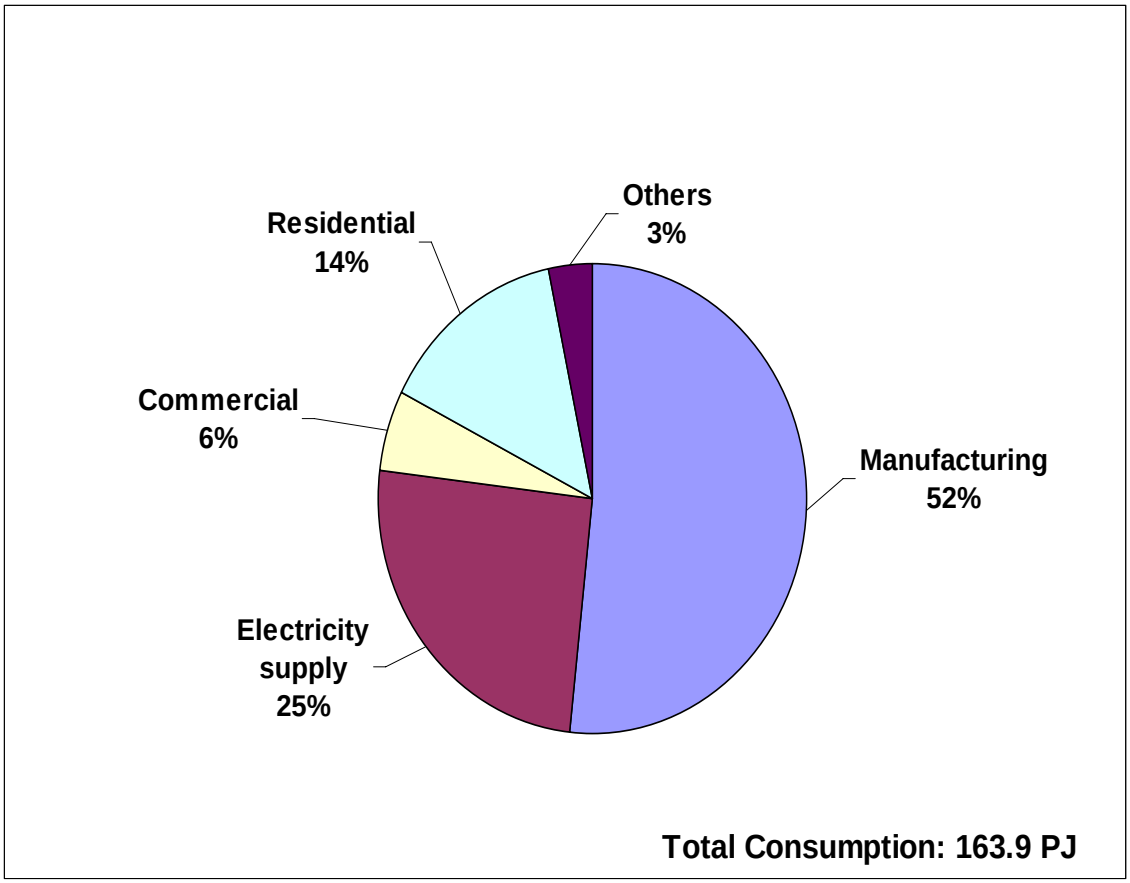
Source: ABARE 2011

Figure 2: Gas Consumption for Electricity Generation in NSW



Source: ABARE 2011

Figure 3: Natural Gas Consumption by Sectors in NSW (2009-10)



Source: ABARE 2011

The Australian Energy Market Operator (AEMO) forecasts significant expansion of the gas industry for the NEM regions including NSW, Queensland, Victoria, SA and Tasmania. The gas demand in these regions is expected to increase by 2.9-4.8% per annum, excluding LNG exports, over the next 20 years.

Total gas demand is forecast to increase to a maximum of 1,700PJ per annum, of which gas for power generation is forecast to contribute around 1,000PJ per annum, or 60-79% of total gas demand under various scenarios.[3]

Under a forecast medium growth scenario, over the next 20 years gas demand in NSW is forecast to more than triple to around 550PJ per annum, at an average annual growth rate of 6.9%. New gas-based power generation is projected to start coming on line from 2017, with demand for gas from this sector forecast to increase 12 fold from around 30PJ today to 350PJ per annum in 2030, making up two thirds of total NSW gas demand.

Metropolitan Sydney, Newcastle and Wollongong have the largest gas demand base from residential and commercial consumers in NSW. Annual gas demand in this combined area is projected to grow at average rate of 8% under a medium growth scenario.

Gas demand is subject to daily as well as seasonal variation. The peak daily demand for gas in NSW in 2010-11 varied between 250 and 620 TJ/day, with an average for the year of 436TJ/day. NSW winter peak day gas demand is forecast to increase by

480TJ to over 1,100TJ[4] by 2020. Gas production and supply infrastructure needs to be able to meet these changing peak day demands. This is similar to peak electricity demand, though with electricity the demand and supply have to match instantaneously due to the absence of in-transit storage. With gas, the pipeline acts as storage thereby providing a certain amount of buffer that can smooth out day to day imbalances between supply and demand.

5.2 Gas Supply in NSW

Australia has large resources of gas. Natural gas resources are located in Western Australia, Victoria and South Australia, whereas CSG resources are located in Queensland and NSW. In August 2010, Australia's proved and probable (2P) reserves, which represent a best estimate of commercially recoverable resources, stood at around 106,000PJ, comprising of 78,000PJ of natural gas and 37,000PJ of CSG[5]. Almost 34,000PJ of the 37,000PJ 2P CSG reserves are located in Queensland. However, the total CSG reserves, including the possible and prospective reserves, are estimated to be over 327,000PJ, of which 150,000PJ are located in NSW (Table 1).[6]

Therefore as projected gas consumption in NSW is expected to rise to 550PJ pa there are projected CSG reserves to meet the State's growing gas needs for over 250 years.

Table 1: Gas Reserves in NEM Regions (PJ)

Gas Resources	Proved & Probable (2P)	Proved, Probable and Possible (3P)
Coal Seam Gas in Queensland		
Bowen and Surat	34,222	153,535
Galilee	0	21,840
Coal Seam Gas in NSW		
Clarence-Moreton	461	1,655
Gloucester	721	895
Gunnedah	1,636	149,740
Sydney	165	(included with Gunnedah)
Total Coal Seam Gas	**37,204**	**327,666**
Total Natural Gas	**10,410**	**24,691**

Source: Gas Statement of Opportunities 2010 by Australian Energy Market Operator (AEMO) for Bowen-Surat total reserves and natural gas data. The CSG data comes mainly from the Mineral Resources Branch of DTIRIS. Note: Reserves include the NEM regions of Queensland, NSW, Victoria, SA & TAS, and exclude WA & NT

Australia produced 1,911PJ of gas in 2009-10, of which 54% was used for the domestic market, with the rest exported as liquefied natural gas (LNG). The CSG share of total production rose from 8% in 2008-09 to 10% in 2009-10.

NEM regions contain around 35% of known gas reserves, the majority of which are CSG. CSG production rose by around 32% to 195PJ in 2009-10, and accounted for almost 30% of gas production in NEM regions over the same period.

Currently NSW does not have any significant gas production facilities. The two main sources of gas supply to NSW come from the Moomba to Sydney Pipeline (MSP) and the Eastern Gas Pipeline (EGP) connecting to the Gippsland basin in Victoria. MSP has a capacity of 439TJ/day and is over 2,000 kilometres long including laterals to regional centres. EGP has a capacity of 268TJ/day and is around 800 kilometres long.

There are two other small sources of gas supply to NSW. The NSW-Victoria interconnect is a 150 kilometre long bi-directional pipeline connecting MSP (near Wagga Wagga) to the Victorian transmission system and with a maximum capacity of around 90TJ/day. There is also a small CSG plant at Camden providing a maximum of 20TJ/day.

The current total capacity of all the above mentioned pipelines supplying NSW is around 800 TJ per day. In 2010-11 the shares of gas (160 PJ) supplied to NSW were 49% from EGP, 43% from MSP and 4% each from the NSW-Victoria interconnect and Camden CSG.

Over the next 20 years, CSG reserves in NSW are expected to increase from 2,000PJ to 6,000PJ and the Queensland reserves are expected to increase from 24,000PJ to 36,000PJ. Hence, despite the anticipated high growth rates in consumption, the AEMO forecasts that there will be sufficient gas reserves to meet domestic as well as LNG export demand to 2030. Natural gas production is projected to decline in Victoria and South Australia, but be more than compensated by increased CSG in Queensland and NSW, provided there is sufficient production capacity, as well as transmission infrastructure and connections, to allow the CSG to be supplied to the demand centres.

5.3 Emission intensity of CSG versus other energy sources

CSG is a relatively clean fuel for power generation, producing around half the CO2 emissions of coal generation. Other non-renewable fuels that can be used for power generation (mainly base load) are natural gas, coal mine waste gas, LNG and coal. CSG, natural gas and LNG all have exactly the same emission intensity of 51.3kg/GJ based on direct combustion only. Coal mine waste gas is a by-product of coal mining and has an emission intensity of 56.63kg/GJ, slightly higher than that of CSG or natural gas (Table 2).

Table 2: Emission intensity (kg CO_2-e /GJ)[7]

Fuel	Total
Natural gas	51.33
CSG	51.33
Coal mine waste gas	56.63
LNG	51.33
Black coal	88.43

Source: Department of Climate Change and Energy Efficiency (July 2011), National Greenhouse Accounts Factors

Whole of lifecycle emission intensity includes direct combustion emission intensity (as provided above) and fugitive emission intensity. The fugitive emissions are generated during resource extraction, processing and transportation. The fugitive

emissions depend on several mine specific factors and is difficult to provide general comparisons.

CSG is likely to have lower fugitive emission intensity as compared to natural gas or LNG. The processing of CSG is simpler and mostly only requires the removal of water. Natural gas normally requires removal of CO_2 and other heavier hydrocarbons. Furthermore, CSG being available locally within NSW would require less transportation as compared to gas from other states. LNG also requires additional energy for compression and liquefaction. As a result the whole of lifecycle emission intensities of natural gas and LNG are likely to be higher than that of CSG.

A recent report by Worley Parsons and the Australian Petroleum Production and Exploration Association (APPEA) has found CSG/LNG to be significantly less GHG intensive than coal in power generation. It compares the GHG life-cycle of Australian LNG derived from CSG and Australian black coal, from extraction and processing in Australia to combustion in China for power generation. It found that on average, coal combusted in a subcritical, supercritical or ultra-supercritical pulverised coal plant produces respectively 87%, 51% and 43% more life cycle GHG emissions per MWh than CSG/LNG combusted in a combined cycle gas turbine (CCGT) plant. The analysis assumes that CSG/LNG projects apply best practice in GHG and environmental management, especially to the prevention of venting and leaks in upstream operations.

5.4 Installed and availability costs of CSG versus other stationary energy sources

The cost of gas supplied to power plants or to industry and business depends on various factors including the mining and transportation costs. The prices paid for gas are mostly under bilateral contracts and not available in the public domain.

The factors influencing the gas price for a power plant are:

- gas demand and supply balance and production costs;
- available pipeline capacity and cost of increasing capacity;
- physical plant location relative to gas supply sources and transmission infrastructure; and
- supply availability, pipeline tariffs, availability of line-pack, pipeline overrun charges.

The estimated delivered natural gas costs in 2009-10 (published by AEMO) for the four NSW gas based power plants are: $3.80, $4.19, $6.22 and $7.42 per gigajoule (GJ) for Tallawarra, Smithfield, Uranquinty and Colongra respectively[8].

The delivered natural gas cost in Victoria is lower than NSW at $3.87-$5 per GJ. These costs for South Australia are between Victoria and NSW at $3.98-$6.61 per GJ. In Queensland, however, which has both natural gas and CSG based power plants, the delivered gas costs for natural gas based power plants are significantly higher at $4.70-$6.67 per GJ, as compared to the delivered gas costs for CSG based power plants at $0.95-$4.24 per GJ.

The retail prices for residential and small commercial customers who have not entered into contract with retailers are determined by the Independent Pricing and Regulatory Tribunal (IPART). The regulated retail gas prices depend on the annual gas consumption and for residential customers it is typically around $16 per GJ (with a range of $14-$27 per GJ) and for a small business customer around $18 per GJ (with a range of $15-$28). According to the recent IPART determination, the typical residential gas customer annual bill is around $650 (AGL customer) and for a small business customer $3,500 in 2010-11.[9]

There are various commercially available technologies which use different fuels for power generation. CSG can be used for any gas-based technology. Table 3 provides capital cost, long run marginal cost (LRMC) and variable cost data for various power generation technologies (excluding the impact of a carbon price).

CSG can be used in base load technologies such as Combined Cycle Gas Turbine (CCGT) or peaking technologies such as Open Cycle Gas Turbine (OCGT). The capital costs of gas based technologies are in general lower than most other existing and forthcoming technologies. The OCGT operates for very short periods and hence has very high LRMC. The gas based CCGT technologies have lower long run marginal costs compared to other technologies, except for coal; mainly because the impact of a carbon price has not been factored into these data. Nevertheless, even under a carbon tax gas is still expected to be a competitive fuel compared to coal and renewables.

Table 3: Costs of CSG and other energy sources

Technology	Capital Cost (A$/kW or $'000/MW)	Total Cost or LRMC $ / MWh	Variable Cost $ / MWh
Black coal - super critical (SC)	1,900	45.99	1.20
Black coal - ultra super critical (USC)	2,400	54.00	1.20
Integrated gasification Combined Cycle (IGCC)	2,100	56.85	1.50
Combined Cycle Gas Turbine (CCGT)	1,050	58.38	4.85
Open Cycle Gas Turbine (OCGT)	750	522.64	7.50
Nuclear	3,500	76.13	2.00
Hydro	2,000	71.93	2.00
Solar thermal	5,000	224.37	1.50
Solar Photovoltaic (PV)	7,529	384.38	1.50
Wind	2,400	93.31	1.60
Biomass	2,200	70.34	3.00
Geothermal	5,000	87.42	2.00
Coal USC plus Carbon Capture & Storage (95%)	4,100	85.80	1.20
Gas CCGT plus Carbon Capture & Storage (95%)	2,850	112.69	1.20

Source: ACIL Tasman (May 2008), Projected energy prices in selected world regions

Notes:

- Long Run Marginal Cost (LRMC) is defined as the cost of an incremental unit of generation capacity spread across each unit of electricity produced over the life of the station. LRMC includes capital cost, fuel cost, variable operating and maintenance costs.
- Variable costs include fuel costs and variable component of operating and maintenance costs.

- All costs are based on A$ 2008 and exclude a carbon price.

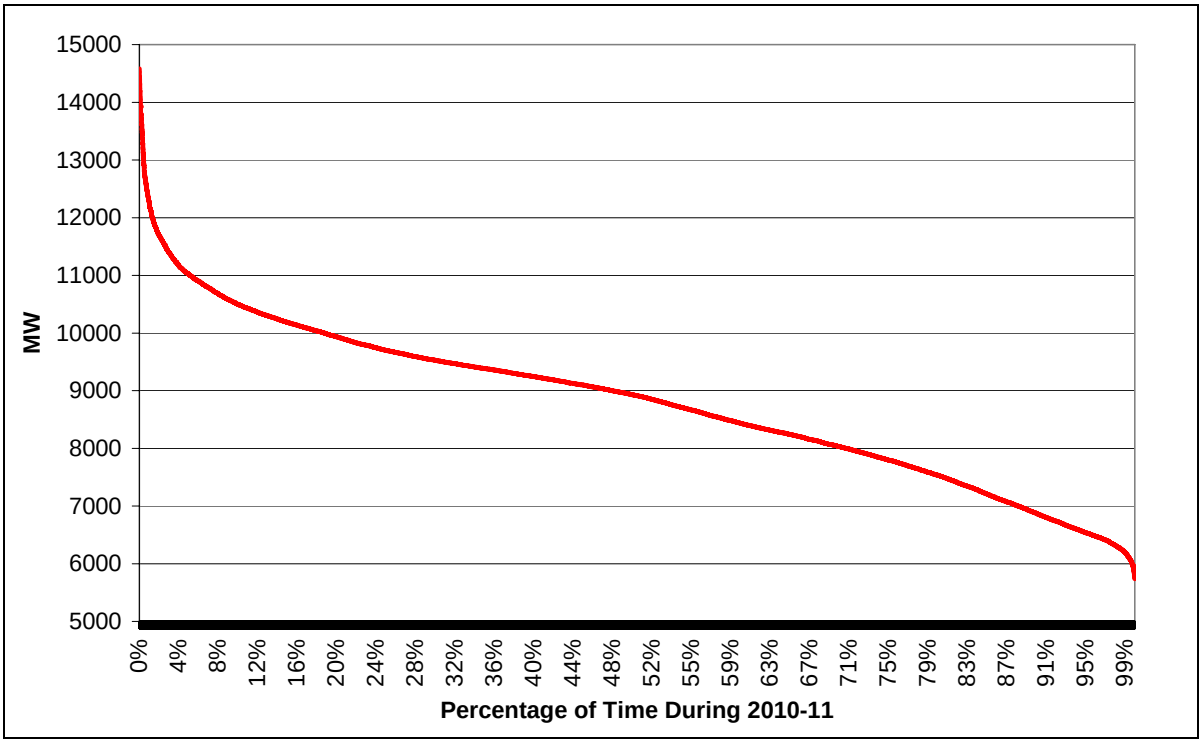
CSG based base load generation is in general less expensive compared to many other technologies and when a carbon price is included it also becomes more attractive than coal based power plants.

5.5 Proportion of NSW energy needs which should be base load or peaking supply and the extent to which CSG is needed for that purpose

Electricity demand varies throughout the day and the year. Typically NSW demand varies between 6,000 and 12,000MW, though the highest recorded peak demand for NSW was 14,580MW on 1 February 2011. The load duration curve for NSW is shown in Figure 4. It contains the half-hourly demand data for NSW for the financial year 2010-11 sorted from lowest to highest demand. This figure provides a clear picture of the 'peakiness' of the demand for energy in NSW: 3,600MW or the top 25% of the load occurs for 5% of the year only, indicating that 3,600MW of power plant capacity needs to operate for 5% of the year only.

In order to meet this fluctuating demand, usually two types of plants are used – base load plants that operate 24 hours a day and peaking plants that come on only when demand rises. Coal and gas based CCGT plants are usually used for base load and hydro and gas based OCGT plants are used as peaking plants. Certain types of hydro plants also operate as intermediate plants operating for longer periods of time.

Figure 4: NSW Load Duration Curve for 2010-11



Source: AEMO data for the chart extracted using Global Roam's NEM Review

Installed generation in NSW is around 12,000MW of coal plants, 2,200MW of gas plants (including 800MW of CCGT and 1,400MW of OCGT) and 4,200MW of hydro. The proportion of electricity generation from gas is around 6%, though it goes up to

11% on some days of the year. This includes around 120MW of coal mine waste gas based power plants.

In 2010, AEMO forecast that in the next 20 years up to 700MW of CCGT (base load) and up to around 7,000MW of OCGT (peaking plants) are likely to be required under a medium growth scenario[10] (Table 4). This increases the gas share from around 11% to 30% and reduces the coal share from 62% to 46% by 2030. Around 4,000MW of coal plants are likely to be required if no carbon price is introduced.

The 2011 National Transmission Network Development Plan is not available yet, however the AEMO Electricity Statement of Opportunity 2011 has reset downwards the baseline for electricity demand (over 4000GWh) and capacity (500MW) for NSW; new generation capacity in NSW will not be required until 2018/19. Reasons for this baseline reset include: more capacity having been built in recent times, slower than expected recovery from the global financial crisis, electricity price rises, distributed generation from small scale solar reducing the customer demand load, revised upward forecasts of the contribution of non-scheduled generation supply, and impacts of energy efficiency and demand management programs.

Table 4: New capacity requirement by 2030 (MW)

Technology	Likely scenario	Possible range	
		Min	Max
Base load coal	-	-	4,074
Base load gas (CCGT)	679	-	679
Peak load gas (OCGT)	6,757	2,316	7,046
Renewable	392	392	3,192
Total	7,828		

Notes:

- Likely scenario is a decentralized world with medium carbon price and high emission reduction, medium economic and population growth, high uptake of demand-side technologies and distribution generation, resulting in increased gas demand.
- Possible range includes the min and max in all the ten scenarios, some of which are without a carbon price.

Source: National Transmission Network Development Plan 2010 by AEMO

It is important to note that some of this 7,000MW of peaking capacity is needed to complement the forecast growth in intermittent renewable energy over this period. Different renewable technologies, such as wind and solar, operate intermittently depending on the prevailing weather conditions. Wind energy forecasting has improved to the point that the predictability in output is generally similar to the predictability of demand – which is managed by the variations in output across the portfolio of generators - but wind generation can still be subject to rapid, unexpected fluctuations and it is these circumstances that alternative capacity is required to meet demand, especially peak demand, and gas can play an important role in ensuring demand can continue to be met when fluctuations in output of other generation is ocurring.

Currently there are around 11,000MW of new generation proposals in NSW with development approval, including around 3,500MW based on gas and 4,700MW based on gas or coal (Table 5). In addition, there are over 10,000MW of new generation proposals in the planning system, including 3,300MW based on gas. The

large amounts of new gas-fired power plants will require additional amounts of gas resources and CSG can play a vital role in meeting this future gas demand.

Table 5: Proposed power projects by fuel in NSW (MW)

Fuel type	With Development Approval	In planning process
Gas	3,557	3,352
Coal	220	-
Coal or Gas	4,700	-
Wind	1,967	6,769
Other	655	307
Total	**11,099**	**10,428**

Source: Data from various sources collected by Energy Branch of DTIRIS.

5.6 Contribution of CSG to energy security and as a transport fuel

AEMO forecasts that under medium growth scenario for NSW to meet its gas demand "additional processing capacity is expected to be required in the Gunnedah Basin from summer 2017-18 and winter 2018 onwards"[11]. The primary reason for these conclusions is the age of the Moomba and Longford Gas Plants, both of which have over 40 years of operation. The gas basins these plants draw from are also significantly depleted, with remaining reserves to decline by 50 per cent in the next 20 years.

It should also be noted these basins and gas plants, supplemented by the smaller Otway basin gas plant, supply Victoria, South Australia and Tasmania as well as NSW/ACT. The capacity of the all gas plants supplying the southern states is 1,875TJ per day, with all regions, including NSW, currently utilising stored gas in pipelines, man-made facilities and converted underground geological formations to meet winter daily peak demand which is expected to reach a combined 3,250TJ by winter 2017.

Consequently, AEMO predicts South Australia, Victoria and Tasmania will become more reliant on gas supplies from northern states, principally Queensland and NSW CSG. Ensuring security of gas supply for NSW electricity generation will require bringing the State's CSG reserves into production and/or the expansion of transmission pipeline capacity from interstate.

Without bringing reserves into production or expanding interstate capacity, potentially significant price rises could be expected to flow on to large gas consuming industries as well as smaller commercial and residential consumers. In addition, these price rises will flow into electricity prices as gas fired electricity generation expands in the region.

Given the primary driver of the growth in gas demand is for lower carbon emission gas fired generation as a transition and ongoing support to renewable generation, halting the growth in gas fired generation would slow gas demand growth. However, as it is currently estimated NSW will require some 500MW of new electricity generation by 2019/20 and some 800MW by 2020/21[12] this will have to be provided by other technologies. The only currently available technologies to deliver this new

capacity are low cost but high emission coal fired generation, with its associated carbon price risks, or higher cost intermittent renewables (wind and solar PV) and the associated challenges for energy reliability.

Compressed natural gas (CNG) is being used as transport fuel in buses in Sydney. Trials are being undertaken for use of natural gas in fuel cells to be used in buses and trucks and LNG to be used in long-haul large trucks. CSG can be used in all these applications as it is a direct substitute for natural gas.

There are over 200 trucks converted to LNG in Australia. Owing to its density, greater volumes of LNG fuel can be stored in liquefied form making it more suitable for long-haul heavy vehicles (compared to CNG). There is no movement, however, in the light or passenger vehicle LNG market mainly due to impractical storage requirements.

LNG presents an attractive alternative in the heavy vehicle segment due to its price stability, environmental benefits and proven performance. Historical movements in natural gas pricing (LNG and CNG), have been small relative to annual movements in the price of automotive diesel. As a consequence, it is anticipated that a significant part of the increase associated with the proposed changes to fuel excise will be offset by net increases in the cost of diesel relative to natural gas for transport in Australia – resulting in these fuels remaining relatively attractive within the transport market. Even a 100% increase in the gas tariffs by 2015 is unlikely to reduce the market attractiveness of these fuels given that the majority of the costs associated with using natural gas are related to compression or liquefaction.

The environmental benefits of LNG make it an attractive alternative to conventional diesel in the growing carbon conscious market. Despite original uncertainty in regard to GHG benefits, recent Australian Government sponsored testing clarified the matter, highlighting that an ADR80/02 15 L LNG engine produced 25% less GHG emissions (CO2-e) than the equivalent diesel engine, and approximately 15% less GHG emissions than the equivalent ADR80/03 engine (Kleenheat Gas 2010). Furthermore, compared to modern diesel vehicles, natural gas vehicles produce lower levels of toxic emissions due to the molecular structure of LNG compared to diesel, resulting in consistently lower particulate emissions.

PART B

6. KEY ISSUES RAISED WITH THE GOVERNMENT

The CSG industry requires access to water and also to land for extraction, processing and gas transportation infrastructure. It thus potentially competes for these resources with other sectors, such as agriculture, the environment and communities. A typical drill site requires a clearance area of at least one hectare in size, and roads linking wells form a transport network to facilitate well creation and ongoing maintenance. Depending on CSG location the well and road network may require clearing of native vegetation or, in agricultural regions, sections of productive land being taken out of production to locate the CSG infrastructure.

There are also concerns that drilling of wells into the CSG seams may affect overlying aquifers and alter groundwater hydrogeology, potentially affecting spring-fed water courses and the viability of surrounding water bores as the water table is lowered. Further concerns include:

- fraccing fluids being lost to the underground system with the potential to pollute groundwater;
- highly saline waste water contaminating underlying or overlying aquifers;
- surface disposal of saline waste water to offsite regions with detrimental effects on surface water quality or soil condition; and
- escape of CSG through uncontrolled paths, adding to carbon emissions and possibly, if the methane is in high enough concentrations, reducing the condition of surface vegetation communities.

7. NSW GOVERNMENT RESPONSE

The NSW Government has responded to community feedback about CSG and is implementing a suite of initiatives to improve the management of the industry. These initiatives were outlined in the Liberal / National pre-election *Strategic Regional Land Use Policy* and are now being implemented through three main work fronts:

- improving water management and water use conflict through the *Strategic Regional Land Use Policy*, an *Aquifer Interference Policy* and Regulation and supporting policies;
- improving land management and reducing land use conflict through the preparation and implementation of *Agricultural Impact Statements* and *Strategic Regional Land Use Plans*; and
- other actions specifically related to CSG, such as a requirement for exploration licences to be publicly exhibited prior to approval, review of hydraulic fracturing standards and limiting the chemicals used in the fraccing process.

The NSW Government appreciates that the issue of CSG cannot be viewed in isolation and acknowledges the growing importance of food production security. NSW has an excellent reputation for producing high quality produce from farming and aquaculture systems, and currently produces sufficient grains, meat and fibre for domestic needs and a healthy export trade. However, global and domestic demand for low cost, safe and nutritious food is increasing, and will continue to increase considerably in the future as both populations and incomes grow. It is predicted that

by 2050 the global population will reach 9 billion and Australia's population will be 35 million. Satisfying the associated growth in food demand will require an increase of 70% in global food production by 2050.

Globally and within Australia, food production is being increasingly challenged by constraints on key inputs (eg. water, energy, land, oil, fertiliser, labour) and environmental risks, such as climate change, soil degradation, overuse of surface and groundwater and loss of biodiversity. It is therefore critically important for NSW's rural communities and the NSW and Australian economies that the land sector continues to contribute in its agricultural as well as its mineral resource capacities.

The suite of measures already introduced and those still under consideration by the NSW Government to manage conflicts between sectors such as mining and agriculture are aimed at establishing a regulatory framework that minimises the risk of adverse development outcomes, but in so doing, also enables development to occur in a way that maintains and enhances those important 'productive', 'social' and 'environmental' values associated with resource access in NSW.

In this regard, it may be helpful to view these measures as:

(i) those that operate at and manage development risks at a regional scale, such as *Strategic Regional Land Use Plans*; and
(ii) those that operate at and manage development risks at the level of individual development proposals, such as requirements associated with *Environmental Impact Assessments*, *Agricultural Impact Statements* and compliance with the soon to be finalised *Aquifer Interference Regulation*.

The NSW Government is seeking ongoing community involvement in considering the right balance between the issues considered in the *Strategic Regional Land Use Policy* aimed at managing the risks associated with mining development in NSW. The Government notes this balanced approach has been supported by a number of stakeholders, including NSW Farmers. The Government therefore welcomes the opportunity provided by the Inquiry to further progress community involvement in this important issue.

7.1 Aquifer Interference Regulation

As noted above, there are community concerns about potential impacts on water quality and quantity as a result of CSG exploration and production. For example, it is claimed that specific CSG exploration and production activities could possibly lower water tables, decrease water pressures in confined aquifers and negatively affect water quality. Contrary to some media coverage they are very unlikely to reduce the yielding capacity of aquifers through compaction of the aquifer.

The likelihood of any such impacts cannot be generalised across the landscape. It is therefore very important that site specific data be used to assess the likely impacts of a CSG extraction so as to limit development where the risk of undesirable impacts is unacceptable, inform project design to incorporate appropriate preventative mechanisms, incorporate appropriate monitoring programs and establish reporting mechanisms to enable rapid responses to address any unforeseen impacts which

may occur. This is particularly important for water sources that form part of drinking water supplies.

Extraction of water is inherent in the extraction of CSG and requires a water access licence, similar to any commercial groundwater user. The coal seams being targeted by these operations are deep underground, typically 500-1,000m below the surface. Coal seams are minor aquifers, the water from which is generally not used by other industries both because of their depth and because they often contain brackish to saline groundwater. Whilst coal seam water may have little beneficial use without treatment, it can be overlain by shallower aquifers that contain good quality water suitable for stock, domestic and irrigation purposes.

Under NSW water sharing plans, total groundwater extractions are managed to theoretical extraction limits and all water is accounted for as part of the water budget. All groundwater extractions are accounted for under these limits, including water taken incidentally as part of mining and CSG extraction activities. To comply with the extraction limits set by water sharing plans it is important that the water taken incidentally is accounted for through the water licensing framework.

A triple bottom line approach has been taken to determine the extraction limits for groundwater sources in water sharing plans across NSW. The rules and extraction limits set in the porous rock water sharing plans will constrain the CSG industry and any other industry taking water from porous rock aquifers. These plans are not yet completed, but as there is currently unassigned water in these aquifers (water that has not been set aside for any other purpose) in-principle the plans could accommodate a substantial CSG industry.

An important first step by the new NSW Government to improving the regulation of impacts associated with aquifer interference activities, such as mining and coal seam gas, was the commencement of an interim *Aquifer Interference Regulation* on 1 July 2011. This Regulation requires new mining and petroleum exploration activities that take more than 3ML per year from groundwater sources to hold a water access licence. Previously under the *Water Management Act 2000* all mining exploration activities were afforded an exemption from requiring a water licence. This first stage of reform is an important step towards ensuring equitable sharing of groundwater amongst all water users. It enables a regulatory instrument to ensure appropriate monitoring and reporting arrangements to be established during exploration such that the assessment of moving to full production is informed by adequate data.

With this new legislative framework, the water-related impacts can be fully considered during the planning assessment phase and if the project does not meet the requirements of the *Water Management Act 2000*, namely minimising harm to groundwater dependent ecosystems and other water users, then it will not be able to obtain an aquifer interference approval.

In that regard, it is critical for NSW to better define what the requirements are for mining and CSG proposals to obtain such an approval. This will be addressed through the development of an *Aquifer Interference Policy.* Specifically, the Policy will establish rules for licensing both the volumetric water accounting of aquifer interference activities and the necessary requirements to obtain an aquifer interference approval for other impacts. The Policy is being developed to ensure that

water taken by certain activities that may interfere with aquifers is properly licensed and accounted for in the water budget and water sharing arrangements.

The Policy will also define what is considered a maximum acceptable level of harm for a number of potential impacts such as water table and pressures, water quality, land subsidence and aquifer compaction. Projects will need to demonstrate that they meet these standards in order to obtain an aquifer interference approval.

The Policy will clarify the Government's approach to assessing approvals. Approvals for aquifer interference activities will be based on an 'avoid, prevent, mitigate' approach to ensure impacts on groundwater and surface water systems are minimised.

The Policy will also give effect to the NSW Government's ban on the use of evaporation ponds as a disposal option for the water extracted during petroleum production activities (including coal seam gas). This will require proponents to develop other treatment and disposal options which can utilise the intrinsic value of this water to other water users (including irrigated agriculture, other industry and town water supply) and the environment.

7.2 Other Regulation

The NSW Government controls CSG through a regulatory framework comprising legislation, regulations, environmental planning instruments and other guidance material. This includes compliance with relevant Commonwealth legislation.

CSG projects generally progress via three stages: exploration, pilot appraisal and full development. Exploration for CSG is subject to approval by the Department of Trade and Investment, Regional Infrastructure and Services. The approvals process also requires an environmental assessment of impacts of exploration activity in accordance with Part 5 of the *Environmental Planning & Assessment Act 1979* (EP&A Act). An exploration licence only allows a company to undertake exploration, environmental assessments and feasibility studies.

Significant changes to the approval process for coal seam gas exploration were introduced recently. The changes mean that interagency consultation is now undertaken in relation to applications for coal seam gas exploration, chemical additives to be used in drilling and extraction processes must be disclosed in all new applications, and community information and consultation processes have been introduced before titles are granted.

The planning approvals system recognises that different types of CSG activities will have differing levels of environmental impact and should therefore be subject to an appropriate level of environmental impact assessment. In general, exploration activity, which does not comprise full development and is therefore limited in terms of both the scale and duration of activity, requires a lower order assessment under Part 5 of the EP&A Act.

However, for those proposals that involve more intensive activity, such as larger-scale exploration activities or those involving petroleum production, there is a requirement for formal planning approval under the EP&A Act. In this regard, a state-

level approval is generally required for proposals considered to be of State or regional significance, depending on whether they meet certain criteria relating to scale and location. These criteria, under both the current Major Project Assessment regime and the proposed State Significant Development regime, are discussed further below.

Provisions relating to the requirement for development consent for CSG activity are contained in *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP). In summary, exploration activity does not require development consent but may currently require approval under Part 3A of the Act or, as stated above, be subject to Part 5 of the Act. Under the Mining SEPP, CSG production proposals are required to obtain development consent under the EP&A Act.

Currently, *State Environmental Planning Policy (Major Development) 2005* contains criteria for CSG projects to be considered as a Major Project under the repealed Part 3A of the EP&A Act. These criteria are:

> *Development for the purposes of drilling and operation of petroleum wells (including associated pipelines) that;*
> *(a) has a capital investment value of more than $30 million or employs 100 or more people, or*
> *(b) is in an environmentally sensitive area of State significance, or*
> *(c) is in the local government areas of Camden, Wollondilly, Campbelltown City, Wollongong City, Wingecarribee, Gosford City, Wyong, Lake Macquarie City, Newcastle City, Maitland City, Cessnock City, Singleton, Hawkesbury, Port Stephens, Upper Hunter or Muswellbrook, but only if the principal resources sought is coal seam methane.*

On 22 June 2011, the NSW Parliament legislated an alternative system for the assessment of projects of State significance. A new State Environmental Planning Policy (SEPP) will clearly and transparently identify the types of development and sites which will be dealt with as State significant under Part 4 of the EP&A Act. The draft SEPP (State and Regional Development) 2011 includes revised criteria for CSG proposals that provide a greater level of consistency across the State, as well as clearer criteria for exploration activity that requires determination at the State level than currently exists under the Major Development SEPP.

The revised criteria are:

> *(1) Development for the purpose of petroleum production.*
> *(2) Development for the purpose of drilling or operating petroleum exploration wells, not including:*
> *(a) stratigraphic boreholes, or*
> *(b) monitoring wells, or*
> *(c) a set of 5 or fewer wells that is more than 3 kilometres from any other petroleum well (other than an abandoned petroleum well) in the same petroleum title.*
> *(3) Development for the purpose of drilling or operating petroleum exploration wells (not including stratigraphic boreholes or monitoring wells) that is carried out in an environmentally sensitive area of State significance.*

(4) Development for the purpose of petroleum related works (including pipelines and processing plants) that:
(a) is ancillary to or an extension of another State significant development project, or
(b) has a capital investment value of more than $30 million.
(5) In this clause, petroleum production has the same meaning as it has in State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007.

Applications for State Significant Development (SSD) will be lodged with and assessed by the Department of Planning and Infrastructure (DP&I). Importantly, the SSD process requires the applicant to request Director General's Requirements (DGRs) for the preparation of an Environmental Impact Statement (EIS), which provides a process for the early and coordinated consideration by agencies of key issues associated with CSG proposals. Such issues are extensive and typically include: strategic context and justification for the proposal; impacts on surrounding land use, including mineral resources, agricultural land, conservation areas and urban settlements; socio-economic issues, including impacts on physical and social infrastructure; impacts on surface and groundwater; biodiversity impacts; cultural heritage issues; air quality; noise and vibration; and hazards and risks;

As with other Part 4 applications, the relevant planning controls in all environmental planning instruments will apply and will need to be considered in the preparation, assessment and determination of the DA.

The DA and EIS, once lodged and accepted by the DP&I, will be publicly exhibited for a minimum 30 days (minimum 45 days if the exhibition period falls within a school holiday period), with issues raised in submissions to be thoroughly considered through the assessment process.

The Minister for Planning and Infrastructure has delegated his determination role to the independent Planning Assessment Commission (PAC) in relation to certain applications made by private applicants (based on whether 25 or more public submissions object to the proposal, whether the relevant Council made a submission objecting to the proposal, or the applicant has made a reportable political donation.) Therefore, the PAC now has an expanded determination role that will apply, where the relevant criteria are met, to CSG applications under the new SSD assessment regime.

It is also important to note that existing applicant and third party appeal rights under Part 4 of the EP&A Act will apply to SSD, including third party appeals where SSD is also designated development.

The Policy will undergo a comprehensive consultation phase, is expected to be signed off by the NSW Government in early 2012 and will be given legislative effect through the commencement of a final Aquifer Interference Regulation.

7.3 Strategic Regional Land Use Plans

As noted previously, CSG exploration and production can lead to land use conflict with other sectors, such as agriculture. The NSW Government's *Strategic Regional*

Land Use Policy will play a critical role in reconciling the various competing interests and to ensuring development proceeds in a way that maintains and enhances the social, productive and environmental values associated with natural resource access.

It is intended that Regional Strategic Plans will identify geospatially the resource endowments of regions and, importantly, where mining activities are associated with higher risks to sectors such as drinking water sources, agriculture and related communities. These maps could, for example, show areas where agricultural productivity is dependent upon groundwater systems and hence where there is a heightened risk to agriculture productivity from mining. In these areas, more stringent assessment requirements will apply. The plan development process will involve community consultation to ensure issues are clearly identified and considered.

While CSG is a relatively new industry in NSW, it is likely that, as more CSG projects are approved, the industry will have an increasing impact on infrastructure demands across all levels of government. The Regional Strategic Plans will also be used to address this issue by identifying the infrastructure needs of each region. This will include a focus on current and future infrastructure needs related to the CSG industry where required. The plans will outline key infrastructure resources in a region; identify key infrastructure needs and pressures, as well as outlining future investment priorities and funding sources.

These strategic plans will be provided to councils to inform the development of their Local Environment Plans as well as providing guidance for councils with regards to the provision of local infrastructure which benefits the community. In relation to specific CSG proposals, councils have the ability to seek infrastructure contributions through the relevant provisions of the EP&A Act, including Section 93F (Planning Agreements), Section 94 and Section 94A (Development Contributions).

The development of these plans for the Upper Hunter (including Gloucester) and New England North West (including Gunnedah and Liverpool Plains) has now commenced, with the plans for Central West and the Southern Highlands scheduled to commence in 2012. Plans for other areas will be developed in subsequent years.

A Stakeholder Reference Group has been established to inform this process. The Reference Group consists of peak representative bodies.

As part of the preparation of the Plans, NSW Treasury and the Department of Planning and Infrastructure are jointly commissioning a project to establish a methodology, data requirements, the base case and options that can be used to assess the costs and benefits of alternative land use mix scenarios in the Upper Hunter Region and in the New England/North West Region. This could then be used as the basis of cost benefit analyses to identify the costs and benefits associated with alternative land use mix options in each of the regions to inform the development of the Plans.

In addition to legislative protection, a number of additional policy requirements exist or are being implemented under the *Strategic Regional Land Use Policy*. These include:

- a requirement for development applicants to place advertisements in local newspapers showing the location of the application area and where information can be obtained, including the Landholders Rights brochure published by the Department of Primary Industries;
- the facilitation of negotiations between the NSW Farmers' Association, the NSW Minerals Council and the Australian Petroleum Production and Exploration Association (APPEA) in relation to a standard template for access arrangements;
- a requirement for public comment on all new coal seam gas exploration licence applications;
- new enhanced community consultation requirements as a condition of exploration licences; and
- a review of access arrangements under the POA, for which a Discussion Paper is currently being prepared.

7.4 Agricultural Impact Statements

A significant interim requirement of the *Strategic Regional Land Use Policy* is that mining development proponents produce an Agricultural Impact Statement (AIS). This will remain a requirement until the regional plans are in place. Hence, all new State Significant Development for mining or petroleum projects which have the potential to affect agricultural resources or industries are required to submit an AIS as part of the Environmental Impact Statement (EIS).

The specific requirements for the EIS, including the AIS, will be listed in the Director General's Requirements (DGRs) for the project by the Department of Planning and Infrastructure.

The purpose of the AIS is to ensure a focused assessment of the potential impacts of mining or petroleum projects on agricultural resources or agricultural industries. The AIS will provide transparent, targeted information about the potential impacts on agricultural industries that can then be balanced against other environmental, social and economic aspects of the project. Projects may not be supported where it is demonstrated they would result in unacceptable impacts on agricultural lands or industries.

In addition to the legislative protection, a number of additional policy requirements exist or are being implemented under the *Strategic Regional Land Use Policy*. These include:

- a requirement for development applicants to place advertisements in local newspapers showing the location of the application area and where information can be obtained, including the Landholders Rights brochure published by the Department of Primary Industries;
- the facilitation of negotiations between the NSW Farmers' Association, the NSW Minerals Council and the Australian Petroleum Production and Exploration Association (APPEA) in relation to a standard template for access arrangements;
- a requirement for public comment on all new coal seam gas exploration licence applications;
- new enhanced community consultation requirements as a condition of exploration licences; and

- a review of access arrangements under the *Petroleum (Onshore) Act 1991* POA, for which a Discussion Paper is currently being prepared.

7.5 Limiting Fraccing Liquid Chemical Additives

As noted above, the geology of many of the most prospective locations for coal seam gas in NSW do not require fraccing as part of the exploration or production process. Nevertheless, the potential for pollution of aquifers as a result of the underground injection of chemicals as part of the fraccing process is one of the concerns raised by the community. 'BTEX' compounds have been identified as being a particular concern.

BTEX is the acronym of a group of organic compounds that include benzene, toluene, ethyl benzene and xylenes. BTEX is found in a wide range of petroleum-based products including petrol and diesel and also occurs naturally in coal seams.

BTEX compounds are naturally occurring, aromatic, highly volatile and somewhat soluble in water. These compounds are readily biodegradable in waters or soils with the presence of oxygen and do not generally persist in low concentrations, they do not bio-accumulate and they are ubiquitous. However, the potential for cumulative toxic effects (mixture toxicity) needs to be considered as part of any site, or usage-specific risk assessment.

The NSW Government is implementing a ban on the use of BTEX chemicals in fracturing fluid additives. The Government will ensure fraccing activities do not compromise beneficial uses of groundwater, surface waters or the environment through the introduction of BTEX. A position paper has been prepared and will be released for public consultation shortly. The position is expected to ban the use of BTEX in fracturing fluid additives to limits consistent with the ANZECC drinking water guidelines, i.e., less than:

- 1 microgram/L for benzene;
- 800 micrograms/L for toluene;
- 300 micrograms/L for ethyl benzene; and
- 600 micrograms/L for xylenes.

7.6 Air Quality Impacts

The Office of Environment and Heritage administers the *Protection of the Environment Operations Act 1997* (POEO) and the associated Environment Protection Licenses (EPL), which regulate the air, noise, water pollution and waste management impacts of operations. CSG production projects are required to hold an EPL where the production capacity is more than 5PJ of methane or natural gas per year.

The *POEO (Clean Air) Regulation 2010* specifies general emissions standards for scheduled and non-scheduled premises. These include the correct operation and maintenance of plant and equipment, materials handling and the standards of air impurities not to be exceeded. In particular, where no prescribed standards exist the proponent must take all necessary steps to prevent or minimise air pollution.

While CSG exploration wells are not required to hold an EPL, the NSW Government recommends the CSG industry use the Regulation as a benchmark/guide for ensuring the proper and efficient operation of flares to reduce the release of methane and other air impurities into the environment and as a means of demonstrating that all practicable means have been implemented to prevent or minimise air pollution.

There are minimal particulate issues for CSG extraction, production and electricity generation as compared to coal extraction and electricity generation, as between 95 and 99 percent of CSG is methane. The only particulate issues for CSG relate to drilling. The major pollution concern with CSG is greenhouse gas emissions. The flaring of CSG during exploration and the burning of CSG through gas fire combined cycle gas turbines produces nitrogen oxides and sulphur oxides. However, with CSG there is a lower risk of impurities such as H_2S compared to landfill methane gas. Both of these environmental harm risks can be minimised by enclosed flaring.

7.7 Legal Rights of Property Owners

In NSW, all mineral and petroleum resources are owned by the Crown and the NSW Government has an obligation to ensure these resources are effectively and responsibly explored for the potential benefit of the State.

In other jurisdictions, conflict has arisen in relation to land access arrangements between resources companies and individual landholders. In Queensland, until relatively recently, exploration licence holders only had to serve notice on landholders in order to enter. This has never been the case in NSW.

Exploration for coal seam gas is regulated under the *Petroleum (Onshore) Act 1991* (POA). This legislation recognises the rights of landholders and aims to ensure that landholders are not adversely impacted and are appropriately compensated for any petroleum exploration or production activities carried out on their land. The POA contains detailed and stringent provisions covering access to land for exploration and compensation. These are outlined in Part 1 (Prospecting Titles) of an information brochure titled “Landholders rights, access arrangements and compensation under the *Petroleum (Onshore) Act 1991*”, which is readily accessible on the Department of Primary Industries website.

The access provisions of the POA underwent significant amendment in 2010. These amendments were done in consultation with affected parties, including the NSW Farmers’ Association, the thoroughbred industry, the NSW Minerals Council and the Australian Bankers Association.

Access arrangement conditions can be tailored to suit the requirements of each landholder and can include provisions for compensation. DTIRIS is currently working with the NSW Farmers’ Association, the NSW Minerals Council and the Australian Petroleum Production and Exploration Association (APPEA) to develop a standard template for access arrangements. This standard template is close to completion and will serve as a starting point for the drafting of access arrangements. If any adverse impacts arise that are not within the provisions of the access arrangement, compensation can be sought by a landholder under section 107 of the POA.

In cases where access arrangements cannot be agreed, there is provision for an arbitrator to be appointed from the Minister's Panel of Arbitrators under the POA. The number of arbitrator appointments has never exceeded ten per annum. This could suggest that the existing arrangements work reasonably well. However, in light of community concerns, the Government has committed to reviewing access arrangements.

Commercial production of coal seam gas requires a petroleum production lease issued under the POA. However, under section 67 of this Act, the Minister must not grant a production lease over the land unless appropriate development consent under the *Environmental Planning and Assessment Act 1979* (EP&A Act) is in force in respect of the land. In these circumstances, the landholder's rights are subject to consideration and protection under both the POA and the EP&A Act.

The provisions of the POA in relation to landholder protection where actual CSG production is to occur are outlined in Part 2 (Production Leases) of the information brochure mentioned above. For example, the holder of a petroleum production lease may not carry out activities on any cultivated land within the vicinity of a landholder's dwelling house, garden, orchard or vineyard without the landholder's consent.

As noted previously, in addition to the legislative protection, a number of additional policy requirements exist or are being implemented under the *Strategic Regional Land Use Policy*.

In summary, an exploration license does not confer a right to the petroleum and only allows access subject to conditions. All exploration work has to be rehabilitated to the original state or better. Legislative and policy provisions in NSW are designed to ensure landholders are not adversely affected by exploration or resource development. During exploration they should largely be able to continue their normal business, with access arrangements and compensation to address any impacts of exploration work on their land. In most cases, this should allow business to continue along with an additional revenue stream from the land alienated by petroleum production faculties.

8. RESPONSES TO INQUIRY TERMS OF REFERENCE

8.1 The environmental and health impact of CSG activities

a. Effect on ground and surface water systems

Drinking water catchments:

As coal seam gas activity is an emerging industry and the potential impacts on surface and groundwater are not yet fully understood, the Sydney Catchment Authority has developed principles to underpin decision making in drinking water catchments. The principles establish outcomes considered essential to protect drinking water supplies. Application of the principles should ensure that there is adequate baseline information, monitoring and modelling to enable the proponent to predict with confidence likely impacts.

- Protection of water quantity - Mining and coal seam gas activities must not result in a reduction in the quantity of surface and groundwater inflows to storages or loss of water from storages or their catchments.
- Protection of water quality - Mining and coal seam gas activities must not result in a reduction in the quality of surface and ground water inflows to storages.
- Protection of water supply infrastructure - The integrity of the SCA's water supply infrastructure must not be compromised.
- Protection of human health - Mining and coal seam gas activities must not pose increased risks to human health as a result of using water from the drinking water catchments.
- Protection of ecological integrity - The ecological integrity of the Special Areas must be maintained and protected.
- Sound and robust evidence regarding environmental impacts - Information provided by proponents, including environmental impact assessments for proposed mining and coal seam gas activities, must be detailed, thorough, scientifically robust and holistic. Potential cumulative impacts must be comprehensively addressed.

Also see comments at Section 7.1.

b. Effects related to the use of chemicals

See comments at Section 7.5.

c. Effects related to hydraulic fracturing

See comments at Section 7.1.

d. Effect on Crown Lands including travelling stock routes and State forests

Crown Lands:

Travelling Stock Reserves (TSRs) are Crown lands managed in trust on behalf of the Minister for Primary Industries, by the Livestock Health and Pest Authorities (LHPAs) across the Eastern and Central Divisions of NSW. The functions and management of LHPAs regarding TRS are described within the *Rural Lands Protection Act 1998.* TSRs have been suggested as an option for the location of CSG infrastructure (wells and pipelines). This is proposed as a strategy to minimise land use conflict within the community.

TSRs are normally in the vicinity of prime agricultural land, can have high biodiversity, conservation and/or Aboriginal cultural values and are in regular use. Due to this wide range of users and potential values associated with TSRs, careful consideration will be needed if the NSW Government is to consider including TSRs in it's analysis of options for the use of Crown Land, for pipeline routes and the establishment of energy and transport corridors. Other Crown Lands may be more preferable when taking into account environmental factors such as biodiversity in these areas compared to agricultural land. Commonwealth Native Title and NSW Aboriginal Land Rights issues will also be considered.

State Forests:

The main impact of CSG activities on State forests is predominately around the clearing of the forest for drill sites and road networks, although it may also impose a significant resource burden on the regional staff managing the affected forest.

In 2010, Forests NSW developed a policy, accompanied by the production of a comprehensive legal document, to protect Forests NSW' interests where a mining company (licensee) is granted the rights for mineral and coal seam gas exploration over State Forests land.

Forests NSW imposes permit conditions on CSG exploration companies which seek to ensure that appropriate environmental standards are met. The conditions dealing with minimising the impact of a range of possible environmental impacts include:

- preventing contamination or pollution;
- minimising power, and water usage;
- minimising waste generation;
- immediate notification of any environmental liability;
- minimising the risk of fire;
- preventing the introduction of livestock, domestic pets or exotic animals;
- preventing the introduction of exotic plants; and
- minimising the clearing of vegetation.

e. Nature and effectiveness of remediation required under the Act

Remediation requirements can and would be imposed as conditions of the title.

f. Effect on greenhouse gas and other emissions

See comments at Sections 5.3 .

g. Relative air quality and environmental impacts compared to alternative fossil fuels

See comments at Sections 5.3 and 7.6.

8.2 The economic and social implications of CSG activities

a. Legal rights of property owners and property values

See comments at Section 7.7.

b. Food security and agricultural activity

See comments at Sections 7 and 7.4.

d. Royalties payable to the State

While the operation of a CSG production facility would generate royalties for the State, the magnitude of the royalty stream would vary on a case-by-case basis and would be only one of the factors taken into consideration in determining whether the development would be in the best interests of the NSW community.

e. Local Government including provision of local/regional infrastructure and local planning control mechanisms

See comments at Sections 7.2 and 7.3.

8.3 The role of CSG in meeting the future energy needs of NSW

a. Nature and extent of CSG demand and supply

See comments at Sections 5.

b. Relative whole-of-lifecycle emission intensity of CSG versus other energy sources

See comments at Sections 5.

c. Dependence of industry on CSG for non-energy needs (eg. chemical manufacture)

This is primarily an issue for industry to respond to. It is noted, however, that CSG can be used wherever natural gas is used and that the non-energy uses of gas include the manufacture of fertilizers, explosives and certain polymers and plastics.

d. Installed and availability costs of CSG versus other stationary energy sources

See comments at Sections 5.

e. Proportion of NSW energy needs which should be base load or peaking supply and the extent to which CSG is needed for that purpose

See comments at Sections 5.

f. Contribution of CSG to energy security and as a transport fuel

See comments at Sections 5.

8.4 The interaction of the Act with other legislation and regulations

The NSW Government has given a commitment to a complete review of just terms legislation.

1 Based on Gas Bulletin Board Data, by the Australian Energy Market Operator (AEMO).
2 Energy Update 2011, Table C by Australian Bureau of Agriculture and Resource Economics.
3 "State of Energy Market 2010" by Australian Energy Regulator (Page 69)
4 2010 GSOO Figure 5-29 page 139
5 "State of Energy Market 2010" by Australian Energy Regulator (Page 69)
6 "Gas Statement of Opportunities (GSOO) 2010" by Australian Energy Market Operator (AEMO) (page 64)
7 Department of Climate Change and Energy Efficiency (July 2011), National Greenhouse Accounts Factors.
8 Fuel resource, new entry and generation costs in the NEM, 2009 by ACIL Tasman prepared for AEMO.
9 Review of regulated retail tariffs and charges for gas from 1 July 2010 to 30 June 2013 – final report by IPART
10 "National Transmission Network Development Plan 2010" by AEMO
11 2010 GSSO by AEMO Section 7.1 Key Messages page 168.
12 "Electricity Statement of Opportunities 2011" by AEMO.