NSW Public Accounts Committee
Inquiry into the Economics of Energy Generation
Questions Taken on Notice, 26 March 2012

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1. What do you estimate the percentage increases for coal and gas prices will be over the foreseeable future? What will be the impact of international parity price and other factors such as the carbon price on coal and gas prices? [p. 21, Chair]

The ACA and NSW Minerals Council are not in a position to respond with detailed quantitative information on these questions as they require expert electricity industry knowledge and modelling capability. There are organisations better placed to do this, such as the Productivity Commission, the Bureau of Resources and Energy Economics (BREE), the National Generators Forum and the Energy Supply Association of Australia.

Having said that, it is possible to make some observations on the matters raised in the question, mainly from a qualitative point of view.

In NSW from 2007-08 to 2012-13, as pointed out by Rod Sims:[1]

> *"around two thirds of the electricity price increases are [being] driven by rising network costs. Network costs are rising due to increased peak demand, rising standards that distributors must now meet, and the renewal and replacement of ageing assets."*

Looking beyond 2012-13, Edwin O'Young from Port Jackson Partners[2] suggests that various factors will drive NSW retail electricity prices to almost double by 2017. These include:

- Continuing increases in network costs
- The effect of the imposition of a carbon price from July 2012
- Rising coal and gas prices as contracts are renegotiated, as gas moves to international parity pricing and reflecting the introduction of a price on carbon from 1 July this year
- Market expectations that few coal fired generation plants will be built in the next 10 to 20 years, even though they are the most economical base load option available. Instead peaking gas and wind generation plant will be built as base load gas plants are difficult to make economic without a much larger carbon price
- Renegotiation of debt and new financial borrowing servicing costs borne by the generation, transmission and distribution segments of the industry
- The many high-cost greenhouse related electricity schemes in place at both national and state levels, which result in high cost outcomes (e.g. measures to support household solar PVs, the Renewable Energy Target mandated requirement that 20 per cent of electricity should be provided by higher cost renewables by 2020, and many others as identified by the Productivity Commission [3]).

In particular, O'Young's modelling projects that between now and 2017:

- With the advent of emissions pricing, wholesale prices are projected to double
- Network charges to increase by 75 per cent
- Renewable costs to rise by 12 per cent, and
- Retail costs and margins to increase by 45 per cent.

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[1] Presentation to the Multi-Party Climate Change Committee meeting in November 2010.
[2] Edwin O'Young (2011), *The Outlook for Retail Electricity Prices*, Port Jackson Partners, 27 September 2011.
[3] The Productivity Commission (2011), *Carbon Emission Policies in Key Economies*, found "The relative cost effectiveness of price-based approaches is illustrated for Australia by stylised modelling that suggests that the abatement from existing policies for electricity could have been achieved at a fraction of the cost." p XIV.

As noted above, one of the contributors to the increase in wholesale prices will be increasing coal and gas prices as gas suppliers gain an export option and as coal contracts come up for renewal.

Since the mid 1990s, domestic thermal coal prices have been linked to overseas prices when negotiating annual contracts. Long-term Power Station supply contracts start with a Base Price which reflects export equivalent pricing at the time after deducting reduced coal preparation and transport costs. That is because domestic prices are typically lower than export parity due to coal quality differences (mainly ash content as Australian coal is generally low in sulphur), lower transport costs and lower coal preparation costs reflecting different requirements for the domestic industry. Once the Base Price is established it is usually inflation adjusted on a quarterly basis for the term of the contract.

Coal companies with contracts to supply domestic power utilities have some flexibility to switch some of their production to export markets. However, ultimately the local power generation industry takes precedence. Surplus coal above domestic commitments may be sold into the export market. The export market generally requires the coal to be washed to lower the Run-of-Mine (ROM) ash level. Access to rail and port capacity is also required and not always available. In addition, today both rail and port capacity is contracted on a long-term basis providing less opportunity to alter tonnages in a strong export market without doing capacity swaps with other producers.

A critical question is what gas will cost on the east coast, from where it will be sourced and what implications will this have for the National Electricity Market (NEM). As pointed out by the Bureau of Resources and Energy Economics:[4]

> *"There are a range of perspectives on future gas prices in Australia. The modelling undertaken in this report assumes that gas prices are likely to gradually increase over the next two decades as a result of interactions between demand and supply. However, there are a number of factors that could affect the projected price path, including the renegotiation of existing long-term contracts, timeframes for new projects, the pace of development of coal seam gas (CSG), the extent and pace of convergence in gas prices in the eastern gas market and global LNG markets and international developments."*

There is a view, contested in some quarters, that gas prices will reach $8 per GJ – compared with the current east coast cost for supply of $3.50 to $4. According to O'Young's analysis, a $4/GJ rise in gas costs could add $28 to gas generation costs compared with only a $14/MWh increase for coal plant costs if prices for coal rise by a more modest $1.50/GJ.

Based on O'Young's modelling, when a $27 per tonne carbon price is added to the above coal/gas price increases, this would add about:

- $26/MWh to the cost of coal fired generation in NSW, and
- $14/MWh to gas fired generation.

Allowing for the higher fuel prices and carbon tax impacts suggested above, the outcome would be an increase of $40/MWh for coal compared with a larger increase of $42 for gas generation.

According to BREE's modelling,[5] if the gas price on the east coast rises significantly, as assumed in its high gas price scenario, then **the demand for both black coal and brown coal goes up** – the supply of electricity does not come from renewables. Under this scenario, black coal power stations produce 4,000 GWh *more* in 2019-20 and 23,000 GWh *more* in 2034-35 relative to the more moderate gas price scenario.[6]

Even under the more moderate gas price scenario, there is a very substantial reliance on black coal set out in the BREE modelling results over the next quarter century. This should not be construed as extending the lives of existing coal plants until CCS facilitates new coal fired generation to be built and the cost of other, low emissions options fall (such as solar thermal). It is about the important technological developments taking place (ultra-super-critical plant and integrated gasified combined cycle plant) to take coal generation to a new scale of efficiency.

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[4] Bureau of Resources and Energy Economics (2011), *Australian energy projections 2034-35,* December, p 41.
[5] Ibid, Table 12, p 42. The high gas price scenario assumes gas prices increase by around 40 per cent in the latter part of the projection period relative to the more moderate price scenario.
[6] Ibid, Table 11, p 36.

Moreover, the BREE analysis underlines the fact that the only feasible base load options for Australia for the foreseeable future is fossil fuel based. It also makes it clear that base load supply remains central to electricity delivery at affordable prices over the next 25 years just as it has done for the past quarter-century (and more).

Another critical question regarding gas relates to its environmental benefits. There is a view that gas has substantial greenhouse emission benefits compared to black coal. However, current proposals for gas fired electricity generation in Australia are limited to Open Cycle Gas Turbine (OCGT) peaking plants. The environmental performance of OCGT is not much better than supercritical, black coal technology.[7] In addition, their generation output will be more costly than coal base load plant.

In summary, this discussion reinforces how important it is for the NEM jurisdictions – South Australia, Tasmania, Victoria, NSW and Queensland – to engage in serious discussion about electricity strategies for the next 20-25 years to ensure the NEM, and NSW in particular, have the most efficient, reliable and cost-effective, integrated power system.

Moreover, while federal government modelling points to a decline in the share of black coal-fired generation in the power supply mix over two to three decades, these plants will still be the largest single source of State power in 2034-35 and government policy settings need to recognise this. Too much attention being paid to other forms of power supply and neglect of sustaining coal power could have unintended consequences for consumers and the State economy.

2. It has been suggested that New South Wales may not have the appropriate geological formations to store carbon long term and that further comprehensive mapping is required. Could you provide us with a progress report on such mapping and indicate what percentage of the State has been sufficiently mapped? Is the CSIRO currently involved in this research? [pp. 26-27, Mr Michael Daley]

Compared with some other Australian states, relatively little of NSW has been extensively mapped for oil and gas production which provides the most useful data for initial consideration of carbon storage potential. Data from coal and minerals exploration, while providing some background, is less useful. Early suggestions that NSW may not have appropriate geological formations reflect speculation based on a lack of data rather than sound, evidence-based conclusions.

The 2009 Carbon Storage Taskforce[8] highlighted the need to undertake a strategically-phased, pre-competitive exploration program for CO_2 storage in Australia to provide the data needed prior to exploration. A pre-competitive program was recommended and much of this work is under way in Queensland, New South Wales, Victoria and Western Australia, supported by joint funding from the Australian Government, state governments and industry.

As part of this pre-competitive program, the New South Wales government is undertaking a project to explore the sedimentary basins in the State for their suitability to geological storage. This project is being managed by the NSW Department of Trade and Investment and is jointly funded by the NSW Government through Coal Innovation NSW, by Geoscience Australia through the National Carbon Mapping and Infrastructure Plan, and by the Australian coal industry through its COAL21 Fund.

The objective of this project is twofold:

- First, to identify a suitable storage site for a CCS demonstration project in NSW

[7] See WorleyParsons (2011), *Greenhouse Gas Emissions Study of Australian CSG and LNG*, Australian Petroleum Production and Exploration Association, pages 18 and 22. www.appea.com.au/publications/climate-change-publications.html and Paul E Hardisty, et al (2012), *Life Cycle Greenhouse Gas Emissions from Electricity Generation: A Comparative Analysis of Australian Energy Sources,* Energies, 5, pp 872-897.
[8] Carbon Storage Taskforce (2009), *National Carbon Mapping and Infrastructure Plan – Australia,* report to the Minister for Resources and Energy, September.

- Secondly to identify prospective areas for CO_2 storage across the State and to allow acreage (ie areas designated specifically for the assessment of their greenhouse gas storage potential) to be released by the NSW Government.

The project has completed drilling four wells, two near the coast between Newcastle and Sydney in the vicinity of Munmorah and Vales Point Power Stations respectively, and two in the Upper Hunter Valley near Merriwa. The analysis of these wells is complete. All four wells were drilled to provide base data from which to consider further drilling for more detailed site characterisation. However, none showed adequate porosity and permeability over sufficient depths to indicate potential for storage of even modest storage volumes. It was concluded that the available budget would be better spent in other areas. The project is planning to drill a further four wells in the Darling basin, which is located in the far east of the State. The planning and procurement for this drilling is currently under way.

Although CSIRO is not involved in the above mentioned work, a separate Munmorah CO_2 Capture Pilot Plant has been operating for two years and is a joint venture between Delta Electricity and CSIRO. The results of this pilot will feed into the Delta CCS demonstration project (see response to Question 6).

3. Do you see a role for measures to manage demand more effectively and how can governments assist in managing demand for electricity? [p. 28, Chair]

In the past, NSW governments have encouraged industry to implement cost effective demand-side management practices. For example, in the 1980s both the wholesale provider (Pacific Power) and electricity retailers, such as Sydney Electricity, worked with heavy industry (e.g. forging, foundries, powder metallurgy, pump manufacturing and shipbuilding) to improve energy efficiency outcomes. This was in their interest as the marginal cost of building a new power station could be deferred if energy intensive industries were able to apply improved or different energy use practices.

Energy saving initiatives included co-generation, using waste heat from boilers to heat office areas and installing alarms to warn manufacturers if they were straying into a higher cost electricity pricing period – thus encouraging more energy intensive manufacturing to be conducted in the early hours of the morning. With the opening up of the NSW and broader Australian economies since the 1990s, cost minimisation pressures have encouraged industry to continue the pursuit of better energy efficiency practices. It would be inappropriate to take the regulatory route of enforcing industry to adopt identified energy efficiency opportunities rather than rely on the discovery power of markets to reveal the best investment solutions for business from a wide range of cost saving measures, not just those associated with energy efficiency.

In fact it is household demand that is the main reason Australia's peak electricity demand has been rising over the past ten years. This is true in all States, even though the residential sector's share of overall energy consumption has been decreasing. This trend appears to be related to the penetration of high energy appliances (such as TVs, computers and air-conditioners). Air-conditioning is particularly significant – "modelling and anecdotal evidence supports a hypothesis that temperature and peak demand are strongly correlated".[9] A genuine energy policy debate must openly acknowledge that any policy setting which discriminates against coal will drive up the cost of energy consumption, accelerate the rising cost of living and disproportionately harm low-income households.

Unfortunately, there is limited understanding of the nature of electricity, where it comes from and the roles that renewables can and do play. For example:

[9] Ernst and Young (2011), *Rationality and drivers for DSP in the electricity market – demand and supply of electricity*, Australian Energy Market Commission Power of Choice review, p 5.

- Electricity is not like other commodities:
  - ***It cannot be stored economically*** thus production must match consumption on a real-time basis. This explains why gas currently produces 12% of output but has 26% of total National Electricity Market generation capacity; renewables produce around 7% of output but comprise 16% of capacity; and coal produces 78% of output but comprises about 56% of capacity
  - ***As electricity demand increases additional (more expensive) generating capacity must be brought online***. This results in a proportion of *more expensive* generating options being utilised for far shorter periods of time than in other industries with less expensive base load options doing the "heavy lifting"
  - ***It is an invisible and intangible commodity*.** Typically an aggregate electricity bill reflects a broad range of energy-using activities or inputs. This makes it difficult for consumers to learn which activities have the highest cost so they can make conscious, economy-saving decisions regarding their energy use so as to get value for money
- **Owing to the intermittency of wind, the percentage of the installed wind generation capacity that is actually available on average in Australia is only between 25% and 40%.** According to the Australian Energy Market Operator:

  "This means that while wind generation may be used effectively to meet regional energy requirements (reducing the need for energy driven investments), it cannot be used to the same extent when meeting capacity requirements." [10]
- **It is estimated that to generate sufficient power to meet Australia's current demands it would be necessary to construct an array of solar panels that would occupy over 4,000 square kilometres**. As the Australian Strategic Policy Institute points out, that corresponds to:

  "an area greater than twice the Sydney urban area. The requirement can also be expressed as 200m^2 of panel per person, or about four times the average amount of roof area per person in Australia today." [11]

The ACA/NSW Minerals Council recommend that the Committee's final report commits to a long-term, comprehensive strategy to improve energy literacy among NSW citizens and thereby assist in managing demand for electricity.

With regard to government regulation to manage demand more effectively (whether it is demand by households, government agencies or business), this should be designed to ensure policy objectives are achieved at least cost:

"For regulation to meet the tests of "minimum effective regulation", it needs to satisfy a variety of criteria, which the [Productivity] Commission has emphasised in successive reports over the years:

***Regulation should not be unduly prescriptive**. Where possible, it should be specified in terms of performance goals or outcomes. It should be flexible enough to accommodate different or changing circumstances, and to enable businesses and households to choose the most cost effective ways of complying.*

***Regulation should be clear and concise**. It should also be communicated effectively and be readily accessible to those affected by it. Not only should people be able to find out what regulations apply to them, the regulations themselves must be capable of being readily understood.*

***Regulation should be consistent** with other laws, agreements and international obligations. Inconsistency can create division, confusion and waste.*

***Regulation must be enforceable**. But it should embody incentives or disciplines no greater than are needed for reasonable enforcement, and involve adequate resources for the purpose.*

*Finally, regulation needs to be **administered by accountable bodies** in a fair and consistent manner, and it should be **monitored and periodically reviewed** to ensure that it continues to achieve its aims.*

Regulation which is deficient in one or more of these respects may not achieve its objectives and can impose unnecessary costs, impede innovation, or create barriers to productivity and efficiency." [12]

[10] Australian Energy Market Operator (2011), *Electricity Statement of Opportunities Executive Briefing*, p 12.
[11] Australian Strategic Policy Institute, *Keeping the home fires burning: Australia's energy security*, December, p 17.
[12] Gary Banks (2003), *'Minimum effective regulation' and the mining industry*, address to the Minerals Council of Australia's Annual Industry Seminar, Old Parliament House, Canberra, 3 June, pp 7-8.

Based on the above criteria, mandated regulatory solutions specifying particular technologies, fuels or energy efficiency opportunities that must be taken up by industry distort the market outcome, add inefficiencies and almost certainly impose higher costs on consumers by, for example, locking in higher cost alternatives.

4. What should the State Government do to ensure long-term energy security in New South Wales? [p. 28, Chair]

Energy security is defined in the National Energy Security Assessment as encompassing:

- Adequacy (the provision of sufficient energy to support economic and social activity)
- Reliability (the provision of energy with minimal disruptions)
- Affordability (the provision of energy at a price that does not adversely impact the competitiveness of the economy and supports continued investment in the energy sector). [13]

In the past, successive NSW governments have recognised the value of the State's coal resources to all three elements of energy security. Indeed, they have accepted that, in order to take full advantage of this resource endowment, it was necessary to invest steadfastly in coal mines, power stations and road, rail and port infrastructure. This has enhanced the standard of living for the State's population and created jobs – both directly in coal mining and, indirectly, in industries that service mining or involve energy intensive manufacturing and take advantage of the reliable, secure and relatively affordable electricity produced from base load coal generation.

NSW has around 18,000 megawatts (MW) of installed electricity generation capacity with 89% produced from coal fired generation. Coal is also the single largest export from NSW. Responsible development of the State's coal resources is thus providing enormous benefits in terms of wealth creation for households, and will do so for generations to come. It also facilitates continued utilisation of existing economic infrastructure (e.g. rail, port and generation/transmission assets) and continued access to reliable, affordable and secure base load electricity to industry and commerce. If, in the future, Australia is able to go down the CCS path it will preserve the value of this infrastructure, which can continue to be utilised, as well as enable NSW to reap the benefits of continued access to its coal resources for future generations.

The International Energy Agency (IEA) projects that Australia could enjoy coal and natural gas export revenues of more than $2 trillion through to 2035. Realising this unprecedented economic dividend will depend on policy settings which encourage investment in the development of NSW's and Queensland's coal resources. The Committee's report should reflect NSW's role as a global energy supplier and provide a solid foundation for this investment. It should also recognise that the coal resources are owned by the people of NSW and should be managed by state governments in a way that maximises their benefit to the people of NSW, including future generations.

This inquiry is of the utmost importance to the NSW economy and to consumers given the substantial coal resources in the State and the reality that all low emissions technologies will be costly. If NSW is to meet its energy emissions targets at the lowest cost, then it is vital that the development and extensive deployment of Carbon Capture and Storage receives bipartisan support. CCS is the only technology available to significantly reduce emissions from the use of fossil fuels including coal and gas-fired power generation, natural gas processing associated with LNG production and other industrial activities such as cement and steel manufacturing.

[13] Department of Resources, Energy and Tourism (2011). *National Energy Security Assessment*, p 2.

In order to improve welfare outcomes for all those living in NSW, the Commonwealth and NEM state jurisdictions need to develop complementary electricity network policy frameworks. The aim would be for each jurisdiction to have a harmonizing and clear energy strategy for the next 10, 20 and 25 years. These regional energy strategies should:

- Provide an effective policy approach to assessing when new base load power is needed in a State, whether the government plans to have any role in such generation and how, if a stronger renewable energy contribution is projected, the intermittency and reliability challenges associated with this contribution will be addressed
- Build on current government sponsored programs and initiatives in Australia to develop demonstrations of low emissions coal technologies given their strategic importance to Australia both in terms of domestic electricity generation and future coal exports
- Work with other NEM governments to ensure that the most efficient power system is developed with adequate interconnector capacity to allow trade between NEM participants.

The long-term, comprehensive strategy to improve energy literacy (recommended in response to Question 3) will help marginalise politics and ideology from critical public policy discussion about energy security. It will also facilitate policy outcomes that intersect with climate change objectives, maintain the competitiveness of NSW industries over the next 20 to 30 years and satisfy energy security imperatives at least cost.

The benefits of improving energy understanding in the community are likely to include:

- **Improving energy demand side efficiency** by making more information accessible to households and businesses on the nature of energy costs and the options available to manage those costs
- **Better appreciation of the trade-offs and relative costs involved in choosing different fuels and technologies in the mix**
- **Improved understanding of the intersection of and potential conflicts between energy security and climate change goals** to help reduce the risks of adopting high cost solutions that have costly, dysfunctional consequences.

Finally, as explained by the Australian Strategic Policy Institute, it needs to be emphasised that reserving energy resources, such as gas for domestic consumption, is counterproductive:

> "As for most complex subjects, there are many misconceptions about energy security. There are myths concerning the level of security and pricing certainty that can be derived from controlling energy supplies within a nation's borders by quarantining production for local use, or through 'locking down' foreign-sourced supplies." [14]

Similarly, mandating a fuel source or technology solution is counterproductive. It is far better to ensure open market approaches are adopted based on well-established and consistently applied energy policy principles.

5. Some submissions have referred to the need for certainty in government policy to promote investment. What do you think government can do to provide certainty to investors in the electricity market? [p. 28, Chair]

The ACA/NSW Minerals Council joint submission suggests the new electricity generation capacity requirements in NSW over the next 8 to 10 years will be met provided adequate private sector generation investment occurs.

The NSW Government needs to have a well thought out strategic plan, with actions, so that NSW does not operate in semi-crisis mode and to ensure adequate capacity is available to meet all eventualities (e.g. a failure at one of the older coal-fired plants reducing local supply availability). Such

[14] Australian Strategic Policy Institute, *Keeping the home fires burning: Australia's energy security*, December, p 14.

a strategic approach should also guard against ad hoc interventions by government in the energy market that risk producing sub-optimal outcomes.

Looking beyond the next 8 to 10 years, the aging NSW fleet will require new base load investments in the early to mid-2020s as generation assets reach 50 years of operation.

The Australian Government's commitment to price carbon emissions will provide a long-term signal for investment in low emission technologies. However, alone it will not be sufficient to support the development of nascent technologies, including CCS, geothermal and solar thermal, which will continue to require targeted support for large-scale demonstration and early deployment. This is because, even with a strong carbon price signal, private investors can only capture part of the "spillover" benefits of new low-emissions technologies, and therefore will invest too little to generate socially desirable levels of innovation. It is therefore critical that tax revenue is invested in the development and deployment of a portfolio of solutions that will provide secure, reliable and low emission energy supply for the future.[15]

The strategic plan therefore needs to be based on a principled approach to energy policy. Such an approach emphasises open markets, transparency, reliability and economic efficiency. Provision of government support should be based on addressing established market failures.

Such a principled approach does not diminish the important role governments have in setting policy and creating an institutional and regulatory framework within which the market economy operates. It emphasises that markets deliver more competitive outcomes than approaches designed to foster specific, mandated solutions. It also recognises that competitively priced energy should reflect the cost of supply within an overall level of demand, with the price generated in a competitive and efficient market.

6. In your submission you refer to a number of carbon capture and storage projects that are currently under way—the NSW Storage Program and the Delta Post-Combustion Capture Project. Could you provide some information about the projects and what they aim to achieve? [p. 28, Chair]

The NSW Storage program, which is exploring the sedimentary basins in the State for their suitability for geological storage, is described in the answer provided to Question 2.

Post Combustion Capture (PCC) Technology can be applied to new plant or as retrofit technology for existing coal fired or natural gas power plants. When successfully applied it can dramatically reduce CO_2 emissions by as much as 90% through the process of removing CO_2 from flue gases.

Demonstrating PCC technology is very important for Australia, given its aged coal fired power fleet. It is also important for other developed countries for the same reason. Ultimately, the uptake of the PCC and other CCS technologies will also be required by developing countries.

The Delta PCC project is a demonstration project for NSW that aims to demonstrate that a coal fired power plant can be retrofitted with post combustion capture technology and then transport the CO_2 to

[15] Ross Garnaut (2011), *The Garnaut Review 2011: Australia in the global response to climate change, Final Report*, 31 May, p. 116. This position is widely supported in the literature. For example, see Tony Wood and Tristan Edis (2012), *No easy choices: which way to Australia's energy future?*, Grattan Institute, February, section 4 "Why government should intervene"; and Nicholas Stern (2006), *Stern Review: The Economics of Climate Change,* Cambridge University Press – e.g. p 308 where he states:

> *"But the presence of a range of other market failures and barriers mean that carbon pricing alone is not sufficient. Technology policy, the second element of a climate change strategy, is vital to bring forward the range of low-carbon and high-efficiency technologies that will be needed to make deep emissions cuts. Research and development, demonstration, and market support policies can all help to drive innovation, and motivate a response by the private sector."*

a suitable storage site for geological storage. This project builds on the CSIRO pilot plant at the Munmorah Power station.

The project is currently in the pre-feasibility stage. The key piece of work the project team is currently completing is the identification and assessment of a suitable geological storage site capable of receiving the proposed volume of CO_2. Once this is defined, the project will be better able to select a power station to host the demonstration PCC plant. Current preliminary design studies are based on locating the PCC plant at Vales Point Power Station. The Delta project is working closely with the NSW Storage Program and the first four wells completed under the NSW Storage Program were for the benefit of the Delta PCC project. As noted in the answer to question 2, none of these wells has shown sufficient storage potential for the Delta Project. Consideration is now being given to other alternatives, in particular discussions have been initiated with Santos with the aim of identifying near depleted oil and gas fields that may be amenable to CO_2 storage.

7. Do you believe the State Government should invest in the mapping process for CCS to determine what storage capability there is in New South Wales, or is there another aspect of CCS technology that you believe the Government should focus on supporting? [p. 28, Chair]

In March 2012, the National Carbon Capture and Storage (CCS) Council provided a submission to the Australian Government's Draft Energy White Paper consultation process. Part 2 of the submission is a report entitled *"Carbon Capture and Storage in Australia - Contributing to a Clean Energy Future".* [16]

The report argues that "development of CCS in Australia is critically dependent on identifying, assessing and developing geological storage sites." [17] The long lead times for CCS projects from pre-exploration to the commencement of storage operations emphasises the need to invest now to establish viable storage options.

The report also found that a key learning from early CCS projects in Australia, such as ZeroGen and Gorgon, "has been the critical importance of developing confidence in storage capacity in the early stages of a project and before significant investment is made in capture plant or transport infrastructure."[18]

Geological storage is a natural resource of the State. Part of the role of a state geological survey is to assess these natural resources up to a level where acreage can be released so that industry can play its role in the exploration, development and appraisal process.

In the commercial world of oil and gas, or coal mining, the Australian and state government geological surveys complete a number of pre-competitive studies and work programs that includes well drilling, core analysis, seismic data collection and interpretation. This information is used by the geological surveys to define areas that can be released as acreage and where industry can make bids to secure these areas so that they can conduct further exploration and better assessment of the potential resources. The risk carried by industry in these subsequent exploration projects is balanced by the potential commercial return.

In the absence of State Government Geological Surveys investing in pre-competitive geological data, coal and other resource companies would need to collect this data at their own expense. Any such data would be kept confidential for a period rather than being published immediately. The cost of collecting this data would be weighed up against investing in other states where such data is already available. In the extreme this could result in NSW coal resources becoming stranded, with the associated loss of royalty revenue and employment opportunities.

[16] Available at www.ret.gov.au/energy/
[17] Ibid, p 12.
[18] Ibid, p 13.

For CCS, there is a need to develop and identify the geological storage resource, and this is a clear role for the geological surveys. **However, the same level of commercial return does not exist for geological storage compared to the development of oil, gas, coal or other minerals beyond the pre-competitive stage**. Hence, there is a need for geological surveys to develop the resource beyond what is typically the case for government involvement in mineral and hydrocarbon resource development.

Given that geological storage is a key resource for CCS, which is a carbon reduction technology, it is imperative for the State Government to continue to invest in the mapping process across the State. That is why the ACA/NSW Minerals Council joint submission to the Committee's Inquiry into the Economics of Energy Generation recommended:

> *Locating storage sites for CO_2 sequestration is fundamental to the deployment of CCS technology in NSW, whether coal or gas is being used for new generation, and should be a focus of the Coal Innovation NSW work program.*

There remains a role for the NSW government in promoting carbon capture technologies as well as storage. As forecast by the International Energy Agency, energy demand is likely to grow at an average annual rate of 1.3% to 2035 and coal is projected to remain the dominant energy source in 2035.[19] The IEA also projects that abatement achieved through CCS by 2050 will be roughly equally divided between power generation and industrial processes. The IEA considers that "to meet global climate change goals at lowest cost, extensive deployment of CCS is critical."[20]

However, from a global perspective, the IEA and the Global Carbon Capture and Storage Institute[21] reported last month that:

> *"Despite being amongst the technologies with the greatest potential for carbon dioxide (CO_2) emissions savings, considerable work remains to be done. Deployment rates for large-scale integrated projects (LSIPs) are off pace; … In short, current global efforts do not match the significant emission reduction ambitions associated with CCS."*

Given NSW's coal resources are owned by the people of NSW, successive State governments should ensure adequate investment in all aspects of CCS relevant to the State is taking place in order to maximise welfare outcomes in the long term. Moreover, the development of a commercial scale geological storage reservoir will take a considerable time:

> *"The elapsed time to mature an aquifer storage site from commencement of exploration to commencement of CO_2 storage at large scale could be 10-13 years" and*
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> *"To prove up storage reservoirs to match future needs, work therefore needs to begin immediately".* [22]

3 May 2012

[19] IEA (2011), *Key World Energy Statistics 2011*, p 74.
[20] IEA (2011), *Clean Energy Progress Report, Update,* June, p 13.
[21] IEA/Global CCS Institute (2012), *Tracking Progress in Carbon Capture and Storage*, report to the Third Clean Energy Ministerial, April.
[22] Carbon Storage Taskforce (2009), *National Carbon Mapping and Infrastructure Plan – Australia,* report to the Minister for Resources and Energy, September, pp 26 and 27 respectively.