Submission

No 10

INQUIRY INTO THE ECONOMICS OF ENERGY GENERATION

Organisation: Delta Electricity

Name: Mr David Hogg

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Inquiry into the Economics of Energy Generation

Delta Electricity

Introduction

Energy demand and industry structure have strongly reflected government policies over recent decades. Both state and federal governments have recognised the importance of reliable, low-cost energy as a significant input into energy intensive manufacturing industries and the economy more generally. For the last sixty years, NSW has benefited from highly reliable, secure and low-cost electricity generation, largely from coal.

Throughout most of the post-war years successive governments, especially at the state level, promoted energy intensive manufacturing to take advantage of Australia's abundant mineral and energy resources such as bauxite, iron ore and coal. Policies were developed that encouraged energy intensive industries, such as aluminium and steel manufacture, to establish in Australia to capitalise on this abundance of low-cost raw materials, a skilled workforce and a stable political climate.

These policies required a significant expansion of electricity generation capacity to meet the rising demand from the 1950s through the 1980s. This expansion occurred at a time of considerable technological improvement in electricity generation. Generator unit sizes increased by an order of magnitude, rising from the 50 MW class in the 1950s to the 500 MW class in the late 1960s. With the resultant economies of scale came significant increases in the thermal efficiency of converting coal into electricity. Together they drove down the real cost of electricity, making Australia and NSW in particular, an attractive place for energy intensive industries.

At the same time, advances in the technology of transmitting electricity over considerable distances saw the establishment of major generation facilities at the sources of the coal such as the Hunter Valley and western coalfields in NSW and the Latrobe Valley in Victoria. These generation facilities rapidly replaced those established at the load centres, the cities and the towns, in the first half of the twentieth century. This further reduced generation costs by replacing the high cost of transporting coal to power stations at the load centres, with the lower cost of transporting electricity by high voltage transmission lines from the distant coalfields.

The result was that by the 1980s the electricity sector in NSW operated with among the lowest prices in the world, bettered only by countries or states with considerable hydroelectric resources. As a result, NSW was able to attract more energy intensive industries that played an important part in economic and employment growth. Increasing population growth further stimulated electricity demand and, until recent years, electricity demand grew in line with GDP. All the while electricity prices were falling in real terms.

The development of federal competition policy in the 1990s saw a change in the structure of the electricity supply industry. Prior to this period, the electricity supply industry in all states had been state-owned and centrally planned. In NSW, Pacific Power (the former Electricity Commission of

NSW) was responsible for all generation and transmission of electricity to distribution authorities in the form of county councils. In the mid-1990s Pacific Power was disaggregated into three state-owned generators and one state-owned transmission authority.

The formation of the National Electricity Market (NEM) in late 1990s saw generators across four states competing to supply electricity into the NEM. This market-based approach to electricity generation saw further price reductions as generators competed to supply. Over the following decade or so, excess base-load generation capacity in the NEM was progressively taken up with increases in electricity load and the retirement of older, less efficient power stations. This further improved the economics of electricity generation and kept prices low. At the same time the historically high reliability of electricity supply was maintained.

The last five years have seen a measurable change in both electricity demand and the generation mix. The demand for electricity at peak times, typically late afternoon and early evening, has increased relative to the base-load or underlying demand. The peak in electricity demand in NSW is also in the process of shifting from a winter peak to a summer peak and the growth in electricity load has slowed. As a consequence, there has been an increase in peak-load generation plant that can start within minutes and respond quickly to rapid changes in demand. This plant is typically open-cycle gas turbines (OCGTs) burning natural gas as compared to base-load generating plant which burn coal to raise steam to drive steam turbines.

There are a number of factors that together have contributed to these changes. There has been a change in government policies with less emphasis on energy intensive manufacturing as the economy, especially in NSW, has moved towards the service sectors such as finance, education and tourism. Energy intensive manufacturing in NSW is not as strong in relative or absolute terms as it was in the 1980s and the growth of the services sector and improving lifestyles have resulted in increased consumer demand for high energy use appliances such as air-conditioning. This has been a major factor in the shift towards summer peaking in NSW. The competitive generation market has responded to the price signals generated by this peakier demand profile with both state-owned generators and the private sector building gas turbine power stations.

Government policies at both the state and federal level have also promoted renewable forms of electricity generation such as wind and solar photovoltaics (PV). The market has responded strongly, in the form of wind farms in rural areas and residential rooftop PV systems in urban areas. This and the global financial crisis have contributed to a reduction in the apparent growth of electricity load.

At present there appears to be sufficient base-load generation capacity in NSW to meet likely needs for the next ten years or more, despite some remaining uncertainties. These uncertainties include the economic impact of the carbon tax on coal-fired generation in NSW and the ability of renewable sources of energy such as wind generation to displace base-load generation, especially overnight.

Post this decade the oldest of the base-load power stations will reach fifty years in age, a traditional retirement age for such plant as increasing maintenance, refurbishment and life-extension costs typically make them uneconomic to operate. It is not clear what will replace such base-load plant given the emerging technology options such as carbon capture and storage and the development of the coal seam gas industry, government policies and the market's lack of appetite for the relatively high risk that base-load generation entails.

The need to maintain energy security and a relatively low-cost, reliable electricity supply within a competitive energy framework that explicitly factors in concerns for global climate change is a key challenge for governments. Implicit in this is the need for energy policy to be shaped by and respond to broader state and national policies that guide the development of new technologies and the economy more broadly.

The remainder of this submission amplifies and clarifies the matters raised briefly in this introduction.

Energy vs Capacity

When considering electricity generation investment issues it is helpful to understand the distinction between energy and capacity (or, on the demand side, energy vs MW demand). The amount of electricity demanded or required at any point in time relates to megawatts (MW) capacity and MW demand whereas the accumulation of this over a period of time relates to overall energy measured in megawatt-hours (MWh). In the chart below, the red line depicts MW requirements, whereas the blue area reflects MWh.

Large energy producing plants tend to have a high capital cost but lower operating costs. The average cost of energy from these plants is low because the capital is spread over massive output. When this type of plant is not required to produce large amounts of energy, a lower capital cost solution which may be limited in energy output will deliver a lower cost solution. In the example graph, a mix of baseload plant to 6000MW and peaking plant (open cycle gas turbines or hydro) would likely deliver the lowest overall cost solution.

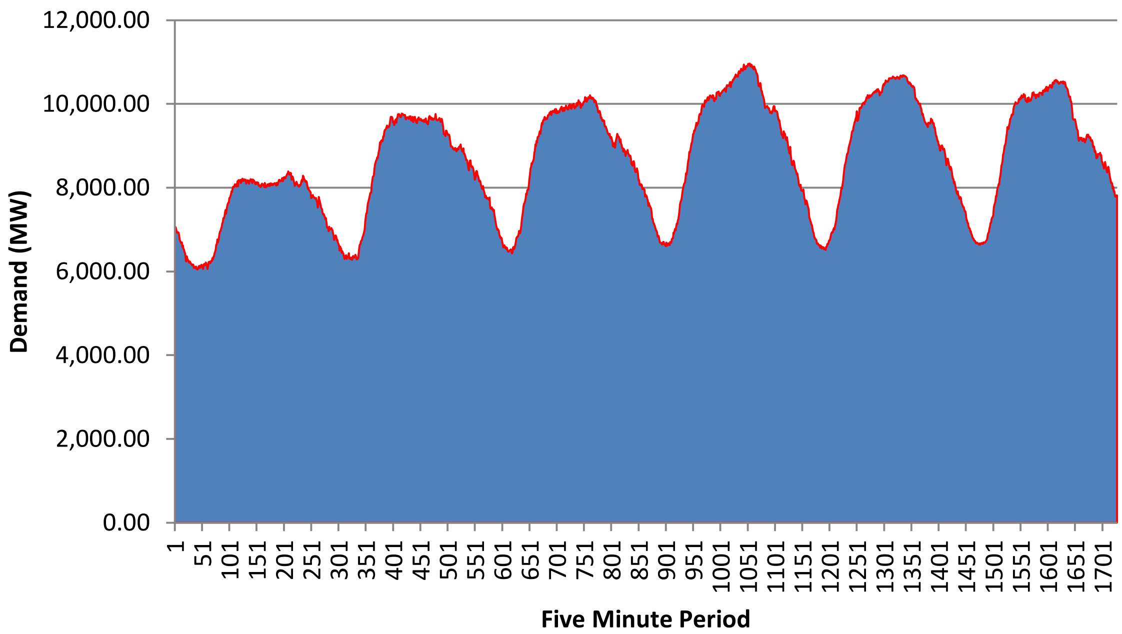

Figure 1: Illustration of demand and energy

i) The mix of energy sources used in NSW

Today, the main source of energy generation in NSW remains black coal. During 2010-11, 89.2% of electricity generated came from coal fired power stations (Figure 2). However this proportion has been reducing as supply diversity is driven by the market and policies of various governments. In particular, NSW has seen growth in energy sourced from natural gas, wind and solar.

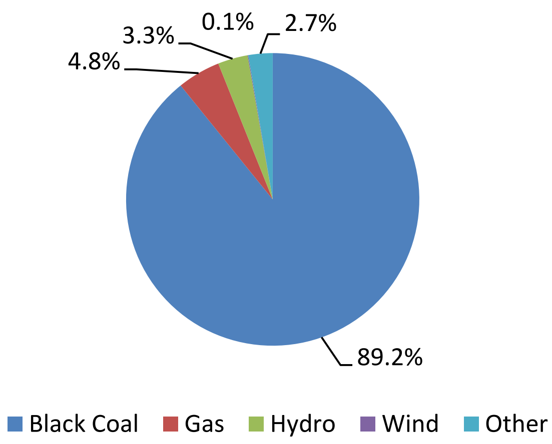

Figure 2: Electrical Energy in NSW by fuel type 2010-11 (source: AEMO data)

Some of the recent large-scale developments in NSW are shown in Table 1. The dominance of gas plant capacity being developed in response to the increased peakiness of demand can be seen in the development of Uranquinty and Colongra. This response to market prices and demand is an efficient outcome of a market in operation. However, overly-generous regulatory schemes like the solar feed-in tariff drove the rapid deployment of 300MW of solar PV in NSW. These schemes are economically inefficient and result in an unnecessary cost burden being imposed on consumers. Government should engender investment in generating capacity in NSW on the basis of legitimate market signals rather than implement policies that distort the market. Having a price on carbon values this environmental consideration, and investors should now make decisions based on electricity and carbon market information without further regulatory intervention.

Table 1: Recent generation developments in NSW

Generator Name	Capacity Increase (MW)	Timing	Fuel/type
Uranquinty	640	2009	Gas peaking
Tallawarra	420	2009	Gas/intermediate
Mt Piper Upgrade	80	2009	Black Coal/base load
Eraring Upgrade	240	2011-2012	Black Coal/base load
Colongra	668	2009	Gas/peaking
Wind	186	1997-present	Wind/intermittent
Solar PV	>300	2009-2011	Solar/intermittent
Total	**2234**		

ii) Comparison of NSW energy mix with other jurisdictions

The variation in energy sources used in different jurisdictions has been driven by the resources available within these regions. For example, Victoria has enormous reserves of brown coal. This fuel was the basis for their generation industry because it was the cheapest and most reliable source available. In Tasmania, the predominant source of energy is hydro-electric due to the abundant rainfall and elevation changes that make hydro-electricity reliable and plentiful. Internationally, New Zealand's generation mix includes 10% geothermal power because it is available and competitive.

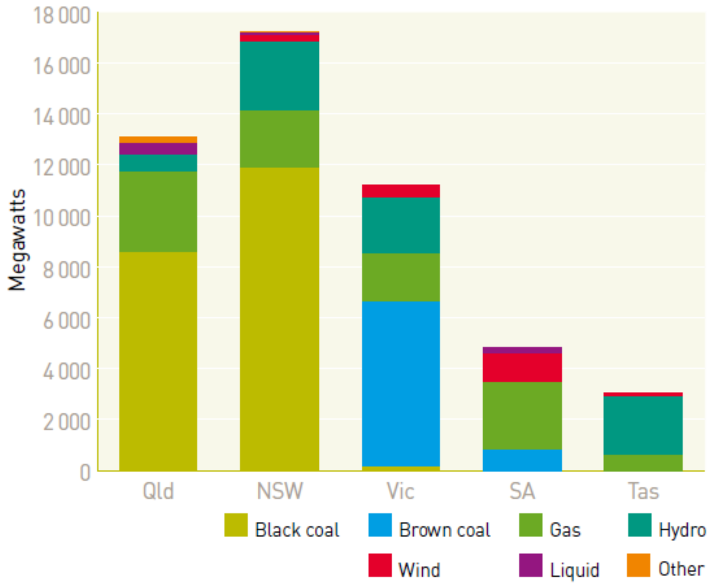

Figure 3: Comparison of generation capacity by fuel type across the NEM (source: AER)

It is Delta's view that the cost of resources and technologies available should drive the energy mix within any jurisdiction. The current electricity market structure supports this approach. The recent introduction of a price on carbon dioxide emissions will encourage the development of low emissions generation technologies as it changes the cost structure for power generators relying on fossil fuels. This is the intention of such a policy and Delta believes that this approach, a broad-based pricing of an environmental externality, has greater merit than the directive approach which limits technological choice. Government should ensure that market participants are free to select the most economically efficient technology and fuel solution for providing energy generation.

iii) Energy Security in this Decade

Capacity

AEMO's assessment of the supply-demand balance in the 2011 ESOO indicates that demand in NSW is well served for most of this decade. Based on AEMO's 10% Probability of Exceedance (POE) measure, new capacity is not required until 2018/19 (Figure 4).

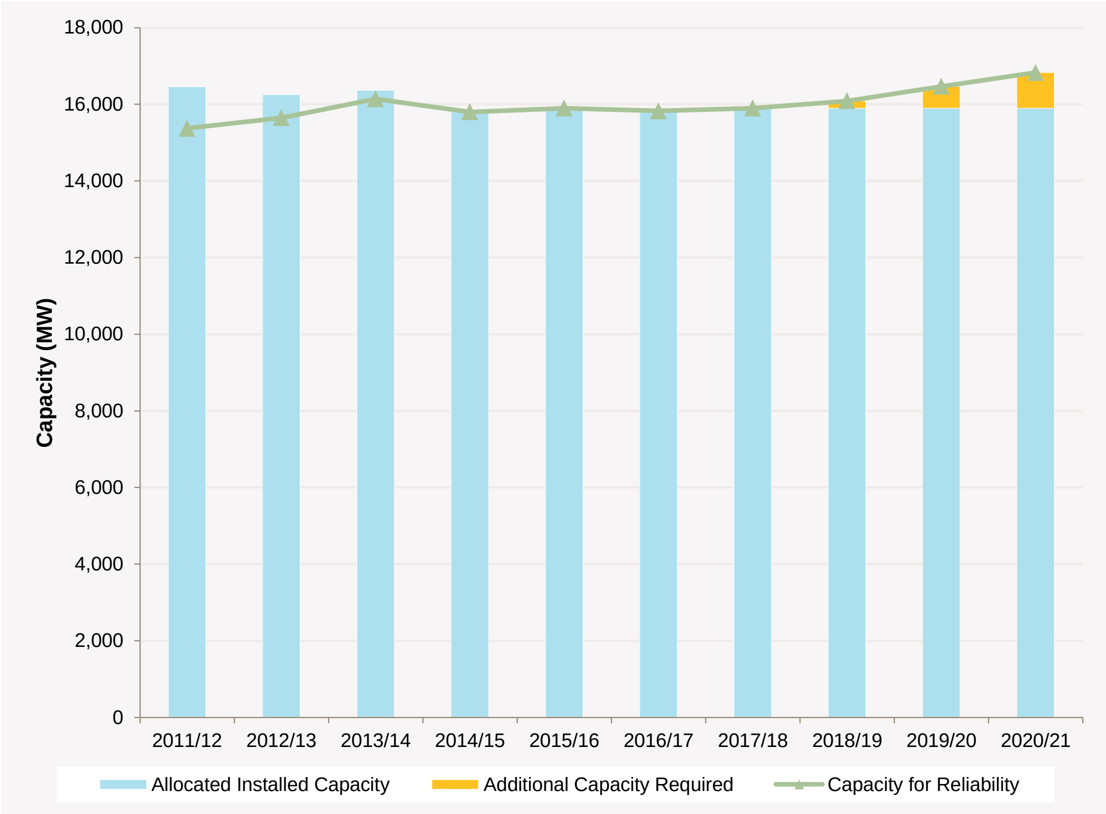

Figure 4: AEMO supply demand assessment – 10% POE (source: 2011 ESOO)

The 10% POE level can be interpreted as a forecast of maximum demand that is likely to occur one year in ten. Since maximum demand is highly correlated with maximum temperature, the primary determinant of the POE outcome is the summer maximum temperature. For example a one in ten year temperature event is likely to result in a 10% POE demand level. On this basis, AEMO's assessment (Figure 4) indicates that the electricity system will remain stable under these conditions.

However, the 10% POE forecast has been shown to be highly conservative. This can be seen from a comparison of historical maximum summer demand outcomes with recent AEMO forecasts of maximum summer demand, as shown in Figure 5. The chart clearly shows that the forecasts are well above the actual outcomes. This data includes February 2011 when temperatures in Sydney were among the highest recorded for a sustained period of time.

While Delta agrees that a 10% POE level is appropriate for system planning and reliability assessment, the forecast methodology should be reconsidered with clearer links to forecast temperature outcomes. A process of consultation on this issue is currently underway within AEMO.

A more reasonable forecast level in Delta's view is the 50% POE forecast published by AEMO. This forecast has been much more closely aligned to actual demand outcomes (Figure 6). AEMO's assessment of new capacity requirements at this forecast level can be seen in Figure 7. The indication is that the system will remain stable and reliable without any new capacity additions beyond 2020/21.

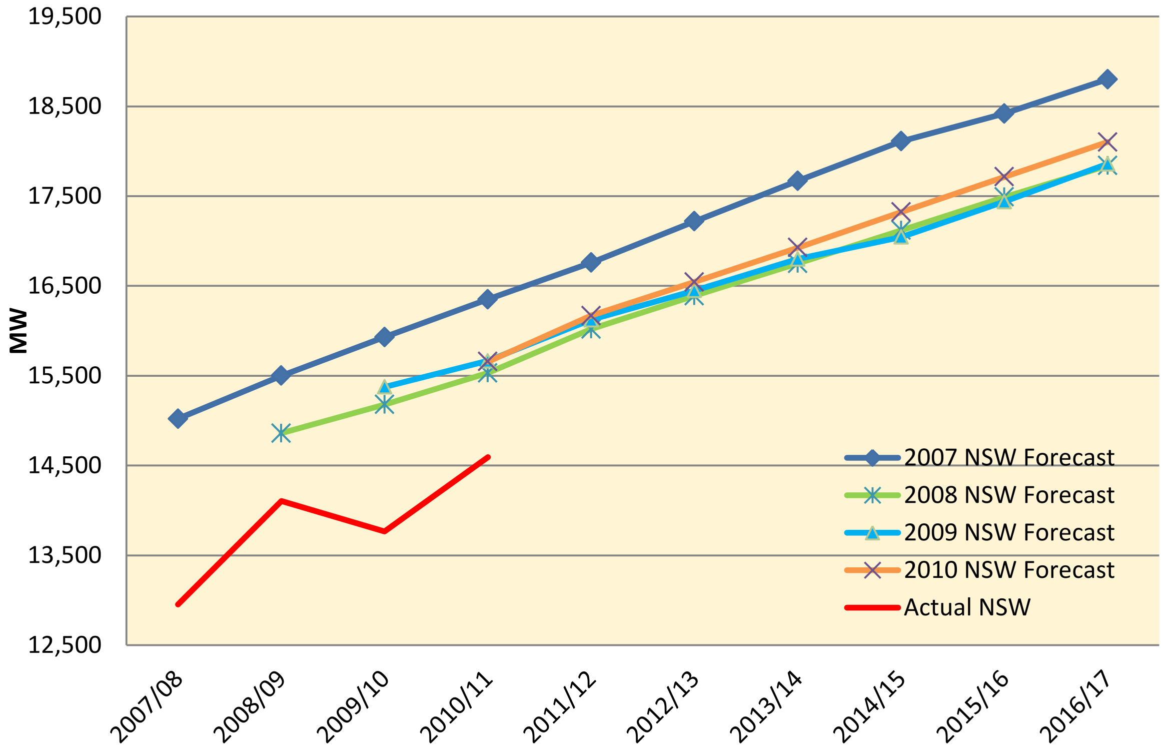

Figure 5: Comparison of AEMO summer maximum demand forecast 10% POE with actual maximum summer demand

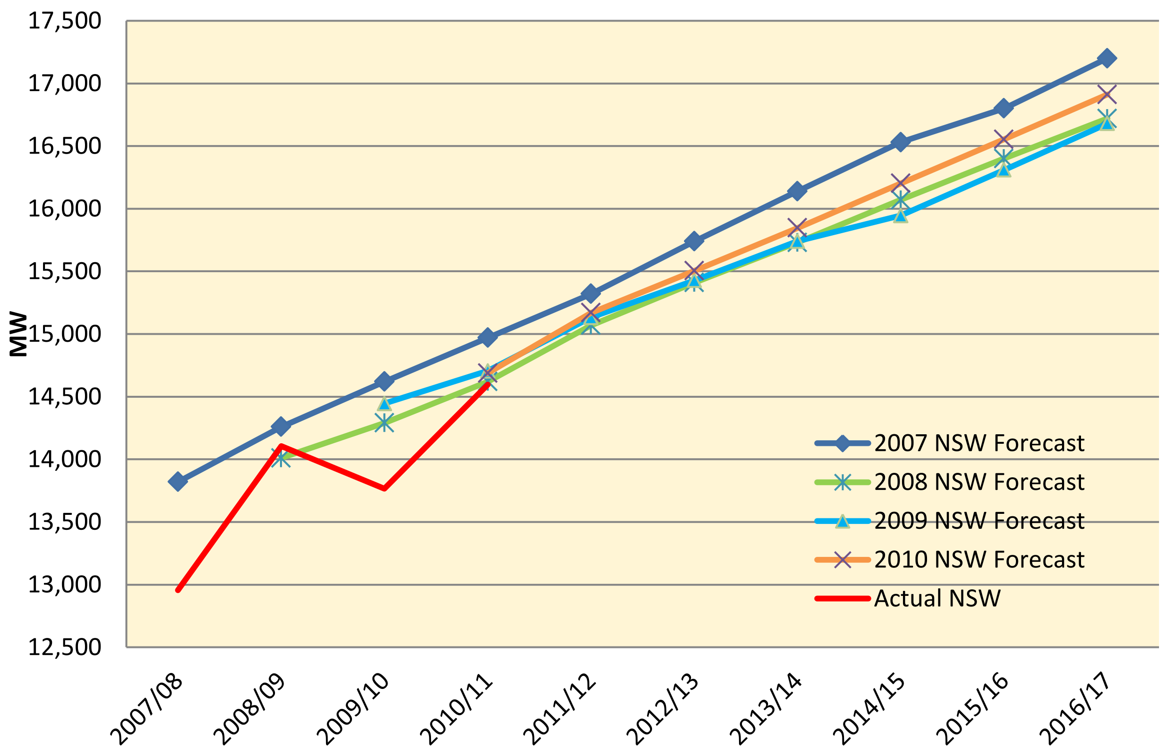

Figure 6: Comparison of AEMO summer maximum demand forecast 50% POE with actual maximum summer demand

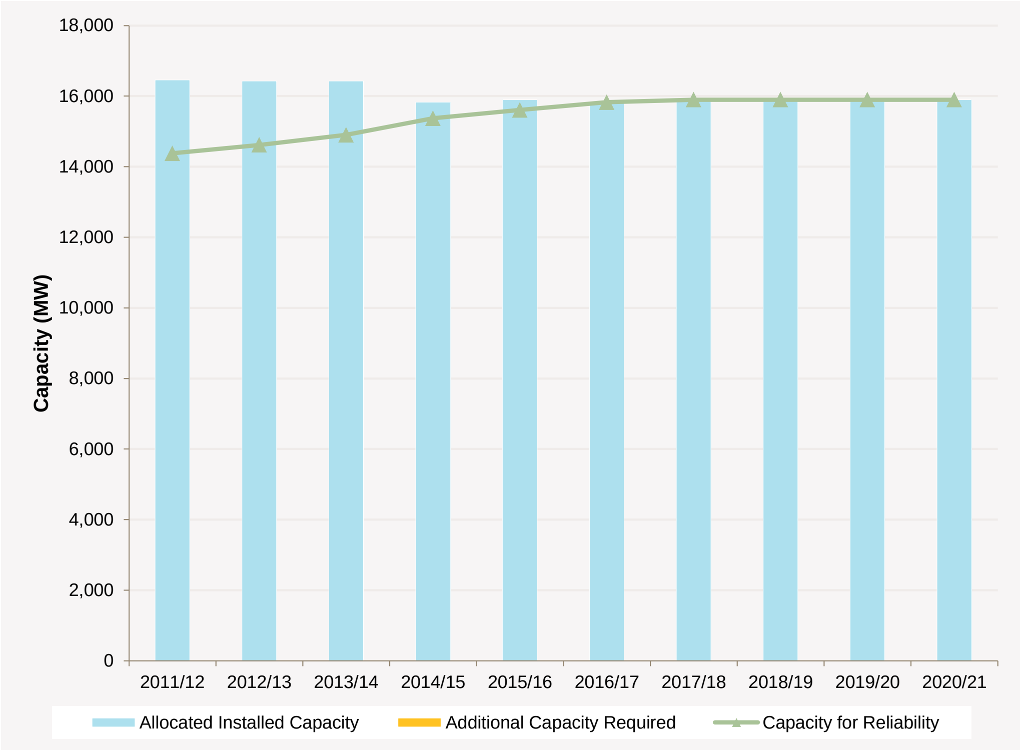

Figure 7: AEMO supply demand assessment – 50% POE (source: 2011 ESOO)

Even at the 10% POE forecast level the requirement for new capacity will be easily met if private sector proposals come to fruition. The number of proposed gas plant projects and project approvals indicates that there is sufficient capacity ready to deploy well within the timeframe required under AEMO's 10% POE demand forecast. Table 2 shows that there are up to ten gas power station projects proposed for NSW with a total potential capacity of 4920MW. The outlook for demand in the market and the prices available to generators will drive the timing of plant construction and ensure that electrical reliability is maintained.

Table 2: Proposed gas generation projects in NSW (source: AEMO 2011 ESO)

Name	Proponent	Capacity (MW)	Type
Dalton	AGL	500	Peaking
Kerraway	Origin	1000	Peaking
Tallawarra B	TRUenergy	450	Intermediate
Wellington	ERM	510	Peaking
Parkes	Intl. Power	150	Peaking
Leafs Gully	AGL	360	Peaking
Bamarang	Lumo Energy	400	Peaking or intermediate
Marulan	TRUenergy	450	Peaking or intermediate
Bannaby	Snowy Hydro	600	Peaking
Tomago	Macquarie Generation	500	Peaking
Total		4920	

Energy

For the last five years, the actual annual energy requirement in NSW has been flat or decreasing. However, the forecasts invariably predict significant growth in both maximum demand and energy requirement. A comparison of recent forecasts with actual demand can be seen in Figure 8.

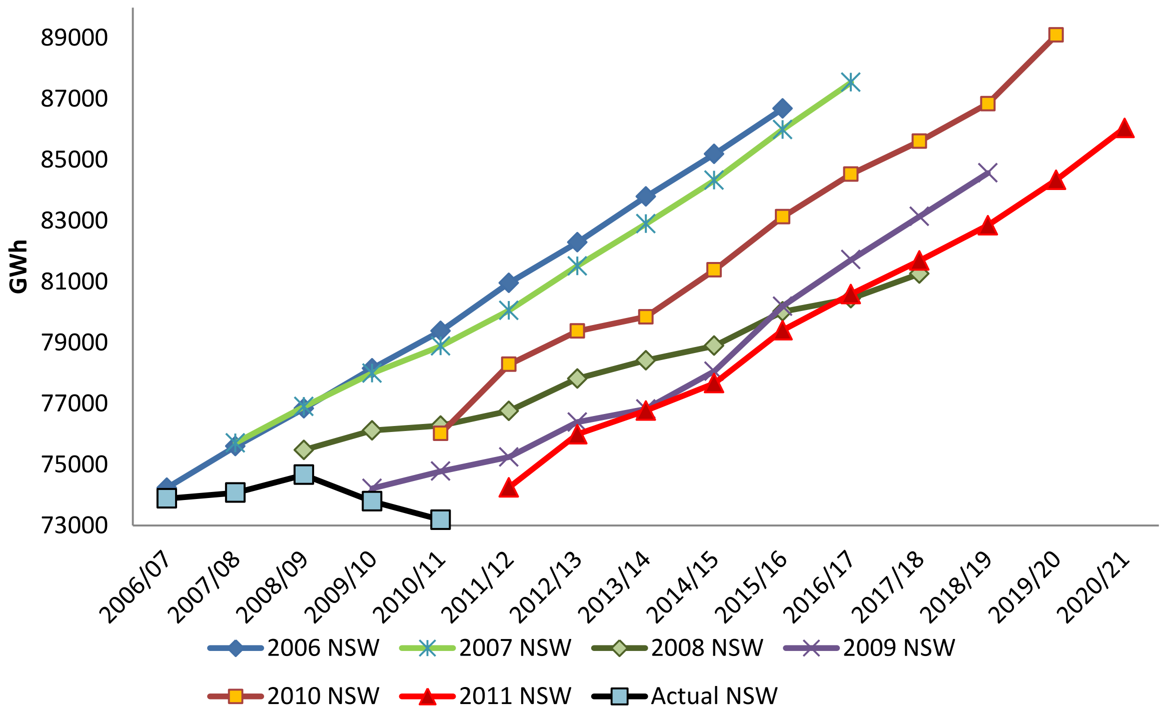

Figure 8: Comparison of AEMO energy forecasts with actual outcomes

These forecasts broadly reflect historical trends because the models used to produce the forecasts assume that the key driver of energy growth is economic growth. This link to economic growth has clearly been severed based on the actual market outcomes over the last 5 years. This is the result of a fundamental shift in energy usage patterns that has resulted from rooftop solar panel deployment, energy efficiency legislation, accelerated deployment of efficient appliances, price increases and fuel switching (including gas and solar hot water heating). Market growth well below these forecasts and well below historical trend growth is the most likely outcome over the medium term unless government policy once again supports industrial growth.

Even taking these optimistic market growth forecasts as fact, the requirement for new base load energy supply is at least a decade away. The build-up of plant during the 80s and 90s provided significant surplus of energy generation capability which is still yet to be fully absorbed by market growth. The table below sets out the potential for energy production from existing base load and intermediate plant within NSW. The total annual production far exceeds that required under even the forecasts presented by AEMO above.

Table 3: Energy production capability in NSW

	Continuous Capacity (MW)	Assumed Capacity Factor	Potential Annual Output (GWh)
Mt Piper	1400	90%	10,486
Bayswater	2640	90%	19,773
Eraring	2880	90%	21,571
Vales Point	1320	85%	9,337
Wallerawang	1000	75%	6,242
Liddell	2000	75%	12,483
Tallawarra	420	65%	2,272
Imports (incl Tumut)	-	-	8,000
Total	**11660**	**85%**	**90,163**

iii) Energy Security in Beyond 2020

Beyond the 10 year timeframe existing plant will begin to reach the end of its economic life at 50 years of service. Figure 9 highlights the magnitude of this reduction over the 10-15 years from 2021 assuming no early retirements due to asset impairment. The power stations are stacked in order of retirement with Liddell the first to reach 50 years of service in 2021/22, followed by Wallerawang in 2027/28, Vales Point in 2029, Eraring in 2033/34, Bayswater in 2036/37 and finally Mt Piper in 2042/43. This roll-off of capacity and energy production will require significant investment in new base-load plant.

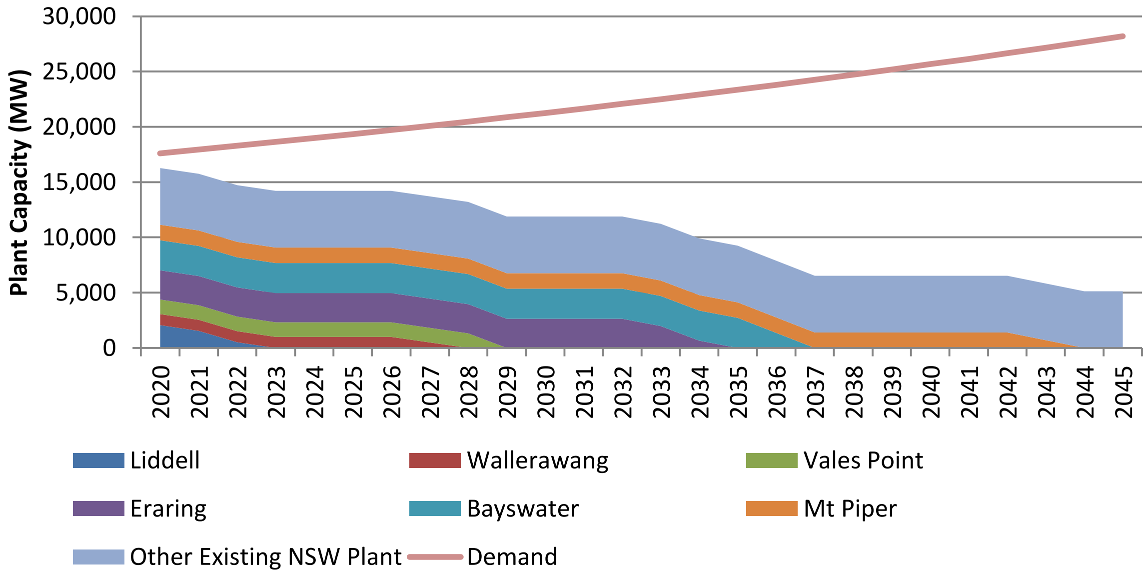

Figure 9: Roll-off of NSW base load capacity after 2021

The role for government in securing the NSW energy supply over the long term is to ensure that the barriers to deploying new plant are minimised. Any new base load plant built within 10-15 years is likely to be gas fuelled due to the Commonwealth's carbon pricing scheme. Therefore gas resources will need to be developed and pipeline infrastructure will need to be built to support the deployment of this plant. Government can facilitate the development of domestic resources and pipeline infrastructure by ensuring environmental and development approvals processes are efficient.

Beyond the 15 year horizon, new plant is likely to start to need geo-sequestration to be competitive under a carbon pricing scheme. The potential for carbon dioxide geo-sequestration within NSW needs to be understood much more deeply by this time. Government support for locating and studying geo-sequestration sites is essential and should begin as early as possible. Early research into geo-sequestration sites will ensure that reliable information is available to generation project proponents with sufficient time to begin their design and approvals process. Also, the legislation surrounding liabilities and ownership of sequestered carbon dioxide needs to be finalised well before the 15 year horizon to give developers and researchers certainty that their projects will operate in a robust legal environment.

iii) Primary Energy Security

The coal mines supplying coal to NSW generators were sold as part of the PowerCoal transaction in 2002. This resulted in private ownership of these mines which led to a change in priorities for mine and business development. International prices for coal subsequently increased at a rate much faster than domestic electricity prices.

This divergence of pricing (Figure 10) has made supply to the domestic coal market, the NSW power stations, less attractive to coal producers than the export option. Increasingly, suppliers target the production and sale of export quality coal. The consequences have been that domestic coal has become increasingly subject to export parity pricing and the quantities and terms offered have declined. At the same time other generators in Queensland and Victoria controlled fuel resources, making NSW generators less competitive with interstate operators who are not exposed to export parity pricing.

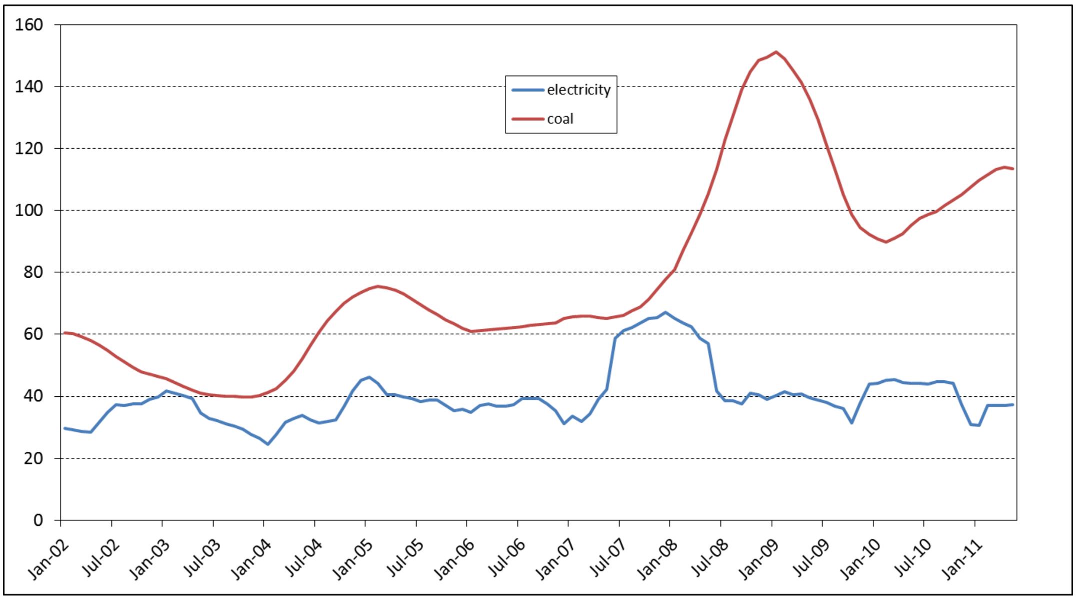

Figure 10: 12 month rolling average coal ($/t) and NSW electricity ($/MWh) prices

Sources: AEMO, GlobalCoal NEWC index and Oanda.com

It became apparent to the NSW coal generators in the mid 2000's that fuel supply price and volume risk threatened competitiveness and represented a significant impediment to maintaining affordable electricity supplies to NSW homes and businesses. However, NSW generators were not permitted control resources in this period.

It was only after the coal market risks had been realised by NSW generators that a coal mine development project was initiated near Cobbora in NSW. The Cobbora project began as a joint venture between the state-owned generation companies, Delta Electricity, Eraring Energy and Macquarie Generation. It was an effort to secure domestic supply in the face of changing coal market dynamics.

As a result of the conditions in the coal market, Delta Coast is critically reliant on supplies from Cobbora. Moreover, it is understood that both Macquarie and Eraring are similarly reliant, to lesser or greater degrees, on Cobbora. From 2015 onwards, Cobbora supplies will represent up to 35% of the total NSW coal consumption for electricity.

Given the importance of this project to the State's electricity supplies, it must be recognised that the development faces a number of challenges to meet the contracted timeframe. These include:

- securing appropriate mining and associated infrastructure expertise;
- timely environmental and development approvals;
- significant infrastructure requirements; and
- significant capital investment.

Cobbora is a key part of maintaining affordable electricity generation in NSW but it has an ambitious development timetable. A delay of just one year could well result in a shortage of fuel, given the market conditions described above and the fact that all three generators would be seeking replacement coal contracts at the same time. This shortfall could translate to a loss of about 13,000 GWh or 16% of NSW electricity production with a probable, consequent rise in electricity prices and/or electricity shortages.

In the context of NSW what has happened on NSW coal supplies and West Australian gas supplies, where domestic contracts are priced near export parity levels, the NSW Government may wish to consider the need for dedicated domestic control of primary energy resources. If the future development of gas in NSW is to be guided by similar policies that applied to coal in the past, then a similar outcome could eventuate. Gas developments will target lucrative international markets and leave domestic essential services at risk of supply shortfalls. Domestic energy reservation systems are a complex topic in themselves, as evidenced by the West Australian debate.

It should not be interpreted that Delta is advocating a reservation system by raising the issue, but rather that it is an important issue that the Committee may wish to consider and seek further advice on.

iv) Potential for NSW sourcing energy interstate

NSW sources a substantial proportion of both its gas and electrical energy requirements from interstate. Gas is sourced via the Moomba to Sydney Pipeline and the Eastern Gas Pipeline while electricity is transmitted via the Queensland-NSW interconnector and from Victoria. In 2009-10, 99% of NSW gas demand was sourced from interstate (AEMO GSOO). A much lower proportion, 10.5% in 2011, of the electrical energy required in NSW is sourced from interstate (AEMO data). This reflects the historical development of energy resources and markets and the relative costs of fuel between NSW and other regions.

Imports of electricity from Queensland and Victoria vary greatly from year to year. Congestion on the transmission interconnectors is relatively low[1] and past assessments of major capacity increases have not been shown to be economic[2]. There is no evidence to suggest there is a case for further increasing the capacity of transmission interconnection into NSW. Development of new generation capability across the NEM regions has ensured ample supply is available within each region and there is no trend of increasing utilisation of interconnector capacity.

Any future development of interstate energy sourcing should carefully consider the costs of this development against the alternative of sourcing energy from within NSW. As AEMO identifies in its 2011 National Transmission Network Development Plan, gas transmission infrastructure is much cheaper and has lower impact than electrical transmission infrastructure. This being the case, and with the discovery of substantial CSG resources within NSW, it is more efficient for gas generation to be located closer to demand centres in NSW with gas pipelines built to accommodate the increased gas demand.

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[1] Assessment of Inter-regional Congestion, IES report to AEMC, November 2011, http://www.aemc.gov.au/Media/docs/IES%20Assessment%20of%20Inter-regional%20Congestion-11f355a2-cc9c-4890-8467-e0af0bd1b995-0.PDF

[2] Powerlink Queensland, “Potential Upgrade of Queensland/New South Wales Interconnector (QNI) – Assessment of Optimal Timing and Net Market Benefits”, http://www.powerlink.com.au/Network/Documents/QNI_upgrade_Final_Report.aspx, October 2008.

Delta expects the market to deliver this economically efficient outcome if the costs of building new electrical transmission capacity to support generation projects are properly allocated and if the government ensures timely delivery of environmental and development approvals.

v) Barriers to development of alternative forms of energy generation in NSW

Delta has experience with alternative energy projects through its development of biomass projects and its biomass co-firing operations. Existing policies such as the Commonwealth Renewable Energy Target Scheme and the carbon pricing scheme are adequate drivers of alternative energy generation.

It has been our experience that there are alternative fuel sources available, but there is a conflict between state and federal legislation as to what fuels are determined as eligible fuels for power generation. Fuels permitted by the Office of the Renewable Energy Regulator (ORER) for the generation of Renewable Energy Certificates (RECs) are not approved by the Office of Environment and Heritage (OEH) as eligible fuels for power generation. This resulted in fuels which were permitted as power station fuels in some states and territories were prohibited in New South Wales.

The benefits of biomass for renewable power generation in NSW could be substantial since biomass fuel provides the potential for continuous base-load renewable power generation. In contrast, renewables like solar and wind are intermittent and will require breakthroughs in commercial scale storage to become a reliable source of energy.

Delta understands the need for caution when dealing with alternate fuels, including waste streams in particular, nevertheless we recommend that this situation be reviewed to ensure that access to these resources is predictable and reliable.