Project Need and Justification | Chapter 2

2.1 Introduction

The National Electricity Market (NEM) governs the supply of electricity in Australia and is managed by the National Electricity Market Management Company (NEMMCO). NEMMCO predicts that growth in electricity demand in NSW will exceed existing capacity, requiring the construction and operation of new power stations. Due to the type of load growth, the immediate need is for power stations that meet demand during the electricity peaks only. In the longer term there is a possible need for base load generation capacity.

To ensure that the state's future electricity demands are adequately met and in accordance with NSW Government policy, Delta Electricity and EnergyAustralia are proposing the Marulan Gas Turbine Facilities comprising two separate operations with open cycle gas turbines generating approximately 320 MW and 350 MW respectively. If required, Delta Electricity's Facility would be converted to a combined cycle Facility for a total output of approximately 450 MW. Depending on the electricity demand growth, Delta Electricity may progress with the construction and operation of a combined cycle Facility directly.

In this chapter, the electricity market and the drivers behind the supply and demand of electricity are discussed in more detail and the Project justification is addressed in terms of the NEM and the transmission network.

2.2 Background

2.2.1 The National Electricity Market

In December 1998, a single competitive national electricity market for the supply of electricity was introduced. The NEM introduced competition in the wholesale supply and purchase of electricity combined with an open access regime for the use of electricity networks across the Australian Capital Territory, New South Wales, Queensland, South Australia, Victoria and Tasmania.

The NEM is a wholesale market for the supply and purchase of electricity, the arrangements for which are defined in the National Electricity Code. The NEMMCO manages the operation of the wholesale electricity market and security of the power system.

Generators bid their electricity into the NEM, which is split into regions based largely upon state boundaries. The last bid accepted sets the spot price for electricity with prices set on a half-hour basis. Retailers purchase the electricity direct from the NEM. The NEMMCO facilitates these purchases. The electricity is then on-sold to the consumer and transported by transmission lines (high voltage) and distribution networks (lower voltage).

The cost of power in the market varies each half hour based on the prices that are bid in by generators that wish to sell power. As demand varies, different power plants run and the price of power varies. NSW, Snowy Mountains, Victoria, South Australia, Queensland and Tasmania are interconnected and electricity flows between the regions based on the half hour price that prevails between adjacent regions.

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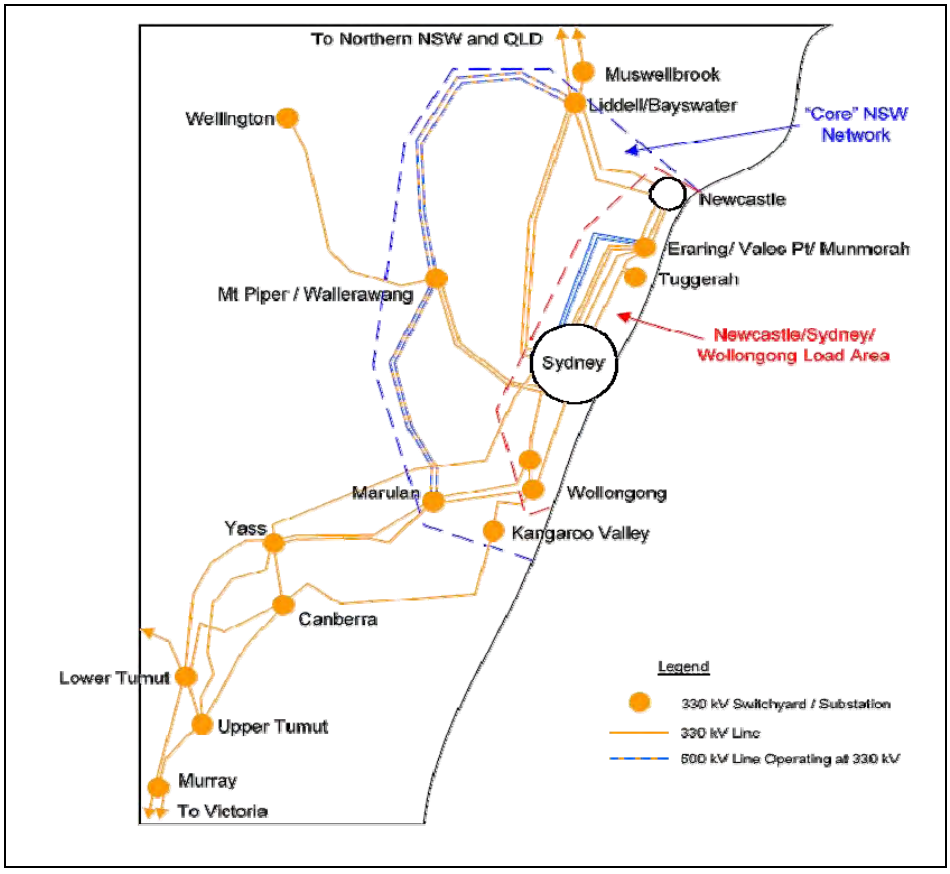
Prior to the NEM, the price of electricity had not played an important role in shaping energy infrastructure development. Since the creation of the NEM, the price has had a great influence on the development of infrastructure through the supply and demand mechanism.

2.2.2 Transmission Network

In May 2006, TransGrid published an Application Notice "*Development of Supply to the Newcastle – Sydney – Wollongong Area*" which identifies the transmission infrastructure requirements and also the limitations of the network in terms of the location of new generating capacity.

As shown in **Figure 2-1**, the existing TransGrid Marulan switchyard is a major node within the NEM for electricity flows to the major NSW load centres of Newcastle – Sydney – Wollongong as well as flows to and from Snowy/Victoria to the south and Queensland to the north.

Figure 2-1 Stylised NSW Network



(Source: TransGrid Application Notice, May 2006)

TransGrid's Application Notice outlined the commissioning of the western 500 kV system and associated works. The western 500 kV system consists of twin circuit 500 kV lines from Bayswater to Mt Piper power stations and from Mt Piper to Marulan. It forms the western half of the proposed 500 kV ring main around the Newcastle – Sydney – Wollongong load centres. This system, currently operating at 330 kV, is to operate at its design rating of 500 kV by the summer of 2009/10.

Local Marulan Network Configuration

TransGrid's Marulan switchyard currently provides connection for:

- a twin circuit 500 kV transmission line from Mt Piper and Wallerawang power stations in the north (these lines are currently operating at 330 kV);
- two 330 kV transmission lines connecting to Yass in the south;
- two 330 kV transmission lines, one connecting to Avon and the other to Dapto in the north east; and
- a 132 kV transmission line to supply Country Energy's local distribution area.

The Application Notice involves works (among many other works) that will affect TransGrid's Marulan switchyard:

- construction of new 500/330 kV switchyard at Bannaby, approximately 20 km to the north of TransGrid's Marulan switchyard where the 500 kV circuits from Mt Piper/Wallerawang cross the 330 kV line (Circuit 39) from Yass to Sydney West;
- turn-in of the Mt Piper 500 kV lines into Bannaby;
- 330 kV transmission at Bannaby;
- operation of the 500 kV rated lines from Bannaby to Marulan at 330 kV;
- turn-in of the Circuit 39 at Bannaby creating Yass-Bannaby and Bannaby-Sydney West 330 kV circuits. This is part of a longer term plan to re-build both circuits to either twin 330 kV or twin 500 kV lines; and
- up-rating of Circuits 8 and 16 from Marulan to Dapto and Avon respectively to give them capacities of approximately 1,000 MVA each.

No line work would appear to be necessary at TransGrid's Marulan switchyard as part of the works for the above TransGrid upgrade. However, commissioning of the Western 500 kV system will have significant positive effects on electricity flows in the region.

Maximum Generation Capacity

Modelling was conducted of the maximum generation capacity that can be connected to the transmission system.

Modelling of Stage 1 of the Delta Electricity Gas Turbine Facility identified that there are unlikely to be constraints on the maximum output of Stage 1 for normal system conditions especially when flow is to the north supplying peak demand in the Greater Sydney region of Newcastle – Sydney – Wollongong. There are, however, likely to be constraints should a critical transmission line trip or if there is very

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high flow south to Snowy/Victoria. The probability of the former occurring is considered very low. The probability of exposure of this dispatch constraint is very low when compared to high flow north from Snowy/Victoria.

Modelling of the EnergyAustralia Gas Turbine Facility at a maximum 350 MW of gas generation has identified that there are unlikely to be constraints on the network system and that any potential constraint would be alleviated by the proposed Bannaby upgrade and the 'western 550 kV' conversion project.

In terms of operation of the two separate Facilities (including Delta Electricity Facility Stage 2), the southern NSW system between Marulan and the south coast can be fully utilised at times by high imports from the western generators to Marulan, noting that this only tends to occur at high load times and is governed by the dispatch of generated electricity into the system. With the operation of the Facilities at Marulan, the available transmission capacity would need to be shared. The electricity generated would be dispatched according to market rules.

On the basis of the results of the preliminary network studies, two separate Connection Enquiries have been lodged with TransGrid for the Facilities.

2.3 Electricity Demand

2.3.1 Government Energy Policy

As the security of energy supply is a critical issue for the future of NSW, the NSW Government released their *Energy Directions Green Paper* (the Green Paper) in December 2004. This Green Paper stated that while there is currently sufficient electricity generation capacity to meet demand, the level of maximum demand is increasing by around 4 % per year. The Green Paper stated that in New South Wales the summer peak demand has grown by around 3.8 % per year for the previous five years. The Green Paper noted that if this trend continues additional generation capacity or demand management will be needed by the end of the decade.

Over the coming decade, it is predicted that rising electricity demand from NSW will exceed existing generation capacity unless a new source of electricity generation is constructed and fully operational by 2009. The Green Paper also identifies that new base load generation capacity may be required from around 2012/13.

2.3.2 NEMMCO Statements of Opportunities

Each year NEMMCO releases its Statement of Opportunities (SOO) which, in part, analyses the supply and demand scenarios for each region of the NEM. The 2006 SOO report confirms forecasts that NSW is likely to experience a summer peak deficit (or shortfall below the low reserve condition) by 2008 / 2009 unless additional generation capacity is provided to cater for this deficit. The 2006 SOO was updated in the 2007 SOO released on 31 October 2007.

The 2006 SOO states that the 10 % probability of exceeding summer maximum demand is projected to increase over the forecast period (commencing 2006 / 2007) by an average of 3.2 % and 2.2 % for the high and low-growth scenarios respectively.

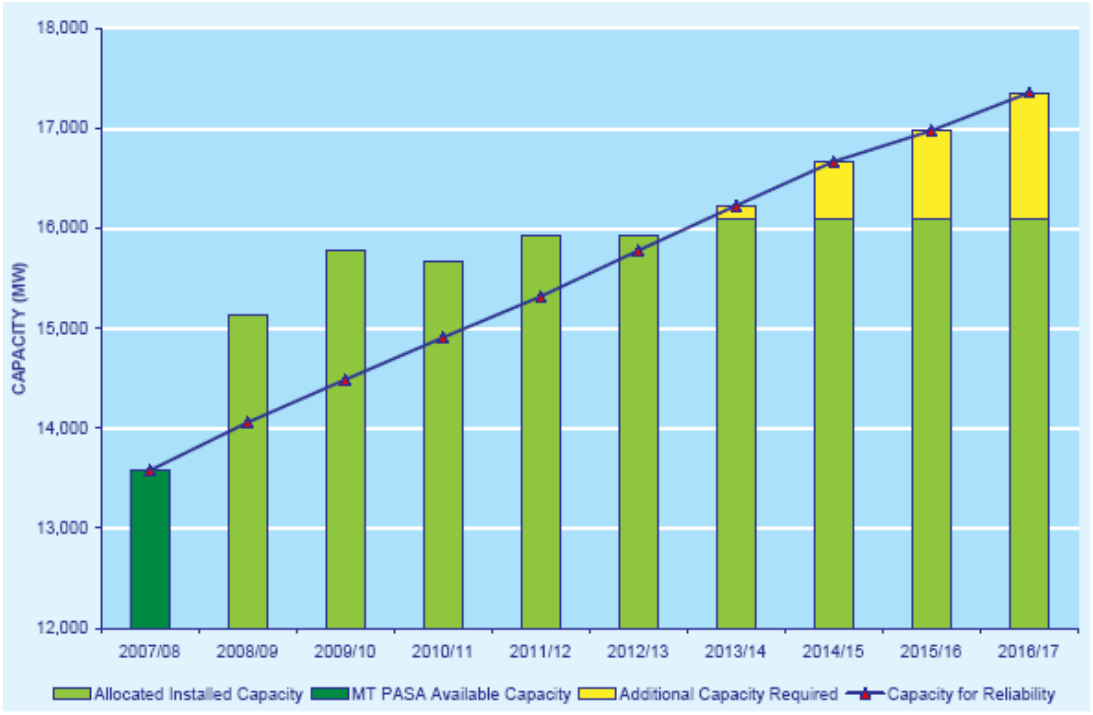
The 2006 SOO forecast growth in NSW peak summer load to 2015 / 2016 and, in particular, the report highlighted a shortfall in NSW reserve peaking capacity of some 287 MW requiring additional reserve capacity as early as 2007 / 2008.

The 2007 SOO forecast is presented in **Figure 2-2.** Due to a number of factors including different analysis techniques and new generation capacity, this figure shows a revised assessment from the 2006 SOO projecting that additional capacity would be required around 2013 / 2014.

While its latest report indicates an improvement in the NSW reserve capacity outlook and does not identify the previous 287 MW reserve deficit, the 2007 SOO does state that its analysis does not include any allowance for generation limitations arising from drought conditions restricting water availability. This is particularly important in considering 2007 SOO projections that additional capacity in NSW will not be required until the summer of 2013 / 2014.

Further, the 2007 SOO projects that NEM-wide summer demand deficits could occur as early as 2011 / 2012.

Figure 2-2 2007 Projected NSW Summer Outlook to 2016/2017



(Source: NEMMCO SOO 2007)

2.3.3 Owen Inquiry

The NSW Government established an inquiry into Electricity Supply in NSW in May 2007 to advise the Government on the actions it needs to take for a timely investment in new base load generation. The inquiry was undertaken by Anthony Owen, Professor of Energy Economics at Curtin University of Technology (generally referred to as the Owen Inquiry), with the terms of reference to:

- review the need and timing for new base load generation that maintains both security of supply and competitively priced electricity;
- examine the base load options available to efficiently meet any emerging generation needs;
- review the timing and feasibility of technologies and / or measures available both nationally and internationally that reduce greenhouse gas emissions; and
- determine the conditions needed to ensure investment in any emerging generation, consistent with maintaining the NSW AAA Credit Rating.

The Owen Inquiry Report was released in September 2007. The Inquiry found that energy consumption in NSW is forecast to increase to 91,000 GWh a year by 2013-14, an increase of 10,500 GWh from 2006-07.

The Owen Inquiry Report stated that NSW's innovative energy efficiency measures are currently playing, and will continue to play, a significant role in reducing energy consumption and that renewable energy and other small-scale generation are forecast to provide over 1,500 GWh of the 10,500 GWh needed.

The Owen Inquiry Report found the remaining 9,000 GWh base load electricity required annually by 2013-14 is likely to be met by gas- or coal-fired generation. Other technologies such as solar or geothermal are expected to contribute significantly in the longer term.

2.3.4 Proponent Response

Based on the forecasts provided in the SOO report, Owen Inquiry and Delta Electricity's and EnergyAustralia's own analysis of current market conditions and potential future demand scenarios, Delta Electricity and EnergyAustralia have identified the need to provide additional generating capacity to meet the likely short to medium-term shortfall in electrical supply during peak demand periods and potentially in the future for base load supply.

2.3.5 Demand

There are two types of electricity demand:

- *peak demand:* demand that typically occurs when customers use air conditioning or heating at times of high or low temperatures respectively; and
- *average (base load) demand*: demand that occurs most of the time.

Peak Energy Demand

The Green Paper stated that peak demand is growing faster than average demand. In NSW, summer peak demand has grown by around 3.8 % (500 MW) per year for the past five years. Average demand growth has been significantly slower at around 2.8 %. The Green Paper further noted that effectively 10 % of NSW generation and network capacity is used for only 1 percent of the time. If current growth trends continue, the Green Paper stated that in the following 10 years around 18 % of generation capacity will be required for only 1 % of the year. The Green Paper stated that trend toward 'peakier' electricity demand has significant cost implications for NSW consumers. The Green

Paper further noted that this trend has further implications for the types of new generating plants that are likely to be cost effective in the future.

Historically, NSW peak electricity requirements have been met by the Snowy Mountains hydro-electric scheme and through older coal plants. However, as demand has risen, the older coal plants are required to meet base load demand. As a result, the NSW Government has acknowledged that new peaking capacity will be needed in the next few years while the need for new power plants to meet base load demand will not be required for some time.

The Green Paper stated that major options for providing new peaking capacity are additional hydro pump-storage technology and gas-fired peaking plants. The Green Paper outlines the advantages and disadvantages of these two options. It states that hydro-pump storage requires the building of dams that store water for hydroelectric generation at peak times which is very expensive and can severely impact on environmentally sensitive areas. It notes that "open cycle" gas generation plants are effective in meeting the peak demand and can be built for a relatively low cost in a short timeframe. It further notes that as they are expensive to run they are only suited to meet high priced peak demand.

In addition, gas peaking plants have two thirds the greenhouse emissions of coal fired plants and are lower in capital cost than base load power plants.

Base Energy Demand

The Green Paper also highlights the benefits of 'combined cycle' generation plants over upgrading existing coal-fired plant and construction of new coal-fired plants. The Green Paper notes that combined cycle plants are suitable for operation as base load capacity as they are cheaper to run and can be run more economically more often than open cycle. Further, the Green Paper states that the attraction of gas is its relative greenhouse efficiency compared to coal fired generation. The relatively high cost of gas in NSW means that currently combined cycle plants are a higher cost way of providing base load capacity than using coal. However, the Green Paper states that as a result of its lower greenhouse gas emissions intensity, the economics of gas-fired generation relative to coal-fired generation as a means of providing base load generation in NSW will be heavily dependent on the possible governmental subsidies placed on greenhouse gas emission reductions.

The more recent Owen Inquiry Report found the remaining 9,000 GWh base load electricity required annually by 2013-14 is likely to be met by gas- or coal-fired generation. The Owen Inquiry found that combined cycle gas turbines are capable of running efficiently at high capacity factors. It further stated that combined cycle gas turbines are cheaper to build than coal-fired generators, but have higher fuel costs, and it is this that reduces their attractiveness for base load power. The combined cycle gas turbine technology is amongst the most attractive for new intermediate plant and it was further noted that combined cycle gas turbines have less than half the carbon emissions of new coal fired power stations, and will benefit relative to coal from an emissions trading scheme. With a high enough carbon price, combined cycle gas turbines could potentially provide lower cost base load than coal-fired generation.

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2.4 Delta Electricity Proposal

Based on the forecasts provided in the SOO reports, Owen Inquiry, and Delta Electricity's own analysis of current market conditions and potential future demand scenarios, Delta Electricity has identified the need to provide additional generating capacity to meet the likely short to medium-term shortfall in electrical supply during peak demand periods.

In order to meet this short term deficit in NSW's peak electricity generating capacity Delta Electricity proposes to construct an electricity generating Facility consisting of two open cycle gas turbines. This type of generating system can supply electricity to the grid at short notice and is therefore well suited to providing electricity in peak demand periods. Gas turbines represent one of the most effective options to provide electricity for short term demand. At a later stage, Delta Electricity proposes to convert the open cycle gas turbines to combined cycle turbines to generate intermediate / base load electricity. The conversion of the peaking plant to a base load plant will be dependent on the future demand for electricity in NSW. Depending on the electricity demand growth, Delta Electricity may progress with the construction and operation of a combined cycle plant directly.

2.5 EnergyAustralia Proposal

Based on the forecasts provided in the *2007 National Electricity Market Management Company Statement of Opportunities* and EnergyAustralia's own analysis of current market conditions and potential future demand scenarios, there is a need to provide additional generating capacity to economically meet growth in demand in electrical supply during peak demand periods.

As the largest electricity retailer in NSW, EnergyAustralia needs to purchase a significant volume of electricity in the NEM.

There are a number of changes occurring in the NEM and, in particular, NSW that affect EnergyAustralia's future electricity purchasing strategy. These include:

- a significant increase in recent wholesale pool and forward contract prices for electricity in NSW;
- a tightening of the supply/demand balance in NSW;
- recent constraints on the output of interstate generators caused by the drought; and
- the phasing out of the Electricity Tariff Equalization Fund, a legislated fund that has secured the wholesale supply cost for much of EnergyAustralia's load.

As the supply demand balance tightens it is increasingly important for EnergyAustralia to secure the cost of supplying its customers with electricity during periods of high wholesale market price, which are inherently difficult to predict.

EnergyAustralia believes that control of physical supply is required to manage this wholesale risk. This strategy has been executed by EnergyAustralia's largest retail competitors, AGL, Origin Energy and TRU Energy.

EnergyAustralia's view is that there is a strong case for more peaking capacity in NSW over the next few years given the growing reliance on interconnected supply, potential for network constraints, reliance on diversity of load across states and the potential for supply constraints outside the NSW NEM region under prolonged drought conditions.

The Project will meet EnergyAustralia's commercial imperative to manage supply costs during peak demand periods and will also help secure the State's energy supplies into the future.

2.6 Project Siting

The Proponents sought advice on the most appropriate location for a Gas Turbine Facility in NSW. Such a site must be located close to existing gas and transmission infrastructure. The Marulan Site was selected as the most appropriate available location for the peaking plants, with suitable land potentially available close to TransGrid's switchyard and to the Moomba to Sydney gas pipeline.

EnergyAustralia was aware of Delta Electricity's publicly announced proposal to build a Gas Turbine Facility near TransGrid's switchyard.

EnergyAustralia and Delta Electricity subsequently agreed to jointly purchase land from the University of Sydney to meet their individual requirements for the Facilities. The purchased land is being sub-divided between Delta Electricity and EnergyAustralia. Further discussion on the alternatives considered by Delta Electricity and EnergyAustralia is presented in **Chapter 3**.

As mentioned previously, both Delta Electricity and EnergyAustralia recognised that the Marulan Site was a favourable location and co-locating the Facilities would reduce the environmental footprint. Common infrastructure such as the gas pipeline, access road and transmission lines effectively reduces the amount of vegetation clearing required for the construction and operation of the two Facilities.

2.7 Project Benefits

The Project would benefit the local and regional community on a number of levels. Potential benefits include:

- increased reliability of supply during peak demand periods;
- improved security of electricity supply during system emergencies;
- ability to quickly convert to a base load plant should there be a substantial increase in electricity demand;
- improved environmental outcomes due to lower greenhouse gas emissions per unit of output compared to conventional coal-fired power generation technologies;
- provision of social and economic benefits associated with the ability of the NSW supply network to meet peak energy demands in the short term and base load demands in the longer term; and
- where possible, local job creation for construction works.