Strategic Justification

2

2. Strategic Justification

This section of the Environmental Assessment reviews:

- the strategic justification for the Proposal, need, scale, scope and location, in relation to predicted electricity demand, transmission constraints and the strategic direction of the region
- site suitability
- consideration of alternative base load generation.

2.1 Future Electricity Supply and Demand

2.1.1 Owen Inquiry

Over the last few years, a process of review and recommendation has been undertaken with respect to electricity demand and supply in NSW. In May 2007, the NSW Premier established the Inquiry into Electricity Supply to be undertaken by Professor Anthony D Owen of the School of Economics and Finance in the Curtin Business School in Canberra (the "Owen Inquiry"). The findings of the Owen Inquiry were reported in September 2007. A key outcome of that inquiry was:

> *"With a risk-averse approach, New South Wales needs to be in a position where new baseload generation can be operational by 2013/14 if necessary, in order to avoid potential energy shortfalls."*

The Owen Inquiry noted that the bulk of NSW's electricity generation capacity was constructed during the 1970s and 1980s, with Delta Electricity's Vales Point B commissioned in 1978/79 and Mt Piper in 1993, with no new major baseload power generating facilities constructed since Mt Piper (1993). Existing generation, including inter-state energy transfers, have continued to meet electricity demand in NSW. Owen characterised the maximum base load power generation capacity in NSW (from coal, gas and hydro power generating facilities) as 85,100 GWh per year. The report indicated that with growth in electricity demand as forecast, there is anticipated to be a shortfall in available energy within the next decade – by 2013/14.

2.1.2 NSW electricity consumption

The growth of electricity use in NSW is very dependent on economic growth. Higher economic growth results in higher energy consumption. Consequently it is prudent to consider the economic forecasts underpinning the energy projections when investigating their applicability. It is noted that the TransGrid 2009 projections were based on Gross Domestic Produce (GDP) and Gross State Product (GSP) economic growth predictions prepared some months ago. At that time, these forecasts were projected to be significantly lower as a consequence of the Global Financial Crisis (GFC). More recent GDP and GSP forecasts as part of the Commonwealth and NSW State budgets reflect an expectation of higher economic growth.

The total (Native) energy (electricity) consumption in the National Electricity Market (NEM) is met by:

- scheduled energy – energy from the larger power generating facilities scheduled by Australian Energy Market Operator (AEMO)
- non-scheduled energy – smaller renewable and embedded generation sources
- semi-scheduled energy – future new larger wind energy sources.

Assumed Native Energy growth using TransGrid's 2009 Annual Planning Review (APR) projections together with forecasts using revised more recent GSP projections are shown in the Table 2.1.

Table 2.1 – NSW Native Energy Consumption Medium Scenarios

Year	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	15/16	17/18	18/19
						GWh					
A	80,430	79,860	80,470	81,140	82,630	83,190	84,600	86,910	88,610	90,260	91,850
B	80,430	80,000	80,700	81,300	83,400	85,000	87,100	90,200	92,300	93,900	95,700
Change	0	+140	+230	+160	+770	+1,810	+2,500	+3,290	+3,690	+3,640	+3,850

NOTE: A = TransGrid's 2009 Annual Planning Review
B = Revised GDP/GSP

Both these forecasts include provision for:

- current proposals for the introduction of a national Carbon Pollution Reduction Scheme (CPRS)
- NSW generation resulting from the introduction of the expanded Renewable Energy Target (RET)
- the effect of demand management measures to improve end use efficiency reducing electricity consumption.

2.1.3 NSW electricity supply

The growth scenarios shown in Table 2.1, like the Owen Inquiry, do not take into account any potential new major industrial demand. When considering the projected energy supply to meet the revised projected growth, there are a variety of issues that need to be considered:

- the contribution from NSW's share of Snowy electricity output is projected to decline marginally over the past long term contribution due to the effect of additional environmental flows
- the net contribution to NSW's electricity needs from Victoria is projected to remain negative as electricity supply in Victoria, South Australia and Tasmania is likely to become tighter by 2014/15
- electricity supply to NSW from Queensland has progressively declined over the past three years and there is no reason to expect that trend would reverse
- the non-State Owned Corporation (SOC) NSW generator at Tallawarra (CCGT) makes a contribution of about 2.300 GWh - 3% of total energy supply in 2009/10
- the balance of supply is to be made by the SOC coal fired power stations that by 2015/16 will be generating at historically high levels since installed from the early 1970s. All the SOC generators will be generating at record sustained levels of production by 2015/16.

All these factors have an impact on the ability to meet electricity demand through the supply options currently facing NSW. This includes a limited range of technologies, a restricted supply from other sources (including interstate transfers) and the constraints placed on current generation facilities.

Table 2.2 shows the current NSW 2008/09 electricity supply based on actual native energy consumption and the projected electricity supply for 2015/16 taking into account the scenario described above.

Table 2.2 shows that the existing SOC coal fired generators will be required to sustain a 17% increased output (an extra 11,000 GWh per annum) above 2008/09 levels. This has serious implications for maintaining supply reliability given that the oldest of these plants will be 45 years old by 2015/16.

Table 2.2 – Electricity supply for 2008/09 and projected for 2015/16

	2008/09 [1]		2015/16	
Electricity Supply	**%**	**GWh**	**%**	**GWh**
Unscheduled renewable and embedded generation	1.5	1,200	4.0	5,200
Semi scheduled large wind *(Will contribute from 2009/10 onwards)*	0	0		
Interstate net imports	7.0	5,900	Virtually nil	Virtually nil
NSW Region component of Snowy (Tumut generation)	2.0	1,900	2.0	2,000
Non State Owned Corporation (SOC) scheduled generation	3.0	2,600	5.0	4,600
SOC coal fired generation	**86.0**	**68,800**	**89.0**	**80,400**
TOTAL		**80,400**		**92,200**

NOTE: [1] actual native energy consumption

Reviews of the Owen Inquiry in 2008 and 2009 and updates in the energy consumption predictions show that deficiency in the base load power capability would still occur by mid to late next decade. The recently released 2009 AEMO Statement of Opportunities has predicted that the low reserve capacity will occur in 2015/16.

The Owen Inquiry highlighted the timeframe requirements (including planning approvals, detailed design processes, contracting periods, mobilisation, construction and commissioning). This greatly restricts the types of fuels and technologies that can be considered as viable to be operational within the 6-10 year timeframe when these timeframe constraints are considered. As the time by which new plant is required reduces, so will the technology options that can be constructed in the period available.

Munmorah Power Station Units 3 and 4 could be rehabilitated within the designated time frame and a rehabilitated power station could generate around 4,800 GWh per annum.

2.1.4 Renewable energy targets and demand management

Renewable energy targets

The Commonwealth Mandatory Renewable Energy Target (MRET) scheme was introduced in 2001. Following this, the NSW Government initiated the development of a State-based scheme to supplement the MRET scheme in 2006. That NSW State-based scheme is now intended to be absorbed into the Commonwealth's more recently developed expanded Renewable Energy Target (RET) requiring 20% of energy to come from renewable sources by 2020.

End-user demand management

End-user demand management has been managed primarily through electricity retailers under the NSW Code of Practice (2004). This includes Demand Management strategies to:

- reduce peak level electricity demand
- reduction in electricity consumption through increases in efficiency (e.g. compact fluorescent light bulbs, BASIX requirements)
- alternate reticulated energy sources (such as natural gas) and renewable energy sources.

The MRET and the expanded RET will see renewable energy production increase. At this stage the increase is not predicted to be sufficient to fulfil the need for increased base load generation in NSW. The Commonwealth Parliamentary Research Paper (Needham, 2008) notes that technology for the continuous and reliable generation of electricity from some renewable generation sources is already available but predicts that it is unlikely to be economic before approximately 2040.

However, semi scheduled non-continuous generators such as wind farms scattered across the climatic regions of the State will make some contribution to base load generation, The extent of this contribution in the time frame considered cannot yet be determined.

The proposed rehabilitation of Munmorah Power Station Units 3 and 4 does not replace the need for the continued development of renewable energy sources, or undermine the need for government policy to regulate and reduce greenhouse gas emissions. It is intended that the rehabilitation project would be undertaken within this context as it is proposed to be a dual fuel operation. The Proposal would be subject to both Commonwealth reporting legislation and the CPRS when commenced and would similarly be subject to NSW government initiatives and policy requirements.

2.1.5 Efficiency and greenhouse gas emissions

Sector efficiency and initiatives have been driven by a variety of sources. As the rehabilitation works would enable gas to be used as a fuel source, either in combination with coal or as a replacement and would make provision to develop carbon capture options as and when they are required, Munmorah Power Station would be more competitive with the following schemes in force. These initiatives and schemes are discussed in more detail in Chapter 6.

Greenhouse Gas Reduction Scheme (GGAS)

This scheme was introduced in 2003 with the aim of reducing greenhouse gas emissions associated with the production and use of electricity and to develop and encourage activities to offset the production of greenhouse gas emissions. The scheme requires electricity retailers in NSW and ACT to meet mandatory targets for reducing (or offsetting) the emission of greenhouse gases from the production of the electricity they supply or use.

The scheme is likely to be phased out with the introduction of a National Emissions Trading Scheme from about 2011.

NSW Greenhouse Plan (2005)

The DECCW NSW Greenhouse Plan is soon to be superseded by the NSW Climate Change Action Plan. The Action Plan is due this year, however, until that time, the Greenhouse Plan remains a key document in the NSW response to greenhouse gas emissions. The plan outlines a number of measures to reduce GHG emissions through abatement measures.

National Greenhouse and Energy Reporting Act 2007

This Commonwealth Act brought into force a single reporting framework for reporting greenhouse gas emissions. It is aimed to provide a consistency of accurate information to understand the current levels of GHG being generated and to inform both the Commonwealth Carbon Pollution Reduction Scheme as well as State based policy initiatives to reduce GHG emissions.

Carbon Pollution Reduction Scheme

This scheme is intended to be implemented through Commonwealth legislation shortly and will focus on a market based carbon pricing and trading process.

2.2 Strategic Directions

2.2.1 NSW electricity supply

Priority P2 of the *NSW State Plan* (2006, updated 2008) aims to maintain and invest in infrastructure including roads, railways, power, water supply and ports. The plan states

> "*The Government needs to ensure we have the right infrastructure at the right place at the right time.*"

The plan commits to maintain an average annual growth rate in Government capital expenditure of 4.6% nominal over the decade to 2015-16.

Increasing the reliability of electricity generation is also discussed in the NSW State Plan objectives. Priority E2 (a) states that

> *"A reliable electricity supply is a basic service and critical to our quality of life and the State's business competitiveness".*

The plan identifies a target of electricity reliability for NSW of 99.98% by 2016[1].

This equates with National Electricity Market Management Company (NEMMCOs)[2] 2008 *Statement of Opportunities* which stated that

> "*The power system is considered reliable if, over the long-term, at least 99.998% of consumer demand is met. The amount of energy that is not supplied to meet consumer demand in any given year is referred to as 'unserved energy'. The Reliability Standard permits an average annual level of unserved energy over the long-term that is no more than 0.002% of annual regional energy consumption." (Part 1 p3)*

The NSW Government developed an Energy Reform Strategy[3]. On 2 July 2009, Minister Tripodi (Minister for Finance and Minister for Infrastructure) announced the lodgement of planning applications for new baseload power stations, including the rehabilitation of Munmorah Power Station Units 3 and 4. Minister Tripodi's announcement also reflected the timing issue:

> *With the prospect of carbon pollution pricing, gas will become an increasingly attractive fuel source for future base-load generation. The Rees Government is preparing for the next generation of baseload power stations using more environmentally friendly gas-fired technology.*
>
> *As we transition towards a low carbon economy, the Government is creating a platform to secure our energy needs and look after the environment.*
>
> *Whichever fuel source is ultimately used by the developer these new stations will use the cleanest, greenest commercially-available and viable technology which will lead to a reduction in the intensity of greenhouse gas emissions.*

Munmorah rehabilitation in context

The rehabilitation works would improve the generating capability of the two operational units at the site, while reducing the overall carbon emissions per unit of electricity generated, making it more suitable for baseload generation and more

[1] http://www.nsw.gov.au/stateplan/
[2] From 1 July 2009, National Electricity Market Management Company (NEMMCO) ceased to exist and the Australian Energy Market Operator (AEMO) is now responsible for operating the NEM as well as the retail and wholesale gas markets of south eastern Australia.
[3] http://www.nsw.gov.au/energy/

attractive to the private sector. The rehabilitated units, with the appropriate burners installed, would be able to generate on coal or natural gas fuel, consistent with the Government's fuel neutral policy.

Technical investigations have shown that gas firing of the Munmorah boilers is achievable. Adaption of the plant to permit substitution of gas could be undertaken at any time during the life of the rehabilitated station. Ultimately this would be determined by the owner of the facility based on strategic, commercial, legislative and technical considerations. Fuel supply issues are discussed further in Section 3.4.

Munmorah Power Station is a valuable power generation site for NSW due to its established use as an electricity generation site, its established buffer zone with the surrounding community and existing fuel delivery, transmission and other infrastructure connections. The cooling water system makes use of the salt water in Tuggerah Lakes. The use of a 'once through' salt water cooling system results in greater generation efficiencies when compared with other wet and dry cooling systems as well as providing generation security during times of severe droughts when inland power stations water supplies are threatened. The rehabilitation works would increase the generation efficiency of the plant and therefore reduce greenhouse gas emissions per unit of electricity generated.

2.2.2 NSW electricity demand

The *NSW State Infrastructure Strategy* (Department of Treasury, 2008), states that the NSW population is projected to grow from about 7 million in 2008 to 7.6 million in 2018. Sydney (including the Central Coast) is expected to account for 70% of this growth. The population growth experienced from 2007 to 2008 was 1.1%, higher that the average increase of 0.9% per annum, measured over the previous five years. The Central Coast is estimated to grow by around 12% between 2008 and 2018, the largest of the State Infrastructure Strategy regions.

The Infrastructure Strategy also notes *"The growing spread of the population is fuelling greater infrastructure demand in coastal and new urban areas, in particular for expanded transport, health, education and police services."*[4]

It references infrastructure required to support development (ie infrastructure to support large scale demand based industry).

Munmorah rehabilitation in context

One of the main aims of the rehabilitation works is to restore the output of Units 3 and 4 to 350 MW. All four operational units were down rated to 300 MW in 1984. The resulting 700 MW baseload generation would provide around 4,800 GWh of electricity per annum.

2.2.3 Generation technologies

NSW accounts for the largest share of electricity generation capacity and consumption in the National Electricity Market (NEM) (Table 2.3) with the growth in maximum electricity demand across both NSW and the NEM expected to increase at about 3.0% per annum annually over the next 10 years.

Coal (black and brown) makes up 81.2% of the fuel sources used to provide electricity generation capacity to the NEM. Lower emission generation sources including gas and hydro contribute 12.2% and 6.1% respectively. The remaining 0.6% is made up of other sources including renewables and oil (AEMO, July 2009).

Table 2.3 – NEM capacity and total generation output by jurisdiction (excluding Tasmania)

State	Total NEM Capacity	Total NEM Output
NSW	**31%**	**35%**
Victoria	23%	27%
Queensland	28%	30%
South Australia	9%	6%
Snowy Mountains	9%	2%
	39,284 MW	**199,278 GWh**

Source: New South Wales Energy Reform Strategy: Defining an Industry Framework, New South Wales Government, 2009

With the introduction of the Federal Government's MRET and the NSW Government's GGAS, the lower emission generation sources (renewables and gas) are increasing their market share. While they are expected to continue to increase their share of total generation capacity, following the introduction of the national CPRS, coal-fired generators are expected to continue to play a

[4] http://www.treasury.nsw.gov.au/sis/state_infrastructure_strategy

crucial role in both the NEM and in NSW for the foreseeable future.

Priority E2(b) of the NSW State Plan addresses Renewable Energy consumption and the role the government would like it to play in the State's future. However the Government recognises that "*a long term strategy and development of a robust industry will be essential if renewable energy is to have a significant future role in reducing greenhouse gas emissions*".

The plan seeks to achieve a target consistent with the proposed Commonwealth expanded RET of 20% renewable energy supply by 2020. It should be noted that this priority is closely linked to Priority E3: Cleaner air and progress on greenhouse gas reductions.

With the base load power deficiency predicted to occur within the next decade, the timeframe for providing additional needs is a key issue. The Owen Inquiry findings were based on 2007 energy consumption forecasts.

- electricity consumption has grown at a rate of about 1,700 GWh per year for the past 30 years
- a slightly lower growth rate of 1,600 GWh is forecast over the next 10 years
- forecast growth in electricity indicated that around 91,000 GWh of electrical energy will be required in 2013/14. This is about 10,500 GWh above current annual production (equivalent to the yearly output of the Mt Piper power station)
- renewable energy and small-scale generation schemes, including wind, solar and wave, are forecast to provide about 1,500 GWh of the 10,500 GWh needed. The remainder will need to be met by gas or coal-fired generation
- part of this gap will be met by energy efficiency measures, new energy generation and increased output from existing generators
- new base load generation needs to be operational by 2013-14 to avoid potential energy shortfalls
- the lead time to develop new base load generation is around 6 to 7 years
- while NSW currently imports about 10% of its energy needs, future imports of electricity may be constrained by growth in the other States
- the growth in demand could be impacted by the introduction of a carbon emissions trading scheme.

TransGrid's 2009 forecast now expect new renewable energy generation sources in NSW to provide around 5,200 GWh per annum by 2015/16.

Despite the timeframe and technology requirements, these still require to be viewed within the context of the NSW State Plan and broader environmental policies. Priority E3 of the NSW State Plan is Cleaner air and progress on greenhouse gas reductions. The target for Priority E3(a) is to *"Meet national air quality goals as identified in the National Environment Protection Measure for Ambient Air Quality."* The target for Priority E3(b) is *"A return to year 2000 greenhouse gas emission levels by 2025 and a 60 per cent cut in greenhouse emissions by 2050."*

Munmorah rehabilitation in context

The aim of the rehabilitation works is to replace outmoded and worn components with the currently available technology (Best Achievable Practice) which would improve the overall efficiency of the plant and reduce greenhouse gas emissions per unit of electricity generated. In addition, the plant would be suitable for fitting future carbon capture technologies when they are commercially available and practical.

2.2.4 Site suitability and infrastructure availability

Munmorah Power Station is located on the NSW Central Coast within the Wyong Shire Local Government Area (LGA) on land owned by Delta Electricity. The power station site comprises nearly 940 hectares of which approximately 200 hectares are operational land comprising the power station site and associated infrastructure. Large tracts of bushland within the Delta land holding provide a buffer between the power station and the surrounding residential and industrial areas. Two decommissioned collieries are located adjacent to the site.

The use of the site for power generation is permitted in the Wyong LEP (zoned 5a Special Uses Power Station) and this status is reflected in the Central Coast Regional Strategy (NSW Department of Planning, 2008) and the State Infrastructure Strategy for the Central Coast (Department of Planning, 2008).

As Munmorah is an existing operational power station the existing infrastructure can be utilised when the station is rehabilitated. The potential impact of their development is reduced or negated. Existing infrastructure advantages include:

- no additional work on transmission lines would be required. Two of the three available 330 kV transmission lines connect to Sydney and the other connects to nearby Vales Point Power Station as part of the State's transmission network
- an upgrade of the existing Munmorah – Vales Point Conveyor for fuel transport would replace the existing conveyor within the existing corridor and easement
- an approved 'once-through' salt water cooling water system from Tuggerah Lakes and associated lower fresh water consumption requirements
- waste disposal (ash) infrastructure is operational and licensed.

The availability of the existing infrastructure reduces the impacts when compared with new generation developments. The rehabilitation of Munmorah units 3 and 4 should be considered a priority coal plant rehabilitation in NSW.

2.3 Consideration of Feasible Alternatives

A number of different base load generation options could be considered to achieve the projected shortfall in 2014. The proposed rehabilitation of Munmorah Power Station Units 3 and 4 has a number of advantages over the alternatives based on economic factors, infrastructure, environmental and engineering considerations. Practicable base load generation options are described briefly below.

2.3.1 New coal-fired power station

Coal fired generation is a mature, but still evolving technology, widely used to provide base-load generation capacity. It provides much of the world's baseload power and provides 85% of Australia total energy supply (Owen, 2007)

The most modern coal fired power plants in NSW, commissioned in the early 1990's, operate at a steam temperature of 540°C and pressure of 16.8 MPa. These stations are referred to as subcritical as the pressure is lower than that of the critical point of water (22.1 MPa). Due to concerns with greenhouse gases, numerous countries embarked on programs to increase the thermal efficiency of coal fired conventional steam cycles and significant advances have been made, and supercritical and now ultra supercritical steam cycles (26 MPa and 580-600°C) have been adopted in Japan and Denmark, and efficiencies of 41% (for wet cooled plant) and 39% (for dry cooled plant) are expected to be achievable. Both supercritical and ultra-supercritical coal fired power stations are suitable for base load generation in NSW (Connell Wagner, 2007).

The Owen Inquiry stated that based on power station developments in Australia, it can typically take up to six years to reach the stage of letting a contract for a new power station with a further four years to construct the power station (inclusive of pre-commissioning works). This indicates that if the decision to build a new fired power station was taken 2009, the likelihood is that the plant would only be available in 2019, five years after the base load plant is required. Depending on the planning process, the rehabilitated Munmorah Power Station could be fully operational in 2015, when the shortfall is likely to occur.

The Owen Inquiry reviewed various technologies suitable for base load generation. Part of the review included indicative cost estimates for each of the technologies. The Stage two upgrade studies of Units 3 and 4 carried out by Worley Parsons for Delta Electricity included a net present value analysis (NVA) to determine if the proposed Munmorah rehabilitation was commercially viable. The NVA analysis was based on "after tax" using Delta's methodology and required return (discount rate) and assumed inflation.

Table 2.4 provides a comparison of technical and cost characteristics for Munmorah Power Station rehabilitation and new ultra super critical coal fired plant based on the information from the Owen Inquiry and Worley Parsons, 2007. This cost comparison is indicative only, but demonstrates that the rehabilitation of Munmorah Power Station would be approximately a third of the cost (in $m/MW) of building a new ultra supercritical power station.

Table 2.4 – Comparison of technical and cost characteristics for Munmorah Power Station rehabilitation and new ultra super critical coal fired plant

Technology	USC [1]	Munmorah Rehabilitation
Maturity	mature	mature technologies
CO_2e intensity (kg/MWh)	785-820	868 (sent out) [2]
Capital Cost ($m/MW)	1.4-2.0 1.5(3)	0.8 [3]
Total Cost ($/MWh)	~53	
Capacity factor	~90	~80
Reliability	High	High

Note: [1] From Owen, 2007
[2] From Aurecon, 2009 – see Chapter 6
[3] From SKM, 2009

Water requirements can be an issue for coal fired plant and the design and location of a new power station would need to be fully investigated. Higher efficiencies are obtained if wet cooling is used, but where water is scarce, a dry cooling system can be installed. Coastal sites are therefore valuable as they enable wet cooling, making Munmorah Power Station an attractive site for investors.

2.3.2 Gas turbine power station

Gas turbine engines are commonly used for electrical power generation. The two most common configurations are open cycle and combined cycle

Open cycle gas turbine power stations generally represent the best practice technology option for peak load operations while Combined Cycle Gas Turbine (CCGT) power stations are better suited for intermediate and base-load generation (Parsons Brinkerhoff, 2005). Gas turbines can be fuelled by many liquid and gaseous fuels, although the common fuels are distillate and natural gas.

CCGTs make use of waste heat from the gas turbine exhaust to produce steam. The steam is then used to drive a steam turbine coupled to an electrical generator. CCGT are capable of running efficiently at high capacity factors and are significantly cheaper to build than coal fired technology, however the fuels costs are much higher. This is the main restriction to the attractiveness of CCGT as base load stations (Owen, 2007).

2.3.3 Integrated gasification combined cycle

Integrated gasification combined cycle (IGCC) is an advanced power generation technology that has been developed to achieve higher thermal efficiencies and lower environmental emissions than coal based thermal generation. The technology is suitable for a variety of fuels including coal, petroleum, biomass and municipal waste. IGCC is well suited for base load generation however due to high construction costs and lower system technology maturity, this option is not feasible in the short to medium term.

2.3.4 Nuclear

Nuclear power is an internationally proven technology that is competitive with fossil fuel base load generation in many parts of the world and contributes 15% of global electricity generation.

Although nuclear power is considered suitable for base load electricity, it is not currently an option in NSW due to the NSW Government’s policy position. In addition, establishing a nuclear energy regulatory framework and planning, building and commissioning a nuclear power plant in Australia is expected to take at least 10 to 20 years (Owen, 2007).

Section 10 of the *Australian Radiation Protection and Nuclear Safety Act 1998*, prohibits certain nuclear installations, including nuclear power plant; while Part 5 of the act expressly prohibits the *“Construction, operation etc. of nuclear installations or prescribed radiation facilities*” (OECD, 2008).

The Department of the Environment, Water, Heritage and the Arts (DEWHA) are responsible for the administration of the *Environmental Protection and Biodiversity Conservation Act 1999.* This Act covers actions that are likely to have significant impact on matters of National Environmental Significance (NES) and are subject to rigorous assessment and approvals. Nuclear actions are one of seven listed NES matters.

2.3.5 Hydroelectric generation

The current operational hydroelectric capacity for NSW is 4,272 MW (DEWHA, April 2009) comprising some 38 'power stations', including the Snowy Mountains Scheme[5], consisting of seven power stations (31 turbines) with a total generating capacity of 3,756 MW (www.snowyhydro.com). The remaining installed capacity of 512 MW is from around 30 hydro projects ranging in size from mini hydro to large projects of 240 MW (Connell Wagner, 2007).

The Owen Inquiry stated that even though hydro generation is a significant contributor to meeting NSW peak demand and some intermediate energy needs, the potential for hydro to provide future baseload energy is very limited. At the time of writing the Owen Inquiry, only around 50 MW of additional capacity and 275 GWh of additional hydro energy was thought to be available to NSW. Pumped storage hydro can meet peaking demand but is carbon intensive as it requires baseload generation to supply the pumps, not all of which is recovered.

Owen also noted that in the first half of 2007 a drought, in addition to maintenance outages, resulted in increased wholesale electricity prices and energy restrictions in the NEM. This drought resulted in the Snowy Hydro Scheme using its more expensive gas-fired plants in Victoria, while south east Queensland generation reductions at hydroelectric generation were experience following a water shortage.

Due to all the aforementioned reasons, hydroelectric generation is not considered a viable option to meet NSW's short to medium term peak energy demand requirements.

2.3.6 Wind generation

Wind power is a mature renewable technology with over 74 GW installed and operating worldwide. Australia currently has approximately 1,500 MW and by the end of 2009 NSW will have approximately 187 MW of operational wind farm capacity with more projects in the pipeline (DEWHA, April 2009).

While wind energy provides an effective renewable energy supply with zero emissions, the ability of wind generation to provide reliable load generation is primarily constrained by the variability of wind resource to produce consistent and stable output. In addition, wind farm developments in NSW has been limited by a poorer than average wind resources (Connell Wagner, 2007)

The absence of viable technologies to store excess generation capacity produced by the wind turbines also makes this type of technology unsuitable for meeting the rapid increase in supply needed during peak demand periods.

2.3.7 Economics for alternatives considered

Table 2.5 Table 2.5and Figure 2.1 show a comparison of technical aspects, capital and fuel costs for the Munmorah Power Station rehabilitation (MMR) against other potential base load technologies and alternative future renewable technologies

[5] www.snowyhydro.com

Table 2.5 – Comparison of technical characteristics and costs for various technologies (Owen, 2007)

Technology	Maturity	Expected Operational Capacity Factor	Cons Cost ($m/MW)	Fuel Cost $/MWh (so)	CO_2 intensity kg/MWh (so)
MMR	mature technologies	~80	0.8 [(1)]	8 – 14 [(2)]	868 (sent out)[(3]
USC	Mature	~90	1.4 – 2.0	8 – 14	785 – 820
USC with CCS[(4)]	CCS available 2020		3.0 – 3.5	11 – 20	~100
CCGT	Mature	70 – 90	0.8 – 0.94	>28	345
CCGT with CCS[(3)]	CCS available 2020		1.3 – 1.7	>33	~50
IGCC	Available 2015	~85 (future)	2.1 – 2.6	9 – 14	~785 – 840
IGCC with CCS[(3)]	CCS available 2020		3.1 – 3.5	9 – 16	~100
Nuclear	Mature	90	2.8 – 3.0	5	~3
Hydro	Mature	Depends on water availability	Site specific	0	4 - 10
Wind	Mature	~30	1.8 – 2.5	0	7
Solid Biomass	Mature	Varies (seasonal)	~2.5	0* – 30	0 (Possibly -ve)
Solar thermal	Available (early stages)	25 (without storage)	~3	0	0
Geothermal hot rock	Research	Potentially high	high	0	~2

Note: (1) From SKM, 2009
(2) Assuming same as USC plant
(3) From Aurecon, 2009 – see Chapter 6
(4) CCS – Carbon capture and storage

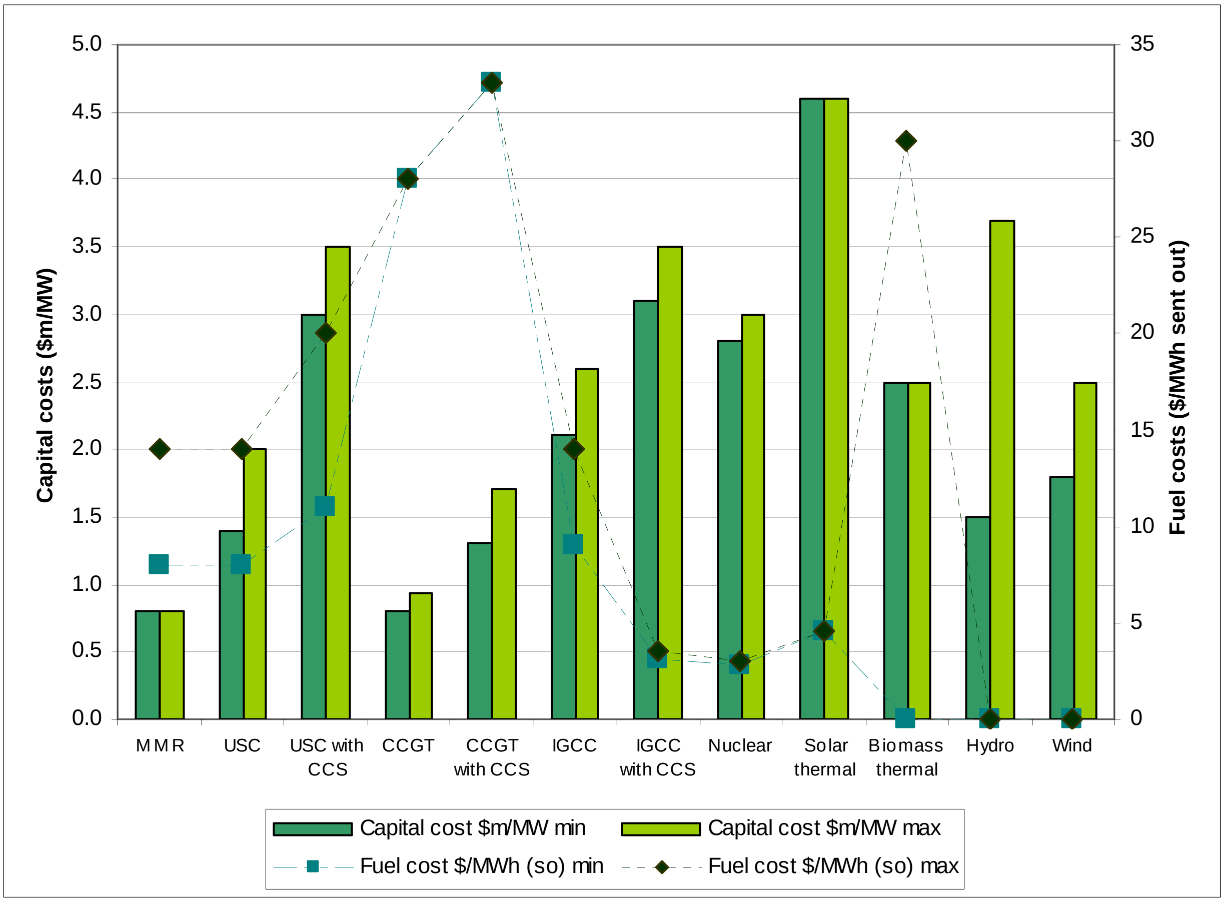

Figure 2.1 – Comparison of capital and fuel cost for various technologies considered (From Table 2.3)

2.4 Conclusion

The key objectives outlined above are summarised below in relation to the requirements of the Director-Generals Requirements.

Table 2.6 – Summary objectives and commentary

Proposal Objective	Commentary/Justification
Proposal need	
Develop a project that will help to meet base load power generation demand	The proposed power station would meet the base load power generation demand by providing up to around 4,800 GWh.
Develop a project that can be constructed and operational within the timeframe required	The rehabilitation of Munmorah is expected to take approximately 24 months to complete, so could be available by 2015/16, which coincides with the timeframe of anticipated need.
Develop a project that will be of sufficient scale to allow for best thermal efficiency and best efficiency in capital cost	The Proposal aims to replace outmoded and worn components with the currently best achievable technology at that site. The Proposal represents the best achievable thermal efficiency for the site.
Site Suitability and Infrastructure Availability	
Retain access to fuel sources (both coal and gas)	Both coal and gas are resources that are either located nearby or have transport options nearby.

Proposal Objective	Commentary/Justification
Minimise potential impacts on residents and sensitive environments	Although the site is within 1 to 1.5 km of the closest resident, Munmorah is a well established and accepted industry.
Maximise use of existing infrastructure to reduce potential constraints and impacts from the project	Munmorah Power Station is a currently operational plant therefore all currently available infrastructure (fuel transport, water, transmission) would be utilised and remain essentially unchanged.
Strategic Directions	
Support the NSW government in providing increased electricity supply and reliability	This Proposal supports the NSW government's need for an increase in base load power generation to be available within a specific timeframe. It supports the NSW State Plan and supports the future direction of the State, NSW's projected population growth and future industrial development for economic growth.
Support local and regional planning to ensure land use compatibility to ensure no other party or development is prohibited from future use	Munmorah Power Station is an existing approved facility. This site is set aside for power generation purposes in the Wyong LEP and recognised as a power generation site in the Central Coast Regional Strategy and the State Infrastructure Strategy.
Develop the project using the Best Achievable Technology to reduce greenhouse gas emissions	This Proposal aims to improve the efficiency of the current plant to achieve the best thermal efficiency for the site. This would result in a decrease in greenhouse gas emissions per unit of electricity generated.
Provide additional base load power in the context of ongoing government initiatives with respect to population growth and future development needs.	This Proposal would not negate any need for renewable energy sources or for government regulation and policy directives. This Proposal would be undertaken within the context of these issues.
Designing the project so as to be carbon capture ready in order to support government objectives for the State	This Proposal is being designed to be carbon capture ready in order that, in the absence of a CPRS and in the presence of implementable and economically viable technology, emissions that cannot be reduced at source may, in the future, be captured and stored.

The rehabilitation of Munmorah Power Station would provide additional generation capacity at the lowest cost to minimise the risk of high value stranded assets in the event of more significant greenhouse gas reductions are eventually implemented. In the event that the proposed rehabilitation works are not undertaken the Munmorah Power Station would be placed on stand-by duty to be called in for service only if an electricity shortfall was to occur, such has been the case during the last drought period (1999- 2008). This Proposal provides the best opportunity for an interim measure to provide baseload electricity to the NEM.