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Munmorah Power Station
Rehabilitation

Environmental Assessment

VOLUME 1: Main Volume

Delta electricity

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Document prepared by:

Aurecon Australia Pty Ltd
ABN 54 005 139 873
116 Military Road
Neutral Bay
New South Wales 2089 Australia

T: +61 2 9465 5599
F: +61 2 9465 5598
E: sydney@ap.aurecongroup.com
W: aurecongroup.com

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Environmental Assessment Certification

Environmental Assessment Certification

This Environmental Assessment supports the submission of a Major Projects Application under Part 3A of the Environmental Planning and Assessment Act 1979, for:

Rehabilitation of Munmorah Power Station Units 3 and 4

Munmorah Power Station is located on land as shown on Figure 1.2 of the Environmental Assessment.

Project Proponent: Environmental Assessment prepared for proponent based on proponent's project description, record of consultation and proposed measures to mitigate its impacts	Mr Rodney Ward, General Manager Development Delta Electricity Level 20/175, Liverpool Street SYDNEY NSW 2000
Environmental Assessment prepared by: Organisation: Business Address:	Graham Mackay, Environmental Consultant *(Bachelor of Natural Resources, University of New England and Diploma of Environmental Studies, Macquarie University)* Aurecon Australia Pty Ltd 116 Military Road Neutral Bay NSW 2089
Certification of Environmental Assessment	I Graham Mackay, _____ Date: 14 October 2009 *Signature* certify that I have prepared this Environmental Assessment. To the best of my knowledge the Environmental Assessment: • addresses the requirements of the Director-General of NSW Department of Planning for the Environmental Assessment. • provides a thorough assessment of the potential impacts of the proposed Rehabilitation of Munmorah Power Station, and • does not seek to materially mislead

Executive Summary

Executive Summary

Introduction and Background

Delta Electricity is seeking planning approval to rehabilitate Munmorah Power Station to restore the efficiency to two of the original four units at the power station and extend its operational life for the purposes of providing baseload power generation in NSW. The efficiency improvements that would result from the rehabilitation will mean the combined output of the two units (Units 3 and 4) will increase by around 100 MW for the same fuel consumption.

An Environmental Assessment has been prepared to support an application to the Department of Planning for project approval and to satisfy the requirements of Part 3A of the *Environmental Planning and Assessment Act 1979*. This Environmental Assessment describes the Proposal and its benefits and examines the potential impacts of the Proposal. The environmental management measures and safeguards proposed to be implemented to mitigate or reduce potential environmental impacts are also outlined.

This summary provides a brief description of the key issues and findings of the assessment.

The Proponent

Delta Electricity is a NSW State Owned Corporation that produces around 12% of the electricity distributed by the National Electricity Market (NEM). The NEM operates in all states and territories except Western Australia and the Northern Territory.

Most of Delta Electricity's generation occurs at four coal fired power stations located in NSW. These are Mt Piper and Wallerawang power stations near Lithgow, and Vales Point and Munmorah power stations which are located on the NSW Central Coast. These stations have a combined generating capacity of 4,240 MW.

Delta, in a joint venture with NSW Sugar Milling Co-operative also manages Australia's largest renewable baseload energy project, two 30 MW co-generation facilities using waste from Condong and Broadwater sugar mills. Small amounts of renewable energy are also produced from mini-hydro facilities located at Mt Piper near Lithgow, Chichester Dam in the upper Hunter Valley and Dungog water treatment plant.

A 667 MW gas turbine power station, developed to provide power at times of peak demand, is nearing completion at Colongra, adjacent to Munmorah Power Station and development approval has also been obtained for another gas turbine power station at Bamarang near Nowra. A development application for a third gas turbine power station, proposed to be built at Marulan, near Goulbourn is also currently under consideration.

Delta Electricity operates under the *Energy Services Corporations Act 1995* and the *State Owned Corporations Act 1989.*

Proposal Objectives

Delta Electricity is proposing to rehabilitate two of the four original units at Munmorah Power Station (Units 3 and 4) by replacing worn and obsolete components with currently available technology. The purpose of the rehabilitation is to:

- maintain base load generating capacity using the existing infrastructure to meet short to medium term (up to 20 years) energy requirements of NSW and the NEM
- restore the output of Units 3 and 4 to 350 MW
- replace outmoded and worn components with the currently available technology
- reduce the greenhouse gas emissions (GGE) per unit of electricity generated
- include modifications or provisions required to enable Munmorah to be carbon capture ready
- identify, minimise and manage environmental and social impacts that might arise as a result of the rehabilitation.

Recognising the environmental benefits of gas as a fuel source, it is also proposed that the rehabilitation would make provision to enable gas, either in combination with coal or as a replacement, to be used as a fuel source. This flexibility of fuel source would provide for potential changes in the availability of gas and the market responses regarding the use of coal.

Strategic Justification

NSW accounts for the largest share of electricity generation capacity and consumption in the NEM. Maximum electricity demand across both NSW and the NEM is expected to increase at a rate of about 3.0% per annum annually over the next 10 years.

Coal provides around 81.2% of the fuel used to provide electricity generation capacity to the NEM, with gas and hydro contributing 12.2% and 6.1% respectively. The remaining 0.6% is made up of other sources including renewable energy projects and oil

(AEMO[1], July 2009). While the share of total generation capacity contributed by renewable energy sources and gas are expected to continue to increase, coal-fired generation is expected to continue to play a crucial role in the provision of energy to both the NEM and in NSW for the foreseeable future.

In 2007, the NSW Government established an inquiry into electricity supply in NSW. The Owen Inquiry found that the State's energy consumption had grown consistently over the last 30 years and is expected to continue to grow. As no base load generation plant has been constructed in NSW since 1996, the energy consumed in NSW is catching up with supply and as such new base load generation would need to be operational by 2013/14 to avoid potential energy shortfalls. 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 while the recently released 2009 AEMO Statement of Opportunities has predicted that the low reserve capacity will occur in 2015/16.

Since the Owen Inquiry, the NSW Government developed an Energy Reform Strategy. The 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 in July 2009,. Like Owens report, the Ministers announcement also reflected the timing issue.

The rehabilitation works would improve the generating capability of the two remaining 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 attractive to the private sector.

The rehabilitated units, with the appropriate burners installed, would be able to generate on coal or a combination of up to 75% natural gas, consistent with the Government's fuel neutral policy. The rehabilitation works could also be completed within 24 months, well within the 2015/16 time frame. Restoring the output of Units 3 and 4 to 350 MW would provide around 4,800 GWh of electricity per annum.

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.

Alternatives Considered

The number of options that can be considered to provide for the projected electricity shortfall in 2015/16 is limited. They include demand side management, rehabilitation and upgrading of existing power stations, the construction of new ultra supercritical coal fired power stations, new wind farms, new hydroelectric power developments, nuclear power stations and gas fired power stations.

Wind power is constrained by the availability of reliable wind resources in NSW, while hydroelectric power generation contributions have been influenced by a move away from the development of additional large scale hydro electricity schemes and associated large water storages, and the limitations during drought conditions which have been experienced in recent times.

Nuclear power is not currently an option in NSW due to Government policy. While Combined Cycle Gas Turbine (CCGT) power stations are capable of running efficiently at high capacity factors and are significantly cheaper to build than new coal fired technology power stations, fuel costs (assuming sufficient quantities of gas is available) are much higher making them less attractive as base load stations (Owen, 2007)

Munmorah Power Station has a number of features that make it an attractive option to meet the projected supply shortfall. It is already an operational power station with local infrastructure (electricity transmission and fuel supply) and workforce already in place. No additional transmission lines would be required. In addition, Munmorah Power Station makes use of salt water from Tuggerah Lakes for cooling, which minimises the consumption of scarce water resources compared with other options for thermal power stations, effectively making the coastal water cooled power stations drought resistant. The cost of rehabilitation would be a third of the cost of new plant

[1] From 1 July 2009 NEMMCO ceased operations. NEMMCO's roles and responsibilities have transitioned to the Australian Energy Market Operator (AEMO)

Proposal Description

Upgrade options for Units 3 and 4 at Munmorah Power Station were investigated by Worley Parsons in 2007. The study concluded that returning the units back to the original design rating of 350 MW output with up to 20 years at high reliability was feasible and this option, the subject of this Proposal, was subsequently adopted by Delta Electricity.

The proposed rehabilitation does not involve any significant changes to the current layout of the site and the majority of the works would occur within the existing turbine hall of the power station.

Overview of works

- upgrade Units 3 and 4 steam turbine components
- refurbish major boiler components
- provide for coal and gas firing options
- replace, upgrade, modify and/or maintain auxiliary equipment including:
  - condenser, circulating water system, air heater upgrade, economiser upgrade, furnace upgrade,
  - Replace instrumentation and control system
- carbon capture ready
- fuel delivery - MV conveyor coal deliveries from Vales Point PS to Munmorah PS capacity increase
- removal of obsolete plant

Planning Context and Approvals

Federal statutory control

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires the approval of the Commonwealth Minister for the Environment, Water, Heritage and the Arts for actions that may have a significant impact on matters of National Environmental Significance (NES). Approval from the Commonwealth is in addition to any approvals under NSW legislation. The Proposal has been assessed as not having a significant impact on matter of NES and referral under the EPBC Act is not required.

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) passed in September 2007, introduced a single national reporting framework for the reporting and dissemination of information about the greenhouse gas emissions, greenhouse gas projects, and energy use and production of corporations. Businesses emitting large amounts of greenhouse gases are required to monitor and measure emissions from 1 July 2008 as part of the new National Greenhouse and Energy Reporting System. Various other schemes and regulations are applicable to greenhouse gas emissions. These include the Carbon Pollution Reduction Scheme (CPRS), Greenhouse Gas Reduction Scheme (GGAS) and Greenhouse Gas Challenge Program. Delta Electricity participates in the Greenhouse Challenge program.

NSW Legislation and development control

Delta Electricity is seeking Project Approval for the proposal under Part 3A of the EP&A Act, Section 75J in accordance with the provisions of Section 75B(2) of the Act which makes provision for 'major projects' to be identified through various means. This includes the *State Environmental Planning Policy (Major Projects) 2005* (SEPP 2005) planning instrument.

Schedule 1 of SEPP 2005 identifies classes of development which constitute major projects. Section 24 of Schedule 1 includes works for the purpose of an electricity generation facility with a capital investment of more than $30 million. As the Proposal involves works for the purpose of electricity generation and the cost of the rehabilitation works would be over $100 million, the Proposal is classified as a 'major project'. The Minister for Planning has confirmed the approval process for the application.

The Proposal was also declared a 'critical infrastructure' project by virtue of the Minister of Planning's declaration of 26 February 2008, with respect to generating facilities with the capacity to generate at least 250 MW and for which the application is made prior to 1 January 2013.

Other planning instruments that have been considered include Regional Environmental Plans (REPs), Local Environmental Plans (LEPs). The proposal is located wholly within the area to which the Wyong LEP 1991 and the *Draft Sydney Regional Environmental Plan – Wyong Development Areas and Coal Mining 1987* apply. As no SEPP specifically relates to this Proposal, the provisions of Wyong LEP 1991 and *Draft Sydney Regional Environmental Plan – Wyong Development Areas and Coal Mining 1987* would not apply to the development.

Munmorah Power Station is located on land classified as 'Zone 5(a) Special Uses (Power station)', for which the proposed rehabilitation works are permitted with development consent. The Munmorah-Vales Point conveyor, which is installed on a constructed bench, also traverses land which is classified as 'Zone 6(a)

Open Space and Recreation' and 'Zone 7(g) Wetland Management' of which would be permissible with development consent.

Greenhouse Issues

The future greenhouse gas emissions from the proposed Munmorah rehabilitation have been predicted using the emission factors provided in *NGER (Measurement) Technical Guidelines 2009* produced by the Commonwealth Government's Department of Climate Change. The study included point source emissions (Scope 1), emissions from purchased electricity consumed on site (Scope 2), and Scope 3 emissions relating to the extraction and transportation of fuels.

The predicted future greenhouse gas emissions from the proposed Munmorah rehabilitation for the coal/gas firing scenarios were compared with calculated emissions using operational data from 13 December 2006 (100% coal) and with as built conditions. Estimated reductions of 120 kg CO_2e/MWh_{SO} for the 100% coal firing scenario and up to 379 kg CO_2e/MWh_{SO} when co-firing with 75% gas could result. The predicted emissions for each of the coal/gas firing options are also expected to be less than 2009 NSW pool coefficient.

Mitigation of greenhouse gas emissions particularly CO_2, has been considered. Numerous technologies for carbon capture are currently available and feasible under specific conditions; however there are a number of critical factors that would impact the suitability of CO_2 capture technology to be used with base load power generation. Delta Electricity is currently working with the CSIRO to construct a research scale post combustion capture pilot plant at Munmorah Power Station, to provide proof of the post combustion capture concept for Australian conditions. The demonstration project is part of a broader scope of works, by the NSW Department of Primary Industries which include investigation and characterisation of geological traps suitable for long term storage of CO_2.

The technical investigations also evaluated the requirements necessary to make the rehabilitated Munmorah Units 3 and 4 "Carbon Capture Ready" and may be considered during the rehabilitation works.

Air Quality

Munmorah Power Station currently demonstrates compliance with Group 2 emission standards. The Department of Environment, Climate Change and Water (DECCW) Regulation requires older plant operating in NSW to comply with Group 6 emission standards by 2012 as stipulated in the *Protection Of the Environment Operations (Clean Air) Act 1997* (POEO Act). Previous studies have found that emissions of all pollutants (with the exception of NO_x) are compliant with Group 6 emission standards.

Low NO_x burners are being proposed as part of the rehabilitation works. Comprehensive modelling of the emissions from the rehabilitated power station, with the installation of low NO_x burners, suggest that the Group 6 NO_x limits would be achieved under most operating conditions. The possible exceptions may be the plant operating at lower plant loads during start-up and shut-down and when the station is in stand-by mode. Predicted SO_2 emissions from the rehabilitated plant for firing with 100% coal and coal/gas combinations are predicted to be well within international guidelines (World Bank, 2005).

A review of the regional air quality measured at a number of sites in the Munmorah locality has confirmed that concentrations are within relevant air quality standards.

A conservative assessment of the emissions from regional power stations undertaken by the CSIRO, using the currently permitted maximum sulphur content for coal supplies, has indicated that Munmorah makes a minor contribution to elevated SO_2 concentrations in the region. The Proposal has recommended a reduction in the maximum monthly average sulphur content of coal burnt in the boilers from 1% to 0.7%.

Emissions of PM_{10}, total suspended particulates, trace elements (including lead and other heavy metals), carbon monoxide, VOCs and subset groups (including PAHs) are already compliant with Group 6 emission standards and world's best practice Best Available Techniques (BAT) limits. There would be a negligible change in the air quality impact with respect to the emissions of these pollutants following plant rehabilitation.

Water Cycle Management

Fresh water for drinking, general power station use and steam plant make-up is currently obtained from the Central Coast Water Supply Authority (operated by Wyong and Gosford Councils). Water consumption varies from year to year depending on power station generation and other operational, local supply and climatic factors.

It has been estimated that the rehabilitated Munmorah would consume around 380 ML of domestic water per annum. This represents about 2% of the total water supply within the Wyong distribution area.

While Munmorah's domestic water usage is dependent on generation levels, Delta Electricity is continuing to review options for further water savings across at their Central Coast Power Stations. A Water Management Plan has been developed for the for the site that includes commitment to monitor water use and identify actions that Delta Electricity can undertake to conserve water and achieve water efficiency. Delta Electricity has already implemented measures that save around 500 million litres of domestic water per year at the two Central Coast Power Stations.

Munmorah Power Station is an integral component of the Tuggerah Lakes system. The water management systems developed for the operation of Munmorah are subject to ongoing monitoring and improvement where necessary and provide adequate safeguards for the protection of water quality in the lakes.

The rehabilitation of Munmorah would not cause the discharge temperatures to exceed the current Environment Protection Licence (EPL) conditions because the attemperation pumps in combination with improved turbine efficiency and reduction in condenser temperature rise can accommodate above average ambient lake temperatures and recirculation into the inlet canal.

Seagrass beds are assumed to be the key habitat indicator for the assessment of effects of the rehabilitation on aquatic ecology in the Tuggerah Lakes due to their importance as habitat in the lakes system. Modelling of the lakes has demonstrated that the size and temperature of the rehabilitated cooling water plumes would not add to the effects of the equivalent 'as built' two unit power station seagrasses in the lakes. The extent of the cooling water plume from the rehabilitated power station has also been predicted to be significantly smaller than the plume generated under current operating conditions.

Investigations of likely impacts on local water quality and the lakes have shown that the effects of the rehabilitated, Munmorah Power Station would be significantly less than the effects of the previously operating four unit power station and consistent with the effects of two units operating when the power station was built.

An examination of the recreational uses of the lakes and predicted changes following rehabilitation has predicted that there would be no additional impact on the recreational use of the lakes.

Waste Management

Achieving a reduction in waste generation, and turning waste into recoverable resources is a priority for NSW. The NSW Government's Waste Reduction and Purchasing Policy (WRAPP) requires all state government agencies and state owned corporations to develop and implement a WRAPP plan to reduce waste in four scheduled areas. Delta fully complies with the NSW Government's WRAPP.

Ash production volumes generated at power stations would be dependant on annual power production requirements, power plant design and performance, coal properties (particularly % ash content) and ash sales. Based on these requirements a number of scenarios were identified as being indicative of future coal characteristic and of future planned ash sales for Munmorah Power Station. While beneficial use of the ash product is preferred and promoted, the majority of ash produced by Munmorah power station is currently stored in ash dams – the furnace ash is currently disposed of at Munmorah ash dam and fly ash is pumped to Vales Point ash dam as a lean-phase slurry.

Munmorah Ash Dam has capacity in excess of the furnace ash storage requirements over the twenty year life of the rehabilitated power station. Estimations of ash generated indicate that Vales Point Ash Dam has the capacity to receive fly ash form Munmorah surplus to the remaining storage requirements for the life Vales Point Power Station for six to seven years.

While it is expected that additional ash storage would be developed within the boundaries of the existing Central Coast Ash Dams, further assessment, approval and development of a preferred long term ash storage option is required. A review of potential ash storage options at a conceptual level concluded that suitable options would be able to be developed.

With the coal/gas co-firing scenarios, increasing the gas component of the co-firing would reduce the quantity of ash generated and therefore the predicted life of the available ash storage would be extended.

Noise and Vibration

Noise emissions from the proposed rehabilitation of the existing Munmorah Power Station have been assessed and compared to the existing noise sources on site. The proposed upgrade works would not introduce additional operational noise and vibration sources and therefore nil additional operational impact is expected. Increases in efficiency and the replacement of worn and damaged items of

equipment is expected to slightly reduce the operational noise emission level of the power station.

Construction requirements and techniques have not been confirmed, however preliminary assessment of noise and vibration impact from construction indicate that a Construction Noise and Vibration Management Plan would need to be developed to assess in detail the impact of construction noise on the local community and ensure noise criteria are met.

Hazard, Risk and Incident Management

The Director-General's requirements stipulate that a screening of potential hazards on site and determination of the potential for offsite impacts be undertaken. A Preliminary Hazard Analysis (PHA) and risk assessment (RA) was prepared in accordance with the Department's relevant documentation and guidelines.

Preliminary risk screening of the proposed development is required under NSW *State Environmental Planning Policy No 33* (SEPP 33). SEPP 33 requires potentially hazardous and/or offensive developments to undertake a PHA to determine the level of risk to people, property and the environment at the proposed location and in the presence of controls.

All risks identified during the risk assessment with high cumulative, consequence and likelihood scores have been qualitatively assessed and have demonstrated effective technical and management controls to ensure the ongoing safety of the proposed development. None of the other hazard scenarios identified had the potential of presenting an unacceptable risk to the surrounding land users.

Quantitative calculations of a possible natural gas leak and subsequent fire, carbon dioxide release and ammonia release showed that it would not impact on the neighbouring land users. The risk assessment has demonstrated that the Proposal can operate with an acceptable risk level provided that the documented procedures and controls are applied.

Risks to aviation have been examined. Consultation with appropriate aviation authorities confirmed that no additional risk to aviation would result from the rehabilitation.

Other Environmental Issues

Traffic and transport issues

Construction traffic may temporarily disrupt and impact on normal traffic flow, however based on the construction traffic estimates, potential impacts on the local traffic conditions are likely to be low.

The transport of large plant components has the potential to restrict traffic flow due to their size and slow speed however the scheduling of these activities during the early periods of the day and the use of appropriate traffic management measures would ensure disruptions to the local road users are minimised.

Transport of the overmass components would require liaison and approval of the NSW Roads and Traffic Authority and Newcastle, Lake Macquarie and Wyong Councils. A Traffic and Transport Management plan was established for the construction of the Colongra Gas Turbine Facility. This plan includes detailed planning and provides an appropriate route and mitigation measures for overmass transport.

Traffic generated by site staff during normal operations would be negligible in comparison with existing traffic flows. There may be the occasional requirement for additional vehicles to access the site during maintenance activities. This aspect of the Proposal would be managed via a specific traffic management plan to be developed for the maintenance task.

Flora and fauna

The Proposal is expected to be located within the existing plant layout and restricted to existing operational areas of the power station and would not impact terrestrial flora or fauna. Safeguards to ensure adjacent areas are adequately protected from disturbance have been proposed.

Heritage

No impacts on Aboriginal heritage are expected as the Proposal involves works within the existing plant area of the power station and the MV conveyor bench. Upgrade. Safeguards to ensure adjacent areas are adequately protected from disturbance have been proposed.

Socio-economic issues

The Proposal would result in little perceivable change from the existing situation for the local community. It would offer extension of employment opportunities for the staff of Munmorah Power Station and some Delta Maintenance staff based at Vales Point Power Station. This is regarded as an important contribution to the local economy and one that if removed could cause some disruption to the local community through

either unemployment or relocation of existing local residents.

It is anticipated that a portion of the workers required for the rehabilitation would be sourced from the Wyong/Lake Macquarie/Newcastle area. However, due to the specialist nature of many trades required for the rehabilitation, many of the skilled workers would be sourced from outside the local area. During construction the potential for adverse impacts would primarily be associated with increases numbers of workers in the area placing increased demands on services within the area.

As any short term increase in the local population would be minor, it is expected that the area is well suited to provide any services required during construction. There is the potential for construction traffic and activities that generate noise and dust during rehabilitation. These impacts would be managed in accordance with mitigation measures presented in the Environmental Assessment and the construction environmental management plan.

Visual

Apart from upgrading of the existing MV conveyor, the rehabilitation works would mainly occur within the existing building. As a result, the potential of the rehabilitation works to impact the visual environment is minimal. The possible future addition of carbon capture facilities would introduce elements on a scale similar to the Colongra Gas Turbine Facility, and hence would be predicted to be unlikely to have a significant impact on the visual landscape of the area, due to the existing surrounding vegetation and the scale of this plant against the existing Munmorah Power Station. The rehabilitation of Munmorah Power Station is unlikely to have a significant impact on the visual landscape of the area.

Proposal Justification

With a risk-averse approach, New South Wales needs to be in a position where new baseload generation can be operational by 2015-17 if necessary, in order to avoid potential energy shortfalls.

The rehabilitation of Munmorah Power Station is part of a portfolio of developments that would provide independent investment opportunities to meet this timetable for baseload and future capacity needs. The projects that proceed first would be dictated by economic, market and policy developments and the location opportunities each project brings to the market.

This Environmental Assessment provides a review of information that provides the basis for justification of the rehabilitation of Munmorah Power Station Units 3 and 4 having regard to environmental, social and economic impacts of the Proposal, the suitability of the site and public interest. The Proposal is also consistent with the objects of the EP&A Act, as set out in Section 5 of the Act.

The Environmental Assessment undertaken for the Proposal has identified the benefits arising from the Munmorah rehabilitation and considered potential environmental impacts arising from project.

Mitigation measures have been incorporated, where appropriate, as commitments for environmental management. These measures would be further developed in the Environmental Management Plan's (EMPs) for the rehabilitation work and ongoing operations at the site. The EMPs provide the procedures by which the impact of the project on the environment would be managed and mitigated.
The Proposal described in this EA is consistent with the principles of ESD defined in the *Protection of the Environment Administration Act 1991* (POEA Act) and the Intergovernmental Agreement on the Environment.

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Acronyms and Glossary

Acronyms and Glossary[2]

Term	Definition
ACW	Auxiliary cooling water
AEMO	Australian Energy Market Operator
AGO	Australian Greenhouse Office
AVOC	Ambient volatile organic compound
Base load generation	Power plants optimised economically and in an engineering sense to a relatively constant, steady and reliable stream of energy
CCGT	Combined Cycle Gas Turbine
CEMP	Construction Environmental Management Plan
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
CPRS	Carbon Pollution Reduction Scheme
CW	Cooling water
DCS	Distributed Control System
DEC	Department of Climate Change (Federal Government)
DECC	Department of Environment and Climate Change (NSW)
DEWHA	Department of Environment, Heritage, Water and the Arts
EMS	Environmental Management System
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPA	Environment Protection Authority
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
EPL	Environmental Protection License
FD	Forced draft (fan)
GGAS	NSW Greenhouse Gas Reduction Scheme
GGE3	Greenhouse Gas Emissions – gases covered by the Kyoto Protocol, including carbon dioxide, nitrous oxide, methane, sulphur hexafluoride, perfluorocarbons (PFCs) and hydrofluorocarbons (CHFCs)
GW	Giga watts – 1 billion watts
GWh	gigawatt hours – one billion watt-hours (or 1000 MWh). The amount of energy produced or consumed over one hour in a system operating at a capacity level of one gigawatt.
HP	High pressure (turbine cylinder)
ICMS	integrated control and monitoring system
IGCC	Integrated gasification combined cycle
INP	NSW Industrial Noise Policy
IP	Intermediate Pressure (turbine cylinder)
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram
kJ/kWh	kilo joules per kilowatt hour - fuel heating value consumed per unit of useful output (usually electrical output)
kPa	Kilo Pascal
kV	kilovolt – one thousand volts
LEP	Local Environmental Plans
LBL	Load based licensing
Leq	Equivalent continuous noise level

[2] For consistency, this Glossary uses the same meanings as the Owen Inquiry, where applicable
[3] Definition from Garnaut Climate Change Review Final Report

Term	Definition
L10	Average maximum noise level – the noise level exceeded for 10% of a sampling period
L90	Background noise level – the noise level exceeded for 90% of a sampling period
LGA	Local Government Area
LP	Low pressure (turbine cylinder)
m^3	Cubic metre
m/s	Metres per second
mg/m^3	Milligrams per cubic metre
MPa	Mega Pascal – 1 x 106 Pascals
MRET	Federal Government – Mandatory Renewable Energy Target
MW	Megawatt – one million watts (or 1000 kW)
MWh	Megawatt hours – one million watt-hours
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company Limited - From 1 July 2009 NEMMCO ceased operations and NEMMCO's roles and responsibilities were transitioned to the Australian Energy Market Operator (AEMO)
NES	National Environmental Significance
NETS	National Emissions Trading Scheme
NGACs	NSW Greenhouse Abatement Certificates
NGER	National Greenhouse and Energy Reporting Act
NO_X	Nitrogen Oxides
NVA	Net present value analysis
OECD	Organisation for Economic Co-operation and Development
Once-through cooling system	Salt water is drawn from Lake Munmorah through an inlet canal, used in the power station and discharged via an outlet canal into Lake Budgewoi.
PCR	Plant Control Room
PA	Primary air (fans)
PEA	Preliminary Environmental Assessment
PF	Pulverised fuel
POEO Act	Protection of the Environment Operations Act 1997
REP	Regional Environmental Plans
SEPP	State Environmental Planning Policy
SO_X	Sulphur Oxides
t	tonne
VOC	Volatile organic compounds
WRAPP	Waste Reduction and Purchasing Policy