Planning and Approvals

4

4. Planning and Approvals

This chapter of the Environmental Assessment describes the relevant statutory planning instruments and their application to the proposed refurbishment.

4.1 Key Planning Considerations

The following key planning considerations were taken into account for the refurbishment of Munmorah Units 3 and 4.

- consideration of the requirements of the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1995* (EPBC Act)
- development consent under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act)
- an Environment Protection Licence (EPL) under the NSW *Protection of the Environment Operations 1997* (POEO Act).

In addition, the requirements of various State Environmental Planning Policies (SEPPs), Regional and Local Environmental Plans and other environmental legislation have been considered as described in Sections 4.2 to 4.6. The approvals required by the project are listed in Section 4.7.

4.2 Federal Statutory Controls

4.2.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Commonwealth Government's central piece of environmental legislation and provides a legal framework to protect and manage nationally and internationally important matters of national environmental significance (NES). Under the EPBC Act, approval of the Commonwealth Minister for the Department of Environment, Water, Heritage and the Arts is required if any action may have a significant impact on NES matters. The EPBC Act also provides for the management of Commonwealth heritage places and establishes the Australian Heritage Council.

4.2.2 Matters of NES

The EPBC Act lists seven matters of NES which must be addressed when assessing the impacts of a proposal. Matters of national environmental significance include heritage areas, national heritage places, wetlands of international importance (Ramsar wetlands), threatened species and ecological communities listed in the EPBC Act, migratory species listed in the EPBC Act, nuclear actions, and actions affecting the Commonwealth marine environment.

As the Proposal falls within the currently existing Munmorah Power Station site and as the following appraisal shows, the proposed rehabilitation works would not have a significant impact on any of the matters and referral to the Department of the Environment, Water, Heritage and the Arts (DEWHA) is not proposed.

Table 4.1 lists the matters of NES and their applicability to the Proposal.

Table 4.1 – Matters NES and applicability to the Munmorah rehabilitation

	Matters of NES	Applicability to the Munmorah rehabilitation project
1	World heritage properties	There are no world heritage properties in the vicinity of the Proposal, or that would potentially be affected by the Proposal.
2	National heritage places	There are no National heritage properties in the vicinity of the Proposal, or that would potentially be affected by the Proposal.
3	Wetlands of international importance	The Proposal is not expected to have an impact on any Ramsar Wetland.
4	Nationally threatened species and ecological communities	The proposal is not expected to have any significant impacts on threatened species and ecological communities. This is addressed in more detail in Section 12.2.
5	Commonwealth-listed migratory species	The Proposal is not expected to have an impact on listed migratory species.
6	Commonwealth marine areas	There are no Commonwealth marine areas proximate to the Proposal, or that would potentially be affected by the Proposal.
7	Nuclear action	The Proposal would not involve a nuclear action as defined under the EPBC Act.

Commonwealth land

In addition, the EPBC Act confers jurisdiction over actions that have a significant environmental impact on Commonwealth land, or that are carried out by a Commonwealth agency (even if that significant impact is not on one of the seven matters of 'national environmental significance').

The Proposal would not be undertaken on Commonwealth land, nor would any Commonwealth land likely be affected by the Proposal. Neither is the Proposal being carried out by a Commonwealth agency.

4.2.3 National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) was passed on 29 September 2007 and 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. The Commonwealth Government's Department of Climate Change (DCC) is the Government Agency tasked with administering the NGER Act.

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. Although measurement of emissions started in July 2008, businesses have until 31 August 2009 to register under the scheme, and have until 31 October 2009 to submit their first annual greenhouse and energy report.

Various other schemes and regulations are applicable to greenhouse gas emissions. These are listed below and are described in more detail in Chapter 6.

- Carbon Pollution Reduction Scheme (CPRS)
- Greenhouse Gas Reduction Scheme (GGAS)
- Greenhouse Gas Challenge Program

4.3 NSW Legislation

All development proposals in NSW must be assessed to ensure they comply with relevant planning controls and, according to nature and scale, that they are environmentally and socially sustainable. The development assessment system in NSW is set out in Parts 3A, 4 and 5 of the EP&A Act, and supported by the *Environmental Planning and Assessment Regulation 2000*.

The NSW Department of Planning is responsible for ensuring that the requirements of the EP&A Act and its Regulation are addressed for developments where the Minister for Planning is the Consent Authority.

State, regional and local plans and policies indicate what level of assessment is required, and who is responsible for assessment. The relevant planning instruments created under the EP&A Act include

SEPPs (State Environmental Planning Policy), REPs (Regional Environmental Policy) and LEPs (Local Environmental Policy).

4.3.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) sets out the processes for obtaining development consent and requirements for:

- the process for lodging Development Applications and review requirements for the Consent Authority
- determination of Development Applications
- matters to be addressed by environmental impact assessments
- preparation of LEPs
- other related matters

A Development Application and Preliminary Environmental Assessment were submitted to the Department of Planning on 12 May 2009. A planning focus meeting was held on 19 June 2009 at the Department of Planning in Sydney with representatives from various authorities attending the meeting. The Director-General's Requirements for the scope and content of the Environmental Assessment were issued with a letter on 4 July 2009 (provided as Appendix A).

In accordance with the *State Environmental Planning Policy (SEPP) (Major Projects) 2005* (Major Projects SEPP) the Director-General under delegation from the Minister for Planning has formed the view that the Proposal is development of a kind described in Schedule 1 of the Major Projects SEPP and is therefore a project to which Part 3A of the EP&A Act applies.

The Director General has also advised that the Proposal is 'critical infrastructure' under Section 75C of Part 3A of the EP&A Act by virtue of a declaration made by the Minister for Planning on 26 February 2008, with respect to energy generating facilities with the capacity to generate at least 250 MW and for which an applications made prior to 1 January 2013.

As the rehabilitated Munmorah Power Station would have a capacity grater than 250 MW, the Proposal is to be assessed by the Minister for Planning as a 'critical infrastructure' under Part 3A of the EP&A Act.

This Environmental Assessment has been prepared in accordance with statutory requirements of the EP&A Act and the Director-General's Requirements. Due care has been given to clause 5 of the EP&A Act which encourages ecologically sustainable development and the protection of the environment (including threatened species, populations and ecological communities). This has been addressed in Chapter 12 of the Environmental Assessment.

Environmental Planning Instruments

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.

Under Part 3A clause 75R of the EP&A Act, environmental planning instruments (other than State environmental planning policies that expressly apply to the project) do not apply. However, in deciding whether or not to approve the carrying out of a project, the Minister may (but is not required to) take into account the provisions of any environmental planning instrument that would not (because of Section 75R) apply to the project if approved.

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.

It is noted that Munmorah Power Station and Munmorah-Vales Point conveyor is located on land classified as 'Zone 5(a) Special Uses (Power station), for which the proposed rehabilitation is permitted with consent.

The MV conveyor also traverses land which is classified as 'Zone 6(a) Open Space and Recreation' and 'Zone 7(g) Wetland Management'. (Figure 4.1)

The conveyor upgrade works do not constitute 'works for the purposes of landscaping, gardening or bushfire hazard reduction' which are permissible without development consent. As such, the conveyor upgrade works would fall in to the category of permissible with development consent from Wyong Shire Council.

For Zone 7(g) 'Wetland Management', utility installations (which mean a building or work used for a public utility undertaking) are permissible in this zone with development consent from Wyong Shire Council. The upgrade of the conveyor would constitute a utility

installation and so would require development consent from Council.

However the provisions of the Infrastructure SEPP (Part 3A, clause 75R) remove the need for seeking approval from Wyong Shire Council for the proposed works in either Zone 6(a) or 7(g). The approval authority for the Munmorah Rehabilitation works is the Minister for Planning and it is acknowledged that the proposed rehabilitation works would normally be permissible (with development consent) under the provisions of the Wyong LEP.

The *Draft Sydney Regional Environmental Plan – Wyong Development Areas and Coal Mining 1987* was created to ensure that the sequencing of underground coal mining did not conflict with the release of land for urban development. The general aims of the draft REP are not affected by the proposal.

While not applying to critical infrastructure projects under Part 3A of the EP&A Act, the Proposal has also had regards to the provisions of:

SEPP 14 – Coastal Wetlands

A small area of SEPP 14 wetlands occur at the mouth of Colongra Creek, while a larger SEPP 14 wetland occurs within the Colongra wetlands (now owned and managed by National Parks and Wildlife Services). As the rehabilitation works would occur mainly in the turbine and boiler halls, no areas within the boundary of these wetlands would be cleared or disturbed. These areas are generally protected as part of Delta Electricity's environmental management practices.

SEPP 33 – Hazardous and Offensive Development

Where an industry is considered potentially hazardous, SEPP 33 requires that a preliminary hazard analysis (PHA) be prepared. Consideration of the need for a PHA is included in the Director-General's Requirements. A PHA has been undertaken and is discussed further in Chapter 10.

SEPP No. 44 – Koala Habitat Protection

SEPP 44 encourages the conservation and management of koala habitats, to ensure permanent free-living koala populations will be maintained over their present range. The policy applies to 107 local government areas, including Wyong Shire. The proposed rehabilitation would be restricted to existing operational areas of the power station and it is not anticipated that the Proposal would have an impact on koala habitat.

SEPP 71 – Coastal Protection

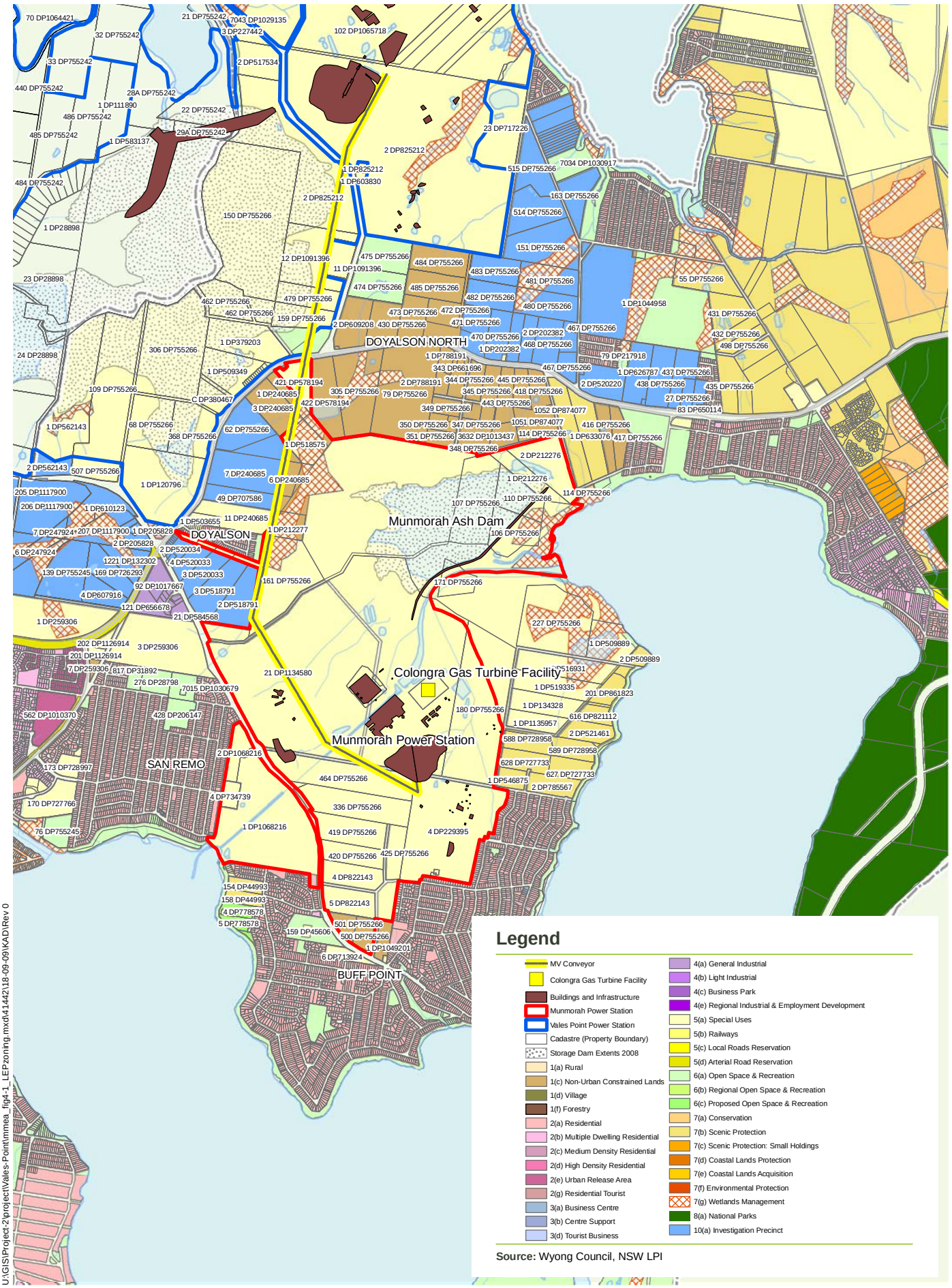
The policy has been made under the EP&A Act to ensure that development in the NSW coastal zone is appropriate and suitably located, to ensure that there is a consistent and strategic approach to coastal planning and management and to ensure there is a clear development assessment framework for the coastal zone.

Areas that would be classed as sensitive coastal locations under the SEPP occur within 100 m of the water's edge for Lake Munmorah and Lake Budgewoi or within 100 m of SEPP14 areas. The proposed rehabilitation works would not affect these areas.

4.3.2 Approvals under other NSW legislation

Under Section 75U of the EP&A Act certain approvals are not required for projects assessed under Part 3A. Accordingly, if the Minister grants approval to carry out the Proposal under Section 75J(1) of the Act, the following approvals would not be required:

- concurrence under Part 3 of the *Coastal Protection Act 1979* of the Minister administering that Part of the Act
- a permit under section 201, 205 or 219 of the *Fisheries Management Act 1994*
- an approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977*



U:\GIS\Project-2\project\Vales-Point\mmea_fig4-1_LEPzoning.mxd\41442\18-09-09\KAD\Rev 0

SCALE 1:40,000 @ A4

0 0.5 1 Kilometers

Projection: MGA

Munmorah Power Station **Rehabilitation Environmental Assessment**

FIGURE 4.1: DPs and LEP zoning

- a permit under section 87 or a consent under section 90 of the *National Parks and Wildlife Act 1974*
- an authorisation referred to in section 12 of the *Native Vegetation Act 2003* (or under any Act to be repealed by that Act) to clear native vegetation or State protected land
- a permit under Part 3A of the *Rivers and Foreshores Improvement Act 1948*
- a bush fire safety authority under section 100B of the *Rural Fires Act 1997*.

Also, under Section 75V of the EP&A Act, certain authorisations cannot be refused if it is necessary for carrying out an approved project and is to be substantially consistent with the approval. Approvals that fall under this category are discussed in the following sections.

Protection of the Environment Operations (POEO) Act 1997

The POEO Act is administered by the Department of Environment, Climate Change and Water (DECCW) and prohibits any person from causing pollution of waters or air, and provides for penalties for air, water and noise pollution offences. Schedule 1 of the POEO Act lists the activities that are "scheduled activities" for the purposes of this Act and Part 1, clause 17 includes electricity generation.

Munmorah Power Station is currently classified as a Group 2 facility under the POEO (Clean Air) Regulation and operates under Environment Protection Licence (EPL) No. 759. The power station is classed as generating plant 1,000 to 4,000 GWh per annum. The license sets emission and operational limits and monitoring requirements for the power station. Other activities permitted under the EPL include chemical storage and waste activities. A full copy of the current licence can be accessed through the POEO Act public register at: http://www.environment.nsw.gov.au/prpoeoapp/searchregister.aspx

Relevant aspects of the license requirements are discussed in more detail in Chapters 7 and 8 of this assessment.

Dangerous Goods (Road and Rail Transport) Act 2008

The aim of this Act is to regulate the transport of dangerous goods by road and rail in order to promote public safety and protect property and the environment.

Road tankers are used to deliver bulk quantities of various chemicals to the Munmorah site for normal day to day operation.

Occupational Health and Safety Act 2000

This Act regulates dangerous goods in NSW by requiring the various activities, such as the keeping, conveyance, use and manufacture of certain dangerous goods to be licensed by WorkCover.

A licence would be required for the storage of greater than 250 L of a dangerous good (fuel or oil) and construction of a pipeline less than 10 km in length.

Roads Act 1993 (NSW RTA)

The main aim of this Act is to set out the rights of members of the public to pass along public roads. Consent is required from the Roads and Traffic Authority for work in, on, under or over a public road.

Transport of overmass plant items would require Roads and Traffic Authority consent under the Act.

Electricity Supply Act 1995

One of the objects if the Electricity Supply act is "*..to confer on network operators such powers as are necessary to enable them to construct, operate, repair and maintain their electricity works"*. A license is required to supply electricity. Delta Electricity has a license to operate Munmorah Power Station.

Pipelines Act 1967

The Pipelines act is administered by the Department of Water and Energy (DWE).

In the event that dual fuel operation occurs at Munmorah Power Station, gas would need to be transported to the site. While the current pipeline supplying the Colongra gas turbine may play a role in future gas supplies to Munmorah significant augmentation to the gas supply will be required to supply gas to Munmorah. This is discussed further in Section 3.5.

An application for a licence to construct, modify and operate a pipeline would need to be made to the DWE under the Pipelines Act.

Mine Subsidence Compensation Act 1961

An application for approval is required to alter or erect improvements within a mine subsidence district or to subdivide land. Depending on detailed design considerations, approval under Section 15 of this Act may be required.

Water Management Act 2000

The *Water Management Act 2000* aims to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations.

Chapter 6 of the *Water Management Act 2000* applies to major utilities referred to in Schedule 2 of the Act. Clause 60 (3) of the Act indicates that a major utility access licence authorises the taking of water for the purposes of electricity generation. Delta Electricity is listed in Schedule 2 and is committed to ensuring the appropriate use of water for the operation of Munmorah Power Station.

The domestic water consumed by Munmorah Power Station is regulated by the Water Sharing Plan for the Central Coast Unregulated Water Sources 2009 which is made under Section 50 of the *Water Management Act 2000.*

The operations within the Munmorah land holding are governed by the Basic Land Holder rights discussed in Part 5 of the Water Sharing Plan. Beyond these rights, Munmorah does not currently hold any special licences for water extraction and would be required to apply for a licence, should water extraction be proposed.

While the extraction of saltwater from the Lakes is regulated by the *Water Management Act 2000*, it is not included in the Water Sharing Plan for the Central Coast from the plan and the NSW Office of Water (pers Comm) has advised that there are no current plans to license saltwater extraction from the Lakes.

Dam Safety Act 1978

The NSW Dams Safety Committee (DSC) is a statutory body whose basic role is to ensure that all prescribed dams are in such a condition as to not endanger downstream residents, property or the environment. The DSC fulfils its role under the *Dam Safety Act*.

The DSC has established guidelines for dam owners relating to the design, safety management and surveillance of dams, and in particular requires compliance in the areas of flood capacity, seismic stability, emergency planning, inspection and monitoring activities, safety management, surveillance reporting and hydrological analysis.

The DSC currently lists Munmorah Ash Dam and Vales Point Ash Dam as prescribed dams under the *NSW Dams Safety Act, 1978*. Under this legislation a dam safety management plan is in place and includes, amongst other routine monitoring, annual intermediate inspections and five yearly comprehensive inspections

Issues Identification

5

5. Issues Identification

5.1 Environmental Risk Assessment

5.1.1 Environmental risk analysis

The Director-General's Requirements for the Munmorah rehabilitation Proposal include a requirement for a general environmental risk analysis to ensure that all potential environmental issues are captured and assessed, and management options identified. The Director-General's Environmental Assessment requirements identified the following key issues (see Appendix A).

Key Issue	Chapter in the EA
Greenhouse Gases	6
Noise and Vibration Impacts	11
Water Cycle Management	8
Air Quality Impacts	7
Hazards and Risk Impacts (Hazardous substances)	10
Waste Management	9
Other includes Flora and fauna, Heritage, Traffic and transport issues and Socio economics	12

Table 5.2 represents a summary of the risk analysis carried out for the Prop osal using the qualitative risk analysis matrix shown in Table 5.1. The preliminary environmental risk analysis was prepared in accordance to the general principles outlined in *Australian Standard HB 2003:2006 Environmental Risk Management – Principles and process*.

The information in Table 5.2 demonstrates that all relevant issues have been identified and assessed in terms of the Proposal's potential environmental issues, and that potential impacts can be effectively managed through the mitigation options that have been recommended.

Table 5.1 – Qualitative risk analysis matrix

		Consequence				
		Catastrophic	Major	Moderate	Minor	Insignificant
Likelihood		1	2	3	4	5
Almost certain	A	Extreme	Extreme	Extreme	High	High
Likely	B	Extreme	Extreme	High	High	Moderate
Possible	C	Extreme	Extreme	High	Moderate	Low
Unlikely	D	Extreme	High	Moderate	Low	Low
Rare	E	High	High	Moderate	Low	Low

Level of risk and management requirements

Extreme (Ext)	Immediate action required
High (H)	senior management attention needed
Moderate (Mod)	management responsibility
Low	managed by routine procedure

Table 5.2 – Environmental Risk Analysis

C – consequence**, L** – Likelihood**, LoR** – Level of risk

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Chapter in EA
Greenhouse gas						**6**
Greenhouse gas emissions	Generation of greenhouse gases	A	4	High	• Increasing efficiency, reducing the greenhouse gas emissions per unit of electricity • Co-firing with gas reducing the greenhouse gas emissions per unit of electricity • Carbon capture readiness	6
Air quality						**7**
Construction emissions	Earthworks and fugitive emissions from construction equipment are often associated with construction work	D	4	Low	• No substantial earthworks would be required • Well maintained equipment and reduce idling where possible • Addressed in CEMP	7
Operational emissions	Combustion of fossil fuels generates emissions of SO_x, NO_x, particulate and trace element. Levels are dependent on the function of boiler, burner design, operating conditions and fuel properties	B	3	High	• POEO Environmental Protection Licence limits • Improved efficiency reduces the amount of coal burnt per unit of electricity • Burning low sulphur coal and co-firing with gas would reduce SO_x emissions. Delta proposes to reduce the limit of sulphur in coal from 1% to 0.7%, given this power station is proposed to operate for a further 20 years coal • Low NO_x burners for gas and coal <500 mg/m^3 expected • Fabric filters already in place <50 mg/m^3 expected	7.5
Local impacts	• Increasing SO_2 local ground level concentrations • NO_x (fugitive and industrial) and VOC are precursors to O_3 formation and photochemical smog. Increased NO_2 with increased NO_x emissions	C	5	Low	• Ongoing ambient monitoring at Wyee and Lake Munmorah • Managed by using low sulphur content fuels. Current ambient SO_2 levels are well below the current air quality criteria • Low NO_x burners decreasing the intensity of NO_x emissions from the plant. Increases in local NO_2 or O_3 concentrations over an hourly averaged time period are not expected. Current ambient NO_x levels are well below the current air quality criteria	7.7

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Chapter in EA
Regional and interregional impacts	NO_x (fugitive and industrial) and VOC are precursors to O_3 formation and photochemical smog. Increased smog formation with increased NO_x emissions	C	5	Low	• Ongoing ambient monitoring at Wyee and Lake Munmorah • Low NO_x burners decreasing the intensity of NO_x emissions from the plant. Increases in regional NO_2 or O_3 concentrations over an hourly averaged time period are not expected	7.8
Noise and vibration						**11**
Construction noise	• Traffic noise relating to equipment transport trucks • Operation of mechanical equipment such as cranes, oxyacetylene equipment and loaders for dismantling the turbine and new turbine installation • Other on-site equipment maintenance	D	5	Low	• Construction noise management plan would be developed when details of the construction activities are finalised • Much of the rehabilitation works would be restricted to existing operational areas of the power station and noise would be consistent with noise from routine maintenance • Adherence to standard hours of operation for the construction works ie Monday to Friday (7am to 6pm), Saturdays (8am to 1pm) and no work to be conducted on Sundays or public holidays	11.3
Operational noise	Noise from the power station is primarily from air intake, noise from turbine/generator hall and from exhaust stack	D	5	Low	• Compliance with the criteria specified in noise management plan • Expect the rehabilitation of the power station would lead to a decrease in the operational noise emissions due to replacement of worn parts • Much of the operation occurs in the turbine and boiler house	11.5
Vibration operation and construction	Dependent on source level and trans-mission path attenuation. Increased distance and higher levels of ground attenuation would reduce the impact on sensitive receivers	D	5	Low	• Closest residence is approximately 1 km from the proposed redevelopment site • Compliance with the criteria specified in noise management plan	11.4
MV Conveyor noise	Increased noise due to increased capacity	C	4	Mod	• The proposed upgrade of the MV coal conveyor would be designed to be consistent with existing noise levels. It is therefore expected that no additional noise sources would be introduced. • Compliance with the criteria specified in noise management plan	11.5.3

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Chapter in EA
Hazards and risks	**Hazardous substances**				Addressed in Chapter 10	**10**
Water cycle management						**8**
Operational water management	Increase cooling water plumes and increased lake temperatures	A	3	Ext	• POEO Environmental Protection Licence limits. Attemperation in place for warmer than normal summer periods • Increasing efficiency, reduces the levels of reject heat and the size of the cooling water plume. Impacts are predicted to be significantly less than the effects of the previously operating four unit power station and recent operations.	8.2
Water quality	Discharge of trace elements, nutrients, total suspended solids and increased pH	C	3	High	• POEO Environmental Protection Licence limits • Annual, quarterly and monthly monitoring • Clean and dirty drain system in place. Potentially contaminated water is discharged to the dirty water system which includes measures to remove floating debris or oil. Monitoring also undertaken. Residual water directed to ash dam	8.5
Waste management						**9**
Construction waste	Generation of redundant equipment, oil etc generation of general construction and maintenance waste	B	5	Mod	• Delta Electricity fully compliant with NSW WRAPP - aim to reduce landfill by about 10% each year in accordance with WRAPP • Delta Electricity waste management framework which addresses waste reduction, reuse and recycling • Hazardous solid waste managed in accordance with government guidelines	9.3
Operational waste – not ash	Generation of redundant equipment, oil etc generation of general construction and maintenance waste	B	4	High	As above	9.4

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Chapter in EA
Operational waste – ash disposal	Generation of additional fly ash due to continuous operation resulting in a reduction of the life of current disposal facilities (Munmorah and Vales Point ash dams)	B	4	High	• POEO Environmental Protection Licence • Managed through the Central Coast Ash Dam Management Plan which is reviewed on a five years basis • Feasibility study identifying viable methods for disposal of flyash from Munmorah Power Station, beyond the current projected life of the Vales Point ash dam. • Delta Electricity aims to continue to encourage development of new markets for ash products to increase sales in the future. It is noted that current ash sales reflect the state of the market for the beneficial use of ash products at present and significant increases may be unlikely without market and regulatory changes	9.5
Other						**12**
Construction traffic	• Increased traffic from construction personnel • Increase in oversize transport adversely impacting on local traffic movement	C	5	Low	• Managed by traffic and transport management plan • Transport of oversize equipment and additional transport used by construction personnel is a temporary situation	12.1
Operational traffic and transport	• Increase traffic adversely impacting on local traffic movement	D	5	Low	• No change from the current traffic	12.1
Flora	• Removal of vegetation and disturbance of habitats • Impacts from MV conveyor upgrade	E	5	Low	• Rehabilitation works would occur within the plant layout areas and therefore no removal of vegetation and disturbance of habitats expected • The MV conveyor upgrade would make use of existing cleared easement. Alternative design options would require additional assessment and be addressed in accordance with the current legislation • Safeguards to ensure adjoining sensitive areas identified and protected	12.2

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Chapter in EA
Fauna	• Removal of vegetation therefore disturbing existing habitats for local fauna • Impacts from MV conveyor upgrade	E	5	Low	• Rehabilitation works would occur within the plant layout therefore no removal of vegetation minimal impacts on local fauna • The MV conveyor upgrade would make use of existing easement. Alternative design options would require additional assessment and be addressed in accordance with the current legislation • Safeguards to ensure adjoining sensitive areas identified and protected	12.2
Fauna	• Noise impacts from construction	D	5	Low	• May be some noise impact during construction but controls applied include working hours • Managed by noise management plan	12.2
Aquatic flora and fauna	• Sea grass beds destroyed and loss of zooplankton, fish larvae etc by high water temperatures	C	3	High	• POEO Environmental Protection Licence limits. Attemperation in place for warmer than normal summer periods • Increasing efficiency, reduces the levels of reject heat and the size of the cooling water plume. Impacts are predicted to be significantly less than the effects of the previously operating four unit power station	8.6
Indigenous and non-indigenous Heritage	• Disturbance of existing heritage site • Impacts from MV conveyor upgrade	E	5	Low	• Rehabilitation works would occur within the plant layout therefore no disturbance of exiting known heritage sites • The MV conveyor upgrade would make use of existing easement. Alternative design options would require additional assessment and be addressed in accordance with the current legislation • Safeguards to ensure adjoining sensitive areas identified and protected	12.3

Environmental Aspect	Potential Impact	L	C	LoR	Proposed Management Options	Chapter in EA
Socio-economic	• increased numbers of workers in the area placing increased demands on services • Stakeholder consultation • Local workforce • Indirect income • Visual amenity	C	4	Low	• Positive impacts including indirect income for local population and continuation of employment in area at same level. Munmorah Power Station makes an important contribution to the local economy • Site is already operational and accepted as an industry • CARE Forum Meetings with senior Delta Electricity managers are held quarterly. This would be on-going • Ongoing Community Consultation Strategy Media releases, newsletter etc	12.4
Visual impacts	• Large buildings (up to 60 m tall) and two 150 m high chimneys can be seen from most locations surrounding the site • Additional carbon capture plant increasing impact	E	5	Low	• The expansive buffer zones provide a bushland setting for the site which softens the impact of this industrial facility. The buffer zones provide a transition to the surrounding area, which is characterised by large areas of bushland and wetlands interspersed with settlements surrounding the lakes, which provide the dominant natural feature in the area	12.5

5.2 Community and Stakeholder Consultation

This section describes the extent of liaison and consultation with government and the community, following the Preliminary Environmental Assessment announcement made on 2 July 2009. It identifies the issues raised during that consultation and outlines how those issues are addressed in the Environmental Assessment.

5.2.1 Planning focus meeting

A planning focus meeting was held on 19 June 2009 at the Department of Planning, Sydney. Representatives from the following authorities attended the meeting:

- Department of Planning
- Department of Environment, Climate Change and Water
- Department of Water and Energy.

Written submissions stating the requirements of individual agencies were received by the Department of Planning following the completion of the Planning Focus Meeting. The Director-General's requirements were issued by the Department of Planning on 4 July 2009. These are provided in Appendix A.

Requirements were also received from Department of Water and Energy and from Department of Environment, Climate Change and Water. These requirements are also provided in Appendix A.

5.2.2 Consultation with agencies

Further to the Planning Focus Meeting, letters describing the Proposal and request for comment were sent to the Department of Primary Industries and Commonwealth Department of Climate Change on 12 August 2009.

Munmorah Power Station is in the Wyong Shire LGA. A briefing package was sent to Bob Graham, Wyong Mayor on 6 July 2009. A briefing package was also sent to Greg Piper, State Member for Lake Macquarie, and the Mayor of Lake Macquarie and Wyong Shire Mayor in the week of July 6 2009. Similar approaches were made to Robert Coombs State Member for Swansea, Craig Thomson Federal Member for Dobell, Jill Hall, Federal Member for Shortland and David Harris State Member for Wyong.

A further meeting to discuss Proposal progress, preliminary results, and to seek any additional comments occurred with Wyong Shire Council at the Council Office on 27 August 2009. Additional consultation occurred with Council officers in relation to water use planning and Tuggerah Lakes issues.

5.2.3 Community consultation

The Director-General's Requirements also requires consultation with the local community during the preparation of the Environmental Assessment.

In response, Delta Electricity developed a comprehensive Community Consultation Strategy to ensure that the local community was well informed about the Proposal and had the opportunity to provide feedback to Delta Electricity on issues associated with the Proposal.

Several mechanisms were adopted during this Proposal to consult with residents and community groups and a range of techniques were employed to engage community feedback on the Proposal. The scope and detail of each of the consultation components are described in detail in Table 5.3. Copies of the relevant documents are provided in Appendix B.

Table 5.3 – Consultation mechanisms

Mechanism	Description
Newsletter	The first Community Newsletter, published in July 2009, provided an overview of the background to the Proposal, the Proposal description, the environmental assessment process and consultation activities. Proposal e-mail, postal address and telephone contact details were also provided. The newsletter was letter box dropped to 8,600 homes in Doyalson, Doyalson North, San Remo, Halekulani, Lake Munmorah, Budgewoi and Mannering Park between the 13 and 18 July 2009. An additional 400 were delivered to Lake Wyee following requests from members of Delta Electricity's pre-existing community consultative group (see below). The newsletter was published on the Delta Electricity Website on 3 July 2009.
Media Statement	A statement was released to the media on 2 July 2009.
Newspaper advertisement	An advertisement was placed in the Newcastle Herald in the week of 9 July 2009 also outlining the ways to access the Preliminary Environmental Assessment (either through Delta's website or the Department of Planning's website). It encouraged community members to send comments on the PEA document specifically, or the Munmorah Rehabilitation Proposal more generally to either the email or 1800 contacts.
1800 Line	A free-call 1800 line, staffed by Aurecon Australia, was established for the Proposal (1800 057 630). All inquiries were logged in a database and actioned
Dedicated email	A dedicated Delta Electricity e-mail was established (munmorahrehabilitation@de.com.au)
Website	Delta Electricity maintains a website of all its operations (www.de.com.au). The Preliminary Environmental Assessment, the contact details and a community newsletter about the Proposal were made available.
face to face consultation	Additional consultation was also undertaken with key community stakeholders.

Community Access Regional Environmental forum

The Central Coast Community Access Regional Environmental (CARE) Forum and is made up of representatives of local communities and organisations. Meetings with senior Delta Electricity managers are held quarterly to discuss the general activities and environmental monitoring results of Delta Electricity's Central Coast operations.

A meeting was held with the CARE Forum on 15 July 2009. Issues raised at the forum were registered and discussed at subsequent Proposal meetings and actioned accordingly. Members of the Forum were provided with a copy of the newsletter.

5.2.4 Issues raised by stakeholders

Issues raised at the CARE Forum meeting included the distribution of the newsletter, noise, increased coal trucks on the roads, increased usage of the MV conveyor, any plans for the future upgrade of Vales Point Power Station; the timeframe for the rehabilitation, the impact of privatisation of electricity on the future price of electricity to the consumer, the role of Wyong Shire Council in the approval process, water, ash placement, noise and fuel sources and rehabilitation.

Feedback from the community has been mainly through the 1800 line and the dedicated email. To date 11 responses have been received.

Issues raised include:

- requests to be added to the mailing list
- sales of wetland material
- radio interference
- noise
- seeking employment
- Impact on the Tuggerah Lakes.

Table 5.4 describes what actions were taken and indicates where the issue has been addressed in the Environmental Assessment.

Table 5.4 – Issues raised and addressed

Issue	How addressed
Distribution of newsletter	The distribution area was subsequently expanded by 400 to include Wyee Point
Impact of privatisation on consumer	Referred to Delta Electricity management
Employment	Referred to Delta Electricity management
Increased number of coal trucks	Refer to Chapter 3
Increased usage of MV conveyor	Refer to Chapter 3
Time frame	Refer to Chapter 3
Rehabilitation	Refer to Chapter 3
Approval process	Refer to Chapter 4
Water	Refer to Chapter 8
Ash placement	Refer to Chapter 9
Noise	Refer to Chapter 11
Noise and fuel sources	Refer to Chapter 11 and 3
Vales Point Upgrade	Not relevant to Proposal and not addressed in EA
Radio interference	Not relevant to Proposal and not addressed in EA

Greenhouse Gases

6

6. Greenhouse Gas Emissions

This Chapter of the Environmental Assessment provides an overview of:

- the greenhouse effect, greenhouse gases and its links to climate change
- the Commonwealth Government and State Government responses to climate change
- the predicted greenhouse gas emissions from the proposed Munmorah rehabilitation.

6.1 Introduction

The Garnaut Climate Change Review (Garnaut Review, 2008) was initiated in April 2007 by the then Leader of the Opposition, and by the Premiers of the six states and the Chief Ministers of the two territories of Australia. The Review was required to examine the impacts of climate change on the Australian economy, and to recommend medium- to long-term policies and policy frameworks to improve the prospects of sustainable prosperity. This chapter provides a brief summary of the outcomes of the Review, which was published in September 2008.

6.1.1 Greenhouse effect

The earth's atmosphere acts like the roof of a greenhouse, allowing short wavelength (visible) solar radiation from the sun to reach the surface, but absorbing the long-wavelength heat that is emitted back. This process is referred to as 'the greenhouse effect', and the gases that absorb the emitted heat are known as greenhouse gases

6.1.2 Greenhouse gases

The main naturally occurring greenhouse gases are water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and ozone (O_3). In addition, there is a range of human-made halocarbons such as perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), chlorofluorocarbons (CFCs) and sulphur hexafluoride (SF_6) that are present in small amounts but are potent and contribute significantly to the total warming.

Compared to nitrogen and oxygen, which together comprise 99% of the volume of the atmosphere, greenhouse gases occur only at trace levels, making up about 0.1% of the atmosphere by volume. Despite the small volumes, their presence is important in maintaining the average global surface temperature at about 14°C, about 33°C warmer than if there were no greenhouse gases at all (Garnaut, 2008).

6.1.3 Greenhouse gas levels

Historical records provided by fossil plants and ice core data are available for the last 400 million years. These records indicate that atmospheric concentrations have fluctuated between about 180 ppm and levels higher than 4000 ppm, with 250 ppm being the pre-industrial (c1750) concentration and 383 ppm the concentration measured in 2007. Over the last 10 years, CO_2 in the atmosphere has increased at an average rate of 2 ppm per year. Without effective mitigation, it is expected that the CO_2 concentrations will continue to strongly increase for the next two decades and then at moderated rates beyond (Garnaut, 2008).

6.1.4 Major greenhouse gas emitters

The Intergovernmental Panel on Climate Change report (IPCC 2007) estimated that in 2004, global human activity resulted in about 50 Gt CO_{2e}, of which almost 60% resulted from fossil fuel combustion and other carbon dioxide-emitting industrial processes. Forty per cent these emissions resulted from China, the United States and the European Union with emissions of approximately ~6.7 Gt CO_{2e}, 6.5 Gt CO_{2e} and 4.7 Gt CO_{2e} respectively.

Table 6.1 shows the total emissions (Gt) and emissions per capita (t CO_{2e}) for the top five global greenhouse gas emitters for 2004. Australia is one of the top 20 greenhouse gas emitters with the total emissions of approximately 0.5 Gt per annum. However, on a per capita basis Australia emits more that China and the United States.

Table 6.1 – Top five greenhouse gas emitters versus Australia greenhouse gas emissions for 2004 (Garnaut Review, 2008)

	Top order emitters	Total mass emissions per annum	% contribution to global emissions	annual emissions per capita
		Gt		t CO_{2e} (1)
China	1	6.7	13.2	5
United States	2	6.5	13.0	22
EU	3	4.7	9.4	10
Indonesia	4	3.2	6.4	15
Brazil	5	2.2	4.4	13
Australia	**13**	**0.5**	**1.0**	**26**
Global		**~50**		

NOTE: (1) includes land use, land use change and forestry

6.1.5 Australia's greenhouse gas emissions

Under the United Nations Framework Convention on Climate Change (UNFCC) Australia submits an annual *National Inventory Report* which contains national greenhouse gas emission estimates. The current report, released in May 2009, provides the estimates for the 1990 to 2007 period. Parties to the Convention are committed to develop, publish and regularly update national emission inventories of greenhouse gases. The *National Inventory Report 2007* is compiled using methods which conform to the international guidelines adopted by the UNFCC. Table 6.2 show the estimated net greenhouse gas emission by sector.

Table 6.2 – Australia's net greenhouse gas emissions by sector (DEC, May 2009)

	Emissions Mt CO2			Est. emissions with measures(3)	% change
Sector and subsector	**1990**	**2006**	**2007**	**2008 – 2012**	**1990-2007**
All Energy	286.4	400.1	408.2	429	42.5
Stationary Energy	*195.1*	*287.1*	*291.7*	*304*	*49.5*
Transport	*62.1*	*78.6*	*78.8*	*88*	*26.9*
Fugitive Emissions	*29.2*	*34.3*	*37.7*	*37*	*28.9*
Industrial Processes (1)	24.1	29.4	30.3	38	25.7
Agriculture	86.8	90.8	88.1	93	1.5
Waste	18.8	14.2	14.6	15	-22.5
Total net emissions (2)	**416.2**	**534.5**	**541.2**	**575**	**30**
LULUCF(2)	136.5	62.9	284.7	24	656.6
Australia's Net Emissions	**453.8**	**551.1**	**825.9**	**599**	**82**

NOTE: (1) Solvent and other product use is included industrial processes for confidentially reason
(2) LULUCF – land use, land use change and forestry. It should be noted that this sector may change from a net source to a net sink. The trends are primarily driven by inter-annual climate variability and natural disturbance. The **total net emissions excludes LULUCF**
(3) Tracking to the Kyoto Target 2007, DEC publication, February 2008

Stationary Energy, which includes emissions from electricity generation, fuels consumed in the manufacturing, construction and commercial sectors and other sources like domestic heating, is the largest contributor to Energy sector emissions. The Stationary Energy sector contributes almost half of Australia's total emissions.

Key drivers influencing Stationary Energy emissions growth are the structure and growth of Australia's economy, the fuel mix used in electricity generation and energy efficiency improvements across the economy. These factors affect the demand for electricity and its emissions intensity, as well as the demand for fuel for direct combustion (DEC, February 2008)

6.1.6 Commonwealth and NSW Policies

Since the Commonwealth Government's ratification of the Kyoto protocol, NSW has been working constructively through the Council of Australian Governments (COAG), the major intergovernmental forum in Australia, to progress a number of important reforms including a national emissions trading scheme and a mandatory renewable energy target (http://www.environment.nsw.gov.au/climatechange/).

There are a large number of policies in place in Australia to address the issue of greenhouse gas emissions at a national level, as well as at State level. Some of the policies are described below.

National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting (NGER) Act 2007* was passed on 29 September 2007 and 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. The Commonwealth Government Department of Climate Change (DEC) is the Government Agency tasked with administering the *NGER Act*.

Businesses emitting large amounts of greenhouse gases will be required to monitor and measure emissions from 1 July 2008 as part of the new National Greenhouse and Energy Reporting System. Although measurement of emissions started in July 2008, businesses have until 31 August 2009 to register under the scheme, and have until 31 October 2009 to submit their first annual greenhouse and energy report.

Carbon Pollution Reduction Scheme (CPRS)

In the White Paper on the Carbon Pollution Reduction Scheme (CPRS), the Commonwealth Government has made substantial commitments to reduce carbon pollution by between 5%[1] and 15%[2] below 2000 levels by 2020 (representing a cut of around 27% on a per capita basis) and up to 60 per cent of 2000 levels by 2050 have been indicated.

The aim is to achieve this through three pillars:

- reducing Australia's carbon pollution emissions
- adapting to climate change that cannot be avoided
- helping to shape a global solution.

Although the CPRS will be the primary mechanism for achieving emission reduction objectives, other Government mitigation strategies including investments into renewable energy targets, carbon capture and storage and energy efficiency will be equally important for making the transition towards a low carbon pollution future.

The Government's intention is to commence the CPRS on 1 July 2011. It will utilise a 'cap and trade' emissions trading mechanism to limit greenhouse gas emissions. The *NGER Act* will underpin the CPRS, providing the emissions data on which obligations under the CPRS will be based.

NSW Greenhouse Gas Reduction Scheme (GGAS)

The objectives of GGAS are to reduce 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. State greenhouse gas benchmark expressed in tonnes of carbon dioxide equivalent (tCO_{2e}) per capita have been outlined in Part 8A of the NSW *Electricity Supply Act 1995.* An initial level of 8.65 tCO_{2e} was set at the

[1] 5% below 2000 levels – represents a minimum (unconditional) commitment, irrespective of the actions by other nations.
[2] 15% below 2000 levels – represents a commitment to reduce emissions in the context of global agreement

start of the scheme and was then progressively dropped to 7.27 tCO_{2e} in 2007, a level which remains until 2012 and represents a reduction of 5% below the Kyoto Protocol baseline year of 1990.

While the Scheme is likely to be phased out with the introduction of a National Emissions Trading Scheme from about 2011 the NSW 'pool coefficient' currently provides a useful indicator of the average emission intensity of electricity sourced from a selected set of the major power stations ("pool") serving the NSW Electricity Grid.

NSW Greenhouse Plan (2005)

The DECCW NSW Greenhouse Plan was released in November 2005. The plan provides a strategic approach to combating climate change in NSW from 2005 to 2008. The plan outlines a number of measures to reduce greenhouse gas emissions through abatement measures. http://www.environment.nsw.gov.au/climateChange/greenhouseplan.htm

The Greenhouse Plan will be superseded by the NSW Climate Change Action Plan, which is due this year (2009). However, until that time, the Greenhouse Plan remains a key document in the NSW response to greenhouse gas emissions.

Australian Greenhouse Office / Greenhouse Gas Challenge Program

The Australian Greenhouse office (AGO) is the world's first government agency dedicated to cutting greenhouse gas emissions. It was established in 1998 as a separate agency within the environment portfolio to provide a whole of government approach to greenhouse matters.

Delta Electricity participates in the Greenhouse Challenge program. Greenhouse Challenge Plus enables Australian companies to form working partnerships with the Commonwealth Government to improve energy efficiency and reduce greenhouse gas emissions.

6.2 Project Related Greenhouse Gas Emissions

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 Governments Department of Climate Change. This study includes 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 NGER Method 1 takes into account emissions of CO_2, CH_4 and N_2O.

6.2.1 Scope 1 and Scope 2 greenhouse gas emission calculations

Scope 1 greenhouse gas emission factors

The following tables outline the data (Table 6.3) and emission factors (Table 6.4) used in the calculation of the Scope 1 greenhouse gas emissions for the proposed Munmorah rehabilitation. Emission factors have been adopted from *NGER (Measurement) Technical Guidelines 2009*. The Scope 1 emissions are provided in Table 6.5.

Table 6.3 – Unit operational data used for Munmorah rehabilitation calculations

Parameter	Value
Gross Power Output	350 MW
Capacity Factor	80%
Energy Generated per Year	2,452,800 MWh/year

Table 6.4 – Greenhouse gas emission factors (*NGER (Measurement) Technical Guidelines 2009*)

Fuel Type	Greenhouse Gas	Greenhouse Gas Emission Factor ($kgCO_2e/GJ$)
Black Coal Gross Specific Energy (SE) = 27 MJ/kg	CO_2	88.2
	CH_4	0.03
	N_2O	0.2
Natural Gas Gross SE = 0.0393 GJ/m^3	CO_2	51.2
	CH_4	0.1
	N_2O	0.03

Scope 2 greenhouse gas emission factors

The Scope 2 greenhouse gas emissions from the consumption of purchased electricity on site have been estimated using the 0.89 $kgCO_2/kWh$ emission factor as stated in the *NGER (Measurement) Technical Guidelines 2009*. The amount of electricity

purchased is estimated to be 2% of the total generated electricity, based on auxiliary load data provided by Delta Electricity. This 2% is in addition to the 5% auxiliary load taken from the total electricity generated.

The Scope 2 emissions for the Munmorah rehabilitation options are provided in Table 6.5.

NSW pool coefficient

The NSW pool coefficient is an indicator of the average greenhouse gas emissions produced from the generation of electricity sourced from the NSW electricity grid. The NSW pool coefficient represents the greenhouse gas emissions from Category B Generators (which includes Delta Electricity plants) as defined in Schedule B of the Greenhouse Gas Benchmark Rule (Generation) No. 2. The pool coefficient is measured in kilograms of carbon dioxide equivalent per megawatt hour of electricity sourced from the grid (kg CO_2e/MWh_{SO}).

The NSW pool coefficient is calculated according to Clause 9.1 of the Greenhouse Gas Benchmark Rule (Compliance) No. 1. The NSW Independent Pricing and Regulatory Tribunal (IPART) is responsible for the annual calculation and publishing of the pool coefficient. The NSW pool coefficient can be used to compare the emission intensity of the coal and gas firing options against the existing average emission intensity in the NSW electricity grid. The NSW pool coefficient for 2009 is 967 kg CO_2e/MWh_{SO} as published by IPART.

Comparison of Munmorah emission intensity to NSW pool coefficient

A comparison of the greenhouse intensity factors (see Table 6.5 below) and the NSW pool coefficient shows that all options for the Munmorah rehabilitation works would result in less greenhouse emissions than the average emissions from the NSW electricity grid. The greenhouse intensity factors provided in Table 6.5 are instantaneous values at maximum continuous rating (MCR).

Table 6.5 – Estimated greenhouse gas emissions from rehabilitated units (two Units)

Parameter	100% Coal	25% Gas	50% Gas	75% Gas
Unit Efficiency (HHV) (sent out)	37.5%	37.4%	37.3%	37.0%
Scope 1 Greenhouse Gas Emissions ($MtCO_2e$/year) (at 80% capacity factor)	3.96	3.55	3.15	2.75
Scope 2 Greenhouse Gas Emissions ($MtCO_2e$/year) (at 80% capacity factor	0.09	0.09	0.09	0.09
Total Greenhouse Gas Emissions ($MtCO_2e$/year) (at 80% capacity factor)	4.04	3.63	3.23	2.84
Greenhouse Intensity Factor (kg CO_2e/MWh_{SO})	**868**	**780**	**694**	**608**

NOTE: The NSW pool coefficient for 2009 is **967 kg CO_2e/MWh_{SO}** as published by IPART.

The rehabilitation works under all coal/gas firing scenarios will ultimately result in a reduction in the greenhouse intensity factor of the Munmorah Units compared to current operation. Calculations made from operational data from 13 December 2006 using 100% coal result in a greenhouse intensity factor of 988 kg CO_2e/MWh_{SO}. All rehabilitation options have a greenhouse intensity factor below these levels.

Figure 6.1 compares the predicted emissions intensity for the coal/gas firing scenarios with the 2009 pool co-efficient.

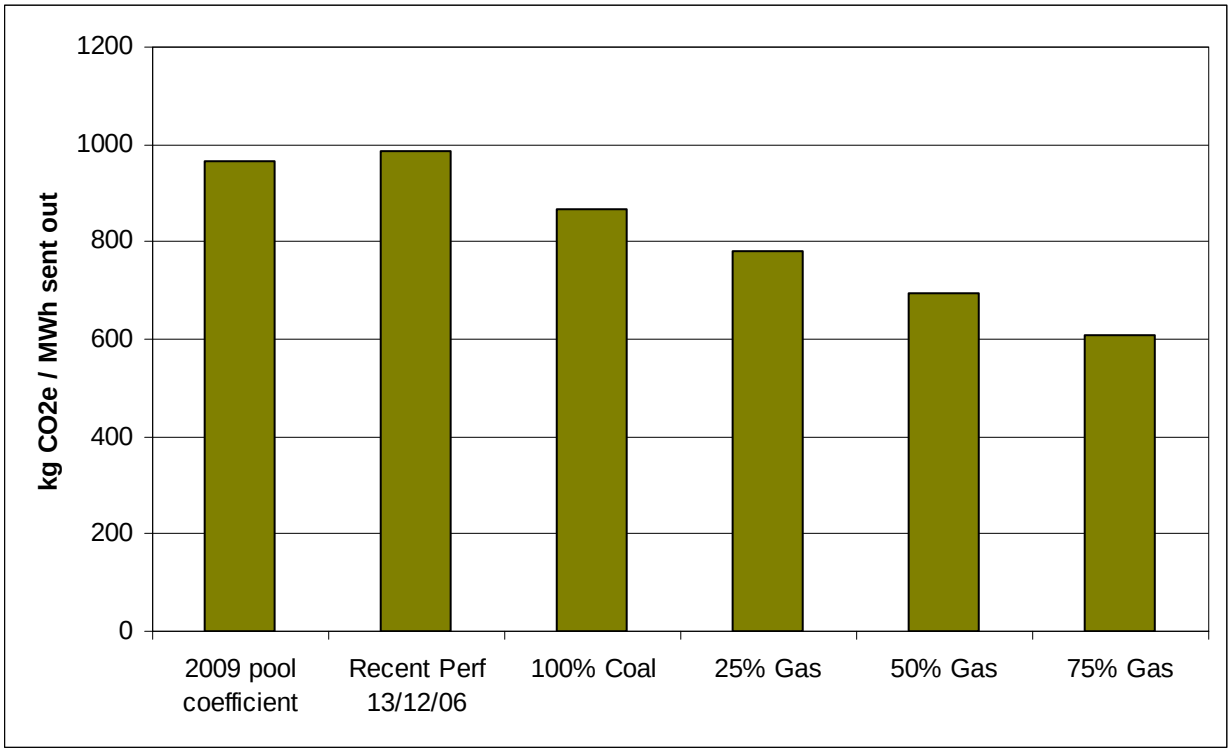


Figure 6.1 – Predicted emissions intensity for the Munmorah rehabilitation scenarios compared with the 2009 pool co-efficient and recent 100% coal data

6.2.2 Scope 3 greenhouse gas emission calculations

Scope 3 emissions are defined by the Greenhouse Gas Protocol as emissions that are a "consequence of the activities of the company, but occur from sources not owned or controlled by the company". Scope 3 emissions are not mandatory to report, and as such there is no definitive list of emission sources which are to be estimated in a Scope 3 assessment.

Aurecon's methodology to assessing the Scope 3 emissions of the Munmorah rehabilitation project has included the concept of a CO_{2e} threshold at which the annual Scope 3 emissions, as a percentage of the annual rehabilitated Scope 1 emissions for each scenario, become significant. Due to the large amount of greenhouse gas emissions from coal fired power stations, the Scope 3 emissions are quite small in comparison.

Aurecon facilitated a discussion workshop with technical and environmental experts from Aurecon and Delta Electricity. At this workshop possible Scope 3 emission sources were assessed, with the extraction, production and transportation of fuel emerging as the major contributors. A threshold value of 1% of the annual Scope 1 emissions from the rehabilitated plant for each scenario was chosen based on emission factors provided in the 2009 NGER Technical Guidelines.

Table 6.6 lists the Scope 3 emission sources considered in this study, including the assumptions made in the calculations of Scope 3 emissions from the rehabilitated plant:

Table 6.6 – List of Scope 3 emission sources and assumptions

Emission Source	Assumptions made in Estimating Scope 3 Emissions
Extraction of Coal	• CO_{2e} Emission Factor = 0.045 t CO_2e/t raw coal (fugitive emission factors from open cut coal mining – NSW) (1) • 80% Capacity Factor • Coal Energy Content = 27 MJ/kg (1)
Transportation of Coal	• CO_2 Emission Factor = 0.021 kg CO_2e/t km (UK) (2) • CH_4 Emission Factor = 2.65e-5 kg CO_2e/t km (UK) (2) • N_2O Emission Factor = 0.0001 kg CO_2e/t km (UK) (2) • 80% Capacity Factor • Coal Energy Content = 27 MJ/kg (1) • Payload of standard coal train (4 locomotives with 42 wagons) is 3,150 t (3) • Estimated distance between coal mine and Munmorah is 300 km
Gas Exploration	• CO_2 Emission Factor = 2.8 t CO_2e/t of fuel flared (1) • CH_4 Emission Factor = 0.7 t CO_2e/t of fuel flared (1) • N_2O Emission Factor = 0.03 t CO_2e/t of fuel flared (1) • 1% of total gas consumed is flared during gas exploration (4) • 80% Capacity Factor • Gas Energy Content = 0.0393 GJ/m^3 (1)
Gas Processing	• CH_4 Fixed Roof Tank Emission Factor = 4.20e^{-6} t CO_2e/t of gas throughput (1) • CH_4 Leakage Emission Factor = 1.20e^{-3} t CO_2e/t of total gas throughput (1) • CO_2 Flaring Emission Factor = 2.70 t CO_2e/t of gas flared (1) • CH_4 Flaring Emission Factor = 0.10 t CO_2e/t of gas flared (1) • N_2O Flaring Emission Factor = 0.03 t CO_2e/t of gas flared (1) • 1% of total gas consumed is flared during gas processing (4) • 80% Capacity Factor • Gas Energy Content = 0.0393 GJ/m^3 (1)
Gas Transmission	• CO_2 Emission Factor = 0.02 t CO_2e/km pipeline (1) • CH_4 Emission Factor = 8.7 t CO_2e/km pipeline (1) • 80% Capacity Factor • Gas Energy Content = 0.0393 GJ/m^3 (1) • Assume gas is from SE Queensland gas supply and transmission distance Is approximately 1,000 km

NOTE:
(1) NGER (Measurement) Technical Guidelines 2009
(2). Greenhouse Gas Protocol – Mobile Freight Emission Factors 2009
(3) Email: "Fwd: train tare mass", Gordon Deans (Delta Electricity) to Graham Mackay (Aurecon), 17/08/2009
(4) Black, Stuart; "Greenhouse Gas Assumptions: Fugitive Emissions", New Zealand Ministry for Economic Development, 20 February 2008 (http://www.med.govt.nz/templates/MultipageDocumentPage____18010.aspx)

Scope 3 emissions were calculated based on NGER emission factors and compared to the 1% threshold. The results of these calculations are provided in Table 6.7. The results show that only the extraction of coal for fuel exceeds the threshold, and the exploration and processing of gas approaches the threshold value. As such, the Scope 3 emissions form the Munmorah rehabilitation project appear to be small compared to the annual Scope 1 and 2 emissions.

Table 6.7 – Scope 3 greenhouse gas emissions in terms of tCO_2e/year and the percentage of total annual Scope 1 emissions

Emission Source	100% Coal	25% Gas	50% Gas	75% Gas
Extraction of Coal	73,890 t CO_2e/yr 1.87%	56,115 t CO_2e/y 1.58%	37,939 t CO_2e/yr 1.21%	19,143 t CO_2e/yr 0.70%
Transportation of Coal	10,415 t CO_2e/yr 0.26%	7,910 t CO_2e/yr 0.22%	5,348 t CO_2e/yr 0.17%	2,698 t CO_2e/yr 0.10%
Gas Exploration	0 t CO_2e/yr 0.00%	7,351 t CO_2e/yr 0.21%	14,876 t CO_2e/yr 0.47%	22,660 t CO_2e/yr 0.82%
Gas Processing	0 t CO_2e/yr 0.00%	6,144 t CO_2e/yr 0.17%	12,433 t CO_2e/yr 0.40%	18,939 t CO_2e/yr 0.69%
Gas Transmission	0 t CO_2e/yr 0.00%	8,720 t CO_2e/yr 0.25%	8,720 t CO_2e/yr 0.28%	8,720 t CO_2e/yr 0.32%

6.2.3 Emissions from construction and decommissioning of the rehabilitation works

An assessment of the greenhouse gas emissions resulting from the construction and decommissioning of the rehabilitation works has been carried out. Within this study the Scope 1 emissions from the combustion of fuel for transportation and other machinery, Scope 2 emissions from electricity usage, as well as the lifecycle Scope 3 emissions resulting from the production of materials and plant used, have been assessed.

Direct emissions from transportation and fuel usage, as well as indirect emissions from electricity usage, have been estimated based on Aurecon experience. The estimation of life cycle emissions from the production of materials and plant is based on estimates of weights and energy equivalencies of materials used. The rehabilitation scope list provided in the SKM report (July 2009) has been used to determine the major items of plant considered in the lifecycle assessment.

Table 6.8 below shows the estimated greenhouse gas emissions resulting from the construction and decommissioning of the Munmorah rehabilitation works. It must be noted that these figures are only estimates and that detailed assessment of the emissions from construction and decommissioning cannot be made at this stage, as the required data is not available.

Table 6.8 – Estimated greenhouse gas emissions resulting from the construction and decommissioning of the Munmorah rehabilitation works

Emission Scope	Greenhouse Gas Emissions (tCO_2e)
Scope 1 – Direct Emissions from Combustion	336
Scope 2 – Indirect Emissions from Electricity Usage	2,930
Scope 3 – Lifecycle Assessment	272,926

The total Scope 1, 2 and 3 emissions account for approximately 50% of the rehabilitated Munmorah Power Station greenhouse gas emission savings in the first year of operation on a per MWh basis.

6.2.4 Impact of carbon tax

The impending introduction of the CPRS will create a \$/t of CO_2 impost on greenhouse gas emissions, which will have a significant economic impact on large emitters such as Munmorah Power Station. Aurecon has conducted a high level economic analysis of the impact of a range of possible CO_2e unit costs on the marginal cost of electricity generation.

The CPRS is expected to commence on 1 July 2011, with a one year period fixed emission cost of \$10/tCO_2e. After this first year, fully flexible price trading commences on 1 July 2012. Therefore

Aurecon has considered three different carbon costs of $10, $25 and $50 per tCO_2e in its analysis.

Table 6.9 provides details of the impact of the impost on a per MWh basis of electricity sent out by the power station.

Logically, the change in marginal cost of generation reflects the amount of greenhouse gas emissions for each case. The lower greenhouse gas emissions resulting from increased gas combustion converts to a lower change in marginal cost of electricity generation due to a "carbon tax".

The long term cost of carbon is the subject of current public debate, and an accurate estimation of this value cannot be achieved at this point in time. However, the benefit of gas combustion in terms of the impact of a "carbon tax" is clearly demonstrated.

The expected performance levels of other NSW generator's under the CPRS has also been studied. Estimated emission data for other NSW generators has been obtained from the ACIL Tasman report "Fuel resource, new entry and generation costs in the NEM" (April 2009) and includes fugitive emissions. This data has been normalized to recent 100% coal CO_2e emission estimations (with no fugitive emissions or mitigation measures considered). Table 6.10 shows the estimated change in marginal costs of electricity generation due to a "carbon tax" for NSW generators.

The results of the economic analysis show that the rehabilitated Munmorah Power Station on 100% coal will perform comparably with the best NSW generators in terms of the impact of the carbon cost on the marginal cost of electricity generation. The impact of the carbon tax on the economic performance of the plant will improve with the increased combustion of gas, replacing the use of coal.

Table 6.9 – Estimated change in marginal cost of electricity for Munmorah rehabilitation cases due to carbon tax

Cost of Carbon	100% Coal	25% Gas	50% Gas	75% Gas
$10/tCO$_2$e	+ $8.7/MWh$_{SO}$	+ $7.8/MWh$_{SO}$	+ $6.9/MWh$_{SO}$	+ $6.1/MWh$_{SO}$
$25/tCO$_2$e	+ $21.7/MWh$_{SO}$	+ $19.5/MWh$_{SO}$	+ $17.4/MWh$_{SO}$	+ $15.2/MWh$_{SO}$
$50/tCO$_2$e	+ $43.4/MWh$_{SO}$	+ $39.0/MWh$_{SO}$	+ $34.7/MWh$_{SO}$	+ $30.4/MWh$_{SO}$

Table 6.10 – Change in marginal cost of the generation of electricity for existing NSW generators (no CO_2 mitigation)

Generator	Greenhouse Intensity (tCO_2e/MWh)	$10/$tCO_2e$	$25/$tCO_2e$	$50/$tCO_2e$
Bayswater PS	0.843	+ $8.43/MWh$_{SO}$	+ $21.07/MWh$_{SO}$	+ $42.15/MWh$_{SO}$
Eraring PS	0.851	+ $8.51/MWh$_{SO}$	+ $21.29/MWh$_{SO}$	+ $42.57/MWh$_{SO}$
Liddell PS	0.920	+ $9.20/MWh$_{SO}$	+ $22.99/MWh$_{SO}$	+ $45.98/MWh$_{SO}$
Vales Point PS	0.851	+ $8.51/MWh$_{SO}$	+ $21.29/MWh$_{SO}$	+ $42.57/MWh$_{SO}$
Mt Piper PS	0.800	+ $8.00/MWh$_{SO}$	+ $20.01/MWh$_{SO}$	+ $40.02/MWh$_{SO}$
Wallerawang PS	0.894	+ $8.94/MWh$_{SO}$	+ $22.35/MWh$_{SO}$	+ $44.70/MWh$_{SO}$
Munmorah PS (Existing)	**0.988**	**+ $9.88/MWh$_{SO}$**	**+ $24.69/MWh$_{SO}$**	**+ $49.38/MWh$_{SO}$**
Munmorah PS (Predicted 100% Coal)	**0.868**	**+ $8.68/MWh$_{SO}$**	**+ $21.70/MWh$_{SO}$**	**+ $43.39/MWh$_{SO}$**
Redbank PS	1.030	+ $10.30/MWh$_{SO}$	+ $25.76/MWh$_{SO}$	+ $51.51/MWh$_{SO}$

6.2.5 Effect of mitigation measures on carbon tax marginal costs

Reducing the greenhouse emissions from the rehabilitated power station may ease the effects of a carbon tax. A number of mitigation measures to reduce greenhouse gas emissions from fossil fuel plants are recognised in the industry. These measures include fuel replacement, turbine upgrades, and many more. However, the proposed Munmorah rehabilitation involves a number of works which are considered greenhouse mitigation measures. Therefore, the assessment of mitigation measures on carbon tax marginal costs will focus on two methods of greenhouse gas reduction: carbon capture technologies and biomass co-firing.

Analysis was undertaken to determine the effect of carbon capture on the impact of the carbon tax on the marginal cost of electricity generation. See Appendix D for information on carbon capture technologies and their application to Munmorah Power Station. The predicted effects of carbon capture on the impact of the carbon tax are shown in Table 6.11 under the assumption of 1 million tCO_2 captured per year.

A separate analysis has been undertaken to determine the effect of biomass substitution for coal on the marginal increase in the cost of electricity generation due to a carbon tax. Combustion of biomass is considered carbon neutral as the biomass absorbs carbon during its lifetime. A number of options for co-firing biomass are possible, including direct injection into pulverised fuel pipes prior to existing burners, injection into dedicated mills and burners, biomass gasification, and combustion in an auxiliary boiler. However, this study has assumed that the biomass is fed into the plant's existing pulverisers and burners, in substitution for coal.

Two options were considered, 10% and 20% biomass co-firing (based on the 100% coal case), which corresponds to a reduction in CO_2 emissions of 10% and 20% respectively. The impact of the carbon tax, with biomass co-firing, is shown in Table 6.12 below.

Table 6.11 – Estimated change in marginal cost of electricity for Munmorah rehabilitation cases due to carbon tax with biomass co-firing

Cost of Carbon	10% Biomass	20% Biomass
$10/tCO$_2$e	+ \$7.81/MWh$_{SO}$	+ \$6.94/MWh$_{SO}$
$25/tCO$_2$e	+ \$19.53/MWh$_{SO}$	+ \$17.36/MWh$_{SO}$
$50/tCO$_2$e	+ \$39.05/MWh$_{SO}$	+ \$34.71/MWh$_{SO}$

It is clear from Table 6.11 and Table 6.12 that the viability of carbon capture or biomass co-firing depends largely on the size of the carbon tax at a given time and the level of CO_2 mitigation achieved. It must be made clear that the long term economic viability of these options relies on fuel and construction costs and that the figures in the Table 6.11 and 6.12 relate to the carbon tax only.

6.2.6 Contribution to national greenhouse gas emissions

The annual greenhouse emissions from the proposed Munmorah rehabilitation have been compared to the total Australian emission projections according to *Tracking to the Kyoto Target (2007*) released by the Commonwealth Governments Department of Climate Change. The report provides projected data for the years 1990, 2010 and 2020. This data has been linearly interpolated and projected to provide annual national emission data over the operating life of the proposed rehabilitation.

Table 6.12 – Estimated change in marginal cost of electricity for Munmorah rehabilitation cases due to carbon tax with carbon capture

Cost of Carbon	100% Coal	25% Gas	50% Gas	75% Gas
$10/tCO$_2$e	+ \$7.07/MWh$_{SO}$	+ \$6.12/MWh$_{SO}$	+ \$5.19/MWh$_{SO}$	+ \$4.26/MWh$_{SO}$
$25/tCO$_2$e	+ \$17.67/MWh$_{SO}$	+ \$15.29/MWh$_{SO}$	+ \$12.97/MWh$_{SO}$	+ \$10.65/MWh$_{SO}$
$50/tCO$_2$e	+ \$35.34/MWh$_{SO}$	+ \$30.58/MWh$_{SO}$	+ \$25.94/MWh$_{SO}$	+ \$21.31/MWh$_{SO}$

The *Tracking to the Kyoto Target (2007)* report projects emissions under two separate assumptions: "business as usual (BAU)" in which no measures are taken to reduce greenhouse gas emissions, and a case in which measures are taken to reduce emissions. The "measures taken" projections have been used in this study to provide a conservative estimate of the percentage contribution to total national greenhouse gas emissions (Table 6.13). It has been assumed that the 20 year operational life of the rehabilitated plant begins in 2010.

If total national greenhouse gas emissions increase as expected, the percentage contribution of the Munmorah Units to total national emissions will decrease as long as the emissions from the Munmorah units remain steady.

Table 6.13 – Contribution of Munmorah rehabilitation to total Australian greenhouse gas emissions (two Units)

	Year	100% Coal	25% Gas	50% Gas	75% Gas
Munmorah Contribution to Total Australian Emissions	2010	0.68%	0.61%	0.54%	0.47%
	2030	0.55%	0.50%	0.44%	0.39%

6.3 Carbon Capture Readiness

Carbon dioxide capture and storage (CCS) is considered to be a key climate change mitigation option for the future and as a result there is significant research and development effort focusing on the development of CCS technologies. To avoid the undesirable outcome that all new coal fired plants continue to operate at the same CO_2 emissions intensity value for their lifetimes, there is a current trend to build 'capture ready" plant. Therefore as legislation changes, CCS technology improves or there is a financial benefit in operating CCS, the carbon capture facilities may be retrofitted.

At present there is no universal definition of what carbon capture ready means, however for the purposes of this Environmental Assessment the International Energy Agency (2007) definition has been assumed. The definition is as follows:

- *"It is one which can include CO_2 capture when necessary regulatory or economic drivers are in place"*
- *"Developers of capture ready plant should take responsibility for ensuring that all known factors in their control that would prevent installation and operation of CO_2 capture have been identified and eliminated. This might include:*
  - *A study of options for CO_2 capture retrofit and potential pre-investments*
  - *Inclusion of sufficient space and access for additional facilities that may be required*
  - *Identification of reasonable route(s) to storage of CO_2."*

As part of the technical studies undertaken for the Munmorah rehabilitation Environmental Assessment, Aurecon investigated the requirements necessary to make the rehabilitated Munmorah Units 3 and 4 "Carbon Capture Ready". This review is available in Appendix D and includes:

- a review of carbon capture technologies and the current status of these technologies
- as post combustion carbon capture technologies are the most suitable for retrofit to existing power plants a more in-depth review of these technologies was undertaken
- a preliminary investigation on modifications required for future carbon capture at Munmorah Power Station
- a brief comment on work currently being undertaken on geological storage within NSW.

6.4 Conclusions

Australia's greenhouse gas emissions are projected to reach 599 Mt CO_{2e} annually over 2008-12, which is 108% of the 1990 level. The new projection is slightly lower than the previous projection of 109% of the 1990 level. The Federal, State and local governments have implemented a range of policies and programs to address the expected increases in emissions and the combined effect of the Governments efforts and actions taken by business, like Delta Electricity, is expected to cut annual emissions by 88 Mt CO_{2e} per

annum over the Kyoto target period (2008-2012) (DEC, 2007)

When comparing the predicted future greenhouse gas emissions from the proposed Munmorah coal/gas firing scenarios with calculated emissions using operational data from 13 December 2006 (100% coal), it is estimated that 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 in this chapter. Numerous technologies for carbon capture are currently available and feasible under specific conditions; however there are a number of critical factors that will 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 Industry 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.