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Sydney CityGrid Project
Concept Application

Belmore Park Zone Substation Project
Project Application

April 2008

Document Control and Approval

PlanCom Consulting Pty Ltd

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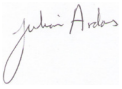
Signed:	
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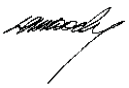
Signed:	
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Concept Application for Sydney CityGrid Project and

Project Application for Belmore Park Zone Substation

April 2008

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Abbreviations and Glossary

Term	Definition
Acoustic enclosure	An enclosure or building designed to minimise noise
Adit	An almost horizontal entrance to a tunnel
Alluvium	Sediment deposited by flowing water, as in a riverbed, flood plain, or delta.
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
Belmore Park Zone Substation	Belmore Park Zone Substation Project – an element of the Sydney CityGrid Project
Belmore Park site	The proposed site for the Belmore Park Zone Substation.
CBD	Central Business District
CCT	Cross City Tunnel
CECT	City East Cable Tunnel
City East Zone Substation	City East Zone Substation – an element of the Sydney CityGrid Project.
CSCT Extension	City South Cable Tunnel Extension
CWCT	City West Cable Tunnel
Electric fields	Electric fields are produced by voltage and increase in strength as the voltage increases. The electric field strength is measured in units of volts per metre (V/m).
EMF	Electric and magnetic fields (see electric fields and magnetic fields)
EAR	Environmental Assessment Report
EP&A Act	NSW Environmental Planning and Assessment Act 1979
ESAA	Energy Supply Association of Australia
ESR	Eastern Suburbs Railway
Feeders	Three individual electrical transmission cables (phases) bundled together make up a feeder.
FSR	Floor Space Ratio
GIT	Gas Insulated Transformers
GFA	Gross Floor Area
kV	Kilovolts or 1,000 volts. A measure of the strength of an electrical source.

Term	Definition
Magnetic field	Magnetic fields result from the flow of current through wires or electrical devices and increase in strength as the current increases. Magnetic fields are measures in gauss (G) or tesla (T).
mG	milligauss
MREP	Metropolitan Rail Expansion Programme
MVA	Mega Volt-Amps, or 1 Million Volt-Amps. A measure of electrical energy.
n-2 licence conditions	Design, Reliability & Performance Licensing Conditions by the Minister for Energy for the Sydney CBD by 2014
NHMRC	National Health and Medical Research Council
Project	Sydney CityGrid Project
Riley Street site	The proposed site at the corner of Riley and Albion Streets where the tunnel construction site set up would be located and, in its final form, where the STSS and CECT control room/access point could be established.
RL	Relative Level
Roadheader	Mechanical excavating machines that have a large rotating cutting head mounted on a moveable boom. They are able to turn tight corners during tunnel construction.
SEPP	State Environmental Planning Policy
SF6	Sulphur hexafluoride
Sydney CityGrid Project	New and/or refurbished substations in the Sydney CBD and a tunnel network for 132kV cables.
SREP	Sydney Regional Environmental Plan
Stub tunnel	A short section of tunnel which links to a main tunnel
STS	A sub-transmission substation – generally 132kV to 33kV (with transformers)
STSS	A sub-transmission switching station – generally 132kV (without transformers)
TBM	Tunnel Boring Machine
VENM	Virgin Excavated Natural Material
Zone Substation	A zone substation at 132kV/11kV or 33kV/11kV supplying the 11kV distribution network (with transformers)

Executive summary

Introduction

On 11 February 2008 the Minister for Planning declared that the EnergyAustralia Sydney CityGrid Project (Project) be a project to which Part 3A of the Environmental Planning and Assessment Act (EP&A Act) applies.

This document:

- Supports a Concept Application for the Project, an application under Section 75M of the EP&A Act, for the Sydney CityGrid Project under Part 3A of the EP&A Act;
- Supports a Project Application, an application under Section 75E of the EP&A Act for Ministerial approval (being a part application under Section 75E(4) of the EP&A Act), to carry out the proposed Belmore Park Zone Substation and commercial/retail development under Part 3A of the EP&A Act;
- For the purposes of the Concept Application and the Project Application, describes the Project, identifies its likely environmental impacts and the mitigation measures proposed to be adopted; and
- Seeks environmental assessment requirements for the Project under Section 75F(3) for the purposes of any environmental assessment, which may be required under Sections 75F(5) and 75H(1).

The proposed Project

The Project components include the following proposals:

- **Sydney CityGrid Project Concept Application**

New and/or refurbished substations in the Sydney CBD and a tunnel network for 132kV cables, comprising:-

1. Extension to the existing City South Cable Tunnel from Wade Place to Riley Street, Surry Hills (approximately 150m);
2. Stub tunnel connection from the existing City South Cable Tunnel (nominally 20m below Campbell Street) to Belmore Park Zone Substation;
3. Belmore Park Zone Substation, encompassing commercial/retail development (at the corner of Pitt, Hay and Campbell Streets);
4. City East Cable Tunnel (approximately 3.2km) from Riley Street, Surry Hills to Erskine Street, City North, inclusive of potential ventilation shaft and services at a midway along the alignment;
5. City East Zone Substation, potentially encompassing commercial/retail development (at a site yet to be determined);
6. New Sub-transmission Switching Station (STSS) at Riley Street, Surry Hills, and potentially a tunnel services control and access to the City East Cable Tunnel (in the alternative the control and access would be located at a midway point along the tunnel alignment); and
7. Potential refurbishment or replacement of the existing Dalley Street Zone Substation or building at a nearby site (including possible use of 183-185 Clarence Street as a switching station).

- **Belmore Park Zone Substation Project Application**

A new substation located at the corner of Pitt, Hay and Campbell Streets and 132kV cables via a tunnel connection, comprising:

1. Belmore Park Zone Substation, encompassing commercial/retail development; and
2. Stub tunnel connection from the existing City South Cable Tunnel (nominally 20m below Campbell Street) to Belmore Park Zone Substation.

Key environmental aspects for further consideration

The preliminary environmental assessment indicates that the following aspects would require detailed consideration as part of the environmental assessment of the Project:

- Design review;
- Electric & magnetic fields (EMF);
- Traffic and access;
- Noise and vibration;
- Surface and groundwater management
- Heritage and archaeology;
- Greenhouse gas and air quality;
- Property (including settlement); and
- Spoil management.

The environmental assessment of these aspects would form the focus of the Environmental Assessment Report. A draft Statement of Commitments would be prepared to describe how these aspects would be managed through the implementation of the Project.

The preliminary environmental assessment suggests that the following aspects are unlikely to significantly affect the environment and could be readily managed through mitigation measures:

- Amenity;
- Socio-economics;
- Health, safety, risk and hazards;
- Cumulative impacts; and
- Demand management.

These aspects are proposed to be addressed and managed through the Statement of Commitments and Conditions of Approval.

1 Introduction

1.1 Purpose and scope of this document

By order dated 11 February 2008 made under Section 75B(1) of the EP&A Act, the Minister for Planning declared that the development described below is a project to which Part 3A of the EP&A Act applies:

'Development by EnergyAustralia for the purposes of upgrading the electricity supply network in the Sydney Central Business District (known as the 'Sydney CityGrid Project'), located within the City of Sydney local government area, and involving:

1. *construction and operation of up to three new zone substations (including, as necessary, the demolition and/or refurbishment of existing zone substations, and the construction and use of commercial and/or retail developments on, adjacent to, or integrated with, the new zone substations);*
2. *the refurbishment and augmentation of existing zone substations;*
3. *replacement of, and upgrades to, EnergyAustralia's existing high voltage cable network;*
4. *the construction and use of tunnels for the installation and operation of high voltage cables and associated cables, and other infrastructure; and*
5. *the construction, operation and use of associated works, including ventilation shafts and access structures,*

generally in the locations, or following the route, shown on the indicative map prepared by EnergyAustralia dated December 2007 and titled 'Sydney CityGrid Project'

(NSW Government Gazette No. 21, page 1168, 22 February 2008)

This document:

- Supports a Concept Application for the Project, an application under Section 75M of the EP&A Act, for the Sydney CityGrid Project under Part 3A of the EP&A Act;
- Supports a Project Application, an application under Section 75E of the EP&A Act for Ministerial approval (being a part application under Section 75E(4) of the EP&A Act), to carry out the proposed Belmore Park Zone Substation and commercial/retail development under Part 3A of the EP&A Act;
- For the purposes of the Concept Application and the Project Application, describes the Project, identifies its likely environmental impacts and the mitigation measures proposed to be adopted; and
- Seeks environmental assessment requirements for the Project under Section 75F(3) for the purposes of any environmental assessment, which may be required under Sections 75F(5) and 75H(1).

1.2 Background to Project

EnergyAustralia is responsible for Australia's largest electricity network serving Sydney, the Central Coast and the Hunter region. Between 2008 and 2020, EnergyAustralia is investing in the order of $16 billion in its network to meet increasing electricity demand and further enhance the high levels of supply and reliability customers have enjoyed. This investment involves maintaining and replacing existing infrastructure and building additional capacity to support new developments.

During the next decade EnergyAustralia must augment and replace infrastructure which is due for retirement in the Sydney CBD and the inner metropolitan area in order to comply with new licensing requirements. The requirements specify that all CBD substations achieve "n-2" (Design, Reliability & Performance Licensing Conditions by the Minister for Energy) by 2014.

EnergyAustralia's strategy for the Sydney CBD network area is in accordance with these requirements and is based on a holistic approach to network planning, taking into account relevant planning criteria, asset replacement requirements, network reliability standards and anticipated longer term network needs. It seeks to meet network needs in a cost effective manner, while facilitating prudent longer term network investment decisions.

In order to provide a reliable supply for the Sydney CBD EnergyAustralia must between 2008 and 2020, and beyond:

- Carry out the construction of new, or upgrade and refurbish existing, zone substations; and
- Carry out replacement of high voltage cables supplying the CBD zone substations.

1.3 EnergyAustralia (The Proponent)

EnergyAustralia is a statutory state-owned corporation owned by the NSW Government, and constituted under the NSW Energy Services Corporations Act 1995 as an energy distributor. Its distribution network is used to convey electricity from the transmission network operated by TransGrid to end users.

EnergyAustralia is a public authority under the EP&A Act.

1.4 Key environmental aspects

The following key environmental aspects have been identified:

- Design review;
- EMF;
- Traffic and access;
- Noise and vibration;
- Surface and groundwater management;
- Heritage and archaeology;
- Greenhouse gas and air quality;
- Property (including settlement); and
- Spoil management.

It is proposed that the Environmental Assessment Report (EAR) required under Section 75H of the EP&A Act would consider these key aspects.

The preliminary environmental assessment is presented in Section 5.

1.5 Study area

The study area is in the Sydney Central Business District (CBD) and outlined in Appendix A.

All work associated within the Sydney CityGrid Project is within the City of Sydney Local Government Area.

2 Project appreciation

2.1 Project summary

Peak electricity demand in the Sydney CBD is growing at an average rate of 1.7% per annum driven primarily by new residential, hotel and office developments.

EnergyAustralia, over the next 10 years, needs to construct new, or upgrade and refurbish existing, zone substations and replace high voltage cables supplying the substations in order to:

- Meet n-2 licence conditions;
- Cater for future demand and introduce new technologies that are likely to reduce electricity 'losses' by reducing the resistance of the electricity network; and
- Ensure timely replacement of infrastructure which is due for retirement to maintain a reliable supply of electricity for the CBD.

Building works would include the construction of up to three zone substations (including, if necessary, the demolition and/or refurbishment of existing zone substations and would most likely include integrated commercial/retail developments on or in conjunction with the zone substations). The Project also involves the construction of up to three new tunnel sections in the Sydney CBD, and the city fringes, which would 'link' the existing tunnel networks and key zone substations servicing the city together.

2.2 Project components

2.2.1 Sydney CityGrid Project Concept Application

New and/or refurbished substations in the Sydney CBD and a tunnel network for 132kV cables comprising:-

1. Extension to the existing City South Cable Tunnel from Wade Place to Riley Street, Surry Hills (approximately 150m);
2. Stub tunnel connection from the existing City South Cable Tunnel (nominally 20m below Campbell Street) to Belmore Park Zone Substation;
3. Belmore Park Zone Substation, encompassing commercial/retail development (at the corner of Pitt, Hay and Campbell Streets);
4. City East Cable Tunnel (approximately 3.2km) from Riley Street, Surry Hills to Erskine Street, City North, inclusive of potential ventilation shaft and services at a midway point along the alignment;
5. City East Zone Substation, potentially encompassing commercial/retail development (at a site yet to be determined);
6. New Sub-transmission Switching Station (STSS) at Riley Street, Surry Hills, and potentially a tunnel services control and access to the City East Cable Tunnel (in the alternative the control and access would be located at a midway point along the tunnel alignment); and
7. Potential refurbishment or replacement of the existing Dalley Street Zone Substation or building at a nearby site (including possible use of 183-185 Clarence Street as a switching station).

2.2.2 Belmore Park Zone Substation Project Application

1. Belmore Park Zone Substation, encompassing commercial/retail development (at the corner of Pitt, Hay and Campbell Streets); and
2. Stub tunnel connection from the existing City South Cable Tunnel (nominally 20m below Campbell Street) to Belmore Park Zone Substation.

Figure 1 – Belmore Park Zone Substation locality

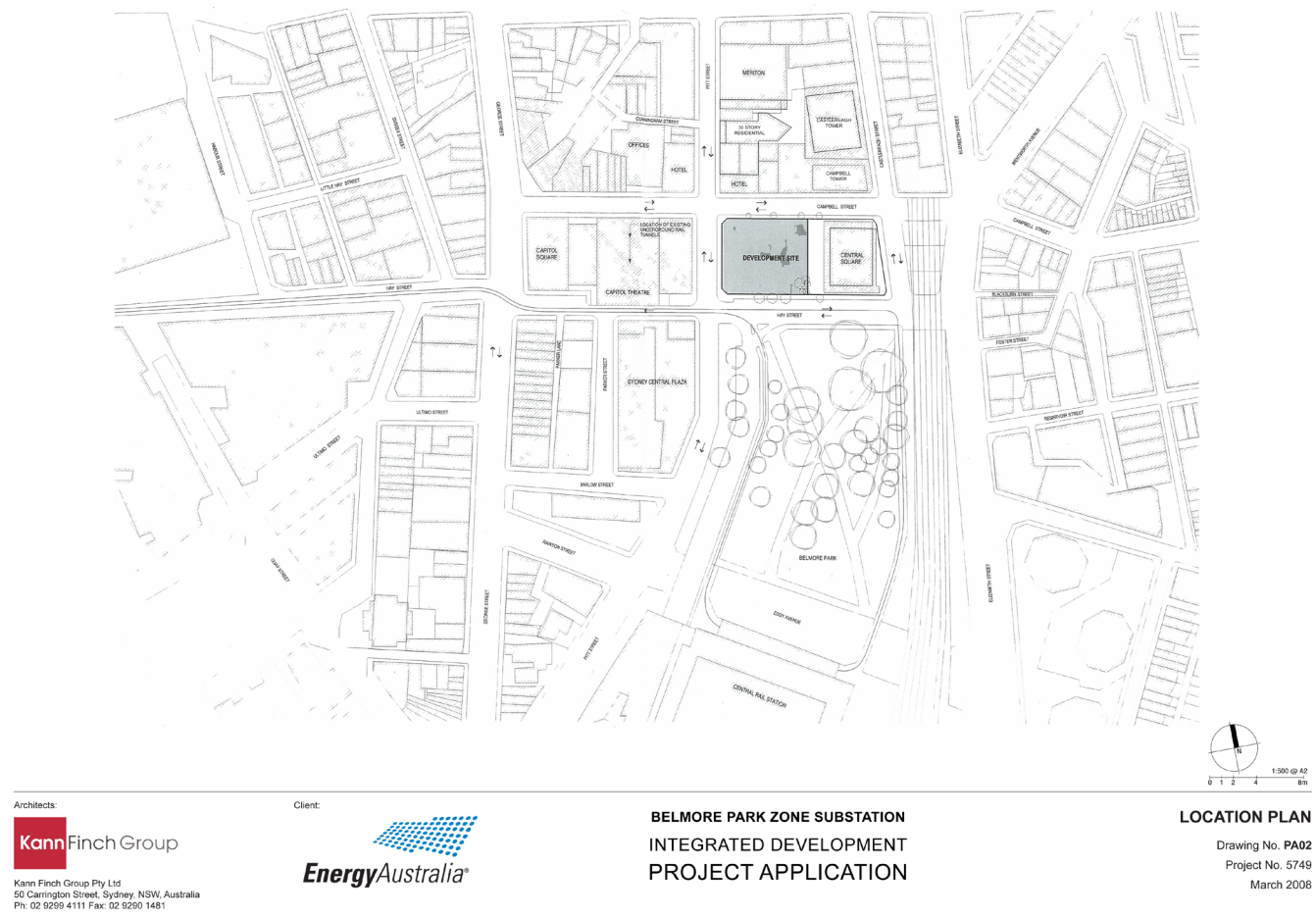


Figure 1 - Belmore Park Zone Substation locality

2.3 Strategic need

The main electricity supply to the Sydney CBD is through five zone substations and a network of 33kV and some 132kV feeders. The zone substations range in age from three years to more than 50 years. The older zone substations must be replaced between 2012 and 2017.

Many of the high voltage feeders were installed more than 45 years ago while others were installed between 30 and 40 years ago. A recent condition assessment prepared by EnergyAustralia indicates that a number of critical feeders must be replaced by 2015. In order to find a flexible and long term solution to increasing electricity demand, (and in order to minimise disruptions that can occur during extended maintenance), EnergyAustralia is proposing to construct a series of tunnels forming a circuit around the Sydney CBD (linking with the existing City South Cable Tunnel and the City West Cable Tunnel, currently being constructed).

The land required for the construction of the new substations within the CBD is scarce and, correspondingly, has high financial and public/planning value. In order to maximise the appropriate use of such land and in the interests of the proposed works being complementary to their CBD surroundings, EnergyAustralia is considering constructing the new substations such that appropriate commercial and/or retail developments can be integrated into or constructed on or adjacent to those substations. EnergyAustralia is carrying out feasibility studies giving consideration to how such commercial and/or retail developments could align with the construction and operation of the proposed new substations. Subject to those studies, mixed developments of this nature may allow for optimum public benefits for the land.

City East Zone Substation, located at the northern end of Lincoln Crescent Woolloomooloo, was commissioned in the 1960s and is approaching time for retirement. A recent condition assessment of the substation recommended that the majority of the equipment should be replaced in the next 5 to 10 years.

After the decommissioning of the existing City North Zone Substation, City East Zone Substation would be the last 33kV/11kV style CBD substation still in service. This style of substation is no longer used. The new 132kV/11kV style substations provide a higher level of capacity. It is anticipated that the older style 33kV/11kV substations would remain in service until such time that the 11kV transfer work is complete. The 11kV work is assessed and carried out under the Electricity Supply Act 1995 (NSW), and Part 5 of the EP&A Act, and is not subject to this planning application.

EnergyAustralia has purchased land next to Belmore Park on the corner of Pitt, Campbell and Hay Streets Sydney to construct a new 132kV to 11kV substation. This substation to be known as Belmore Park Zone Substation is required by 2012.

2.4 Alternatives considered

2.4.1 Doing nothing

EnergyAustralia has a duty of care as an asset manager of long-life assets, and it must manage its network to ensure that assets continue to operate in the manner for which they are designed. Where assets fail to perform as required, EnergyAustralia asset managers implement a strategy to address the risk of asset failure and ensure adequate network performance.

Demand growth, asset condition and operational issues influence EnergyAustralia's investment decisions. Where there is more than one driver for an investment, EnergyAustralia seeks to implement investment management strategies that address a variety of network needs to ensure that the replacement programmes, demand management initiatives and augmentation projects complement each other as much as possible.

The consequences of not proceeding with the Project would ultimately result in:

- EnergyAustralia being unable to meet n-2 licence conditions;
- Demand for electricity increasing without sufficient existing supply capabilities, and
- Reliability issues in the supply of electricity for the Sydney CBD.

2.4.2 Refurbishing existing substations without the need for more substations

Refurbishment of existing substations is not always possible due to the risk difficulties both in operating and maintaining supply. Work in live substation is restrictive causing the introduction of a number of safety features that could impede or slow down the efficient and effective nature of any planned works. In some instances, it can be seen to be "high risk" from both a safety and supply reliability perspective. Where possible (although not always practicable) EnergyAustralia prefers to build on greenfield sites, where there is less danger of:

i) risk to life; and

ii) risk to supply.

2.4.3 Using existing cables or replacing cables by trenching in roads

Replacing cables by trenching in the streets is not considered an option for the Project as there are many disadvantages, particularly in a major built up city environment, these include:

i) lengthy construction time;

ii) restricted cable rating;

iii) reduced potential for future expansion;

iv) restricted cables pulling lengths;

v) more joints in the cables (introduces more risk of failure);

vi) restricted working hours;

vii) trench reinstatement and integrity;

viii) traffic disruption;

ix) density of other services;

x) pedestrian, business and community disruption; and

xi) construction of large vaults in the city streets.

2.4.4 Belmore Park Zone Substation

EnergyAustralia had been progressing the purchase of a site in the south and the east of the Sydney CBD when an opportunity arose to purchase land opposite Belmore Park. Because the existing 132kV infrastructure is located in close proximity, under Campbell Street, in the form of the City South Cable Tunnel (reducing the cost of extensive 132kV supply), other options were not progressed and meaningful negotiations took place to secure the site.

Investigations for development were undertaken into the following three categories:

1. Standalone substation;
2. Substation and separate commercial/retail development; and
3. Integrated substation and commercial/retail development.

The investigations identified eleven options for assessment and considered opportunities for maximising returns, whilst ensuring the timely delivery of a CBD zone style substation. The findings were as follows:

The investigation which maximised usage of the residual land value by integrating the zone substation into a commercial/retail development found that the use of the permissible floor space above the substation would technically be achievable and would provide the best return on residual land value.

The integrated option was chosen as the preferred option.

A critical consideration is that the zone substation must be operational by 2012 whereas the integrated commercial/retail developments could be staged subject to market requirements.

2.4.5 Tunnel options

A preliminary geotechnical study and options assessment of potential tunnel route alignments for the City East Cable Tunnel (CECT) and City South Cable Tunnel Extension resulted in the development of alignment options described generally as follows:

1. Option 1 – Riley Street Alignment;
2. Option 2 –Yurong Street Alignment; and
3. Option 3 – Bridge Street Alignment.

Further feasibility analysis of these options is currently being undertaken to determine likely constraints, and to assess risks and operational requirements associated with each alignment option.

A number of constraints have been taken into account to date in assessing the preliminary horizontal and vertical tunnel alignments. Constraints primarily arise from the locations and depths of existing and proposed road and rail tunnels, and the practicalities and limitations associated with modern tunnelling techniques.

Preliminary investigations indicate that geological conditions give rise to constraints on vertical and horizontal alignments in the following two areas:

- Sydney Cove and Tank Stream fill and alluvial deposits in the area of the Dalley Street Substation; and
- Alluvium within the Woolloomooloo Palleovalley in the vicinity of Yurong Street and Sir John Young Crescent.

The proposed tunnel routes considered to date are approximately 3.2km in length and range in depth from approximately 10 to 70 metres below existing ground level.

In general, the tunnels would be located beneath existing road alignments, parkland and private residential and commercial properties. EnergyAustralia would acquire an underground stratum easement for the tunnels, including a distance approximately three to four metres around the tunnels to protect them from future development.

Where the tunnel alignment interfaces with an existing building it is considered that this would have minimal impact due to:

i) the distance to the building's foundations;

ii) the type of tunnel construction (Tunnel Boring Machine (TBM) with concrete segmental lining); and

iii) the quality of the rock being excavated.

These aspects will be discussed in greater detail in the Environmental Assessment Report (EAR).

2.5 Key aspects of the Project

2.5.1 Belmore Park Zone Substation

A zone substation integrated with a commercial/retail development is proposed on the corner of Pitt, Campbell and Hay Streets Sydney with the critical element being the completion of the substation by 2012.

One of the primary objectives for this integrated development is for it to be designed to allow for continuous operation and maintenance of the zone substation unimpeded by other activities that may be occurring within the remainder of the development.

The proposed substation layout allows the residual space above the substation to be used for commercial/ retail development. The gas insulated transformers are proposed to be configured in a single row along the eastern site boundary, with an additional level on top of the substation to accommodate sealed radiators for cooling the transformers. The use of the remaining space above the substation is proposed for commercial development.

In order to minimise the required basement depths for the zone substation and in order to optimise the retail areas at street level, the zone substation basement would undercut the ground level commercial/retail development.

Depending upon projected market demand for the commercial/retail development, the construction of this component may need to be staged. If required, short term land use options would be developed for the surplus site area. For example, an interim land use option for the residual land could be to operate a commercial carpark to ground level, similar to the site's current use.

It is further anticipated that any staged option would include bulk excavation of the entire site with basement floors constructed to at least ground level. This would negate the need for:

i) two separate bulk excavation contractors;

ii) hoarding to remain around the perimeter of the commercial/retail development; and

iii) separate costly earthing requirements.

It is proposed to integrate the substation with an 'A' grade 5 Star Green Star office, which in itself has the potential to enhance the aesthetics of the area.

Plans of the proposed Belmore Park Zone Substation and integrated development are shown in Appendix B.

2.5.2 Tunnel alignment

The tunnel components of the Project include:

- The City East Cable Tunnel (CECT);
- The City South Cable Tunnel Extension (CSCT Extension); and
- A stub tunnel connection of approximately 12m between the existing City South Cable Tunnel and the proposed Belmore Park Zone Substation.

Indicative alignments of the tunnels are provided in Appendix A.

It is proposed that the CECT would be constructed, between the Riley Street, STSS and City North Substations, with connections to the proposed new City East and Dalley Street Substations, and potentially for a new services shaft and control room facility along the tunnel alignment, if required.

It is proposed that the CSCT Extension be constructed between the existing Surry Hills shaft and the Riley Street STSS site, generally beneath the alignment of Little Albion Street. Other interface works in and around Little Albion Street would also be required.

The Riley Street STSS site would be used as the primary construction site for both the CECT and CSCT Extension. It is anticipated that the CECT would be constructed using a TBM, whereas the CSCT Extension and Belmore Park stub tunnel connection would be constructed using a roadheader.

It is envisaged that most, if not all, of the tunnelling works would need to be complete at the Riley Street site, prior to commencing construction of the STSS. However, options are being considered for staging both the tunnelling and the STSS works at the site concurrently.

The tunnels would be primarily constructed within Hawkesbury Sandstone, although Ashfield Shale and beds of Mittagong Formation may be expected in the uppermost parts of the profile, particularly to the south of Oxford Street.

Reclaimed land is known to be present in the Circular Quay area. The fill material is expected to be water bearing and overlying unconsolidated alluvial sediments and sandstone bedrock. Fill also overlies parts of the Woolloomooloo Paleovalley and shallow fill occurs in parts of the Domain and Farm Cove.

Major geological features that may impact upon tunnelling include:

1. The GPO and Woolloomooloo Fault Zones;
2. Dykes: Pittman LIV (between Dalley and Bridge Streets); Oxford Street Dyke (southern side of Oxford Street) and the Great Sydney Dyke (beneath Albion Street)
3. Martin Place Joint Swarm; and
4. Low Angle Bedding Shears (found in the vicinity of all three abovementioned features).

The following guidelines were adopted in developing the preliminary alignments:

- To locate the tunnels beneath existing road easements as much as is practicable;
- To connect the tunnel/s to the existing Surry Hills sub-transmission substation (STS), Dalley Street and City North Zones Substations, and to the proposed zone substations at, new City East and Belmore Park including the proposed STSS at Riley Street;
- A minimum vertical clearance to other tunnel structures of 3m where the tunnels are to be excavated in slightly weathered and fresh sandstone and laminate;
- To provide required clearances to existing buildings along or adjacent to the tunnel alignments;
- To provide a minimum plan radius of 350m for changes in the tunnel alignment; and
- To limit the maximum tunnel grade to 3% to facilitate efficient TBM excavation and spoil removal.

Notwithstanding the guidelines, the proposed tunnel alignments do pass beneath or adjacent to several existing properties. The impacts upon specific building foundations would require assessment on a case-by-case basis. Refer also to Section 2.4.5.

2.5.3 Tunnel excavation

It is envisaged the principal access location for constructing the tunnel would be at a large, vacant site located on the corner of Riley and Albion Streets. It is probable that construction activities at this site would include spoil removal, tunnel ventilation and launching the tunnel boring machine. It is envisaged that the timing of construction activities at this site would be between 2010 and 2014. Measures to manage construction impacts would be investigated as part of the environmental assessment and at the detailed design stage.

2.5.4 City East Zone Substation

A new City East Zone Substation is also required to be constructed which may include an integrated commercial/retail development. The specific site is still to be confirmed. A detailed environmental assessment in support of a separate project application will be submitted to the Department of Planning at a later date.

The CECT would be designed to allow for the connection of five 132kV feeders at new City East, emanating from the Riley Street STSS. Similarly, the City East connection must also allow for the installation of the four 132kV feeders that would run between the new City East and Dalley Street zone substations.

2.5.5 Dalley Street Zone Substation

Dalley Street Zone Substation was commissioned in 1969 and is an important asset feeding the northern end of the CBD. Presently, supply is fed via four oil-filled cables (feeders) running from Lane Cove. When these feeders were installed in the 1960s, they were the major supply route to the CBD and Eastern suburbs.

Two of the four cables between Lane Cove and Dalley Street are now in a condition requiring replacement or retirement by 2012. The remaining circuits have been prioritised for retirement by 2017. Therefore, refurbishment or replacement of the existing zone substation must be achieved to support new feeders emanating from new City East Zone Substation.

2.5.6 Riley Street Sub-transmission Switching Station

A new sub-transmission switching station (STSS) is required at Riley Street, Surry Hills by 2015/16. The STSS would be established to provide a connection of the Eastern CBD load and the 132kV supply to the Eastern Suburbs but more importantly provide 132kV connections for a future bulk supply point, post 2020.

2.6 Potential interfaces

2.6.1 Cross City Tunnel

The Cross City Tunnel (CCT) comprises two main east to west tunnels and a number of on and off ramp tunnels in the vicinity of Riley/Crown/Yurong Streets, and a ventilation tunnel that lies below all of those features.

It is not considered viable to thread the CECT between the CCT at Riley Street hence the CECT would have to pass below the CCT (ventilation tunnel). A 3m clearance between the crown of an indicative 3.8m diameter tunnel and the ventilation tunnel means the invert of the CECT would be at about RL-49.5m. This is about 62m below William Street.

At Yurong Street, the CCT is deeper and more spread out. The crown of the shallowest tunnel is at about RL-5.5m with the ground surface at about RL+13.5m. The invert of the lowest CCT (ventilation tunnel) is at about RL-44.5m. If the CECT were to be located below the CCT (ventilation tunnel) the invert of the CECT would be at about RL-51.6m. This is a depth of about 65m below William Street.

Based on preliminary investigations and to avoid these excessive depths, it is considered feasible to align the CECT over the top of the CCT, with an invert at about RL+0.5m. A CECT at this level would probably have up to 2m of sandstone rock above the crown of an indicative 3.8m diameter tunnel with a further 7.5m of weaker sandstone and residual/fill soils above this. The most significant vertical gap between the tunnels at this location is about 12.5m, a distance which does not take into account rock bolt support of the CCT which is expected to reduce the gap to about to about 6/6.5m. This may allow the CECT to pass between these tunnels with an invert at about RL-33.3m.

In the vicinity of Crown Street, the CCT is spread out from near surface to a depth of about 55 metres with the largest vertical separation being about 7 to 7.5 metres. The ground surface at this location is at about RL+15m. At this location the CECT would pass below the CCT (ventilation tunnel) with the invert at about RL-47.5m.

2.6.2 Proposed Anzac Line

The preliminary information obtained on the proposed Anzac Line rail tunnel alignment indicates that these tunnels may have an invert at about RL-21m at Bent/O'Connell Streets and about RL-7.7m at Wynyard Station/ Kent Street.

The depth of the Anzac Line at O'Connell Street controls the depth of the CECT in the vicinity of the Dalley Street Zone Substation for the Riley Street and Yurong Street alignments.

2.6.3 MetroWest

Preliminary information regarding the proposed MetroWest tunnels indicates that they could be at about RL–5m where they pass beneath York and Grosvenor Streets.

Furthermore, it should be noted that the Metropolitan Rail Expansion Programme (MREP) is considering a wide variety of routes and the final alignment has not been confirmed at this time.

2.6.4 City Circle Rail Line

Near the intersection of Grosvenor and York Streets the inverts of the tunnels are at about RL+5.8m whereas below the State Library the invert of the tunnels are at about RL+11m.

2.6.5 Eastern Suburbs Rail Line

In the vicinity of Art Gallery Road, where the proposed CECT alignments cross the Eastern Suburbs Rail Line, the inverts of the rail tunnels are between about RL+6.6m and RL+8.7m.

2.6.6 Dalley Street Telstra Cable Tunnel

The tunnel invert is at about RL-8.5m along Dalley Street, and nominally 14.5m below the corner of Pitt and Dalley Streets.

2.6.7 Tank Stream

The Tank Stream at Dalley Street is located above the level of the Telstra Cable tunnel

2.6.8 EnergyAustralia interfaces

Little Albion Street interface

Existing feeders that enter the Surry Hills STS Annex Building from Little Albion Street would ultimately be cut, jointed and extended to the Riley Street STSS through the CSCT Extension.

Services shaft and control room

An intermediate permanent shaft may be required along the tunnel alignment for the purpose of installing ventilation equipment, and for housing the permanent control room for the CECT.

Potential locations for this facility have been identified on Sir John Young Crescent, immediately opposite the existing Domain Carpark and on the southern side of St Mary's Road near Yurong Parkway. However alternative locations for this facility would also be considered including the Riley Street STSS site.

City East Zone Substation interface

Planning and feasibility studies in regard to the construction of a new City East Zone Substation are underway and an area in the northern CBD, in the general vicinity of Bent Street is considered to be a favourable location.

The CECT would be designed to allow for the connection of five 132kV feeders at new City East, emanating from Riley Street STSS. Similarly, the City East connection must also allow for the installation of four 132kV feeders that would run between the new City East and Dalley Street zone substations. The following three potential options have been identified to achieve those requirements:

- A shaft, and associated headworks within, or nearby to the substation building, and connection to the tunnel either directly or by stub tunnel between the main CECT alignment and the shaft.
- Construction of a cable vault near to the substation building and then connection to the CECT alignment via directional drilling or microtunnelling; and
- Direct connection between the CECT alignment and the substation basement via directional drilling or microtunnelling.

Dalley Street Zone Substation interface

The Dalley Street Zone Substation is situated on Dalley Street, between George and Pitt Streets. The CECT is to be designed to allow for the connection of four 132kV feeders at Dalley Street, emanating from the new City East Zone Substation. Similarly, the Dalley Street connection must also allow for the installation of the four 132kV feeders that would run between the Dalley Street and City North zone substations. To achieve these requirements the same three options as described for City East Zone Substation interface are proposed.

City North Zone Substation interface

The City North Zone Substation is being constructed as part of works for the City West Cable Tunnel (CWCT). A provision has been included at tunnel level on the northern side of the City North Zone Substation interface to incorporate a future tunnel extension to Dalley St Zone Substation.

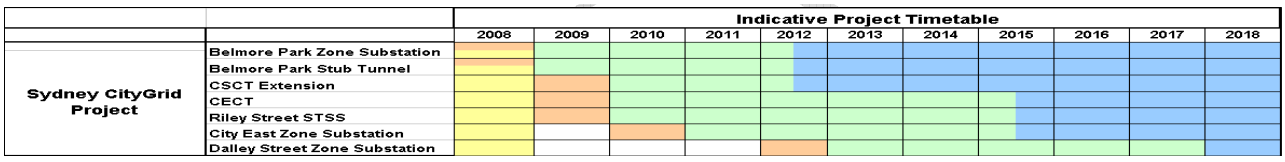
2.7 Capital Investment Value

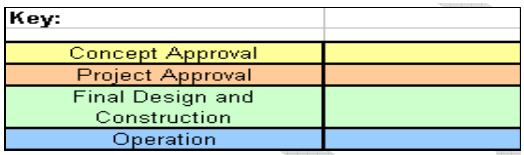
The cost of the Project is estimated to be $800 million.

The estimated cost of the proposed Belmore Park Zone Substation development, a component of the Project, is $125 million. The substation is estimated at $65 million with the proposed commercial development costing an estimated $60 million.

2.8 Indicative Project Timetable

The following nominal key target dates have been developed for the Project:





3 Statutory framework

On 11 February 2008 the Minister for planning declared the Project to be a project to which Part 3A of the EP&A Act applies.

3.1 Part 3A of the EP&A Act 1979

Part 3A of the EP&A Act commenced on 1 August 2005 and consolidates the assessment and approval regime for all major projects that need the approval of the Minister for Planning. Previously these were dealt with under Parts 4 and 5 of the Act. Part 3A applies to State government infrastructure projects, developments previously classed as State significant, and other projects, plans or programs declared by the Minister. It provides a separate streamlined and integrated development assessment and approvals regime for major infrastructure and other projects of significance to the State of NSW.

Clause 75B states:

'(1) General

This Part applies to the carrying out of development that is declared under this section to be a project to which this Part applies:

- *by a State environmental planning policy, or*
- *by order of the Minister published in the Gazette.'*

3.2 Commonwealth environmental legislation

A search of the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* protected matters (National Environmental Significance) database shows that a number of sites listed on the Register of the National Estate are close to the proposed Project corridor.

The Project is unlikely to result in any significant impact on the protected matters and, as such, the proposal would not need to be referred to the Commonwealth Minister for the Environment pursuant to the *Environment Protection and Biodiversity Conservation Act 1999*.

3.3 State environmental legislation

3.3.1 State Environmental Planning Policy (Major Projects) 2005

State Environmental Planning Policy (Major Projects) 2005 (the Major Projects SEPP) was gazetted on 25 May 2005. The Major Projects SEPP prescribes what constitutes a major project for the purposes of Part 3A of the EP&A Act.

Clause 6 of the SEPP defines Part 3A projects:

Development that, in the opinion of the Minister, is development of a kind:

(a) that is described in Schedule 1 or 2, or

(b) that is described in Schedule 3 as a project to which Part 3A of the Act applies, or

(c) to the extent that it is not otherwise described in Schedules 1–3, that is described in Schedule 5,is declared to be a project to which Part 3A of the Act applies.'

3.3.2 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 was gazetted on 21 December 2007 and came into effect on 1 January 2008. *Part 3, Division 5, Clauses 40 – 45* contains provisions relating to electricity transmission or distribution.

Under *Clause 41(1)* development for the purpose of an electricity transmission or distribution network may be carried out by or on behalf of an electricity supply authority or public authority without consent on any land.

Clause 41(2) describes development that can be conducted without the need for development consent and includes the following relevant provisions:

'(a) construction works (whether or not in a heritage conservation area), including:

(i) laying and installation of cables and cable pits, co-location of cabling and erection of ventilation and access structures, bridges and tunnel adits, and construction of a tunnel or conduit for an underground cable, and

(ii) alteration, demolition or relocation of a local heritage item, and

(iii) alteration or relocation of a State heritage item,

(d) establishment of a new substation or an increase in the area of existing substation yards or the installation of equipment, plant or structures in existing substation yards or substation buildings.'

3.4 Other local, regional and state planning instruments

The other following environmental planning instruments and associated legislation apply to the land on, and within, which the Project is proposed to be located:

- *Environmental Planning and Assessment Model Provisions 1980;*
- *State Environmental Planning Policy No. 4 (SEPP No. 4) — Development without Consent and Miscellaneous Exempt and Complying Development;*
- *Sydney Regional Environmental Plan (Sydney Harbour Catchment)*
- *Sydney Local Environment Plan 2005;*
- *Central Sydney Heritage Local Environment Plan 2000;*
- *South Sydney Local Environmental Plan 1998; and*
- *Central Sydney Development Control Plan 1996.*

While development consent from the City of Sydney is not required, appropriate reference to the planning principles comprised in these instruments will be made during the assessment process for the Project.

3.5 Restrictive covenant on title

The Belmore Park site has a restrictive covenant on title which, among other things, restricts the floor space ratio and building height.

4 Consultation

4.1 Overview

Part 3A requires the Director General of the Department of Planning to consult with relevant stakeholders in the preparation of the EAR for the Project. Depending on the nature of further assessments required for the various stages of the project (be it Part 3A or another Part of the EP&A Act), EnergyAustralia would carry out further environmental assessment and community consultation, which may allow, or require, further input prior to the carrying out of aspects of the Project.

4.2 Identified stakeholders

Stakeholders include:

Participants	
Local and state government	• Department of Planning • City of Sydney • Department of Environment and Climate Change • Roads and Traffic Authority • NSW Heritage Office • RailCorp • NSW Fire Brigade • State Transit Authority • Department of Water and Energy • Sydney Water Corporation • TransGrid • Royal Botanic Gardens and Domain Trust • NSW Police
Other stakeholders and community groups	• Neighbours impacted through construction and new land use • Businesses impacted through construction and new land use • NSW National Trust • Australian Stock Exchange • Telstra • Cross City Motorway (Cross City Tunnel) • Local community and resident groups • Local Aboriginal Land Councils • Environment groups • Special interest groups • Other potentially affected organisations and utilities • State Library of NSW
General community	• Interested members of the broader community who may wish to make comments through any public exhibition process required. • Schools • Day care facilities

4.3 Approach to stakeholder consultation

EnergyAustralia aims to involve the local community at the planning stage of its infrastructure projects to balance local issues against the wider community's increasing electricity needs and its promise to deliver safe and reliable electricity for customers. In developing projects, EnergyAustralia places a high value on engaging local communities to achieve an outcome that assesses social, environmental, technical and economic considerations.

Consultation for this project would be focused upon government authorities and on those stakeholders likely to be directly affected by the proposal. Community and stakeholder consultation for the project would be likely to involve activities such as identifying key stakeholders, distribution and display of written materials, identifying and responding to community issues and other community involvement activities based on the level of community interest and/or concern.

5 Preliminary Environmental Assessment

5.1 Overview

The key environmental aspects for the Project include:

- Design review;
- Electric & magnetic fields (EMF);
- Traffic and access;
- Noise and vibration;
- Surface and groundwater management;
- Heritage and archaeology;
- Greenhouse gas and air quality;
- Property (including settlement); and
- Spoil management.

The preliminary environmental assessment and the scope of further investigations are set out in Section 5.2. The assessment of more generic environmental aspects is set out in Section 5.3.

5.2 Key environmental aspects

5.2.1 Design review

Existing environment

The proposed Project is in the Sydney Central Business District (CBD) area, which includes state and locally listed heritage buildings and residential, commercial and recreational uses. There are also a number of existing and future infrastructure corridors within the Project study area.

The design review process for new buildings would apply to new electricity infrastructure under the Part 3A of the EP&A Act. The design review process would therefore potentially apply to the following Project components:

- Belmore Park Zone Substation;
- City East Zone Substation;
- Dalley Street Zone Substation; and
- Clarence Street STSS.

Belmore Park Zone Substation

The surrounding locality for the Belmore Park site is characterised by a mixture of retail, commercial, entertainment and residential land uses. The eastern half of the street block fronting Castlereagh Street, was developed in 1972 and contains a 23 storey commercial tower ("Central Square"). The Belmore Park site is currently used as a privately operated open-air commercial car park accommodating approximately 100

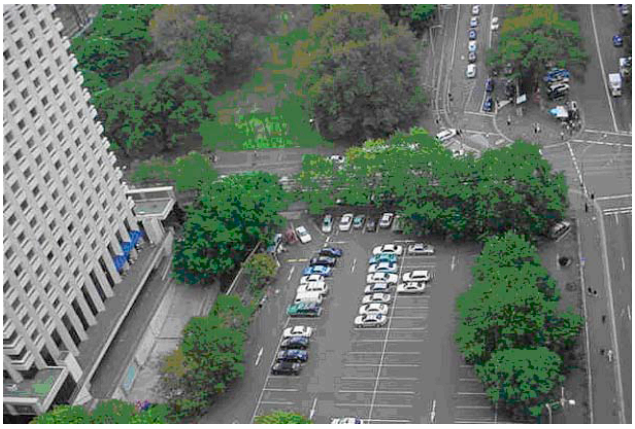


Figure 2: The Belmore Park site viewed from Regis Tower, looking south.

vehicles. It is open 24 hours, seven days per week and allows vehicles to enter and exit via the site's single two-way driveway off Hay Street. Figure 2 is a photographic image of the Belmore Park site.

Key planning provisions relevant to the Belmore Park Zone Substation include:

- The Belmore Park site is zoned "Central Sydney" under the Sydney Local Environmental Plan 2005 (LEP).
- The Belmore Park site and adjoining property, known as "Central Square" tower building, has a restrictive covenant on title (the "covenant") which limits the combined Floor Space Ratio (FSR) to 10:1;
- The covenant limits the height and setback of the built form to ensure the "sun access plane" to Belmore Park is maintained; and
- The site is subject to a 6m wide easement over the width along the eastern site boundary.

Key impacts

The proposed Belmore Park Zone Substation and integrated commercial/retail development would be designed to be sympathetic the streetscape (including Belmore Park) and nearby heritage buildings. The building will be designed to be in keeping with the locality and maintain its identity as a bold, modern addition to the area.

The Belmore Park site offers opportunities to:

- Orientate the building to Belmore Park with its mature trees and landscaped setting;
- Define a built edge to Belmore Park and encourage greater use and surveillance of the park;
- Activate the Hay, Campbell and Pitt Street frontages within the proposed commercial/retail development;
- Provide an integrated pedestrian through-site mid-block connection between Hay and Campbell Streets;
- Incorporate Ecologically Sustainable Design (ESD) by adopting the principles of a 5 star base office building under the Green Star rating scheme and a 4.5 star base building under the Australian Building Greenhouse Gas Rating (ABGR);
- Create an integrated development outcome with a high quality design overlay to an otherwise functionally driven zone substation; and
- Incorporate in the pedestrian through-site connection public environmental art, sculpture or installation that will focus on the themes of place, porosity and urban transformation. The use of lighting for night-time expression will be explored. The artworks will become identified with the project and the place and mark the transformation of the site and its relationship to the public domain.

Environmental Planning Instruments (EPIs) such as the Sydney LEP 2005 and Central Sydney DCP 1996, along with the provisions outlined in the Restrictive Covenant on Title for the Belmore Park site, would be used to guide the design of the proposed Belmore Park Zone Substation and integrated commercial/retail development. To facilitate the design in a timely manner, the following three controls and provisions outlined in the Restrictive Covenant on Title are proposed to be relaxed:

1) Sydney LEP Clause 26 'Design Excellence' – aims to ensure the consent authority gives consideration to design excellence. This clause requires the design of proposed developments to be subject to a competitive process.

The design of the Belmore Park Zone Substation and integrated commercial/retail development will be subject to a design review process. This would allow for the following:

- a high standard of architectural design, materials and detailing appropriate to the building type and location; and
- the building form and external appearance to improve the quality and amenity of Belmore Park.

The review process would include input from key stakeholders including the Department of Planning, City of Sydney, EnergyAustralia and leading architects and substation designers.

The design review process would include:

- A presentation of design investigations conducted by EnergyAustralia and leading architects;
- Feedback on the design investigations; and
- Design refinements and improvements

2. Central Sydney DCP Clause 2.2 – Street Frontage Heights. "Objectives: To achieve comfortable street environments for pedestrians in terms of daylight, scale, sense of enclosure and wind mitigation as well as a healthy environment for street trees and to reinforce the intrinsic character of Central Sydney while enabling flexibility in building design".

A minor increase of 5m in the street wall height, above the specified 45m maximum, is required on Campbell Street. This would achieve a better architectural outcome and reinforce the intrinsic character of the streetscape, whilst still complying with the sun access plane height limit.

This control is also specified in the Restrictive Covenant on Title for the Belmore Park site.

3. Central Sydney DCP Clause 2.3 – Building setback . "Objectives: To enhance the amenity of building occupants in terms of daylight, outlook, view sharing, ventilation, wind mitigation, and privacy in residential buildings and serviced apartments and to enhance the quality of the public domain in terms of wind mitigation and daylight access".

A minor non-compliance with the building setback control is required along the Campbell Street frontage. The adjoining land uses and existing built form around the Belmore Park site is such that privacy to residential buildings would not be compromised as a result of the proposed departure from the building setback control. The minor non-compliance would still ensure the sun access plane to Belmore Park is maintained.

This control is also specified in the Restrictive Covenant on Title for the Belmore Park site.

4. Central Sydney DCP Clause 2.5 – Street Frontage Activities. "Objective: To provide active frontages and pedestrian-oriented activities that adds life to Central Sydney, particularly at ground level in the retail streets and major pedestrian streets".

There are obvious challenges associated with a mixed use zone substation and commercial/retail development - namely noise and visual amenity.

The ground floor of the Belmore Park site is proposed to include retail areas as well as the zone substation. The retail area would allow active use of street frontages, however, it is not possible to activate street frontages along the zone substation area. A sense of activation can be provided through articulation of the façade, provision of public environmental art and through the use of architectural lighting. This would be subject to the design review process.

Conclusions

To ensure the proposed Belmore Park Zone Substation is designed to be in keeping with the locality and maintain its identity as a bold, modern addition to the area, the environmental assessment would include a design review process. The review process would include input from key stakeholders including the Department of Planning, City of Sydney, EnergyAustralia and leading architects and substation designers.

City East Zone Substation, Dalley Street Zone Substation and Clarence Street STSS

The sites and/or proposals for the City East Zone Substation, Dalley Street Zone substation and the potential Clarence Street STSS are unknown at this stage. Accordingly, information on the design review for these substations will be outlined in separate Project Applications.

5.2.2 Electric and magnetic fields (EMF)

Existing environment

EMF is part of the natural environment and are present in the Earth's core and the atmosphere.

EMF is also produced wherever electricity or electrical equipment is in use. Power lines, electrical wiring, household appliances and electrical equipment all produce EMF.

The Australian regulator on this issue, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has concluded:

"On balance, the scientific evidence does not indicate that exposure to 50 Hz EMFs found around the home, the office or near power lines is a hazard to human health".

(ARPANSA 2003).

Key impacts

EnergyAustralia's position on EMF has been adopted in the light of authoritative reviews having concluded that no adverse health effects from exposure to EMF have been established, but recognising that there is, within the community, genuine public concern about the issue which must be addressed.

The following is EnergyAustralia's position on EMF, which largely reflects the policy of the energy industry representative body, the Energy Networks Association:

- To provide balanced, accurate information to our employees and customers, including EMF measurements and advice;
- Take reasonable steps to limit field exposures from new facilities by locating and operating our electrical installations prudently within the latest Australian health guidelines;
- Closely monitor engineering and scientific research, overseas policy development and major reviews of scientific, medical and engineering research regarding EMF and health; and
- Co-operate fully with any bodies established by governments in Australia to investigate and report about power frequency EMF.

Conclusions

Considering the currently available information on EMF worldwide, the following conclusions may be drawn:

- EMFs are created whenever electricity flows, they are not something unique to power lines or substations;
- The body of scientific literature on the issue is both complex and voluminous, and public policy initiatives should be based on independent and authoritative reviews and reports;
- There is no basis to establish human exposure limits for EMF other than those which presently exist, and, in particular there is no scientific basis to support arbitrary exposure limits below the guidelines as a prudent avoidance measure;
- EnergyAustralia should continue to act prudently in relation to the issue of EMF. This includes implementing prudent avoidance measures in accordance with the principles established by the Gibbs Report;
- Design of the Belmore Park Zone substation has incorporated a number of mitigation measures. These include attempts to fit all transformers in a single line (single loaded) to minimise the ground floor area and also reduce any "possible" EMF issues; and
- Furthermore, the transmission cables would be located in a concrete lined tunnel at a depth of 10 - 70 metres below ground level. As such the EMF from these cables will be indiscernible from typical background levels.

5.2.3 Traffic and access

Existing environment

Traffic and transportation movements within and around the Sydney CBD occur using a variety of transportation modes including private vehicles, public bus services, light rail and heavy rail services, pedestrian and cyclist movements. These movements are critical for the transportation of people, goods and services and play an integral role in the prosperity and vitality of the CBD.

At present traffic movements from the sites forming part of the Project are limited to the 100 space commercial car park on the Belmore Park site.

Key impacts

Construction

The construction of the CECT and CSCT Extension would generate traffic movements to and from the Riley Street site. The main access routes to and from the Riley Street site are expected to be off Albion and Riley Streets.

Similarly, the proposed works at the Belmore Park, Surry Hills, City East and Dalley Street sites, and the proposed services shaft would also generate additional traffic movements.

The works at the various sites may require temporary use of traffic lanes and/or the need for temporary road occupation.

At the Surry Hills STS, new City East, and Dalley Street zone substation interface sites, it is expected that road closures would be required in order to excavate shafts, joint bays and other interface structures. It is not expected that road closures would be required at the Riley Street site.

Roads identified, to date, that may need to be closed during construction include:

- Little Albion Street;
- Underwood Street;
- Dalley Street; and
- Gresham Street.

Operations

Operational traffic movements for the Project would be minor and limited to regular maintenance inspections and activities.

The commercial/retail development of the Belmore Park site would generate movements from the use of the proposed basement carparking spaces and deliveries and maintenance activities.

Depending upon projected market requirements for the commercial/retail development, the construction of this component may need to be staged. If required, short term land use options would be developed for the surplus site area. For example, an interim land use option for the residual land could be to operate a commercial carpark to ground level, similar to the site's current use.

It is further anticipated that any staged option would include bulk excavation of the entire site with basement floors constructed to at least ground level. This would negate the need for:

- two separate bulk excavation contractors;
- hoarding to remain around the perimeter of the commercial/retail development; and
- separate costly 'earthing' requirements.

Conclusions

As part of the environmental assessment a detailed traffic and access assessment would be undertaken. This assessment would identify appropriate mitigation measures to be adopted during construction and operations. Traffic management measures would be required to minimise impact on other road users and ensure that the construction activities would be conducted safely. These measures would feed into the CEMPs and would include the following:

- Identification of preferred haulage routes;
- Access routes and signage, including access arrangements at the site;
- Measure to ensure that relevant intersections would not be affected; and
- Measures to protect pedestrians, cyclists and other road users in the vicinity of the construction sites.

Operational traffic movements would be assessed and mitigation measures developed where required, this would feed into the OEMPs.

5.2.4 Noise & vibration

Existing environment

It is considered that the existing local noise environments are consistent with the land use and zoning for the CBD and surrounds. The noise environment for the area is dominated by road traffic noise. A number of elevated residential receivers and commercial and recreational land uses are also located within close proximity to the construction sites at the proposed Belmore Park site and Riley Street site.

Key impacts

Construction

In general, areas of impact concerning noise and vibration during construction include:

- Tunnel construction works which would be predominantly below ground, and would generally not be audible;
- General construction works, spoil removal and equipment and material deliveries at the construction sites would generate noise that may affect nearby residential and commercial receivers; and
- Tunnelling could generate vibration resulting in regenerated noise, where the tunnel is close to residential and commercial buildings.

The following construction activities may potentially result in noise related impacts:

- Surface works during the construction and excavation of shafts and pits;
- Truck movements associated with the removal of excavated material; and
- Regenerated noise from tunnelling works by the TBM, roadheaders and rock breakers.

Residential buildings located close to the construction sites may be more sensitive to noise and vibration, particularly during the evening and night time when background noise levels are lower.

Short-term noise impacts may occur as a result of high intensity construction activities and would be assessed in accordance with the Environmental Noise Control Manual (ENCM).

EnergyAustralia propose to locate the main construction site for the CECT and the CSCT Extension within the Riley Street site. Furthermore, it is proposed that noisier activities such as rock-breaking for the excavation of the shaft be contained within an acoustically designed enclosure, which would also provide sound attenuation during full tunnelling operations.

Vibration would primarily be associated with the tunnelling works carried out by the TBM, roadheaders, and rock breakers. Road transport trucks would also be a secondary vibration source.

Operations

Operations have the potential to generate noise and vibrations from activities such as:

- Noise would be generated by the operation of the proposed zone substations and STSS; and
- Minimal noise would be generated by the operation of the tunnel (ventilation fans and similar) as these are likely to be located underground.

For the proposed substations, noise levels would be predicted and appropriate design measures adopted to manage operational noise in accordance with the Industrial Noise Policy guidelines.

Vibration levels would be predicted for occupants of the zone substations that have an integrated commercial/ retail development.

Belmore Park Zone Substation will have appropriate design measures adopted to manage impacts in accordance with the relevant guidelines.

Conclusions

A noise and vibration impact assessment would determine the existing noise and vibration conditions in the vicinity of the proposed construction sites and model the likely construction and operational noise impacts of the Project to compare these regulatory criteria applicable to the study area. Appropriate mitigation measures would be developed to manage potential exceedences.

5.2.5 Surface & groundwater management

Existing environment

The Project is within the catchment area of Sydney Harbour.

The catchment area is highly urbanised with the exception of parklands such as Belmore Park, Frog Hollow Reserve, The Domain and Royal Botanical Gardens.

Surface water is managed by drainage systems which direct water into Sydney Harbour.

Shallow, perched groundwater tables, controlled by sea levels, may be expected in the fill and alluvial deposits in and around the vicinity of paleovalleys of Sydney Cove, Farm Cove and Woolloomooloo Bay. A deeper groundwater table exists in the Hawkesbury Sandstone.

Key impacts

The main issues during construction would be:

- The prevention of erosion and containment of any sediment generated to prevent discharge into stormwater systems;
- The potential for chemical spills; and
- Stormwater run-off could potentially contain elevated silt loads from tunnel spoil deposited by trucks.

It is expected that groundwater will be intercepted which may contain relatively high levels of manganese and/ or iron. Any groundwater intercepted during both the construction and operational stages of the Project would

be treated to an accepted level and discharged to stormwater. This would be carried out in consultation with DECC, Sydney Water and/or City of Sydney.

Although changes to the water table could potentially result in settlement of buildings founded on alluvium and/or fill as a result of groundwater drawdown, this is unlikely to occur because the CECT is progressively lined during construction (providing a 'proper concrete structure' underground) and has been designed to exclude groundwater seepage.

The tunnels would be fully sealed (tanked) to control groundwater seepage and chemistry.

The operation of the Belmore Park Zone Substation and commercial/retail development may require the use of a water treatment plant. Groundwater would either be managed on site in a new water treatment plant installed within the building proper or groundwater may be pumped to the existing water treatment plant located at Campbell Street Zone Substation (via the existing CSCT).

During operations the Project is not expected to increase the proportion of impervious surfaces or have a significant impact on the nature of land uses within the catchment.

Conclusions

A Soil and Water Management Plan would be prepared as part of the Construction Environmental Management Plan for the Project. This would detail how soil and water-related mitigation measures would be implemented at the various construction stages.

The plan would be developed in consultation with stakeholders to ensure the appropriate mitigating measures and safeguards are incorporated and would be updated as the Project progresses.

5.2.6 Heritage and archaeology

Existing environment

Based on a review of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Protected Matters Report for the Sydney LGA there are many properties listed on the Register of the National Estate within the Sydney LGA. However, due to the depth of the tunnel route, only the areas where surface works are proposed have the potential to encounter known and unknown cultural heritage resources.

There are a number of listed heritage items near the Riley Street site.

As the location of the New City East Zone Station is currently unknown it is also may need to be assessed but cannot be determined at this stage.

Existing heritage items near the Belmore Park site include:

- Chamberlain Hotel (420-438 Pitt Street);
- Manning Building (441-459 Pitt Street); and
- Hay and Campbell Streets are listed as Heritage Streetscapes, between George and Pitt Streets. The Belmore Park site is not itself located on the Heritage Streetscape sections.

The City of Sydney has an 'Archaeological Zoning Plan' for the city and requires assessments of sites identified on the zoning plan. The Belmore Park site and the Dalley Street Zone Substation are both identified on this plan. Furthermore, the archaeological potential of the Belmore Park site has been subject to investigations, which found that the Belmore Park site is likely to contain remnants from the demolished Hotel Sydney.

Key impacts

As part of the environmental assessment, a detailed heritage impact assessment would be carried out. This would include an assessment on impacts on areas of archaeological potential.

While generally the tunnels would have limited impact on potential archaeological sites, as they would be dug at depth and therefore avoid sites by being much deeper, there are still some potential issues such as heritage sewerage and drainage services. For example the branch of the Bondi Ocean Outfall Sewer (BOOS) which is located down Young Street, near Bent Street.

Potential for Aboriginal Archaeological impacts is anticipated to be low.

Conclusions

Non-indigenous and Aboriginal archaeological and heritage investigations would be undertaken as part of the EAR in accordance with relevant statutory requirements.

Project components subject to a design review, such as the Belmore Park Zone Substation, would consider how the design responds to heritage streetscapes and nearby heritage items.

5.2.7 Greenhouse gas and air quality

Existing environment

The existing air quality for the Project and Belmore Park Zone Substation study areas would be characteristic of an urban air shed close to a busy road in the CBD. Acceptable ranges of particulates, dust, hydrocarbons, oxides of nitrogen and sulphur would be expected throughout the study area for most of the time.

Key impacts

Construction

During construction, potential sources of air pollutants would include:

- Dust produced within the tunnel from construction activities and from the loading, transport and stockpiling of spoil; and
- Vehicle emissions from the tunnel construction equipment, such as roadheaders and other tunnel construction equipment, from the trucks used to transport spoil from the site and from general traffic associated with a construction site.

Potential construction air quality impacts would be limited to particulate matter emissions. The impact of fugitive dust sources is related to the quantity and drift potential of the particles. Larger particles generally settle out near the source whereas fine particles can be dispersed over greater distances from the source.

The Project is not likely to generate air emissions that could potentially affect residential and commercial land uses at the construction sites.

Operations

Operational air emissions would be clean air at an elevated temperature. Air emissions would be exhausted through ventilation systems.

For the Belmore Park Zone Substation, it is proposed to use sulphur hexafluoride (SF6) for the transformers and in some supporting switchgear. A greenhouse gas assessment would be undertaken in accordance with the National Greenhouse Accounts (NGA) Factors (which has replaced AGO Factors and Methods Workbook). EnergyAustralia would aim to take a life cycle assessment approach to assess the emissions associated with the construction, operation and decommissioning of the Belmore Park Zone Substation.

EnergyAustralia is currently a voluntary member of the Commonwealth Government's Greenhouse Challenge Plus Program, reporting all greenhouse emissions across the corporation. Beginning in July 2008, EnergyAustralia will be required to report greenhouse gas emissions and energy consumption as part of the National Greenhouse and Energy Reporting System (NGERS). All greenhouse emissions for the Project would be included within this reporting framework.

For the commercial component of the development, it is to be noted that the 5 star Green Star and 4.5 star ABGR design intent would result in a more sustainable building judged to represent 'Australian Excellence' in building design. Green Star is an environmental rating system for buildings that seeks to reduce the environmental impact, improve occupant heath and productivity and showcase innovation in sustainable building practices. Presently, less than 30 buildings in Australia have been certified with Green Star ratings of 5 star or more.

Conclusions

Air quality assessment would consider the construction phase of the investigation within the immediate vicinity of the construction sites.

During operation of Belmore Park Zone Substation, EnergyAustralia would report greenhouse gas emissions and energy consumption as part of the National Greenhouse and Energy Reporting System (NGERS). All greenhouse emissions for the Project would be included within this reporting framework.

The commercial component of the Belmore Park Zone Substation development would result in a more sustainable building judged to represent 'Australian Excellence' in building design. It is anticipated that all future development as part of the Project would also adhere to these principles.

5.2.8 Property (including settlement)

Existing environment

A variety of land uses including residential, commercial, recreational and public services exist within the vicinity of the properties that may be potentially impacted by the proposed Project. The key locations where surface works may impact upon surrounding property include Pitt Street Sydney (Belmore Park site); Riley Street site; potentially in the vicinity of Sir John Young Crescent/St Mary's Road (services shaft/control room); Dalley Street Sydney (upgrade existing zone substation) and a future site in the vicinity of the northern Sydney CBD (City East Zone Substation).

Key impacts

Construction

The proposed tunnels would be predominantly aligned under publicly owned lands, publicly owned road easements and several privately owned properties. It is envisaged the tunnel would pass between 10 – 70 metres beneath the surface of the ground, under a range of urbanised land uses. Key design considerations would be identifying existing basements, underground car parks and existing and future infrastructure corridors.

At the northern end of the tunnel alignments, particularly in the vicinity of Dalley Street Circular Quay, and in the low lying areas around Riley Street and Yurong Streets Woolloomooloo, there may be potential for settlement if substantial drawdown of the water table occurred in the alluvium and sediment/fill.

Although changes to the water table could potentially result in settlement of buildings founded on alluvium and/or fill as a result of groundwater drawdown, this is unlikely to occur because the CECT is progressively lined during construction (providing a 'proper concrete structure' underground) and has been designed to exclude groundwater seepage.

Operations

EnergyAustralia proposes to acquire an underground stratum for the tunnels which would protect them from future development.

The proposed tunnels are not expected to cause measurable settlements in the structures along the route given that significant structures are founded on Hawkesbury Sandstone. The tunnel alignments would be designed to accommodate requisite clearances to existing structures.

The tunnels would be fully sealed (tanked) to control groundwater seepage and chemistry.

Conclusions

Land uses and impacted properties within the study area would be identified through a combination of site visits, research and consultation with stakeholders. Potential impacts during the construction and operational phase would be examined and, where appropriate mitigation measures would be identified.

Further investigations and design are required to assess the risks of settlement in these areas and it is proposed to prepare appropriate mitigation measures.

5.2.9 Spoil management

Existing environment

The tunnels would be primarily in Hawkesbury Sandstone. It is envisaged that the majority of this material would be classified as Virgin Excavated Natural Material (VENM) which could be a valuable resource for construction activities.

The type and quality of spoil at the Riley Street site and the future City East Zone Substation site is not known at this stage.

The geological map of the Belmore Park site indicates that the site is underlain predominantly by filling on previous swampy alluvial areas. Previous studies further indicate the upper 4m to 5m is filling, clays and sandy clays, below this medium to high strength sandstone.

Key impacts

The excavation of the substations sites, tunnels and shafts would generate considerable quantities of spoil.

It is envisaged material excavated during night shift operations would need to be stockpiled on site overnight and then transported off site by heavy vehicles during standard construction hours.

The possibility may exist to encounter potentially contaminated soils.

Conclusions

The volume of excavated material would be determined and measures developed to manage spoil generated during construction for activities such as classification, stockpiling, transportation movements, disposal sites, proposed routes.

Wherever practicable spoil would be reused as part of the Project.

Sites for the disposal of surplus soil would be selected according to the rate of development activity and the volume of material generated elsewhere.

Spoil that is not VENM would be transported to approved landfill sites and/or off-site recycling depots.

Probable spoil haulage routes and disposal sites would be identified and assessed in the traffic assessment.

Spoil handling and management procedures would be developed.

5.3 Further Project Applications

This preliminary environmental assessment is in support of the Project components described in Section 2.2. Future project applications will be submitted to address the remaining Sydney CityGrid Project components. The timing will be subject to EnergyAustralia programme requirements, however, an indicative timeline is shown in Section 2.8.

5.4 Other environmental aspects

Environmental Aspect	Potential Impact	Management and Mitigation Measures
Amenity		
Visual impacts during construction are expected to be concentrated around the work sites. These areas would be restored to their previous condition, and as such the visual impact of operational works is not assessed in detail.	Visual impact during construction include: • Construction hoardings, fences and/or temporary noise barriers around work sites. • Traffic barriers and signs necessary to divert traffic and pedestrians around work sites. • Modifications to the work site to establish a noise control enclosure. Upon completion, the visible components of the Project tunnel would be limited to the substation buildings and possibly the air intake structure.	Management measures would be developed during the design review process. The following measures would take place during construction: • Hoardings, noise walls and fences would be painted to a consistent, harmonious colour scheme • Work sites and the surrounding areas would be maintained in a clean and tidy condition • The tunnel access and air inlet if proposed in the vicinity of St John Young Crescent, Woolloomooloo would be designed in consultation with an urban designer or architect to ensure that the visual components of the Project are aesthetically pleasing.

Environmental Aspect	Potential Impact	Management and Mitigation Measures
Socio-economics		
Increased development pressures due to: • Increased floor space for residential and employment populations. • Redevelopment or conversion to more intensive land uses and increased floor space.	Impacts to the area include: • Increases in noise, dust and changes to traffic conditions. • Capital cost of the Project has been estimated to be over $800 million. • Job creation during construction and operation. • Indirect economic impacts i.e. incomes would be generated. • Construction of the Project would be undertaken to 2020 and beyond. • Increased reliability and supply of electricity. These impacts are also likely to affect tourists and visitors. Operational impacts are expected to be minimal. The underground location would ensure that impacts on existing services and infrastructure are negligible.	• A traffic management plan would be prepared prior to the commencement of construction activities. • Where access to private property and businesses is required, consultation with land-owners would be undertaken
Health, Safety, Risks and Hazards		
The risks and hazards can be managed through the development of construction phase risk management planning and operation phase risk management planning.	Health, safety, risks and hazards include: • Security of the cable tunnel and substation. • Likelihood of cable being damaged. • Potential to damage other infrastructure during construction (eg water and sewer pipelines). • Identification of other risks/hazards posed by the construction and operation of the cable tunnel and substation. • Description of hazard and emergency management measures for both the construction and operation stages. • Security of the site to avoid vandalism and securing risk to adjoining sites. • Potential for fire events and proposed fire management strategy. • Potential releases of sulphur hexafluoride into the atmosphere.	Construction and operation phase risks and hazards would be managed through the preparation of construction and operation phase risk and hazard management plans.

Environmental Aspect	Potential Impact	Management and Mitigation Measures
Cumulative Impacts		
The construction and operation of other major developments in the Sydney CBD could result in cumulative impacts. Key areas of concern include • traffic • noise and vibration • property issues • spoil disposal	Other potential major developments in the Sydney CBD. The timing for the construction of developments may overlap with the Project, and as such cumulative impacts may occur.	Preliminary assessment of other known projects suggests that the Project would not result in any significant adverse effects on the environment. In general, the development and implementation of the construction and operational environmental management plans in response to the proposed Statement of Commitments and Conditions of Consent would prevent, avoid, minimize, and manage the various impacts associated with the Project to avoid the potential with any unknown proposals that overlap the Project.
Demand Management		
	EA has elected to construct the Project because it is the most prudent and feasible route for replacing feeders, which are approaching time for retirement and that presently run through streets in Sydney CBD. Recent changes to substation design security standards in NSW distribution licences require that all CBD substations achieve "n-2" capacity by 2014. This means that by 2014 the full forecast load supplied from Belmore Park Zone Substation must be available through all feeders in the tunnel. In accordance with its Demand Management (DM) and Planning processes, EA completed a Demand Management Screening Test for the Sydney CBD. The screening test compared forecast demand (with varying degrees of demand reduction) with network investment requirements. Several scenarios were developed to demonstrate the effect of DM on network investment, and the potential cost savings that may be achieved by deferring network expansion. The screening test showed even with very large demand reductions (representing about 25% of the current total CBD demand) EA would not be able to defer or avoid building the proposed substations or tunnels through which it would be supplied.	Because of the "n-2" design security standards contained in the conditions of its distribution licence, EnergyAustralia is unable to defer or avoid immediate investment. EnergyAustralia participates with TransGrid and the NSW Government in a Demand Management and Planning Project.

6 Conclusion

6.1 Environmental aspects to be assessed further

The preliminary environmental assessment presented in this report indicates that the following issues would require detailed consideration as part of the environmental assessment of the Project:

- Design review;
- Electric & magnetic fields;
- Traffic and access;
- Noise and vibration;
- Surface and groundwater management,
- Heritage and archaeology;
- Greenhouse gas and air quality;
- Property (including settlement); and
- Spoil management.

The environmental assessment of these issues would form the focus of the Environmental Assessment Report.

A draft Statement of Commitments would be prepared to describe how these issues would be managed through the implementation of the proposal.

6.2 Other environmental aspects

The preliminary environmental assessment suggests that the following issues are unlikely to significantly affect the environment and could be readily managed through mitigation measures:

- Amenity;
- Socio-economics;
- Health, safety, risk and hazards;
- Cumulative impacts; and
- Demand management.

These issues are proposed to be addressed and managed through the Statement of Commitments and Conditions of Approval.

References

Gutteridge Haskins and Davey (2001) Sydney CBD and Inner Suburbs 132kV Cable Project: Environmental Impact Statement

Parsons Brinckerhoff (December 2005) City West Cable Tunnel: Project Application