



## **FINAL REPORT**

# **DEVELOPMENT OF PORT BOTANY 33/11kV ZONE SUBSTATION**

**30<sup>th</sup> July 2008**

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## EXECUTIVE SUMMARY

This paper has been prepared to report on upgrade work that is proposed to develop the electricity supply network in the Port Botany area in accordance with Clause 5.6.2 (h) of the National Electricity Rules. The work proposed by this report is classified as a new large distribution asset.

A Consultation Paper on the projected limitation and options for corrective action was published on 14th April 2008. This Consultation Paper included a preliminary application of the Regulatory Test to options that had been identified to address the projected limitations. No submission was received in response to the Consultation Paper.

Due to planned major expansion at Sydney Ports site, a significant load increase has been requested to be supplied. To ensure a safe and reliable electricity supply for existing customers as well as additional loads, EnergyAustralia is providing additional capacity to meet forecast load demands and facility to address relevant aged asset issues.

The provision of additional capacity is required to meet network performance requirements set by EnergyAustralia in accordance with Schedule 5.1 of the Rules.

This report covers the following issues:

**Section 1** provides a background of the Port Botany and its surrounding load area and the need for augmentation.

**Section 2** describes the various capacity and aged asset issues as well as future increase in customer load in the Port Botany area. The concept of service standard, as implemented by EnergyAustralia, is discussed.

**Section 3** describes the proposed augmentation in relation to the National Electricity Rules (the Rules). The proposed development of new Port Botany zone substation (ZS) is classified as a distribution system asset by the Rules, and the proposed development is classified as a large network asset as it involves expenditure above \$10 million.

**Section 4** describes the options that were considered, including Demand Management as well as:

- Option 1: 11kV feeder development from Maroubra ZS.
- Option 2: Port Botany 33/11kV ZS with three transformers.
- Option 3: Port Botany 33/11kV ZS with initially two transformers and load transfer to Maroubra.

**Section 5** presents the results of economic analysis of the options considered, sensitivity analysis and the ranking of the options and identification of the least cost option.

**Section 6** concludes that the preferred option is Option 2 – Port Botany 33/11kV ZS with three transformers.

EnergyAustralia's recommended action is the development of a 33/11kV Port Botany ZS equipped with three transformers in the vicinity of customer premises. Distribution feeder works to facilitate the staged refurbishment of switchgear at Matraville ZS are also part of this option. The estimated capital cost of the recommended option is \$27.21M with a NPC of \$25.09M.

# 1. BACKGROUND

## 1.1. Introduction

This Final Report has been prepared to advise on the upgrade work that is proposed to be carried out in the Port Botany area. This Final Report relates to a Consultation Paper published on 14<sup>th</sup> April 2008. No submission was received in response to the Consultation Paper. The information provided in this Final Report includes:

- a discussion of additional load requests and supply system limitations identified by EnergyAustralia that have led to the necessity of identifying possible options for augmentation of the distribution network in the area;
- a discussion of the service standard that has been adopted for planning purposes;
- a description of possible options which have currently been identified for development of the electricity supply in the area; and
- a detailed preliminary cost effectiveness analysis of each of these options, carried out in accordance with the requirements of the regulatory test.

Sydney Ports site is located in the suburb of Port Botany, on the northern shore of Botany Bay. The current tenants on the site are Patrick and P&O. The stevedoring site is planned for significant expansion within the next few years, with a third stevedore anticipated to lease the majority of the new facility.

Sydney Ports Corporation and its tenants at the ports site have requested approximately 13MVA of additional load. It is also anticipated that other tenants at the site will also request further load increases of approximately 11MVA.

EnergyAustralia currently has three zone substations in the area: Botany 33/11kV, Matraville 33/11kV, and Maroubra 132/11kV.

Geographical overview of the Port Botany and its surrounding load area is shown in the figure below.



Figure 1.0 – Geographic overview of Port Botany's surrounding area

## 1.2. Existing Supply Arrangement

The existing supply arrangement to Sydney Ports site and surrounding area are as follows:

### Port Botany Area Supply

Presently, the Port Botany area is supplied at 11kV from Maroubra and Matraville zone substations.

### Botany Zone Substation

Botany 33/11kV zone substation was commissioned in 1931 and is supplied from Bunnerong North STS via four 33kV feeders. Botany zone substation is equipped with three 19MVA and one 12MVA transformers. The zone substation has a firm capacity of 36.9MVA in summer and 41.2MVA in winter.

### Maroubra Zone Substation

Maroubra 132/11kV zone substation was commissioned in 1977 and is supplied at 132kV via a feeder from TransGrid's Beaconsfield West substation and a feeder from Bunnerong STS. Maroubra zone substation consists of two 45MVA transformers and a 50MVA transformer. The zone substation has a firm capacity of 97.2MVA in both summer and winter. There are spare 11kV panels available for 11kV development. However, it is approximately 5.5 km from the proposed Port Botany development and hence is located further than Botany and Matraville zone substations from the port development.

### Matraville Zone Substation

Matraville 33/11kV zone substation was commissioned in 1965 and is supplied from Bunnerong North STS via five 33kV feeders. Matraville zone substation also has a 33kV connection with Randwick zone substation 33kV busbar. Matraville zone substation has a firm capacity of 61.4MVA in summer and 68.7MVA in winter.

## 2. ISSUES

### 2.1. Applied Service Standard

The service standards that are applicable to a consideration of supply constraints affecting the Port Botany and its surrounding load area are summarised below:

#### Applicable to all Network Elements

The minimum requirement for any network element is that, with all elements in service, the thermal capacity is required to meet at least 115% of forecast demand. The requirements described in the following sections are additional to this requirement.

#### Subtransmission substations

For a failure of a single critical element (i.e. N-1 conditions) within a subtransmission substation, the forecast demand is not to exceed the thermal capacity. Recovery of load should be within one minute.

The upper voltage level on the underground 132kV system is restricted to 1.05 per unit. Marginally higher voltages may be possible in some areas with overhead connection. The lower voltage limit is determined by the requirement during first contingency outages for: Transformers in subtransmission substations to maintain regulation; and voltage levels on the 132kV system should not fall below 90% of their nominal voltage (0.9 pu).

The voltage regulation range of the 33kV system is determined by the requirement for zone transformers: to maintain regulation under normal system conditions; and be less than 4% below their set voltage level (allowing for line drop compensation) during first contingency outages.

### **Zone substations and Overhead Subtransmission Feeders**

For a failure of a single critical element (i.e. N-1 conditions) within zone substations supplying greater than 10MVA of load and for overhead subtransmission network, the forecast demand is not to exceed the thermal capacity for more than 1% of the time i.e. a total aggregate time of 88 hours per annum; up to a maximum of 20% above the thermal capacity. Recovery of load should be within one minute.

Under normal conditions (i.e N conditions), the thermal capacity is required to meet at least 115% of forecast demand.

### **Underground Subtransmission Feeders**

For an underground subtransmission feeder, any overhead section should be designed as if it was a subtransmission overhead feeder, providing the forecast demand does not exceed the thermal capacity of the underground section at any time under N-1 conditions.

### **11kV distribution network**

For a distribution feeder in urban<sup>1</sup> area, the expected demand is to be no more than 80% of feeder thermal capacity (under system normal operating conditions), with switchable interconnection to adjacent feeders to enable restoration following an unplanned failure of a single network element (i.e. N-1 conditions). The 11kV network where in a number of feeders forms an interrelated system, the limits apply to the average loading of the feeders within the one system.

For 11kV networks, voltage drops of up to 5% are regarded as satisfactory. Higher voltage drops are permissible provided that the network connection provided to low voltage customers is within the limits specified in Australian Standard AS2926.

## **2.2. Description of Network Issues**

### **2.2.1. Spot Load Development**

Sydney Ports site is planned for a significant expansion within the next few years. Sydney Ports Corporation's new development and its existing stevedores have requested an additional load increase of 13MVA.

It is also anticipated that other tenants located on the port facility will request further load increases of approximately 11MVA over the next five years. Therefore, the total likely future increase in load is approximately 24MVA.

There is also a possibility of higher load requests and/or other tenants requesting additional loads.

### **2.2.2. Capacity Limitations**

There are three zone substations in the vicinity of the Sydney Ports site: Botany, Maroubra and Matraville.

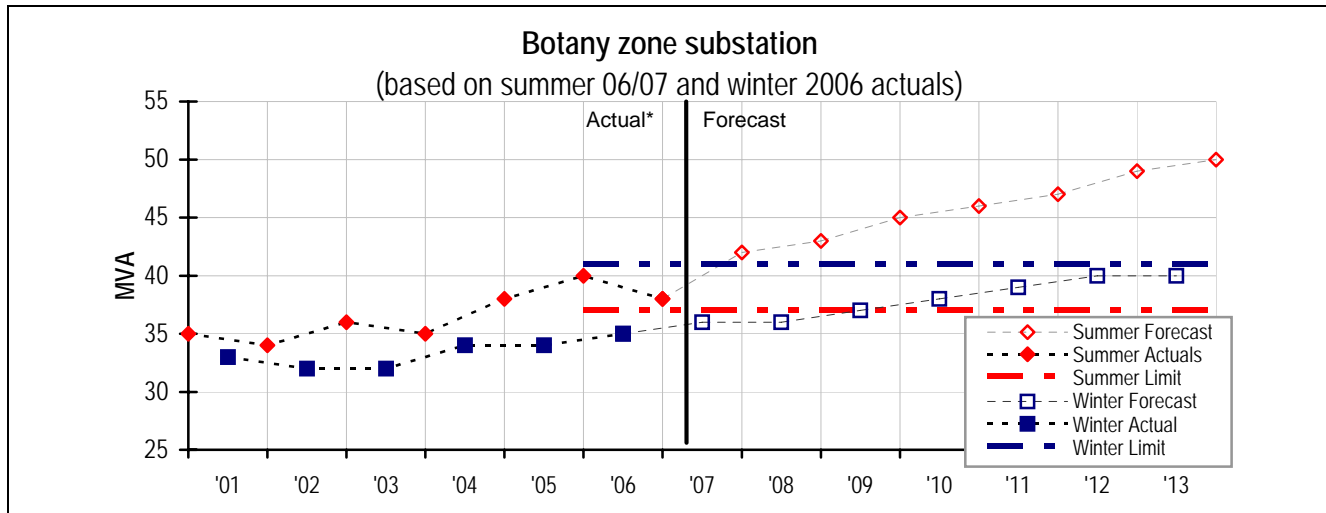
#### **Botany Zone Substation**

Botany zone substation load already exceeds its firm capacity in summer. (Due to its operation arrangement, the 120% contingent utilisation level cannot be used for Botany zone substation.) No spare 11kV circuit breakers are available. Therefore, it is not considered feasible to supply the

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<sup>1</sup> Urban, for EnergyAustralia, means an area where the majority of land is zoned for residential and/or commercial and/or industrial use within a town or city type of area which is contiguous with other similar town or city areas with an aggregated population of at least 5,000 people.

requested Sydney Ports loads from Botany zone substation. Investigations are currently in progress to address the capacity issues at Botany ZS as a separate project.



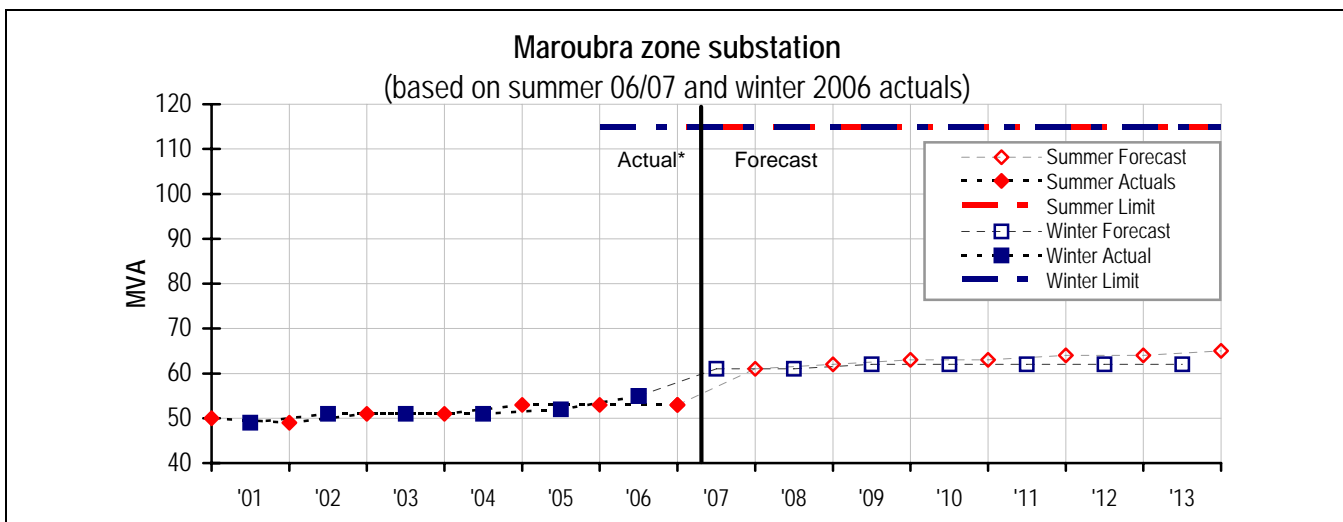
	Actual							Forecast						
	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
<b>SUMMER</b>														
Load [MVA]	35.0	34.2	35.6	35.1	37.7	39.8	37.7	42.1	43.4	44.7	46.0	47.4	48.8	50.3
Firm Capacity (FC) [MVA]	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
Utilisation (Load/FC)	95%	93%	96%	95%	102%	108%	102%	114%	118%	121%	125%	128%	132%	136%
<b>WINTER</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
Load [MVA]	30.8	32.6	32.3	32.2	33.6	33.5	35.4	35.7	36.4	37.2	38.0	38.8	39.6	40.4
Firm Capacity (FC) [MVA]	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2
Utilisation (Load/FC)	75%	79%	78%	78%	82%	81%	86%	87%	88%	90%	92%	94%	96%	98%

Note \* Previous capacity limits were different under a different Licence condition. These previous limits are not shown on the graph for simplicity.

### Maroubra Zone Substation

Maroubra zone substation firm capacity is not forecast to be exceeded within the immediate forecast period. There are spare 11kV panels available for 11kV development.

Maroubra zone substation is located approximately 5.5 km away from the port facility site. The Sydney Ports site is currently supplied via two 11kV feeders from Maroubra zone and any future expansion of the port site will require the installation of additional 11kV feeders from Maroubra if an alternative supply arrangement is not forthcoming.



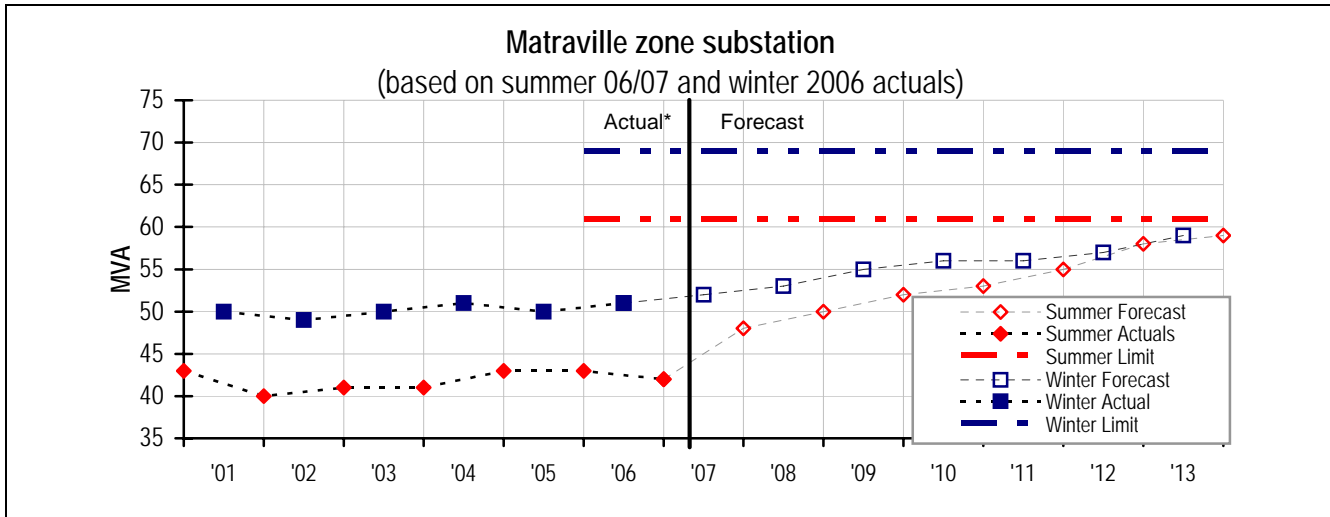
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	Actual							Forecast						
SUMMER	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
Load [MVA]	49.5	48.5	51.4	51.3	52.7	52.7	53.2	61.3	61.9	62.6	63.2	63.8	64.4	65.1
Firm Capacity (FC) [MVA]							97.2	97.2	97.2	97.2	97.2	97.2	97.2	97.2
Limit [MVA] <sup>1</sup>							115.0	115.0	115.0	115.0	115.0	115.0	115.0	115.0
Utilisation (Load/FC)							55%	63%	64%	64%	65%	66%	66%	67%
WINTER	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Load [MVA]	50.9	49.2	51.0	51.3	50.5	52.2	55.0	61.2	61.4	61.5	61.6	61.7	61.8	61.9
Firm Capacity (FC) [MVA]							97.2	97.2	97.2	97.2	97.2	97.2	97.2	97.2
Limit [MVA] <sup>1</sup>							115.0	115.0	115.0	115.0	115.0	115.0	115.0	115.0
Utilisation (Load/FC)							57%	63%	63%	63%	63%	63%	64%	64%

Note \* Previous capacity limits were different under a different Licence condition. These previous limits are not shown on the graph for simplicity.

**Matraville Zone Substation**

Matraville zone substation firm capacity is not forecast to be exceeded within the immediate forecast period. No spare 11kV panels are available for substantial 11kV development and hence it is not considered feasible to supply the requested Sydney Ports loads from Matraville zone substation.



	Actual							Forecast						
SUMMER	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
Load [MVA]	42.8	40.0	40.6	40.5	43.4	43.1	41.8	48.1	50.0	52.0	53.0	55.2	57.5	58.6
Firm Capacity (FC) [MVA]							61.4	61.4	61.4	61.4	61.4	61.4	61.4	61.4
Utilisation (Load/FC)							68%	78%	81%	85%	86%	90%	94%	95%
WINTER	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Load [MVA]	51.2	49.6	48.5	49.7	50.5	49.5	51.0	51.7	53.3	54.5	56.1	56.1	57.3	58.5
Firm Capacity (FC) [MVA]							68.7	68.7	68.7	68.7	68.7	68.7	68.7	68.7
Utilisation (Load/FC)							74%	75%	78%	79%	82%	82%	83%	85%

Note \* Previous capacity limits were different under a different Licence condition. These previous limits are not shown on the graph for simplicity.

**2.2.3. Asset Issues**

**Botany Zone Substation**

All major substation equipments at Botany zone are approaching the end of their serviceable life and will require major refurbishment or replacement within the next five years. The refurbishment of Botany zone substation is planned to be carried out on site.

### **Maroubra Zone Substation**

Most of the major equipment at Maroubra zone substation have recommended remaining life of 10 to 20 years.

### **Matrville Zone Substation**

Condition assessments indicate that most of the 11kV circuit breakers and circuit breaker housings are recommended to be replaced within the next five years. One 33/11kV transformer is recommended to be replaced within the next five years, three within the next 5 to 10 years, and one within 10 to 20 years. Load transfers from Matrville zone substation will be required in order to carry out Matrville switchgear replacement.

## **3. TYPE OF AUGMENTATION**

Most of the EnergyAustralia network within the Port Botany and its surrounding load area, including the aforementioned three zone substations are classified as distribution system assets by the National Electricity Rules (the Rules).

The rules (clauses 5.6.2 (e) and (f)) requires that, where analysis indicates that any relevant technical limits of a distribution system will be exceeded, that the Distribution Network Service Provider must notify any affected Registered Participants of these limitations and the expected time for corrective action and consult with affected Registered Participants and interested parties on the possible options to address the projected limitations of the relevant distribution system. A Network Service Provider does not need to consult on a network option that would be a small network asset, or for options that do not augment the system.

The proposed development strategy for the Port Botany area involves expenditure in excess of \$10 million and is regarded by the Rules as a new large network asset. Accordingly, a Consultation Paper on the projected limitation and options for corrective action was published on 14th April 2008. This Consultation Paper included a preliminary application of the Regulatory test to options which had been identified to address the projected limitations. No submission was received in response to the Consultation Paper. In addition, EnergyAustralia has provided notification of these limits in its Annual Electricity System Development Review (AESDR).

The new capacity provided by the proposed augmentation has been necessitated by both the need to supply customers and to provide increased system capacity to meet minimum network performance standards required by EnergyAustralia's service standard described in Section 2 and would thus be regarded as a reliability driven augmentation for the purposes of the Regulatory Test. Consequently, EnergyAustralia has used a least cost test to examine the options identified to address projected system limitations.

## **4. OPTIONS CONSIDERED**

The following section describes Demand Management and supply side options considered to address the future load increases at Sydney Ports site. Supply side options considered include:

- Option 1: 11kV feeder development from Maroubra ZS.
- Option 2: Port Botany 33/11kV ZS with three transformers.
- Option 3: Port Botany 33/11kV ZS with initially two transformers and load transfer to Maroubra.

(Note: As the anticipated load increases that are not presently committed are **highly likely** to be requested by the Sydney Ports tenants in the near future, the economic analysis will consider the supply of total anticipated load of 24MVA.)

#### **4.1. Consideration of Demand Side Management and Local Generation**

Investigation of demand management opportunities in the Sydney Ports site has been carried out in April 2008. As the proposed supply side investment is predominantly necessitated by the need to supply new customer loads, it is not reasonable to expect that the proposed supply side solution can be cost effectively deferred by implementing demand management strategies.

#### **4.2. Option 1: 11kV feeder development from Maroubra ZS**

Under this option, the additional load request from Sydney Ports site will be supplied at 11kV from Maroubra zone substation. At present, the Sydney Ports site is supplied via two 11kV feeders from Maroubra zone and new 11kV feeders are required to be installed for this option. Maroubra zone substation has sufficient capacity to supply the present anticipated load increase (of 24MVA). The distance between Maroubra zone substation and Port Botany is approximately 5.5 km, which would result in a significant cost for 11kV feeder development.

In addition, a proportion of 11kV load from Matraville ZS will also need to be transferred to Maroubra ZS to enable the replacement of switchgear at Matraville ZS. One bus group from Matraville ZS will need to be vacated in order to carry out the staged switchgear replacement. There is a minimal 11kV interconnection between Matraville ZS and Maroubra ZS which will lead to significant cost in 11kV load transfers.

The estimated capital cost of this option is \$27.9M with a NPC of \$25.3M.

#### **4.3. Option 2: Port Botany 33/11kV ZS with three transformers**

This option involves construction of a new 33/11kV zone substation “Port Botany” equipped with three transformers in the vicinity of customer premises.

This option consists of

- Construction of the new zone equipped with three 33MVA 33/11kV transformers,
- Installation of three new 33kV feeders from Bunnerong STS to supply the new zone,
- 11kV feeder work to supply the new loads at the Sydney Ports site, and
- 11kV feeder works to facilitate staged refurbishment of switchgear at Matraville.

This new zone substation will

- Supply all new anticipated loads for two existing and one future stevedoring tenants at the Sydney Ports site,
- Provide a facility/opportunity to supply existing loads at the Ports area and general network load from the surrounding area, primarily relieving Matraville zone substation,
- Provide a facility to cater for future load growth at the Sydney Ports site and its surrounding area.
- Provide a facility/opportunity to transfer load from Botany zone substation to address its capacity issues if required, and
- Provide a facility/opportunity to transfer load from Matraville zone substation to facilitate in its refurbishment.

Under this option, a proportion of 11kV load from Matraville ZS will be transferred to the proposed Port Botany ZS to enable the staged switchgear replacement at Matraville ZS. Since the proposed Port Botany ZS site is located in the close vicinity of the existing 11kV feeders from Matraville ZS,

the load transfer cost under this option will be significantly less than the cost of load transfer to Maroubra ZS.

The estimated capital cost of this option is \$27.21M with a NPC of \$25.09M.

#### **4.4. Option 3: Port Botany 33/11kV ZS with initially two transformers and load transfer to Maroubra**

This option involves construction of a new 33/11kV zone substation “Port Botany” equipped initially with two transformers in the vicinity of customer premises.

This option consists of

- Construction of the new zone initially equipped with two 33MVA 33/11kV transformers with provision for a third transformer,
- Installation of two new 33kV feeders from Bunnerong STS to supply the new zone with a provision for a third feeder (spare duct),
- 11kV feeder work to supply the new loads at the Sydney Ports site, and
- 11kV feeder works to facilitate staged refurbishment of switchgear at Matraville.

This new zone substation will

- Supply all new anticipated loads for two existing and one future stevedoring tenants at the Sydney Ports site,
- Provide a facility/opportunity (with an addition of a third transformer) to supply existing loads at the Ports area and general network load from the surrounding area, primarily relieving Matraville zone substation,
- Provide a facility to cater for future load growth at the Sydney Ports site and its surrounding area.
- Provide a facility/opportunity (with an addition of a third transformer) to transfer load from Botany zone substation to address its capacity issues if required, and
- Provide a facility/opportunity to transfer load (with an addition of a third transformer) from Matraville zone substation to facilitate in its refurbishment.

Under this option, sufficient 11kV load from Matraville ZS (to enable its switchgear replacement) cannot be transferred to the proposed Port Botany ZS without the installation of a third transformer and a third 33kV feeder within two years. The installation of the third transformer and 33kV feeder within two years of the zone substation commissioning will result in significantly greater cost than the commissioning of the zone substation with three transformers from the beginning (as in the case of Option 2).

Therefore, if the installation of the third transformer within two years is to be avoided, a proportion of 11kV load from Matraville ZS will need to be transferred to Maroubra ZS to enable the replacement of switchgear at Matraville ZS. One bus group from Matraville ZS will need to be vacated in order to carry out the staged switchgear replacement. There is a minimal 11kV interconnection between Matraville ZS and Maroubra ZS which will lead to significant cost in 11kV load transfers.

The estimated capital cost of this option is \$27.50M with a NPC of \$25.10M.

## **5. APPLICATION OF THE REGULATORY TEST**

A preliminary economic analysis has been carried out. It involves the comparison of options on an economic basis by carrying out Net Present Cost (NPC) analysis for each of the three options.

The economic analysis incorporates:

- Capital costs.
- Operation and Maintenance (O&M) costs.
- Sensitivities to changing:
  - Substation construction costs.
  - Transmission mains costs.
  - Distribution mains costs.
  - Discount Factor.
  - Load growth.

The unserved energy benefits do not vary materially between options and have thus been excluded from analysis.

### 5.1. Base Case Analysis

As the anticipated load increases that are not presently committed are **highly likely** to be requested by the Sydney Ports tenants in the near future, the economic analysis will consider the supply of total anticipated load of 24MVA.

The results of the base case economic analysis using a discount factor of 8.5% are summarised in Table 1 below.

*Table 1 - Comparison of Options – Base Case*

Option	Description	Capital Cost (\$M)	NPC <sup>2</sup> of Costs (\$M)
Option 1	11kV Feeder Development from Maroubra ZS	27.85	25.32
Option 2	Port Botany 33/11kV ZS with three transformers	<b>27.21</b>	<b>25.09</b>
Option 3	Port Botany 33/11kV ZS with initially two transformers and load transfer to Maroubra	27.50	25.10

The analysis above indicates that Options 2 has the least Net Present Cost.

### 5.2. Sensitivity Analysis

The base case and the range over which sensitivity checks were conducted are shown in Table 2.

*Table 2 - Base Case Values and Range of Values Used in Sensitivity Checks*

Parameter	Base Case Value	Sensitivity Checks at
Substation Costs	100%	75% and 125%
Transmission Mains Costs	100%	75% and 125%
Distribution Mains Costs	100%	75% and 125%
Discount Factor	8.5%	7.0% and 10.0%
Anticipated load growth	100%	75% and 125% <sup>3</sup>

The results of sensitivity analysis are displayed in Table 3 below.

<sup>2</sup> NPC includes operation and maintenance cost for 10 years.

<sup>3</sup> Variation in anticipated load request for not-yet-committed loads.

Table 3 - Sensitivity Analysis: Comparison of Options

Scenario	Net Present Cost (\$M)		
	Option 1	Option 2	Option 3
25% reduction in substation costs	25.32	<b>21.03</b>	21.56
25% increase in substation costs	<b>25.32</b>	29.16	28.63
25% reduction in transmission mains costs	25.32	<b>23.41</b>	23.52
25% increase in transmission mains costs	25.32	26.77	<b>26.67</b>
25% reduction in distribution mains costs	<b>18.99</b>	24.56	23.93
25% increase in distribution mains costs	31.65	<b>25.62</b>	26.26
7% discount factor	26.16	<b>25.88</b>	25.93
10% discount factor	24.53	24.35	<b>24.31</b>
25% reduction in anticipated load	25.32	<b>25.09</b>	25.10
25% increase in anticipated load	27.28	<b>25.09</b>	25.10

The results from the sensitivity analysis indicate that Option 2 remains the least cost option under the majority of sensitivity checks.

## 6. CONCLUSION

Option 2 has the lowest NPC and has the least cost under the majority of sensitivity scenarios.

Option 2 also offers greater future benefits strategically as discussed in section 3.2. The costs for Options 2 and 3 are very similar, however the Option 3 will require the installation of a third transformer to achieve similar strategic future benefits as those of the Option 2. Furthermore, any additional load increase in the future above the anticipated amount from the Ports area will result in greater marginal costs for Option 1 (due to the possible need of additional 11kV cables) and for Option 3 (due to the possible need of a third transformer and 33kV cable) compared to Option 2. Therefore, Option 2 is the preferred option.

This option involves the development of a new 33/11kV zone substation equipped with three transformers in the vicinity of customer premises. Associated works would include 33kV feeder works and 11kV works to connect new loads from the Sydney Ports site. The 11kV load transfer works associated with Matraville ZS 11kV switchgear refurbishment is also part of this option. The estimated capital cost of this option is \$27.21M with a NPC of \$25.09M.

The establishment of the proposed Port Botany ZS is forecast to be completed by mid 2010. This service availability date may change if the project is affected by circumstances beyond EnergyAustralia's control, such as changes in the timing of customer load increases or other issues such as: delays in the approval process, equipment supply difficulties, unforeseen technical constraints, acts of God and industrial action.

## 7. CONTACT DETAILS FOR ENQUIRIES

This report recommends the construction of a new large distribution network asset. Registered Participants may dispute the recommendations of the report under Clause 5.6.2(i) of the Rules. Registered participants who intend to dispute the recommendations of this report must do so within 40 business days of the report being published and made available on EnergyAustralia's website.

Any enquiries regarding this report should be directed to the contact listed below:

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## 8. APPENDIX A – ECONOMIC ANALYSIS OF BASE CASE

WACC = 8.5% p.a.

### Option 1 – 11kV Feeder Development from Maroubra ZS

Actions	NPC [\$M]	CAPEX [\$M]	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020
11kV feeders from Maroubra ZS to Port Botany area.	19.41	22.35	0.10	5.67	16.58	-	-	-	-	-	-	-	-	-	-
11kV load transfer from Matraville ZS to Maroubra ZS to enable Matraville switchgear replacement.	4.31	5.50	-	-	-	5.50	-	-	-	-	-	-	-	-	-
Operation and Maintenance (O&M)	1.60	-	-	-	-	0.09	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
<b>Total</b>	<b>25.32</b>	<b>27.85</b>	0.1	5.67	16.58	5.59	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32

Note: All figures are in 2007/2008 real dollars [\$M].

### Option 2 – Port Botany 33/11kV ZS with three transformers

Actions	NPC [\$M]	CAPEX [\$M]	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020
New 33/11kV Port Botany Zone Substation	21.44	24.71	-	6.18	18.53	-	-	-	-	-	-	-	-	-	-
<i>Substation works</i>	14.93	17.21	-	4.30	12.91	-	-	-	-	-	-	-	-	-	-
<i>33kV feeder works</i>	6.51	7.50	-	1.88	5.63	-	-	-	-	-	-	-	-	-	-
11kV load transfer from Matraville ZS to Port Botany ZS to enable Matraville switchgear replacement.	1.96	2.50	-	-	-	2.50	-	-	-	-	-	-	-	-	-
Operation and Maintenance (O&M)	1.70	-	-	-	-	0.22	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
<b>Total</b>	<b>25.09</b>	<b>27.21</b>	0.00	6.18	18.53	5.72	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30

Note: All figures are in 2007/2008 real dollars [\$M].

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Option 3 –Port Botany 33/11kV ZS with initially two transformers and load transfer to Maroubra

Actions	NPC [\$M]	CAPEX [\$M]	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020
New 33/11kV Port Botany Zone Substation	19.09	22.00	-	5.50	16.50	-	-	-	-	-	-	-	-	-	-
<i>Substation works</i>	12.98	14.96	-	3.74	11.22	-	-	-	-	-	-	-	-	-	-
<i>33kV feeder works</i>	6.11	7.04	-	1.76	5.28	-	-	-	-	-	-	-	-	-	-
11kV load transfer from Matraville ZS to Maroubra ZS to enable Matraville switchgear replacement.	4.31	5.50	-	-	-	5.50	-	-	-	-	-	-	-	-	-
Operation and Maintenance (O&M)	1.71	-	-	-	-	0.21	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
<b>Total</b>	<b>25.10</b>	<b>27.50</b>	0.00	5.50	16.50	5.71	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30

Note: All figures are in 2007/2008 real dollars [\$M].