

FINAL REPORT

PEATS RIDGE ZONE 11kV DEVELOPMENT

17th 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 lower Central Coast 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 small distribution asset.

A Distribution Network Service Provider does not need to consult on an option which would be a new small network asset. Accordingly, EnergyAustralia has not previously consulted on this project.

Due to load growth in the lower central coast area, resulting in developing supply constraints on the network, 11kV zone development is required at Peats Ridge and Somersby zone substations. To provide a safe and reliable electricity supply for existing customers and provide capacity for future loads, EnergyAustralia is providing additional capacity to relieve current loading and meet the forecast load demands.

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 of the paper provides a background of the Central Coast supply area and the need for augmentation of the 11kV network at Peats Ridge and Somersby zone substations.

Section 2 describes the issues associated with the increase in 11kV feeder loading and the projected load forecast. The concept of service standard, including the risk of loss of load, as implemented by EnergyAustralia is discussed.

Section 3 describes the proposed augmentation in relation to the National Electricity Rule (the Rules). Peats Ridge and Somersby zone substations are classified as a distribution system asset by the Rules, and the proposed development is classified as a small network asset as it involves expenditure of below \$10 million.

Section 4 describes the options that were considered, including Demand Side Management:

- Option 1 – 11kV development at Peats Ridge and Somersby zone substations.
- Option 2 – Installation of a new 11kV feeder at Peats Ridge zone.

Section 5 presents a least cost analysis of the options detailed in Section 4.

Section 6 concludes the preferred option is Option 1 - 11kV development at Peats Ridge and Somersby zone substations.

EnergyAustralia's recommended action is to develop 11kV feeders between Peats Ridge and Somersby zone substation in accordance with Option 1 at an estimated capital cost of \$4.2m and with a net present cost (NPC) of \$3.8m. This recommendation is made based on a least cost to provide increased future capacity.

1. BACKGROUND

This Final Report has been prepared to advise on the 11kV development between Peats Ridge and Somersby zone substations. The proposed works will address general load increase and developing capacity issues in the lower central coast area. The information provided includes:

- A discussion of emerging supply system limitations identified by EnergyAustralia that have lead to the necessity for augmentation of the distribution network in the area.
- A discussion of the service standard that has been adopted for planning purposes.
- Descriptions of options for development of the electricity supply in the area.
- Details of the outcomes of cost effectiveness analysis for the options that have been considered.

Peats Ridge zone substation is supplied from Ourimbah and Gosford Subtransmission substations (STS). Somersby zone substation is supplied from Gosford and Mount Colah STS. Due to increasing demand in the area, and outage emergency risks, a new additional supply to the zone substation is required.

These constraints place operational restrictions on the 11kV network in a contingency event with adjoining feeders unable to supply the load following network switching. Figure 1, details the neighbouring geographic area.

Action is required to ensure Peats Ridge and Somersby zone substations can operate within the service standard.

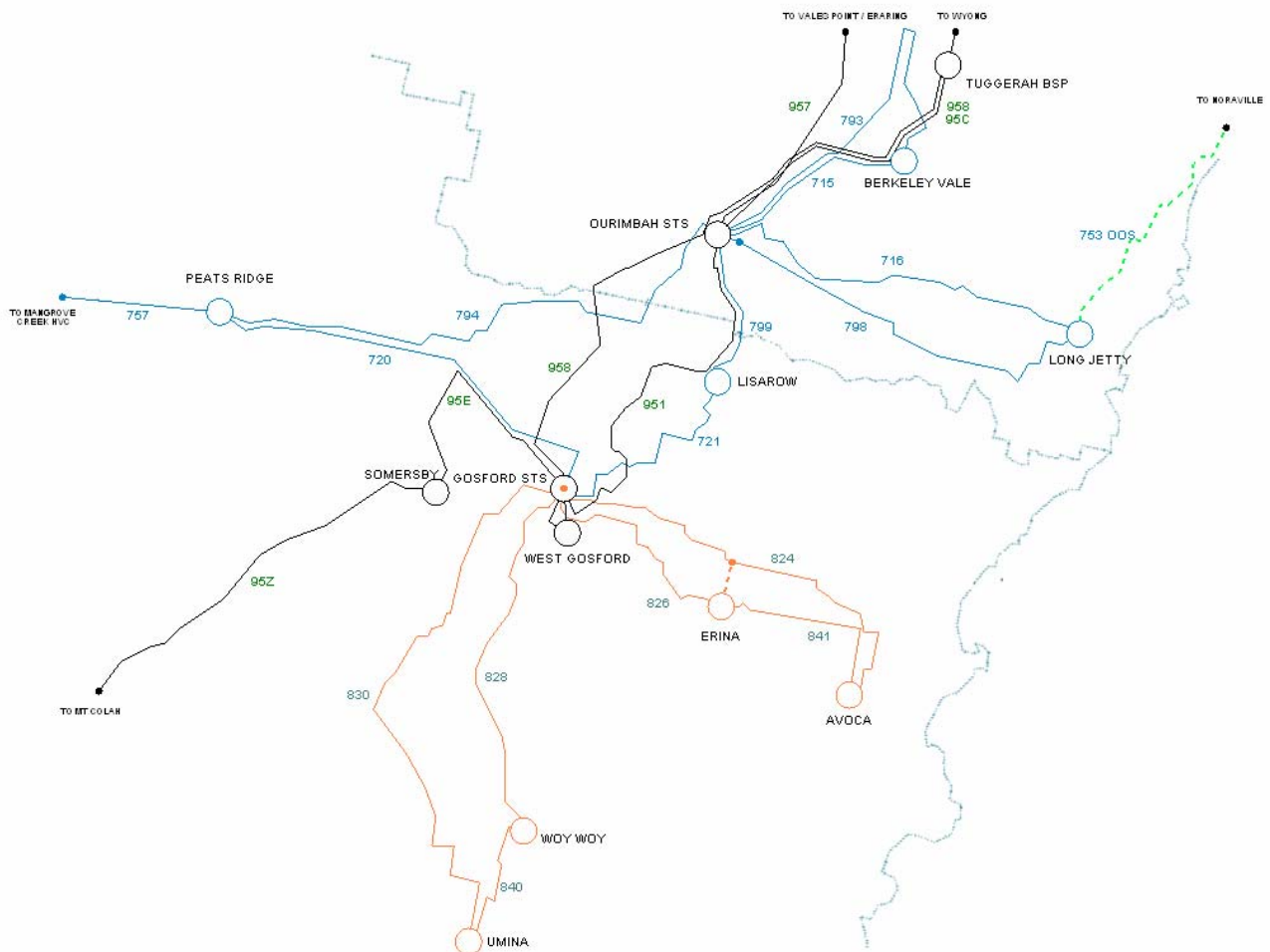


Figure 1: Current Configuration in the lower Central Coast region.

2. ISSUES

2.1. Applied Service Standard

The service standards that are applicable to a consideration of supply constraints affecting the Lower Central Coast load area are summarised below:

2.1.1. 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.

2.1.2. 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.

2.1.3. 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

2.1.4. 11kV Distribution Network

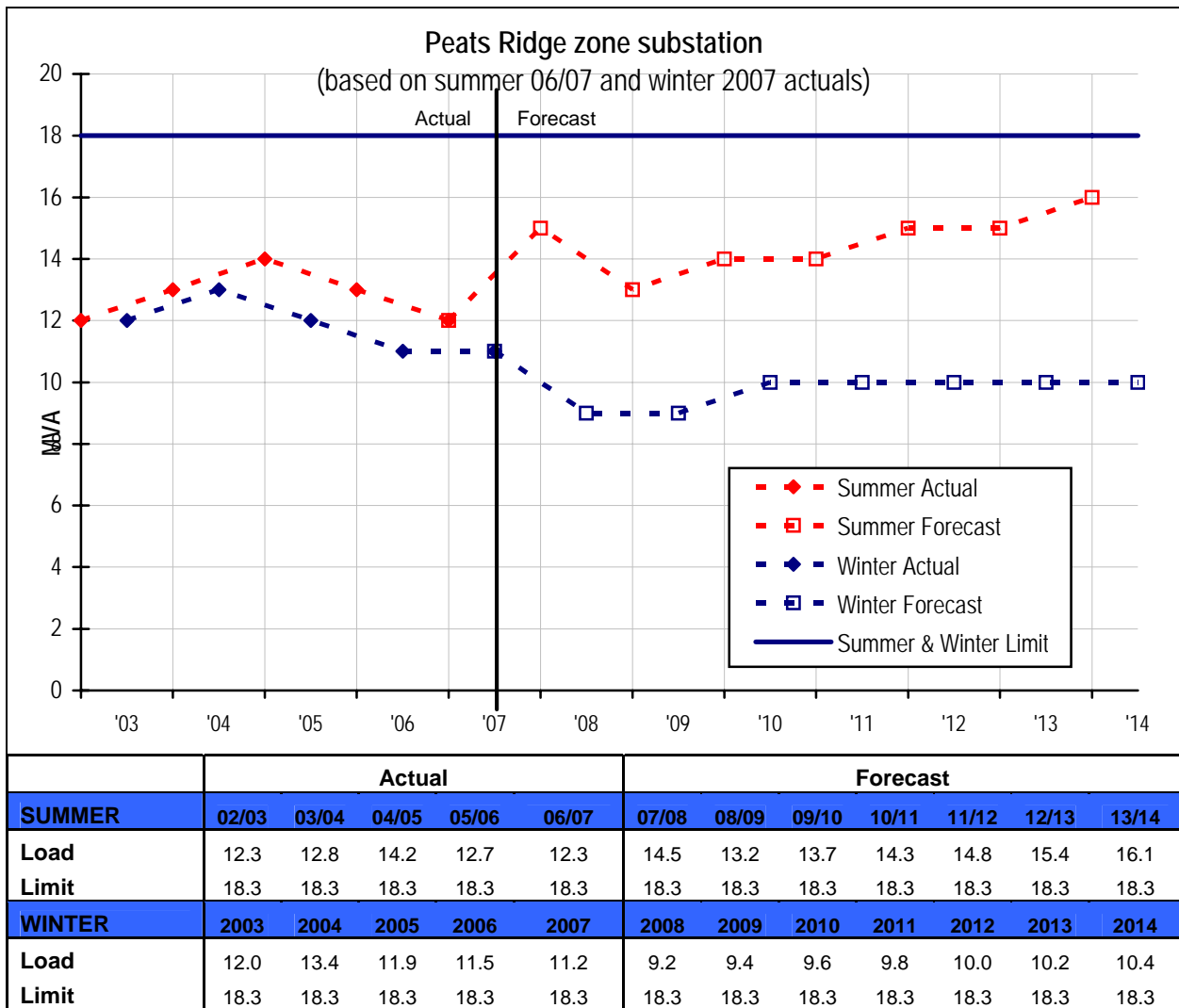
For urban feeders , the expected demand is to be no more than 80% of feeder thermal capacity (under system normal operating conditions), with switchable interconnection to adjacent feeders to enable restoration following an unplanned failure of a single network element (i.e. N-1 conditions). The 11kV network where in a number of feeders forms an interrelated systems, 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 Constraints

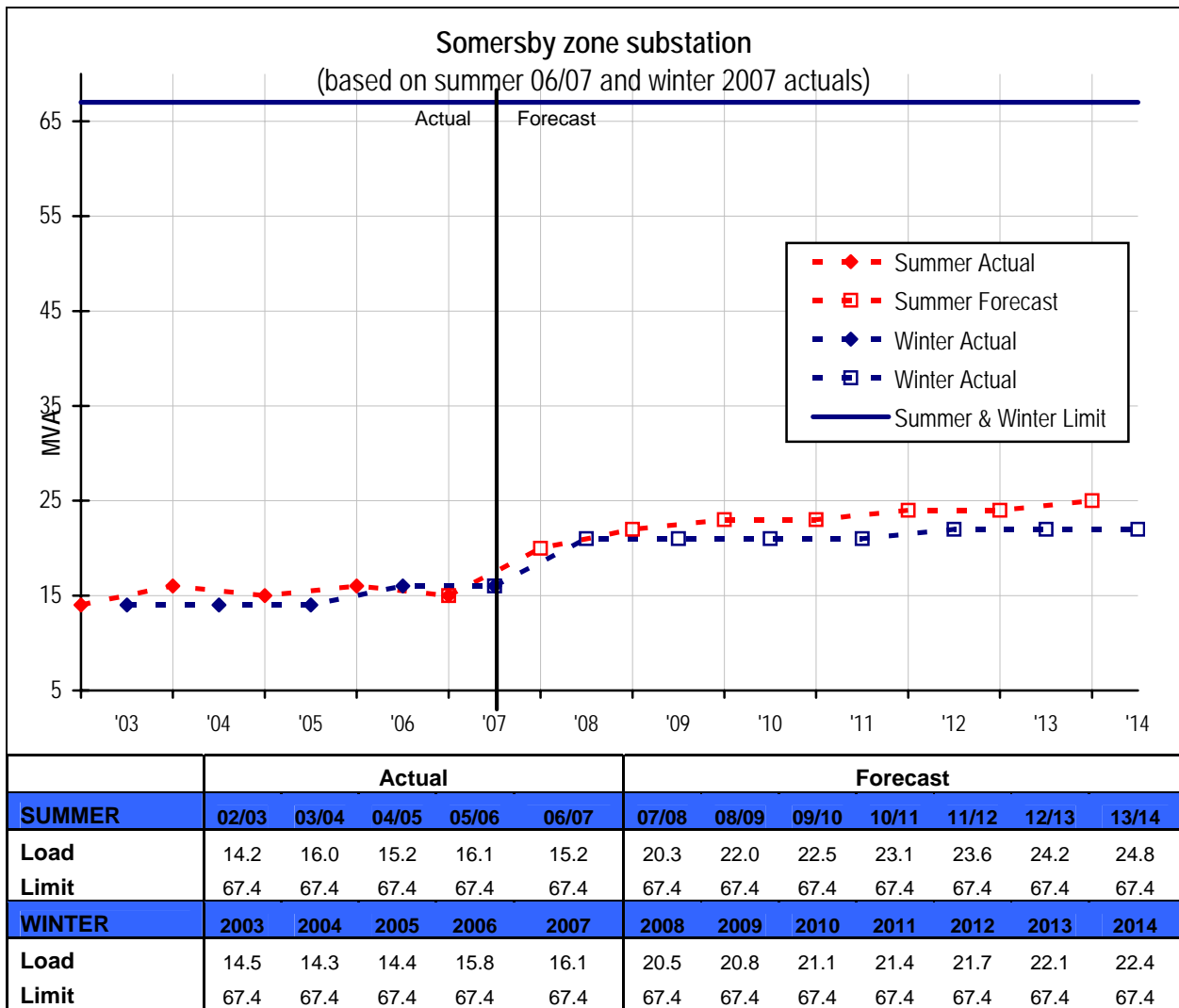
2.2.1. Peats Ridge Zone Substation

Peats Ridge is a 33/11kV zone substation comprised of 2x12.5MVA transformers with a 33kV customer high voltage connection. Peats Ridge zone substation is supplied via 33kV feeders 794 from Ourimbah STS and 740 from Gosford STS. This substation was commissioned in 1965. The firm capacity of the zone substation is 15.2MVA both in summer and winter limited by the 11kV switchgear. Under the current planning limits of 120%, Peats Ridge zone has a system limit of 18.3MVA both in summer and winter. The zone is not expected to exceed planning limits until 2018.



2.2.2. Somersby Zone Substation

Somersby is a 132/11kV zone substation comprised of two 37.5MVA transformers. The zone substation is supplied via 132kV feeders 95E from Gosford STS and 95Z from Mt Colah STS. The firm capacity of the substation is 56.2MVA both in summer and winter. Under the current planning limits of 120%, Somersby zone has a system limit of 67.4MVA both in summer and winter. The zone is not expected to exceed planning limits until beyond 2024.



2.2.3. 11kV Network Capacity Limitation at Peats Ridge and Somersby Zone Substation

Peats Ridge 11kV feeder from Panel 2 supplies the area from Mooney Mooney Creek to Wiseman’s Ferry in the west and to Somersby in the North where it interconnects with 11kV feeders 14 and 17 from Somersby Zone. It has a total length of approximately 114km and includes two voltage regulators.

This is classified as a rural feeder system and as such is designed to ensure that forecast peak demands do not exceed the thermal rating of any element of the feeder. As per EnergyAustralia’s Design Planning Criteria, 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 acceptable limits.

The existing Peats Ridge Zone feeder from Panel 2 is not able to achieve the required Licence Compliance Design Planning Criteria:

- There are multiple non-trunk portions of the Feeder which are overloaded in the normal state at times of peak load, which in turn exacerbates the voltage problems (PT 18484 to PT 13348, PT14974 to PT 13127, and ABS 44162 to ABS 40574).
- Voltage regulation - As the distance from the Zone increases, the voltage is below acceptable levels due to the conductor size constraints. Further, the voltage regulators are loaded and unable to adequately compensate for these excessive voltage drops.
- There are also pickup constraints in the N-1 contingency state. However, this in itself is not necessarily constraint as the feeders are classified as "Rural".

The upgrading of selected voltage regulators also needs to be coupled with the upgrading/uprating or respective sections of high voltage overhead mains to maintain acceptable voltage levels according to the Design Planning Criteria.

The following utilisation summary considers the related group of feeders – Peats Ridge zone feeder Panel 2, Somersby zone feeder Panels 14 and 17. However, the average utilisation does not reflect the maximum density of the load, with current utilisation reflecting much higher percentages under certain scenarios.

Average Utilisation	Do Nothing
Current Utilisation (2008)	72%
Forecast Utilisation (2014)	93%

Table 1- Current Network Utilisation.

Without augmentation, the existing feeders will have insufficient capacity to maintain supply in an ‘N-1’ scenario or will involve an unacceptably high number of switching operations, and thus will not comply with EnergyAustralia’s Planning Standards.

2.3. Network Asset Conditions

Peat Ridge zone substation

- The 33kV circuit breakers are of the bulk oil type and are at the end of their service lives. They have been prioritised for replacement by 2015/16.
- The 11kV outdoor oil circuit breakers have been prioritised for replacement in the period 2009-11.

3. TYPE OF AUGMENTATION

The requirements of the National Electricity Rules (the Rules) for new asset proposals are outlined in Section 5.6 and depend on the cost, purpose and function of the new asset.

The 11kV Peats Ridge zone feeder upgrade is classified as distribution system assets by the National Electricity Rules (the Rules). The Rules (clauses 5.6.2(e) and (f)) require 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 of the expected time for corrective action and consult with affected 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.

Each of the options considered under Section 4 are considered new small distribution network assets as they involve a network augmentation with expenditure less than \$10 million. A DNSP is not required to consult of a project that is a new small distribution asset and hence no consultation paper was issued in regards to this project.

The new capacity provided by the proposed augmentation has been necessitated by the need to meet the service standards described in Section 2 and has therefore been treated 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

4.1. Demand Management

An assessment of Demand Management opportunities in the Peats Ridge/Somersby area was completed in March 2007. The Demand Management Screening Test concluded that the augmentation of the existing 11kV feeder network in the Peats Ridge/Somersby area could not be cost-effectively deferred in the required timeframe by implementing demand management strategies.

4.2. Option 1 - 11kV development at Peats Ridge and Somersby zone substations

The existing Peats Ridge Zone Panel 2 Feeder is approx 114 km long. The preferred option is to transfer 3MVA from Peats Ridge zone feeder Panel 2 to Somersby zone feeder Panel 17 by changing open points and also upgrading the feeders to enable the voltage regulation to comply with the Design Planning Criteria.

This option involves transfer of a large portion of the existing feeder Panel 2 (approx 88 km) at Peats Ridge zone to feeder Panel 17 at Somersby zone. This will require reconductoring and line design temperature augmentation of various sections of the feeder Panel 2 at Peats Ridge zone and the feeder Panel 17 at Somersby zone to enable voltage regulation to comply with design Planning Criteria. As part of this option, a new 4MVA tap changing auto transformer (voltage regulator), a new 2.5MVA tap changing auto transformer (voltage regulator) and two remote controllable smart reclosers and ABS switches will be installed.

The following utilisation summary considers the related group of feeders – Peats Ridge zone feeder Panel 2, Somersby zone feeder Panels 14 and 17 before and after Option 1.

Average Utilisation	Do Nothing	After Option 1
Current Utilisation (2008)	72%	45%
Forecast Utilisation (2014)	93%	54%

Table 2- Network Utilisation after Option 1

The total estimated capital cost of this option is \$4.2m. The Net Present Cost (NPC) is \$3.8m.

4.3. Option 2- Installation of a new 11kV feeder at Peats Ridge zone substation

This option involves the installation of 11kV circuit breaker at Peats Ridge zone and a new feeder from Peats Ridge zone to the vicinity of air breaker switch ABS.44524.

The total estimated capital cost of this option is \$5.5m. The Net Present Cost (NPC) is \$4.9m.

5. ANALYSIS OF OPTIONS

5.1. Base Case Analysis

The results of the base case economic analysis are summarised in table 4 below using the base discount factor of 8.5%.

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Options	NPC (\$m)**	Capital Cost (\$m)
Option 1 - 11kV development of panel 2 and 14/17 at Peats Ridge and Somersby zone substations respectively	3.8	4.2
Option 2 - Installation of a new 11kV feeder at Peats Ridge zone substation	4.9	5.5

** The net present cost includes operation and maintenance cost.

Table 3- Summary of Base Case Economic Analysis.

Refer to Appendix A for further details of the base case economic analysis.

Under the base case analysis, Option 1 is the least cost option.

5.2. Sensitivity Analysis

Sensitivity analysis was carried out to consider the impact of various factors.

5.2.1. Variations in Discount Factor

The NPC results for variation in line costs, discount rate of 7% and 10% are shown in table 4 below.

Sensitivity Factor	NPC (\$m)	
	Option 1	Option 2
8.5 % Discount Rate (Base Case)	3.8	4.9
7.0% Discount Rate	3.9	5.1
10% Discount Rate	3.7	4.8
50% Increase in line costs	4.5	6.0
50% Decrease in line costs	3.4	4.4

Table 4-Sensitivity Analysis

Option 1 is the least cost option for all the sensitivity analysis scenarios.

5.2.2. Variations in Load Growth Rates

Variations in load growth rates will not affect the cost of the supply options as the network constraint issues exist during the construction period of the project.

6. CONCLUSION

Option 1 is the least cost option for all analysed scenarios and is thus the recommended course of action to be taken by EnergyAustralia.

EnergyAustralia’s recommended action is to carry out 11kV development of Panel 2 at Peats Ridge zone and Panels 14 and 17 at Somersby zone in accordance with Option 1 at an estimated cost of \$4.2m. This recommendation is made based on a least cost to provide increased future capacity.

This work is forecast to be completed by December 2008. 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. APPENDIX A – ECONOMIC ANALYSIS OF BASE CASE

Discount Rate – 8.5%

Option 1 - 11kV zone development at Peats Ridge and Somersby zone substation

Description	NPC (\$m)	Capex (\$m)	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Design	0.16	0.16	0.13	0.03								
Project Management	0.12	0.14	0.01	0.02	0.09	0.02						
Construction Labour	1.58	1.84	0.11	0.29	1.15	0.29						
Construction Materials	1.31	1.53	0.07	0.24	0.97	0.24						
Environmental Services	0.11	0.12	0.03	0.09								
Contracted Services	0.20	0.23	0.01	0.04	0.15	0.04						
Land Survey	0.14	0.14	0.14									
Total	3.62	4.16										
O&M Costs	0.16						0.01	0.04	0.04	0.04	0.04	0.04
TOTAL	3.78	4.16	0.50	0.71	2.36	0.59	0.01	0.04	0.04	0.04	0.04	0.04

Option 2 - Installation of a new 11kV Feeder at Peats Ridge zone substation

Description	NPC (\$m)	Capex (\$m)	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Design	0.18	0.18	0.15	0.03								
Project Management	0.15	0.17	0.01	0.03	0.10	0.03						
Construction Labour	1.86	2.20		0.20	1.60	0.40						
Construction Materials	2.00	2.34		0.50	1.50	0.34						
Environmental Services	0.12	0.13	0.03	0.10								
Contracted Services	0.13	0.15		0.05	0.03	0.07						
Land Survey	0.30	0.30	0.30									
Total	4.72	5.47										
O&M Costs	0.22						0.02	0.05	0.05	0.05	0.05	0.05
TOTAL	4.94	5.47	0.49	0.91	3.23	0.84	0.02	0.05	0.05	0.05	0.05	0.05

All amounts are quoted in 2007/08 real dollars (\$m).