



FINAL REPORT

UMINA ZONE 11KV DISTRIBUTION FEEDER DEVELOPMENT

2nd December 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 Umina zone substation (ZS) load area in accordance with Clause 5.6.2 (h) of the National Electricity Rules.

There are capacity issues on the Umina zone substation 11kV distribution network. To ensure a safe and reliable electricity supply for existing customers, EnergyAustralia is providing additional capacity to restore the licence compliance of this distribution network and to meet 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 provides a background of the Umina ZS and the need for augmentation.

Section 2 describes the capacity issues on the Umina ZS 11kV distribution network. 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 on the Umina ZS distribution network is classified as a distribution system asset by the Rules, and the proposed development is classified as a small network asset as the proposed investment involves expenditure of less than \$10 million.

Section 4 describes the options that were considered:

- Option 1 – Two new underground feeders and overhead works,
- Option 2 – Three new underground feeders, and
- Demand Management.

Section 5 presents the results of an economic analysis of the options (base case) and a sensitivity analysis on a selection of key variables.

Section 6 concludes that the preferred option is Option 1 – Two new underground feeders and overhead works.

EnergyAustralia's recommended action is Option 1 and this option involves the installation of two new underground feeders and upgrading and reconductoring of a number of overhead sections in order to address the capacity issues on the Umina ZS distribution network. The estimated capital cost for this option is \$6.02M with a Net Present Cost (NPC) of \$6.06M. The proposed project is planned to be completed in late 2009.

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 Umina zone substation load area. The information provided in this Final Report includes:

- A discussion of emerging supply system limitations identified by EnergyAustralia that have led to the necessity for augmentation of the 11kV network for the zone substation;
- 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; and
- Details of the outcomes of the cost-effectiveness analysis of the options considered.

Umina 66/11kV zone substation (ZS) is located in the southern part of the Lower Central Coast network area. The Umina ZS is supplied by Gosford sub-transmission substation (STS) via two 66kV feeders. A third transformer has recently been installed at the Umina ZS in order to address zone substation capacity issues. There are a number of existing 11kV distribution feeders from Umina ZS that require further development to fully comply with the licence condition.

A geographical overview of the Umina ZS load area is shown in Figure 1.

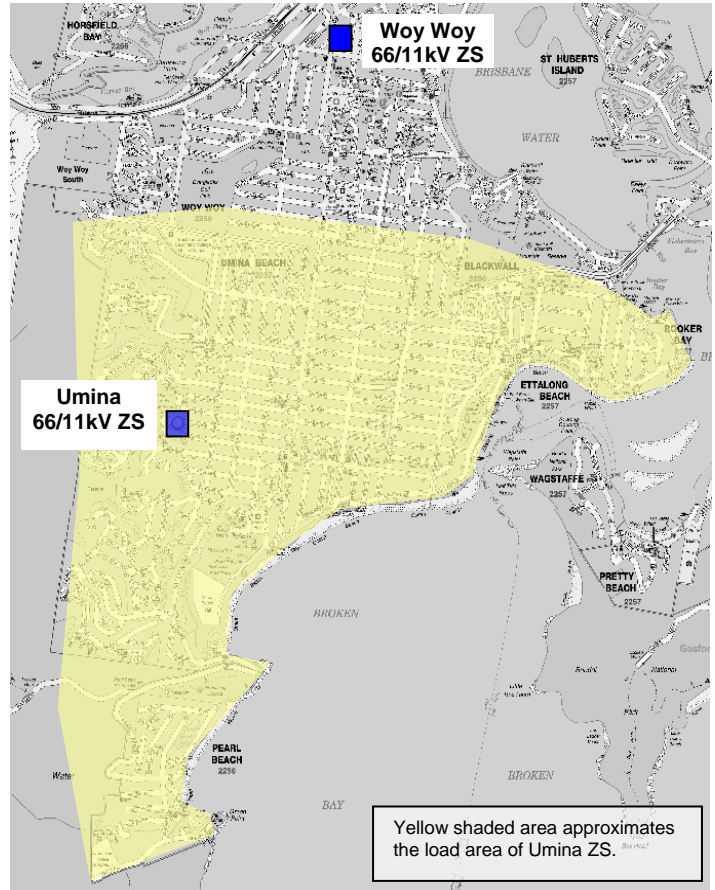


Figure 1 – Geographical overview of Umina ZS load area.

2. ISSUES

2.1. Licence Conditions

The service standards that are applicable to a consideration of supply constraints affecting the Umina zone substation 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.

11kV Distribution Network

For a distribution feeder in urban¹ 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. The customer interruption time following an outage is expected to be less than four hours.

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. Capacity Issues

The average utilisation of an interconnected group of 11kV distribution feeders from Panel 10, 15 and 16 at Umina ZS is greater than 80% under the system normal operating condition, and hence this network does not comply with the Licence conditions. The present average utilisation and forecast utilisation of this 11kV network are shown in Table 1 below.

Table 1: Average utilisation of Pa 10, 15 and 16 feeders

System Normal State	Average utilisation of interconnected Pa10, 15 & 16 feeders
Present utilisation	111%
Forecast utilisation – 6 years	133%

In addition, at times of peak load, feeders from Panel 13 and 18 feeders are not able to maintain the N-1 licence condition for all failure scenarios.

3. TYPE OF AUGMENTATION

Umina ZS is classified as a distribution system asset by the National Electricity Rules (the Rules).

The Rules require that, where analysis indicates that any relevant technical limits of a distribution system will be exceeded, the Distribution Network Service Provider (DNSP) must notify any affected Registered Participants and interested parties of these limitations and the expected time for corrective action. Further, the DNSP must 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 new small network asset, or for options that do not augment the system.

The proposed development strategy for the Umina ZS distribution network involves the expenditure of less than \$10M and hence the proposed strategy is considered as a new small distribution network asset.

A Distribution Network Service Provider is not required to consult on 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

¹ 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.

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 development strategy for the Umina ZS load area is driven by the need to address the capacity limitations on the 11kV distribution network. The following section describes options to address these issues.

4.1. Demand Management

An investigation of Demand Management opportunities in the Umina ZS load area was carried out in September 2008. In order to defer the proposed supply side solution by one year, the required demand reduction is 7.2MVA by November 2009. This represents 28% of the forecast load of the relevant feeders. The cost saving from a one year deferral is \$61/kVA, which is low.

Considering the low cost saving and high demand reduction required, it is not considered reasonable to expect that the proposed supply side solution can be cost effectively deferred by implementing Demand Management strategies. Therefore, Demand Management is not a viable option in this instance.

4.2. Option 1: Two new underground feeders and overhead works

This option involves the installation of two new 11kV feeders to the northern part of Umina ZS load area which will effectively split the Panel 10 and 15 feeders' loads into four feeders. This option also includes overhead feeder uprating and reconductoring works in the southern part of Umina ZS load area in order to relieve load constraint and provide N-1 switching compliance for Panel 13 and 18 feeders.

The present average utilisation and forecast utilisation of the interconnected Panel 10, 15 and 16 feeder network after the implementation of the Option 1 is shown in Table 2 below.

Table 2: Average utilisation of Pa 10, 15 and 16 feeders after implementation of Option 1

System Normal State	Average utilisation of interconnected Pa10, 15 & 16 feeders	
	Present network	After Option 1
Present utilisation	111%	54%
Forecast utilisation – 6 years	133%	64%

The estimated capital cost of this option is **\$6.02M**.

4.3. Option 2: Three new underground feeders

This option involves installation of two new underground feeders to the northern part of the Umina ZS load area along an alternative route to those in the Option 1. An additional new underground feeder will be installed in the southern part instead of the overhead feeder works as in the case of Option 1. This option provides similar benefits as those of the Option 1 but the cost of this option is higher due to the greater length of cable required to be installed.

The estimated capital cost of this option is **\$9.04M**.

5. ANALYSIS OF OPTIONS

5.1. Base Case Analysis

The results of the base case economic analysis are summarised in Table 3 below using a discount rate of 8.5% per annum.

Table 3 – Summary of base case economic analysis

Options	NPC# [\$M]	Capital Cost [\$M]
Option 1 – Two new underground feeders and overhead works	6.06	6.02
Option 2 – Three new underground feeders	9.25	9.04

Note: NPC is higher than Capital Cost since the NPC also includes the operation and maintenance costs.

Refer to Appendix A for further details of base case.

Under the base case condition, 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

Summary of economic analysis with various discount factors is shown in Table 4 below.

Table 4 – Summary of economic analysis with various discount factors

Sensitivity Factor	NPC [\$M]	
	Option 1	Option 2
8.5% p.a. Discount Rate (Base Case)	6.06	9.25
7.0% p.a. Discount Rate	6.14	9.34
10% p.a. Discount Rate	6.00	9.17

For the upper and lower discount factors, Option 1 is the least cost option in all cases.

5.2.2. Variations in Capital Cost

The NPC results for +/-25% variation of capital costs at the base case discount factor of 8.5%p.a. are shown below:

Table 5 – Effects of variation in capital costs

Options	NPC [\$M]	
	-25% Capital Cost	+25% Capital Cost
Option 1 – Two new underground feeders and overhead works	4.55	7.58
Option 2 – Three new underground feeders	6.94	11.56

For the upper and lower limits of capital cost variation, Option 1 is the least cost option in all cases.

The Net Present Cost also includes operation and maintenance costs.

5.2.3. Variations in Load Growth Rate

Variations in load growth rates will not affect the cost of the supply options as the network constraint issues already exist.

6. CONCLUSION

Option 1 has the lowest NPC under the base case and under all sensitivity scenarios.

EnergyAustralia intends to augment the Umina ZS 11kV distribution network by installing two new underground feeders and carrying out overhead feeder uprating and reconductoring works in order to address the issues discussed in Section 2.

The estimated capital cost for this option is \$6.02M with a NPC of \$6.06M.

The works associated with the Option 1 are forecast to be completed by late 2009. 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

WACC = 8.5% p.a.

Option 1 – Two New Underground Feeders and Overhead Works

Actions	NPC[\$k]	CAPEX[\$k]	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019
Install two new underground feeders, and uprate and reconductor overhead lines	5,730	6,020	2,320	3,700									
Operation & Maintenance	331	-			20	72	72	72	72	72	72	72	72
TOTAL	6,062	6,020	2,320	3,700	20	72	72	72	72	72	72	72	72

Option 2 – Three New Underground Feeders

Actions	NPC[\$k]	CAPEX[\$k]	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019
Install three new underground feeders	8,752	9,039	5,377	3,662									
Operation & Maintenance	498	-			31	108	108	108	108	108	108	108	108
TOTAL	9,250	9,039	5,377	3,662	31	108	108	108	108	108	108	108	108

All values are in 2008/2009 real \$k.