



FINAL REPORT

Drummoyne Zone 11kV Development for Feeders 18, 21 and 26

9th December 2008

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EXECUTIVE SUMMARY

This Final Report has been prepared to report on upgrade work that is proposed to develop the electricity supply network in the Drummoyne zone substation 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.

To provide a safe and reliable electricity supply for existing customers and provide capacity for future loads, EnergyAustralia is faced with a primary need to provide additional supply system capacity to meet forecasted 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 Drummoyne zone substation supply area and the need for augmentation of the 11kV network.

Section 2 describes the issues associated with the increased load demand. 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 Rules (the Rules). Drummoyne zone substation is classified as a distribution system asset by the Rules, and the proposed development is classified as a small network asset as it involves expenditure below \$10 million.

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

- Option 1 – Feeder Replacement in conjunction with minor augmentation works.
- Option 2 – Install a new feeder from Drummoyne zone substation to Birkenhead Point.

Section 5 presents the results of economic analysis of the options considered in Section 4.

Section 6 concludes that the preferred option is Option 1 – Replacement of existing ageing cable with new or existing out-of-service cable in the feeders 18 and 21, in conjunction with minor augmentation works on the feeders 14 and 26.

EnergyAustralia's recommended action is to provide an increase in the 11kV feeder capacity at Drummoyne zone by the replacement of existing ageing cable in feeders 18 and 21, and augmentation works on feeders 14 and 26 at a cost of \$3M. This recommendation is made based on the least cost test to provide medium to long term capacity and meet EnergyAustralia's reliability standard for the Drummoyne supply area.

1. BACKGROUND

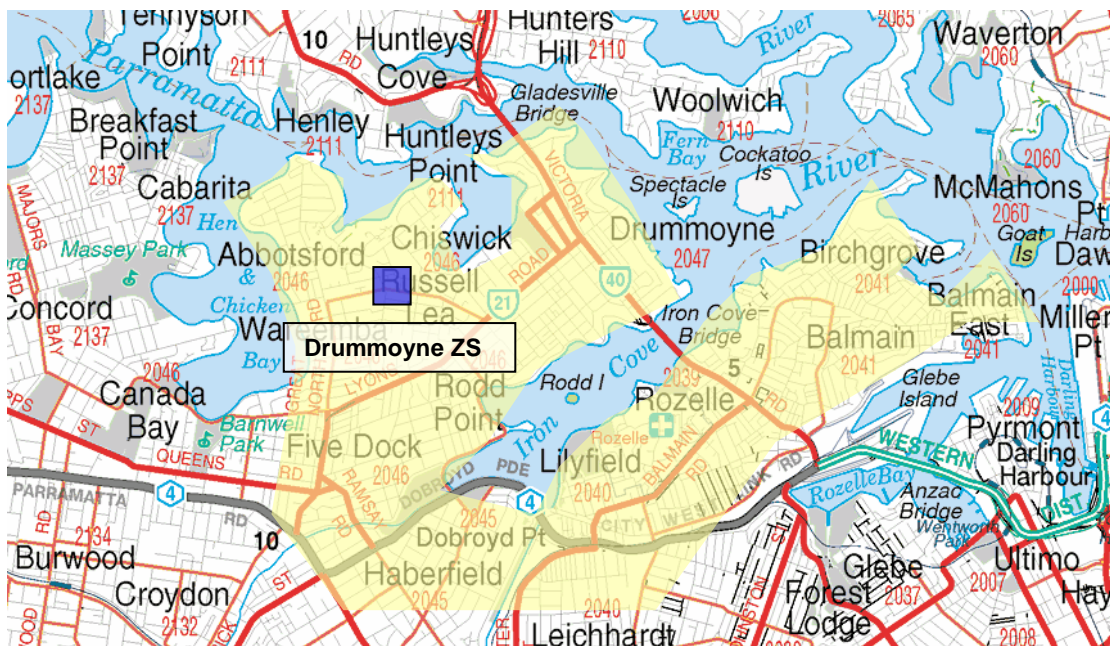
This Final Report has been prepared to advise on the upgrade work that is proposed to be carried out on the Drummoyne Zone Substation 11kV network. The information provided includes:

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

Drummoyne 132/11kV zone substation was commissioned in 1979. The 11kV feeder system supplies parts of Abbotsford, Balmain, Balmain East, Birchgrove, Chriswick, Drummoyne, Five Dock, Rozelle and Russell Lea.

This Final Report analyses the additional capacity to the existing 11kV feeders to be achieved by the project that is the subject of this report in order to meet the required Licence Compliance Design Planning Criteria at Drummoyne zone substation.

Figure 1 – Area supplied by Drummoyne ZS shaded in yellow



2. ISSUES

2.1. Applied Service Standard

The service standards that are applicable to a consideration of supply constraints affecting the Drummoyne zone substation supply area is summarised below:

- 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.
- For urban 11kV distribution feeders¹, 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.

¹ An urban feeder is defined as a feeder with actual maximum demand greater than 0.3MVA/km

- 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. Drummoyne Zone Substation Capacity Issues

There are many forthcoming developments, ranging in size, that have been planned in the Drummoyne Zone area. In particular at Birkenhead, the primarily commercial precinct, which has recently undertaken large redevelopment works and is proposing associated load increases.

Sufficient to satisfy the load increase requirements, the front line trunk portions from Drummoyne Zone are high capacity 500mm² Al3 cables. However, these are being constrained by lower capacity aged networks in the Birkenhead / Drummoyne areas, mainly comprised of aged 32/39/97mm² Cu3 and <300mm² Al3 cables.

At a normal condition operating utilisation of 86%, feeder 18 is currently loaded above the 80% licence requirement. In 6 years, utilisation increase to 105%.

3. TYPE OF AUGMENTATION

Drummoyne zone substation is classified as a distribution system asset by the National Electricity Rules (the Rules). Installation of 4 feeder sections and augmentation of existing out-of-service cables from Drummond zone substation was calculated to be \$3.00M. Accordingly, since the proposed development strategy for the Drummoyne zone substation area involves a growth component expenditure of less than \$10 million, it is regarded by the Rules as a small network asset.

The new capacity provided by the proposed work will be used to maintain existing standards of service and would thus be considered a reliability driven augmentation. EnergyAustralia has analysed the cost-effectiveness and feasibility of a range of options which will provide increased long term future capacity.

4. OPTIONS CONSIDERED

4.1. Demand Management

A Demand Management Screening Test was undertaken in September 2008, establishing the potential to reduce demand on feeder 21 at Drummoyne zone by 1.9MVA by summer 2009/10 at \$220,000, and increase to 2.1MVA at \$430,000 the following year.

Given the size of the demand management requirement, and the moderate savings potential, it is not considered reasonable to expect that it would be cost-effective to postpone the proposed supply-side solution by implementing demand management strategies.

4.2. Option 1 – Feeder Replacement in conjunction with minor augmentation works.

This option involves:

- The installation of 11kV feeder sections, providing interconnections between feeders 18 and 14.
- The installation of 11kV feeder sections, providing interconnections between feeders 14 and 26.
- Replacement of 11kV feeder sections with 500mm² underground cable on feeders 18, 21 and 26.

The estimated capital cost of this augmentation is \$3.00M.

Table 4-1 Utilisation summary of feeder 14, 18, 21 and 26 for summer and winter under normal conditions.

Feeder	Do Nothing				After Selected Option			
	Now		6 year		Now		6 year	
	S	W	S	W	S	W	S	W
14	66%	65%	76%	71%	66%	65%	76%	71%
18	86%	68%	105%	71%	71%	55%	83%	58%
21	49%	70%	55%	71%	34%	41%	38%	41%
26	30%	43%	37%	44%	48%	73%	58%	75%
Total Avg	58%	62%	68%	64%	55%	59%	64%	61%

As shown in table 2-1 above, Feeder 18 is currently loaded above 80% utilisation and is forecast to increase to 106% over the next 6 years.

Table 4-2 Loads on Feeder sections during outages of feeders 21 and 18.

Pick Up Feeder	location		Feeder Rating (A)	Outage Feeder (A)	
	from	to		21	18
18	Trunk	S3963	380	427	-
	S3963	S1324	380	400	-
	S1324	S367	380	373	-
	S367	S4326	250	345	-
	S4326	S2433	225	326	-
	S2433	S801	205	296	-
14	Trunk	S4672	340	-	395
	S4672	S3024	340	-	380
	S4672	S3047	135	-	137
21	Trunk	S3730	250	-	297
	S3730	S1478	295	-	285
	S3730	S35573	220	-	270

Table 2-2 above demonstrates the deficiencies in Feeders 18, 14 and 21 to comply with the N-1 requirement following the failure of feeders 21 and 18.

4.3.Option 2 – Install a new feeder from Drummoyne zone substation to Birkenhead Point.

This option involves the installation of a new 11kV feeder from Drummoyne ZS to Birkenhead Point. This requires significant underground cable work in comparison to option 1. Also, the opportunity to utilise out-of-service cable is reduced.

The estimated capital cost of this augmentation is \$3.81M.

5. ANALYSIS OF OPTIONS

5.1. Base Case Analysis

The results of the base case economic analysis are summarised below using a discount rate of 8.5%.

Table 1: Summary of base case analysis of options

Options	Capital Cost (\$M)	NPC (\$M)
Option 1 – Feeder Replacement in conjunction with minor augmentation works	3.00	2.71
Option 2 – Install a new feeder from Drummoyne zone substation to Birkenhead Point.	3.81	3.59

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

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

5.2. Sensitivity Analysis

The NPC results for variations in discount factor, capital cost and load growth rate are shown in table 2 below:

Table 2: Summary of sensitivity analysis of options

Scenario	NPC (\$M)	
	Option 1	Option 2
7% discount factor	2.77	3.65
10% discount factor	2.66	3.52
25% decrease in capital cost	2.63	3.31
25% increase in capital cost	2.71	3.64

Variations in load growth have no impact on the timing of the project supply options due to Drummoyne zone 11kV feeders being presently loaded above EnergyAustralia service standards.

Option 1 is the least cost option under all analysed sensitivity scenarios.

6. CONCLUSION

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

EnergyAustralia intends to replace existing ageing cable with new or existing out-of-service cable in feeders 18 and 21, in conjunction with minor augmentation works on feeder 26.

This work is forecast to be completed in July 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%

Option 1 – Feeder Replacement in conjunction with minor augmentation works.

Actions	NPV (\$M)	CAPEX (\$M)	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Bulk Cable Laying	0968	1.050		1.050							
Materials	0.337	0.366		0.366							
Permanent Reinstatement	0.886	1.000		0.500	0.500						
Project Management and Labour	0.082	0.089		0.089							
Field Services	0.416	0.490			0.490						
O&M	0.025					0.001	0.004	0.004	0.004	0.004	0.004
	2.71	3.00									

Option 2 – Install a new feeder from Drummoyne zone substation to Birkenhead Point.

Actions	NPV (\$M)	CAPEX (\$M)	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Bulk Cable Laying	1.788	1.940		1.940							
Materials	0.214	0.233		0.233							
Permanent Reinstatement	0.886	1.000		0.500	0.500						
Project Management and Labour	0.484	0.525		0.525							
Field Services	0.093	0.110			0.110						
O&M	0.016					0.001	0.003	0.003	0.003	0.003	0.003
	3.48	3.81									

Note: The above figures are quoted in real (2007/08) dollars.