

FINAL REPORT

NEWCASTLE CBD ZONE 11kV CAPACITORS

14 October 2008

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EXECUTIVE SUMMARY

This paper has been prepared to report on the assessment of options to address the limitation of the electricity supply network in the Newcastle Inner City area in accordance with Clause 5.6.2 (h) of the National Electricity Rules (The Rules). The work proposed by this report is classified as a new small distribution network asset.

The Rules do not require a Distribution Network Service Provider (DNSP) to consult on an option that 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 new developments in the Newcastle Inner City area, EnergyAustralia is faced with a primary need to provide additional supply capacity to meet forecasted load demands. The provision of additional capacity is required to be as compliant as reasonably practicable with the network performance requirements set by EnergyAustralia, in accordance with Schedule 5.6 of the Rules and EnergyAustralia's DNSP licence conditions.

This report covers the following issues:

Section 1 provides a background of the Newcastle Inner City area and the need for augmentation at the Newcastle CBD zone substation.

Section 2 describes the capacity issue at the Newcastle CBD zone substation and the concept of service standard, as implemented by EnergyAustralia is discussed.

Section 3 describes the options that were considered, including Demand Side Management.

Newcastle CBD 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 of below \$10 million.

Section 4 presents an analysis of the selected option.

Section 5 concludes the installation of 11kV capacitors at Newcastle CBD zone substation represents a cost effective means of reducing the load at risk.

While the additional capacity provided by this option is insufficient to reduce the peak demand below the limit implied by the design planning criteria, it will reduce the size and duration of the excursions above this level and lead to a substantial reduction in the exposure to potential outages.

Accordingly, EnergyAustralia recommends the installation of 11kV capacitors at Newcastle CBD at an estimated capital cost of \$1.97 million. The capacitors are expected to be installed in November 2008.

1. BACKGROUND

1.1. Purpose and Scope

This Final Report has been prepared to advise on a project to install 11kV capacitors at Newcastle CBD zone substation (ZS) in order to meet the requirement of Clause 5.6.2 (h) of the National Electricity Rules (the Rules). The information provided includes:

- A discussion of emerging supply system limitations identified by EnergyAustralia that have led to the necessity for augmentation at Newcastle CBD ZS.
- A discussion of the service standard that has been adopted for planning purposes.
- Descriptions of the options for development of the electricity supply in the Newcastle Inner City area.
- Details of the methodology adopted to determine the cost effectiveness of the recommended option.

1.2. National Electricity Rules

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.

Newcastle CBD ZS and the associated 33kV network are classified as distribution system assets by 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 (DNSP) must notify any 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.

EnergyAustralia has previously provided notification of the projected limitation at Newcastle CBD (City Main) ZS in the Electricity System Development Review of 2007/08 and in the Consultation Paper for the new Adamstown 132/11kV substation published on 24 January 2008.

1.3. Existing Supply Arrangements

The Newcastle Inner City area is supplied by the Newcastle CBD, Adamstown, Carrington, Kotara, Broadmeadow and New Lambton zone substations. Newcastle CBD ZS was commissioned May 2008 to replace the now retired City Main ZS, which was aged, and to provide additional capacity to the Newcastle Inner City area. Load was transferred to the new zone from City Main as well as Adamstown, Broadmeadow and Carrington zones, to relieve forecast capacity constraints at these zones. This new substation includes three 33/11kV transformers supplied at 33kV from Merewether subtransmission substation.

The Newcastle Inner City area network is shown geographically in Figure 1 and schematically in Figure 2. A new 132/11 kV zone substation has been approved to replace the existing Adamstown 33/11kV zone, which is aged and recommended for retirement. This will also provide additional capacity to the Newcastle Inner City area. This project is anticipated to be completed in 2010.

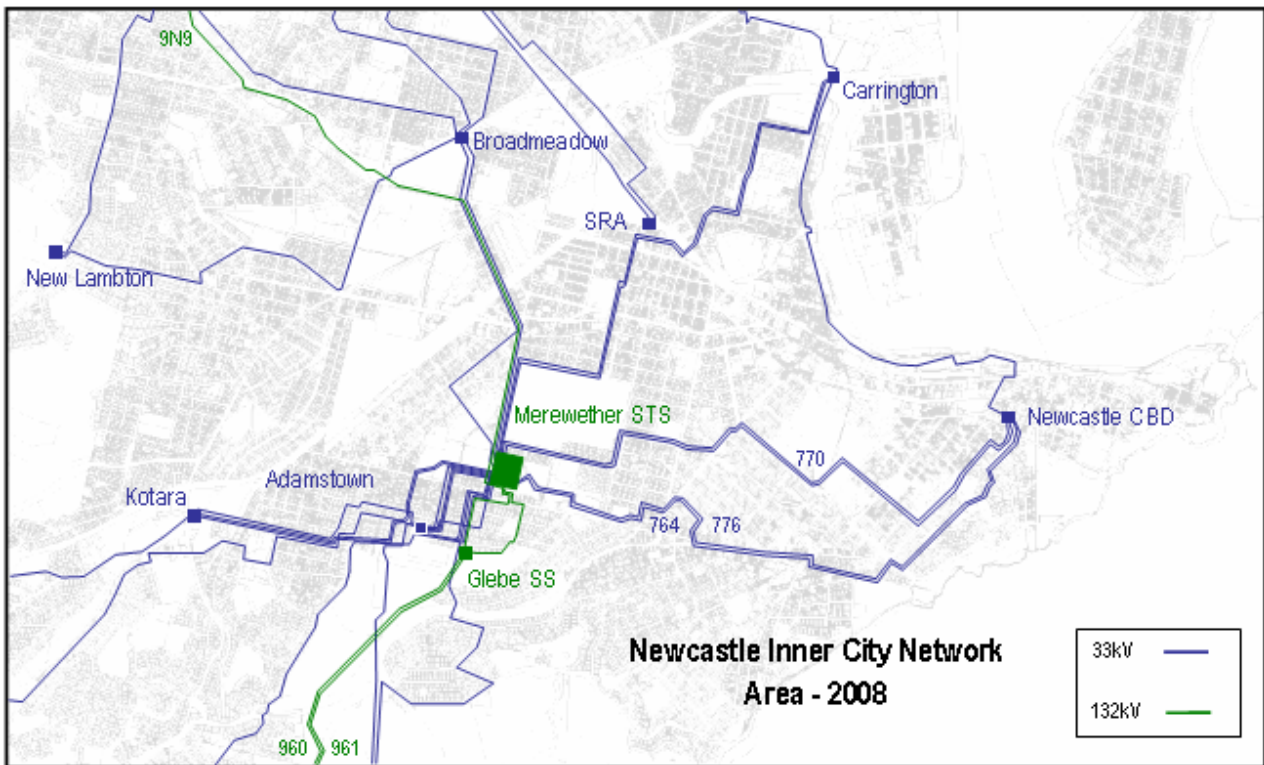


Figure 1: The Newcastle Inner City Area Network - Geographic

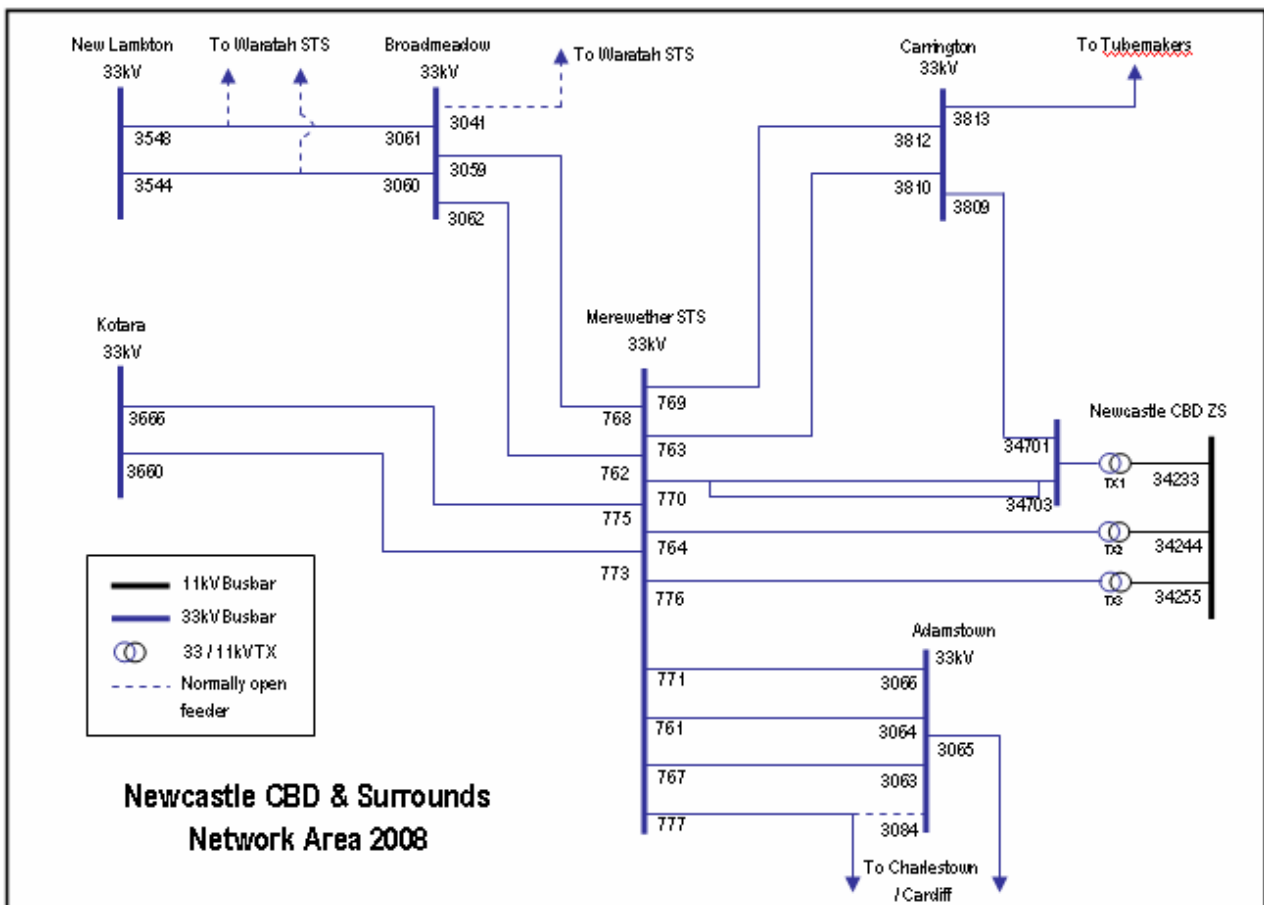


Figure 2: The Newcastle Inner City Area Network - Schematic

2. ISSUES

2.1. Applied Service Standards

The service standards that are applicable to a consideration of supply constraints affecting the Newcastle Inner City area are summarised below:

2.1.1. 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 33kV Sub-Transmission Network

For a failure of a single critical element (i.e. N-1 conditions) within zone substations supplying greater than 10MVA of load and for 33kV overhead 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); and up to a maximum of 20% above the thermal capacity. Recovery of load should be within one minute. For a failure of a single critical element of an underground 33kV network, the forecast demand is not to exceed the thermal capacity.

2.2. Network Issues

2.2.1. Newcastle CBD zone substation

Under the applicable design planning criteria, the Newcastle CBD zone substation can supply up to 64MVA in summer, limited by the ratings of the incoming 33kV feeders. Load on the substation is forecast to grow progressively, including load transfers from adjacent zones which are also approaching the limit required in design criteria. In summer 2008/09, load is forecast to be 13.4MVA higher than the design planning limit. The new Adamstown 132/11kV zone, will provide sufficient capacity to reduce load on Newcastle CBD zone; however this option can not be delivered until 2010.

Prior to the commissioning of Adamstown ZS there would be an estimated 2177MVAh of load at risk¹ over summer 2008/09 and 2009/10 on the Newcastle Inner City area network.

2.2.2. Other Zone Substations

Generally, there is a shortfall in zone substation capacity in the Newcastle Inner City area. All zones are forecast to exceed their planning limit, either due to limitations at the zone or limitations on the feeder network that supplies them. Consequently, transferring load to adjacent zones is not feasible.

3. OPTIONS CONSIDERED

3.1. Demand Management

A Demand Management screening test was completed in October 2007. It found that the DM requirement would be large in both absolute terms and relative to the total demand of the area (17%). The savings are negligible if the capacitors would be required at a later date anyway, and only moderate if the investment can be avoided entirely. It is concluded that it would not be reasonable to expect that it would be cost effective to postpone or avoid the proposed supply side solution by implementing demand management strategies.

¹ 'Load at risk' is defined as the energy (in MVAh) which is supplied to customers when the peak load on the limiting network supply element is above the design risk rating.

3.2. Installation of 11kV Capacitors (Option 1)

This option involves the installation of 24MVAR 11kV capacitors at Newcastle CBD zone substation. The option will increase power factor at the zone substation at peak load times from 0.85 to 0.98 in addition to reducing peak load on the incoming 33kV supply from Merewether STS. The capital cost of this option is \$1.97 million and the Net Present Cost (NPC) is \$1.94 million.

It should be noted that while it is insufficient to reduce the peak demand below the limit implied by the design planning criteria, it will reduce the size and duration of the excursions above this level and lead to a substantial reduction in the exposure to potential outages. The estimated reduction in the load at risk as a result of this project is 1670MVAh over summer 2008/09 and 2009/10, which reflects a 77% reduction in the load at risk.

Figure 3 shows the reduction in the summer peak load following the capacitor installation.

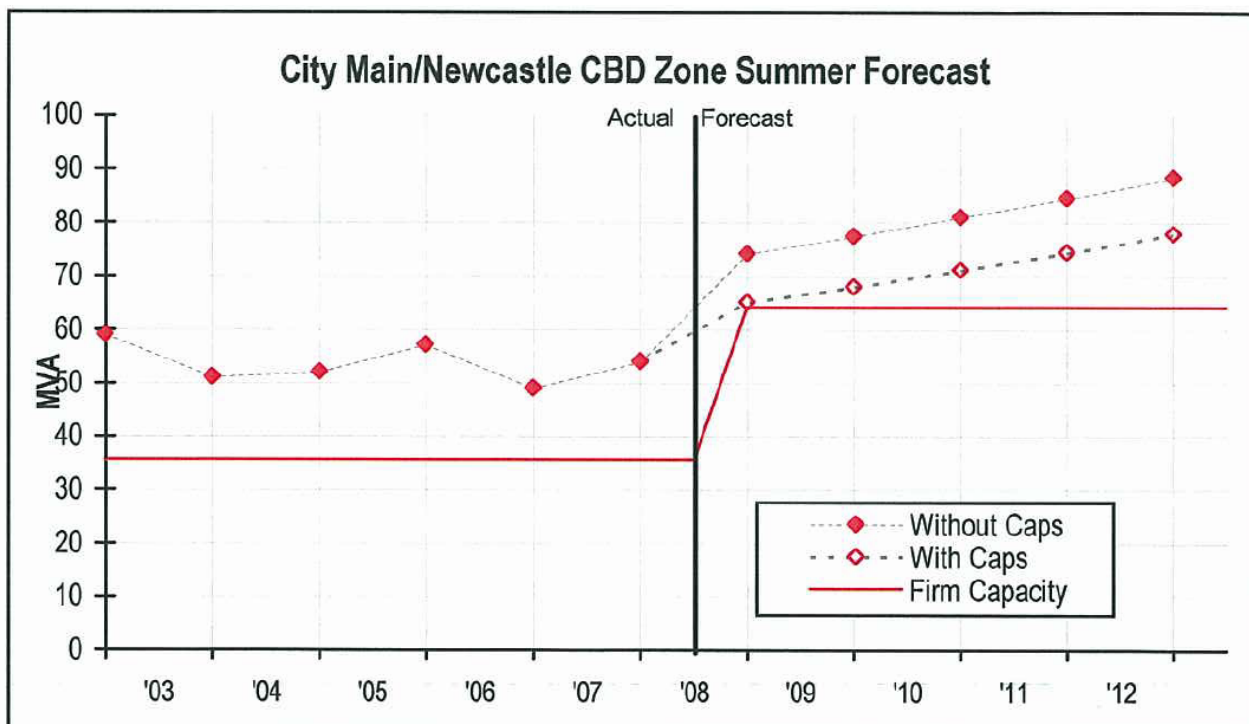


Figure 3: City Main/Newcastle CBD zone summer peak reduction with capacitor installation.

4. ANALYSIS OF OPTIONS

4.1. Introduction

The Independent Pricing and Regulatory Tribunal (IPART) has approved a methodology for calculating the value of avoided distribution costs for the purposes of determining the cost effectiveness of demand management projects that reduce load at risk where a capital project has been delayed beyond the system need date. Whilst this methodology specifically refers to demand management projects, the principles can be equally applied to the proposed capacitor project, which also has the purpose of reducing load at risk.

The methodology is based on proportioning the effective avoided distribution costs according to the reasonably expected impact of the risk mitigation measure. The avoided distribution costs are the present value of the difference between the cash flows that would have occurred if the supply solution had been delivered by the system need date and the cash flows that will actually occur.

4.2. Installation of 11kV capacitors (Option 1)

Applied to this circumstance, constructing the new 132kV zone substation at Adamstown two years earlier than proposed such that it is completed in 2008, would resolve the capacity issues at Newcastle CBD ZS. The

difference in NPC between completing the new Adamstown ZS in 2008 (the system need date) and 2010 (actual expected) is \$4.29 million dollars (including capital and operational costs).

The proposed project will reduce the load at risk by up to 77%. Under the methodology, such a project would be considered cost effective if its Net Present Cost (NPC) was less than \$3.28 million (77% of \$4.29 million). The proposed augmentation has a NPC of \$1.94 million, which is less than \$3.28 million.

5. CONCLUSION

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

EnergyAustralia intends to install 24MVA_r 11kV capacitors at Newcastle CBD zone substation at an estimated cost of \$1.97 million.

This work is anticipated to be completed in November 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.