



APPLICATION NOTICE

DEVELOPMENT OF HURSTVILLE NORTH ZONE SUBSTATION

19th December 2008

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EXECUTIVE SUMMARY

This Application Notice has been prepared to provide a basis for EnergyAustralia to consult with affected registered participants and interested parties on the potential options for the development of the electricity supply network in the Hurstville area.

To ensure a safe and reliable electricity supply for existing customers and new developments in the area, an integrated strategy is required to:

- Replace or retire aging equipment in zone substations over the next decade.
- Provide additional supply system capacity to meet projected load growth.

EnergyAustralia has conducted an economic analysis of the potential options to identify a preferred option which satisfies the regulatory test as set out by the Australian Energy Regulator (AER). The 'Regulatory Test' is a methodology that assesses the economic prudence of a network investment.

This paper is presented in the following sections:

Section 1 of the paper provides a description of the load area and the context of the Application Notice within the regulatory approval process.

Section 2 describes the limitations affecting the supply network in the area and the need for augmentation of the supply to the area. The objectively measurable service standard (planning criterion), against which the need and effectiveness of augmentation options are to be assessed, is also presented.

Section 3 presents the options to address the issues affecting the supply network including non-network options. Two feasible augmentation options based on technical and economic performance are described:

Option 1: Conversion of Hurstville North to 132/11kV operation.

Option 2: Conversion of Hurstville North to 132/11kV operation on alternative site.

Section 4 presents the results of a preliminary application of the regulatory test and the options are ranked.

Section 5 concludes that the least cost option is to convert the existing 33/11kV Hurstville North zone to 132/11kV operation. The conclusion was made in accordance with the regulatory test to meet EnergyAustralia's reliability standard.

Therefore, EnergyAustralia's recommended action is Option 1: Conversion of Hurstville North to 132/11kV Operation in 2012, to address the electricity supply constraints in the Hurstville load area. The total capital cost of this work is estimated to be \$45.7M and is expected to be commissioned in 2012.

1. INTRODUCTION

1.1. Purpose and Scope

This Application Notice has been prepared to provide a basis for EnergyAustralia to consult with Registered Participants and interested parties. It sets out potential options for the development of electricity supply in the Hurstville load area.

It includes:

- A discussion of the supply system limitations identified by EnergyAustralia. From this, feasible options have been identified for the replacement and augmentation of network infrastructure in the area.
- A discussion of the service standard that has been adopted for planning purposes.
- A description of potential options which have been identified for development of the electricity supply in the area.
- A detailed preliminary cost effectiveness analysis in Net Present Cost (NPC) of each of these options, carried out in accordance with the requirements of the Regulatory Test.

1.2. Electricity Supply Network

The St George load area which incorporates the Hurstville load area comprises more than 30 suburbs and has been historically characterised by a mixture of light industrial, commercial and residential load. In recent years, increasing numbers of commercial and high density residential developments have been established in the area, particularly along the railway corridor between Hurstville and Wollri Creek. Since the mid 1990's, these developments have resulted in steadily increasing demand for electricity supply which is expected to continue.

The zone substations in the area are supplied from Peakhurst 132/33kV Subtransmission Substation (STS). Peakhurst STS in turn is supplied at 132kV from TransGrid's Sydney South 330/132kV Bulk Supply Point (BSP), with interconnection to Bunnerong 132/33kV STS and TransGrid's Beaconsfield West BSP via the 132kV network. The main supply network comprises of an aged 33kV network, overlaid with a more modern 132kV network. A large proportion of the 33kV network, including substantial lengths of 33kV cable, are approaching the end of their operational life and will require replacement within the next 10 years.

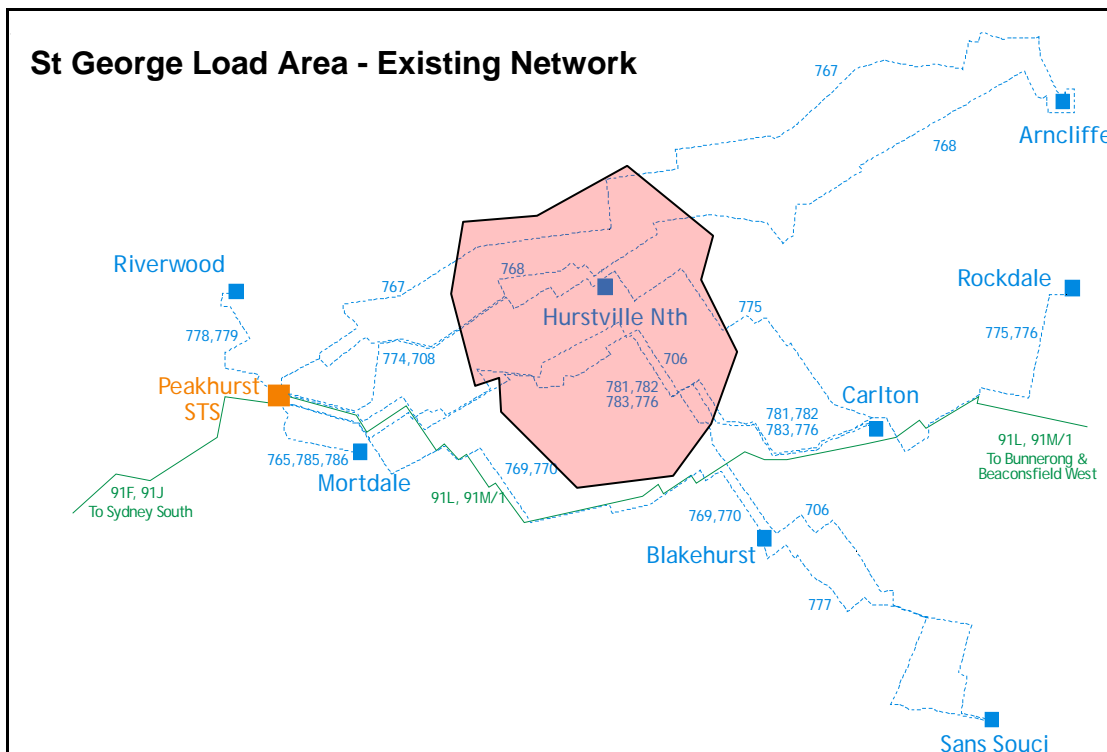


Figure 1: Existing St George network showing Hurstville North load area

Hurstville North 33/11kV zone substation is situated near the centre of the St George area and is currently loaded above its firm capacity in both summer and winter. There are also aged asset issues at the substation, in addition to the presence of 33kV underground gas pressure cables supplying the zone.

1.1.1. Supply Arrangements

Hurstville North 33/11kV Zone Substation

Hurstville North 33/11kV zone substation was commissioned in 1962 and comprises of three 15MVA transformers. Hurstville North receives supply via two direct underground 33kV feeders 708 and 774 from Peakhurst STS. A third 33kV feeder 775 provides interconnection to Carlton and Rockdale zones.

1.2. Supply Strategy

In order to provide a safe and reliable supply of electricity, a long term strategy must address the following:

- Replace and/or retire aging infrastructure.
- Provide additional supply system capacity to meet projected load growth.

An integrated replacement and augmentation strategy is required to provide:

- Sufficient capacity to enable infrastructure to be replaced or retired.
- Low cost capacity to meet long term load growth.

In general, construction of 132/11kV zone substations provide significant savings if a substation site is available in close proximity to existing 132kV feeder routes. Furthermore, construction of a 132/11kV zone substation facilitates an increase in zone substation capacity and reduces loading on subtransmission substations. The construction of such a 132/11kV zone substation would result in an overall increase in capacity which is therefore regarded as an augmentation under the National Electricity Rules (the Rules).

1.3. National Electricity Rules Requirements

The existing Hurstville North 33/11kV zone substation and its associated 11kV distribution network are presently classified as distribution system assets by the Rules. However, following completion of the conversion of Hurstville North to 132/11kV operation, and assuming that the 132kV feeder between future Kogarah 132/11kV zone and Beaconsfield West BSP is completed on schedule in 2012, the new Hurstville North 132/11kV zone will become in parallel with the transmission network and hence, Hurstville North will be regarded as a transmission asset by the Rules.

The Rules (clauses 5.6.2 (e) and (f)) requires that, where analysis indicates that any relevant technical limits of a transmission system will be exceeded, that the Transmission 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.

The timing of the proposed work is primarily driven by the need to replace aged assets at Hurstville North zone substation. However, there is a capacity driven component. It was determined, as part of the 2009 - 2014 Regulatory Submission to the AER, that the portion of the funding split to be allocated as growth for the Hurstville North project was approximately 39%, due primarily to the substation capacity increase that would result from the conversion of the substation to 132/11kV operation. EnergyAustralia has provided notification of these limits in its AESDR and is consulting with registered participants and interested parties in accordance with the Rules due to the increased capacity which will result from the strategies.

The proposed development strategy for the Hurstville area involves growth-driven expenditure in excess of \$10 million and is regarded by the Rules as a new large network asset.

This paper has been prepared to consult on identified options which satisfy the Regulatory Test and meet the network performance standards set out in Schedule 5.1 of the Rules. The development of options is necessitated solely by the future inability to meet the minimum network performance requirements set out in Schedule 5.1 of the Rules and by EnergyAustralia Licence conditions. Limb (a) of the Regulatory Test must be applied to determine the option that satisfies the Regulatory Test. Under limb (a) of the Regulatory Test, the option which meets the test is the one that minimises the present value of costs compared with a number of alternative options in the majority of reasonable scenarios.

EnergyAustralia is consulting separately over the community aspects of the proposed development.

1.4. Joint Planning

EnergyAustralia and TransGrid have jointly planned the 330kV and 132kV networks supplying the Sydney Metropolitan area for many years.

TransGrid and EnergyAustralia have carried out joint annual planning reviews as required by Clause 5.6.2(b) of the Rules. As required by Clause 5.6.2(c) they have identified that the network limitations outlined in section 2.1 give rise to a need for network augmentations and have carried out joint planning to determine options for these augmentations.

1.5. Material Inter-network Impact

The rules require an assessment of whether a proposed new large transmission network asset is reasonably likely to have a material inter-network impact.

EnergyAustralia and TransGrid have determined that none of the options described in section 3 will impose power transfer constraints or adversely impact on the quality of supply to adjoining transmission networks.

2. IDENTIFICATION OF NEED FOR AUGMENTATION

2.1. Applied Service Standard

Distribution Network Service Providers (DNSPs), such as EnergyAustralia, are required to follow the service standards specified in the "*Design, Reliability and Performance Licence Condition for Distribution Network Service Providers*", issued by the Minister for Energy and dated 1 December 2007. The service standards specified in this document that are applicable to a consideration of supply constraints affecting the Hurstville 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 Subtransmission Network

2.1.2.1. Overhead Subtransmission Line and Zone Substations

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.

2.1.2.2. Underground Subtransmission Cables

For an underground subtransmission cable the forecast demand must not exceed the thermal capacity of any underground section at any time under N-1 conditions.

2.1. Description of Network Constraints

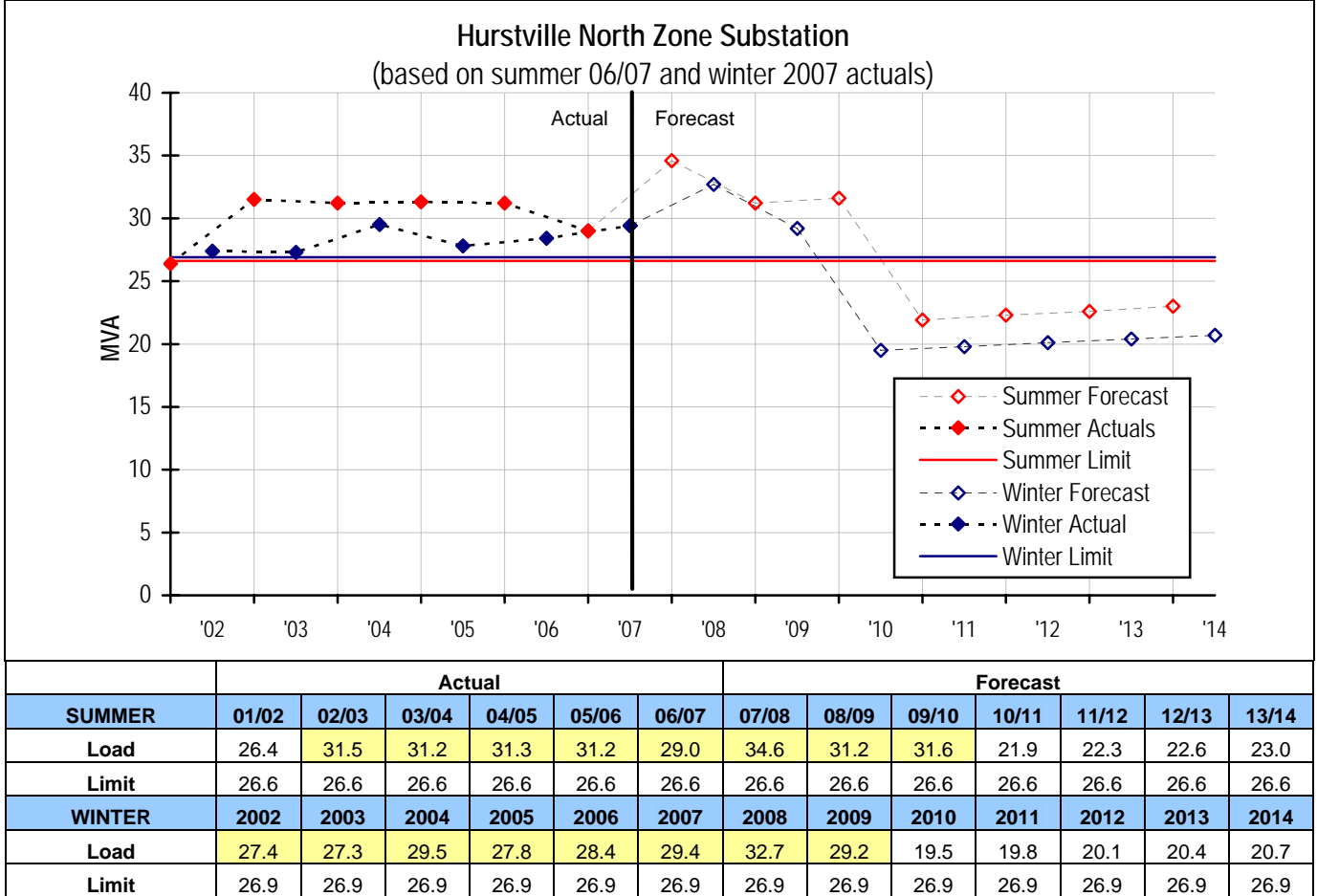
2.1.1. Load Forecast

EnergyAustralia has previously published details of its load forecasts and the timing of loads exceeding technical limits of the system in its Annual Electricity System Development Review. The load forecast includes committed spot loads and normal levels of load growth. The timing of the constraint for each zone substation is summarised below and is based on the forecast projected from the summer 2006/07 and winter 2007 actual loads.

2.2.1. Capacity Issues

Hurstville North 33/11kV Zone Substation

Hurstville North zone has a firm capacity of 26.6MVA in summer and 26.9MVA in winter, limited by the rating of the 33kV underground feeders supplying the zone from Peakhurst STS. Due to this limitation, risk is not applicable at Hurstville North zone. The summer and winter peak load forecast is shown below:



Although Hurstville North is presently loaded over firm capacity in both summer and winter, load is expected to fall to within acceptable limits following the commissioning of the new Kogarah 132/11kV zone substation in 2010 (addressed in a separate Final Report: "Development of Supply to the St George Area") which enables load transfers to relieve Hurstville North. At this stage, it is expected that approximately 10MVA will be transferred to Kogarah zone from Hurstville. This is depicted in the graph above.

Also, a decrease in load in summer 2008/09 and winter 2009 is due to the future installation of two capacitor banks, which is necessary to mitigate load risk at Hurstville North zone in the interim period leading up to the commissioning of Kogarah zone.

2.2.2. Condition Issues

Hurstville North 33/11kV Zone Substation

The compound-filled 11kV switchgear at Hurstville North zone has limited remaining life and has been prioritised for replacement in the period 2017 to 2019.

The 33kV gas-filled feeder 774 has been prioritised for replacement early in the 2012 to 2017 period. The need to replace this cable is the primary replacement driver for Hurstville North 33/11kV zone.

Feeder 708 requires replacement in the period 2017 to 2022. These feeders limit the firm capacity of the zone and form part of the overall population of 33kV gas feeders to be progressively retired from the EnergyAustralia network due to their obsolete technology and history of past failures.

3. OPTIONS

The development strategy for the Hurstville load area is driven by the need to:

- Provide sufficient capacity to keep loading at Hurstville North zone substation within licence conditions and to meet forecast load growth for the medium term;
- Address condition issues associated with the 33kV gas-filled underground cables supplying Hurstville North zone from Peakhurst STS; and
- Address condition issues associated with the compound-filled 11kV switchgear at Hurstville North zone.

From an area strategy perspective, the St George area was analysed and presented in a separate Final Report: *"Development of Supply to the St George Area"*. Although this report focussed primarily on the project to establish the new Kogarah 132/11kV zone substation, there were three broad area strategies presented and analysed according to the Regulatory Test:

- Strategy 1A - Mixed 132kV and 33kV strategy (NPC = \$168.7M);
- Strategy 1B - Full 132kV strategy (NPC = \$208.0M); and
- Strategy 2 - Full 33kV strategy (NPC = \$173.9M).

Strategy 1A was deemed the least cost area strategy under all analysed scenarios. In accordance with this preferred strategy, the existing Hurstville North 33/11kV zone substation was planned for conversion to 132/11kV operation. Accordingly, the following section presents, in addition to Demand Management, the two 132/11kV conversion options for Hurstville North zone:

- Option 1: Conversion of Hurstville North to 132/11kV operation;
- Option 2: Conversion of Hurstville North to 132/11kV operation on alternative site.

3.1. Consideration of Demand Management

Due to the anticipated 10MVA load transfer to the new Kogarah 132/11kV zone substation in 2010 which relieves the existing capacity constraint at Hurstville North 33/11kV zone in 2010, Demand Management is not required to postpone the proposed supply solution.

3.2. Option 1: Conversion of Hurstville North to 132/11kV Operation

This option involves the conversion of the existing Hurstville North 33/11kV zone to 132/11kV operation in 2012. The new substation, to be constructed on an adjacent site, would be initially equipped with two 50MVA 132/11kV transformers with provision for a future third. The new Hurstville North 132/11kV zone would initially have a firm capacity of approximately 68MVA, which would increase to 126MVA following the installation of a 3rd 50MVA transformer, dictated by capacity needs. The new Hurstville North 132/11kV zone will enable the entire load of the existing Hurstville North 33/11kV zone to be transferred in addition to providing load relief for Mortdale 33/11kV zone and transfer capacity between Kogarah 132/11kV zone.

The proposed Hurstville North 132/11kV zone would be connected to the future 132kV transmission feeder from Peakhurst STS to future Kogarah zone (to be designated as 91C and 91H - see figure 2 below). The feeder routes of 91C and 91H will be laid through the intended site for Hurstville North 132/11kV zone, resulting in minimal 132kV connection costs. This feeder route was finalised through the analysis of the broader St George area strategy in the Consultation Paper and Final Report for the establishment of Kogarah 132/11kV zone: *"Development of Supply to the St George Area"* where in accordance with the least cost area strategy, the existing Hurstville North 33/11kV zone was to be converted to 132/11kV operation. These feeders will ultimately form part of the "St George 132kV ring" and will become transmission assets when the existing Rockdale 33/11kV zone is converted to a 132/11kV zone. The establishment of this 132kV ring will aid in the retirement of aged 132kV feeders 91L and 91M.

The required projects, including strategic load transfers, under this option are:

- 2010 - Load transfer of 10MVA from existing Hurstville North 33/11kV zone to future Kogarah 132/11kV zone;
- 2012 - Conversion of Hurstville North to 132/11kV operation;
- 2012 - Installation of 132kV reactor at new Hurstville North zone (for 91L and 91M retirement).
- 2014 - Load transfer of 15MVA from Mortdale 33/11kV zone to Hurstville North 132/11kV zone;

- 2015 - Load transfer of 6.5MVA from Blakehurst 33/11kV zone to Hurstville North 132/11kV zone;

Upon completion of this project, the new Hurstville North 132/11kV zone substation will form part of the "St George 132kV Ring" as shown below:

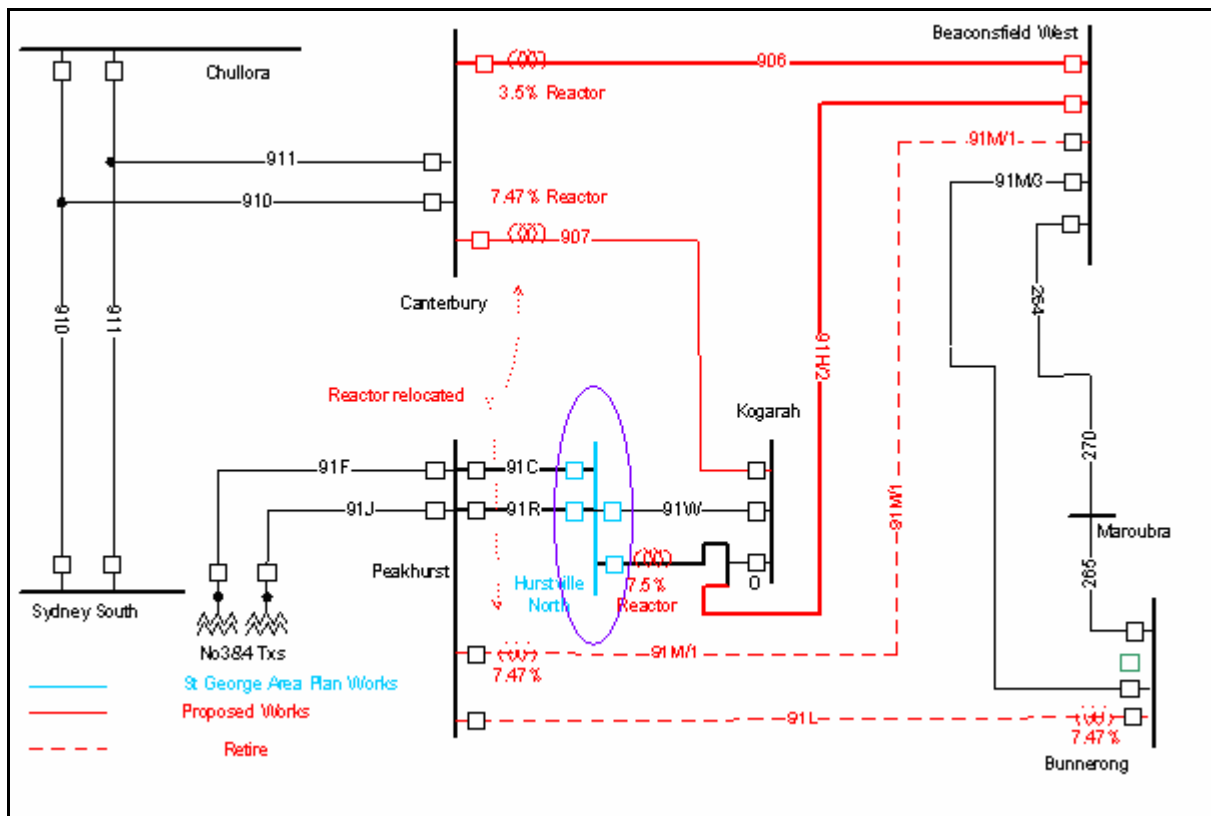


Figure 2: 132kV St George Ring showing 91L and 91M retirement

The above diagram shows the ultimate 132kV network configuration for the St George ring following the replacement of feeders 91L and 91M. The installation of a feeder between the double banked 132kV circuit breaker at Kogarah zone to Beaconsfield West BSP (to be designated as feeder 91H/2) scheduled for completion in 2012 will result in Hurstville North 132/11kV zone to be considered as a transmission asset under the Rules.

The future Kogarah zone to Canterbury STS 132kV circuit is also shown above, to be looped into the future Rockdale 132/11kV zone (expected completion in 2015/16). The costs associated with the retirement of 91L and 91M are the subject of a separate Application Notice: "Replacement of 132kV Feeders 91L and 91M".

The total Capital Cost of this supply option is **\$45.7M**.

3.3. Option 2: Rebuild Hurstville North on New Site

This option involves the rebuild of Hurstville North on a different (non-adjacent) site, on land that has been identified on the western edge of the Hurstville CBD, bounded by Forest Rd, Gloucester Rd and Pearl St in Hurstville.

Relocating the substation to this site would provide a number of benefits:

- The zone would be located in closer proximity to the primary source of demand (Hurstville CBD);
- Reduced impact on residential communities, since new site is located in a primarily commercial district;
- Reduction in 132kV cable length of approximately 0.5km;
- Closer proximity to Blakehurst zone, which is to be retired and some of its load transferred to Hurstville North 132/11kV zone - this will lead to reduced 11kV transfer costs.

Due to the geographic difference of this site, there will be a variation in costs compared to Option 1 due to:

- 132kV route length reduction of approximately 0.5km as compared to the route for Options 1 and 2;
- Land costs - the new site has a Development Application in place for the construction of a mixed-use development including high-rise residential apartments. The cost of acquiring this site would need to

factor in the opportunity cost of forgoing the proposed development by the private developer and would be substantial. A preliminary estimate indicates that this cost is estimated at \$9.5M;

- 11kV transfer costs from the existing Hurstville North, Blakehurst and Mortdale 33/11kV zones.

In all other respects, this option will achieve the same outcomes as described in Option 1 above.

The total Capital Cost of this supply option is **\$50.4M**.

4. APPLICATION OF THE REGULATORY TEST

A preliminary economic analysis has been carried out using Net Present Cost (NPC) analysis for each of the two options.

The economic analysis incorporates:

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

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

4.1. Base Case Analysis

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)*	NPV of Costs (\$M)*
Option 1	Conversion of Hurstville North to 132/11kV operation	45.7	34.2
Option 2	Conversion of Hurstville North to 132/11kV operation on alternative site	50.4	38.8

The analysis above indicates that the NPV of Option 1 is the least cost solution under the base case scenario.

4.2. 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
Labour costs	100%	75% and 125%
Materials costs	100%	75% and 125%
Contracted services costs	100%	75% and 125%
Land costs	100%	75% and 125%
Discount Factor	8.5%	7.0% and 10.0%

* Including future works covering the long term strategy for the area.

Variation in annual load growth rate from the base rate.

The project options are not sensitive to variations in growth rate due to the condition issues associated with 33kV feeder 774 and the need to replace it around 2012.

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

Table 3 - Sensitivity Analysis: Comparison of Options

Scenario	NPV of Costs (\$M)*	
	Option 1	Option 2
25% reduction in labour costs	33.4	37.8
25% increase in labour costs	33.8	38.7
25% reduction in materials costs	33.3	37.9
25% increase in materials costs	33.7	38.4
25% reduction in contracted services costs	33.5	37.7
25% increase in contracted services costs	33.8	38.9
25% reduction in land costs	33.8	37.3
25% increase in land costs	34.7	40.4
7% discount factor	36.5	41.2
10% discount factor	32.2	36.7

The results from the sensitivity analysis indicate that Option 1 remains the least cost option under all analysed sensitivity scenarios.

5. CONCLUSION

Option 1 is the least cost option under the base case condition and all analysed sensitivity scenarios. Accordingly, subject to comments received during consultation, EnergyAustralia favours Option 1 - conversion of Hurstville North to 132/11kV operation and associated load transfers at an estimated capital cost of \$45.7M.

6. CONTACT DETAILS FOR SUBMISSIONS AND ENQUIRIES

This report recommends the construction of a new large network asset. In accordance with the National Electricity Rules. EnergyAustralia seeks written submission from interested parties on this application notice. The closing date for submissions is 6th February 2009.

Submissions or enquires should be directed to:

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7. APPENDIX A – ECONOMIC ANALYSIS OF BASE CASE

WACC = 0.085

Option 1 – Conversion of Hurstville North to 132/11kV Operation

Actions	NPV* (\$M)	CAPEX #(\$M)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Hurstville Nth Conversion																
Construct Hurstville Nth 132/11kV zone including load transfers from existing Hurstville Nth 33/11kV ZS	24.72	33.17	-	-	4.69	7.22	16.63	4.63								
Hurstville Nth loop in 4 x 132kV cables	1.60	2.31	-	-	-	0.12	0.74	1.46								
Install 1 x 132kV reactor at Hurstville Nth	1.80	2.69	-	-	-	-	0.24	2.45								
O&M	1.79		-	-	-	-	-	-	0.44	0.47	0.47	0.47	0.47	0.47	0.47	0.47
Load transfer - Mortdale 33/11kV ZS to Hurstville Nth 132/11kV ZS (15MVA)	2.46	4.33	-	-	-	-	-	-	0.33	4.00						
O&M	0.11		-	-	-	-	-	-	-	-	0.01	0.05	0.05	0.05	0.05	0.05
Load transfer - Blakehurst 33/11kV ZS to Hurstville Nth 132/11kV ZS (6.5MVA)	1.69	3.22	-	-	-	-	-	-	-	0.24	2.98					
O&M	0.07		-	-	-	-	-	-	-	-	-	0.01	0.04	0.04	0.04	0.04
TOTAL	34.23	45.73														

Notes:

- 1) 2007 refers to the 2007/08 financial year and so forth.
- 2) All amounts are quoted in 2007/08 dollars.

* Including future works covering the long term strategy for the area.

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Capital cost of work proposed by this Consultation Paper.

Option 2 – Conversion of Hurstville North to 132/11kV Operation on alternative site

Actions	NPV* (\$M)	CAPEX #(\$M)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Hurstville Nth Conversion																
Construct Hurstville Nth 132/11kV zone including load transfers from existing Hurstville Nth 33/11kV ZS	31.73	42.07	-	-	10.61	7.22	16.63	7.61								
Hurstville Nth loop in 4 x 132kV cables	1.60	2.32	-	-	-	0.12	0.74	1.46								
Install 1 x 132kV reactor at Hurstville Nth	1.80	2.69	-	-	-	-	0.24	2.45								
Difference in cost of 132kV feeder route to new site	-2.08	-2.93	-	-	-	-0.07	-2.21	-0.65								
O&M	2.17		-	-	-	-	-	-	0.56	0.58	0.58	0.58	0.58	0.58	0.58	0.58
Load transfer - Mortdale 33/11kV ZS to Hurstville Nth 132/11kV ZS (15MVA)	1.92	3.38	-	-	-	-	-	-	0.26	3.12						
O&M	0.09		-	-	-	-	-	-	-	-	0.01	0.04	0.04	0.04	0.04	0.04
Load transfer - Blakehurst 33/11kV ZS to Hurstville Nth 132/11kV ZS (6.5MVA)	1.52	2.90	-	-	-	-	-	-	-	0.22	2.68					
O&M	0.06		-	-	-	-	-	-	-	-	-	0.01	0.03	0.03	0.03	0.03
TOTAL	38.81	50.43														

Notes:

- 1) 2007 refers to the 2007/08 financial year and so forth.
- 2) All amounts are quoted in 2007/08 dollars.

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