



APPLICATION NOTICE

PROPOSED NEW LARGE TRANSMISSION NETWORK ASSET

SYDNEY SOUTH 330/132 kV SUBSTATION 330/132 kV TRANSFORMER REPLACEMENTS

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EXECUTIVE SUMMARY

This application notice has been prepared to provide a basis for TransGrid to consult with registered participants and interested parties to identify options to overcome limitations in the capacity of the 330/132kV transformers at Sydney South 330/132kV Substation that will be included in an application of the AER's regulatory test.

Section 1 provides a description of the supply arrangements at Sydney South and the context of the application notice within the regulatory process. It is proposed to allow interested parties to make submissions and provide other feedback in the period to 09/06/2006. A final report, which will include a decision on the preferred option is envisaged during August 2006.

Section 2 describes in detail the regulatory requirements, nature of the growing load in the area, the limitations in the capacity of the 330 kV transformers at Sydney South and the need for augmentation of that capacity. The agreed network performance requirements (planning criterion), against which the need and effectiveness of augmentation options are to be assessed, is presented.

In Section 3 one reasonable augmentation option, and a range of other options that were considered but not developed, are described. The one reasonable option involves the replacement of the 250 MVA 330/132 kV transformers # 1 and # 2 at Sydney South by 375 MVA units as soon as practicable.

The capital costs of this option are estimated to be \$ 14 million ($\pm 25\%$).

In Section 4 the results of a preliminary application of the regulatory test are presented. As there is only one option this is clearly the lowest cost option. The present value of the costs of this option are presented and are considered reasonable. On this basis, subject to completion of the consultation process, it is the option preferred by TransGrid. This option involves the replacement of the # 1 and # 2 250 MVA banks of single phase transformers at Sydney South by 375 MVA three phase units by summer 2007/8. The existing transformers # 1 and # 2 would be scrapped.

Should other reasonable options arise in response to this application notice they may be considered in the final application of the regulatory test, the results of which will be presented in the final report of this consultation.

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1. INTRODUCTION

1.1. Purpose and Scope

TransGrid owns the majority of the transmission network within NSW and is responsible, inter alia, for planning and developing its network to meet the requirements of customers within the state and to facilitate operation of the National Electricity Market (NEM). As part of its planning responsibilities and the requirements of the National Electricity Rules (the Rules) TransGrid consults with NEM registered participants, NEMMCO and interested parties on emerging limitations within its transmission network and options being considered to relieve them.

This application notice has been prepared in accordance with Clause 5.6.6 (b) of the Rules. It relates to a proposal for a new large transmission network asset that will address emerging limitations in the capacity of the 330/132 kV transformers at Sydney South 330/132 kV Substation to reliably supply the load at that site.

It includes:

- A summary of the load forecast for the area;
- A description of the network reliability standard that has been adopted for planning purposes;
- A description of transmission network limitations identified by TransGrid that have led to the necessity for an augmentation of the transformer capacity at Sydney South;
- A description of all reasonable network and non-network options that have been identified to meet these limitations;
- An analysis of the ranking of these options in accordance with the Australian Energy Regulator's (AER's) regulatory test;
- A preliminary assessment of the outcome of the regulatory test and recommended course of action; and
- An invitation to NEM registered participants and interested parties to make submissions on this application notice.

1.2. Outline of Consultation Process

TransGrid has published a description of the limitations in the capacity of the 330/132 kV transformers at Sydney South in its Annual Planning Reports for 2004 and 2005. To date there have been no comments or other feedback by interested parties on any aspect of these limitations.

A summary of this application notice has been published on NEMMCO's website. In accordance with Clause 5.6.6 of the National Electricity Rules it is intended to proceed with further consultation on this new large transmission network asset proposal as follows.

Application Notice Submissions Period	Until 09/06/2006
Consideration of Submissions	13/06/2006 - 24/07/2006
Meetings with Interested Parties (if Required)	25/07/2006 - 22/08/2006
Publication of Final Report	25/08/2006 ¹
Period for Notification of Disputes	28/08/2006 - 09/10/2006

¹ This and subsequent dates assume that meetings with interested parties are required. If this is not the case these dates may be advanced by up to 21 business days.

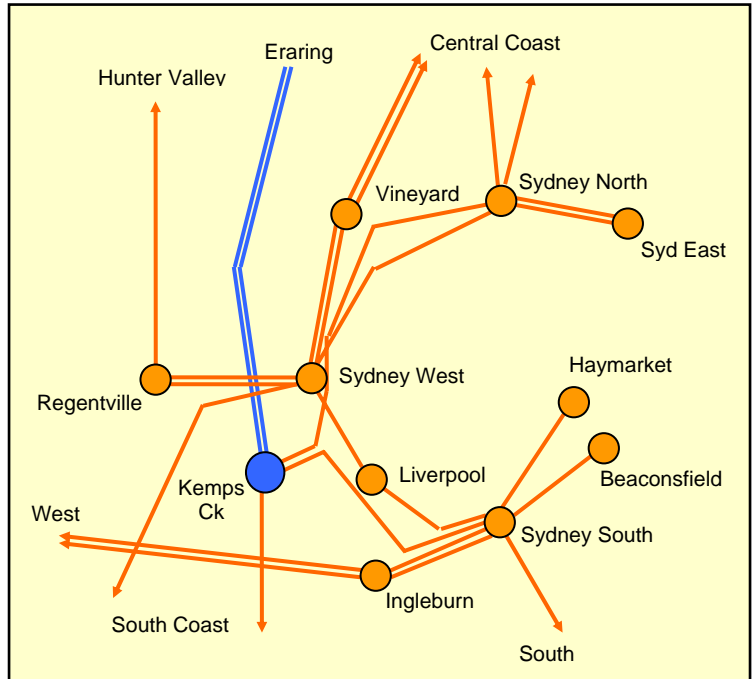
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1.3. Supply Arrangements at Sydney South

Sydney South 330/132 kV Substation is one of a ring of 500 kV and 330 kV substations that individually provide supply to nearby suburban areas in Sydney and collectively provide supply to the Sydney CBD and surrounding suburbs as indicated in the diagram at right. They are interconnected by an extensive network of 330 kV and 132 kV transmission lines and cables owned by TransGrid and EnergyAustralia (not all shown in the diagram).

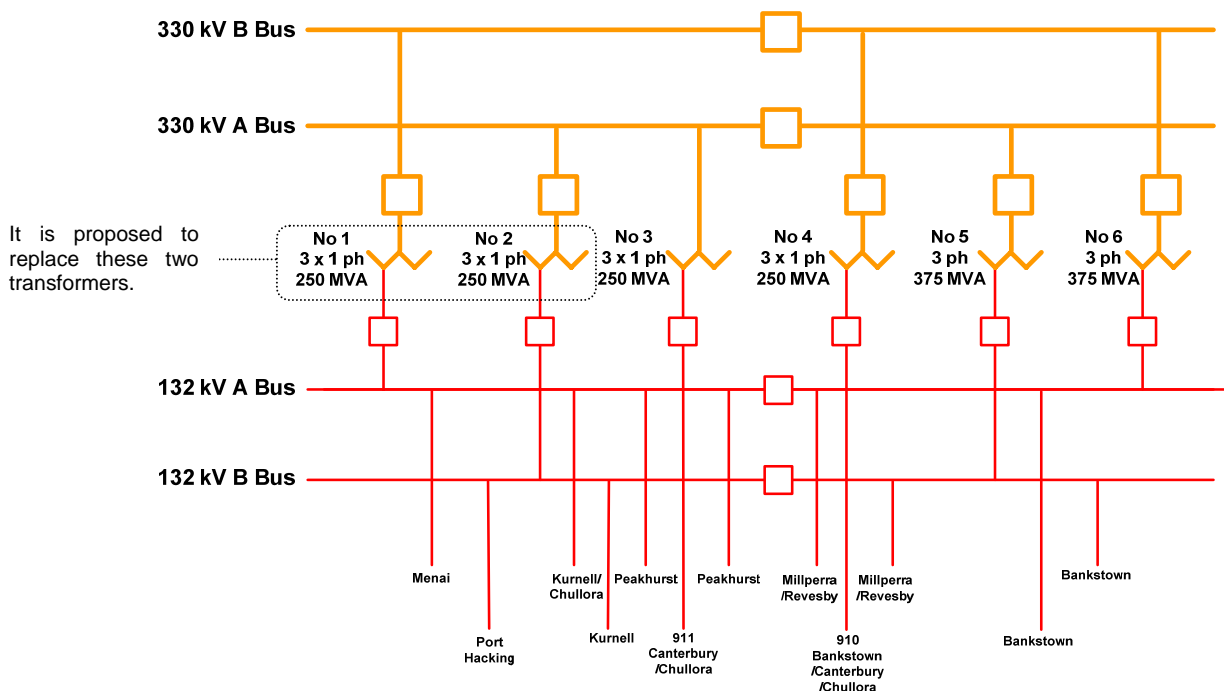
Sydney South is the take-off point for two 330 kV cables supplying Beaconsfield and Haymarket 330/132 kV Substations.

A number of 132kV substations, including Bankstown, Canterbury, Kurnell, Menai, Peakhurst, Port Hacking and Revesby, are supplied from 132 kV lines and cables emanating from Sydney South.



The 132 kV load at Sydney South is supplied via six 330/132 kV transformers. Transformers # 1 and # 2 are 250 MVA banks of single phase units connected to the 132 kV busbars and transformers # 5 and # 6 are 375 MVA 3-phase units also connected to the 132 kV busbars. Transformers # 3 and # 4 are 250 MVA banks of single phase units connected directly to 132 kV lines supplying Bankstown and Chullora/Canterbury. These 132kV supply arrangements at Sydney South are depicted in Figure 1 below.

Figure 1 – 132 kV Supply Arrangements at Sydney South



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2. IDENTIFICATION OF A NECESSITY FOR AUGMENTATION

2.1. Regulatory Requirements

2.1.1. Requirements of the National Electricity Rules

This application notice covers a proposal for a new large transmission network asset.

The requirements of the National Electricity Rules for new large transmission network asset proposals are set out in Clause 5.6.6. This requires applicants (in this case TransGrid), inter-alia, to:

- Set out the reasons for proposing the new large transmission network asset, including the actual or potential constraint or inability to meet network performance requirements;
- Describe all reasonable network and non-network options to address the constraint;
- Rank the options in accordance with the principles of the AER's regulatory test including detailed analysis of why the applicant considers the new large transmission network asset satisfies the regulatory test;
- Provide analysis of why the applicant considers the new large transmission network asset is a reliability augmentation; and
- Provide an augmentation technical report or consents to proceed from affected TNSPs if the new large transmission network asset is likely to have a material internetwork impact.

These requirements are underpinned by Clause 5.6.2 (c) of the Rules, which requires that a necessity for an *augmentation* or *extension* to the transmission system should be identified by network service providers.

2.1.2. Requirements of the Regulatory Test

The regulatory test may be applied in either one of two ways. The regulatory test states that an option satisfies the test if:

- (a) in the event the option is necessitated solely by the inability to meet the minimum network performance requirements set out in schedule 5.1 of the Rules or in relevant legislation, regulations or any statutory instrument of a participating jurisdiction - the option minimises the present value of costs, compared with a number of alternative options in a majority of reasonable scenarios;
- (b) in all other cases - the option maximises the expected net present value of the market benefit (or in other words the present value of the market benefit less the present value of costs) compared with a number of alternative options and timings, in a majority of reasonable scenarios.

The Rules define a reliability augmentation as:

A transmission network augmentation that is necessitated solely by inability to meet the minimum network performance requirements set out in schedule 5.1 or in relevant legislation, regulations or any statutory instrument of a participating jurisdiction.

Thus, for reliability augmentations, clause (a) of the test should be used. That is, for reliability augmentations, the option that passes the regulatory test is the one that minimises the cost of meeting the minimum network performance requirements set out in schedule 5.1 of the Rules or via a jurisdictional or customer requirement.

2.1.3. Jurisdictional and Customer Requirements – Planning Criterion

As stated in its Annual Planning Report, TransGrid is expected by the NSW jurisdiction to plan and develop its transmission network on an “N-1” basis. That is, there will be no inadvertent loss of load (other than load which is interruptible or dispatchable) following an outage of a single circuit (a line or a cable) or transformer, during periods of forecast high load.

In fulfilling this obligation, TransGrid must also recognise specific customer requirements. Thus it may modify the standard N-1 approach where requested to do so by a distribution network owner or major directly connected end-use customer.

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These requirements are underpinned by the recent introduction of mandatory licence conditions for DNSPs which, inter-alia, set out reliability standards for subtransmission and distribution networks. The licence conditions specify N-1, one minute reliability levels at connection points supplying load greater than minimum values that range from 5-15 MVA depending on the type of load. The licence conditions also specify N-2 reliability levels for EnergyAustralia's network supplying the CBD area.

EnergyAustralia and TransGrid have agreed, when considering the need to augment the 330/132 kV transformer capacity at Sydney South, to apply the same planning reliability criterion that is used for supply to the inner metropolitan area of Sydney. This is a "modified N-2" criterion.

The modified N-2 criterion requires that there will be no inadvertent loss of load (other than load which is interruptible or dispatchable) following concurrent outages of combinations of two underground cable circuits or an underground cable circuit and a 330/132 kV transformer. Concurrent outages of the two 330 kV underground cables supplying Sydney is excluded. Further details are given in Section 2.3.

2.2. Description of Network Constraints

Within the next ten years, the transformer capacity at Sydney South is expected to be constrained during the contingencies described below.

2.2.1. Concurrent Outage of the Sydney South – Haymarket 330 kV Cable and the # 6 330/132 kV Transformer at Sydney South

For this contingency, the emergency overload ratings of the Sydney South – Beaconsfield West 330 kV cable and the # 1 and # 2 330/132 kV transformers at Sydney South will be exceeded at times of high summer demand from summer 2006/7. This situation cannot be effectively managed via load transfers because transfers that reduce the transformer loading increase the loading on the 330 kV cable to above its emergency overload rating.

Replacing the # 1 and # 2 330/132 kV transformers by 375 MVA units would reduce the loading on the 330 kV cable. The 375 MVA 330/132 kV transformers would be within their emergency overload ratings.

This contingency is one of those considered by the "modified N-2" criterion. In this case the 330 kV cable is the critical network element and the transformer is the other network element.

Similar outcomes may be expected for other concurrent outages involving the Sydney South – Haymarket 330 kV cable and # 6 transformer at Sydney South, or the Sydney South – Beaconsfield West 330 kV cable and either the # 5 transformer or # 6 transformer at Sydney South.

2.2.2. Single Outage of the # 6 330/132 kV Transformer at Sydney South

For this contingency, the emergency overload ratings of the # 1 and # 2 330/132 kV transformers at Sydney South are exceeded at times of high summer demand from 2008/9. However the loading on the Sydney South transformers can be effectively managed during this contingency by transferring the Bankstown and Greenacre load to Chullora. With this load transfer in effect, the emergency overload ratings of the # 1 and # 2 330/132 kV transformers at Sydney South are not expected to be exceeded until summer 2009/10.

This contingency is consistent with the standard N-1 approach. It has been included to indicate the degree to which the need for augmentation has been advanced by the modification of the standard N-1 approach to a modified N-2 approach described in Section 2.1.3.

2.3. Agreed Network Performance Requirements

TransGrid and EnergyAustralia have jointly agreed that the network performance requirements for reliability to be applied to the 132 kV supply from Sydney South are as follows:

1. With all network elements in service, the loading on each element is not to exceed the continuous rating of that element.
2. Following concurrent outages of a 330 kV cable or 132 kV cable and a 132 kV cable or a 330/132 kV transformer, the loading on each remaining element is not to exceed the emergency overload rating of that element whilst operator actions, such as opening of other network elements and transferring of loads via lower voltage networks, are taking place.
3. Following concurrent outages of a 330 kV cable or 132 kV cable and a 132 kV cable or a 330/132 kV transformer and following operator actions:

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- The loading on each remaining element is not to exceed the emergency overload rating of that element;
- The voltage levels at end-user premises are to be within acceptable levels following switching of reactive plant and operation of transformer tap-changers.

This constitutes the “modified N-2” reliability criterion referred to in Section 2.1.3.

2.4. Joint Planning

EnergyAustralia and TransGrid have jointly planned the 330 kV and 132 kV network supplying the Sydney CBD and surrounding suburbs for many years. The most recent major increase in supply capacity to the inner metropolitan area, the establishment of Haymarket 330/132 kV substation and associated 330 kV cable from Sydney South, was facilitated by joint planning.

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 constraints described in Section 2.2 give rise to a need for a network augmentation.

Arising from this joint planning is the network option described in Section 3.

2.5. Reliability Augmentation

It follows from Sections 2.1 – 2.3 that the proposals covered by this application notice constitute a reliability augmentation and that the regulatory test will be applied in accordance with Clause 1(a) of the test.

2.6. Material Internetwork Impact

The Rules require TransGrid to assess whether a proposed new large network asset is reasonably likely to have a material internetwork impact. TransGrid has determined that none of the options described in Section 3 will impose power transfer constraints or adversely impact on the quality of supply to EnergyAustralia’s transmission networks.

2.7. Local Load Forecast

The Sydney South maximum demand is expected to continue to grow at around 2.5% p.a. during summer periods.

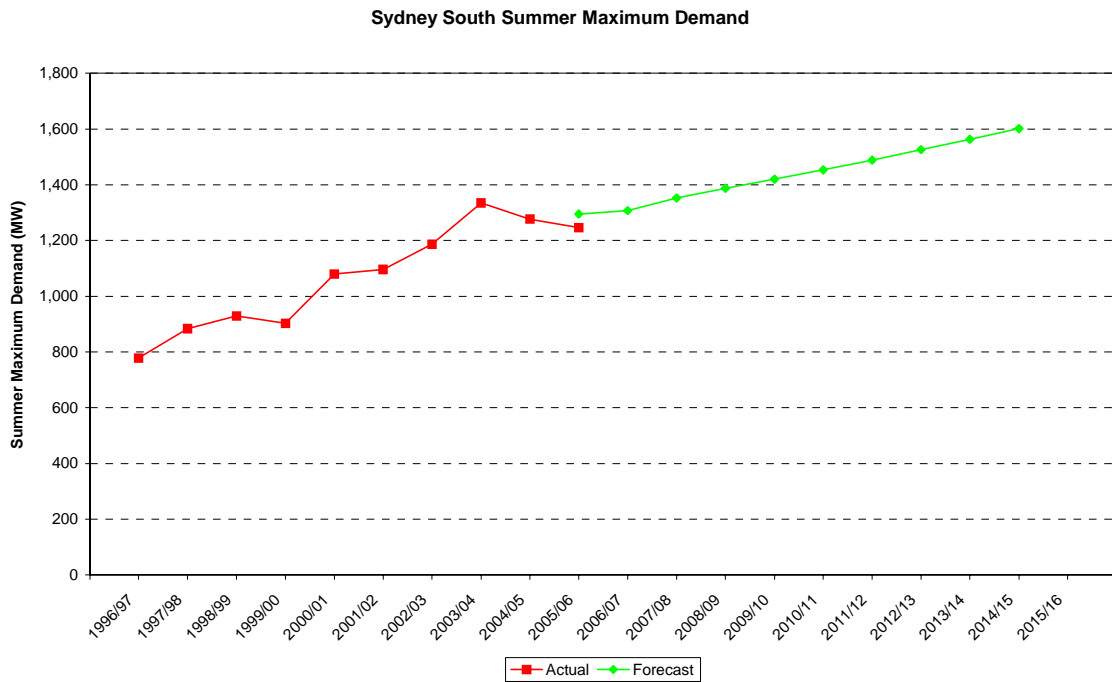
The most recent forecast for the load supplied from Sydney South 330/132 kV Substation is given in Table 1 below and depicted in Figure 1.

Table 1 Sydney South 330/132 kV Substation: Forecast Summer Maximum Demands

Summer	MW	MVA_r
2005/06	1,295.1	446.9
2006/07	1,307.3	468.3
2007/08	1,352.5	491.2
2008/09	1,387.7	490.5
2009/10	1,420.2	469.2
2010/11	1,453.8	441.6
2011/12	1,488.6	434.7
2012/13	1,526.3	441.4
2013/14	1,563.4	452.2
2014/15	1,601.4	463.2

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Figure 1 Sydney South: Actual and Forecast Maximum Summer Demands



2.8. Consideration of DSM and Local Generation

TransGrid and EnergyAustralia are presently undertaking a demand management program aimed at reducing the rate of growth of the summer maximum demand in the inner metropolitan area of Sydney. The above load forecast incorporates the impact of this program.

None the less, proponents of demand management or local generation projects which may delay the onset of the network limitations described in Section 2.2 are encouraged to submit those proposals. . Should a proponent come forward in response to this application notice, demand management or local generation options may be considered.

In any event TransGrid and Energy Australia will continue to address demand management issues in the area to ensure that demand management has been fully utilised to defer the need for network augmentation if possible.

2.9. Quantification of Network Constraints

The network constraints are discussed in Section 2.2. The timing of the expected occurrence of each constraint is shown in Table 2 below.

Table 2 Onset of Network Constraints

Constraint	Year of Onset	Reliability Criterion	Comment
Overloading of # 1 and # 2 transformers at Sydney South on concurrent outage of the Sydney South – Haymarket 330 kV cable and #6 transformer at Sydney South.	2006/7	Modified N-2	Criterion Agreed with EnergyAustralia
Overloading of # 1 and # 2 transformers at Sydney South on outage of # 6 transformer at Sydney South.	2009/10	N-1	Minimum standard expected by Jurisdiction

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3. OPTIONS

Through joint planning TransGrid and EnergyAustralia have developed one reasonable network option to meet the network constraints described in Section 2.

The network option would involve replacement of the # 1 and # 2 250 MVA banks of single phase transformers at Sydney South by 375 MVA three phase units as soon as practicable. The existing transformers are more than 35 years old and are single phase units of a non-standard capacity as used by TransGrid. They would therefore be scrapped after replacement. This option would cost \$14 million ($\pm 25\%$) and could be completed by before summer 2007/8.

Other options to increase aggregate 330/132 kV transformer capacity in the area were considered but were not further developed as they are not considered to be reasonable:

- The establishment of a new 330/132 kV substation with associated 330 kV and 132 kV line works near Sydney South would be significantly more expensive than replacing transformers at Sydney South;
- The replacement of the transformers by units of intermediate rating between 250 MVA and 375 MVA is not considered to be good engineering practice. These units would be of a non-standard capacity as used by TransGrid;
- The implementation of operational load transfers to relieve the 330 kV transformer loading at Sydney South during contingencies has already been taken into account in quantifying the network constraints, and therefore is not available as an option;
- The implementation of a demand management or local generation project specifically targeted to relieve the 330/132 kV transformer loading at Sydney South may delay the onset of the network constraints described above. However, at this point in time there are no known proponents of such options. As discussed in section 2.8 TransGrid and Energy Australia will continue to address demand management issues in the area to ensure that demand management has been fully utilised to defer the need for network augmentation if possible.

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4. PRELIMINARY APPLICATION OF THE REGULATORY TEST

A preliminary application of the Regulatory Test, considering the single network option, has been carried out. A summary of the results is presented in the following sections:

4.1. Form of the Regulatory Test

As discussed in Section 2 the new large transmission network asset covered by this application notice is a reliability augmentation and the regulatory test is to be applied in accordance with Clause 1(a) of the test:

- (a) in the event the option is necessitated solely by the inability to meet the minimum network performance requirements set out in schedule 5.1 of the Rules or in relevant legislation, regulations or any statutory instrument of a participating jurisdiction - the option minimises the present value of costs, compared with a number of alternative options in a majority of reasonable scenarios;

TransGrid has, through an economics consultant, had discussions with the ACCC and subsequently the AER as to what costs should, and should not be counted by the regulatory test under this clause. As a result of these discussions TransGrid's interpretation of the regulatory test for reliability augmentations is as follows.

The following costs should be included:

- Capital costs of options;
- O&M costs of options;
- Costs associated with relevant government taxes;
- Negative costs associated with relevant government subsidies; and
- Costs of other transmission developments that may be required to address future constraints.

The following avoided costs should not be included:

- Reductions in electrical losses;
- Reductions in unserved energy;
- Deferrals of generation investment in the NEM; and
- Avoided fuel costs elsewhere in the NEM.

Market development scenarios are only relevant to the extent that they affect the timing of the onset of network constraints and/or the ability of options to meet those constraints.

4.2. Preliminary Regulatory Test Application - Summary

4.2.1. Costs

For the preliminary regulatory test application only the capital and operating & maintenance costs of Option 1 have been explicitly included.

There are no known committed, advanced or publicly announced generation developments that are likely to affect the timing of the onset of the network constraints described in Section 2.2 or the ability of Option 1 to meet those constraints.

As there is only one option being considered the operation of government tax or subsidy schemes such as the New South Wales Greenhouse Gas Abatement Scheme need not be explicitly included as they will not affect the ranking of options.

As there is only one option being considered the inclusion of other network constraints in the area that may occur within the 10 year planning horizon need not be explicitly included as they will not affect the ranking of options.

4.2.2. Scenarios

There are no known committed, advanced or publicly announced generation developments that are likely to affect the timing of the onset of the network constraints described in Section 2.2 or the ability of Option 1 to meet those constraints.

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The need for Option 1 is determined by a constraint that will emerge from summer 2006/7 (next summer). Variations in the load forecast due, for example, to different economic growth rates, are unlikely to affect this outcome.

Considering the above two factors only a single market development scenario has been considered, which corresponds to a medium economic growth outcome, and which does not explicitly model NEM generation developments.

4.2.3. Results

The present value of costs of Option 1 has been calculated for a base case of financial and technical assumptions. Sensitivity tests of these calculations due to reasonable variations to the major assumptions have been carried out.

The base case assumptions and the range over which sensitivity tests were conducted are shown in Table 3. The results of the analysis are shown in Table 4 and Table 5. Details of the base case economic model are shown in Appendix A.

Table 3 Base Case Values and Range of Values Used in Sensitivity Checks

Parameter	Base Case Value	Sensitivity Checks at
Real Discount Rate	9%	6% and 12%
Annual O&M Cost	2% of Capital Cost	1% and 3% of Capital Cost
Asset Lifetimes Transformers	30 years	20 and 40 years
Capital Costs	Nominal Value	±25% increase

Table 4 Comparison of Options – Base Case

Option	Description	PV of Costs (\$M)	Rank
Option 1	Replacement of Transformers 1 and 2 at Sydney South by 375 MVA units	10.4	1

Table 5 Comparison of Options - Results of Sensitivity Studies

Sensitivity Case	PV of Costs of Option 1 (\$M)	Rank
Base Case	10.4	1
12% Discount Rate	9.9	1
6% Discount Rate	10.6	1
25% Increase in Capital Costs	12.6	1
25% Decrease in Capital Costs	8.2	1
Decrease in Asset Lives	11.1	1
Increase in Asset Lives	10.0	1
Decreased O&M Cost	9.6	1
Increased O&M Cost	11.1	1

Clearly as there is only one option this is the highest ranked option in each case. These results have been included because:

- Sensitivity testing on key input variables is a mandatory requirement of the regulatory test; and
- To show that for the range of key input variables, the present values of costs of Option 1 are reasonable.

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4.3. Preliminary Recommendation

At this stage and subject to comments received in response to this application notice, TransGrid prefers Option 1, that is, the replacement of the # 1 and # 2 250 MVA banks of single phase transformers at Sydney South by 375 MVA three phase units as soon as practicable. At this stage it is expected that this could be achieved prior to summer 2007/8. The existing # 1 and # 2 250 MVA banks of single phase transformers would be scrapped.

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5. Contact Details for Submissions and Enquiries

In accordance with the National Electricity Rules, TransGrid invites written submissions from interested parties on this application notice.

Submissions are due by Friday 09/06/2006.

Submissions or other enquiries should be directed by email to:

regulatory.consultation@transgrid.com.au

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6. APPENDIX A

Least Cost Analysis of Base Case

Option 1: Replace Sydney South Txs 1&2

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Residual
<u>Capital Costs</u>																
Transformers	0.00	0.00	14.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-7.93
<u>O & M Costs</u>																
Transformers	0.00	0.00	0.00	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	
Total Expenditure	0.00	0.00	14.0	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	-7.93
PV of Costs	10.4	million														