New Large Network Asset - Kadina East

Regulatory Test Final Report

November 2009

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The Final Report contains the results of financial modelling and economic analysis undertaken by ElectraNet and ETSA Utilities. It contains assumptions regarding, among other things, economic growth and load forecasts that may or may not prove to be correct.

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Contents

Executive Summary

ElectraNet is proposing to augment its Kadina East 132/33kV substation by installing two new transformers, communications and Supervisory Control and Data Acquisition (SCADA) facilities.

The need for this augmentation is two fold. First a change in the Essential Services Commission of South Australia's (ESCOSA) Electricity Transmission Code (ETC) reliability classification is driving the increase in the number of transformers to two. Secondly, an increase in the level of demand is driving the increase in capacity of the transformers.

In the most recent version of the ETC (July 2008), the level of supply reliability for the Kadina East connection point has been increased from Category 1 to Category 2, requiring N-1 equivalent transformer capacity at the substation. N capacity was the previous requirement. The ETC also requires adequate capacity to be maintained to meet the agreed maximum demand over time.

As this project is driven by the revised reliability standard of the ETC, the Regulatory Test has been conducted under the reliability augmentation limb.

ElectraNet has considered both network and non-network alternatives to address the capacity limitations and has determined that installing two 60MV.A transformers (the next largest standard-size transformer currently in service) to replace the function of the existing single existing 25MV.A transformer, satisfies the reliability limb of the Regulatory Test.

Accompanying the transformer installation, the proposed new large transmission network asset includes the establishment of an appropriately configured 132kV switchyard that will facilitate the transformer N-1 requirement. Also included is a range of required telecommunications infrastructure for establishment of a microwave link to provide SCADA capability.

To accommodate the resulting increase in 33kV fault levels and to fully utilise the increased capacity of the substation, the proposed development also involves ETSA Utilities rebuilding its 33kV switchyard at the substation and establishing an additional 33kV connection from the substation to the load centre.

This Final Report presents the technical and economic justifications for the proposed new large transmission network asset, which has an estimated total capital cost of $25.9m, of which $19.9m is attributable to ElectraNet's portion of the work, and $6.0m to ETSA Utilities' portion. In accordance with the ETC reliability standards, the augmentation must be commissioned and commercially available by 30 June 2011.

1. Introduction

Changes to the South Australian ETC that took effect on 1 July 2008 have increased the level of supply reliability that ElectraNet must provide for the Kadina East connection point.

The ETC now classifies Kadina East as a Category 2 connection point, an increase from the previous Category 1. The increase requires ElectraNet to continue to provide N equivalent line capacity, but to also now provide continuous N-1 transformer capacity into Kadina East for at least 100% of the agreed maximum demand for that connection point.

The previous ETC Category 1 standard (provision of N line and transformer capacity for 100% of the agreed maximum demand) has been provided for through a single transmission line and 25MVA transformer.

In addition, the load supplied by the Kadina East substation is forecast to exceed the normal cyclic rating of the single 25 MVA transformer that is presently installed at the substation. This is estimated to occur by the summer of 2010/11.

In accordance with clause 5.6.6 of the National Electricity Rules (Rules), this Final Report must set out the matters detailed in clause 5.6.6(c) and summarise the submissions received from interested parties, and ElectraNet's and/or ETSA Utilities' response to each submission. Accordingly, the Final Report must contain the following:

    (1) a detailed description of:

        (i) the proposed asset;

        (ii) the reasons for proposing to establish the asset (including, where applicable, the actual or potential constraint or inability to meet the network performance requirements set out in schedule 5.1 or relevant legislation or regulations of a participating jurisdiction, including load forecasts and all assumptions used); and

        (iii) all other reasonable network and non-network alternatives to address the identified constraint or inability to meet the network performance requirements identified in clause 5.6.6(c)(1)(ii). These alternatives include, but are not limited to, interconnectors, generation options, demand side options, market network service options and options involving other transmission and distribution networks;

    (2) all relevant technical details concerning the proposed asset;

    (3) the construction timetable and commissioning date for the asset;

    (4) an analysis of the ranking of the proposed asset and all reasonable alternatives as referred to in clause 5.6.6(c)(1)(iii). This ranking must be undertaken by the applicant in accordance with the principles contained in the regulatory test;

(5) an augmentation technical report prepared by the Inter-regional Planning Committee in accordance with clause 5.6.3(j) but only if:

    (i) the asset is reasonably likely to have a material inter-network impact; and

    (ii) the applicant has not received consent to proceed with such construction from all Transmission Network Service Providers whose transmission networks are materially affected by the asset; and

(6) a detailed analysis of why the applicant considers that the asset satisfies the regulatory test and, where the applicant considers that the asset satisfies the regulatory test as a reliability augmentation, analysis of why the applicant considers that the asset is a reliability augmentation.

This final report provides the required information and analysis set out above.

In order to address both transformer capacity requirements for the Kadina East connection point, ElectraNet is proposing to replace the existing transformer at Kadina East substation with two larger units, with ETSA Utilities undertaking upgrade and augmentation works to its 33kV network. The estimated total combined cost for the project is $25.9m.

2.   Background

2.1   Geographic Area and Existing Supply Network

Kadina East substation is a 132/33kV connection point that is located in the northern reaches of Yorke Peninsula, and supplies the surrounding mainly rural area, including the towns of Kadina, Wallaroo, Moonta, Paskeville, and Port Hughes. It is supplied radially from Hummocks substation, at the northern tip of the Gulf of St. Vincent, 35 kilometres to the east of Kadina, and comprises a single 25MVA 132/33 kV transformer. The substation contains minimal associated 132kV and 33kV infrastructure, and is not equipped with remote communications or control facilities.

The physical location of the Kadina East connection point and the existing substation assets is shown in Figures 1 and 2 respectively.
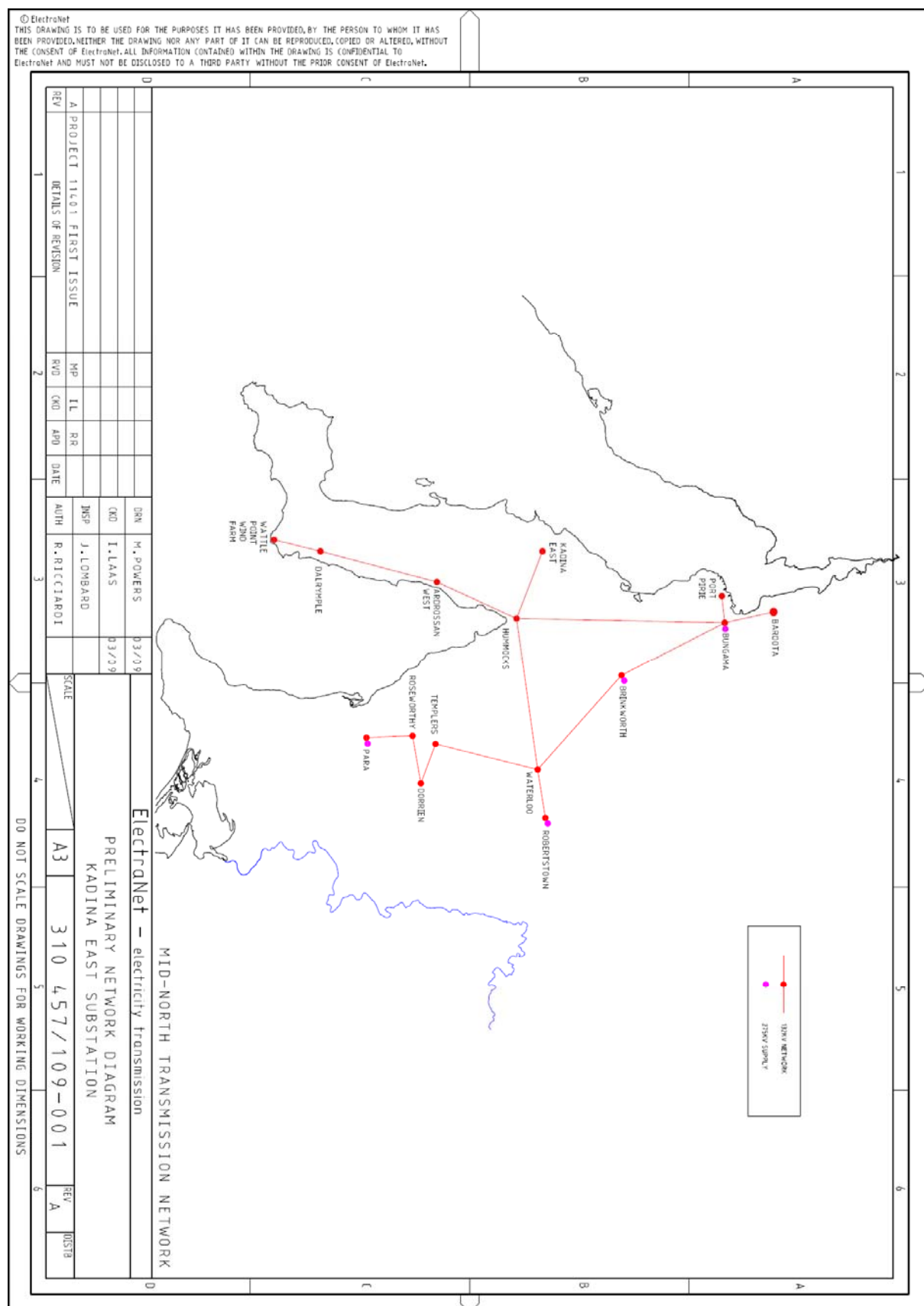
Figure 1: Mid-north transmission network
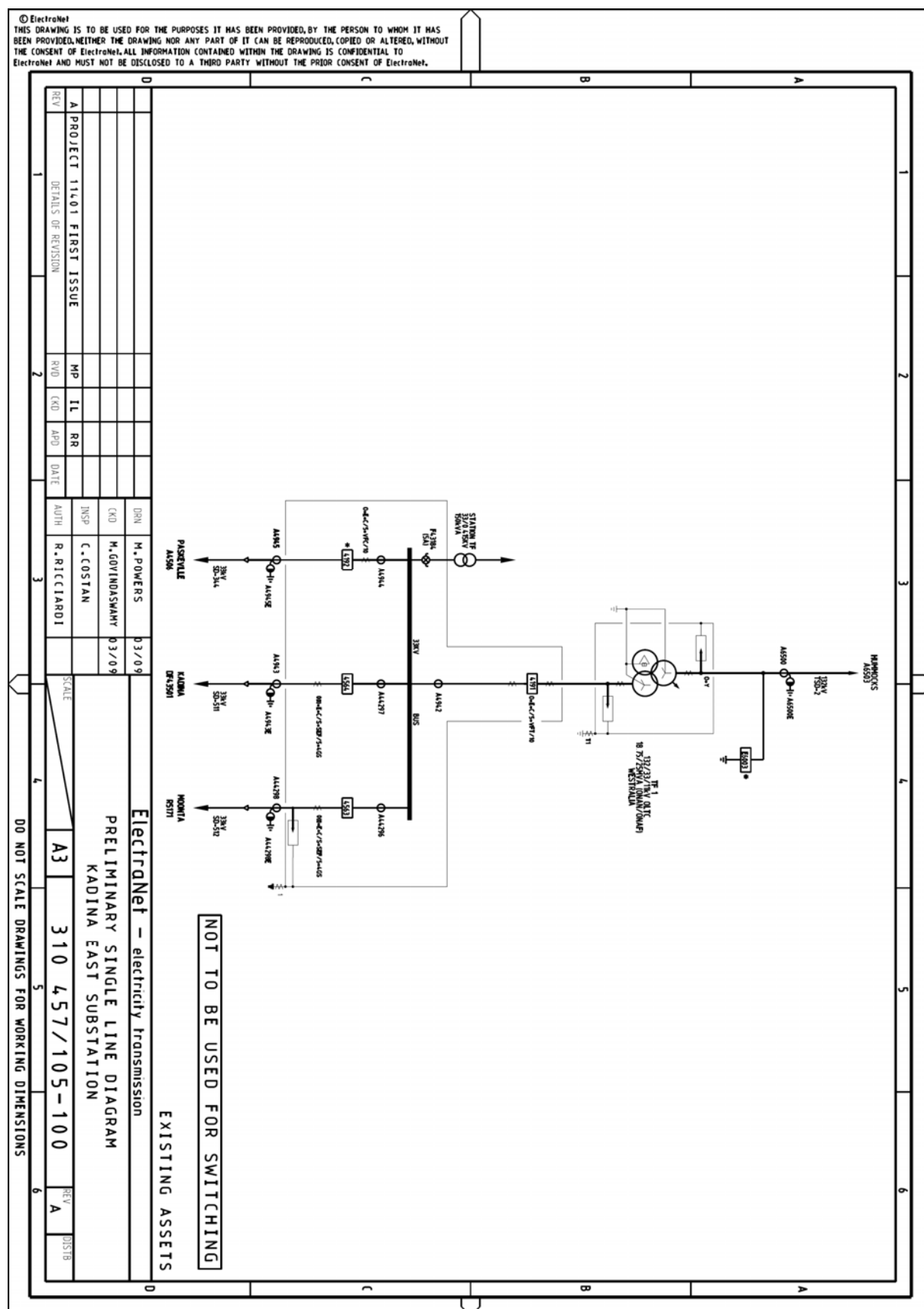
Figure 2: Existing assets – Kadina East substation

2.2   Existing Network and Operational Constraints

As noted above, Kadina East substation is supplied radially from Hummocks substation.   Three other 132kV transmission lines also connect into Hummocks substation. To the south a radial line extends to Ardrossan West, Dalrymple and to Wattle Point Wind Farm, at the southern tip of Yorke Peninsula.   To the east and north respectively, the Hummocks - Waterloo and Hummocks - Snowtown Wind Farm - Bungama 132kV lines connect into the backbone of the 132kV network. The Hummocks-Kadina East line is rated at 41MV.A, while the remaining three lines are each rated at 88MV.A.

Under most anticipated system-normal operating conditions, all four lines are considered to be adequately rated. However, under high interstate export, high mid-north wind generation, or contingency conditions, it is likely that thermal ratings will be exceeded. Under such circumstances, where applicable, N-1 operational requirements are currently managed with constraints, and this regime is expected to be continued into the foreseeable future.

However, such network and generation constraints are independent of the Kadina East substation augmentation, and will not be affected by the proposed developments at Kadina East.

As the Kadina East connection point is radially fed, and since there is no local generation connected to the substation, no additional constraints are presently imposed on the operation of the substation. This status will not be affected by the proposed augmentation.

Lack of alternative adjoining distribution systems with adequate capacity prevents the supply of the total agreed maximum demand (AMD) of the Kadina East connection point via those alternative networks during line or transformer outages, using either permanent or rapid automatic distribution load shifting. This situation will be unchanged by the proposed substation augmentation.

2.3   Planned/ Committed Network Developments

The following regulated network development proposals are planned for the mid-north region during the ten-year period commencing 2009/10:

- Reinforcement of the Templers / Dorrien / Roseworthy 132kV network in 2010;

- Establishing Clare North 132/33kV substation in 2010;

- Rebuilding Ardrossan West substation and installing 2x25MV.A 132/33kV transformers and a 132kV switched capacitor bank in 2011;

- Rebuilding Hummocks substation and installing 2x25MV.A 132/33kV transformers in 2013;

- Rebuilding Waterloo substation and installing 2x25MV.A 132/33kV transformers in 2014;

- Installing a third 60MV.A 132/33kV transformer at Dorrien substation in 2014;

- Installing 132kV capacitor banks at Kadina East and Dalrymple substations in 2015;

- Establishing 275/132kV injection at Hummocks substation in 2019;

- Constructing a second 132kV circuit from Hummocks to Kadina East, with timing dependent on ETC requirements; and

- Constructing a new 132kV circuit from Kadina East to Ardrossan West, with timing again dependent on ETC reliability requirements.

Despite the significant extent of the foreshadowed future works in the area, none of the above developments impact on the need to augment equivalent transformer capacity at Kadina East substation within the required timeframe.

2.4   Committed Generation Facilities

Wattle Point wind farm and Snowtown wind farm are presently connected to the mid-north transmission network. North Brown Hill (formerly Hallet Stage 2) and Clements Gap wind farms are expected to be connected to the network in the near future. In addition, several wind farms in the vicinity of Robertstown and Waterloo have also been proposed, but not yet confirmed.

Despite the relatively close proximity of those wind farms to Kadina East substation, all will connect into either the 275kV or 132kV transmission networks, and as such, will not present a means of providing N-1 equivalent transformer capacity for the Kadina East connection point.

2.5   Electricity Demand

Ten-year electricity demand forecasts are determined by ETSA Utilities with input from customers at each connection point on ElectraNet's transmission network. Those forecasts take account of demand-side management programmes and embedded generation in the distribution network that are either presently in place or foreseen by ETSA Utilities, each of which may have the effect of reducing the forecast demand to be supplied via a particular transmission connection point. The forecast peak summer demand is based on medium economic growth, hot weather, a 10% probability of exceedance, and excludes transmission losses.

ETSA Utilities has provided three demand forecasts for Kadina East, reflecting low, medium and high load-growth scenarios. ElectraNet has then extrapolated those forecasts to cover the entire 15-year period of the analysis using the corresponding annual growth rates of 3.6%, 4.5%, and 5.4% respectively (refer Figure 3).

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25
MW	26.4	27.6	28.9	30.2	31 5	32.9	34.4	36.0	37.6	39.3	41.1	42.9	44.8	46.9	49.0	51.2
pf	0.93	0.93	0.92	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90	0.90	0.91
MV.A	28.43	29.80	31.25	32.76	34.34	35.99	37.71	39.52	41.41	43.39	45.45	47.62	49.87	52.24	54.71	56.42

Medium demand forecast: (4.5% pa)

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25
MW	26.2	27 2	28.1	29.1	30 2	31.3	32.4	33.6	34.8	36.0	37.3	38.7	40.1	41.5	43.0	44.6
pf	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.91
MV.A	28.16	29.25	30.39	31.56	32.78	34.05	35.36	36.72	38.13	39.59	41.10	42.67	44.30	45.98	47.73	48.70

Low demand forecast: (3.6% pa)

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25
MW	29.6	31 2	32.9	34.7	36.6	38.5	40.6	42.8	45.1	47.6	50.1	52.8	55.7	58.7	61.9	65.2
pf	0.92	0.92	0.92	0.91	0.91	0.91	0.90	0.90	0.90	0.90	0.89	0.89	0.89	0.90	0.90	0.90
MV.A	32.12	33.98	35.94	38.01	40.20	42.50	44.94	47.50	50.21	53.06	56.07	59.24	62.58	65.21	68.92	72.84

High demand forecast: (5.4% pa)

Figure 3: Kadina East load forecasts

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3.   Identified Network Limitations

3.1   Service Obligations

ElectraNet is required to meet the supply reliability standards of the ETC and power system and security and quality of supply standards of the Rules. Similarly, ETSA Utilities is bound by the service obligations of the Rules and the EDC.

The principal driver for the proposed large network augmentation at Kadina East substation is the revision of the supply reliability classification for the connection point from Category 1 to Category 2 in the July 2008 ETC. That revision requires ElectraNet to continue to provide N equivalent line capacity, but to also now provide N-1 equivalent transformer capacity to meet 100% of the AMD of the Kadina East connection point.

ElectraNet must use its best endeavours to achieve the increased supply reliability requirement within 12 months, and in any case, within three years, of the date that the July 2008 ETC came into effect.

3.2   Kadina East Installed Transformer Capacity

In addition to the change in the service obligations for the Kadina East connection point, ElectraNet has identified capacity limitations in the current network arrangement.

Forecast growth in the load on the substation under medium load growth conditions indicates that the demand at Kadina East substation will exceed the allowable maximum normal cyclic loading of the substation's existing transformer (28.3 MVA) by the summer of 2009/10 (refer Figure 3).

As a consequence, and given that there is no opportunity to transfer load to adjoining networks or other demand reducing options available, an increase in transformer capacity is required at Kadina East substation to meet the growing demand.

ElectraNet will use the overload capability on the existing transformer (32.3MV.A) to manage peak demand for the limited period between the forecast exceedance of the normal cyclic rating and commissioning of the new plant.

To address the above requirements, the project will be delivered by a planned completion date of June 2011.

4.   Options Considered

As the network limitation to be solved at Kadina East is twofold, that is the ETC requirement for N-1 transformer capacity and the forecast increase in demand, the available options are:

- Non-network options including demand side participation;

- Shifting the load in the distribution network;

- Rebuilding the substation with 2 x 60MV.A transformers; and

- Rebuilding the substation with 3 x 25MV.A transformers.

4.1   Non-network Options

A non-network option could potentially defer replacement of the existing transformer for a given period of time by reducing expected peak load growth. In the case of local generation, specific ETSA Utilities and Rules requirements apply to generators operating in 'islanded mode' for loss of either the Kadina East transmission line or transformer.

ElectraNet considered non-network options. However, due to the radial nature of the 132kV supply to Kadina East substation; the only non-network option that could meet the ETC reliability redundancy requirement for Kadina East substation would be to contract the entire connected load to a demand-side or generation proponent.

ElectraNet has not received any submission in response to its public consultation identifying committed or potentially feasible demand-side management arrangements or generation options that would achieve the required N-1 equivalent transformer capacity at Kadina East.

4.2   Network Options

4.2.1   Permanent or Rapid Load Transfer

Load transfer to another source of supply by reconfiguring the distribution network open-points following transformer failure is not possible. This is due to the lack of adequate alternative distribution networks in the area, as well as the limited spare transformer capacity at neighbouring Hummocks substation, the only viable alternative source of supply.

4.2.2   Rebuilding Kadina East as a 2x60MV.A 132/33kV Substation

This option involves replacing the existing 25MV.A transformer at Kadina East with two 60MV.A units (ElectraNet's next standard transformer size). Associated with the transformer installation will be the installation of 132kV switchgear suitably configured to support the N-1 transformer requirement.

ElectraNet has determined that the proposed works for this option can be co-located within the existing substation boundary, thereby providing the additional advantage that minimal interruption to supply will be required both during construction and when connecting the new assets to the existing 132kV and 33kV networks.

Installing two 60MV.A transformers at Kadina East will provide sufficient N-1 equivalent transformer capacity at the substation well beyond the 2024/25 horizon of the economic analysis period.

4.2.3   Installing Three 25MV.A Transformers

This option involves the installation of a second 25MV.A transformer in parallel with the existing transformer at Kadina East substation. However, given that the emergency cyclic rating of the existing transformer is only 32.3MV.A, failure of the new transformer would result in the existing transformer overloading within two years of the new transformer's installation under that contingency situation (refer Figure 3).

This limitation would then trigger the need to either replace the two transformers with larger units, or install a third 25MV.A transformer. However, from a high-level assessment, this option appears to represent an uneconomical and technically inefficient solution to the provision of N-1 equivalent transformer capacity for Kadina East substation. This is due to the extensive redesign of the substation and additional switchgear that would be required to incorporate a three transformer layout and additional ongoing maintenance effort. In addition, the limit of this solution under the ETC N-1 transformer requirement occurs sooner that the 2 x 60MV.A transformer option.

Therefore, the options analysis presented above reduces to rebuilding Kadina East as a 2x60MV.A 132/33kV Substation. This option has been analysed further by considering two alternate switchyard configurations: meshed and breaker and a half, as discussed in section 5, and is subjected to the Regulatory Test for reliability augmentations.

5.   Technical Details

5.1   Transformer Capacity

ElectraNet has elected to use 60MV.A transformers as they are the next standard transformer size used on its existing transmission network and the installation of these transformers is also consistent with ElectraNet's Spares Policy.

5.2   132kV Switchyard Arrangement

With forecast demand growth and increasing reliability requirements for the region beyond the 15-year planning period, it will be necessary to progressively connect additional 132kV transmission lines and 132kV capacitor banks at Kadina East and neighbouring substations.

ElectraNet's long-term development plans for the transmission network in the region are contained in the Annual Planning Review 2009, and additional to the augmentation that is the subject of this report, include (refer also Figure 4):

- Rebuilding Ardrossan West substation and installing 2x25MV.A 132/33kV transformers and a 132kV switched capacitor bank, in 2011;

- Rebuilding Hummocks substation and installing 2x25MV.A 132/33kV transformers, in 2013;

- Installing 132kV capacitor banks at Kadina East and Dalrymple substations in 2015;

- Establishing 275/132kV injection at Hummocks substation in 2019;

- Constructing a second 132kV circuit from Hummocks to Kadina East, with timing dependent on ETC requirements; and

- Constructing a new 132kV circuit from Kadina East to Ardrossan West, with timing again dependent on ETC reliability requirements.

It was therefore essential that any switchyard design be expandable to accommodate those augmentations in the ultimate configuration, and two technically preferred 132kV switchyard arrangements have consequently been proposed for Kadina East substation, and are presented below.
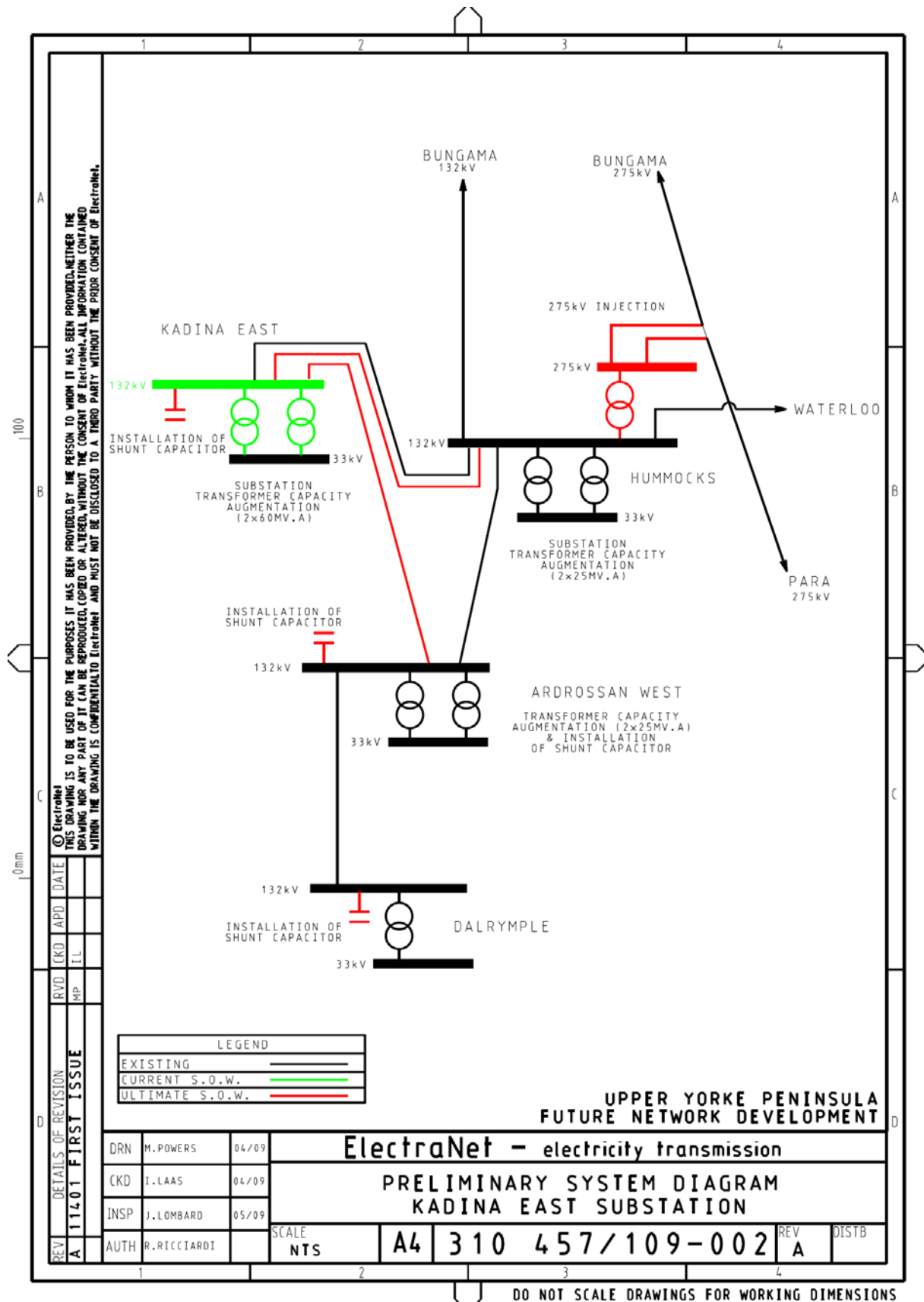
Figure 4: Future network developments

5.2.1 Option 1: Breaker-and-a-Half Arrangement

This option will involve maintaining provision for a fully switched breaker-and-a-half configuration in the ultimate substation layout. The single line diagram for this proposed arrangement is provided in Figure 5, with initial developments shown marked in green, and future developments in red.

The total estimated implementation cost for this option is $27.2m, of which $21.3m would be attributable to ElectraNet's portion of the required works, and $6.0m to ETSA Utilities' (2008 dollars).
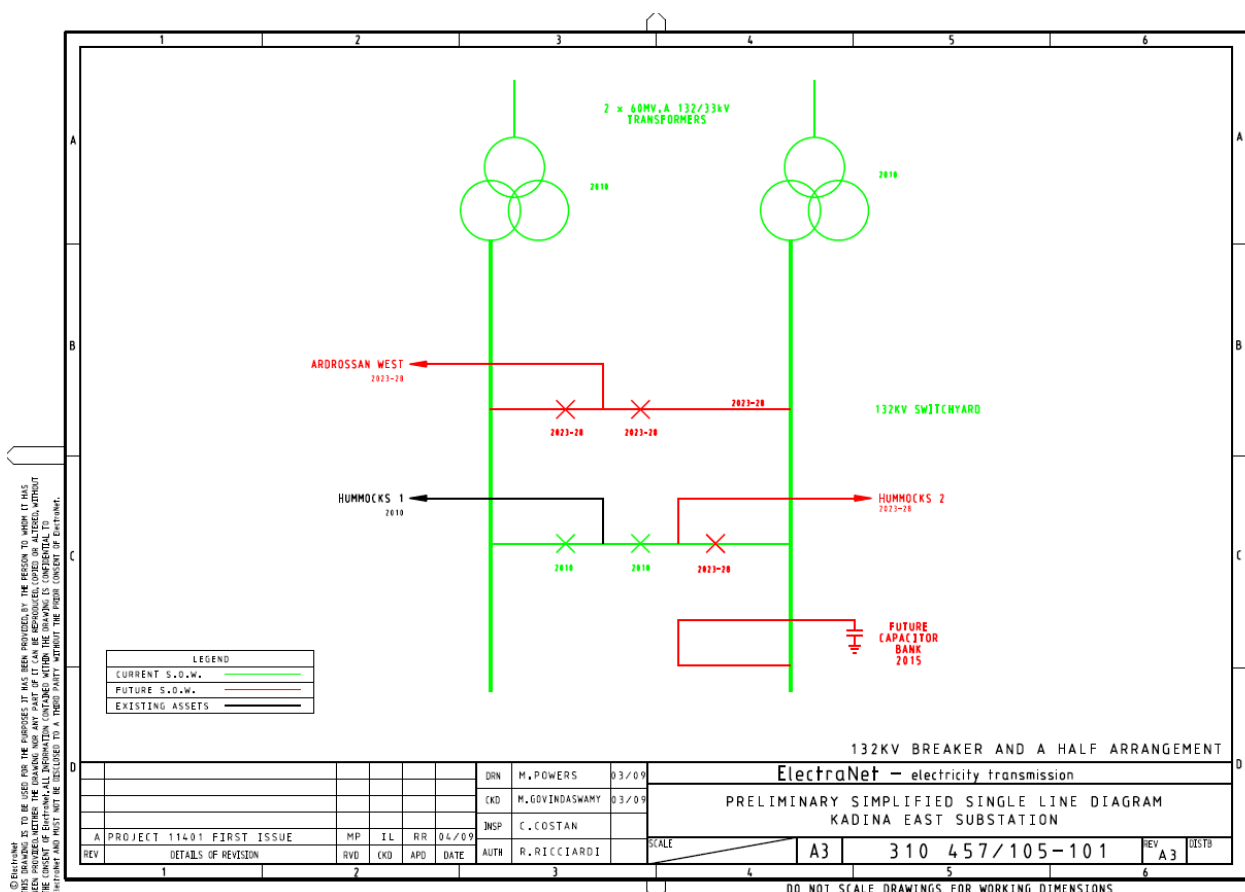
Figure 5: Kadina East 132kV breaker-and-a-half arrangement

5.2.2 Option 2: Meshed Configuration

This option would involve maintaining provision for a fully switched meshed configuration. The single line diagram for this proposed arrangement is given in Figure 6, and as with Option 1, the initial developments are shown marked in green, with future developments marked in red.

The total estimated implementation cost for this option is $25.9m, of which $19.9m will be attributable to ElectraNet's portion of the required works, and $6.0m to ETSA Utilities' (2008 dollars).

This option has been chosen as the preferred option for substation design as the least cost option that meets the applicable reliability requirements. This analysis is discussed in detail in Section 9.
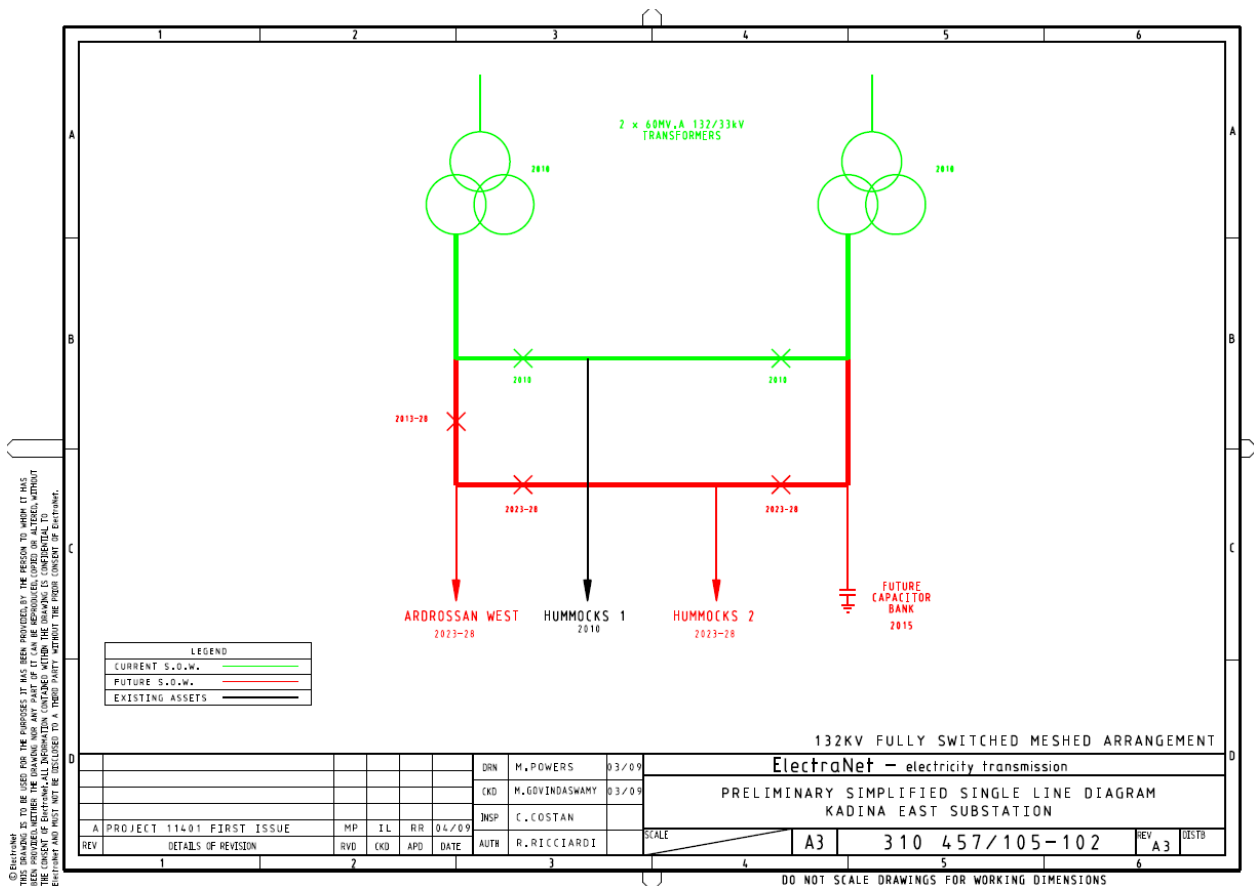
Figure 6: Kadina East 132kV fully switched meshed arrangement

5.3 ElectraNet Scope of Works Required for 132kV Connection

The scope of works required to implement the proposed new large transmission network asset at Kadina East substation includes:

- Designing and constructing all civil works and associated supporting services infrastructure;

- Designing, procuring and installing all 132kV primary plant and equipment, including the two 132/33kV 60MV.A transformers, 132kV switchgear, and voltage and current transformers;

- Designing, procuring and installing all ElectraNet owned 33kV primary plant and equipment, including transformer disconnects, circuit breakers, and current transformers;

- Designing, procuring and installing SCADA and secondary systems at Kadina East and remotely at Hummocks substation;

- Installing new terminal towers and redirecting the existing Hummocks 132kV line to the western end of the switchyard;

- Decommissioning and removing the existing transformer and redundant primary and secondary systems;

- Installing a new telecommunications tower within the switchyard; and

- Establishing new communications links to Kadina East substation for protection and SCADA.

The total cost of ElectraNet's portion of the work, which is represented schematically in Figure 6, is estimated to be $19.9m.

5.4   ETSA Utilities Scope of Work for 33kV Connection

The scope of works required to fully integrate the new transformer capacity and reliability standard into ETSA Utilities' existing 33kV network includes:

- Installing a new two-section 33kV bus to accommodate the two new ElectraNet transformer connections;

- Installing 33kV bus section breakers and 33kV feeder circuit breakers to connect the 33kV feeders to the new bus;

- Installing 33kV bus voltage transformers;

- Installing auxiliary transformers;

- Establishing a new control building;

- Upgrading the existing 33kV earth grid to accommodate the increased fault levels;

- Extending existing fencing to encompass the switchyard expansion;

- Installing telecommunications for SCADA and protection;

- Installing SCADA for all assets; and

- Constructing a new 33kV line from Kadina East substation to the township of Kadina to fully utilise the additional transformer capacity.

The total cost of ETSA Utilities' portion of the work, which is represented schematically in Figure 7, is estimated to be $6.0m.
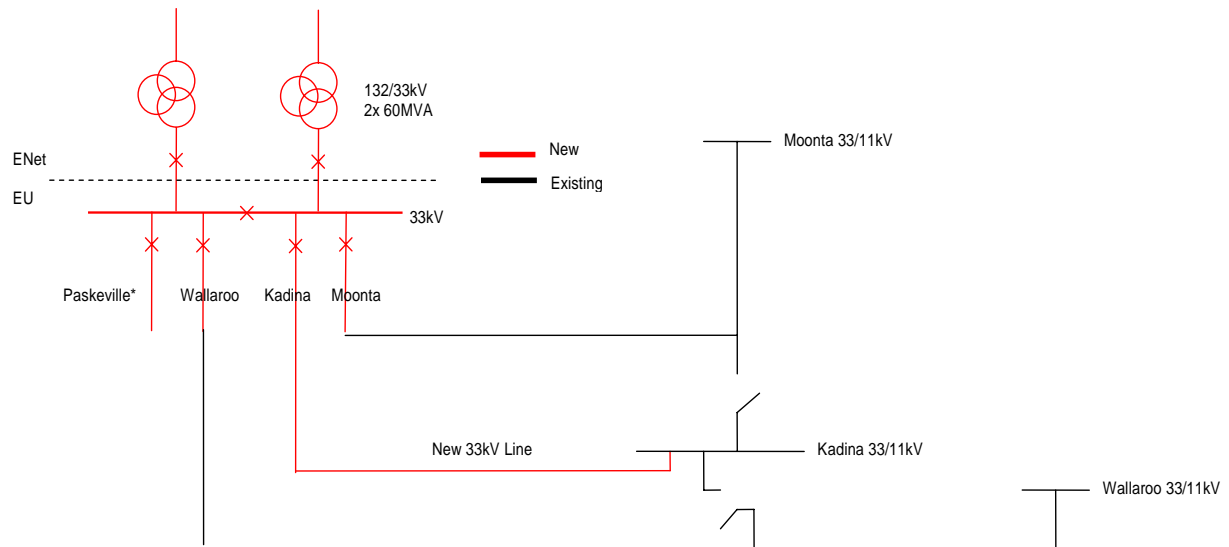
Figure 7: 33kV switchgear upgrade and connection to the existing 33kV distribution network

5.5 Construction Timetable and Commissioning Date

The target construction and commissioning programme for the remainder of the work associated with the Kadina East transformer augmentation project is as follows:

- Delivery of plant by November 2010;

- Delivery of transformers by February 2011; and

- Assets commissioned and in service by July 2011

5.6 Compliance with Service Obligations

As discussed in section 3 of this report, ElectraNet is now required to provide N-1 equivalent transformer capacity to meet 100% of the Kadina East connection point AMD, rather than the previous N requirement. Compliance with the requirements for transformer reliability is demonstrated through the fact that should one of the two 60 MV.A transformers fail, there will be no requirement for interruption of supply to any customers or load shedding, for the remainder of the forecast period.

6.   Intra-Network Impact

The main impact that the new substation will have on the existing network in the area will be increased 33kV fault levels at the substation, due principally to the lower impedance presented by two transformers operating in parallel.

To accommodate the increased fault levels and to take advantage of the increased transformer reliability at the connection point, ETSA Utilities will undertake a major rebuild of its 33kV switchyard, as described in section 5.4 of this report, and construct a new 33kV line from Kadina East substation to the township of Kadina, thereby improving the reliability of supply to the main load centre.

The overall impact of the proposed augmentation will be improved supply reliability and improved voltages on the 33kV network supplying the upper Yorke Peninsula.

7.   Inter-Network Impact

Increasing the N-1 transformer capacity at the Kadina East connection point will have no material inter-network impact on transfer capability between adjoining transmission networks, where *'material inter-network impact'* and 'network' are defined within Chapter 10 of the Rules as:

Material inter-network impact…

- A material impact on another Transmission Network Service Provider's network, which impact may include (without limitation):

    (i)   the imposition of power transfer constraints within another Transmission Network Service Provider's network; or

    (ii)   an adverse impact on the quality of supply in another Transmission Network Service Provider's network; and

Network…

- In relation to a Network Service Provider, a network owned, operated or controlled by that Network Service Provider.

8.   Scenarios Considered

8.1   Context for Evaluation of Options

In accordance with Rules requirements, all feasible options to address the identified supply requirements must be viewed in the context of wider developments in the NEM. ElectraNet is not aware of any inter-state or intra-state transmission network augmentations that would impact on the proposed reliability augmentation to meet the increased ETC reliability standard for the Kadina East connection point.

FINAL REPORT – KADINA EAST TRANSFORMER CAPACITY

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8.2   Assumed Market Development Scenarios

The Regulatory Test for reliability augmentations requires that options to address network requirements be assessed against a number of reasonable scenarios, and that those scenarios must consider:

- The existing network;

- Future network developments;

- Committed generation and demand side developments;

- Potential generation and demand side developments; and

- Variations in load growth.

The intended purpose of that approach is to test the present value costs of the options being evaluated under a range of plausible scenarios to ensure that the ranking of the options is robust over the range of scenarios.

8.2.1   Existing Network and Future Transmission Developments

Existing and future network developments have been discussed previously in this report, with the conclusion that any such developments would be common to all options considered given the remote, radial location of the load centre, thereby not affecting their relative ranking when subjected to the Regulatory Test.

8.2.2   Committed and Potential Generation and Demand Side Developments

The net effects on the two options under assessment of potential generation and demand side development scenarios are the same and do not affect their present value ranking.

As mentioned previously in section 4.1, neither ElectraNet nor ETSA Utilities are aware of any generation or demand-side proposals that would provide the increased reliability level required for the Kadina East connection point under the ETC.

8.2.3   Variations in Load Growth

The forecast demand growth used in this assessment is based on medium economic conditions and hot weather forecasts (10% Probability of Exceedance, or PoE) for electricity usage[1].

For the purposes of the Kadina East augmentation studies, scenarios assuming both high (5.4%) and low (3.6%) demand growth were also studied to ensure the robustness of the findings of this report, which are based on medium load growth (4.5% per annum). However, given the significant increase in capacity from the existing Kadina East transformer to the capacity of the proposed transformers, which are the next-largest standard size of transformer used by ElectraNet, the

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[1]   Use of 10% PoE weather forecasts is consistent with Australian TNSP practice when planning the backbone 275kV and 132kV networks.

**FINAL REPORT – KADINA EAST
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November 2009

choice of load growth rate does not influence the choice of future augmentations for many years to come, and therefore has no impact on the findings of this report.

9. Economic Analysis

9.1 Regulatory Test Requirements

The Regulatory Test requires that, for reliability augmentations, the recommended option be the option that "minimises the present value of costs, compared with a number of alternative options in a majority of reasonable scenarios".

It is then the ranking of those options, rather than their actual present value, that is significant since the Regulatory Test requires that the recommended option have the lowest present value cost to market participants when considered under a range of assumed scenarios.

The Regulatory Test contains guidelines for the methodology to be used to identify the lowest cost option. Information to be considered includes construction, operating and maintenance costs, and the cost of complying with existing and anticipated laws and regulations. However, the Regulatory Test specifically excludes indirect costs and costs that cannot be measured as a cost in terms of financial transactions in the electricity market.

9.2 Inputs to Analysis

The Regulatory Test has been carried out using a discounted cash flow model and a pre-tax real Weighted Average Cost of Capital (WACC) of 8.5% as the discount rate, and which equates to a nominal WACC of 11.35%.

Economic analysis has been undertaken over a fifteen year period, taking into account the total capital cost of implementing each of the two options. In this instance, all future augmentations of the network will be common to both options, and can therefore be omitted from the financial analysis since their cost impact will be identical for both and have no bearing on the ranking.

All cost estimates that have been used are current as at 2008.

9.3 Cost of Network Augmentations

To properly apply the Regulatory Test, the economic analysis and comparison of the options must consider all foreseeable cost impacts of the proposed network augmentations to market participants. However, in this instance, no future augmentations have been identified that are particular to one or other of the two options identified.

The capital cost to implement each of the two options identified in section 4 of this report has been estimated by ElectraNet and ETSA Utilities based on a conceptual scope of works. Sensitivity studies that would normally be carried out to examine the effect of variations in capital cost estimates have not been necessary since the only costs that feature in the financial analysis are the initial establishment cost for

either option, variations on which would have similar effect on both and therefore not affect ranking.

9.4 Results of Analysis

In consideration of the above, application of the Regulatory Test in this instance is reduced to a comparison of the 2010/11 establishment costs of the two options, with the least-cost option in present value terms satisfying that test. Variation in discount rate in this instance has no impact on the ranking of the options.

Accordingly, since the estimated total implementation costs for stage 1 of Options 1 and 2 are $27.0m and $24.4m respectively, Option 2 (rebuilding Kadina East substation as a 2x60MV.A 132/33kV substation with a meshed 132kV switchyard configuration) is the option that satisfies the Regulatory Test for reliability augmentations.

On the basis of PV cost analysis incorporating capital expenditure, as well as operating and maintenance costs and system losses, the relativities in PV costs were determined. These results are summarised in the following table:

	Option 1 Breaker and a half configuration	**Option 2** Meshed configuration
Establishment Cost	$28.8m	$25.9m
Net Present Cost Over 15 years	$27.0m	$24.4m
RANK	2	1

Figure 7: Summary of Regulatory Test Results

10.   Recommendation

Based on the information provided in this paper, including system study results and financial analysis, ElectraNet and ETSA Utilities recommend the installation of 2x60MV.A 132/33kV transformers in mesh configuration, together with the associated 33kV changes required to achieve the revised reliability requirements imposed by the ETC for Kadina East substation.

The estimated implementation cost for this option is $25.9m, of which $6m is attributable to ETSA Utilities' portion of the project, and $19.9m to ElectraNet's. This project is required to be commissioned and commercially available by no later than 30 June 2011.

11. Consultation

The joint application notice entitled "Proposed New Large Network Asset – Kadina East Transformer Capacity Increase" was published in accordance with the requirements of the Rules and ESCOSA Guideline 12 on 10 July 2009. No submissions were received.

Based on the results contained within this report, and given that there were no submissions received in response to the Application Notice, the requirements of the Rules and Guideline 12 have been met.

In accordance with Rules, Registered Participants, the AEMC, Connection Applicants, Intending Participants, AEMO and interested parties may, by a referral to the AER, dispute this Final Report but only in relation to its contents, assumptions, findings or recommendations with respect to certain matters set out in clause 5.6.6(j).

A person disputing this final report under clause 5.6.6(j) must:

- Lodge notice of the dispute in writing (the dispute notice) with the AER;

- Give a copy of the dispute notice to ElectraNet and ETSA Utilities within 30 business days after publication of the summary of this final report on NEMMCO's website; and

- Specify in the dispute notice the grounds for the dispute in accordance with clause 5.6.6(j).

The AER must resolve any disputes referred under clause 5.6.6(j) by making a determination. Following the 30 business day period referred to above, the Regulatory Test consultation process will have concluded (subject to any disputes) and ElectraNet and ETSA Utilities will proceed to implement the proposed new large transmission network asset.

Please address any correspondence to:

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12. Glossary of Terms

Term	Description
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AMD	Agreed Maximum Demand – for a connection point or a group of connection points this is the contracted demand specified in the connection agreement between ElectraNet and the relevant transmission customer or ETSA Utilities.
Final Report	A notice made available to Registered Participants and Interested Parties pursuant to clause 5.6.6 of the Rules
Distribution Code	South Australian Electricity Distribution Code – as issued by ESCOSA
EDC	
DNSP	Distribution Network Service Provider
ElectraNet	ElectraNet is the principal transmission network service provider in South Australia. It is a privately owned company that has a long term lease for the operation, maintenance, and development of the South Australian transmission system which comprises plant and equipment mainly operating at voltages of 132 kV and above. ElectraNet is registered with AEMO as a Transmission Network Service Provider (TNSP)
Equivalent Transformer Capacity	Capacity to transform energy to meet demand using means including, but not limited to: • transmission system capability; • network support arrangements. as defined in the ESCOSA Electricity Transmission Code
ESCOSA	Essential Services Commission of South Australia established under the Essential Services Commission Act 2002
ETC	South Australian Electricity Transmission Code issued by ESCOSA
ETSA Utilities	ETSA Utilities is South Australia's principal Distribution Network Service Provider (DNSP), and is responsible for the distribution of electricity to all distribution grid connected customers within the State. ETSA Utilities is a partnership of Cheung Kong Infrastructure Holdings Ltd (CKI), Hong Kong Electric International Ltd (HEI), and Spark Infrastructure
Market Participant	A person who has registered with AEMO as a Market Generator, Market Customer or Market Network Service Provider under Chapter 2 of the Rules
NEM	National Electricity Market
PV	Present Value
PoE	Probability of Exceedance
Registered Participant	A person who is registered with AEMO as a Network Service Provider, a System Operator, a Network Operator, a Special Participant, a Generator, a Customer or a Market Participant
Regulatory Test	The economic investment test promulgated by the AER, which all major regulated network augmentation investments must satisfy
RFI	Request for Information
RFP	Request for Proposals
Rules	National Electricity Rules
TNSP	Transmission Network Service Provider
WACC	Weighted Average Cost of Capital

13.   Appendix A Financial Analysis

November 2009

Scenario A			**Low load Growth**														
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Option 1			**Kadina 2x60 breaker and a half**														
Kadina 2x60 breaker and a half	20.19048																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	20.19048	21.2	21.200	20.729	20.258	19.787	19.316	18.844	18.373	17.902	17.431	16.960	16.489	16.018	15.547	15.076	14.604
* Depreciation over	45		0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711
* Opex	0.015		0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180
* WACC	0.085		1.802	1.762	1.722	1.682	1.642	1.602	1.562	1.522	1.482	1.442	1.402	1.362	1.321	1.281	1.241
=> TUOS		0	2.591	2.551	2.511	2.471	2.431	2.391	2.351	2.311	2.271	2.231	2.191	2.151	2.111	2.071	2.030
==> NPV of TUOS	$19.68																
Kadina East swap 25s to 60s	3.809524																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	3.809524	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
* Depreciation over	45		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
* Opex	0.015		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
* WACC	0.085		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
=> TUOS		0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
==> NPV of TUOS	$0.00																
ENet Kadina East telecom bearers	1.488571																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	1.488571	1.563	1.563	1.528	1.4935333	1.4588	1.4240667	1.3893333	1.3546	1.3198667	1.2851333	1.2504	1.2156667	1.1809333	1.1462	1.1114667	1.0767333
* Depreciation over	45		0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347
* Opex	0.015		0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234
* WACC	0.085		0.133	0.130	0.127	0.124	0.121	0.118	0.115	0.112	0.109	0.106	0.103	0.100	0.097	0.094	0.092
=> TUOS		0	0.191	0.188	0.185	0.182	0.179	0.176	0.173	0.170	0.167	0.164	0.162	0.159	0.156	0.153	0.150
==> NPV of TUOS	$1.45																
ETSA Utilites cost	5.714286																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	5.714286	6	6.000	5.867	5.7333333	5.6	5.4666667	5.3333333	5.2	5.0666667	4.9333333	4.8	4.6666667	4.5333333	4.4	4.2666667	4.1333333
* Depreciation over	45		0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333
* Opex	0.015		0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900
* WACC	0.085		0.510	0.499	0.487	0.476	0.465	0.453	0.442	0.431	0.419	0.408	0.397	0.385	0.374	0.363	0.351
=> TUOS		0	0.733	0.722	0.711	0.699	0.688	0.677	0.665	0.654	0.643	0.631	0.620	0.609	0.597	0.586	0.575
==> NPV of TUOS	$5.57																
Total TUOS per year			3.515	3.461	3.407	3.352	3.298	3.244	3.189	3.135	3.081	3.027	2.972	2.918	2.864	2.809	2.755
NPV of total TUOS	$26.71																
Cost of Losses																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Losses after implementation (MW)		0	0.29	0.31	0.33	0.35	0.37	0.40	0.42	0.45	0.48	0.51	0.54	0.58	0.62	0.66	0.70
Cost of Losses $		0	0.022	0.023	0.025	0.026	0.028	0.030	0.032	0.034	0.036	0.039	0.041	0.044	0.047	0.050	0.053
=> NPV of Cost of Losses	$0.27																
Reliability Costs																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
		0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
=> NPV of Reliability Costs	$0.00																
Total for Option 1	$26.97																

Scenario A – Low load growth Option 1

Scenario B			Medium load Growth														
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27

Option 1 — Kadina 2x60 breaker and a half

Kadina 2x60 breaker and a half	20.19048																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	20.19048	21.2	21.200	20.729	20.258	19.787	19.316	18.844	18.373	17.902	17.431	16.960	16.489	16.018	15.547	15.076	14.604
* Depreciation over	45		0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711
* Opex	0.015		0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180
* WACC	0.085		1.802	1.762	1.722	1.682	1.642	1.602	1.562	1.522	1.482	1.442	1.402	1.362	1.321	1.281	1.241
=> TUOS		0	2.591	2.551	2.511	2.471	2.431	2.391	2.351	2.311	2.271	2.231	2.191	2.151	2.111	2.071	2.030
==> NPV of TUOS	$19.68																
			21.200	0.495													

Kadina East swap 25s to 60s	3.809524																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	3.809524	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
* Depreciation over	45		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
* Opex	0.015		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
* WACC	0.085		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
=> TUOS		0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
==> NPV of TUOS	$0.00																

ENet Kadina East telecom bearers	1.488571																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	1.488571	1.563	1.563	1.528	1.4935333	1.4588	1.4240667	1.3893333	1.3546	1.3198667	1.2851333	1.2504	1.2156667	1.1809333	1.1462	1.1114667	1.0767333
* Depreciation over	45		0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347
* Opex	0.015		0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234
* WACC	0.085		0.133	0.130	0.127	0.124	0.121	0.118	0.115	0.112	0.109	0.106	0.103	0.100	0.097	0.094	0.092
=> TUOS		0	0.191	0.188	0.185	0.182	0.179	0.176	0.173	0.170	0.167	0.164	0.162	0.159	0.156	0.153	0.150
==> NPV of TUOS	$1.45																

ETSA Utilites cost	5.714286																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	19/20	20/21	21/22	22/23	23/24	24/25	25/26
* WDV	5.714286	6	6.000	5.867	5.7333333	5.6	5.4666667	5.3333333	5.2	5.0666667	4.9333333	4.8	4.6666667	4.5333333	4.4	4.2666667	4.1333333
* Depreciation over	45		0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333
* Opex	0.015		0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900
* WACC	0.085		0.510	0.499	0.487	0.476	0.465	0.453	0.442	0.431	0.419	0.408	0.397	0.385	0.374	0.363	0.351
=> TUOS		0	0.733	0.722	0.711	0.699	0.688	0.677	0.665	0.654	0.643	0.631	0.620	0.609	0.597	0.586	0.575
==> NPV of TUOS	$5.57																

Total TUOS per year			3.515	3.461	3.407	3.352	3.298	3.244	3.189	3.135	3.081	3.027	2.972	2.918	2.864	2.809	2.755
NPV of total TUOS	$26.71																

Cost of Losses																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Losses after implementation (MW)		0	0.31	0.33	0.36	0.39	0.42	0.46	0.49	0.53	0.58	0.62	0.67	0.73	0.79	0.85	0.92
Cost of Losses $		0	0.023	0.025	0.027	0.029	0.032	0.034	0.037	0.040	0.044	0.047	0.051	0.055	0.060	0.064	0.070
=> NPV of Cost of Losses	$0.31																

Reliability Costs																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
		0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
=> NPV of Reliability Costs	$0.00																

Total for Option 1	$27.02																

Scenario B – Medium load growth Option 1

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November 2009

Scenario C			**High load Growth**														
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Option 1			**Kadina East breaker and a half**														
Kadina 2x60 breaker and a half	20.19048																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	20.19048	21.2	21.200	20.729	20.258	19.787	19.316	18.844	18.373	17.902	17.431	16.960	16.489	16.018	15.547	15.076	14.604
* Depreciation over	45		0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711	0.4711
* Opex	0.015		0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180	0.3180
* WACC	0.085		1.802	1.762	1.722	1.682	1.642	1.602	1.562	1.522	1.482	1.442	1.402	1.362	1.321	1.281	1.241
=> TUOS		0	2.591	2.551	2.511	2.471	2.431	2.391	2.351	2.311	2.271	2.231	2.191	2.151	2.111	2.071	2.030
==> NPV of TUOS	$19.68																
Kadina East swap 25s to 60s	3.809524																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	3.809524	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
* Depreciation over	45		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
* Opex	0.015		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
* WACC	0.085		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
=> TUOS		0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
==> NPV of TUOS	$0.00																
ENet Kadina East telecom bearers	1.488571																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	1.488571	1.563	1.563	1.528	1.4935333	1.4588	1.4240667	1.3893333	1.3546	1.3198667	1.2851333	1.2504	1.2156667	1.1809333	1.1462	1.1114667	1.0767333
* Depreciation over	45		0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347	0.0347
* Opex	0.015		0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234
* WACC	0.085		0.133	0.130	0.127	0.124	0.121	0.118	0.115	0.112	0.109	0.106	0.103	0.100	0.097	0.094	0.092
=> TUOS		0	0.191	0.188	0.185	0.182	0.179	0.176	0.173	0.170	0.167	0.164	0.162	0.159	0.156	0.153	0.150
==> NPV of TUOS	$1.45																
ETSA Utilites cost	5.714286																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	5.714286	6	6.000	5.867	5.7333333	5.6	5.4666667	5.3333333	5.2	5.0666667	4.9333333	4.8	4.6666667	4.5333333	4.4	4.2666667	4.1333333
* Depreciation over	45		0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333
* Opex	0.015		0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900	0.0900
* WACC	0.085		0.510	0.499	0.487	0.476	0.465	0.453	0.442	0.431	0.419	0.408	0.397	0.385	0.374	0.363	0.351
=> TUOS		0	0.733	0.722	0.711	0.699	0.688	0.677	0.665	0.654	0.643	0.631	0.620	0.609	0.597	0.586	0.575
==> NPV of TUOS	$5.57																
Total TUOS per year			3.515	3.461	3.407	3.352	3.298	3.244	3.189	3.135	3.081	3.027	2.972	2.918	2.864	2.809	2.755
NPV of total TUOS	$26.71																
Cost of Losses																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Losses after implementation (MW)		0	0.33	0.36	0.39	0.43	0.48	0.52	0.57	0.63	0.69	0.76	0.83	0.92	1.01	1.11	1.21
Cost of Losses $		0	0.025	0.027	0.030	0.033	0.036	0.040	0.043	0.048	0.052	0.058	0.063	0.069	0.076	0.084	0.092
=> NPV of Cost of Losses	$0.37																
Reliability Costs																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
		0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
=> NPV of Reliability Costs	$0.00																
Total for Option 1	$27.08																

Scenario C – High Load Growth Option 1

Scenario A			**Low load Growth**														
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Option 2			**Kadina 2x60 meshed bus**														
Kadina 2x60 meshed bus	17.3619																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	17.3619	18 23	18.230	17 825	17.420	17.015	16.610	16.204	15.799	15 394	14 989	14.584	14.179	13.774	13.369	12 964	12.558
* Depreciation over	45		0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051
* Opex	0 015		0.2734	0.2734	0.2734	0.2734	0 2734	0 2734	0.2734	0.2734	0.2734	0.2734	0 2734	0 2734	0.2734	0.2734	0.2734
* WACC	0.085		1 550	1.515	1.481	1.446	1.412	1.377	1 343	1.309	1.274	1.240	1.205	1.171	1.136	1.102	1.067
=> TUOS		0	2 228	2.194	2.159	2.125	2.090	2 056	2 022	1.987	1.953	1.918	1.884	1 849	1 815	1.780	1.746
==> NPV of TUOS	$16.93																
ENet Kadina East telecom bearers	1.617143																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	1.617143	1.698	1 698	1.660	1.6225333	1.5848	1.5470667	1.5093333	1.4716	1.4338667	1.3961333	1.3584	1.3206667	1.2829333	1.2452	1 2074667	1.1697333
* Depreciation over	45		0.0377	0.0377	0.0377	0.0377	0 0377	0.0377	0.0377	0.0377	0.0377	0.0377	0 0377	0.0377	0.0377	0.0377	0.0377
* Opex	0 015		0.0255	0.0255	0.0255	0.0255	0 0255	0 0255	0.0255	0.0255	0.0255	0.0255	0 0255	0 0255	0.0255	0.0255	0.0255
* WACC	0.085		0.144	0.141	0.138	0.135	0.132	0 128	0.125	0.122	0.119	0.115	0.112	0.109	0.106	0.103	0.099
=> TUOS		0	0 208	0.204	0.201	0.198	0.195	0.191	0.188	0.185	0.182	0.179	0.175	0.172	0.169	0.166	0.163
==> NPV of TUOS	$1.58																
ETSA Utilites cost	5.714286																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	5.714286	6	6 000	5.867	5.7333333	5 6	5.4666667	5.3333333	5.2	5.0666667	4.9333333	4 8	4.6666667	4.5333333	4.4	4 2666667	4.1333333
* Depreciation over	45		0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333
* Opex	0.015		0.0900	0.0900	0.0900	0.0900	0 0900	0 0900	0.0900	0.0900	0.0900	0.0900	0 0900	0 0900	0.0900	0.0900	0.0900
* WACC	0.085		0 510	0.499	0.487	0.476	0.465	0.453	0.442	0.431	0.419	0.408	0.397	0.385	0 374	0.363	0.351
=> TUOS		0	0.733	0.722	0.711	0.699	0.688	0.677	0 665	0.654	0.643	0.631	0.620	0.609	0 597	0.586	0.575
==> NPV of TUOS	$5.57																
Total TUOS per year			3.169	3.120	3.071	3.022	2.973	2.924	2 875	2.826	2.777	2.728	2.679	2 630	2 581	2.532	2.483
NPV of total TUOS	$24.07																
Cost of Losses																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Losses after implementation (MW)		0	0.29	0 31	0 33	0.35	0.37	0.40	0.42	0.45	0.48	0.51	0.54	0.58	0.62	0 66	0.70
Cost of Losses $		0	0 022	0.023	0.025	0.026	0.028	0.030	0 032	0.034	0.036	0.039	0.041	0 044	0 047	0.050	0.053
=> NPV of Cost of Losses	$0.27																
Reliability Costs																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
		0	0 000	0.000	0.000	0.000	0.000	0.000	0 000	0.000	0.000	0.000	0.000	0 000	0 000	0.000	0.000
=> NPV of Reliability Costs	$0.00																
Total for Option 2	$24.34																

Scenario A – Low load growth Option 2

Scenario B			**Medium load Growth**														
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Option 2			**Kadina 2x60 meshed bus**														
Kadina 2x60 meshed bus	17.3619																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	17.3619	18 23	18.230	17 825	17.420	17.015	16.610	16.204	15.799	15 394	14.989	14.584	14.179	13.774	13 369	12.964	12.558
* Depreciation over	45		0.405	0.405	0.405	0.405	0.405	0.405	0.405	0.405	0.405	0.405	0.405	0.405	0.405	0.405	0.405
* Opex	0 015		0 273	0.273	0.273	0.273	0.273	0 273	0.273	0.273	0.273	0.273	0 273	0 273	0.273	0.273	0.273
* WACC	0 085		1 550	1.515	1.481	1.446	1.412	1 377	1.343	1.309	1.274	1.240	1 205	1.171	1.136	1.102	1.067
=> TUOS		0	2 228	2.194	2.159	2.125	2.090	2 056	2.022	1.987	1.953	1.918	1 884	1 849	1.815	1.780	1.746
==> NPV of TUOS	$16.93																
ENet Kadina East telecom bearers	1 617																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	1 617	1.698	1 698	1.660	1.623	1.585	1.547	1 509	1.472	1.434	1.396	1.358	1 321	1 283	1.245	1.207	1.170
* Depreciation over	45		0 038	0.038	0.038	0.038	0.038	0 038	0.038	0.038	0.038	0.038	0 038	0.038	0.038	0.038	0.038
* Opex	0 015		0 025	0.025	0.025	0.025	0.025	0 025	0.025	0.025	0.025	0.025	0 025	0 025	0.025	0.025	0.025
* WACC	0 085		0.144	0.141	0.138	0.135	0.132	0.128	0.125	0.122	0.119	0.115	0.112	0.109	0.106	0.103	0.099
=> TUOS		0	0 208	0.204	0.201	0.198	0.195	0.191	0.188	0.185	0.182	0.179	0.175	0.172	0.169	0.166	0.163
==> NPV of TUOS	$1.58																
ETSA Utilites cost	5.714																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	
* WDV	5.714	6	6 000	5.867	5.733	5.600	5.467	5 333	5.200	5.067	4.933	4.800	4 667	4 533	4.400	4.267	4.133
* Depreciation over	45		0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133	0.133
* Opex	0 015		0 090	0.090	0.090	0.090	0.090	0 090	0.090	0.090	0.090	0.090	0 090	0 090	0.090	0.090	0.090
* WACC	0 085		0 510	0.499	0.487	0.476	0.465	0.453	0.442	0.431	0.419	0.408	0 397	0.385	0.374	0.363	0.351
=> TUOS		0	0.733	0.722	0.711	0.699	0.688	0 677	0.665	0.654	0.643	0.631	0 620	0 609	0.597	0.586	0.575
==> NPV of TUOS	$5.57																
Total TUOS per year			3.169	3.120	3.071	3.022	2.973	2 924	2.875	2.826	2.777	2.728	2 679	2 630	2.581	2.532	2.483
NPV of total TUOS	$24.07																
Cost of Losses																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Losses after implementation (MW)		0	0.31	0 33	0.36	0.39	0.42	0.46	0.49	0 53	0.58	0.62	0.67	0.73	0.79	0.85	0.92
Cost of Losses $		0	0.023	0.025	0.027	0.029	0.032	0 034	0.037	0.040	0.044	0.047	0 051	0.055	0.060	0.064	0.070
=> NPV of Cost of Losses	$0.31																
Reliability Costs																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
		0	0 000	0.000	0.000	0.000	0.000	0 000	0.000	0.000	0.000	0.000	0 000	0 000	0.000	0.000	0.000
=> NPV of Reliability Costs	$0.00																
Total for Option 2	$24.39																

Scenario B – Medium load growth Option 2

ElectraNet — electricity transmission

ETSA Utilities — Delivering energy to South Australians

November 2009

Scenario C			**High load Growth**													
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Option 2			**Kadina 2x60 meshed bus**														
Kadina 2x60 meshed bus	17.3619																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	17.3619	18.23	18 230	17.825	17.420	17.015	16 610	16.204	15.799	15.394	14 989	14.584	14.179	13.774	13 369	12.964	12.558
* Depreciation over	45		0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051	0.4051
* Opex	0.015		0.2734	0.2734	0 2734	0.2734	0.2734	0.2734	0 2734	0.2734	0.2734	0.2734	0 2734	0.2734	0.2734	0.2734	0.2734
* WACC	0.085		1.550	1 515	1.481	1.446	1.412	1 377	1.343	1.309	1.274	1 240	1.205	1.171	1.136	1.102	1.067
=> TUOS		0	2.228	2.194	2.159	2.125	2.090	2 056	2.022	1.987	1.953	1 918	1.884	1.849	1.815	1.780	1.746
==> NPV of TUOS	$16.93																
ENet Kadina East telecom bearers	1.617143																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	1.617143	1.698	1.698	1 660	1 6225333	1.5848	1.5470667	1 5093333	1.4716	1.4338667	1.3961333	1.3584	1.3206667	1.2829333	1.2452	1 2074667	1.1697333
* Depreciation over	45		0.0377	0.0377	0 0377	0.0377	0.0377	0.0377	0 0377	0.0377	0.0377	0.0377	0 0377	0.0377	0.0377	0.0377	0 0377
* Opex	0.015		0.0255	0.0255	0 0255	0.0255	0.0255	0.0255	0 0255	0.0255	0.0255	0.0255	0 0255	0.0255	0.0255	0.0255	0 0255
* WACC	0.085		0.144	0.141	0.138	0.135	0.132	0.128	0.125	0.122	0.119	0.115	0.112	0.109	0.106	0.103	0.099
=> TUOS		0	0.208	0 204	0.201	0.198	0.195	0.191	0.188	0.185	0.182	0.179	0.175	0.172	0.169	0.166	0.163
==> NPV of TUOS	$1.58																
ETSA Utilites cost	5.714286																
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
* WDV	5.714286	6	6.000	5 867	5.7333333	5 6	5.4666667	5 3333333	5.2	5.0666667	4.9333333	4.8	4.6666667	4.5333333	4.4	4 2666667	4.1333333
* Depreciation over	45		0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333	0.1333
* Opex	0.015		0.0900	0.0900	0 0900	0.0900	0.0900	0.0900	0 0900	0.0900	0.0900	0.0900	0 0900	0.0900	0.0900	0.0900	0 0900
* WACC	0.085		0.510	0.499	0.487	0.476	0.465	0.453	0.442	0.431	0.419	0.408	0.397	0.385	0.374	0 363	0.351
=> TUOS		0	0.733	0.722	0.711	0.699	0.688	0 677	0.665	0.654	0.643	0 631	0.620	0.609	0.597	0 586	0.575
==> NPV of TUOS	$5.57																
Total TUOS per year			3.169	3.120	3.071	3.022	2.973	2 924	2.875	2.826	2.777	2.728	2.679	2.630	2.581	2 532	2.483
NPV of total TUOS	$24.07																
Cost of Losses																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Losses after implementation (MW)		0	0 33	0.36	0.39	0.43	0.48	0.52	0.57	0.63	0 69	0.76	0.83	0.92	1 01	1.11	1.21
Cost of Losses $		0	0.025	0 027	0.030	0.033	0.036	0 040	0.043	0.048	0.052	0 058	0.063	0.069	0.076	0 084	0.092
=> NPV of Cost of Losses	$0.37																
Reliability Costs																	
		11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
		0	0.000	0 000	0.000	0.000	0.000	0 000	0.000	0.000	0.000	0 000	0.000	0.000	0.000	0.000	0.000
=> NPV of Reliability Costs	$0.00																
Total for Option 2	$24.45																

Scenario C – High load growth Option