

# Planning Council Review of ElectraNet SA's Capital Expenditure

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## 1 BACKGROUND

The Australian Competition and Consumer Commission (ACCC), in accordance with its responsibilities under the National Electricity Code (NEC), will commence economic regulation of South Australia's transmission network beginning 1 January 2003.

The ACCC approached the Electricity Supply Industry Planning Council (Planning Council) as the State's jurisdictional planner, to obtain a high level view on future augmentations likely to be required for the State's transmission networks.

The results of a high level analysis performed by the Planning Council for the ACCC investigating the adequacy of the State's networks for the next 5 years is contained in this report.

## 2 METHODOLOGY

### Network Models

Based on the requirements of both the NEC and the South Australian Transmission Code, the Planning Council examined the South Australian transmission network augmentations likely to be needed in order to adequately service anticipated future customer demands. These augmentations were correlated with proposed transmission projects identified by ElectraNet SA as part of its obligations to conduct an Annual Planning Review and summarised in the Planning Council's June 2002 Annual Planning Report.

The Planning Council developed network models that simulate power system conditions incorporating the following operating characteristics:

- ▼ the 275kV and 132kV transmission networks as they are currently configured and operated by ElectraNet SA;
- ▼ all SA based generating plant connected to the transmission network;
- ▼ all exit connection point step down transformers that supply ETSA Utilities distribution networks and ElectraNet SA direct customers.

While the Planning Council has assumed that all connection points achieve their peak load coincidentally, it recognises that this is an over simplification and will therefore represent a somewhat pessimistic assessment of the network performance. The Planning Council has attempted to match the projects proposed by ElectraNet SA against transmission system deficiencies indicated in the study. This process has been based on simulations performed for the years 2002/03 and 2007/08.

Five scenarios were considered with variations on the demand, levels of imports from the eastern states and site location for additional supply capacity.

SCENARIO	YEAR	IMPORT (MW)	ADDITIONAL CAPACITY
A	2002/03	500	None
B	2002/03	100	None
C	2007/08	500	300 MW generically located at the Regional Reference Node
D	2007/08	0	800 MW generically located at the Regional Reference Node
E	2007/08	500	300 MW generically located in the south east of the State

Murraylink and SNI have not been specifically identified in these base models as they are unlikely to significantly alter the basic network performance under the above scenarios.

Reduced power flows arising from the diversity of non-coincident peaks and lower than forecast demands, represent operating conditions that are less severe than the above studies and may result in a delay in the need for network augmentation.

Load transfers and shifts across the sub-transmission and distribution network are assumed to be embedded within the connection point forecasts. As the aim of the Planning Council is to identify likely network limitations over the 5½ year regulatory period, precise timing for implementation of particular augmentation projects is not required and is likely to make little material difference to the total period investment in South Australia's transmission network infrastructure.

The models assume that works in progress by ElectraNet SA in upgrading transformer capacity for ETSA Utilities at Angas Creek, Templers, Blanche, Mt Gambier, Brinkworth and Mobilong connection point substations has been completed and are in service.

The models also assume that all transmission lines are capable of being operated to the line's thermal rating without restrictions imposed by substation line end equipment. While the projects that ElectraNet SA have identified to uprate existing lines and remove end limitations have not been incorporated in the technical analysis for this report they have been included in the summary of results and the project costs have been included in the Planning Council's assessment of the forward capital investment plan.

### Modelling Approach

The Planning Council has adopted a methodology based upon static load flow analysis using the PSS/E network modelling tool applied to the five scenarios. The methodology utilised involves:

- analysing scenarios for thermal overloads, voltages that violate the service quality performance required from the SA transmission network and network element

loadings indicating approaching limitations. This is performed with the network having all elements in service.

- ▼ analysing network performance of the models under selective outages of highly loaded circuits and transformers. This assesses the ability of the network to comply with redundancy requirements of South Australia's networks.
- ▼ where violations are revealed, they are correlated against network augmentations proposed by ElectraNet SA in the most recent APR or by specific reference to ElectraNet SA.

Network weaknesses brought to prominence using this methodology include:

- ▼ thermal overloads of transmission network lines or transformers;
- ▼ impending voltage collapse of transmission networks;
- ▼ deteriorating network performance of plant items under stress; and
- ▼ inability of connection point substations to maintain acceptable conditions as source supply for underlying ETSA Utilities distribution networks.

In the analysis, network performance violations are recorded when:

- ▼ voltage at a model bus is below 95% nominal;
- ▼ transmission line MVA transfer is above the emergency summer thermal rating assigned by ElectraNet SA; and
- ▼ transformer MVA loading is above the cyclic thermal rating assigned by ElectraNet SA.

When identifying relevant network augmentations and costs, the methodology references ElectraNet SA projects identified in the Planning Council's APR where appropriate.

Given the high level nature of the analysis and the limited project information available at this time, the Planning Council has made no attempt to determine if the project proposed by ElectraNet SA is an optimal solution to an identified network deficiency. The process has simply been one of noting where a listed project appears likely to address a deficiency identified by the scenario analysis. The Planning Council notes that, in any event, the NEC requires each project in excess of \$1M to undergo a public, consultative process.

It should also be noted that this report does not include network augmentations/costs associated with the unspecified future nominal generating plant within Scenarios C, D and E. These are assumed to be non-regulated network infrastructure items for the purposes of this report.

The augmentations highlighted in this report thus reflect closely the future augmentations anticipated for South Australia's transmission network in order to keep pace with customer demand growth and are not biased by major transmission developments in anticipation of location or capacity sizing of generation projects which may or may not reach commercial realisation.

### 3 SUMMARY OF RESULTS

PROJECTS IDENTIFIED BY ELECTRANET	PLANNING COUNCIL APR REF	PLAUSIBLE COST INCLUSION	PROJECTS WITH UNCERTAIN NEED	NOTES
Transmission reinforcement for Eyre Peninsula	8.1.9	61.40		
Uprate Davenport-Playford 275kV line		-		
Uprate Davenport-Para 275kV (W) line		3.50		
Uprate Davenport-Brinkworth-Para 275kV (E) line		5.02		
Uprate Davenport-Whyalla#2 132kV line		0.38		
Uprate Whyalla-Middleback 132kV line		1.65		
Uprate Middleback-Yadnarie 132kV line		2.44		
Uprate Yadnarie-Pt Lincoln 132kV line		2.83		
Uprate Waterloo-Templers 132kV line		2.61		
Uprate Templers-Roseworthy 132kV line		0.62		
Uprate Roseworthy-Para 132kV line		1.38		
Uprate MillbrookT-Angas Ck 132kV line		0.32		
Uprate Angas Ck-MAP3 132kV line		0.54		
Uprate MAP3-MAP2 132kV line		0.27		
Uprate MAP2-Mannum 132kV line		0.32		
Bungama 275/132kV substation	8.3.1	29.60		
New Para-Paracombe 132kV line	8.3.3	4.80		

PROJECTS IDENTIFIED BY ELECTRANET	PLANNING COUNCIL APR REF	PLAUSIBLE COST INCLUSION	PROJECTS WITH UNCERTAIN NEED	NOTES
Establish Tungkillo switching station (stages 1 + 2)	8.1.8 + 8.2.18	20.40		
Cultana-Davenport 275kV line double circuit operation	8.2.15	8.00		
South East-Snuggery 132kV transmission line	8.1.1	10.40		
Kincraig 132kV 20MVar capacitor	8.2.10	1.30		
Monash 275/132kV augmentation	8.1.4	11.00		
Riverland 275kV line			33.70	Required if SNI doesn't proceed
Dorrien/Templers capacitor bank	8.2.13	1.20		
Dorrien 132kV network reinforcement	8.2.1	6.00		
Whyalla 132/33kV transformer upgrade		6.37		
Eastern Hills augmentation	8.1.3	9.50		
Magill network/eastern suburbs reinforcement	8.3.4 / 8.4.7	6.55		
Southern suburbs reinforcement	8.4.5 / 8.1.2-7	53.50		
Bungama 132/33kV transformer upgrade	8.4.8	2.93		
Waterloo 132/33kV transformer upgrade	8.4.11	4.58		
Mt Barker 132/66kV transformer upgrade	8.4.19	-		
Playford/Davenport 132/33kV transformer upgrade	8.4.1	4.70		
Pt Lincoln 132/33kV transformer upgrade	8.4.6	4.43		
Hummocks 132/33kV transformer upgrade	8.4.16	-		
Mannum 132/33kV transformer upgrade	8.4.4	4.26		

PROJECTS IDENTIFIED BY ELECTRANET	PLANNING COUNCIL APR REF	PLAUSIBLE COST INCLUSION	PROJECTS WITH UNCERTAIN NEED	NOTES
Snuggery 132/33kV transformer upgrade	8.4.18	4.43		
Kadina East 132/33kV second transformer	8.4.15	5.57		
Baroota 132/33kV second transformer	8.4.13	3.17		
East terrace-Magill 2nd 275kV cable and transformer	8.1.5	45.30		
Western suburbs reinforcement	8.4.3	7.47		
Dorrien connection point reinforcement	8.4.2	4.86		
Para 275/1232kV network transformer capacity upgrade		7.73		
South East 3rd 275/132kV transformer	8.2.6	7.40		
Tailem Bend-Keith #1 132kV transmission line upgrade	8.2.11	4.30		
Keith-Snuggery 132kV transmission line upgrade	8.2.7	3.80		
South East-Tungkillo 275kV transmission line	8.1.10	92.00		
Blanche-Snuggery 132kV transmission line upgrade	8.2.12	1.10		
Happy Valley-Cherry Gardens 275kV CT upgrade	8.2.2	1.30		
Heywood upgrade (275kV series capacitors)	8.1.6		54.80	
Happy Valley or Magill 275kV 100MVAR capacitor bank	8.2.3		2.20	
Happy Valley 275kV 100MVAR capacitor bank	8.2.9		2.20	
Happy Valley 275kV 100MVAR capacitor bank	8.2.19		1.90	
Morphett Vale East 275kV 100MVAR capacitor bank	8.2.16		1.90	

PROJECTS IDENTIFIED BY ELECTRANET	PLANNING COUNCIL APR REF	PLAUSIBLE COST INCLUSION	PROJECTS WITH UNCERTAIN NEED	NOTES
TIPS-Para CT upgrade	8.2.4		1.40	Assumed
Parafield Gardens West-Pelican Point 275kV CT upgrade	8.2.5		1.40	Assumed
Brinkworth West tie	8.2.8		9.80	SAMAG related
Whyalla-Yadnarie 132kV transmission line upgrade	8.2.14		2.90	
Black Range 275kV switching station	8.2.17		8.00	
Davenport 132kV section	8.3.2		9.80	
North West Bend transformer upgrade	8.4.9		5.04	
Tailem Bend transformer upgrade	8.4.10		-	
Kincraig transformer upgrade	8.4.14		-	
Keith transformer upgrade	8.4.17		-	
Total		\$461.23M	\$135.04M	



## Notes

### (a) OUTDATED DESIGN STANDARD LINES

Many of the State's transmission lines were constructed in the 1950's in accordance with the accepted British design practices at that time. These practices were based upon maintaining minimum conductor to ground clearances for safety purposes at a conductor temperature of 49°C (120°F). In the ensuing time, research performed by the CSIRO demonstrated that climatic conditions in Australia were such that conductor temperature could rise above 49°C under summer ambient conditions without any current flowing in the conductor. Later vintage lines have been designed typically for 80°C or 100°C (or higher) operating temperatures. Many older lines have been updated to modern standards. The above table indicates those transmission lines designed to outdated standards that analysis indicates require upgrading.

### (b) ELECTRANET SA PROJECTS WITH NO PLANNING COUNCIL IDENTIFIED NETWORK DEFICIENCY

The above table also indicates projects to the value of up to \$100M identified in the APR by ElectraNet that the Planning Council's analysis for this report has not identified. Some projects appear as natural network augmentations consistent with continuing demand growth. The Planning Council acknowledges that the methodology underlying the analysis for this report may fail to identify all required network augmentations. Consequently, the Planning Council does not assert that these projects are not relevant augmentations for the SA network during the reset period.

In some instances a project in this list category may be an alternative to a project in another category and it is unlikely that both nominated projects would proceed. In other cases, the projects in this category appear to be for NEM opportunities that are related to generating plant site location and not for endemic customer growth in demand that forms the basis of this report.

### (c) NETWORK DEFICIENCIES WITH NO CORRESPONDING ELECTRANET SA PROJECT

At times, the analysis identified network deficiencies that do not appear to have a corresponding ElectraNet SA project to mitigate them. In some of these cases, this may be as a result of not re-analysing the network with the proposed augmentations included and thus not capturing some possible flow-on effects of these projects. In other cases, however, there appears to be a genuine unidentified network deficiency.

The Planning Council understands that the revenue reset process provides a capital provision within which ElectraNet SA is reasonably free to reorder its priorities should some additional projects prove to be necessary within the reset period.

## 4 CONCLUSION

The Planning Council emphasises that while most of ElectraNet SA projects appear to address real network deficiencies, the technical appropriateness and cost-effectiveness of the proposed solutions have not yet been tested or compared against reasonable alternatives.

While the exact make-up of the forward capital program for ElectraNet SA may not be entirely certain, the Planning Council's analysis indicates that the overall quantum in terms of capital investment that ElectraNet SA is seeking may well represents a reasonable level of investment required to support network performance standards.

The Planning Council notes that the authorisation process applied by the ACCC in relation to network augmentations, involves the detailed evaluation of each project against appropriate alternatives and a public consultation process providing a level of investment risk management control. Within that protective framework and recognising the potential for project optimisation following detailed design, the Planning Council recognises the *prima facie* validity of a forward capital investment plan in the South Australian transmission network of the order of \$400M (based on the sum of the projects classified for "plausible cost inclusion") to maintain South Australia's required network performance standards.