



CONSULTATION PAPER

CRONULLA ZONE AUGMENTATION

2nd June 2009

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EXECUTIVE SUMMARY

This consultation paper has been prepared to provide a basis for EnergyAustralia to consult with registered participants and interested parties on the possible options for the development of the electricity supply network in its Sutherland supply area. Specifically, it addresses an emerging capacity constraint in the part of EnergyAustralia's distribution system supplied by Cronulla zone substation, in the south east part of the Sutherland supply area.

Section 1 of the paper provides a description of the Sutherland load area.

Section 2 presents EnergyAustralia's service standards for the area and describes, in detail, the nature of the load growth in the area, the issues affecting the supply network in the area and the need for augmentation of supply to the area.

Section 3 outlines the possible strategies addressing the issues affecting the Sutherland load area. Four feasible strategies are described:

- Strategy 1: Development of three 132kV zones;
- Strategy 2: Development of three 132kV zones with delayed retirement of the 33kV infrastructure at Kurnell STS;
- Strategy 3: Development of three 132kV zones, with increased 33kV capacity at Jannali; and
- Strategy 4: Development of two 132kV zones, with Engadine remaining at 33kV.

The Cronulla zone augmentation is a capacity related project, common to all four strategic options.

Section 4 presents the results of a preliminary application of the regulatory test and ranks the strategies.

Section 5 concludes that EnergyAustralia's most cost effective strategy for the Sutherland supply area, within the regulatory test, is Strategy 2. This includes the replacement of existing 33/11kV zone substations at Gwawley Bay, Kurnell and Engadine with 132/11kV zone substations, as well as the retirement of the 33kV infrastructure at Kurnell.

The estimated capital cost of the preferred strategy is \$231.8M

This consultation paper concerns two projects common to all four strategies considered by EnergyAustralia for its Sutherland load area. Firstly, the Cronulla zone augmentation includes installation of a third 50MVA 132/11kV transformer and associated 11kV switchgear. Secondly, a strategic load transfer from Cronulla zone to Caringbah zone includes construction of the required 11kV infrastructure. The projects scheduled for completion by winter 2012, to address emerging capacity constraints at Cronulla and Caringbah zone substations.

The estimated capital cost of the Cronulla zone augmentation and the load transfer from Caringbah zone to Cronulla zone is \$14.8M

1. INTRODUCTION

1.1. Purpose and Scope

This paper has been prepared by EnergyAustralia to provide the basis for consultation with registered participants and interested parties, identifying the possible options to address projected limitations of the electricity network in its Sutherland supply area. The focus is on the need to address an emerging capacity constraint within one part of this region, specifically the area supplied by Cronulla zone substation.

It includes:

- a discussion of supply system limitations identified by EnergyAustralia that have led to the necessity for augmentation of the distribution network in the area;
- a discussion of the service standard that has been adopted for planning purposes;
- a description of possible options which have currently been identified for development of the electricity supply in the area; and
- a detailed preliminary cost effectiveness analysis of each of these options, carried out in accordance with the requirements of the regulatory test.

1.2. Background

The Sutherland network area extends from the Kurnell peninsula in the north-east, along the southern side of Botany Bay and the Georges River, south as far as Waterfall and west towards the coast. The network in Sutherland serves a mixture of residential, commercial and industrial loads and is supplied from TransGrid's Sydney South BSP via two double circuit 132kV tower lines. The Sutherland network area includes two subtransmission substations at Kurnell and Port Hacking which supply seven 33/11kV zone substations together with three 132/11kV zones.

Geographic and schematic overviews of EnergyAustralia's Sutherland supply network are shown in Figure 1 and Figure 2 on the next page. The portion of this region related to this consultation paper, Cronulla zone substation and the area it supplies, are indicated in red.

Cronulla 132/11kV zone substation is located in the south-east of the Sutherland supply area and supplies parts of the following suburbs: Cronulla, North Cronulla, Woolooware, Burraneer, Dolans Bay, Port Hacking, Lilli Pilli, Maianbar, Yenabilli and Bundeena.

2. IDENTIFICATION OF NEED FOR AUGMENTATION

2.1. Applied Service Standard

EnergyAustralia is required to comply with service standards that are specified in the 'Design, Reliability and Performance Licence Conditions' (Licence Conditions), which were implemented for NSW distributors by the Minister for Energy on 1 October 2007. The design planning criteria are specified in Schedule 1 of the Licence Conditions and reliability standards are specified in Schedules 2 and 3. For existing network, a distributor must be as compliant as practicable with these requirements by 1 July 2014 and fully compliant by 1 July 2019. All new network elements must comply with these requirements.

The service standards that are applicable to a consideration of supply constraints affecting the Engadine load area are summarised below. For further details refer to the Licence Conditions or to EnergyAustralia's Network Management Plan.

2.1.1. Subtransmission Substations (Urban/Non-Urban)

With all elements in service, the thermal capacity is required to meet at least 115% of forecast demand.

For a failure of a single critical element (i.e. N-1 conditions) within a subtransmission substation, the forecast demand is not to exceed the thermal capacity. Recovery of load should be within one minute.

2.1.2. Zone Substations and Subtransmission Network (Urban/Non-Urban)

With all elements in service, the thermal capacity is required to meet at least 115% of forecast demand.

Following a failure of a single critical element (i.e. N-1 conditions), the network must be designed to recover supply within one minute for systems supplying >10MVA, and otherwise, within best practice repair times. For systems that supply >10MVA, the forecast demand of a zone substation or overhead feeder network may exceed the N-1 capacity for up to 1% of the year i.e. a total aggregate time of 88 hours per annum, up to a maximum of 20% above the N-1 capacity; and the forecast demand of an underground feeder network may not exceed the N-1 capacity.

2.2. Description of Network Constraints

2.2.1. Capacity Issues

Cronulla Zone Substation

Cronulla 132/11kV zone substation was commissioned in 1981 and is presently equipped with two 45 MVA transformers. Normal supply is via the 132 kV overhead feeder 916(3) teed off from feeder 916 linking Sydney South BSP and Kurnell STS. The 132kV overhead feeder 281 from Kirrawee zone provides back up supply. The peak load forecast for Cronulla zone in both summer and winter is presented in Table 1 below.

Cronulla zone has a firm capacity of 55.9MVA in summer and 64.0MVA in winter. Licence capacity is limited only by the 132/11kV transformers and hence, the substation can be loaded up to 120% of firm capacity before licence conditions are exceeded. Accordingly, the licence capacity at Cronulla zone is 67.1MVA in summer and 76.8MVA in winter.

Cronulla zone is forecast to be loaded above licence capacity in winter 2012. No loading constraint is forecast for summer in the current forecast period.

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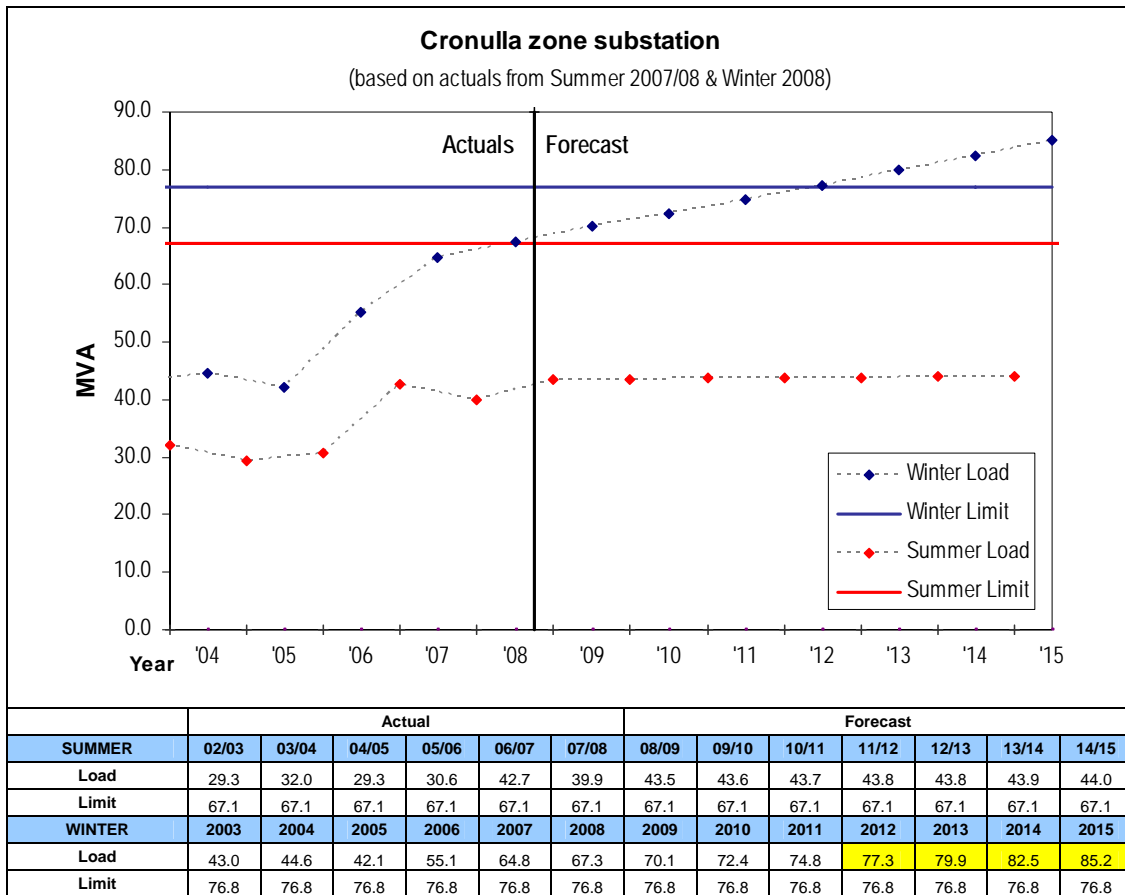


Table 1: Cronulla peak load forecast

Caringbah Zone Substation

Caringbah 33/11kV zone substation is presently equipped with two 33MVA transformers. It is supplied via the 33kV overhead feeder 745 from Kurnell STS with back up supply provided by the 33kV overhead feeder 728 from Port Hacking STS. The substation has a firm capacity of 30.3MVA in summer and 34.4MVA in winter. The peak load forecast for Caringbah zone in both summer and winter is presented in Table 2 below.

The licence capacity at Caringbah zone is limited by the RD rating of the 33kV overhead feeders from Kurnell STS due to the present operating arrangement of backup supply from Port Hacking STS via feeder 728. Accordingly, the licence capacity is limited to firm capacity in summer and 37.2MVA in winter. Licence capacity is now predicted to be exceeded in summer 2011-12. No loading constraint is forecast for winter in the current forecast period.

At this stage, the only feasible means of providing load relief at Caringbah zone is to transfer load to Cronulla zone. The Sutherland Area Strategy (based on 2005/06 load forecasts) proposes a 10MVA load transfer from Caringbah zone to Cronulla zone in 2009. The needs date for this project has been reviewed and subsequently deferred based on the latest forecast information, presented above. Due to the impending capacity constraints at Cronulla zone, this load transfer can only occur once the additional capacity has been installed at Cronulla zone.

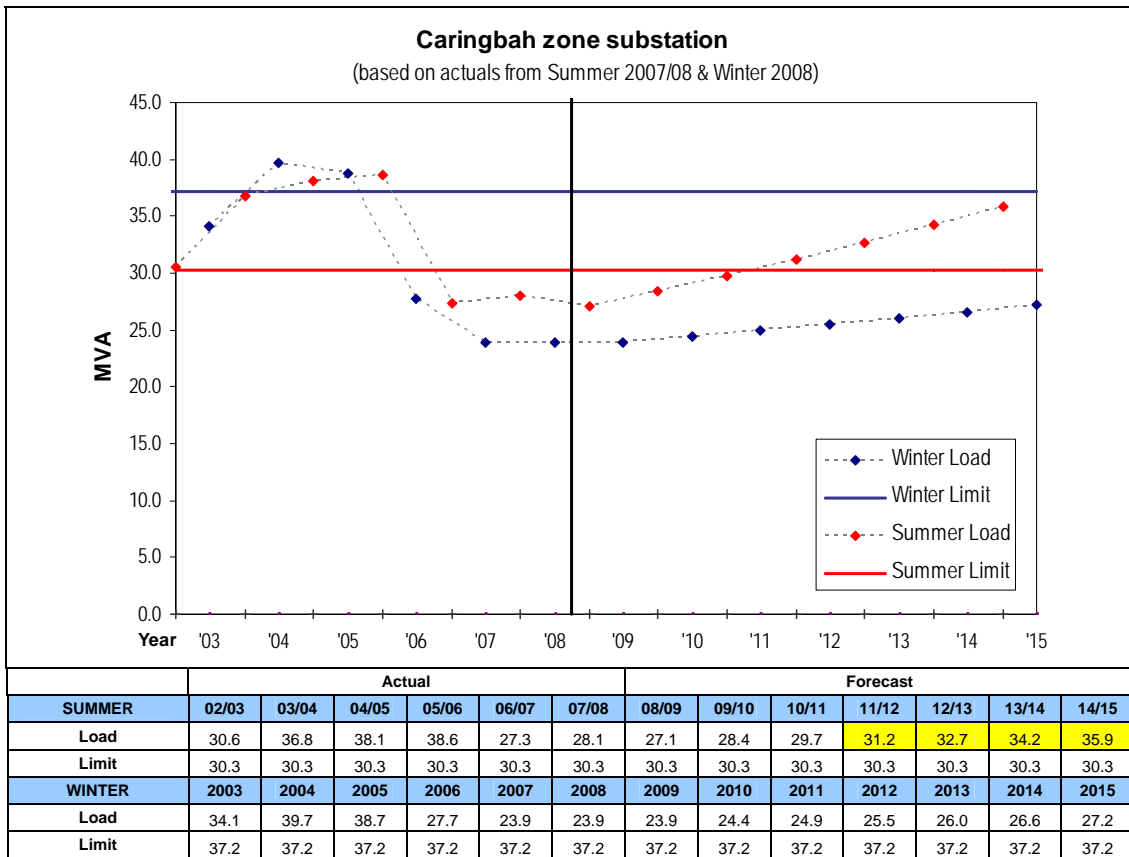


Table 2: Caringbah peak load forecast

2.2.2. Asset Condition Issues

Based on condition assessment by Maintenance and Replacement Planning, there are no major substation equipment condition issues at Cronulla zone.

2.3. National Electricity Rules Requirements

Cronulla zone substation and its associated feeders are classified as distribution system assets by the National Electricity Rules (the Rules).

The Rules (Clauses 5.6.2(e) and (f)) require that, where analysis indicates that any relevant technical limits of a distribution system will be exceeded, the Distribution Network Service Provider (DNSP) must notify any affected Participants of these limitations and of the expected time for corrective action and consult with affected Participants and interested parties on the possible options to address the projected limitations of the relevant distribution system. The proposed options for the Cronulla load area (to address the projected limitations of the system) include new distribution network asset options that involve expenditure in excess of \$10 million. These options are classed as new large network assets and consequently EnergyAustralia has an obligation to consult on these options.

EnergyAustralia has previously published details of its load forecasts and the timing of loads exceeding technical limits of the system in its Annual Electricity System Development Reviews for 2006, 2007 and 2008.

Clause 5.6.2(g) of the Rules requires DNSPs to include the economic analysis of possible options in their consultation on options. This paper has been prepared to consult on identified options which satisfy the regulatory test and meet the network performance standards set out in Schedule 5.1 of the Rules and limb (a) of the regulatory test must be applied to determine the option that satisfies the regulatory test. Under limb (a) of the regulatory test, the option that meets the test is the one that minimises the present value of costs compared with a number of alternative options in the majority of reasonable scenarios.

3. STRATEGIC OPTIONS

For each of its different supply areas, EnergyAustralia's network investment process involves determining the least cost strategy to address emerging network constraints. Both the Cronulla zone augmentation and the load transfer from Caringbah zone to Cronulla zone are capacity related projects common to all four alternative supply strategies identified and analysed within the area plan for the overall Sutherland load area. These strategies are:

- Strategy 1: Development of three 132kV zones;
- Strategy 2: Development of three 132kV zones with deferred retirement of the 33kV infrastructure at Kurnell STS;
- Strategy 3: Development of three 132kV zones, with increased 33kV capacity at Jannali; and
- Strategy 4: Development of two 132kV zones, with Engadine remaining at 33kV.

Refer to Appendix A for details of the projects contained in each strategy.

3.1. Consideration of Demand Side Management

A Demand Management Investigation, issued in March 2009, has concluded that it is reasonable to expect that it may be cost-effective to defer the proposed supply side solution – the installation of the third transformer at Cronulla zone and the load transfer to Cronulla zone from Caringbah zone – by implementing demand management strategies. The result of any Demand Management deferral will be incorporated into the final supply solution.

3.2. Strategies

Strategy 1: Development of three 132kV zones

This strategy for the Sutherland load area includes the replacement of existing 33/11kV zone substations at Gwawley Bay, Kurnell and Engadine with 132/11kV zone substations. Also, the 33kV infrastructure at Kurnell STS be retired and that 33kV supply to the area continue to be maintained from a refurbished Port Hacking STS. The 33kV system will continue to supply Caringbah, Miranda, Jannali and Lucas Heights zones as well as Railcorp and Sydney Water.

The Gwawley Bay zone 132kV conversion addresses the capacity constraint on the 132kV feeders from Sydney South BSP to Port Hacking STS. The development of Gwawley Bay zone at 132kV is also influenced by the proximity of the substation site to 132kV feeders 916 and 917, the provision for 132kV upgrading within the existing substation and the lack of available 33kV network and subtransmission substation capacity.

The conversion of Engadine zone substation to 132kV operation is influenced by its proximity to the 132kV tower line (feeder 285 from Sydney South BSP) and its remoteness from Port Hacking STS. Addressing the emerging 33kV feeder constraints at Engadine would require the installation of a new 33kV feeder of more than 11km in length. This is avoided with the 132kV development of the zone.

The development of a 132/11kV zone at Kurnell rather than the refurbishment and upgrading of the existing substation allows the ultimate retirement of 33kV supply from Kurnell STS, avoiding considerable expenditure on upgrading and refurbishment of the 33kV busbar.

The estimated capital cost of this strategy is \$231.3M.

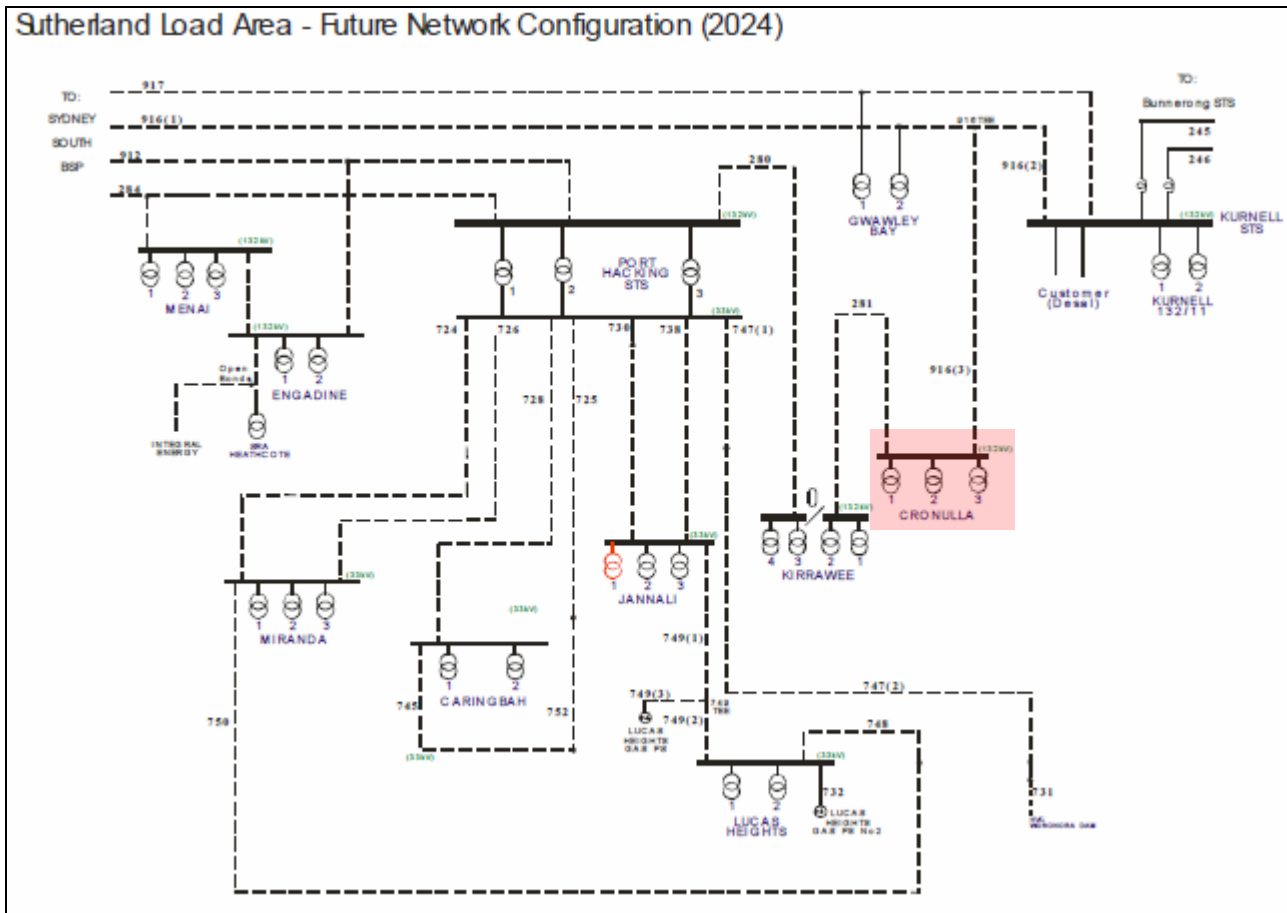


Figure 3: Sutherland supply area 132kV and 33kV diagram in 2024, according to the preferred strategy (Strategy 2)

Strategy 2: Development of three 132kV zones with deferred retirement of the 33kV infrastructure at Kurnell STS

This strategy is similar to Strategy 1 except that it considers the deferred retirement of the Kurnell 33kV busbar. The installation of an additional transformer at Kirrawee zone is advanced to allow for this deferral.

The estimated capital cost of this strategy is \$231.8M.

Strategy 3: Development of three 132kV zones, with increased 33kV capacity at Jannali

This strategy is similar to Strategy 2 except that it involves the uprating of Jannali zone substation, as an alternative to management of Jannali demand via load transfers to Kirrawee. Also, strategy 3 varies from the first two strategies in the following ways:

- Uprating of feeder 730 is accelerated to avoid 11kV load transfers;
- A progressive uprating of the Jannali zone substation and its associated 33kV feeders is required in 2012-13 to provide increased capacity;
- A forecast constraint at Kirrawee 132/11kV zone substation will be addressed by the installation of a 3rd and 4th zone transformer in 2015. This is later than in the other options, as loading at Kirrawee has not been increased via load transfers from Jannali;
- Uprating of the 132kV feeders 912 and 284 needs to be advanced to 2018; and
- Further 11kV load transfers from Jannali to Kirrawee (required in the preferred strategy) are not required over the remainder of the forecast period.

The estimated capital cost of this strategy is \$239.4M.

Strategy 4: Development of two 132kV zones, with Engadine remaining at 33kV

This strategy differs from Strategy 2 in that development of Engadine zone substation occurs at 33kV rather than at 132kV. This has a number of other implications for the development of the system which are included in this strategy, including:

The refurbishment and expansion of the existing Engadine zone substation, together with the installation of an additional 33kV feeder from Port Hacking is required in 2012;

If Engadine zone remains at 33kV, this reconfiguration of the 132kV network is not possible and it is necessary to advance the Port Hacking 132kV busbar replacement to address the limitations arising from the Port Hacking busbar rating. This in turn requires the 33kV switchgear replacement to be advanced as the new 132kV switchboard is located on the site of the old 33kV busbar.

It is also necessary under this strategy to establish a 132kV busbar at Bangor zone to reduce the scope of the uprating work when the 132kV capacity limits are reached.

The estimated capital cost of this strategy is \$228.4M.

3.3. Cronulla Zone Augmentation and Load Transfer from Caringbah Zone to Cronulla Zone

The uprating of Cronulla zone and the load transfer from Caringbah to Cronulla zone are common projects in all four strategies. The installation of a third 50MVA 132/11kV transformer and associated 11kV switchgear at Cronulla zone substation is the only feasible means of addressing the emerging capacity constraint at Cronulla zone. Current utilisation levels at adjacent substations are too high to allow for 11kV load transfers from Cronulla zone. There are no viable strategic alternatives for this project.

The increased capacity at Cronulla zone then allows construction of the 11kV infrastructure required for the transfer of load from Caringbah zone to Cronulla zone. This addresses an emerging capacity constraint at Caringbah.

The estimated capital cost of the Cronulla zone augmentation and the load transfer from Caringbah zone to Cronulla zone is \$14.8M.

4. APPLICATION OF THE REGULATORY TEST

A preliminary economic analysis has been carried out for the period 2007/08 to 2019/20. This analysis involves the comparison of options on an economic basis by carrying out NPC analysis for the four strategies.

4.1. Base Case Analysis

Capital cost in real dollars and the NPC for each of the four strategies are set out in the table below, applying a discount rate of 8.5% as the base case:

Actions	Total Capital Cost (\$M)	NPC (\$M)	Ranking
Strategy 1	231.3	184.8	2
Strategy 2	231.8	182.3	1
Strategy 3	239.4	187.4	4
Strategy 4	228.4	185.2	3

All costs are quoted in 2007/08 real dollars.
Discount factor 8.5%

The analysis above indicates that under base case conditions, the NPC of Strategy 2 is the least cost solution.

4.2. Sensitivity Analysis

Sensitivity Analysis was carried out to consider the impact of different discount factors and cost scenarios on the NPC of each strategy. Since the Cronulla zone augmentation is common to all four strategies, sensitivity to load growth will not impact on the preferred outcome. The results of sensitivity analysis are provided in the following table:

Sensitivity Scenario		NPC (\$M)			
		Strategy 1	Strategy 2	Strategy 3	Strategy 4
Discount rate	7%	195.9	193.8	199.6	196.0
	8.5% (base case)	184.8	182.3	187.4	185.2
	10%	174.8	171.9	176.4	175.3
Contracted Services	25% increase	187.4	180.5	190.5	188.3
	25% decrease	178.5	171.8	180.8	178.2
Labour	25% increase	184.5	177.7	186.9	185.3
	25% decrease	179.1	172.3	181.6	179.2
Materials	25% increase	183.2	176.4	185.8	184.1
	25% decrease	178.1	171.4	180.6	178.4

Table 3: Results of sensitivity analysis

Strategy 2 is the least cost strategy under all scenarios.

5. CONCLUSION

Strategy 2 is the least cost solution under a preliminary application of the regulatory test. Accordingly, EnergyAustralia's preferred strategy for the Sutherland load area includes the replacement of existing 33/11kV zone substations at Gwawley Bay, Kurnell and Engadine with 132/11kV zone substations. The 33kV infrastructure at Kurnell STS is to be retired and that 33kV supply to the area will continue to be maintained from a refurbished Port Hacking STS

The Cronulla zone augmentation and the load transfer from Caringbah zone to Cronulla zone are both common to all four strategies considered by EnergyAustralia for its Sutherland load area.

The estimated capital cost of the two projects is \$14.8M. This includes the installation of a third 50MVA 132/11kV transformer and associated 11kV switchgear at Cronulla zone, as well as the 11kV works required for the load transfer. The projects are scheduled to be completed by winter 2012, addressing emerging capacity constraints at Cronulla and Caringbah zone substations.

6. CONTACT DETAILS

Comments on this Consultation Paper, including proposals for alternative options must be in the form of written submissions, which may be in hard copy or suitable electronic format and must be provided within 40 business days of the issue date of this paper. Proposals or other enquiries should be directed to the contact listed below:

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7. APPENDIX A

All costs are quoted in 2007/08 real dollars.
Discount factor 8.5%

STRATEGY 1	NPC (\$M)	CAPEX (\$M)	07/08	08/09	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
Projects associated with this Consultation Paper																			
Installation of 3rd transformer at Cronulla																			
Estimated Capital Cost	8.42	11.66	-	-	-	0.04	11.62	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	0.92	-	-	-	0.03	0.06	0.06	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Caringbah to Cronulla load transfer																			
Estimated Capital Cost	2.74	3.10	-	1.54	1.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	0.23	-	-	-	-	0.01	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total																			
Estimated Capital Cost	11.16	14.76	-	1.54	1.55	0.04	11.62	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	1.15	-	-	-	0.03	0.07	0.09	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Replacement of existing 33/11kV zone substations at Gwawley Bay, Kurnell and Engadine with 132/11kV zone substations																			
Estimated Capital Cost	67.76	8400	-	2.04	34.05	38.81	9.10	-	-	-	-	-	-	-	-	-	-	-	-
Reconfiguration of existing 132kV feeders 284, 912 and 914																			
Estimated Capital Cost	2.44	6.60	-	-	-	0.32	1.07	-	-	-	-	-	-	-	-	-	-	0.39	4.81
Refurbishment of 33kV and 132kV busbars at Port Hacking STS																			
Estimated Capital Cost	27.28	47.90	-	-	-	-	0.84	21.67	-	-	2.04	23.35	-	-	-	-	-	-	-
Refurbishment of Kurnell STS - retirement of existing 33kV infrastructure																			
Estimated Capital Cost	30.67	35.27	0.28	13.86	18.46	0.16	2.50	-	-	-	-	-	-	-	-	-	-	-	-
Replacement projects: 11kV switchgear at Jannali, Miranda, Gwawley Bay and Kirrawee zones																			
Estimated Capital Cost	7.72	12.66	-	0.38	4.60	-	-	-	-	-	-	3.12	3.82	-	0.74	-	-	-	-
Capacity related: additional transformers at Kirrawee and Menai zones; Kurnell desalination connection																			
Estimated Capital Cost	14.34	22.18	0.17	2.11	-	-	0.96	11.32	-	0.73	6.89	-	-	-	-	-	-	-	-
Strategic load transfers																			
Estimated Capital Cost	4.44	6.84	0.17	2.06	-	0.10	1.18	-	0.11	1.35	-	-	-	-	0.05	0.73	1.10	-	-
Other projects																			
Estimated Capital Cost	0.77	1.05	-	-	-	0.22	0.83	-	-	-	-	-	-	-	-	-	-	-	-
Strategy 1 Total																			
Estimated Capital Cost	166.59	231.25	0.61	21.99	58.69	39.64	28.10	32.98	0.11	2.08	8.93	26.47	3.82	-	0.79	0.73	1.10	0.39	4.81
Operations and Maintenance	18.22	-	-	-	0.97	2.02	2.31	2.60	2.68	2.68	2.68	2.68	2.68	2.68	2.68	2.68	2.68	2.68	2.68
Grand Total	184.81	231.25	0.61	21.99	59.66	41.67	30.41	35.58	2.79	4.76	11.61	29.15	6.50	2.68	3.47	3.41	3.78	3.07	7.49

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All costs are quoted in 2007/08 real dollars.
Discount factor 8.5%

STRATEGY 2	NPC (\$M)	CAPEX (\$M)	07/08	08/09	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
Projects associated with this Consultation Paper																			
Installation of 3rd transformer at Cronulla																			
Estimated Capital Cost	8.42	11.66	-	-	-	0.04	11.62	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	0.92	-	-	-	0.03	0.06	0.06	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Caringbah to Cronulla load transfer																			
Estimated Capital Cost	2.74	3.10	-	1.54	1.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	0.23	-	-	-	-	0.01	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total																			
Estimated Capital Cost	11.16	14.76	-	1.54	1.55	0.04	11.62	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	1.15	-	-	-	0.03	0.07	0.09	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Replacement of existing 33/11kV zone substations at Gwawley Bay, Kurnell and Engadine with 132/11kV zone substations																			
Estimated Capital Cost	65.44	84.38	-	1.69	27.38	20.24	25.88	9.19	-	-	-	-	-	-	-	-	-	-	-
Reconfiguration of existing 132kV feeders 284, 912 and 914																			
Estimated Capital Cost	2.38	6.62	-	-	-	-	0.32	1.09	-	-	-	-	-	-	-	-	-	0.39	4.81
Refurbishment of 33kV and 132kV busbars at Port Hacking STS																			
Estimated Capital Cost	27.28	47.90	-	-	-	-	0.84	21.67	-	-	2.04	23.35	-	-	-	-	-	-	-
Refurbishment of Kurnell STS - retirement of existing 33kV infrastructure																			
Estimated Capital Cost	30.36	35.45	0.28	13.86	18.48	-	-	-	0.17	2.66	-	-	-	-	-	-	-	-	-
Replacement projects: 11kV switchgear at Jannali, Miranda and Kirrawee zones																			
Estimated Capital Cost	7.72	12.66	-	0.38	4.60	-	-	-	-	-	-	3.12	3.82	-	0.74	-	-	-	-
Capacity related: additional transformers at Kirrawee and Menai zones; Kurnell desalination connection																			
Estimated Capital Cost	14.51	22.15	0.17	2.11	-	-	4.48	7.76	-	0.73	6.89	-	-	-	-	-	-	-	-
Strategic load transfers																			
Estimated Capital Cost	4.41	6.85	0.17	2.06	-	0.10	1.18	-	0.11	1.35	-	-	-	-	0.05	0.64	0.09	1.12	-
Other projects																			
Estimated Capital Cost	0.77	1.05	-	-	-	0.22	0.83	-	-	-	-	-	-	-	-	-	-	-	-
Strategy 2 Total																			
Estimated Capital Cost	164.04	231.80	0.61	21.64	52.01	20.60	45.15	39.71	0.28	4.74	8.93	26.47	3.82	-	0.79	0.64	0.09	1.51	4.81
Operations and Maintenance	18.26	-	-	-	0.97	2.02	2.32	2.61	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69
Grand Total	182.30	231.80	0.61	21.64	52.98	22.62	47.47	42.32	2.96	7.43	11.62	29.16	6.50	2.69	3.48	3.32	2.78	4.19	7.50

CONSULTATION PAPER – CRONULLA ZONE AUGMENTATION

All costs are quoted in 2007/08 real dollars.
Discount factor 8.5%

STRATEGY 3	NPC (\$M)	CAPEX (\$M)	07/08	08/09	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
Projects associated with this Consultation Paper																			
Installation of 3rd transformer at Cronulla																			
Estimated Capital Cost	8.42	11.66	-	-	-	0.04	11.62	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	0.92	-	-	-	0.03	0.06	0.06	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Caringbah to Cronulla load transfer																			
Estimated Capital Cost	2.74	3.10	-	1.54	1.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	0.23	-	-	-	-	0.01	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total																			
Estimated Capital Cost	11.16	14.76	-	1.54	1.55	0.04	11.62	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	1.15	-	-	-	0.03	0.07	0.09	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Replacement of existing 33/11kV zone substations at Gwawley Bay, Kurnell and Engadine with 132/11kV zone substations																			
Estimated Capital Cost	65.44	84.38	-	1.69	27.38	20.24	25.88	9.19	-	-	-	-	-	-	-	-	-	-	-
Reconfiguration of existing 132kV feeders 284, 912 and 914																			
Estimated Capital Cost	2.98	6.34	-	-	-	-	0.32	1.09	-	-	-	-	0.37	4.56	-	-	-	-	-
Refurbishment of 33kV and 132kV busbars at Port Hacking STS																			
Estimated Capital Cost	27.28	47.90	-	-	-	-	0.84	21.67	-	-	2.04	23.35	-	-	-	-	-	-	-
Refurbishment of Kurnell STS - retirement of existing 33kV infrastructure																			
Estimated Capital Cost	30.36	35.45	0.28	13.86	18.48	-	-	-	0.17	2.66	-	-	-	-	-	-	-	-	-
Replacement projects: 11kV switchgear at Jannali, Miranda and Kirrawee zones																			
Estimated Capital Cost	7.72	12.66	-	0.38	4.60	-	-	-	-	-	-	3.12	3.82	-	0.74	-	-	-	-
Capacity related: additional transformers at Kirrawee and Menai zones; Kurnell desalination connection																			
Estimated Capital Cost	18.14	31.32	0.17	2.11	-	-	-	0.24	8.58	1.72	18.51	-	-	-	-	-	-	-	-
Strategic load transfers																			
Estimated Capital Cost	3.67	5.64	0.54	1.47	-	-	-	0.07	1.00	1.35	-	-	-	-	-	-	0.09	1.12	-
Other projects																			
Estimated Capital Cost	0.95	1.00	0.36	0.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strategy 3 Total																			
Estimated Capital Cost	167.71	239.44	1.34	21.70	52.01	20.28	38.66	32.26	9.75	5.73	20.55	26.47	4.19	4.56	0.74	-	0.09	1.12	-
Operations and Maintenance	19.69	-	-	-	1.24	2.46	2.74	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78
Grand Total	187.40	239.44	1.34	21.70	53.25	22.74	41.40	35.04	12.53	8.51	23.33	29.25	6.97	7.34	3.52	2.78	2.87	3.90	2.78

CONSULTATION PAPER – CRONULLA ZONE AUGMENTATION

All costs are quoted in 2007/08 real dollars.
Discount factor 8.5%

STRATEGY 4	NPC (\$M)	CAPEX (\$M)	07/08	08/09	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
Projects associated with this Consultation Paper																			
Installation of 3rd transformer at Cronulla																			
Estimated Capital Cost	8.42	11.66	-	-	-	0.04	11.62	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	0.92	-	-	-	0.03	0.06	0.06	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Caringbah to Cronulla load transfer																			
Estimated Capital Cost	2.74	3.10	-	1.54	1.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	0.23	-	-	-	-	0.01	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total																			
Estimated Capital Cost	11.16	14.76	-	1.54	1.55	0.04	11.62	-	-	-	-	-	-	-	-	-	-	-	-
Operations and Maintenance	1.15	-	-	-	0.03	0.07	0.09	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Replacement of existing 33/11kV zone substations at Gwawley Bay and Kurnell with 132/11kV zone substations																			
Estimated Capital Cost	33.43	40.24	-	1.69	25.41	13.14	-	-	-	-	-	-	-	-	-	-	-	-	-
Refurbishment of 33kV and 132kV busbars at Port Hacking STS																			
Estimated Capital Cost	32.08	46.12	-	-	-	0.83	23.24	22.04	-	-	-	-	-	-	-	-	-	-	-
Refurbishment of Kurnell STS																			
Estimated Capital Cost	28.75	32.62	0.28	13.86	18.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Replacement projects: 11kV switchgear at Jannali, Miranda and Kirrawee zones; 33kV switchgear at Caringbah and Kurnell STS																			
Estimated Capital Cost	9.93	16.56	-	0.38	4.60	-	-	-	0.12	3.79	-	3.12	3.82	-	0.74	-	-	-	-
Capacity related: additional transformers at Kirrawee and Menai zones; Kurnell desalination connection																			
Estimated Capital Cost	14.51	22.15	0.17	2.11	-	-	4.48	7.76	-	0.73	6.89	-	-	-	-	-	-	-	-
Strategic load transfers																			
Estimated Capital Cost	4.41	6.85	0.17	2.06	-	0.10	1.18	-	0.11	1.35	-	-	-	-	0.05	0.64	0.09	1.12	-
Other projects																			
Estimated Capital Cost	33.70	49.13	-	-	-	0.22	17.78	31.12	-	-	-	-	-	-	-	-	-	-	-
Strategy 4 Total																			
Estimated Capital Cost	167.98	228.41	0.61	21.64	50.05	14.33	58.30	60.93	0.23	5.86	6.89	3.12	3.82	-	0.79	0.64	0.09	1.12	-
Operations and Maintenance	17.21	-	-	-	0.76	1.78	2.16	2.50	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58
Grand Total	185.19	228.41	0.61	21.64	50.80	16.12	60.46	63.43	2.81	8.44	9.47	5.70	6.39	2.58	3.37	3.21	2.67	3.69	2.58