



FINAL REPORT

DEVELOPMENT OF SUPPLY TO THE CANTERBURY BANKSTOWN AREA

ESTABLISH NEW 132/11kV BANKSTOWN ZONE SUBSTATION

18th July 2008

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EXECUTIVE SUMMARY

This paper has been prepared to report on upgrade work that is proposed to develop the electricity supply network in the Bankstown area in accordance with Clause 5.6.2 (h) of the National Electricity Rules. The work proposed by this report is classified as a new large distribution asset.

A Consultation Paper on the projected limitation and options for corrective action was published on 24th January 2008. This Consultation Paper included a preliminary application of the Regulatory Test to options that had been identified to address the projected limitations. No submission was received in response to the Consultation Paper.

There are various capacity and aged asset issues in the Bankstown load area. To ensure a safe and reliable electricity supply for existing customers, EnergyAustralia is providing additional capacity to meet forecast load demands and facility to retire or refurbish aging infrastructure.

The provision of additional capacity is required to meet network performance requirements set by EnergyAustralia in accordance with Schedule 5.1 of the Rules.

This report covers the following issues:

Section 1 provides a background of the Bankstown load area and the need for augmentation.

Section 2 describes the various capacity and aged asset issues in the Bankstown load area. The concept of service standard, as implemented by EnergyAustralia, is discussed.

Section 3 describes the proposed augmentation in relation to the National Electricity Rules (the Rules). The proposed development of new Bankstown zone substation (ZS) is classified as a distribution system asset by the Rules, and the proposed development is classified as a large network asset as it involves expenditure above \$10 million.

Section 4 describes the options that were considered, including Demand Management as well as:

- Option 1 – Install 132/11kV Bankstown ZS and Retire Padstow ZS,
- Option 2 – Install Two 132/11kV ZS and Retire Padstow ZS and Punchbowl ZS,
- Option 3 – Refurbish Padstow ZS and Install New 132/11kV Punchbowl ZS.

Section 5 presents the results of economic analysis of the options considered, sensitivity analysis and the ranking of the options and identification of the least cost option.

Section 6 concludes that the preferred option is Option 1 – Install 132/11kV Bankstown ZS and Retire Padstow ZS.

EnergyAustralia's recommended action is the development of a new 132/11kV Bankstown ZS and retirement of the existing Padstow ZS. The first stage of this area strategy includes the establishment of Bankstown 132/11kV ZS and its associated feeder works, and load transfers from Padstow ZS to Milperra ZS and from Padstow ZS and Punchbowl ZS to the proposed Bankstown ZS. This Final Report covers the first stage of the area strategy. The estimated capital cost for the first stage is \$36.5M with a NPC of \$33.8M.

The total capital cost of the entire broader area strategy is \$115.3M with the NPC of \$97.7M.

1. BACKGROUND

1.1. Introduction

This Final Report has been prepared to advise on the upgrade work that is proposed to be carried out in the Bankstown area. This Final Report relates to a Consultation Paper published on 24th January 2008. No submission was received in response to the Consultation Paper. The information provided in this Final Report includes:

- A discussion of emerging supply system limitations identified by EnergyAustralia that have lead to the necessity for augmentation of the zone substation;
- A discussion of the service standard that has been adopted for planning purposes;
- Descriptions of options for development of the electricity supply in the area; and
- Details of the outcomes of the cost-effectiveness analysis of the options considered.

Bankstown load area is supplied by a mixture of 33/11kV and 132/11kV zone substations. The 33kV supply in the area is provided by Bankstown 132/33kV subtransmission substation (STS) which supplies Bass Hill, Padstow and Punchbowl zone substations at 33kV, and Integral Energy's Guildford Bulk Supply Point (BSP) which supplies Leightonfield zone substation. Bankstown STS is supplied from TransGrid's Sydney South BSP via two 132kV feeders 914 and 915.

Over the past decade, load has been transferred between Bass Hill, Padstow and Punchbowl zone substations to address the network capacity constraints. There are also capacity issues at the Bankstown STS.

In addition to capacity issues, the 132/33/11kV supply system in the area is aging. Economic analysis has concluded that the most cost-effective solution to address these capacity and aged asset issues is gradual conversion to 132/11kV infrastructure where justified. The provision of 11kV capacity at Bankstown is the first stage in this process.

1.2. Existing Supply Arrangement

1.2.1. Zone Substations

There are eight zone substations supplying the Bankstown load area:

- Bass Hill 33/11kV,
- Greenacre Park 132/11kV,
- Leightonfield 33/11kV,
- Milperra 132/11kV,
- Padstow 33/11kV,
- Punchbowl 33/11kV.
- Revesby 132/11kV, and
- Sefton 132/11kV,

The substation configuration and capacity limitation for each zone substation is summarised below:

Bass Hill Zone Substation

Bass Hill zone substation is a 33/11kV zone substation supplied from Bankstown STS via two 33kV overhead feeders 661 and 655. The zone substation is equipped with two 15MVA and one 10MVA transformers and has a firm capacity of 28.9MVA in summer and 29.9MVA in winter. The summer and winter firm capacities are limited by the 33kV feeders and the transformers respectively.

Greenacre Park Zone Substation

Greenacre Park is a 132/11kV zone substation supplied from Chullora switching station via two 132kV overhead feeders 240 and 241.

The zone substation is equipped with four 37.5MVA 132/11kV transformers. The firm capacity of Greenacre Park zone substation is 76.0MVA in both summer and winter.

Leightonfield Zone Substation

Leightonfield zone substation is a 33/11kV zone substation supplied from Integral Energy's Guildford BSP via two 33kV overhead feeders 735 and 736. The zone substation is equipped with three 15MVA transformers and has a firm capacity of 33.0MVA in both summer and winter. The firm capacity is limited by the transformers.

Milperra Zone Substation

Milperra zone substation is a 132/11kV zone substation supplied from TransGrid's Sydney South BSP via two 132kV feeders 282 and 283. The zone substation has a firm capacity of 64.5MVA in summer and 65.8MVA in winter. Milperra zone substation is equipped with two 50MVA transformers. The firm capacity is limited by the transformers.

Padstow Zone Substation

Padstow zone substation is a 33/11kV zone substation supplied from Bankstown STS via four 33kV underground feeders 657, 658, 659, and 663. The zone substation is equipped with one 19MVA, one 18MVA and two 13.5MVA transformers and has a firm capacity of 46.3MVA in summer and 47.5MVA in winter. The firm capacity is limited by the 33kV feeder ratings.

Punchbowl Zone Substation

Punchbowl zone substation is a 33/11kV zone substation supplied from Bankstown STS via five 33kV underground feeders 665, 666, 667, 668, and 669. The zone substation is equipped with five 19MVA transformers and has a firm capacity of 73.2MVA in summer and 76.0MVA in winter. The firm capacity is limited by the 33kV feeder ratings.

Revesby Zone Substation

Revesby zone substation is a 132/11kV zone substation supplied from TransGrid's Sydney South BSP via two 132kV underground feeders 282 and 283. The zone substation has a firm capacity of 44.9MVA in summer and 47.6MVA in winter. Revesby zone substation is equipped with two 37.5MVA transformers. The firm capacity is limited by the transformers.

Sefton Zone Substation

Sefton zone substation is a 132/11kV zone substation supplied from Chullora switching station via two 132kV overhead feeders 240 and 241.

The firm capacity of Sefton zone substation is 70.7MVA in summer and 77.9MVA in winter

1.2.2. Subtransmission Substations

Bankstown STS

Bankstown 132/33kV STS is equipped with three 60MVA transformers and has a firm capacity of 137.2MVA in summer and 152.6MVA in winter. The STS provides 33kV supply to Bass Hill, Padstow and Punchbowl zone substations, and Revesby RailCorp.

1.2.3. Main Cable Supplies

132kV Feeder System

Bankstown STS is supplied from TransGrid’s Sydney South BSP via two 132kV overhead feeders 914 and 915. Two outgoing underground 132kV feeders 240 and 241 provide 132kV interconnection to Sefton and Greenacre Park zone substations, and Chullora switching station.

33kV Feeder System

Apart from Leightonfield zone substation being supplied from Integral Energy’s Guildford BSP, all other 33kV supply in the Bankstown load area is provided by the Bankstown STS via a mixture of overhead and underground feeders.

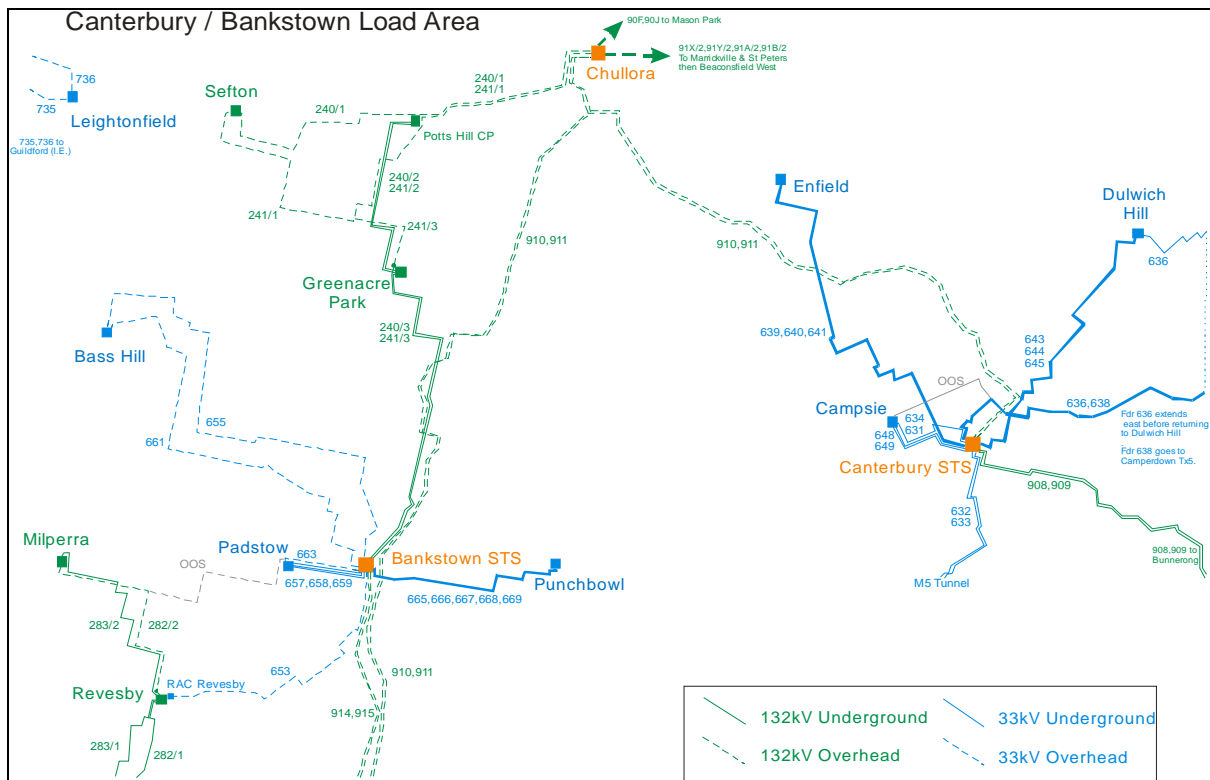


Figure 1: Existing Canterbury/Bankstown Load Area

2. ISSUES

2.1. Applied Service Standard

The service standards that are applicable to a consideration of supply constraints affecting the Bankstown load area are summarised below:

Applicable to all Network Elements

The minimum requirement for any network element is that, with all elements in service, the thermal capacity is required to meet at least 115% of forecast demand. The requirements described in the following sections are additional to this requirement.

Subtransmission substations

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.

The upper voltage level on the underground 132kV system is restricted to 1.05 per unit. Marginally higher voltages may be possible in some areas with overhead connection. The lower voltage limit is determined by the requirement during first contingency outages for: Transformers in subtransmission substations to maintain regulation; and voltage levels on the 132kV system should not fall below 90% of their nominal voltage (0.9 pu).

The voltage regulation range of the 33kV system is determined by the requirement for zone transformers: to maintain regulation under normal system conditions; and be less than 4% below their set voltage level (allowing for line drop compensation) during first contingency outages.

Zone substations and Overhead Subtransmission Feeders

For a failure of a single critical element (i.e. N-1 conditions) within zone substations supplying greater than 10MVA of load and for overhead subtransmission network, the forecast demand is not to exceed the thermal capacity for more than 1% of the time i.e. a total aggregate time of 88 hours per annum; up to a maximum of 20% above the thermal capacity. Recovery of load should be within one minute.

Under normal conditions (i.e N conditions), the thermal capacity is required to meet at least 115% of forecast demand.

Underground Subtransmission Feeders

For an underground subtransmission feeder, any overhead section should be designed as if it was a subtransmission overhead feeder, providing the forecast demand does not exceed the thermal capacity of the underground section at any time under N-1 conditions.

11kV distribution network

For a distribution feeder in urban¹ area, the expected demand is to be no more than 80% of feeder thermal capacity (under system normal operating conditions), with switchable interconnection to adjacent feeders to enable restoration following an unplanned failure of a single network element (i.e. N-1 conditions). The 11kV network where in a number of feeders forms an interrelated system, the limits apply to the average loading of the feeders within the one system.

For 11kV networks, voltage drops of up to 5% are regarded as satisfactory. Higher voltage drops are permissible provided that the network connection provided to low voltage customers is within the limits specified in Australian Standard AS2926.

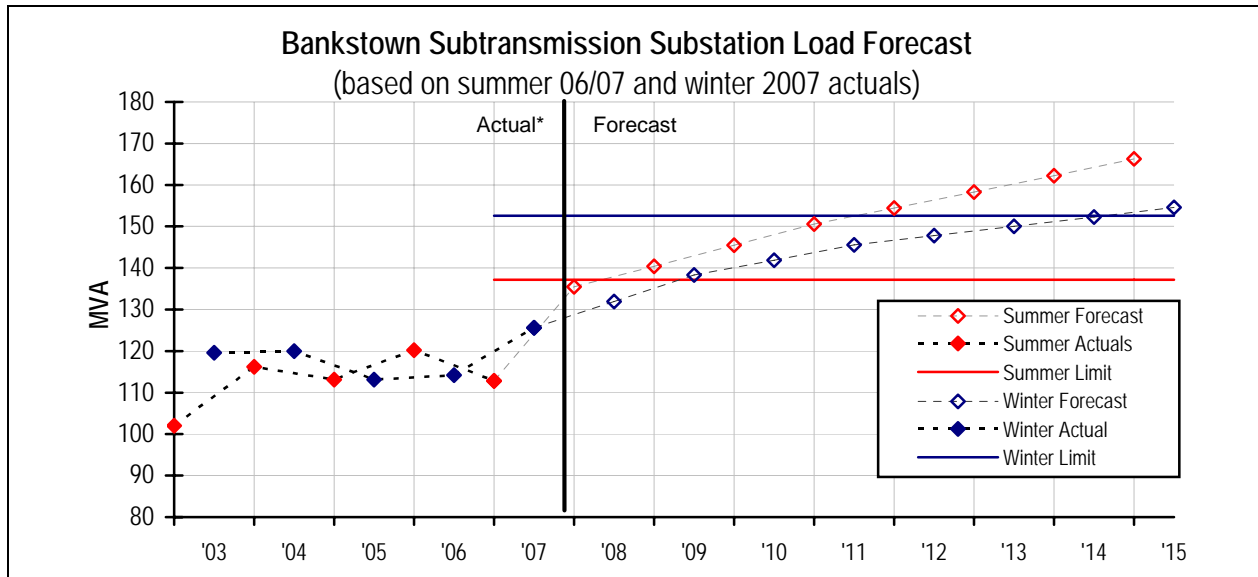
2.2. Description of Network Issues

2.2.1. Bankstown Subtransmission Substation

Bankstown STS load is forecast to exceed the firm capacity in summer 2008/2009.

Most of the major 33kV substation equipment at Bankstown STS is recommended for replacement within five years. The 33kV switchgear and subtransmission transformers are recommended to be replaced within five years. It is anticipated that indoor 33kV switchgear will be installed.

¹ Urban, for EnergyAustralia, means an area where the majority of land is zoned for residential and/or commercial and/or industrial use within a town or city type of area which is contiguous with other similar town or city areas with an aggregated population of at least 5,000 people.



	Actual					Forecast								
SUMMER	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	
Load [MVA]	102.0	116.2	113.1	120.2	112.8	135.5	140.4	145.5	150.6	154.4	158.3	162.2	166.3	
Limit [MVA]					137.2	137.2	137.2	137.2	137.2	137.2	137.2	137.2	137.2	
WINTER	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Load [MVA]	119.6	120.0	113.1	114.2	125.6	131.9	138.3	141.9	145.6	147.8	150.0	152.3	154.6	
Limit [MVA]					152.6	152.6	152.6	152.6	152.6	152.6	152.6	152.6	152.6	

Note * Previous capacity limits were different under the previous Licence condition. These previous limits are not shown on the graph for simplicity.

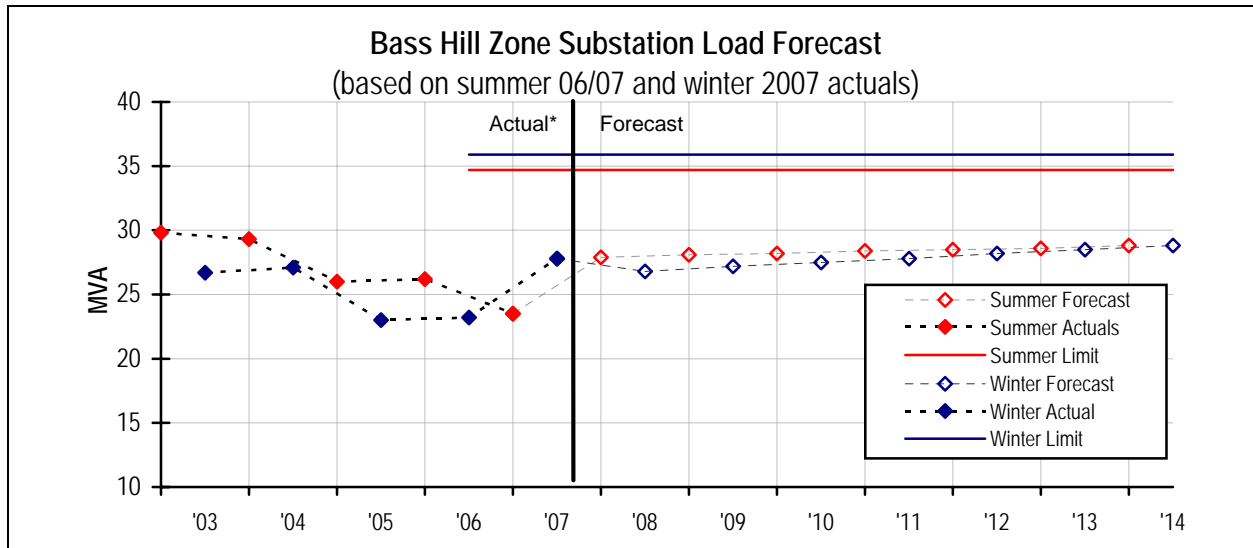
2.2.2. Bass Hill Zone Substation

Bass Hill zone substation load is not forecast to exceed its firm capacity within the immediate forecast period.

Most of the major substation equipment at Bass Hill zone substation is recommended for replacement within five years. The most immediate issue is the replacement of the 11kV switchgear.

The switchgear will be replaced and allow for the replacement of the three existing transformers with two larger units, and ultimately, the firm capacity at Bass Hill could be increased to approximately 60MVA.

EnergyAustralia intends to purchase a block of land adjacent to the existing Bass Hill substation site to facilitate the refurbishment of the zone substation.



	Actual					Forecast							
	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	
SUMMER													
Load [MVA]	29.8	29.3	26.0	26.2	23.5	27.9	28.1	28.2	28.4	28.5	28.6	28.8	
Firm Capacity [MVA]					28.9	28.9	28.9	28.9	28.9	28.9	28.9	28.9	
Limit# [MVA]					34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	
WINTER	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Load [MVA]	26.7	27.1	23.0	23.2	27.8	26.8	27.2	27.5	27.8	28.2	28.5	28.8	
Firm Capacity [MVA]					29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	
Limit# [MVA]					35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	

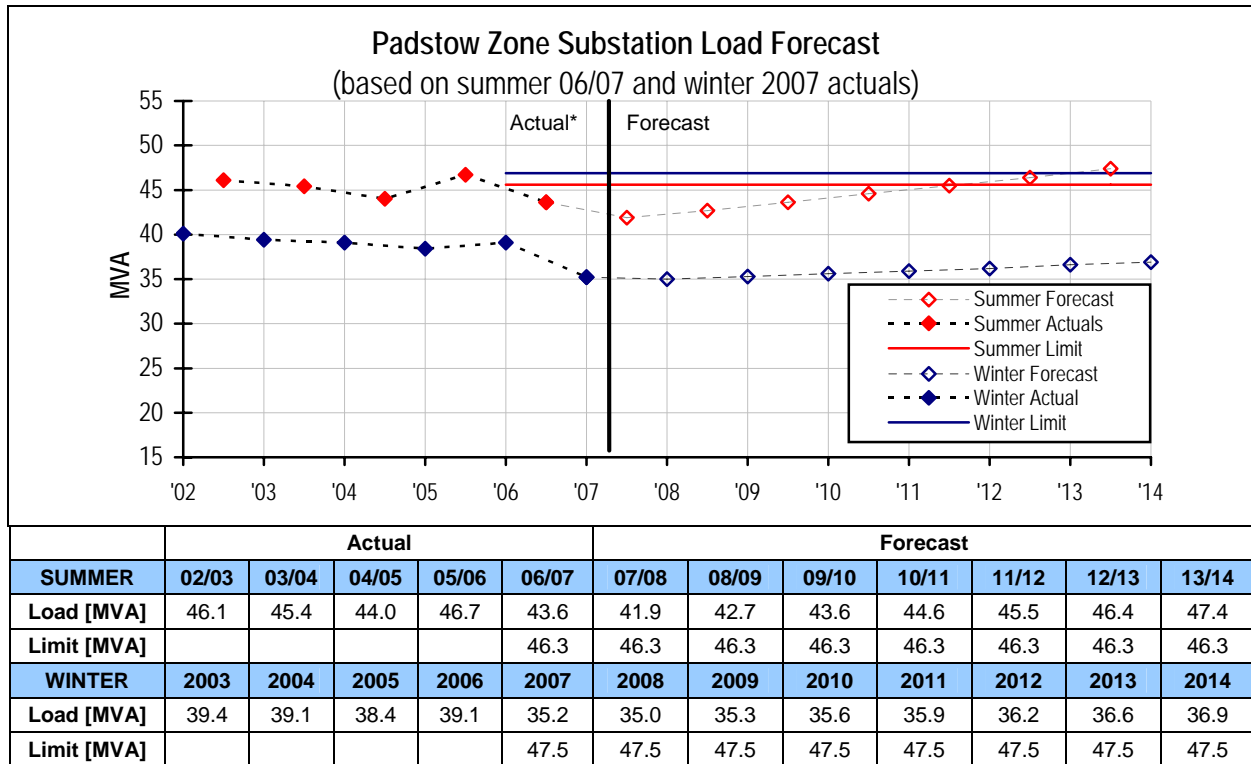
Note: # Bass Hill zone substation limit is 120% of firm capacity.

* Previous capacity limits were different under the previous Licence condition. These previous limits are not shown on the graph for simplicity.

2.2.3. Padstow Zone Substation

Padstow zone substation load exceeded its firm capacity in summer 2005/2006. Load transfers via the 11kV network to Punchbowl zone substation have recently been carried out which will provide temporary relief until summer 2012/2013 when the load is forecast to exceed the firm capacity again. Due to the operation arrangement of the substation, the 120% of firm capacity criterion cannot be used for Padstow zone substation.

Most of the major substation equipment at Padstow zone substation is recommended for replacement within five years. There is limited 11kV capacity available in the surrounding zone substations for a staged refurbishment at Padstow zone substation. Furthermore, the Padstow zone substation site does not have sufficient space for an efficient refurbishment.

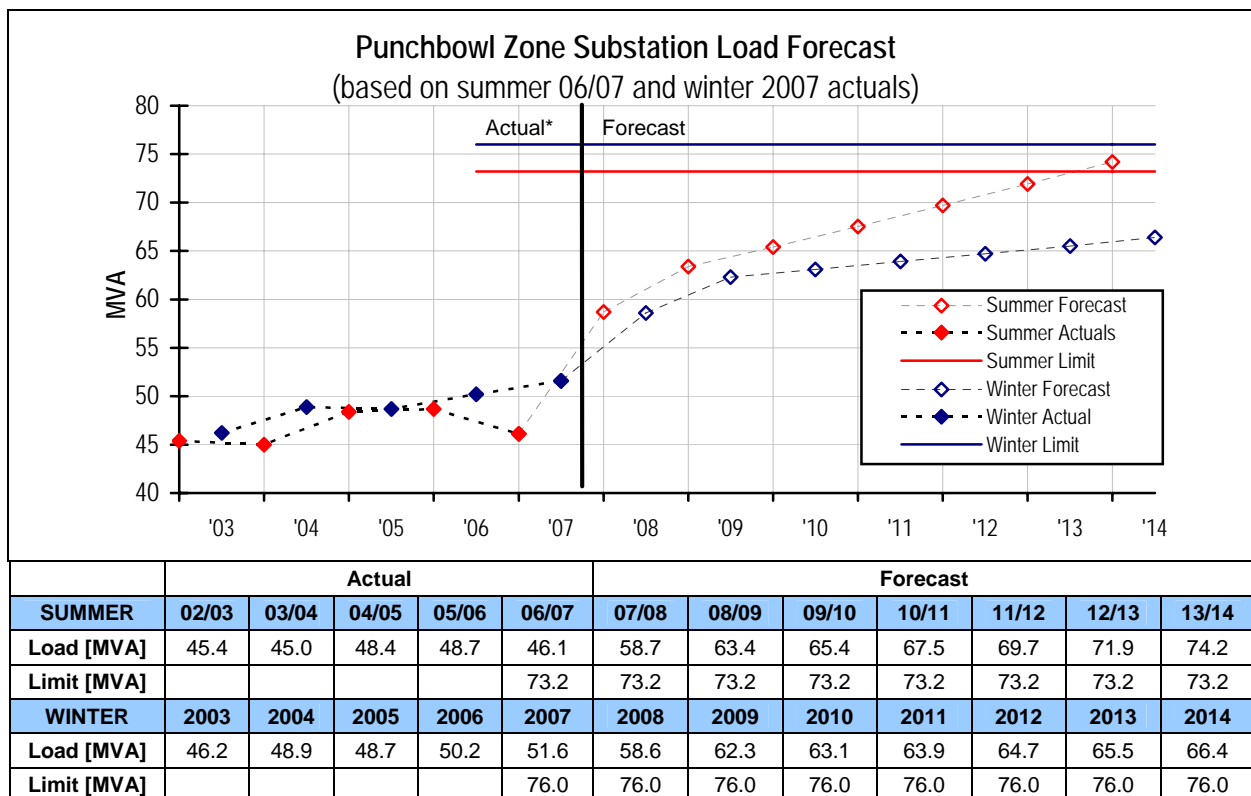


Note * Previous capacity limits were different under the previous Licence condition. These previous limits are not shown on the graph for simplicity.

2.2.4. Punchbowl Zone Substation

Punchbowl zone substation load is forecast to exceed its firm capacity in summer 2013/2014. Due to the operation arrangement of the substation, the 120% of firm capacity criterion cannot be used for Punchbowl zone substation.

All of the 11kV circuit breakers at Punchbowl zone substation are recommended to be replaced within five years. Three transformers are recommended for replacement within 10 years.

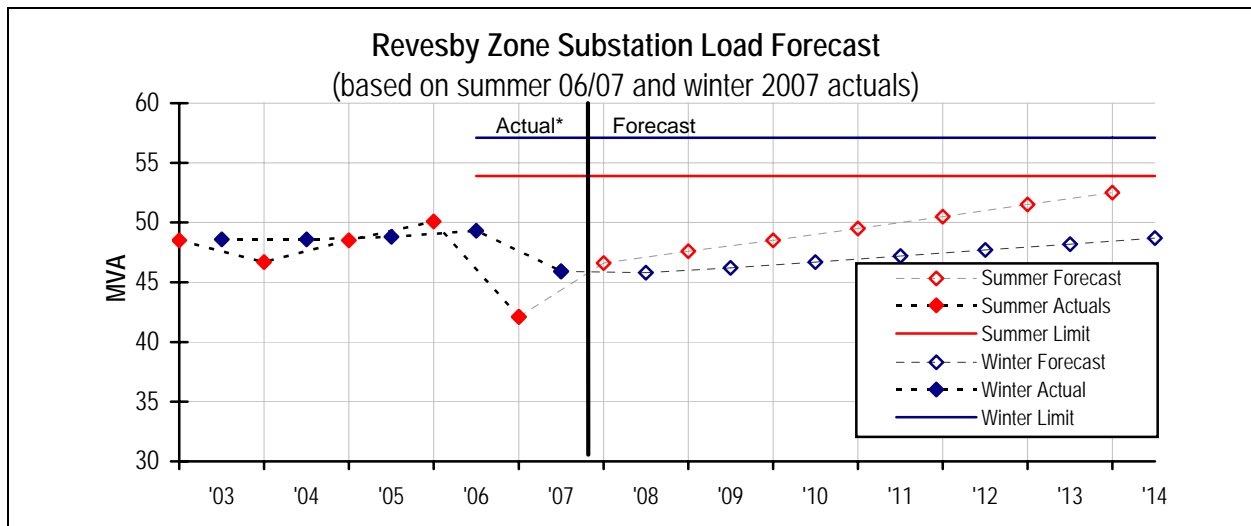


Note * Previous capacity limits were different under the previous Licence condition. These previous limits are not shown on the graph for simplicity.

2.2.5. Revesby Zone Substation

Revesby zone substation load is forecast to exceed the firm capacity in summer 2007/2008 but the load will remain within 120% of the firm capacity during the immediate forecast period.

The 132kV busbar section breaker and the oil circuit breakers are recommended to be replaced within five years.



	Actual					Forecast						
SUMMER	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14
Load [MVA]	48.5	46.7	48.5	50.1	42.1	46.6	47.6	48.5	49.5	50.5	51.5	52.5
Firm Capacity [MVA] [#]					44.9	44.9	44.9	44.9	44.9	44.9	44.9	44.9
Limit [MVA]					53.9	53.9	53.9	53.9	53.9	53.9	53.9	53.9
WINTER	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Load [MVA]	48.6	48.6	48.8	49.3	45.9	45.8	46.2	46.7	47.2	47.7	48.2	48.7
Firm Capacity [MVA] [#]					47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6
Limit [MVA]					57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1

Note: # Revesby zone substation limit is 120% of firm capacity.

* Previous capacity limits were different under the previous Licence condition. These previous limits are not shown on the graph for simplicity.

3. TYPE OF AUGMENTATION

Most of the EnergyAustralia network within the Bankstown load area, including the aforementioned eight zone substations are classified as distribution system assets by the National Electricity Rules (the Rules).

The rules (clauses 5.6.2 (e) and (f)) requires that, where analysis indicates that any relevant technical limits of a distribution system will be exceeded, that the Distribution Network Service Provider must notify any affected Registered Participants of these limitations and the expected time for corrective action and consult with affected Registered Participants and interested parties on the possible options to address the projected limitations of the relevant distribution system. A Network Service Provider does not need to consult on a network option that would be a small network asset, or for options that do not augment the system.

The proposed development strategy for the Bankstown load area involves expenditure in excess of \$10 million and is regarded by the Rules as a new large network asset. Accordingly, a Consultation Paper on the projected limitation and options for corrective action was published on 24th January 2008. This Consultation Paper included a preliminary application of the Regulatory test to options which had been identified to address the projected limitations. No submission was received in response to the Consultation Paper. In addition, EnergyAustralia has provided notification of these limits in its Annual Electricity System Development Review (AESDR).

The new capacity provided by the proposed augmentation has been necessitated by the need to meet the service standards described in Section 2 and has therefore been treated as a reliability driven augmentation for the purposes of the Regulatory Test. Consequently, EnergyAustralia has used a least cost test to examine the options identified to address projected system limitations.

4. OPTIONS CONSIDERED

The development strategy for the Bankstown load area is driven by an immediate need to provide:

- Refurbishment or retirement of the aging Padstow 33/11kV zone substation by 2012.
- Capacity to maintain loading on Bankstown STS below its firm capacity.
- Sufficient capacity to relieve loading for four zone substations in the area (Bass Hill, Padstow, Punchbowl, and Revesby)
- Capacity to meet forecast load growth in the area for the medium term.

To meet these immediate objectives EnergyAustralia has investigated a number of options. Possible options are impacted by:

- The availability of land for substation sites in existing established areas.
- The need to establish new zone substations in close proximity to existing 132kV feeders to minimise connection costs.
- The need for the new zone substations to be located near existing zone substations to minimise 11kV connection costs.
- The need to replace aging 33kV infrastructure.
- The need to be in close proximity to load centres.

The following section describes Demand Management and three area supply strategy options for the Bankstown load area:

- Option 1: Install 132/11kV Bankstown ZS and retire Padstow ZS.
- Option 2: Install two 132/11kV ZS and retire Padstow ZS and Punchbowl ZS.
- Option 3: Refurbish Padstow ZS and install new 132/11kV Punchbowl ZS.

4.1. Consideration of Demand Management

Investigation of demand management opportunities in the Bankstown load area has been carried out in March 2008.

In order to defer the supply side solution, the required demand reduction is the entire Padstow zone substation load of approximately 44MVA (to address its aged asset issues) as well as approximately 21MVA from Punchbowl zone substation (to enable its staged refurbishment) by 2010/2011. The value of one year deferral is approximately \$40/kVA which is low.

Due to the large amount of demand reduction required and a low deferral value, it is not considered reasonable to expect that the proposed supply side solution could be cost effectively deferred by implementing demand management strategies.

4.2. Option 1: Install 132/11kV Bankstown ZS and Retire Padstow ZS

This option involves the establishment of a 132/11kV Bankstown zone substation within the existing Bankstown STS site. The proposed zone substation will be initially equipped with two 50MVA 132/11kV transformers with provision for a third transformer.

The establishment of the Bankstown zone substation is part of the broader area strategy which also includes the following projects:

- Load transfers from Padstow to Milperra ZS (2009)
- Uprate Revesby ZS (2009)
- Load transfers from Punchbowl to Bankstown ZS (2010)
- Install new 132/11kV Bankstown ZS (2010)
- Decommission Padstow ZS (2012)
- Refurbish Bankstown STS (2012)
- Refurbish Punchbowl ZS (2013)
- Refurbish Revesby ZS (2015)
- Refurbish Milperra ZS (2015)
- Load transfers from Revesby ZS to Milperra ZS (2015)
- Refurbish and uprate Bass Hill ZS (2014, 2016)
- Load transfers from Milperra ZS to Bankstown ZS (2020)

This area strategy will provide sufficient capacity to:

- Retire Padstow ZS.
- Relieve loading at Bankstown STS.
- Facilitate refurbishment of Bankstown STS, and Bass Hill, Punchbowl, and Revesby ZS.
- Relieve loading at Bass Hill, Punchbowl, and Revesby ZS via 11kV load transfers.

The costs of these investments have been included in the economic analysis. The first stage of this strategy includes the establishment of Bankstown 132/11kV zone substation and its associated feeder works, and load transfers from Padstow ZS to Milperra ZS and from Padstow ZS and Punchbowl ZS to the proposed Bankstown ZS. The estimated capital cost for the first stage is \$36.5M with a NPC of \$33.8M.

The total Capital Cost of this area strategy is **\$115.3M**. The Net Present Cost (NPC) is **\$97.7M**.

4.3. Option 2: Install Two 132/11kV ZS and Retire Padstow ZS and Punchbowl ZS

This strategy involves the establishment of two 132/11kV zone substations in the Bankstown load area: one within the existing Bankstown STS site to enable retirement of Padstow zone substation, and the other to replace the existing Punchbowl zone substation.

The establishment of the Bankstown zone substation is part of the broader area strategy which also includes the following projects:

- Load transfers from Padstow to Milperra ZS (2009)
- Uprate Revesby ZS (2009)
- Load transfers from Punchbowl to Bankstown ZS (2011)

- Install new 132/11kV Bankstown ZS (2011)
- Decommission Padstow ZS (2011)
- Install new Punchbowl 132/11kV ZS (2011)
- Load transfers from Milperra to Bankstown ZS (2012)
- Refurbish Bankstown STS (2012)
- Refurbish Revesby ZS (2015)
- Refurbish Milperra ZS (2015)
- Load transfers from Revesby ZS to Milperra ZS (2015)
- Refurbish and uprate Bass Hill ZS (2014, 2016)
- Load transfers from Bankstown ZS to Bass Hill ZS (2016)
- Load transfers from Milperra ZS to Bankstown ZS (2020)

This area strategy will provide sufficient capacity to:

- Retire Padstow ZS.
- Relieve loading at Bankstown STS.
- Retire Punchbowl ZS.
- Facilitate refurbishment of Bankstown STS, and Bass Hill and Revesby ZS.
- Relieve loading at Bass Hill and Revesby ZS via 11kV load transfers.

The costs of these investments have been included in the economic analysis.

The total Capital Cost of this area strategy is **\$139.0M**. The Net Present Cost (NPC) is **\$119.9M**.

4.4. Option 3: Refurbish Padstow ZS and Install New 132/11kV Punchbowl ZS

This strategy involves refurbishment of Padstow zone substation to address the aged asset issues at Padstow ZS. A new 132/11kV zone substation will also be installed as part of this strategy to replace Punchbowl zone substation.

The broader area strategy includes the following projects:

- Load transfers from Padstow to Milperra ZS (2008)
- Uprate Revesby ZS (2009)
- Refurbish Padstow ZS (2018)
- Install new Punchbowl 132/11kV ZS (2011)
- Refurbish Bankstown STS (2012)
- Uprate Punchbowl 132/11kV ZS (2014)
- Load transfers from Milperra to Padstow ZS (2015)
- Refurbish Milperra ZS (2015)
- Refurbish Revesby ZS (2015)
- Load transfers from Revesby ZS to Milperra ZS (2015)
- Refurbish and uprate Bass Hill ZS (2014, 2016)
- Load transfers from Milperra to Padstow ZS (2020)

This area strategy will provide sufficient capacity to:

- Refurbish Padstow ZS.
- Relieve loading at Bankstown STS.
- Retire Punchbowl ZS.
- Facilitate refurbishment of Bankstown STS, and Bass Hill and Revesby ZS.
- Relieve loading at Bass Hill, Padstow and Revesby ZS via 11kV load transfers.

The costs of these investments have been included in the economic analysis.

The total Capital Cost of this area strategy is **\$130.1M**. The Net Present Cost (NPC) is **\$104.1M**.

5. APPLICATION OF THE REGULATORY TEST

A preliminary economic analysis has been carried out. It involves the comparison of options on an economic basis by carrying out Net Present Cost (NPC) analysis for each of the three options.

The economic analysis incorporates:

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

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

5.1. Base Case Analysis

The results of the base case economic analysis using a discount factor of 8.5% p.a. are summarised in Table 1 below.

Table 1 - Comparison of Options – Base Case

Option	Description	Capital Cost [\$M]	NPC of Costs ² [\$M]
Option 1	Install 132/11kV Bankstown ZS and retire Padstow ZS	115.3	97.7
Option 2	Install two 132/11kV zone substations and retire Padstow and Punchbowl ZS	139.0	119.9
Option 3	Refurbish Padstow ZS and install new 132/11kV Punchbowl ZS	130.1	104.1

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

² Net Present Cost also includes operation and maintenance costs.

5.2. Sensitivity Analysis

The base case and the range over which sensitivity checks were conducted are shown in Table 2.

Table 2 - Base Case Values and Range of Values Used in Sensitivity Checks

Parameter	Base Case Value	Sensitivity Checks at
Substation Costs	100%	75% and 125%
Transmission Mains Costs	100%	75% and 125%
Distribution Mains Costs	100%	75% and 125%
Discount Factor	8.5%	7.0% and 10.0%
Growth Rate	100%	75% and 125%

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

Table 3 - Sensitivity Analysis: Comparison of Options

Scenario	Net Present Cost [\$M]		
	Option 1	Option 2	Option 3
25% reduction in substation costs	83.7	100.7	87.6
25% increase in substation costs	111.6	139.1	120.6
25% reduction in transmission mains costs	95.3	116.4	100.5
25% increase in transmission mains costs	100.1	123.4	107.7
25% reduction in distribution mains costs	92.3	115.0	100.8
25% increase in distribution mains costs	103.0	124.9	107.4
7% discount factor	104.1	126.5	111.3
10% discount factor	91.9	114.0	97.7
25% reduction in load growth	97.7	119.9	104.1
25% increase in load growth	97.7	119.9	104.1

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

6. CONCLUSION

Option 1 has the lowest NPC and has the least cost under all sensitivity scenarios.

The first stage of this strategy includes the establishment of Bankstown 132/11kV zone substation and its associated feeder works, and load transfers from Padstow ZS to Milperra ZS and from Padstow ZS and Punchbowl ZS to the proposed Bankstown ZS. This first stage will address the capacity issues at the Bankstown STS, and aged asset issues at Padstow ZS and Punchbowl ZS. This Final Report covers the first stage of the area strategy. The estimated capital cost for the first stage is \$36.5M with a NPC of \$33.8M.

For the entire strategy, the estimated capital cost is \$115.3M with a NPC of \$97.7M.

The establishment of the proposed Bankstown ZS is forecast to be completed by mid 2010. This service availability date may change if the project is affected by circumstances beyond

EnergyAustralia's control, such as changes in the timing of customer load increases or other issues such as: delays in the approval process, equipment supply difficulties, unforeseen technical constraints, acts of God and industrial action.

7. CONTACT DETAILS FOR ENQUIRIES

This report recommends the construction of a new large distribution network asset. Registered Participants may dispute the recommendations of the report under Clause 5.6.2(i) of the Rules. Registered participants who intend to dispute the recommendations of this report must do so within 40 business days of the report being published and made available on EnergyAustralia's website. Any enquiries regarding this report should be directed to the contact listed below:

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8. APPENDIX A – ECONOMIC ANALYSIS OF BASE CASE

WACC = 8.5% p.a.

Option 1 – Install 132/11kV Bankstown ZS and retire Padstow ZS (Preferred Option)

Actions	NPC* [\$K]	CAPEX [\$K]	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022
Load transfer from Padstow to Milperra ZS	2,765	3,000	-	3,000	-	-	-	-	-	-	-	-	-	-	-	-	-
Operation and Maintenance (O&M)	265		-	10	36	36	36	36	36	36	36	36	36	36	36	36	36
Bankstown new 132/11kV ZS	17,628	20,633	515	4,825	10,406	4,887	-	-	-	-	-	-	-	-	-	-	-
Substation works			515	4,160	10,091	3,584	-	-	-	-	-	-	-	-	-	-	-
132kV feeder works			-	665	115	703	-	-	-	-	-	-	-	-	-	-	-
11kV feeder works			-	-	200	600	-	-	-	-	-	-	-	-	-	-	-
O&M	1,806		-	-	231	258	258	258	258	258	258	258	258	258	258	258	258
Load transfer from Padstow and Punchbowl to Bankstown ZS	10,480	12,840	-	-	6,420	6,420	-	-	-	-	-	-	-	-	-	-	-
O&M	875		-	-	-	44	154	154	154	154	154	154	154	154	154	154	154
FIRST STAGE³ (above projects)	33,818	36,473															
Decommission Padstow ZS	-289	-528	-	-	7	93	97	128	-853	-	-	-	-	-	-	-	-
Uprating of Revesby ZS	6,061	6,615	-	6,110	505	-	-	-	-	-	-	-	-	-	-	-	-
Additional transformer (tx)			-	4,673	386	-	-	-	-	-	-	-	-	-	-	-	-
Additional 11kV switchgear (SG)			-	1,447	119	-	-	-	-	-	-	-	-	-	-	-	-
O&M	610		-	-	82	87	87	87	87	87	87	87	87	87	87	87	87
Bankstown STS replace 33kV SG	13,642	20,324	-	-	-	-	2,219	18,105	-	-	-	-	-	-	-	-	-
O&M	1,171		-	-	-	-	-	144	264	264	264	264	264	264	264	264	264
Punchbowl ZS replace 11kV SG	4,737	7,165	-	-	-	-	-	6,618	547	-	-	-	-	-	-	-	-
O&M	379		-	-	-	-	-	-	89	94	94	94	94	94	94	94	94
Punchbowl 33kV feeders and tx replacement	11,032	16,842	-	-	-	-	354	12,871	3,617	-	-	-	-	-	-	-	-
33kV fdr replacement			-	-	-	-	354	9,863	597	-	-	-	-	-	-	-	-

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

³ This Final Report focuses on the First Stage of the preferred area strategy.

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Actions	NPC* [\$K]	CAPEX [\$K]	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022
Tx replacement			-	-	-	-	-	3,008	3,020	-	-	-	-	-	-	-	-
O&M	526		-	-	-	-	-	-	77	138	138	138	138	138	138	138	138
Load transfer from Revesby ZS to Milperra ZS	3,244	5,776	-	-	-	-	-	-	-	5,336	440	-	-	-	-	-	-
O&M	175		-	-	-	-	-	-	-	-	20	69	69	69	69	69	69
Bass Hill ZS replace 11kV SG	5,638	9,580	-	-	-	-	-	-	4,701	4,879	-	-	-	-	-	-	-
O&M	430		-	-	-	-	-	-	-	119	125	125	125	125	125	125	125
Bass Hill 33kV feeder uprate & 33kV tx replacement	2,757	5,468	-	-	-	-	-	-	-	-	3,250	2,218	-	-	-	-	-
Repalce Tx			-	-	-	-	-	-	-	-	1,726	1,728	-	-	-	-	-
Reconductor 33kV fdr			-	-	-	-	-	-	-	-	1,524	490	-	-	-	-	-
O&M	147		-	-	-	-	-	-	-	-	-	49	65	65	65	65	65
Load transfer from Milperra to Bankstown ZS	2,830	7,577	-	-	-	-	-	-	-	-	-	-	-	-	7,000	577	-
O&M	38		-	-	-	-	-	-	-	-	-	-	-	-	-	26	91
O&M for existing zone substations (assuming average RC = \$20M)																	
Bass Hill	2,361		262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
Padstow (retire 2012/2013)	1,294		262	262	262	262	262	262	-	-	-	-	-	-	-	-	-
Punchbowl	2,361		262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
Revesby	2,361		262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
Milperra	2,361		262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
	97,680	115,292															

All values are in 2007/2008 real dollars [\$K].

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Option 2 – Install two 132/11kV ZS and retire Padstow ZS and Punchbowl ZS

Actions	NPC* [\$K]	CAPEX [\$K]	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022
Load transfer from Padstow to Milperra ZS	2,765	3,000	-	3,000	-	-	-	-	-	-	-	-	-	-	-	-	-
Operation and Maintenance (O&M)	265		-	10	36	36	36	36	36	36	36	36	36	36	36	36	36
Uprating of Revesby ZS	6,061	6,615	-	6,110	505	-	-	-	-	-	-	-	-	-	-	-	-
Additional transformer (tx)			-	4,660	386	-	-	-	-	-	-	-	-	-	-	-	-
Additional 11kV switchgear (SG)			-	1,170	96	-	-	-	-	-	-	-	-	-	-	-	-
O&M	610		-	-	82	87	87	87	87	87	87	87	87	87	87	87	87
Load transfer from Padstow to Milperra ZS	2,602	3,081	-	-	2,846	235	-	-	-	-	-	-	-	-	-	-	-
O&M	210		-	-	-	10	37	37	37	37	37	37	37	37	37	37	37
Bankstown new 132/11kV ZS	17,628	20,633	515	4,825	10,406	4,887	-	-	-	-	-	-	-	-	-	-	-
Substation works			515	4,160	10,091	3,584	-	-	-	-	-	-	-	-	-	-	-
132kV feeder works			-	665	115	703	-	-	-	-	-	-	-	-	-	-	-
11kV feeder works			-	-	200	600	-	-	-	-	-	-	-	-	-	-	-
O&M	1,806		-	-	231	258	258	258	258	258	258	258	258	258	258	258	258
Decommission Padstow ZS including load transfers	1,804	2,229	-	6	90	1,474	1,512	-	-853	-	-	-	-	-	-	-	-
Load transfer from Milperra to Bankstown ZS	170	235	-	-	-	-	235	-	-	-	-	-	-	-	-	-	-
O&M	14		-	-	-	-	1	3	3	3	3	3	3	3	3	3	3
Bankstown STS replace 33kV SG	10,949	16,276	-	-	-	-	2,202	14,074	-	-	-	-	-	-	-	-	-
O&M	938		-	-	-	-	-	116	212	212	212	212	212	212	212	212	212
Load transfer from Punchbowl to Bankstown ZS	3,634	4,669	-	-	-	4,313	356	-	-	-	-	-	-	-	-	-	-
O&M	277		-	-	-	-	16	56	56	56	56	56	56	56	56	56	56
New 132/11kV Punchbowl ZS	35,202	42,758	-	1,866	20,737	20,064	944	-	-853	-	-	-	-	-	-	-	-
Substation works			-	1,866	15,583	8,551	517	-	-	-	-	-	-	-	-	-	-
132kV feeders			-	-	425	11,513	427	-	-	-	-	-	-	-	-	-	-
Land			-	-	4,729	-	-	-	-853	-	-	-	-	-	-	-	-
O&M	2,206		-	-	-	-	331	415	415	415	415	415	415	415	415	415	415

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

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Actions	NPC* [\$K]	CAPEX [\$K]	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022
Punchbowl 132kV zone – 11kV and 132kV connections	8,621	11,090	-	-	185	9,699	1,206	-	-	-	-	-	-	-	-	-	-
Substation work			-	-	163	4,742	177	-	-	-	-	-	-	-	-	-	-
132kV connection works			-	-	22	1,777	766	-	-	-	-	-	-	-	-	-	-
11kV connection works			-	-	-	3,180	263	-	-	-	-	-	-	-	-	-	-
O&M	632		-	-	-	-	75	122	122	122	122	122	122	122	122	122	122
Load transfer from Revesby ZS to Milperra ZS	3,244	5,776	-	-	-	-	-	-	-	5,336	440	-	-	-	-	-	-
O&M	175		-	-	-	-	-	-	-	-	20	69	69	69	69	69	69
Bass Hill ZS replace 11kV SG	5,638	9,580	-	-	-	-	-	-	4,701	4,879	-	-	-	-	-	-	-
O&M	430		-	-	-	-	-	-	-	119	125	125	125	125	125	125	125
Bass Hill 33kV feeder uprate & 33kV tx replacement	1,833	5,468	-	-	-	-	-	-	-	-	-	-	-	-	-	3,250	2,218
Repalce Tx			-	-	-	-	-	-	-	-	-	-	-	-	-	1,726	1,728
Reconductor 33kV fdr			-	-	-	-	-	-	-	-	-	-	-	-	-	1,524	490
O&M	16		-	-	-	-	-	-	-	-	-	-	-	-	-	-	49
Load transfer from Milperra to Bankstown ZS	2,830	7,577	-	-	-	-	-	-	-	-	-	-	-	-	7,000	577	-
O&M	38		-	-	-	-	-	-	-	-	-	-	-	-	-	26	91
O&M for existing ZS (assuming average RC = \$20M)																	
Bass Hill	2,361		262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
Padstow (retire 2012/2013)	1,120		262	262	262	262	262	-	-	-	-	-	-	-	-	-	-
Punchbowl (retire 2012/2013)	1,120		262	262	262	262	262	-	-	-	-	-	-	-	-	-	-
Revesby	2,361		262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
Milperra	2,361		262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
	119,915	138,988															

All values are in 2007/2008 real dollars [\$K].

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Option 3 – Refurbish Padstow ZS and install new 132/11kV Punchbowl ZS

Actions	NPC* [\$K]	CAPEX [\$K]	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/2 012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022
Load transfer from Padstow to Milperra ZS	3,912	4,072	-	4,072	-	-	-	-	-	-	-	-	-	-	-	-	-
Operation and Maintenance (O&M)	359		-	14	49	49	49	49	49	49	49	49	49	49	49	49	49
Upgrading of Revesby ZS	6,061	6,615	-	6,110	505	-	-	-	-	-	-	-	-	-	-	-	-
Additional transformer (tx)			-	4,940	386	-	-	-	-	-	-	-	-	-	-	-	-
Additional 11kV switchgear (SG)			-	1,170	96	-	-	-	-	-	-	-	-	-	-	-	-
O&M	610		-	0	82	87	87	87	87	87	87	87	87	87	87	87	87
Load transfer from Milperra to Padstow ZS	1,666	2,967	-	-	-	-	-	-	-	2,741	226	-	-	-	-	-	-
O&M	90		-	-	-	-	-	-	-	-	10	36	36	36	36	36	36
Refurbish and uprate Padstow ZS	7,862	18,532	-	-	-	-	-	-	-	-	-	-	8,888	9,644	-	-	-
Substation works			-	-	-	-	-	-	-	-	-	-	5,266	8,825	-	-	-
33kV feeder works			-	-	-	-	-	-	-	-	-	-	3,622	819	-	-	-
O&M	315		-	-	-	-	-	-	-	-	-	-	-	189	229	229	229
Bankstown STS replace 33kV SG	13,642	20,324	-	-	-	-	2,219	18,105	-	-	-	-	-	-	-	-	-
O&M	1,171		-	-	-	-	-	144	264	264	264	264	264	264	264	264	264
New 132/11kV Punchbowl ZS	35,202	42,758	-	1,866	20,737	20,064	944	-	-853	-	-	-	-	-	-	-	-
Substation works			-	1,866	15,583	8,551	517	-	-	-	-	-	-	-	-	-	-
132kV feeders			-	-	425	11,513	427	-	-	-	-	-	-	-	-	-	-
Land			-	-	4,729	-	-	-	-853	-	-	-	-	-	-	-	-
O&M	2,206		-	-	-	-	331	415	415	415	415	415	415	415	415	415	415
Punchbowl 132kV zone – 11kV and 132kV connections	4,267	5,498	-	-	12	4,856	630	-	-	-	-	-	-	-	-	-	-
132kV connection works			-	-	12	1,676	367	-	-	-	-	-	-	-	-	-	-
11kV connection works			-	-	-	3,180	263	-	-	-	-	-	-	-	-	-	-
O&M	258		-	-	-	-	12	53	53	53	53	53	53	53	53	53	53
Punchbowl 132/11kV addition Tx	3,326	5,459	-	-	-	-	-	-	-	5,043	416	-	-	-	-	-	-
O&M	245		-	-	-	-	-	-	-	-	68	72	72	72	72	72	72

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

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Actions	NPC* [\$K]	CAPEX [\$K]	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/2 012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022
Load transfer from Revesby ZS to Milperra ZS	3,244	5,776	-	-	-	-	-	-	-	5,336	440	-	-	-	-	-	-
O&M	175		-	-	-	-	-	-	-	-	20	69	69	69	69	69	69
Bass Hill ZS replace 11kV SG	5,638	9,580	-	-	-	-	-	-	4,701	4,879	-	-	-	-	-	-	-
O&M	430		-	-	-	-	-	-	-	119	125	125	125	125	125	125	125
Bass Hill 33kV feeder uprate & 33kV tx replacement	1,833	5,468	-	-	-	-	-	-	-	-	-	-	-	-	-	3,250	2,218
Repalce Tx			-	-	-	-	-	-	-	-	-	-	-	-	-	1,726	1,728
Reconductor 33kV fdr			-	-	-	-	-	-	-	-	-	-	-	-	-	1,524	490
O&M	16		-	-	-	-	-	-	-	-	-	-	-	-	-	-	49
Load transfer from Milperra to Padstow ZS	1,158	3,100	-	-	-	-	-	-	-	-	-	-	-	-	2,864	236	-
O&M	16		-	-	-	-	-	-	-	-	-	-	-	-	-	11	37
O&M for existing ZS (assuming average RC = \$20M)																	
Bass Hill	2,361		262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
Padstow	2,361		262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
Punchbowl (retire 2012/2013)	1,120		262	262	262	262	262	-	-	-	-	-	-	-	-	-	-
Revesby	2,361		262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
Milperra	2,361		262	262	262	262	262	262	262	262	262	262	262	262	262	262	262
TOTAL	104,103	130,149															

All values are in 2007/2008 real dollars [\$K].