

Annual Planning Statement 2004



2004 Electricity System Development Review



The power is in your hands

2004 Electricity System Development Review

MAXIMISING SUSTAINABLE VALUE IN OUR ASSETS

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Cover

Main image: Castle Towers Shopping Centre, Castle Hill, site of a pilot electricity demand management project.

Inset images: urban development and electrical infrastructure, Sydney's Hills District.

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1.0 Purpose

Before expanding its electricity distribution system, or the capacity of its distribution system, Integral Energy is required to carry out investigations to ascertain the cost-effectiveness of avoiding or postponing this expansion by implementing demand side management strategies. Integral is also required to publish annual planning statements in relation to these investigations.

Integral first published *Network 2010: Our Blueprint for Sustainability* in November 2001, *Network 2012: Improving the Performance of our Network* in October 2002 and *Network 2013: Maximising Sustainable Value in our Assets* in May 2003. These statements were designed to provide stakeholders with an appreciation of the complex and interrelated factors necessary for the optimisation of future investments and the opportunity to have input into the investment planning process in order to improve the financial and operational performance of Integral's network. The statements reflect the plans and strategies which seek to align customer, technical and regulatory drivers to improve long term asset value and deliver optimal returns to shareholders and the customer.

The 2004 Electricity System Development Review is the fourth such document published by Integral. Its theme continues to be *Maximising Sustainable Value in our Assets*. The format of this document is different this year. Previous issues were in two sections with section two providing the detail of network constraints. This year's version is a stand-alone document containing all information required by external stakeholders to evaluate network constraints and identify non-network alternatives and is in line with the disclosure protocol in the current and proposed NSW electricity industry Demand Management Code of Practice.

This document is structured to:

- provide details and information on network constraint areas in accordance with the Demand Management Code of Practice;
- invite stakeholder input and feedback on this Electricity System Development Review, particularly in relation to suggesting alternative proposals to relieving specific network constraints;
- outline actions taken and results achieved as a result of feedback received since the last Planning Statement was issued; and
- explain Integral's Demand Management strategy and initiatives being undertaken; and
- summarise future capital and operating expenditure plans.

The detailed description of network constraints is provided from section 7 onwards and is grouped by regional government area.

Regulatory environment

The *Electricity Supply Act* 1995 requires an electricity distributor operating in New South Wales holding a licence to abide by the conditions imposed by the *Act* and by the Minister for Energy. The *Act* requires that the Minister for Energy impose a condition on each licensed

electricity distributor to conduct investigations on the cost effectiveness of implementing demand management strategies that may permit distribution network augmentation work to be deferred or avoided.

In accordance with the *Act*, the Minister has imposed Licence Condition 1.1 in all electricity distributors' licences. This condition substantially repeats the wording from the *Act*. The NSW electricity industry's Demand Management Code of Practice provides guidance on implementing the requirements in the *Act* and licence condition 1.1. The information contained in the 2004 Electricity System Development Review has been prepared in accordance with the Demand Management Code of Practice. Integral Energy made a major contribution to the development of this Code and subsequent reviews of the Code.

Stakeholder input

As with its predecessors, the 2004 Electricity System Development Review aims to engage the input of stakeholders into Integral's long-term network planning. Integral regards it as a critical document because it is one of the means by which customers, shareholders and the wider community are informed about its plans to improve the network.

Integral has also established a register of interested parties including customers and service providers who want to be informed of Integral's network plans on an ongoing basis. Integral is keen to gather opinions on possible solutions to identified issues or constraints in its network.

If you wish to obtain more information or to be included on the Register of Interested Parties, please forward your details to:

Chief Executive Officer
Integral Energy
PO Box 6366
BLACKTOWN NSW 2148

Or you can e-mail your details to: planning@integral.com.au

Please include your contact details, so Integral can respond to your inquiry.

Feedback invited

Stakeholders are invited to comment on Integral's planning proposals and suggest, if appropriate, alternative viable solutions to relieve network constraints.

The Demand Management Code of Practice outlines all the matters that should be included with stakeholders' proposals. These matters are set out in Appendix B. If you would like to discuss a proposal before making a submission in accordance with Appendix B, please contact us:

By Telephone: 131 081

Or Email: planning@integral.com.au

Where a Request for Proposals (RFP) has been issued by Integral, stakeholder proposals will be evaluated and ranked on the basis of:

- The total net annualised costs of system support incurred by the distributor, plus the cost or benefits of changes to transmission and distribution losses, where “total net annualised costs incurred by the distributor” includes all capital, fixed and operating costs of securing the specified level of system support.
- System support measured in terms of kVA of constrained peak capacity, \$/kVA of constrained peak capacity and the period of constraint.
- Evaluation over a ten-year period (a different period may be chosen provided a sound rationale is provided).
- Environmental and other external costs, wherever these reflect an existing or anticipated regulatory obligation of the distributor.
- The relative intrinsic risk profile or reliability of specific options and technologies will be assessed in accordance with normal commercial practice.

The recommendations of all the evaluations will be publicly announced. This announcement will include the total annualised cost of the recommended options to Integral.

All details of stakeholder proposals including cost information will be treated as public information unless clearly noted otherwise in writing by the proponent. The announcement will be released no longer than eight weeks after the closing date of submissions.

Stakeholders are also able to submit proposals for non-network options for constraint areas where RFPs have not been issued. This document facilitates these types of proposals. Integral will evaluate the financial benefits of these proposals in terms of deferring future capital investment on the network and in the determination of “avoided distribution costs”.

Feedback received

Integral has issued a number of RFPs for demand management services since the release of the *Demand Management Code of Practice*. The RFP documents provide detailed information on the network constraints and overload conditions as well as costing for the proposed network option. The likely financial incentives for demand management services were also provided.

While the initial interest for the RFP document had been strong, the response in terms of submitted proposals for demand reduction was low. A survey of customers that obtained the RFP document was conducted to determine the reason that proposals were not submitted. Several issues were identified which made proponents reluctant to pursue detailed investigation into demand management opportunities.

These issues included:-

- The proponent undertaking the demand management investigation bears the majority of risk associated with identifying demand management opportunities.
- A lot of time and effort is required in undertaking demand management investigations in terms of technical requirements only to find that the commercial aspects are not cost-effective.

- Potential proponents cannot afford the level of resource requirements to undertake these types of studies.
- Risks in undertaking demand management investigations need to be more equitably shared amongst the stakeholders.
- It is difficult to convince customers to accept demand reducing initiatives.
- There is a need to get customers interested first before discussing demand management.

A main thrust of these concerns is related to the equitable sharing of risk associated with undertaking demand management investigations.

Integral Energy has taken steps to help investigate the sharing of these risks. Subsequent RFP releases have resulted in an increase in the number of demand management proposals submitted. Integral sees this as a positive sign of the demand management services market starting to develop. Integral has also raised these issues in the Demand Management Code review-working group to highlight this issue to the industry and regulators.

Results to date

Integral has amended internal policies and procedures to align planning processes with the Demand Management Code of Practice. These revisions are to ensure that the requirements of the Code are formalised and integrated into the strategic network planning process. The improvements that Integral has implemented include:

- The development of a Demand Management Policy.
- The development of a Demand Management Annual Plan containing projects that require an RFP for demand management services.
- The development of a “Reasonableness Test”.
- The development of a “Register of Interested Parties”.
- The development of Electricity System Development Reviews (ESDRs) that meet the Code requirements.
- The issue of RFP documents as stipulated in the Demand Management Annual Plan and in accordance with the Demand Management Code of Practice (successive RFPs have attracted increased interest and submission of demand management proposals).

As stakeholders become more familiar with the ESDR (Annual Planning Statement) it is hoped that more proposals will be submitted in conjunction with submissions received through the RFP process.

2.0 Demand Management Strategy

Integral is an industry leader in seeking out and applying demand management initiatives to its growth-related capital planning process. Integral convened and led the Demand Management Code of Practice Working Group, inaugurated in 1998, and has taken a leadership role in continuing to develop the existing and revised Code in conjunction with key stakeholders.

Embracing demand management opportunities has been fundamental to Integral's network investment planning considerations. Integral has been pro-active in encouraging demand management initiatives to assist with the capacity of the network where constraints exist. The initiatives have involved both market-based and traditional network planning approaches.

Integral has continually demonstrated its willingness to be innovative in developing demand management alternatives. Integral's Interruptible Air Conditioning Trial was recognised¹ as being the first of its kind in Australia in the recent IPART inquiry into the Role of Demand Management and other options in the Provision of Energy Services. Other initiatives include the contracting of load reduction programs at times of network constraint with large customers and contracting demand management service providers to identify and implement a variety of demand management initiatives.

The scope of the demand management opportunities and initiatives considered by Integral is contained in our annual Network Demand Management Plan. Integral's approach to demand management is both embraced in Integral's Network Planning Policy and supported by procedures to integrate demand management into Integral's planning processes. This includes supporting the contracting of demand management opportunities with customers and demand management service providers.

A Network Demand Management Strategy has been developed which sets out the overriding principles and specific action plans for the investigation and development of demand management programs. One of the prime focus areas of this strategy is the development of a sustainable market for the provision of cost-effective non-network options. This is an important part of the long-term success of demand management.

The strategy also focuses on the development of long and short-term initiatives for demand reduction. The strategy also ensures that a public process is adopted by publishing Statements of Opportunity and Requests for Proposals (RFP) for demand management for specific system constraints in accordance with the Demand Management Code. The concept of the 'Standard Offer' will also be further developed and offered not only during the RFP process but also at an earlier stage to capture those opportunities that otherwise may be lost.

The RFP process works well for the development of short-term demand management strategies. IPART's draft decision for demand management expenditure cost recovery² also supports this strategy. The Tribunal's draft decision provides a strong incentive for network distributors to investigate and implement demand management programs that defer capital

¹ Source: "An assessment of residential demand side management technologies and programs" prepared by 'Mark Ellis & Associates' for 'SEDA' in May 2001, page 13.

² 'Treatment of Demand Management in the Regulatory Framework for Electricity Distribution Pricing 2004/05 to 2008/09' IPART Draft Decision.

expenditure in the current regulatory period. However, long-term demand management strategies require a broader perspective beyond the current regulatory period. Integral Energy will continue to work with IPART to ensure that longer term network benefits from demand management are not missed.

The above highlights that there are many components that contribute towards the successful implementation of a Demand Management Strategy, and many stakeholders whose needs must be considered.

Integral has recognised that to ensure the long-term success of Integral's Demand Management Strategy it is imperative to not just focus on Integral's direct demand management activities but to work with and influence the full range of stakeholders in this regard.

To ensure this success Integral is currently:

- working closely with local councils to introduce energy efficiency requirements as part of the development approval process;
- working with government bodies and councils, such as SEDA, to encourage energy efficiency and demand reducing initiatives within all sectors on the community;
- assisting in the development of regulation that meets the principles of demand management;
- working within and meeting regulatory requirements in the investigation and implementation of demand management initiatives; and
- Integral Energy supports energy efficiency performance rating systems that lead to more stringent energy efficient requirements for new housing and other developments. Two such rating systems are National Home Energy rating Scheme (NatHERS) and Building Sustainability Index (BASIX) in particular attempts to reduce the peak demand requirements of a dwelling, particularly for air conditioning.

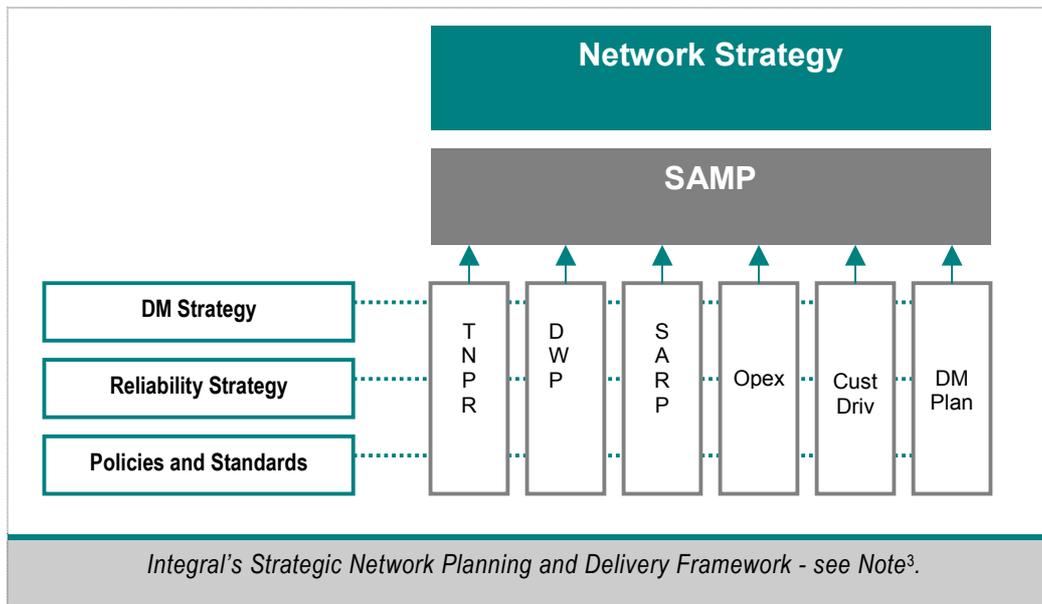
Integral is also supportive of the Tribunal's draft decision for cost recovery for demand management expenditure and lost revenue. This provides a positive signal for the implementation of cost effective demand management programs. Integral will continue to work with the Tribunal to investigate methods of recognising demand management expenditure that results in avoided distribution costs in future regulatory periods as well as network wide demand management expenditure.

3.0 Planning Process

The Integral Energy planning process integrates several elements relating to asset management strategies in terms of network and non-network options giving consideration to:

- safety and environmental issues;
- the service and reliability requirements of all Integral's customers;
- network capability, asset age, condition and performance as leading indicators of customer outcomes; and
- the requirements of Integral's shareholder and customers.

This framework is shown diagrammatically below.



Within this framework, Integral's planning is underpinned by an integrated and robust structure of policies, standards and procedures. This framework in turn supports development of public documents, including the 2004 Electricity System Development Review, which outline to stakeholders the future direction for the development of the network.

The 2004 Electricity System Development Review is an important part of the information gathering process for the development of cost-effective non-network and network options that feed into the planning investigation process.

³ TNPR: Transmission Network Planning Review
 DWP: Distribution Works Program
 SARP: Strategic Asset Renewal Plan
 SAMP: Strategic Asset Management Plan
 DM: Demand Management

Strategic asset management approach

Electricity networks are characterised by large, capital intensive assets with long lives of 35 years or more. The ten-year capital works program is set out in the SAMP and includes a detailed break down of the asset management outcomes and system solutions. The Strategic Asset Management Plan (SAMP) reflects plans and strategies that seek to align customer and technical drivers, improve long-term network asset values and identify opportunities where demand management may be feasible. The SAMP sets priorities and summarises the required investment in Integral's electrical network to maintain the ongoing capability of the network consistent with a "best in class" network asset manager.

The SAMP determines the required network expenditure in the areas of capacity driven capital expenditure, maintenance, refurbishment, and demand side management for a ten-year period. It draws together into a single coordinated asset management plan other more detailed strategic initiatives such as the:

- Demand Management Plan,
- Transmission Network Planning Report,
- Distribution Work Program,
- Strategic Asset Renewal Plan,
- Operating Expenditure Plan.

The development of the SAMP takes into account the drivers affecting the network business, including Integral's customer needs, environmental issues, network condition, business and financial challenges and opportunities.

The SAMP growth related major projects are the starting point for the development of the Demand Management Plan. Each item is passed through a reasonableness test which is further described below.

Demand management plan

The Demand Management Code of Practice calls for a 'Reasonableness Test' to be performed for all capital projects to determine if a public process is required for investigating non-network alternatives. Integral performs this test and summarises the results of in its annual Network Demand Management Plan (DM Plan). If the reasonableness test concludes that a public process is not warranted Integral may still perform an in-house investigation with specific major customers to identify potential demand reduction. In-house demand management investigations are also incorporated into the annual DM Plan.

The scope of demand management opportunities and initiatives considered by Integral is provided in the DM Plan. The plan contains a three year program of investigations and is supported by the inclusion of all areas under investigation in the 'Register of Interested Parties' list on Integral's web-site. This register allows interested parties to register their interest in any of the areas under investigation to ensure that all information relating to the constraint area is received.

The investigation areas included in the 2004/2005 Demand Management Plan are detailed in the two tables below. They include both the public RFP process and the in-house investigation projects.

RFP Projects and Target Dates				
Project	Year	RFP Issue	RFP Results	Decision
Campbelltown CBD	2004/05	Dec 2004	May 2005	Aug 2005
Quakers Hill ZS	2004/05	Dec 2004	May 2005	Aug 2005
Bonnyrigg ZS	2004/05	Dec 2004	May 2005	Aug 2005
Mt. Ousley ZS	2005/06	Nov 2005	May 2006	Aug 2006
South Granville ZS	2005/06	Nov 2005	May 2006	Aug 2006
Moorebank Industrial Area	2006/07	Nov 2006	May 2007	Aug 2007
Caddens ZS (future)	2006/07	Nov 2006	May 2007	Aug 2007
Doonside ZS	2006/07	Nov 2006	May 2007	Aug 2007
<i>Program of Investigations for RFP Process</i>				

Projects for In-house DM Investigation	
Project	Completion Date
Westmead ZS	Upon load application
<i>Planned In-house DM Investigations</i>	

The items that have been identified for in-house demand management investigation are those that have not passed the 'Reasonableness Test' but may have a possible non-network alternative via one or more major customer, generally those responsible for creating the peak demand.

Integral's approach to demand management is both embraced in its Network Planning Policy⁴ and supported by procedures to integrate demand management into the planning processes. This approach includes supporting the contracting of demand management opportunities with customers and/or demand management service providers. The DM Plan ensures that potential demand management proponents are provided with sufficient time to undertake their investigations into non-network alternatives and develop detailed submissions.

As a result of the DM Plan, Integral publishes Statements of Opportunity and Requests for Proposals for demand management in a timely manner for specific system constraints where application of the Code has determined that opportunities may be viable. These documents also provide opportunities for all stakeholders to obtain further information and submit proposals for non-network options.

Supply security standards and network loading

Integral has adopted supply security standards that match internationally accepted approaches to risk management. These standards are set out in a number of network management policies and standards, which are used to determine current and future development of the network.

⁴ Integral Energy Network Asset Management Company Policy 9.2.1 – Network Planning

Supply security planning standards provide the basis or framework for decisions about the most suitable way to provide supply capacity to customers. Supply capacity and supply security planning standards come at an economic cost to the community. Integral attempts to maintain a balance between an appropriate level of capacity, appropriate supply security planning standards and the cost of electricity to customers.

The implementation of supply security planning standards may lead to single or multiple network elements being used to provide supply capacity, subject to the customers' needs, Integral's business needs and the overall cost to the community. The size and number of elements used to provide supply capacity will be influenced by the significance of the load they supply and the cost of the alternatives. Supply security planning standards are a generic set of guidelines which balance the requirements of customers, Integral and the community, however the implementation of the standards can vary on a case by case basis, depending upon the particular needs of a customer, or the risk exposure of Integral.

It is important to note that while new works are to be specified in accordance with current supply security planning standards, previous works may have been constructed to earlier standards.

Customer demand density

Integral's network area, particularly Western Sydney, has experienced strong growth in recent years. This growth is not only reflected in the number of new customers connecting to the network, but also in the increase in demand that existing customers place on the network. One way of measuring this is to review the After Diversity Maximum Demand (ADMD) for various customer classes. ADMD is a measure of the impact of customers (by class) on the network, taking account of the coincidence of peak use. It is used by network planning and design staff when developing plans for the network.

The table below shows typical changes to the ADMD design criteria that have been applied because of the measured increase in demand within Integral's network. In newer release areas where rapid growth has occurred the network is now inadequate to supply customers' demand for electricity in accordance with Integral's planning standards.

Area	Network Design Criteria	
	Pre 2000	Post 2000
	KVA per lot	KVA per lot
Western Sydney	3.5 – 4.0	6.0 - 7.5
South Coast	3.5 – 4.0	5.0 - 6.5
Sth Highlands, Blue Mountains	3.5 – 4.0	5.5 – 7.0
<i>Typical Changes in After Diversity Maximum Demand for Medium House (large villa, town house, apartment)</i>		

These high peak demands appear on the network for relatively short periods of time. Demand management initiatives need to address these high peak demands that usually occur after consecutive hot days. Low energy efficient housing and falling prices for air conditioning have contributed to the increase in electrical demand.

Embedded generation

Embedded generation growth is steady, with a forecasted need to connect several new generators per annum, for the next five years and beyond. These generators may assist deferral of network capital expenditure.

Deregulation of the electricity industry, in concert with increased international desires to reduce greenhouse gas emissions⁵, is promoting the increased establishment of embedded generation facilities. Integral is also encouraging embedded generation as a demand management initiative.

The existing and possible future use of embedded generation in the electricity network has created the need to review current network planning, network configuration and construction standards, which are considered by Integral in its asset management planning.

Network reactive demand

The reactive power demand on the Integral network has in recent years been increasing at a significant rate. This increase has resulted in equipment rating at various levels of the network being exceeded. Additionally the high Reactive Power demand reflected onto the main NSW electricity grid (operated by TransGrid) imposes an increasing risk of network instability at times of peak summer load. The concern extends from the TransGrid 330kV Main Grid network to the various levels of the Integral network.

One of the major factors contributing to the increasing overall summer demand has been the increased reactive power demand of commercial and residential customer air conditioning equipment. This demand is seen by all elements of the network, from the customer installation through to the zone and transmission substations and ultimately impressed on the TransGrid Bulk Supply Points.

The need to address the reactive load on the network has seen major power factor correction programs focused both at the customer level and the network.

⁵ Through co-generation and methane conversion, Integral has recorded the greatest success of any other electricity retailer in reducing greenhouse gas emissions in NSW. Since 1996, Integral has eliminated 11 million tonnes of greenhouse gas, by purchasing energy from two alternative plants located in its supply area at Smithfield and Appin.

4.0 Details of Capacity Constrained Network

This document provides a detailed description of the zone substations that exceed capacity limitations within a five year period. It is divided into several levels being:

- Regions
- Area
- Transmission substation

Each transmission substation contains a table of equipment detailing their installed and emergency/cyclic rating. It then provides a load forecast table for each zone substation and the transmission substation total detailing the capacity rating and the 'Load at Risk'. This represent the level the peak demand exceeds the emergency/cyclic rating.

For each zone substation that exceeds its capacity limit within the first five years, there is a separate page providing details of the load profile for the peak demand day and a description of the load characteristics and area of supply. Also detailed are the proposed and potential network and non-network options.

The 'Details of Capacity Constrained Network' are provided from section 7 onwards.

5.0 Summary of Capacity Constraints

Current Year Forecast Year	2003 2009	Summer			Winter			Possible Constraint Relief Project	Project Ref. Number
		A	B	A-B	A	B	A-B		
Zone Substation / Transmission Substation	Total Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity		
SOUTH COAST AREA									
Bellambi TS	180	132	80.0	52.0	132	79.2	52.8		
Bulli	20	11	12.0	(-1.0)	11	14.5	(-3.5)	Russel Vale ZS-augment	PR 061
Corrimal	38	21	20.3	0.7	21	25.3	(-4.3)	Mt Ousley ZS-establish	PR100
Helensburgh	25	14	15.0	(-1.0)	14	15.1	(-1.1)	Helensburgh ZS-augment	PR122
North Wollongong	40	22	30.9	(-8.9)	22	32.3	(-10.3)	Mt Ousley ZS-establish	PR100
Russell Vale	20	11	11.7	(-0.7)	11	16.1	(-5.1)	Russel Vale ZS-augment	PR 061
Wombarra	10	6	4.3	1.7	6	6.0	0.0		
Ulladulla **	60	33	26.2	6.8	33	28.0	5.0		
Yatte Yattah **	5	5	4.5	0.5	5	4.2	0.8		PR309
Mt Terry TS	240	130	118	12.0	130	133	(-3.0)	Under investigation	
Albion Park	25	25	21	4.0	25	22.6	2.4		
Dapto	40	22	27.8	(-5.8)	22	25.2	(-3.2)	Dapto ZS-augment	PR148
Gerrington	10	5.5	7.6	(-2.1)	5.5	8.2	(-2.7)	Gerrington ZS-augment	PR149
Jamberoo	3.75	4.0	2.5	1.5	4.0	2.8	1.2		
Kiama	31.25	21	13.7	7.3	21	17.4	3.6		
Shellharbour	40	22	30.7	(-8.7)	22	32.2	(-10.2)	Shellharbour ZS-augment	PR124
Warilla	32.5	22	16.1	5.9	22	22.2	(-0.2)	Under investigation	
Outer Harbour TS	120	60	47.5	12.5	60	47.5	12.5		
Port Central	38	19	11.4	7.6	19	11.5	7.5		
Shoalhaven TS	180	130	114	16.0	130	116	14.0		
Berry	10	6.0	7.8	(-1.8)	6.0	7.8	(-1.8)	Berry ZS-augment	PR096
Bolong	12.5	12.5	5.3	7.2	12.5	3.6	8.9		
Bomaderry	30	20	16.2	3.8	20	19.1	0.9		
Culburra	20	11	9.2	1.8	11	11	0.0		
Huskisson	40	22	20.6	1.4	22	21.6	0.4		
Kangaroo Valley	7.5	3.0	2.7	0.3	3.0	2.7	0.3		
Nowra	30	17	20.7	(-3.7)	17	18.4	(-1.4)	Nowra ZS-augment	PR121
South Nowra	22.5	11	13.1	(-2.1)	11	10.1	0.9	South Nowra ZS-augment	PR154
Sussex Inlet	10	5.5	6.2	(-0.7)	5.5	7.5	(-2.0)	Sussex Inlet ZS-augment & 33kV feeder	PR155, 211

Current Year Forecast Year	2003 2009	Summer			Winter			Possible Constraint Relief Project	Project Ref. Number
		A	B	A-B	A	B	A-B		
Zone Substation / Transmission Substation	Total Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity		
Springhill TS	180	130	150	(-20.0)	130	171.3	(-41.3)	End-of-life replacement strategy	
Inner Harbour	25	13	10.8	2.2	13	13.9	(-0.9)	Under investigation	
Kenny Street	50	27	28.1	(-1.1)	27	16.6	10.4	Under investigation	
Kembla Grange	10	11	24.6	(-13.6)	11	16.4	(-5.4)	Kembla Grange ZS-augment stage 2	PR066
Port Kembla	30	20	11.7	8.3	20	13.6	6.4		
South Wollongong	38	20	14.1	5.9	20	14.6	5.4		
Unanderra	36	26	28.6	(-2.6)	26	29.4	(-3.4)	Cordeaux/Figtree ZS-establishment	PR200
West Wollongong	32.5	22	26.2	(-4.2)	22	29.5	(-7.5)	Mt Ousley ZS-establish	PR100
SOUTHERN HIGHLANDS									
Fairfax Lane TS	180	88	75.8	12.2	88	82.3	5.7		
Bowral	32.5	22	18.1	3.9	22	20.2	1.8		
Mittagong	25	13.5	13.3	0.2	13.5	16.8	(-3.3)	Mittagong ZS-augment	PR303
Moss Vale	50	27	16.2	10.8	27	20.3	6.7		
Ringwood	25	14	6.6	7.4	14	7.5	6.5		
Robertson	7.5	3.8	5.3	(-1.5)	3.8	5.7	(-1.9)	Robinson ZS-augment	PR304
Tycan/Tyree	2.5	2.5	2	0.5	2.5	2	0.5		
MACARTHUR AREA									
Bow Bowing	70	38	56.3	(-18.3)	38	51	(-13.0)	Bow Bowing ZS-currently being augmented	PR023, 262
Kentlyn	66	36	39	(-3.0)	36	39.6	(-3.6)	Kentlyn ZS-augment	PR107, 152
Macquarie Fields	66	36	32.1	3.9	36	34	2.0		
Minto	101	68	64.5	3.5	68	60.2	7.8		PR190
Nepean 33kV TS	120	66	71.8	(-5.8)	66	58.8	7.2	Convert Nepean TS to full 132kV operation	PR300
Camden	75	55	53.9	1.1	55	43	12.0	Rebuild Camden ZS, Mt Hunter ZS-new	PR299, 206
Oakdale	20	11	8.7	2.3	11	8.3	2.7		
Warragamba	10	5.5	9.5	(-4.0)	5.5	8	(-2.5)	Warragamba ZS-augment	PR318
Nepean 66kV TS	240	130	104.2	25.8	130	88.5	41.5		
Ambarvale	70	38	30.1	7.9	38	30.4	7.6		
Appin	8	8	9	(-1.0)	8	7.3	0.7	Appin ZS-augment	PR305
Campbelltown	70	38	41.9	(-3.9)	38	31.1	6.9	Campbelltown ZS-augment	297, 73, 152
Maldon	20	11	20.4	(-9.4)	11	18.9	(-7.9)	Maldon ZS-augment, The Oaks ZS-establish	051, 205, 277
Narellan	40	22	35.8	(-13.8)	22	25.9	(-3.9)	Narellan ZS-augment	PR238
Tahmoor	10	11	14.3	(-3.3)	11	12.7	(-1.7)	Tahmoor ZS-augment	PR051

Current Year Forecast Year	2003 2009	Summer			Winter			Possible Constraint Relief Project	Project Ref. Number
		A	B	A-B	A	B	A-B		
Zone Substation / Transmission Substation	Total Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity		
LIVERPOOL AREA									
Guildford TS	240	180	91.4	88.6	180	69.8	110.2		
Cabramatta	50	27	29.5	(-2.5)	27	26.5	0.5	Chipping Norton-establish or Cabramatta-aug	PR126
Carramar	50	27	21.7	5.3	27	20.3	6.7		
Fairfield	51.75	37	37.1	(-0.1)	37	32	5.0		PR274
Sherwood	50	27	32.7	(-5.7)	27	28.3	(-1.3)	Sherwood ZS and 33kV feeder-augment	PR144, 094
Smithfield	50	27	38.6	(-11.6)	27	33.3	(-6.3)	Smithfield ZS-augment	PR145
South Granville	40	21.5	24.7	(-3.2)	21.5	21.3	0.2	South Granville ZS-augment	250, 272, 273
Woodpark	50	27	26.2	0.8	27	25.2	1.8		
Yennora	50	45	26	19.0	45	21.3	23.7		
West Liverpool TS	360	265	416.8	(-151.8)	265	322.7	(-57.7)	East Liverpool TS-establish	59, 060, 201 202, 204, 321
Anzac Village	50	27	38	(-11.0)	27	35.2	(-8.2)	Anzac Village ZS-augment, Holsworthy ZS-new	PR168, 170
Bonnyrigg	75	55	67.6	(-12.6)	55	55.7	(-0.7)	Bonnyrigg-augment, Wakely/Abbotsbury ZS-new	319, 320, 208
Canley Vale	45	32	28.1	3.9	32	26.9	5.1		
Homepride	50	55	44.8	10.2	55	42	13.0		
Hoxton Park	57.5	39	80.3	(-41.3)	39	36.6	2.4	Aerodrome ZS-establish	PR065
Kemps Creek	20	11	17.9	(-6.9)	11	16.1	(-5.1)	Kemps Creek ZS-augment, Aerodrome ZS-new	PR328, 065
Liverpool	70	38	57.6	(-19.6)	38	56.7	(-18.7)	Liverpool-augment, Liverpool Nth ZS-establish	PR103, 081
Moorebank	75	55	55.5	(-0.5)	55	46.8	8.2	Chipping Norton-establish or Cabramatta-aug	PR126
Prestons	50	27	44.9	(-17.9)	27	32.2	(-5.2)	Prestons ZS-augment, Edmondson Park ZS	156, 97, 110
PENRITH AREA									
Penrith TS	180	132	203.1	(-71.1)	132	174.9	(-42.9)	Penrith TS-augment	PR052
Cambridge Park	50	27	40.4	(-13.4)	27	34.9	(-7.9)	Cambridge Park ZS-augment	PR146
Cranebrook	75	53	52.9	0.1	53	41.6	11.4		
Emu Plains	50	27	35.1	(-8.1)	27	30.4	(-3.4)	Emu Plains ZS-augment	PR143
Kingswood	75	55	65.7	(-10.7)	55	51.6	3.4	Caddens ZS-establish	PR070
Luddenham	12	7	11.1	(-4.1)	7	8.3	(-1.3)	Luddenham ZS-augment	PR198
Glenmore Park	37.5	25	36.1	(-11.1)	25	27.8	(-2.8)	Glenmore Park-augment	PR048, 167
Penrith 11 kV	130	130	54.8	75.2	130	42.9	87.1		
BLUE MOUNTAINS AREA									
Ilford TS	30	30	18.2	11.8	30	17.8	12.2		
Bylong	3	1.5	0.9	0.6	1.5	0.4	1.1		
Ilford Hall	2.5	2.5	0.5	2.0	2.5	0.5	2.0		
Kandos	10	5.5	5.9	(-0.4)	5.5	6.5	(-1.0)	Under investigation	

Current Year Forecast Year	2003 2009	Summer			Winter			Possible Constraint Relief Project	Project Ref. Number
		A	B	A-B	A	B	A-B		
Zone Substation / Transmission Substation	Total Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity		
Katoomba North TS	60	60	29.6	30.4	60	40.1	19.9	Katoomba Nth TS does not have firm capacity	PR240
Blackheath	14	8	5.7	2.3	8	8.9	(-0.9)	Blackheath ZS-augment	PR263
Katoomba	50	27	17.2	9.8	27	23.7	3.3		
Wentworth Falls	10	10	6.7	3.3	10	9.6	0.4		
Lawson TS	104	52	26.9	25.1	52	25.7	26.3		
Hazelbrook	50	27	11.4	15.6	27	13.2	13.8		
Mt Piper TS	240	120	29.5	90.5	120	35.6	84.4		
Blackmans Flat	20	11	6.3	4.7	11	7.5	3.5		
Hartley Vale	5	2.5	1.8	0.7	2.5	1.1	1.4		
Lithgow	60	30	16	14.0	30	20.7	9.3		
Meadow Flat	2.5	2.5	0.9	1.6	2.5	1.3	1.2		
Portland	20	10	3.4	6.6	10	3.5	6.5		
Warrimoo TS	120	66	56.5	9.5	66	59	7.0		
Blaxland	70	38	28	10.0	38	28	10.0		
Springwood	70	38	28.2	9.8	38	28.1	9.9		
HAWKESBURY AREA									
Hawkesbury TS	240	130	172	(-42.0)	130	142.6	(-12.6)	Hawkesbury TS-augment	PR101
Cattai	22	11	15	(-4.0)	11	10.6	0.4	Cattai ZS-end-of-life asset replqcement	PR058, 310
Glossodia	20	11	15.9	(-4.9)	11	9.2	1.8	Nth Richmond ZS-augment-offload Glossodia	PR049
Kurrajong	20	11	15.6	(-4.6)	11	12.1	(-1.1)	Nth Richmond ZS-augment-offload Kurrajong	PR049
North Richmond	25	25	15.1	9.9	25	21.9	3.1		
Richmond	50	27	26.6	0.4	27	17.3	9.7		PR157, 158
Riverstone	50	27	30.3	(-3.3)	27	26.1	0.9	Riverstone ZS-augment	PR174
South Windsor	50	27	31.4	(-4.4)	27	26.2	0.8	South Windsor ZS-augment	PR020
Windsor	40	22	22.8	(-0.8)	22	15.2	6.8	South Windsor ZS-augment	PR020
Wisemans	6	6	6.4	(-0.4)	6	5.3	0.7		
BLACKTOWN AREA									
Baulkham Hills TS	240	198	182.7	15.3	198	167.6	30.4		PR267
Baulkham Hills 11 kV	70	35	27.9	7.1	35	27.8	7.2		
Jasper Rd	75	55	50	5.0	55	43.6	11.4	Baulkham Hills 11kV ZS-establish	PR035, 076
North Rocks	50	28	25.7	2.3	28	24	4.0		
Northmead	55	44	25.5	18.5	44	23.7	20.3		
Seven Hills	75	45	37.2	7.8	45	33.6	11.4	Baulkham Hills 11kV ZS-establish	PR035
Westmead	50	28	32.9	(-4.9)	28	23.5	4.5	Westmead ZS & 33kV feeders-augment	115, 95, 266

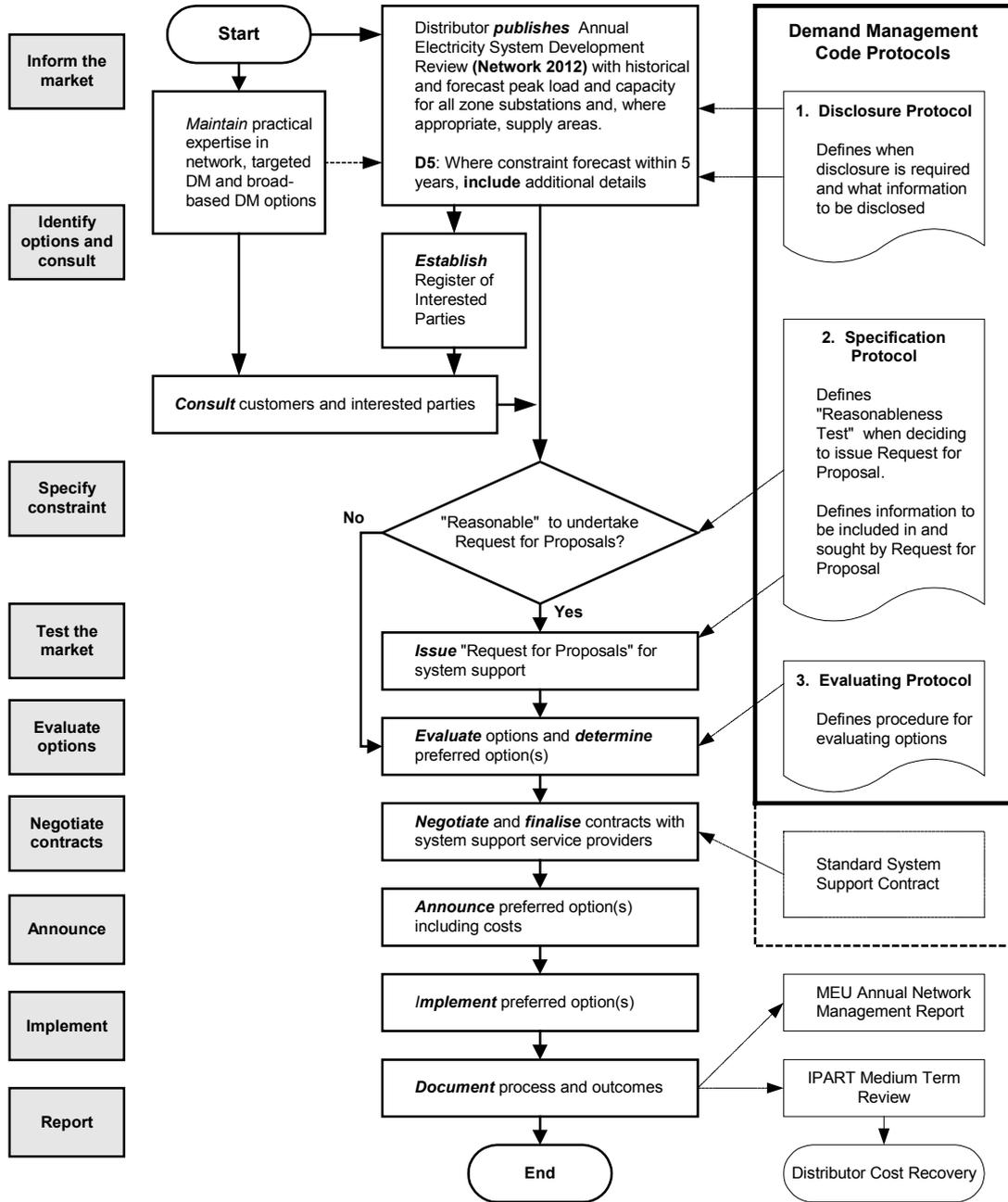
Current Year Forecast Year	2003 2009	Summer			Winter			Possible Constraint Relief Project	Project Ref. Number
		A	B	A-B	A	B	A-B		
Zone Substation / Transmission Substation	Total Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity		
Blacktown TS	360	375	363.7	11.3	375	283.9	91.1		
Bossley Park	70	37	46.8	(-9.8)	37	23.3	13.7	Wetherill Park West & Abbotsbury ZSs-establish	PR022, 208
Doonside	50	37	41.3	(-4.3)	37	38.5	(-1.5)	Doonside ZS-augment	PR090
Greystanes	50	27	32.4	(-5.4)	27	26.1	0.9	Greystanes ZS-augment, Quarries ZS-rebuild	PR082, 069
Holroyd	51.75	37	35.9	1.1	37	25.3	11.7		
Leabons Lane	50	28	33.2	(-5.2)	28	29.9	(-1.9)	Leabons Lane ZS-augment-DM implemented	PR043
Marayong	75	50	47.5	2.5	50	48.2	1.8	New fdr & new zone substation	PR046, 317
Newton	50	27	35.9	(-8.9)	27	24.4	2.6	Newton ZS-augment	PR047, 133
Prospect	45	32	34.6	(-2.6)	32	28.5	3.5	Under investigation	
Mt Druitt TS	240	130	180.4	(-50.4)	130	119.2	10.8	Mt Druitt TS-augment	PR018
Erskine Park	Decommission				15				
Horsley Park	50	27	33.7	(-6.7)	27	16.9	10.1	Wetherill Park West-establish	PR022
Plumpton	50	27	34.9	(-7.9)	27	35.4	(-8.4)	Plumpton ZS-augment	PR189
St Marys	69	48	35.6	12.4	48	26.3	21.7		
Werrington	45	33	38.6	(-5.6)	33	30.6	2.4	Werrington ZS-augment, ADI ZS-establish	PR017, 067
Whalan	50	27	30.4	(-3.4)	27	25.2	1.8	Under investigation	
				21.0					
Kellyville	74	27	35.5	(-8.5)	27	29	(-2.0)	Kellyville ZS-augment to 132kV	PR181
Kenthurst	80	27	28.5	(-1.5)	27	23.8	3.2	Convert Kenthurst ZS to 132kV	PR139
Arndell Park	90	45	50.1	(-5.1)	45	44	1.0	Arndell Park ZS-augment	PR042
Bringelly	44	20	15.6	4.4	20	14.5	5.5	Convert Bringelly to 132kV-south west sector	PR302
Mamre	Future		39	6.0		36.7	8.3		
North Parramatta	110	55	42.5	12.5	55	38	17.0		
Quakers Hill	50	27	44.6	(-17.6)	27	37.9	(-10.9)	Quakers Hill ZS-augment to 132kV	054, 311to313
Rooty Hill	90	45	45.3	(-0.3)	45	38.9	6.1	Glendenning ZS-new, 132 kV Busbar at Rooty	PR032,053
Wetherill Park East	90	40	51.8	(-11.8)	40	39.5	0.5	Wetherill Park West-establish	PR022, 245
Wetherill Park West	Future				45	29	16.0		
PARRAMATTA AREA									
Camellia TS	360	250	137.2	112.8	250	148.3	101.7		
Granville	33	18	21.3	(-3.3)	18	17.4	0.6	Parramatta East ZS-establish, Granville rebuild	PR091, 308
Lennox	50	25	39.9	(-14.9)	25	34.8	(-9.8)	Lennox ZS-augment, Parramatta East-establish	PR019, 091
Parramatta	75	45	46.3	(-1.3)	45	33.8	11.2	Parramatta East, Parramatta West ZS-establish	091, 092, 93
Rosehill	50	27	23.8	3.2	27	21.1	5.9		

Current Year Forecast Year	2003 2009	Summer			Winter			Possible Constraint Relief Project	Project Ref. Number
		A	B	A-B	A	B	A-B		
Zone Substation / Transmission Substation	Total Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity	Current Firm/cyclic Rating	Forecast year peak load	Spare Capacity		
Carlingford TS	480	370	276.6	93.4	370	308.3	61.7		
Castle Hill	50	35	25.4	9.6	35	35.6	(-0.6)	North Castle Hill ZS-establish	PR176, 117
Dundas	80	45	41.3	3.7	45	46.6	(-1.6)	Dundas ZS-augment	PR270
Rydalmere	91	58	47.1	10.9	58	38.7	19.3		
West Pennant Hills	70	37	30.9	6.1	37	28.1	8.9		
Bella Vista	Future	45	37.2	7.8	45	34.2	10.8		
North Castle Hill	Future	65	19	46.0	65	18	47.0		PR176, 117
Parklea	90	45	78.6	(-33.6)	45	61.2	(-16.2)	Parklea ZS-augment	PR172
West Castle Hill	130	65	58.2	6.8	65	58.3	6.7		

6.0 Glossary

ABC	Aerial bundled cable
ACCC	Australian Competition and Consumer Commission
BSP	Bulk Supply Point
DSM	Demand Side Management
IPART	Independent Pricing and Regulatory Tribunal
LDC	Load Drop Compensation
MEU	Ministry of Energy and Utilities
NECA	National Electricity Code Administrator
NEMMCO	National Electricity Market Management Company
REACTIVE POWER (kVAr):	The energy required by all electrical appliances and the network to facilitate the transport of electricity and the operation of those appliances. Reactive power is not consumed by appliances, but is required by them to maintain satisfactory operating conditions.
REAL POWER (kW):	The electrical energy consumed by appliances as part of their normal operation.
RIC	Rail Infrastructure Corporation
SCADA	Supervisory control and data acquisition (computer program for remote control of the supply network)
TS	Transmission Substation
ZS	Zone Substation
A	Ampere (or amp) - unit in which electrical current flow is measured
Ohm	Unit in which the resistance to the flow of an electric current is measured
V	Volt - the unit of electrical potential or electromotive force
W	Watt - a measure of the power present when a current of one ampere flows under a pressure of one volt through a resistance of 1 ohm
kW	Kilowatt - one kW = 1,000 watts
kWh	Kilowatt hour - the standard unit of energy which represents the consumption of electrical energy at the rate of one kilowatt over a period of one hour
kV	Kilovolt - one kV = 1,000 volts
kVA	Kilovolt ampere a unit of apparent power in an alternating current circuit, equal to 1,000 volt amperes
MVA	Megavolt ampere - a unit commonly used when expressing the rating of a transformer
MW	Megawatt - one MW = 1,000 kilowatts or one million watts
MWh	Megawatt hour - one MWh = 1,000 kilowatt hours
GWh	Gigawatt hour - one GWh = 1,000 megawatt hours or one million kilowatt hours

Appendix A – Electricity System Development Procedure



Reproduced from Ministry of Energy and Utilities NSW Code of Practice Demand Management for Electricity Distributors

Appendix B – Stakeholder proposals

Stakeholder proposals may involve an individual project or an aggregation of a number of projects and should include:

the name, address and contact details of the party making the proposal;

the name, address and contact details of the party responsible for the system support option (if different to above);

a brief explanation of the relevance of the proposal;

the size, type and location of load(s) that can be reduced, shifted, substituted or interrupted;

the size, type and location of generators that can be utilised if required;

the type and location of action or technology proposed to reduce peak demand/ provide electricity system support;

the time required to implement these measures, and any period of notice required before loads can be interrupted or generators started;

an estimate of the expected reliability expressed in terms of the availability factor of the option for that portion of the required period for which the option is offered (i.e. the probability that the option will be available if called upon);

other relevant information, including environmental impacts;

the level and availability of electricity system support from this proposal;

the level of initial payment required (\$ and/ or \$/kVA);

the level of availability payment required (\$/MVAh);

the level of dispatch payment required (\$/MVAh); and

the level of compensation payment payable to the distributor in the event of failure to provide system electricity system support when required (\$/MVAh).

SOUTHERN REGION

7.0 South Coast Area

Bellambi Transmission Substation

7.1.1 Bellambi Transmission Substation Status

Bellambi TS is owned by Integral Energy. It has 3 x 60 MVA 132/33 kV transformers with a firm cyclic capacity of 156 MVA. This substation is supplied from TransGrid's Dapto BSP via two 132 kV feeders, 980 and 981, each having a rating of 163/207 MVA summer/winter.

7.1.2 Bellambi Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Bellambi TS	3 x 60	180	132
Bulli	2 x 10	20	11
Corrimal	2 x 19	38	21
Helensburgh	2 x 12.5	25	14
North Wollongong	2 x 20	40	22
Russell Vale	2 x 10	20	11
Wombarra	2 x 5	10	6

7.1.3 Bellambi Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Bulli	MVA	8.4	8.2	8.5	9.3	8.5	9.6	9.8	10.7	11.3	11.7	11.9	12.0	12.1	12.2	12.3	12.4
	Rating	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
	MVA LAR										0.3	0.7	0.9	1.0	1.1	1.2	1.3
Corrimal	MVA	16.1	17.2	16.5	18.7	16.7	18.4	18.5	19.0	19.5	19.8	20.1	20.3	20.6	20.8	21.1	21.3
	Rating	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	MVA LAR																0.1
Darkes Forest	MVA	1.1	1.0	0.9	1.2	1.0	1.1	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4
	Rating																
	MVA LAR																
Helensburgh	MVA	9.1	6.6	8.3	10.6	10.5	11.3	12.3	12.8	13.4	13.9	14.5	15.0	15.6	16.1	16.7	17.2
	Rating	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
	MVA LAR											0.5	1.0	1.6	2.1	2.7	3.2
North Wollongong	MVA	16.7	17.6	18.1	19.2		21.0	23.2	26.7	28.7	29.8	30.3	30.9	31.5	32.0	32.6	33.1
	Rating	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
	MVA LAR							1.2	4.7	6.7	7.8	8.3	8.9	9.5	10.0	10.6	11.1
Russell Vale	MVA	9.7	10.8	9.0	10.1	10.0	10.3	11.6	11.6	11.6	11.7	11.7	11.7	11.7	11.8	11.8	11.8
	Rating	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
	MVA LAR							0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8
Combined Mines and Collieries	MVA	8.8	10.7	10.6	10.6	10.2	6.7	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Rating																
	MVA LAR																
Wombarra	MVA	3.4	3.8	3.7	3.8	4.3	3.5	4.0	4.0	4.1	4.2	4.2	4.3	4.4	4.4	4.5	4.6
	Rating	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	MVA LAR																
Bellambi TS	MVA	60.5	58.6	56.2	64.1	50.2	70.2	67.7	72.4	75.4	77.4	78.8	80.0	81.3	82.6	83.9	85.1
	Rating	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0	156.0
	MVA LAR																

Note: LAR denotes Load at Risk

7.1.4 Bellambi Transmission Substation Winter Demand Forecast

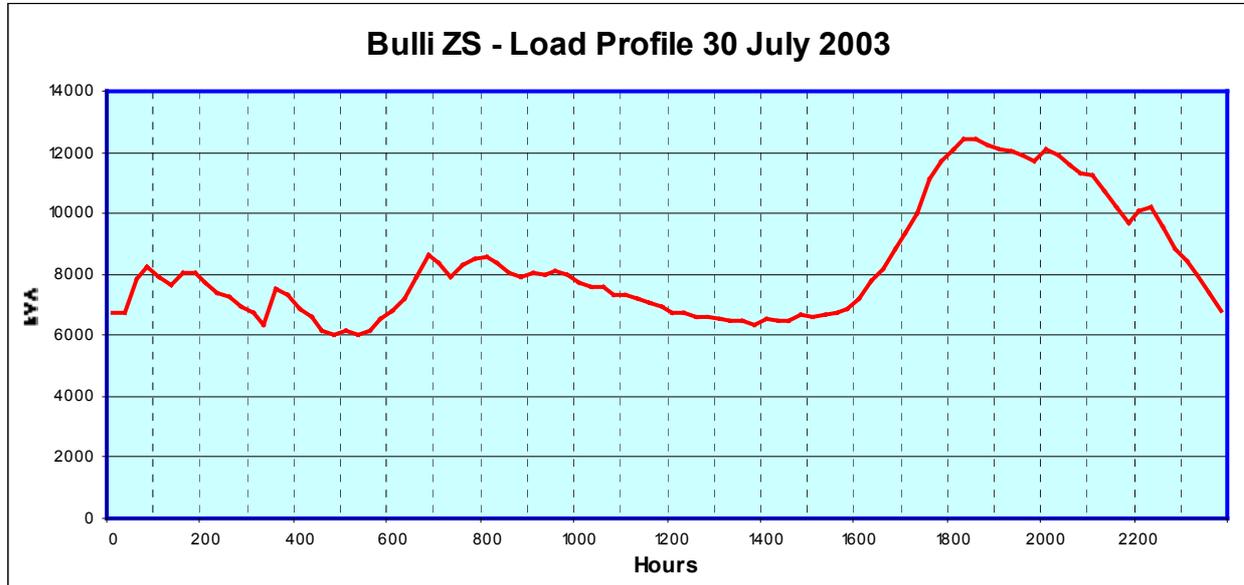
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bulli	MVA	11.2	12.1	11.0	11.6	11.8	12.4	12.0	12.4	13.0	13.6	14.1	14.3	14.5	14.7	14.8	15.0
	Rating	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
	MVA LAR	0.2	1.1		0.6	0.8	1.4	0	1.4	2.0	2.6	3.1	3.3	3.5	3.7	3.8	4.0
Corrimal	MVA	19.4	21.0	20.7	20.9	20.9	22.3	22.6	23.3	23.8	24.2	24.6	24.9	25.3	25.7	26.0	26.4
	Rating	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	MVA LAR						1.3	1.6	2.3	2.8	3.2	3.6	3.9	4.3	4.7	5.0	5.4
Darkes Forest	MVA	0.9	1.0	1.0	1.0	1.2	1.0	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.4
	Rating																
	MVA LAR																
Helensburgh	MVA	11.1	12.1	10.4	13.4	13.1	14.0	14.2	14.4	14.5	14.6	14.8	14.9	15.1	15.2	15.4	15.5
	Rating	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
	MVA LAR							0.2	0.4	0.5	0.6	0.8	0.9	1.1	1.2	1.4	1.5
North Wollongong	MVA	18.0	18.2	19.4	22.6	20.6	22.0										
	Rating	22.0	22.0	22.0	22.0	22.0	22.0										
	MVA LAR				0.6												
Russell Vale	MVA	12.0	13.0	13.5	13.9	13.6	13.9	14.0	15.4	15.6	15.7	15.8	15.9	16.1	16.2	16.3	16.4
	Rating	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
	MVA LAR	1.0	2.0	2.5	2.9	2.6	2.9	3.0	4.4	4.6	4.7	4.8	4.9	5.1	5.2	5.3	5.4
Combined Mines and Collierys	MVA	10.6	10.6	10.6	10.0	10.4	6.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
	Rating																
	MVA LAR																
Wombarra	MVA	4.5	5.4	4.6	5.3	5.2	5.0	5.3	5.4	5.5	5.6	5.7	5.9	6.0	6.1	6.2	6.3
	Rating	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	MVA LAR													0.1	0.2	0.3	
Bellambi TS	MVA	81.5	81.1	81.9	91.6	86.2	85.0	72.0	73.7	75.0	76.3	77.4	78.3	79.2	80.0	80.9	81.8
	Rating	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0
	MVA LAR																

Note: LAR denotes Load at Risk

7.1.5 Constrained Zone Substation Load Profiles, Information and Options

Bulli Zone Substation

Load Profile



Load Characteristics

Bulli ZS supplies a predominantly residential area on the coastal strip north of the Wollongong CBD. It is a typical residential load profile driven by residential winter evening peak loads made up of mainly space heating and cooking. Bulli ZS has a firm rating of 10 MVA and a cyclic rating of 11 MVA.

Options

Network

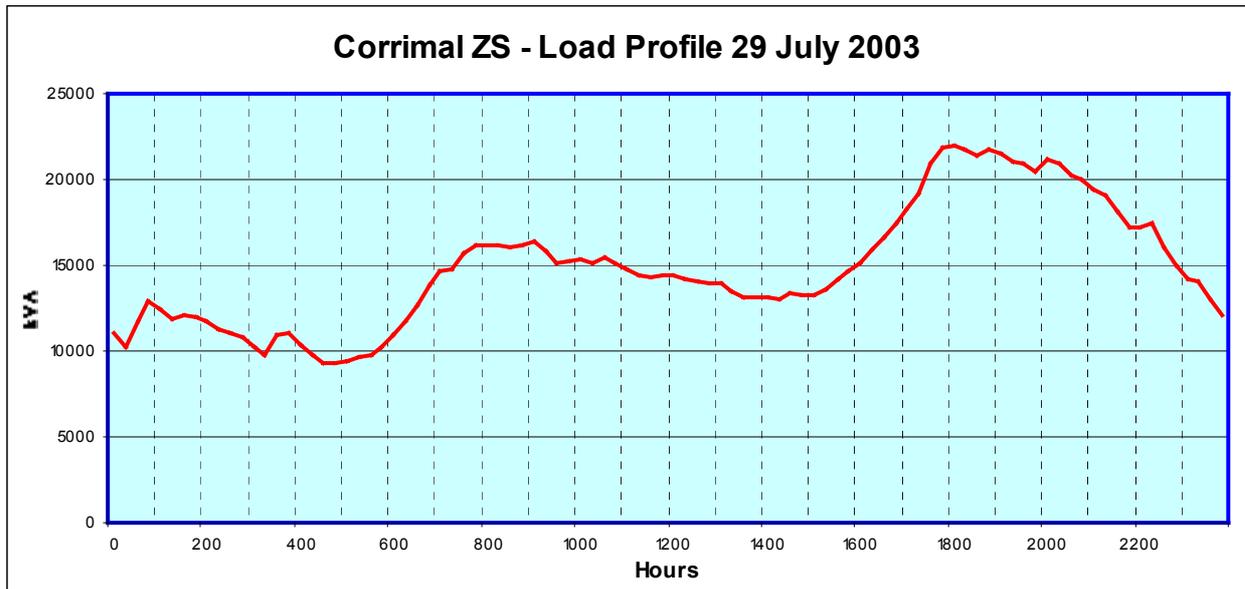
There exists the possibility of transferring load to Russel Vale ZS when this substation is augmented, estimated to be in 2008/09 (refer project item PR061).

Non-network

A non-network option would need to reduce the winter evening peak between the hours of 17:00 to 20:00 weekdays. The winter peak demand is about 2 MVA higher than the summer peak demand. The winter growth rate is about 0.5 MVA per annum.

Corrimal Zone Substation

Load Profile



Load Characteristics

Corrimal ZS supplies a predominantly residential area on the coastal strip north of the Wollongong CBD. It is a typical residential load profile driven by residential winter evening peak loads made up of mainly space heating and cooking. Corrimal ZS has a firm rating of 19 MVA and a cyclic rating of 21 MVA.

Options

Network

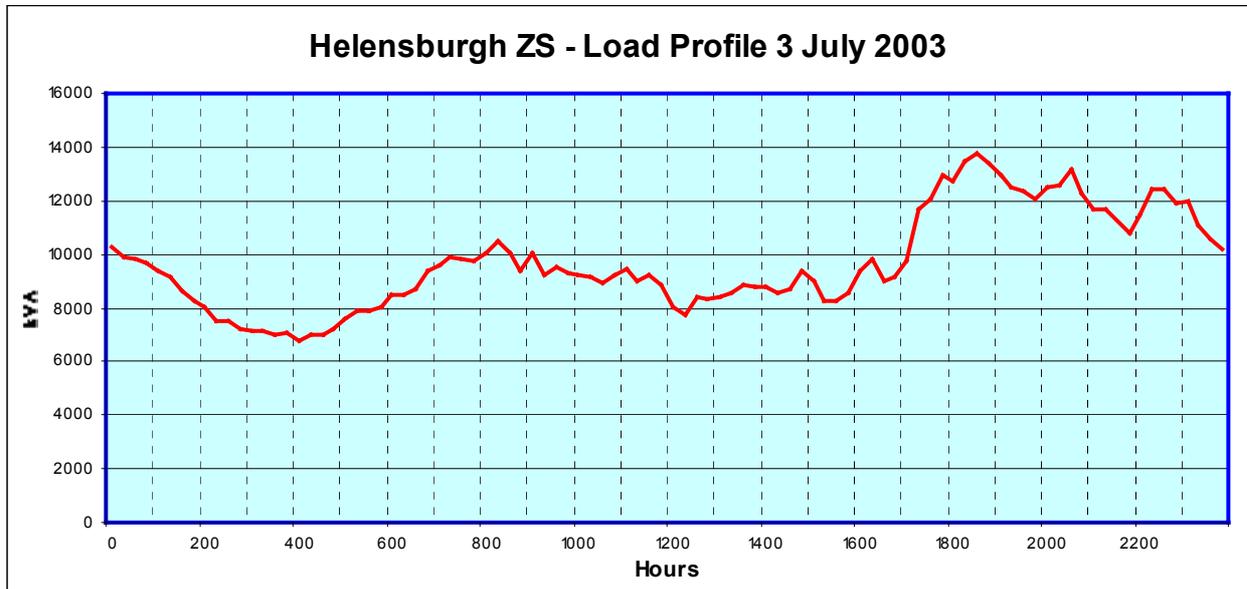
The construction of Mt. Ousley ZS with the current estimated construction date of 2008/09 will offload Corrimal ZS (refer project item PR100).

Non-network

A non-network option would need to reduce the winter evening peak between the hours of 17:00 to 21:00 weekdays. The winter peak demand is about 4 MVA higher than the summer peak demand. The winter growth rate is about 0.5 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Helensburgh Zone Substation

Load Profile



Load Characteristics

Helensburgh ZS supplies a small rural community and a coal mine north of the Wollongong and adjacent the Royal National Park. It is a typical residential load profile driven by residential winter evening peak loads made up of mainly space heating and cooking. The coal mine load creates a fluctuation on the profile and it is unknown if it contributes to the evening peak. Helensburgh ZS has a firm rating of 12.5 MVA and a cyclic rating of 14 MVA.

Options

Network

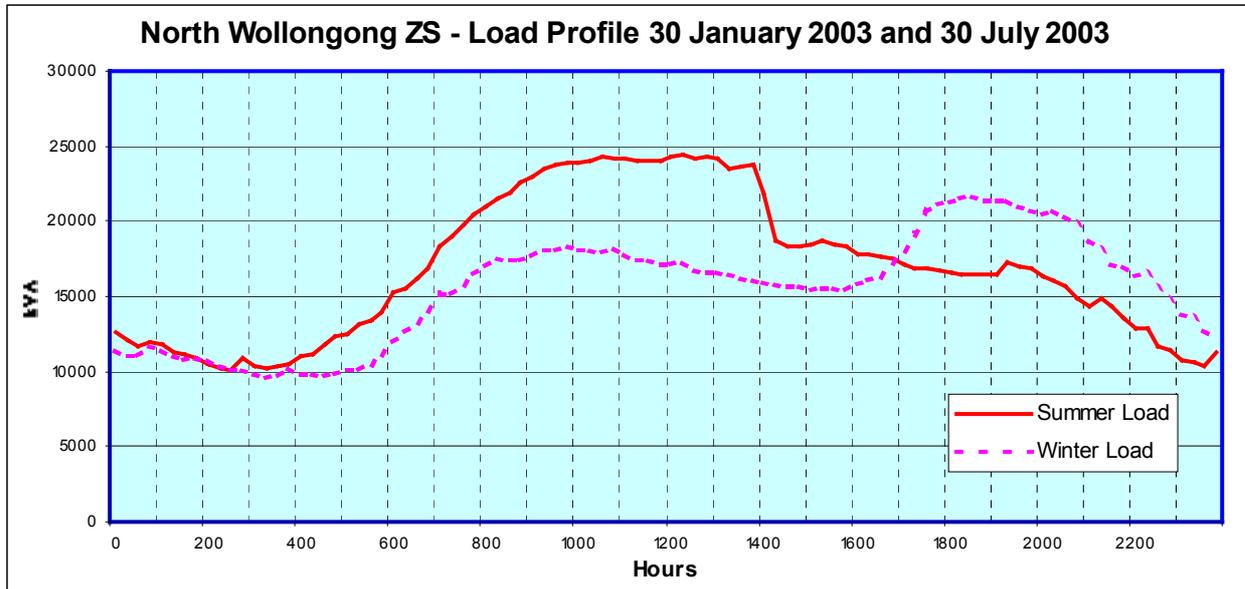
It is proposed to augment Helensburgh ZS by installing an additional transformer with the current estimated construction date of 2011/12 (refer project item PR122).

Non-network

A non-network option would need to reduce the winter evening peak between the hours of 17:00 to 21:00 weekdays. The winter peak demand is about 2.5 MVA higher than the summer peak demand. The winter growth rate is about 0.2 MVA per annum.

North Wollongong Zone Substation

Load Profile



Load Characteristics

North Wollongong ZS supplies the northern part of the Wollongong CBD and surrounding residential areas including high density apartments. It is a summer peaking load profile driven by air conditioning load on hot days. The winter evening peak is driven by the residential heating and cooking loads. A new technology industrial park is with an expected load of 4 to 5 MVA is being planned. This will ultimately require additional network assets unless sufficient demand reducing initiatives can be developed. North Wollongong ZS has a firm rating of 20 MVA and a cyclic rating of 22 MVA.

Options

Network

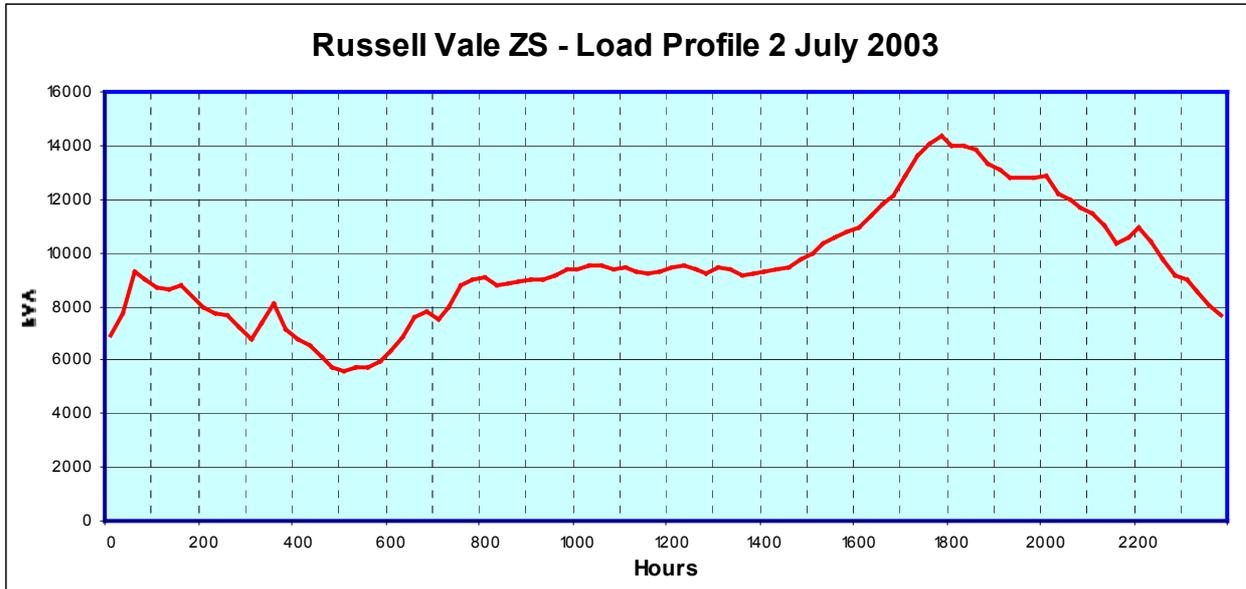
The construction of Mt. Ousley ZS with the current estimated construction date of 2008/09 will offload North Wollongong ZS (refer project item PR100).

Non-network

A non-network option would need to reduce the summer midday/evening peak between the hours of 12:00 to 17:00 weekdays. The summer peak demand is about 2 MVA higher than the winter peak demand. The new industrial load will also need to be addressed in order to defer the new zone substation. Demand Management will be investigated and submissions will be sought from interested parties.

Russel Vale Zone Substation

Load Profile



Load Characteristics

Russell Vale ZS supplies a predominantly residential area on the coastal strip north of the Wollongong CBD. It is a typical residential load profile driven by residential winter evening peak loads made up of mainly space heating and cooking. Russell Vale ZS has a firm rating of 10 MVA and a cyclic rating of 11 MVA.

Options

Network

The augmentation of Russell Vale ZS with the current estimated construction date of 2007/08 will provide additional capacity to supply the area (refer project item PR061).

Non-network

A non-network option would need to reduce the winter evening peak between the hours of 17:00 to 20:00 weekdays. The winter peak demand is about 3.5 MVA higher than the summer peak demand. The winter growth rate is about 0.2 MVA per annum.

Dapto Bulk Supply Point

7.1.6 Dapto Bulk Supply Point Status

Dapto BSP is owned by TransGrid and has 3 x 375 MVA and 1 x 160 MVA 330/132kV transformers. Integral Energy is supplied at 132 kV from Dapto BSP. The Springhill feeders are supplied via series line reactors rated at 286 MVA at Dapto BSP.

Dapto BSP supplies 132 kV north to Bellambi TS and south to Ulladulla ZS on the Integral Energy network, 132 kV west to Burrawang Pumping Station, and provides backup to Fairfax Lane TS to the west. It also supplies 132 kV to the Country Energy network at Batemans Bay ZS and Moruya North TS. The later emanating from Evans Lane Switching Station, which also supplies Ulladulla ZS.

This southern supply arrangement is the subject of a triparted study commissioned on behalf of TransGrid, Integral Energy and Country Energy to assess the long term supply options for the "Far South Coast". The report is complete and approval to implement stage 1 is now being sought.

7.1.7 Dapto Bulk Supply Point Rating Details

Transmission or Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Dapto BSP	Transgrid		
Australian Iron-BHP (Bluescope Steel)	Customer		
BOC Gasses **	Customer		
Burrawang Pumping Station **	Customer		
Batemans Bay (Country Energy)	Customer		
Moruya North (Country Energy)	Customer		
Ulladulla **	2 x 20/25/30	60	33
Yatte Yattah **	1 x 5	5.0	4

Note: Substations designated ** are supplied directly off the Dapto BSP 132kV busbar without an intermediate subtransmission busbar. The remaining locations are transmission substations with their individual subtransmission networks to each zone substation.

7.1.8 Dapto Bulk Supply Point Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Australian Iron (BHP)	MVA Rating MVA LAR	204.2	203.2	201.1	192.6	215.3	186.2	211.0	211.0	270.0	270.0	270.0	270.0	270.0	270.0	270.0	270.0
BOC Gases	MVA Rating MVA LAR	16.1	17.2	16.5	18.7	16.7	18.4	18.5	19.0	19.5	19.8	20.1	20.3	20.6	20.8	21.1	21.3
Burrawang Pumping	MVA Rating MVA LAR	3.5	3.5	3.5	3.8	0.3	0.3	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Batemans Bay (Country Energy)	MVA Rating MVA LAR	16.3	16.2	16.2	16.2	21.3	17.6	17.8	18.2	18.6	19.2	19.6	20.1	20.6	21.0	21.5	22.0
Moruya North (Country Energy)	MVA Rating MVA LAR	21.1	25.8	20.8	20.6	26.0	22.7	26.5	26.8	27.0	27.2	27.4	27.6	27.8	28.0	28.2	28.4
Ulladulla	MVA Rating MVA LAR	20.0 33.0	21.2 33.0	22.0 33.0	20.1 33.0	24.0 33.0	22.6 33.0	23.1 33.0	24.0 33.0	24.7 33.0	25.2 33.0	25.7 33.0	26.2 33.0	26.7 33.0	27.2 33.0	27.7 33.0	28.2 33.0
Yatte Yattah	MVA Rating MVA LAR	2.8 5.0	3.0 5.0	3.1 5.0	2.7 5.0	7.8 5.0	3.3 5.0	4.0 5.0	4.1 5.0	4.2 5.0	4.3 5.0	4.4 5.0	4.5 5.0	4.6 5.0	4.6 5.0	4.7 5.0	4.8 5.0

Note: LAR denotes Load at Risk

7.1.9 Dapto Bulk Supply Point Winter Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Australian Iron (BHP)	MVA Rating MVA LAR	222.7	209.4	216.4	188.5	186.6	192.8	214.0	214.0	214.0	214.0	214.0	214.0	214.0	214.0	214.0	214.0
BOC Gases	MVA Rating MVA LAR	24.1	23.2	23.4	38.1	27.7	39.5	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Burrawang Pumping	MVA Rating MVA LAR	3.5	3.5	3.5	3.8	3.8	0.3	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Batemans Bay (Country Energy)	MVA Rating MVA LAR	16.6	27.6	17.5	17.7	18.0	19.4	19.4	19.8	20.2	20.6	21.0	21.4	21.7	22.1	22.5	22.9
Moruya North (Country Energy)	MVA Rating MVA LAR	21.2	21.0	22.1	22.0	22.7	25.6	25.6	25.9	26.1	26.6	27.1	27.5	28.0	28.5	29.0	29.5
Ulladulla	MVA Rating MVA LAR	20.1 33.0	21.0 33.0	23.4 33.0	23.5 33.0	22.3 33.0	25.0 33.0	25.1 33.0	25.7 33.0	26.4 33.0	27.1 33.0	27.6 33.0	28.0 33.0	28.5 33.0	29.0 33.0	29.4 33.0	29.9 33.0
Yatte Yattah	MVA Rating MVA LAR	3.3 5.0	3.0 5.0	3.6 5.0	3.4 5.0	3.3 5.0	3.8 5.0	3.7 5.0	3.8 5.0	3.9 5.0	4.0 5.0	4.1 5.0	4.2 5.0	4.3 5.0	4.4 5.0	4.5 5.0	4.6 5.0

Note: LAR denotes Load at Risk

7.1.10 Mt Terry Transmission Substation

7.1.11 Mt Terry Transmission Substation Status

Mt Terry TS is owned by Integral Energy. It has 2 x 120 MVA 132/33 kV transformers with a firm cyclic capacity of 156 MVA. The substation is fed via two 132kV feeders, 98W and 98F, each rated at 253 MVA. Feeders 98L and 98U emanate from Mt Terry TS providing supply to Shoalhaven and the far south coast.

7.1.12 Mt Terry Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Mt Terry TS	2 x 120	240	130
Albion Park	2 x 12.5	25	25
Dapto	2 x 20	40	22
Gerringong	2 x 5	10	5.5
Jamberoo	1 x 3.75	3.75	4.0
Kiama	2 x 12.5 + 1 x 6.25	31.25	21
Shellharbour	2 x 20	40	22
Warilla	2 x 10 + 1 x 12.5	32.5	22

7.1.13 Mt Terry Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Albion Park	MVA	12.3	12.4	13.4	13.3	14.1	16.3	16.0	17.5	19.0	19.8	20.4	21.0	21.5	22.1	22.6	23.2
	Rating MVA LAR	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Dapto	MVA	17.5	18.3	23.0	21.4	21.2	25.6	24.1	24.5	25.6	26.4	27.2	27.8	28.5	29.1	29.8	30.4
	Rating MVA LAR	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Gerringong	MVA	4.1	4.4	4.2	4.5	4.9	5.0	5.6	6.2	6.8	7.2	7.4	7.6	7.8	8.0	8.2	8.4
	Rating MVA LAR	5.5	5.5	5.5	5.5	5.5	5.5	0.1	0.7	1.3	1.7	1.9	2.1	2.3	2.5	2.7	2.9
Jamberoo	MVA	1.8	1.9	1.9	2.0	2.2	2.3	2.4	2.4	2.5	2.5	2.5	2.5	2.6	2.6	2.6	2.7
	Rating MVA LAR	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Kiama	MVA	9.5	10.9	10.3	10.6	10.6	10.6	12.1	12.7	13.0	13.3	13.5	13.7	14.0	14.2	14.4	14.6
	Rating MVA LAR	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Mount Terry RIC (Croome)	MVA					3.0	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Rating MVA LAR																
Shellharbour	MVA	14.0	16.2	15.8	18.3	18.0	20.4	23.8	26.3	27.8	28.7	29.7	30.7	31.6	32.6	33.6	34.5
	Rating MVA LAR	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
Warilla	MVA	16.2	14.5	14.5	15.0	14.9	15.3	15.5	15.8	15.9	16.0	16.0	16.1	16.1	16.2	16.2	16.3
	Rating MVA LAR	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Mt Terry TS	MVA	71.6	71.9	80.5	82.5	85.1	95.2	98.8	104.3	109.2	112.4	115.0	117.6	120.1	122.7	125.2	127.7
	Rating MVA LAR	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0

Note: LAR denotes Load at Risk

7.1.14 Mt Terry Transmission Substation Winter Demand Forecast

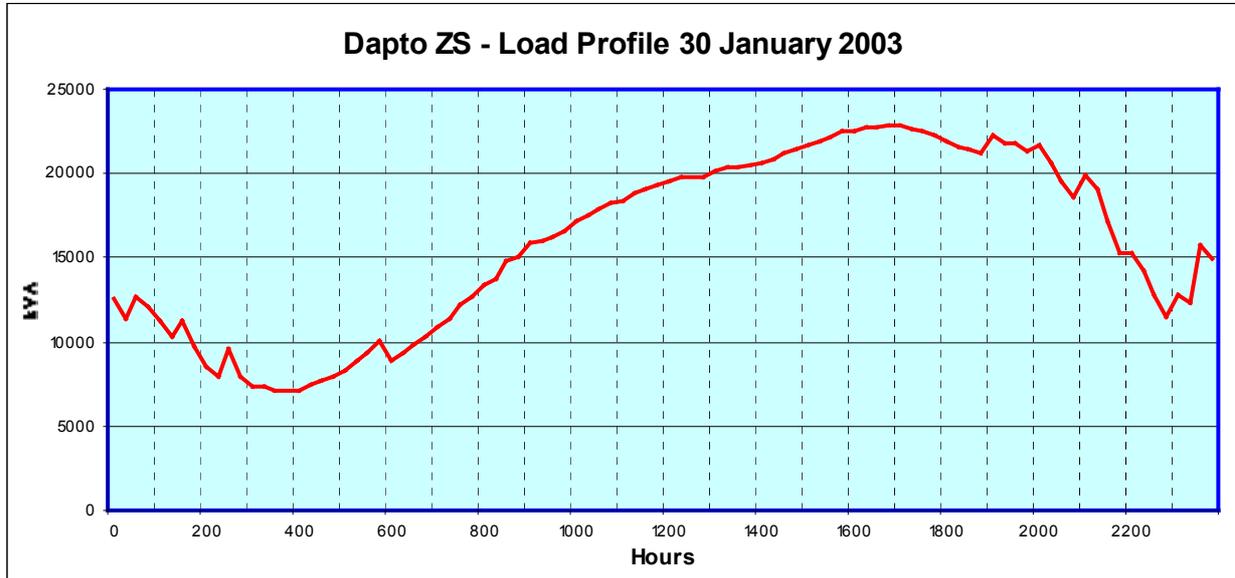
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Albion Park	MVA	13.8	15.3	15.7	15.0	15.9	17.0	17.9	18.7	20.1	21.4	22.2	22.6	23.0	23.4	23.9	24.3
	Rating MVA LAR	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Dapto	MVA	19.2	21.3	20.5	22.9	20.6	23.3	21.9	22.6	22.8	23.8	24.6	25.2	25.8	26.3	26.9	27.4
	Rating MVA LAR	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Gerringong	MVA	5.0	5.2	5.5	5.8	5.4	5.9	6.5	6.9	7.4	7.8	8.1	8.2	8.4	8.6	8.7	8.9
	Rating MVA LAR	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Jamberoo	MVA	2.3	2.8	2.3	2.3	2.4	2.5	2.6	2.6	2.7	2.7	2.8	2.8	2.9	2.9	3.0	3.0
	Rating MVA LAR	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Kiama	MVA	11.7	13.5	12.6	13.5	14.6	14.1	14.8	15.7	16.3	16.8	17.1	17.4	17.7	18.0	18.3	18.6
	Rating MVA LAR	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
Mount Terry RIC (Croome)	MVA						5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Rating MVA LAR																
Shellharbour	MVA	14.1	15.2	17.1	19.2	22.2	19.5	22.9	25.9	28.4	30.0	31.1	32.2	33.2	34.3	35.4	36.4
	Rating MVA LAR	22.0	22.0	22.0	22.0	22.0	22.0	22.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
Warilla	MVA	18.4	19.0	19.0	20.1	20.2	19.2	21.5	21.8	22.1	22.2	22.2	22.2	22.3	22.3	22.3	22.4
	Rating MVA LAR	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Mt Terry TS	MVA	86.9	85.6	92.8	100.7	98.0	107.5	113.1	117.1	122.6	127.4	130.6	133.2	135.8	138.4	140.9	143.5
	Rating MVA LAR	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0

Note: LAR denotes Load at Risk

7.1.15 Constrained Zone Substation Load Profiles, Information and Options

Dapto Zone Substation

Load Profile



Load Characteristics

Dapto ZS supplies predominantly residential areas in the western part of Wollongong. It is a summer peaking load profile driven mainly air conditioning load on hot days. New residential release areas will further increase demand over the ten-year forecast period. Dapto ZS has a firm rating of 20 MVA and a cyclic rating of 22 MVA.

Options

Network

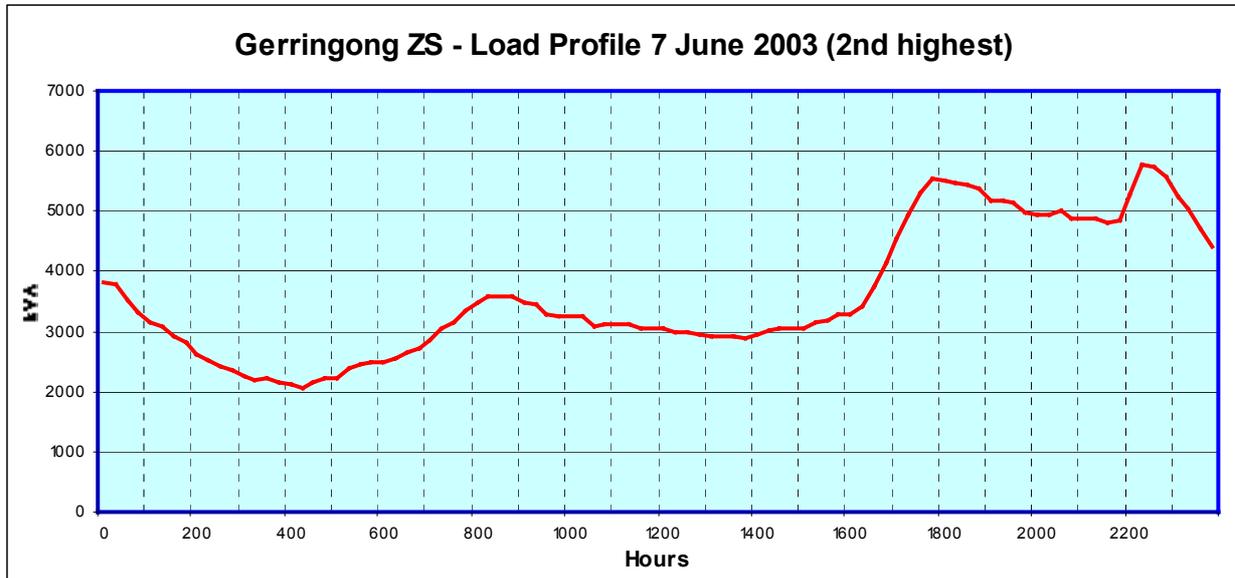
The augmentation of Dapto ZS will provide the additional capacity required to supply the increase in demand. The current estimated construction date is 2008/09 (refer project item PR148).

Non-network

A non-network option would need to reduce the summer midday/evening peak between the hours of 14:00 to 19:00 weekdays. The summer peak demand is about 1.5 MVA higher than the winter peak demand. The new residential developments will also need to be addressed in order to defer the augmentation of this zone substation.

Gerringong Zone Substation

Load Profile



Load Characteristics

Gerringong ZS supplies a predominantly residential/rural areas along the south coast, south of Kiama. This area experiences an increase in demand during the Christmas holiday period as a result of an influx of tourists. Regardless of this, the peak demand is still in winter due to the high proportion of permanent residents of this coastal town. There is a small commercial centre and predominantly residential/rural type loads. It is a typical residential load profile driven by evening peak loads made up of mainly space heating and cooking. The off-peak hot water load is substantial and controlled via time clocks. Gerringong ZS has a firm rating of 5 MVA and a cyclic rating of 5.5 MVA.

Options

Network

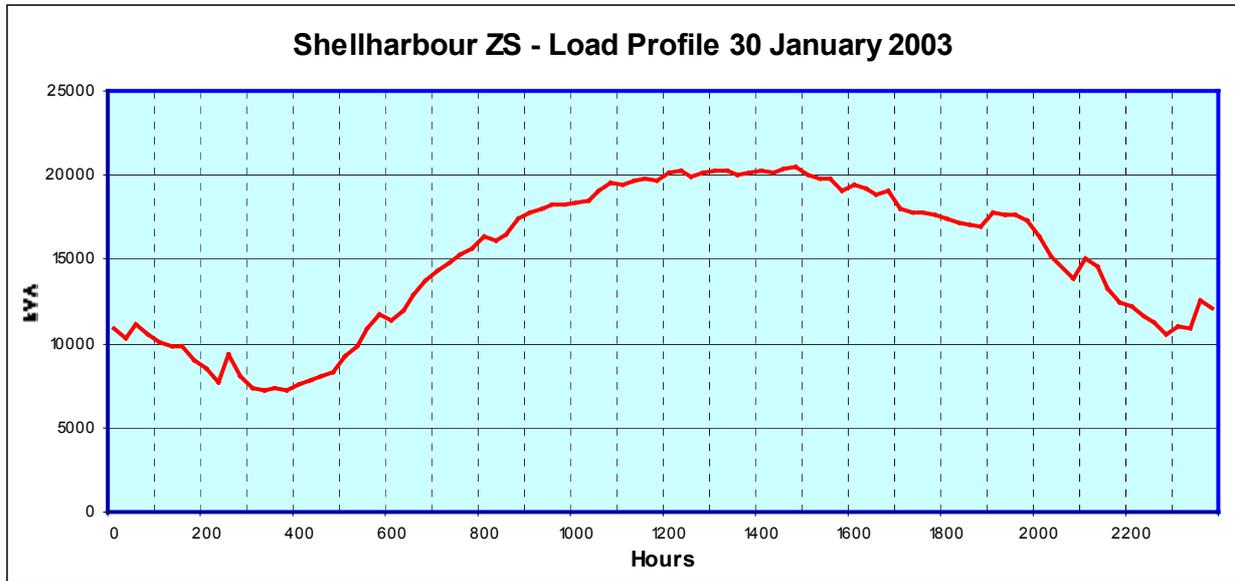
The augmentation of Gerringong ZS will provide the additional capacity required to supply the increase in demand. The current estimated construction date is 2006/07 (refer project item PR149).

Non-network

A non-network option would need to reduce the winter evening peak between the hours of 17:00 to 19:00 weekdays. The midnight off-peak demand will also need to be addressed. The winter peak demand is about 0.2 MVA higher than the summer peak demand. The winter growth rate is about 0.1 MVA per annum.

Shellharbour Zone Substation

Load Profile



Load Characteristics

Shellharbour ZS predominantly supplies new residential areas at Shellharbour south of Warilla. This area has been experiencing load growth due to the release of new residential areas at Shell Grove. There is also a commercial centre at Shellharbour. The load profile is summer peaking driven mainly by air conditioning on hot summer afternoons. Shellharbour ZS has a firm rating of 20 MVA and a cyclic rating of 22 MVA.

Options

Network

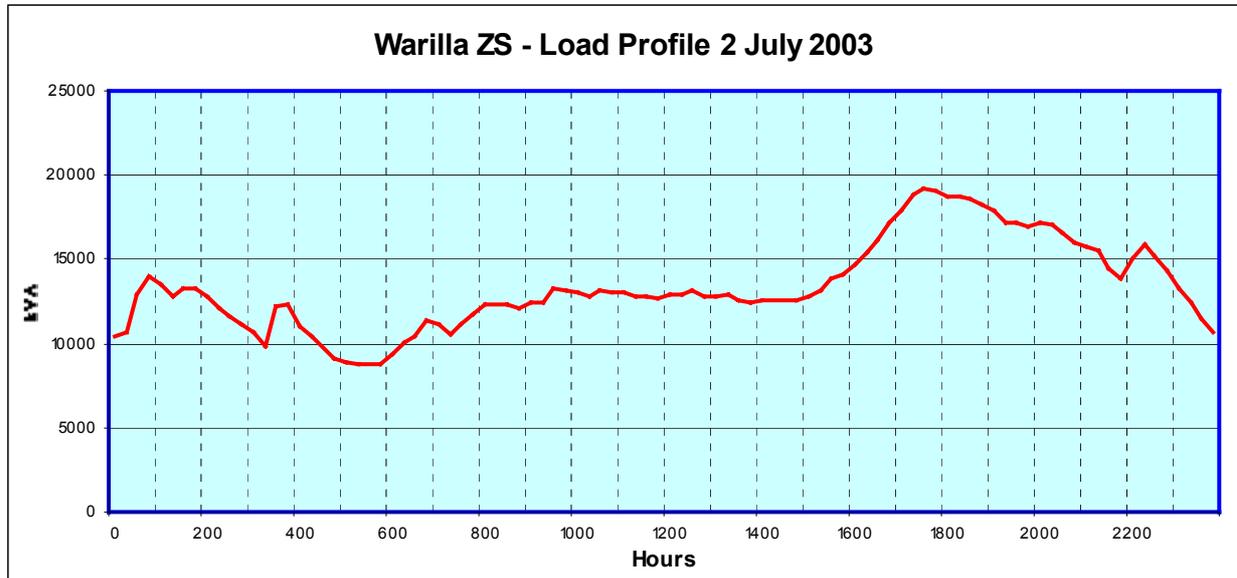
The augmentation of Shellharbour ZS will provide the additional capacity required to supply the increase in demand. The current estimated construction date is 2005/06 (refer project item PR124).

Non-network

A non-network option would need to reduce the summer evening peak between the hours of 12:00 to 17:00 weekdays. The summer peak demand is about 1 MVA higher than the winter peak demand. The summer growth rate is about 1 MVA per annum.

Warilla Zone Substation

Load Profile



Load Characteristics

Warilla ZS predominantly supplies the established residential areas north of Shellharbour. This area has been experiencing slow load growth due to some redevelopment of the residential areas. There is also some commercial load at Warilla. The growth rate for demand is slow and the future overload condition is not of a high level. The load profile is winter peaking driven mainly evening cooking and space heating. Warilla ZS has a firm rating of 20 MVA and a cyclic rating of 22 MVA.

Options

Network

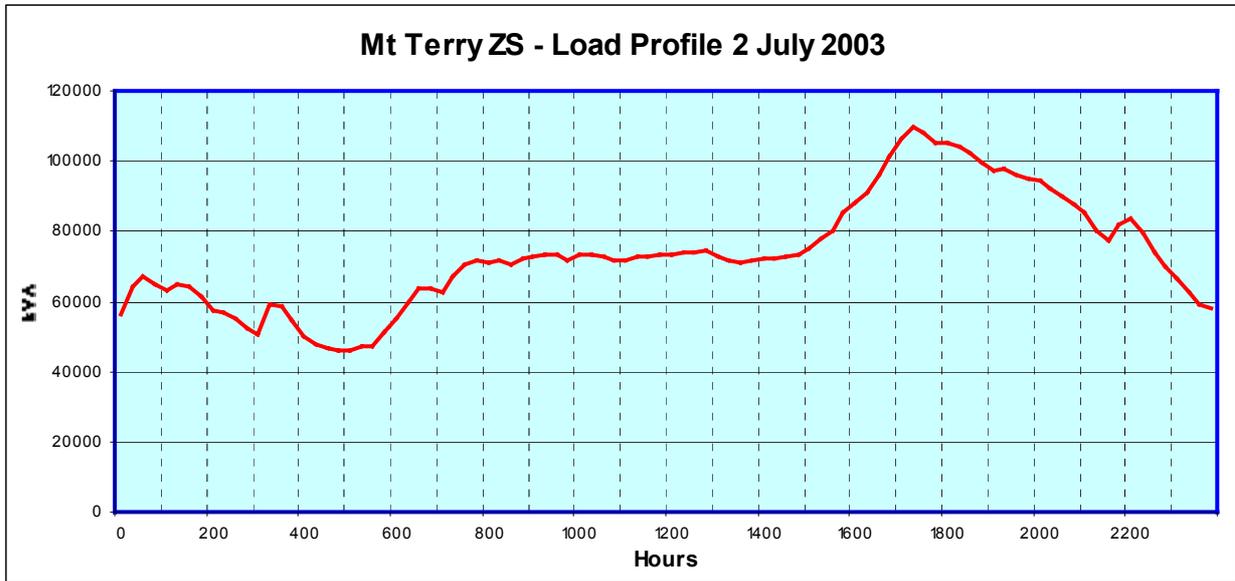
There are no network options identified.

Non-network

A non-network option would need to reduce the winter evening peak between the hours of 17:00 to 19:00 weekdays. The winter peak demand is about 4 MVA higher than the summer peak demand. The winter growth rate is about 0.2 MVA per annum.

Mt Terry Transmission Substation

Load Profile



Load Characteristics

Mt Terry TS supplies eight zone substation south of Wollongong within the Shellhourbour City Council area. This area has been experiencing growth predominantly in the residential sector. There are some summer peaking areas, but at an aggregate level, the transmission substation is still winter peaking. The growth rate for demand is strong with growth rates of 4.5% summer and 4.0% winter. The load profile shows a winter peaking demand. Mt Terry TS has a firm rating of 120 MVA and a cyclic rating of 130 MVA. The substation capacity is only just exceeded at the end of the five year period

Options

Network

There are no network options identified.

Non-network

A non-network option would need to reduce the winter evening peak between the hours of 16:00 to 19:00 weekdays. The winter peak demand is about 10 MVA higher than the summer peak demand. The winter growth rate is about 5 MVA per annum.

Outer Harbour Transmission Substation

7.1.16 Outer Harbour Transmission Substation Status

Outer Harbour TS is supplied from Dapto BSP via Springhill TS by 132 kV feeders 985/1, 985/2 and 989 (rated at 162/217 MVA and 182/231 MVA summer/winter respectively). Feeder 985 is tee connected to BOC Gasses (formally C.I.G.) on feeder 985/3. Outer Harbour TS has 1 x 30/45/60 MVA and 1 x 30/60 MVA 132/33 kV transformers and has a firm rating of 60 MVA.

7.1.17 Outer Harbour Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Outer Harbour TS	2 x 60	120	60
Lysaghts CRM	Unknown		
Port Central	2 x 19	38	19
Southern Copper	Unknown		

7.1.18 Outer Harbour Transmission Substation Summer Demand Forecast

Location		Actual						Forecast										
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
CRM	MVA Rating MVA LAR	4.6	5.1	4.9	5.5	4.7	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	
Port Central	MVA Rating MVA LAR	12.6 19.0	12.4 19.0	12.3 19.0	12.5 19.0	12.4 19.0	13.1 19.0	13.2 19.0	11.3 19.0	11.3 19.0	11.4 19.0	11.4 19.0	11.5 19.0	11.5 19.0	11.6 19.0	11.6 19.0	11.7 19.0	
Port Kembla Copper	MVA Rating MVA LAR	19.2	23.8	26.6	34.4	37.7	39.6	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Port Kembla RIC	MVA Rating MVA LAR	8.1	6.7	5.0	4.9	5.8	4.1	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	
Outer Harbour TS	MVA Rating MVA LAR	30.2 60.0	27.2 60.0	41.6 60.0	51.4 60.0	50.9 60.0	51.5 60.0	47.3 60.0	47.3 60.0	47.4 60.0	47.4 60.0	47.5 60.0	47.5 60.0	47.6 60.0	47.6 60.0	47.7 60.0	47.7 60.0	

7.1.19 Outer Harbour Transmission Substation Winter Demand Forecast

Location		Actual						Forecast										
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
CRM	MVA Rating MVA LAR	4.6	5.1	4.9	5.5	4.7	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	
Port Central	MVA Rating MVA LAR	12.6 19.0	12.4 19.0	12.3 19.0	12.5 19.0	12.4 19.0	13.1 19.0	13.2 19.0	11.3 19.0	11.3 19.0	11.4 19.0	11.4 19.0	11.5 19.0	11.5 19.0	11.6 19.0	11.6 19.0	11.7 19.0	
Port Kembla Copper	MVA Rating MVA LAR	19.2	23.8	26.6	34.4	37.7	39.6	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Port Kembla RIC	MVA Rating MVA LAR	8.1	6.7	5.0	4.9	5.8	4.1	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	
Outer Harbour TS	MVA Rating MVA LAR	30.2 60.0	27.2 60.0	41.6 60.0	51.4 60.0	50.9 60.0	51.5 60.0	47.3 60.0	47.3 60.0	47.4 60.0	47.4 60.0	47.5 60.0	47.5 60.0	47.6 60.0	47.6 60.0	47.7 60.0	47.7 60.0	

Note: LAR denotes Load at Risk

7.1.20 Constrained Zone Substation Load Profiles, Information and Options

No overloaded zone substations.

Shoalhaven Transmission Substation

7.1.21 Shoalhaven Transmission Substation Status

Shoalhaven TS is supplied from Dapto BSP via Mt Terry TS by 132 kV feeders 98L and 98U, each rated at 197 MVA. The Shoalhaven TS 132 kV busbar subsequently supplies the Evans Lane/Ulladulla system on feeders 98H and 98M, along with Country Energy's Batemans Bay and Moruya North substations.

Shoalhaven TS has 3 x 60 MVA 132/33 kV transformers giving it a firm rating of 120 MVA.

7.1.22 Shoalhaven Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Shoalhaven TS	3 x 60 + 1 x 30	180	130
Berry	2 x 5	10	6.0
Bolong	1 x 12.5	12.5	12.5
Bomaderry	3 x 10	30	20
Culburra	2 x 10	20	11
Huskisson	2 x 20	40	22
Kangaroo Valley	1 x 5 + 1 x 2.5	7.5	3.0
Nowra	2 x 15	30	17
South Nowra	1 x 12.5 + 1 x 10	22.5	11
Sussex Inlet	2 x 5	10	5.5

7.1.23 Shoalhaven Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
APM	MVA Rating MVA LAR	17.2	16.6	17.2	14.7	17.7	14.5	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4
Bamarang	MVA Rating MVA LAR					0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Berry	MVA Rating MVA LAR	4.9 6.0	4.9 6.0	5.3 6.0	5.6 6.0	5.3 6.0	6.2 6.0	6.4 6.0	6.7 6.0	7.0 6.0	7.2 6.0	7.5 6.0	7.8 6.0	8.0 6.0	8.3 6.0	8.6 6.0	8.8 6.0
Bolong	MVA Rating MVA LAR	2.3 12.5	2.1 12.5	2.8 12.5	2.4 12.5	3.9 12.5	4.7 12.5	5.0 12.5	5.1 12.5	5.2 12.5	5.2 12.5	5.3 12.5	5.3 12.5	5.4 12.5	5.5 12.5	5.5 12.5	5.6 12.5
Bomaderry	MVA Rating MVA LAR	12.4 20.0	12.5 20.0	13.6 20.0	13.8 20.0	15.8 20.0	15.1 20.0	15.1 20.0	15.3 20.0	15.5 20.0	15.7 20.0	15.9 20.0	16.2 20.0	16.4 20.0	16.6 20.0	16.8 20.0	17.0 20.0
Brundee	MVA Rating MVA LAR	0.4	1.2	1.2	1.2	1.2	0.4	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Burrier	MVA Rating MVA LAR	2.3	2.2	2.2	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Culburra	MVA Rating MVA LAR	7.3 11.0	7.8 11.0	8.0 11.0	8.1 11.0	8.0 11.0	8.7 11.0	8.8 11.0	8.9 11.0	9.0 11.0	9.1 11.0	9.1 11.0	9.2 11.0	9.3 11.0	9.4 11.0	9.5 11.0	9.6 11.0
Huskisson	MVA Rating MVA LAR	12.8 22.0	13.1 22.0	14.1 22.0	14.2 22.0	14.8 22.0	15.5 22.0	15.8 22.0	18.4 22.0	19.0 22.0	19.6 22.0	20.1 22.0	20.6 22.0	21.0 22.0	21.5 22.0	22.0 22.0	22.5 22.0
Kangaroo Valley	MVA Rating MVA LAR	1.5 3.0	1.4 3.0	1.4 3.0	1.8 3.0	2.3 3.0	2.2 3.0	2.5 3.0	2.5 3.0	2.6 3.0	2.6 3.0	2.7 3.0	2.7 3.0	2.8 3.0	2.8 3.0	2.9 3.0	2.9 3.0
Manildra (Shoalhaven Milling)	MVA Rating MVA LAR	10.3	10.3	12.7	12.8	14.2	15.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Nowra	MVA Rating MVA LAR	16.6 17.0	16.8 17.0	17.7 17.0	19.3 17.0	18.2 17.0	20.8 17.0	19.4 17.0	19.7 17.0	19.9 17.0	20.2 17.0	20.5 17.0	20.7 17.0	21.0 17.0	21.3 17.0	21.6 17.0	21.8 17.0
South Nowra	MVA Rating MVA LAR	6.9 11.0	7.3 11.0	7.5 11.0	8.7 11.0	8.7 11.0	10.9 11.0	11.1 11.0	11.5 11.0	11.9 11.0	12.3 11.0	12.7 11.0	13.1 11.0	13.4 11.0	13.8 11.0	14.2 11.0	14.6 11.0
Sussex Inlet	MVA Rating MVA LAR	4.5 5.5	4.7 5.5	4.8 5.5	4.9 5.5	5.6 5.5	5.4 5.5	5.6 5.5	5.7 5.5	5.8 5.5	6.0 5.5	6.1 5.5	6.2 5.5	6.4 5.5	6.5 5.5	6.6 5.5	6.8 5.5
Shoalhaven TS	MVA Rating MVA LAR	72.0 99.0	86.2 99.0	85.1 99.0	87.5 99.0	88.8 99.0	103.9 99.0	103.8 130.0	107.1 130.0	108.8 130.0	110.5 130.0	112.1 130.0	113.7 130.0	115.3 130.0	116.9 130.0	118.5 130.0	120.1 130.0

Note: LAR denotes Load at Risk

7.1.24 Shoalhaven Transmission Substation Winter Demand Forecast

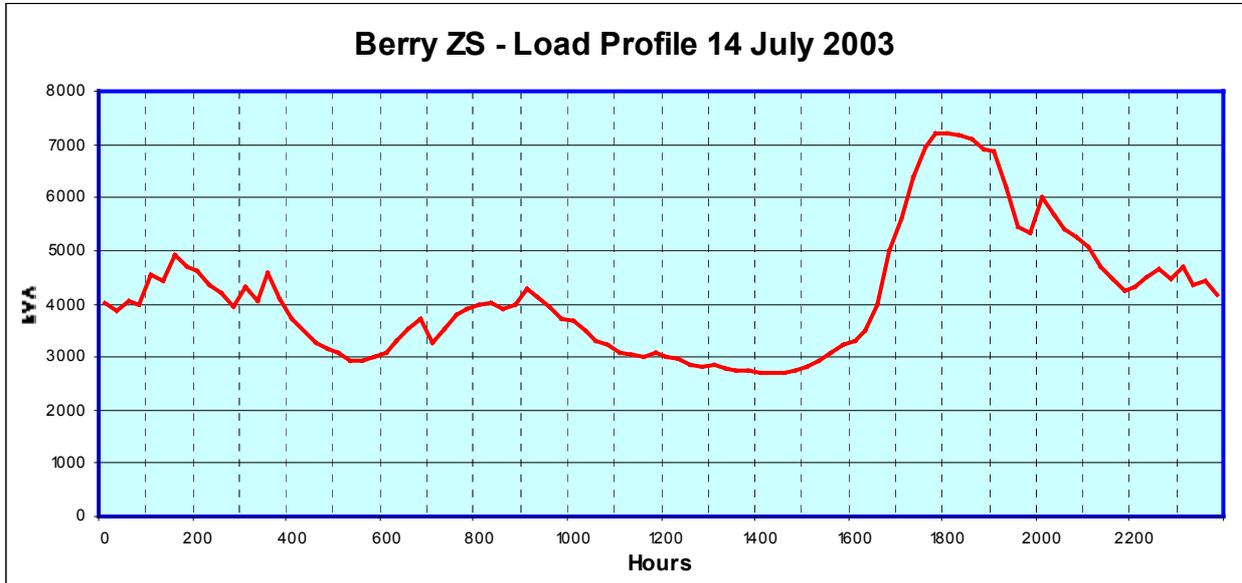
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
APM	MVA Rating MVA LAR	17.2	18.4	13.8	16.3	16.8	14.6	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4
Bamarang	MVA Rating MVA LAR					0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Berry	MVA Rating MVA LAR	6.2 6.0 0.2	5.8 6.0	6.5 6.0 0.5	6.2 6.0 0.2	6.6 6.0 0.6	7.2 6.0 1.2	7.3 6.0 1.3	7.4 6.0 1.4	7.5 6.0 1.5	7.6 6.0 1.6	7.7 6.0 1.7	7.8 6.0 1.8	7.9 6.0 1.9	8.0 6.0 2.0	8.1 6.0 2.1	8.2 6.0 2.2
Bolong	MVA Rating MVA LAR	2.4 12.5	2.2 12.5	2.1 12.5	2.5 12.5	2.9 12.5	3.2 12.5	3.3 12.5	3.3 12.5	3.4 12.5	3.5 12.5	3.6 12.5	3.6 12.5	3.7 12.5	3.8 12.5	3.8 12.5	3.9 12.5
Bomaderry	MVA Rating MVA LAR	16.5 20.0	15.3 20.0	15.1 20.0	17.7 20.0	16.6 20.0	17.1 20.0	17.5 20.0	17.8 20.0	18.2 20.0	18.5 20.0	18.8 20.0	19.1 20.0	19.4 20.0	19.7 20.0	20.1 20.0	20.4 20.0
Brundee	MVA Rating MVA LAR	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Burrier	MVA Rating MVA LAR	2.2	2.2	2.2	2.2	2.2	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Culburra	MVA Rating MVA LAR	9.8 11.0	9.9 11.0	9.5 11.0	8.9 11.0	8.9 11.0	10.0 11.0	10.3 11.0	10.4 11.0	10.5 11.0	10.7 11.0	10.8 11.0	11.0 11.0	11.1 11.0	11.2 11.0	11.4 11.0	11.5 11.0
Huskisson	MVA Rating MVA LAR	17.0 22.0	14.5 22.0	16.3 22.0	17.0 22.0	16.8 22.0	18.3 22.0	18.7 22.0	19.3 22.0	20.0 22.0	20.6 22.0	21.2 22.0	21.6 22.0	22.1 22.0	22.5 22.0	23.0 22.0	23.4 22.0
Kangaroo Valley	MVA Rating MVA LAR	1.7 3.0	1.7 3.0	1.9 3.0	2.0 3.0	2.3 3.0	2.4 3.0	2.5 3.0	2.5 3.0	2.6 3.0	2.6 3.0	2.7 3.0	2.7 3.0	2.8 3.0	2.8 3.0	2.9 3.0	2.9 3.0
Manildra (Shoalhaven Milling)	MVA Rating MVA LAR	10.4	10.0	11.2	13.1	13.9	14.2	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Nowra	MVA Rating MVA LAR	15.9 17.0	16.5 17.0	15.0 17.0	18.8 17.0	17.2 17.0	16.1 17.0	18.2 17.0	17.4 17.0	17.6 17.0	17.9 17.0	18.2 17.0	18.4 17.0	18.7 17.0	18.9 17.0	19.2 17.0	19.5 17.0
South Nowra	MVA Rating MVA LAR	7.0 11.0	8.0 11.0	6.8 11.0	8.2 11.0	7.6 11.0	8.4 11.0	8.6 11.0	8.9 11.0	9.2 11.0	9.5 11.0	9.8 11.0	10.1 11.0	10.4 11.0	10.7 11.0	11.0 11.0	11.3 11.0
Sussex Inlet	MVA Rating MVA LAR	5.5 5.5	5.2 5.5	5.9 5.5	5.6 5.5	5.8 5.5	6.3 5.5	6.7 5.5	6.9 5.5	7.0 5.5	7.2 5.5	7.3 5.5	7.5 5.5	7.6 5.5	7.8 5.5	7.9 5.5	8.0 5.5
Shoalhaven TS	MVA Rating MVA LAR	95.6 99.0	91.5 99.0	90.8 99.0	105.0 99.0	99.9 99.0	97.4 99.0	108.2 130.0	108.7 130.0	110.5 130.0	112.3 130.0	113.9 130.0	115.6 130.0	117.2 130.0	118.8 130.0	120.4 130.0	122.0 130.0

Note: LAR denotes Load at Risk

7.1.25 Constrained Zone Substation Load Profiles, Information and Options

Berry Zone Substation

Load Profile



Load Characteristics

Berry ZS supplies a predominantly rural areas along the south coast , north of Nowra. The peak demand in this area is in winter. It is a typical residential load profile driven by evening peak loads made up of mainly space heating and cooking. Berry ZS has a firm rating of 5 MVA and a cyclic rating of 6 MVA.

Options

Network

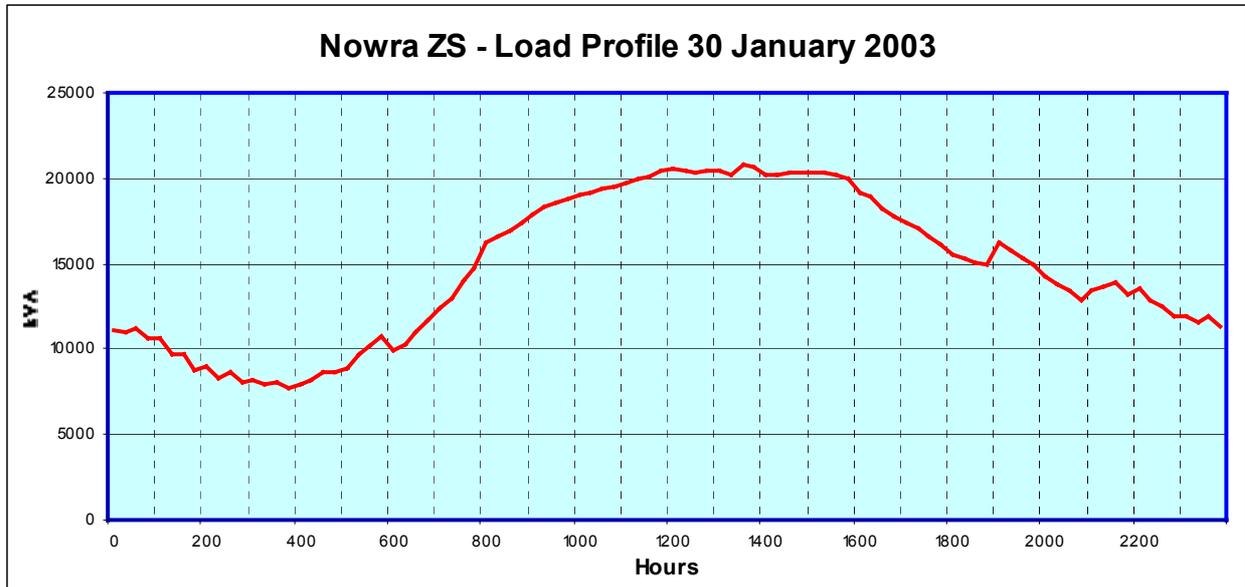
The augmentation of Berry ZS will provide the additional capacity required to supply the increase in demand. The current estimated construction date is 2006/07 (refer project item PR096).

Non-network

A non-network option would need to reduce the winter evening peak between the hours of 17:00 to 19:00 weekdays. The winter peak demand is about 1 MVA higher than the summer peak demand. The winter growth rate is about 0.1 MVA per annum.

Nowra Zone Substation

Load Profile



Load Characteristics

Nowra ZS supplies the commercial centre at Nowra and surrounding residential/rural areas. This area has been experiencing moderate load growth due to residential development and some commercial activity. The load profile is summer peaking driven mainly by air conditioning on hot summer afternoons. Nowra ZS has a firm rating of 15 MVA and a cyclic rating of 17 MVA.

Options

Network

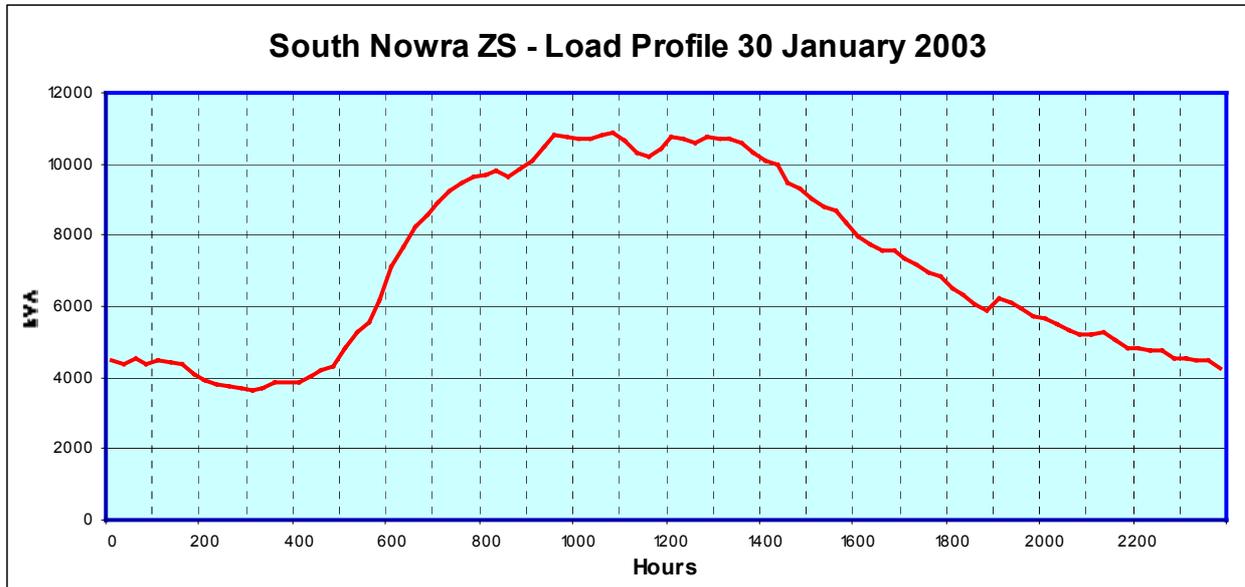
The augmentation of Nowra ZS will provide the additional capacity required to supply the increase in demand. The current estimated construction date is 2007/08 (refer project item PR121).

Non-network

A non-network option would need to reduce the summer evening peak between the hours of 12:00 to 17:00 weekdays. The summer peak demand is about 1.5 MVA higher than the winter peak demand. The summer growth rate is about 0.5 MVA per annum. An RFP has been issued to identify possible demand management initiatives.

South Nowra Zone Substation

Load Profile



Load Characteristics

South Nowra ZS supplies the industrial area at South Nowra, HMAS Albatross and surrounding rural areas. This area has been experiencing moderate load growth due to the industrial development. The load profile is summer peaking driven mainly by air conditioning on hot summer afternoons. South Nowra ZS has a firm rating of 10 MVA and a cyclic rating of 11 MVA.

Options

Network

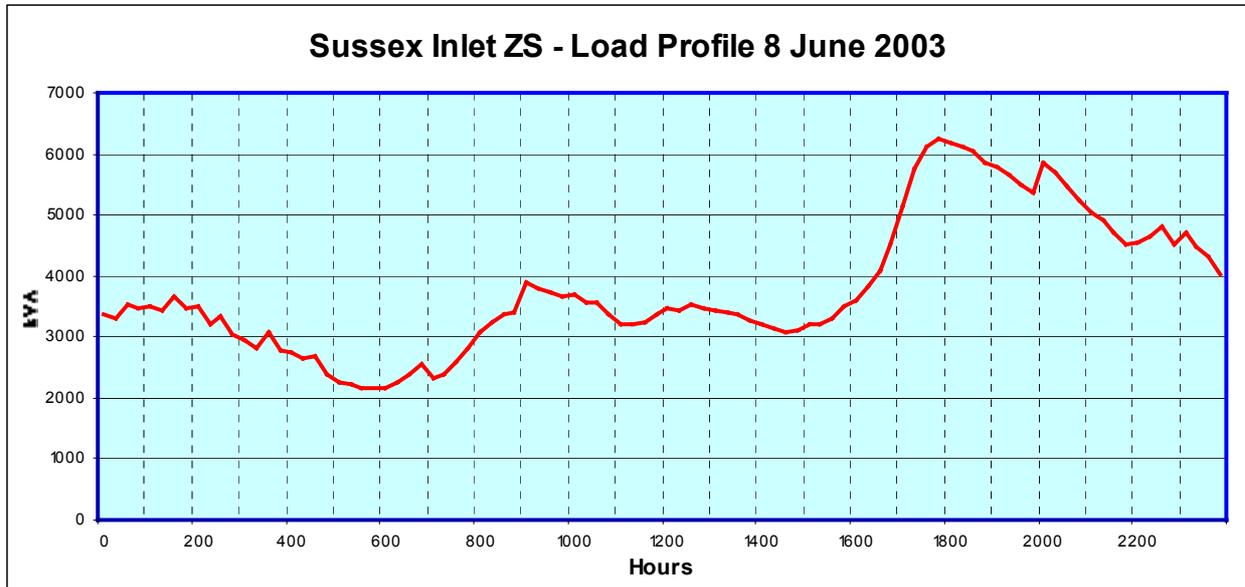
The augmentation of South Nowra ZS will provide the additional capacity required to supply the increase in demand. The current estimated construction date is 2005/06 (refer project item PR154).

Non-network

A non-network option would need to reduce the summer midday peak between the hours of 9:00 to 14:00 weekdays. The summer peak demand is about 1.5 MVA higher than the winter peak demand. The summer growth rate is about 0.5 MVA per annum.

Sussex Inlet Zone Substation

Load Profile



Load Characteristics

Sussex Inlet ZS supplies a coastal resort south of Nowra. This area experiences an increase in demand during the Christmas holiday period as a result of an influx of tourists. Regardless of this, the peak demand is still in winter due to the high proportion of permanent residents of this coastal town. There is a small commercial centre and predominantly residential/rural type loads. It is a typical residential load profile driven by evening peak loads made up of mainly space heating and cooking. Sussex Inlet ZS has a firm rating of 5 MVA and a cyclic rating of 5.5 MVA.

Options

Network

The augmentation of Sussex Inlet ZS will provide the additional capacity required to supply the increase in demand. The current estimated construction date is 2007/08 (refer project item PR155 & PR211).

Non-network

A non-network option would need to reduce the winter evening peak between the hours of 17:00 to 19:00 weekdays. The winter peak demand is about 1.0 MVA higher than the summer peak demand. The winter growth rate is about 0.2 MVA per annum.

Springhill Transmission Substation

7.1.26 Springhill Transmission Substation Status

Springhill TS is supplied from Dapto BSP by 132 kV feeders 983/984 and 982/98Y (rated at 343 MVA summer/392 MVA winter each). The Springhill TS 132 kV busbar also supplies Outer Harbour TS on feeders 989 and 985 Tee and BOC Gasses on feeders 98B and 985 Tee. Springhill TS has 8 x 60 MVA 132/33 kV transformers in total. Five of these are allocated to supply the BHP 33 kV system. The remaining three transformers supply Integral Energy's 33 kV network with an associated firm capacity of 120 MVA and cyclic rating of 144 MVA.

7.1.27 Springhill Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Springhill TS	3 x 60	180	130
Inner Harbour	2 x 12.5	25	13
Kenny Street	2 x 25	50	27
Kembla Grange	2 x 10	10	11
Port Kembla	3 x 10	30	20
South Wollongong	2 x 19	38	20
Tubemills	1 x 6	6	6.0
Unanderra	3 x 12	36	26
West Wollongong	2 x 10 + 1 x 12.5	32.5	22

7.1.28 Springhill Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Avon Colliery	MVA Rating MVA LAR	2.1	2.3	2.9													
Dendrobium Mine	MVA Rating MVA LAR							6.0	6.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Grain Terminal	MVA Rating MVA LAR	2.0	4.1	4.3	4.4	4.1	2.0	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inner Harbour	MVA Rating MVA LAR	8.1 13.0	7.2 13.0	7.4 13.0	6.5 13.0	6.8 13.0	7.1 13.0	10.8 13.0	10.9 13.0	10.9 13.0	10.9 13.0						
Kenny Street	MVA Rating MVA LAR	23.1 27.0	22.5 27.0	22.1 27.0	23.2 27.0	22.2 27.0	22.4 27.0	23.7 27.0	27.0 0.0	27.3 0.3	27.6 0.6	27.8 0.8	28.1 1.1	28.4 1.4	28.7 1.7	29.0 2.0	29.2 2.2
Kembla Grange	MVA Rating MVA LAR					5.3 11.0	18.0 11.0	23.3 11.0	24.2 11.0	24.3 11.0	24.4 11.0	24.5 11.0	24.6 11.0	24.7 11.0	24.8 11.0	24.9 11.0	25.0 11.0
Lysaghts	MVA Rating MVA LAR	36.1	34.5	35.8	35.6	34.4	34.6	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1
North Wollongong	MVA Rating MVA LAR					18.6 22.0											
Orrcon	MVA Rating MVA LAR							2.5	3.5	4.0	5.0	6.0	6.0	6.0	6.0	6.0	6.0
Port Kembla	MVA Rating MVA LAR	10.0 20.0	8.7 20.0	9.5 20.0	10.4 20.0	9.3 20.0	10.5 20.0	11.0 20.0	11.2 20.0	11.3 20.0	11.4 20.0	11.5 20.0	11.7 20.0	11.8 20.0	11.9 20.0	12.1 20.0	12.2 20.0
South Wollongong	MVA Rating MVA LAR	11.7 20.0	12.1 20.0	12.0 20.0	13.4 20.0	15.5 20.0	13.4 20.0	12.1 20.0	12.8 20.0	13.2 20.0	13.5 20.0	13.8 20.0	14.1 20.0	14.4 20.0	14.7 20.0	15.0 20.0	15.3 20.0
Tubemills	MVA Rating MVA LAR	5.1 6.0	5.9 6.0	2.4 6.0	2.4 6.0	5.7 6.0	3.3 6.0	3.0 6.0									
Unanderra	MVA Rating MVA LAR	22.6 26.0	23.5 26.0	25.3 26.0	26.0 26.0	24.2 26.0	29.0 26.0	26.0 3.0	26.4 0.0	27.3 1.3	27.8 1.8	28.2 2.2	28.6 2.6	29.1 3.1	29.5 3.5	30.0 4.0	30.4 4.4
Water Board Dams	MVA Rating MVA LAR	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
West Wollongong	MVA Rating MVA LAR	17.8 22.0	19.1 22.0	18.7 22.0	20.2 22.0	19.0 22.0	22.4 22.0	23.5 22.0	24.2 22.0	24.8 22.0	25.3 22.0	25.7 22.0	26.2 22.0	26.6 22.0	27.1 22.0	27.5 22.0	28.0 22.0
Springhill TS	MVA Rating MVA LAR	101.4 130.0	108.6 130.0	98.8 130.0	113.0 130.0	120.6 130.0	136.7 130.0	137.2 130.0	139.5 130.0	146.0 240.0	147.3 240.0	148.6 240.0	149.9 240.0	151.2 240.0	152.5 240.0	153.8 240.0	155.1 240.0

Note: LAR denotes Load at Risk

7.1.29 Springhill Transmission Substation Winter Demand Forecast

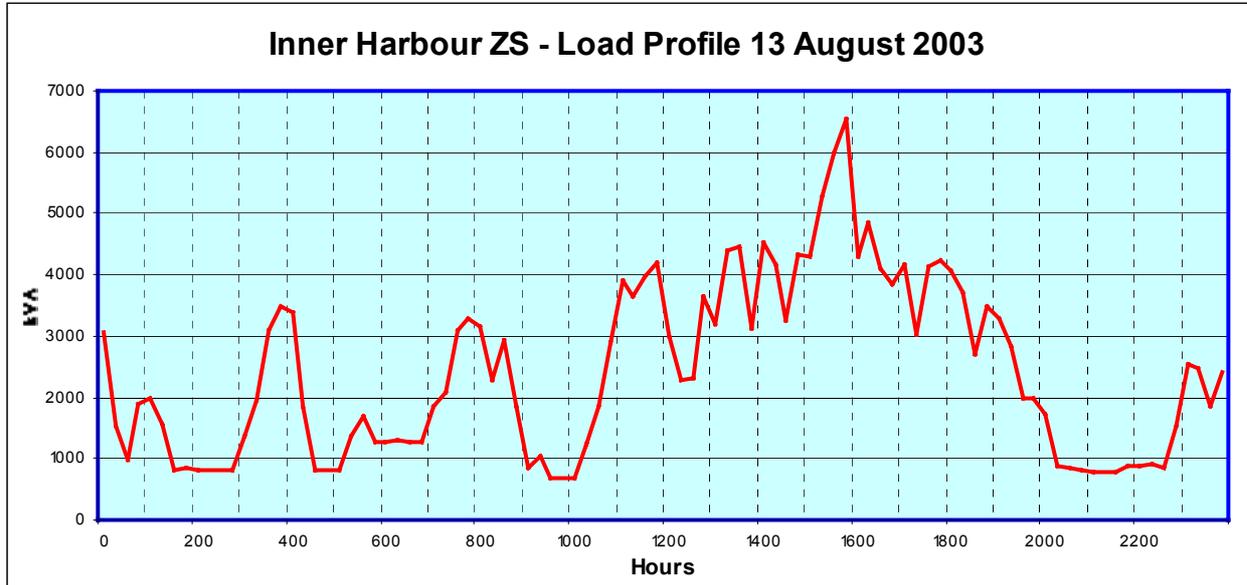
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Avon Colliery	MVA Rating MVA LAR	2.5	2.2	2.8	2.5												
Dendrobium Mine	MVA Rating MVA LAR							6.0	6.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Grain Terminal	MVA Rating MVA LAR	4.4	2.2	4.5	4.5	4.0	4.2	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Inner Harbour	MVA Rating MVA LAR	8.0 13.0	8.1 13.0	7.2 13.0	7.6 13.0	7.2 13.0	6.9 13.0	7.1 13.0	13.9 13.0	13.9 13.0	13.9 13.0	13.9 13.0	13.9 13.0	14.0 13.0	14.0 13.0	14.0 13.0	14.0 13.0
Kenny Street	MVA Rating MVA LAR	16.2 27.0	17.2 27.0	17.0 27.0	17.6 27.0	18.5 27.0	18.1 27.0	18.7 27.0	16.1 27.0	16.3 27.0	16.4 27.0	16.5 27.0	16.6 27.0	16.8 27.0	16.9 27.0	17.0 27.0	17.1 27.0
Kembla Grange	MVA Rating MVA LAR					10.0 11.0	11.3 11.0	10.9 11.0	15.2 11.0	16.1 11.0	16.2 11.0	16.3 11.0	16.4 11.0	16.5 11.0	16.6 11.0	16.7 11.0	16.8 11.0
Lysaghts	MVA Rating MVA LAR	35.7	37.0	35.5	34.3	35.3	34.4	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1	36.1
North Wollongong	MVA Rating MVA LAR							23.8 22.0 1.8	26.1 22.0 4.1	29.3 22.0 7.3	31.1 22.0 9.1	31.9 22.0 9.9	32.3 22.0 10.3	32.6 22.0 10.6	33.0 22.0 11.0	33.3 22.0 11.3	33.7 22.0 11.7
Orrcon	MVA Rating MVA LAR							2.5	3.5	4.0	5.0	6.0	6.0	6.0	6.0	6.0	6.0
Port Kembla	MVA Rating MVA LAR	12.0 20.0	10.8 20.0	11.3 20.0	14.3 20.0	13.0 20.0	11.6 20.0	12.6 20.0	12.8 20.0	13.0 20.0	13.2 20.0	13.4 20.0	13.6 20.0	13.9 20.0	14.1 20.0	14.3 20.0	14.5 20.0
South Wollongong	MVA Rating MVA LAR	11.1 20.0	11.3 20.0	10.4 20.0	12.1 20.0	12.0 20.0	15.1 20.0	15.2 20.0	12.9 20.0	13.4 20.0	13.9 20.0	14.2 20.0	14.6 20.0	14.9 20.0	15.2 20.0	15.6 20.0	15.9 20.0
Tubemills	MVA Rating MVA LAR	5.6 6.0	6.1 6.0	3.3 6.0	3.3 6.0	5.7 6.0	3.3 6.0	3.5 6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Unanderra	MVA Rating MVA LAR	24.1 26.0	24.9 26.0	25.4 26.0	26.5 26.0	25.9 26.0	27.6 26.0	28.6 26.0	27.1 26.0	27.6 26.0	28.2 26.0	28.8 26.0	29.4 26.0	29.9 26.0	30.5 26.0	31.1 26.0	31.6 26.0
Water Board Dams	MVA Rating MVA LAR	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
West Wollongong	MVA Rating MVA LAR	21.9 22.0	23.6 22.0	24.0 22.0	24.8 22.0	24.9 22.0	24.8 22.0	27.6 22.0	27.1 22.0	27.8 22.0	28.4 22.0	29.0 22.0	29.5 22.0	30.1 22.0	30.7 22.0	31.2 22.0	31.8 22.0
Springhill TS	MVA Rating MVA LAR	113.8 130.0	111.5 130.0	106.2 130.0	114.8 130.0	106.9 130.0	131.5 130.0	148.5 130.0	153.3 130.0	162.9 240.0	166.6 240.0	169.5 240.0	171.3 240.0	173.0 240.0	174.8 240.0	176.6 240.0	178.3 240.0

Note: LAR denotes Load at Risk

7.1.30 Constrained Zone Substation Load Profiles, Information and Options

Inner Harbour Zone Substation

Load Profile



Load Characteristics

Inner Harbour ZS supplies the industrial area adjacent the Port Kembla steel works. The demand in this area is influenced by the activity of the major customers in the industrial area. The load profile is summer peaking driven mainly by heavy industrial loads and demonstrates a high level of fluctuation. Inner Harbour ZS has a firm rating of 12.5 MVA and a cyclic rating of 13 MVA. This substation is forecast to be overload in 2004 due to a proposed major pumping station spot load increase.

Options

Network

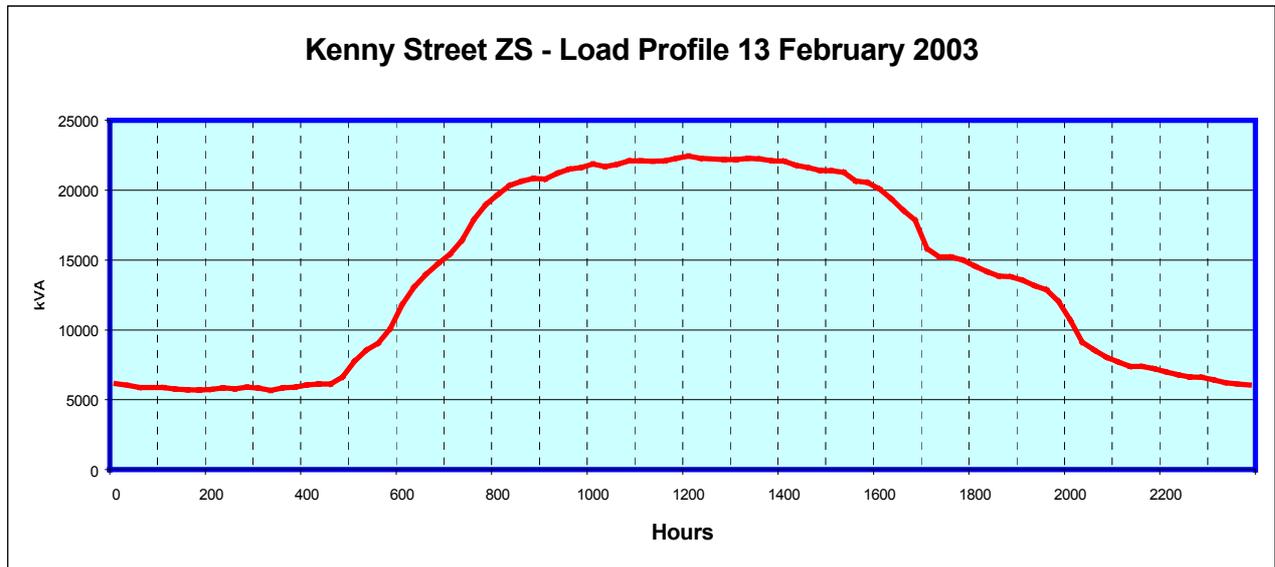
There are no network options identified.

Non-network

A non-network option would need to reduce the high peak demand created by the major industrial customers. The proposed spot load would also need to be addressed. The summer peak demand is very similar to the winter peak demand. The growth rate is about 0.1 MVA per annum.

Kenny Street Zone Substation

Load Profile



Load Characteristics

Kenny Street ZS supplies the Commercial load of the Wollongong CBD. The demand is predominantly retail/commercial and business loads. The load profile is summer peaking driven mainly by air conditioning on hot days. Kenny Street ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. There are several spot loads proposed for 2005, which are contributing to the increase in demand and the capacity constraint.

Options

Network

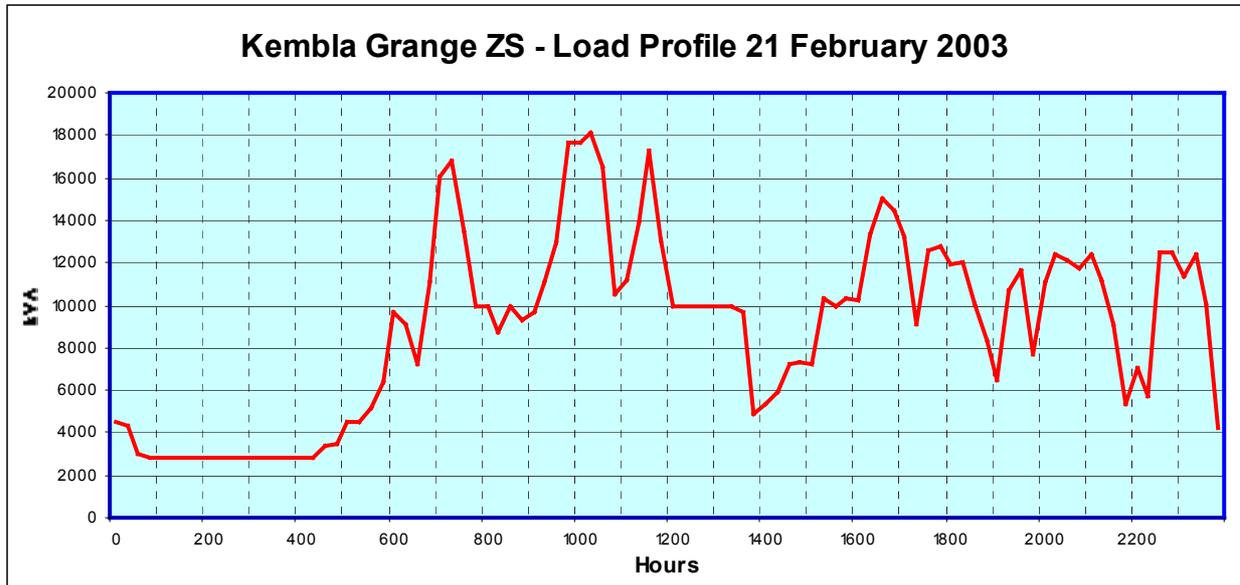
There are no network options identified.

Non-network

A non-network option would need to reduce the peak demand created by the commercial sector. The proposed spot loads would also need to be addressed. The summer peak demand is 4 MVA higher than the winter peak demand. Disregarding the spot loads in 2005, the growth rate is about 0.3 MVA per annum.

Kembla Grange Zone Substation

Load Profile



Load Characteristics

Kembla Grange ZS supplies the industrial area north of Dapto. The demand in this area is influenced by the activity several major customers in the industrial area. The load profile is summer peaking driven mainly by heavy industrial loads and demonstrates a high level of fluctuation. Kembla Grange ZS has two 10 MVA transformers installed. This substation is experiencing rapid growth in industrial load.

Options

Network

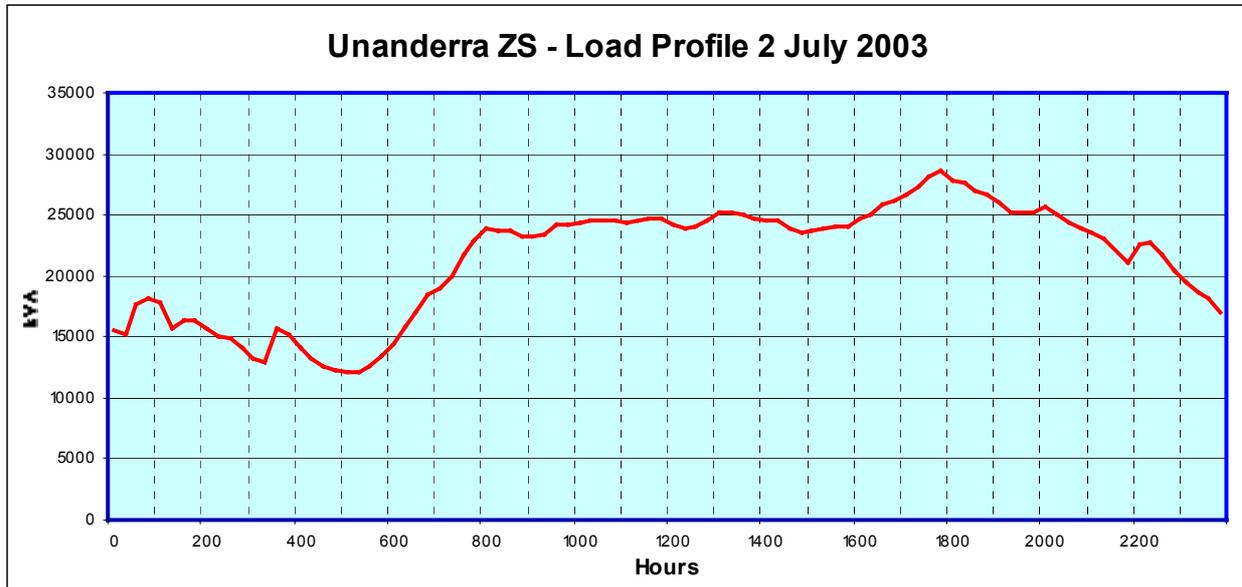
The stage 2 augmentation of Kembla Grange ZS will provide firm capacity required to supply the industrial load. The current estimated construction date is 2003/04 (refer project item PR066).

Non-network

The stage 2 augmentation of Kembla Grange ZS is currently proceeding. There is no network benefit associated with implementing demand management at this stage.

Unanderra Zone Substation

Load Profile



Load Characteristics

Unanderra ZS supplies the industrial area west of the Port Kembla steel works and the residential areas of Chanderra, Cordeaux and part of Figtree. The demand in this area is influenced by the activity of the major customers in the industrial area. The load profile is summer peaking driven mainly by industrial loads. Unanderra ZS has a firm rating of 24 MVA and a cyclic rating of 26 MVA. This substation is experiencing steady demand growth in the industrial sector.

Options

Network

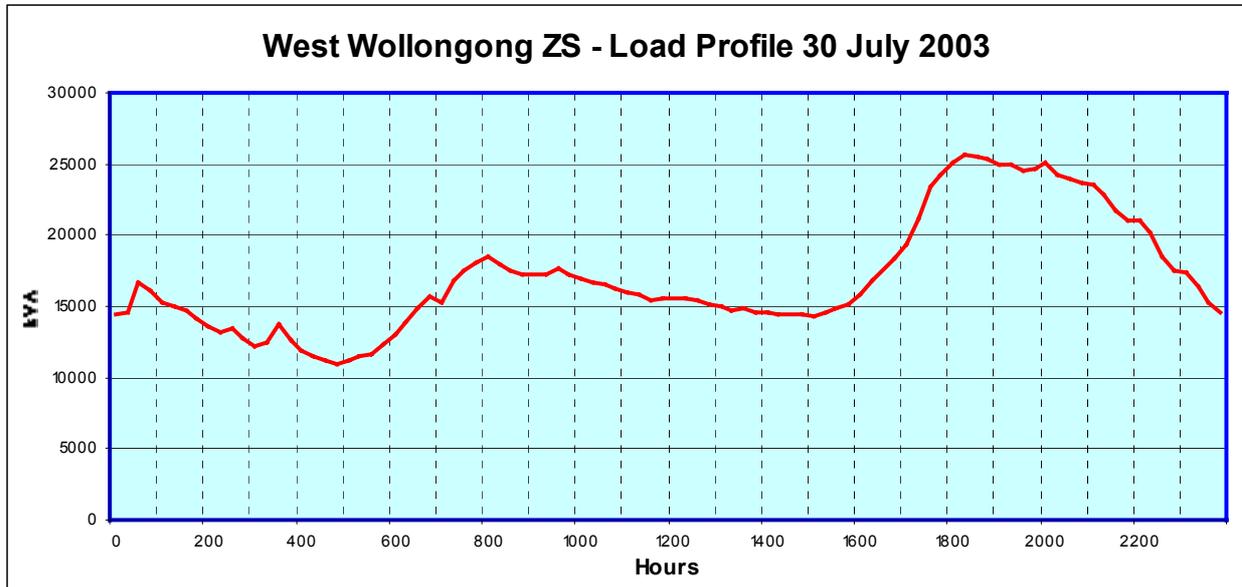
The construction of a new substation at Cordeaux/Figtree will allow the offloading of Unanderra ZS. The current estimated construction date is 2009/10 (refer project item PR200).

Non-network

A non-network option would need to reduce the peak demands created by the industrial customers. The summer peak demand is 1.5 MVA higher than the winter peak demand. The growth rate is about 0.4 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

West Wollongong Zone Substation

Load Profile



Load Characteristics

West Wollongong ZS supplies the western part of the commercial area of the Wollongong CBD, part of Wollongong University and the surrounding residential area. The load profile is winter peaking driven mainly by residential space heating and cooking. West Wollongong ZS has a firm rating of 20 MVA and a cyclic rating of 22 MVA.

Options

Network

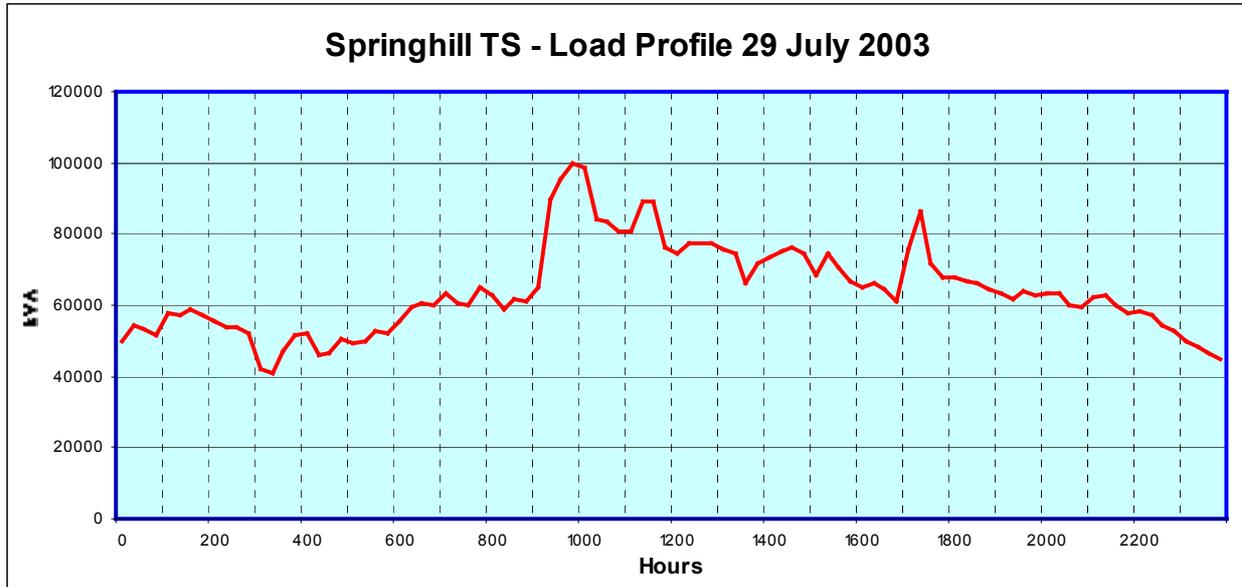
The construction of a new substation at Mt Ousley will allow the offloading of West Wollongong ZS. The current estimated construction date is 2009/10 (refer project item PR200).

Non-network

A non-network option would need to reduce the winter evening peak demand created by the residential sector. The winter peak demand is 2 MVA higher than the winter peak demand. The growth rate is about 0.5 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Springhill Transmission Substation

Load Profile



Load Characteristics

Springhill TZS supplies eight zone substations in southern Wollongong. The demand in this area is influenced by the activity of the major customers in the industrial area. The load profile is summer peaking driven mainly by heavy industrial loads and the commercial loads and demonstrates a high level of fluctuation. Springhill TS has a firm rating of 120 MVA and a cyclic rating of 130 MVA. This substation is forecast to be refurbished in 2007 as a result of the asset end-of-life replacement program.

Options

Network

The transmission substation is being refurbished as a result of the asset end-of-life replacement program.

Non-network

A non-network option would not defer the need to replace the assets.

CENTRAL REGION

8.0 Southern Highlands

Fairfax Lane Transmission Substation

8.1.1 Fairfax Lane Transmission Substation Status

Fairfax Lane TS is owned by Integral Energy. It has 3 x 60 MVA 132/33 kV transformers. The substation is supplied via 132 kV feeder 98C from Marulan BSP with an alternative supply from feeder 988 Dapto BSP. The capacity of each of these 132 kV feeders is adequate to meet the long term needs of the area.

8.1.2 Fairfax Lane Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Fairfax Lane TS	3 x 60	180	88
Bowral	2 x 10 + 1 X 12.5	32.5	22
Mittagong	2 x 12.5	25	13.5
Moss Vale	2 x 25	50	27
Ringwood	2 x 12.5	25	14
Robertson	2 x 3.75	7.5	3.8
Tycan/Tyree	1 x 2.5	2.5	

8.1.3 Fairfax Lane Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
BCSC Berrima	MVA Rating MVA LAR	15.9	20.7	15.6	16.5	17.1	17.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Bowral	MVA Rating MVA LAR	11.6 22.0	11.5 22.0	13.0 22.0	14.0 22.0	13.1 22.0	15.5 22.0	15.8 22.0	16.3 22.0	16.7 22.0	17.2 22.0	17.6 22.0	18.1 22.0	18.5 22.0	19.0 22.0	19.4 22.0	19.9 22.0
Mittagong	MVA Rating MVA LAR	7.7 13.5	8.2 13.5	8.7 13.5	8.5 13.5	9.4 13.5	10.2 13.5	10.4 13.5	10.9 13.5	11.7 13.5	12.4 13.5	12.9 13.5	13.3 13.5	13.7 13.5	14.0 13.5	14.3 13.5	14.6 13.5
Moss Vale	MVA Rating MVA LAR	10.2 27.0	10.2 27.0	11.2 27.0	12.1 27.0	12.4 27.0	13.6 27.0	13.9 27.0	14.3 27.0	14.8 27.0	15.3 27.0	15.7 27.0	16.2 27.0	16.6 27.0	17.1 27.0	17.6 27.0	18.0 27.0
Ringwood	MVA Rating MVA LAR	5.0 14.0	5.1 14.0	5.4 14.0	5.6 14.0	5.7 14.0	5.8 14.0	6.0 14.0	6.1 14.0	6.2 14.0	6.4 14.0	6.5 14.0	6.6 14.0	6.7 14.0	6.8 14.0	7.0 14.0	7.1 14.0
Robertson	MVA Rating MVA LAR	3.6 3.8	4.3 3.8	4.3 3.8	4.3 3.8	4.4 3.8	4.9 3.8	4.9 3.8	5.0 3.8	5.0 3.8	5.1 3.8	5.2 3.8	5.3 3.8	5.4 3.8	5.4 3.8	5.5 3.8	5.6 3.8
Tycan	MVA Rating MVA LAR	2.5	2.1	1.7	1.4	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Tyree	MVA Rating MVA LAR	1.1	1.0	1.0	1.0	1.0	1.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Water Board Dams	MVA Rating MVA LAR	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Fairfax Lane TS	MVA Rating MVA LAR	47.2 88.0	52.4 88.0	50.8 88.0	50.0 88.0	54.6 88.0	54.9 88.0	68.8 88.0	70.2 88.0	71.7 88.0	73.2 88.0	74.6 88.0	75.8 88.0	77.0 88.0	78.2 88.0	79.4 88.0	80.6 88.0

Note: LAR denotes Load at Risk

8.1.4 Fairfax Lane Transmission Substation Winter Demand Forecast

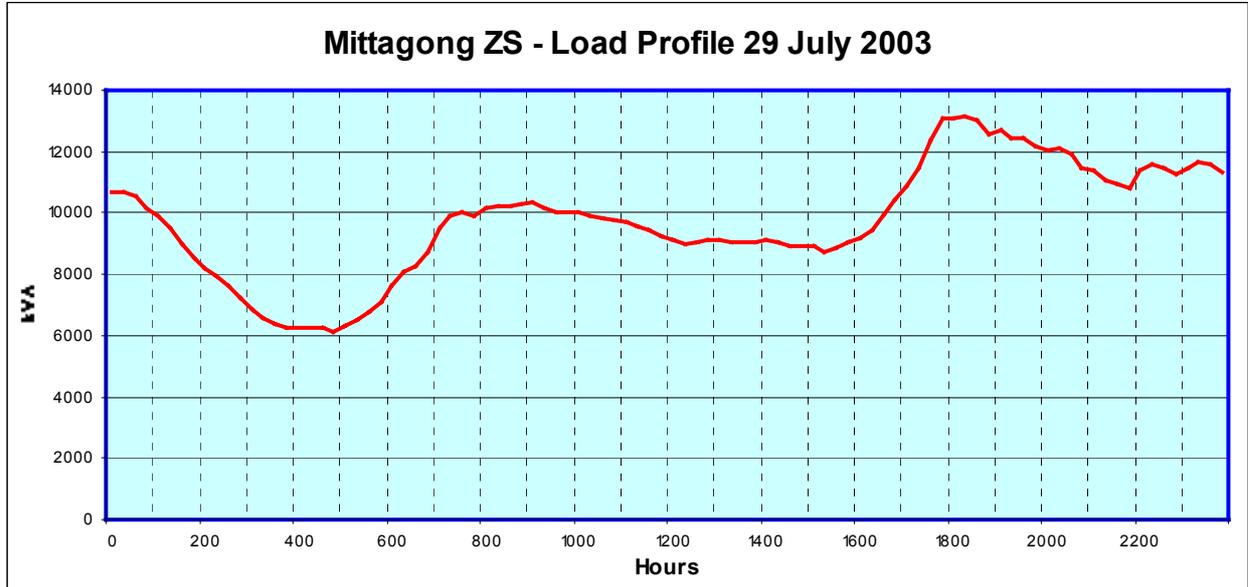
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
BCSC Berrima	MVA Rating MVA LAR	20.5	17.8	16.7	18.0	16.7	22.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
Bowral	MVA Rating MVA LAR	13.8 22.0	15.0 22.0	14.4 22.0	16.8 22.0	16.3 22.0	17.1 22.0	17.4 22.0	17.9 22.0	18.5 22.0	19.1 22.0	19.7 22.0	20.2 22.0	20.8 22.0	21.4 22.0	22.0 22.0	22.6 0.6
Mittagong	MVA Rating MVA LAR	10.5 13.5	11.3 13.5	11.3 13.5	12.6 13.5	12.5 13.5	13.3 13.5	13.4 13.5	13.9 13.5	14.6 13.5	15.4 13.5	16.2 13.5	16.8 13.5	17.3 13.5	17.7 13.5	18.2 13.5	18.6 13.5
Moss Vale	MVA Rating MVA LAR	12.5 27.0	13.9 27.0	14.5 27.0	15.1 27.0	16.3 27.0	16.9 27.0	17.5 27.0	18.1 27.0	18.6 27.0	19.2 27.0	19.7 27.0	20.3 27.0	20.8 27.0	21.4 27.0	21.9 27.0	22.4 27.0
Ringwood	MVA Rating MVA LAR	5.5 14.0	5.8 14.0	5.8 14.0	6.6 14.0	6.3 14.0	6.5 14.0	6.7 14.0	6.9 14.0	7.0 14.0	7.2 14.0	7.3 14.0	7.5 14.0	7.6 14.0	7.8 14.0	7.9 14.0	8.1 14.0
Robertson	MVA Rating MVA LAR	4.4 3.8 0.7	4.3 3.8 0.6	4.3 3.8 0.6	4.3 3.8 0.6	4.7 3.8 1.0	4.9 3.8 1.2	5.0 3.8 1.3	5.2 3.8 1.4	5.3 3.8 1.5	5.4 3.8 1.7	5.5 3.8 1.8	5.7 3.8 1.9	5.8 3.8 2.0	5.9 3.8 2.2	6.0 3.8 2.3	6.2 3.8 2.4
Tycan	MVA Rating MVA LAR	2.3	1.9	1.6	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Tyree	MVA Rating MVA LAR	1.2	1.0	1.0	1.0	1.0	1.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Water Board Dams	MVA Rating MVA LAR	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Fairfax Lane TS	MVA Rating MVA LAR	61.7 88.0	62.1 88.0	62.1 88.0	68.6 88.0	64.8 88.0	76.0 88.0	73.3 88.0	75.0 88.0	76.7 88.0	78.6 88.0	80.6 88.0	82.3 88.0	84.0 88.0	85.5 88.0	87.1 88.0	88.7 0.7

Note: LAR denotes Load at Risk

8.1.5 Constrained Zone Substation Load Profiles, Information and Options

Mittagong Zone Substation

Load Profile



Load Characteristics

Mittagong ZS supplies the Mittagong township and the rural area in the Southern Highlands. The peak demand is in winter evening due to the colder climate and rural/residential load type. The profile indicates a residential/rural load curve driven by morning and evening space heating and cooking. The off-peak demand is disproportionately high due to the time clocks load control system. Robertson ZS has a firm rating of 3.75 MVA and a cyclic rating of 3.8 MVA.

Options

Network

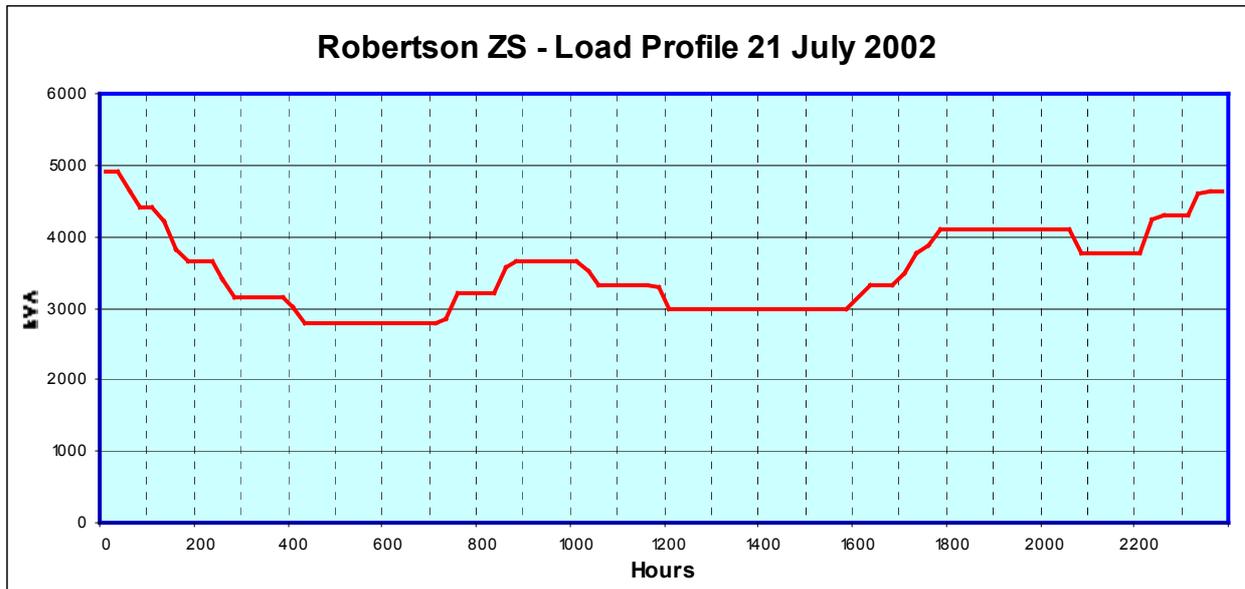
The augmentation of Mittagong ZS will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2007/08 (refer project item PR303).

Non-network

A non-network option would need to reduce the winter evening peak between the hours of 17:00 to 20:00 weekdays. The off-peak demand would also need to be addressed. The winter peak demand is about 3 MVA higher than the summer peak demand. The winter growth rate is about 0.5 MVA per annum.

Robertson Zone Substation

Load Profile



Load Characteristics

Robertson ZS supplies a rural area in the Southern Highlands. The peak demand is in winter evening due to the colder climate and rural/residential load type. The profile indicates a residential/rural load curve driven by morning and evening space heating and cooking. The off-peak demand is disproportionately high due to the time clocks load control system. Robertson ZS has a firm rating of 3.75 MVA and a cyclic rating of 3.8 MVA.

Options

Network

The augmentation of Robertson ZS will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2009/10 (refer project item PR304).

Non-network

A non-network option would need to reduce the winter evening peak between the hours of 17:00 to 20:00 weekdays. The off-peak demand would also need to be addressed. The winter peak demand is about 0.2 MVA higher than the summer peak demand. The winter growth rate is about 0.2 MVA per annum.

9.0 Macarthur Area

Ingleburn Bulk Supply Point

9.1.1 Ingleburn Bulk Supply Point Status

Ingleburn BSP is a 330/66 kV substation owned by TransGrid and has 2 x 250 MVA 330/66 kV transformers. There is sufficient capacity at this supply point for the foreseeable future.

A proposal for a new BSP, being another 330/66 kV injection point in the Campbelltown area is the subject of joint planning discussions with TransGrid.

9.1.2 Ingleburn Bulk Supply Point Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Ingleburn BSP	2 x 250	500	
Bow Bowling	2 x 22/26/35	70	38
Kentlyn	2 x 20/27/33	66	36
Macquarie Fields	2 x 20/27/33	66	36
Minto	2 x 20/27/33 + 1 x 22/26/35	101	68

9.1.3 Ingleburn Bulk Supply Point Summer Demand Forecast

Location		Actual						Forecast										
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Bow Bowling	MVA	36.6	38.1	40.2	40.9	40.3	46.9	44.0	51.0	53.4	55.0	55.9	56.3	56.8	57.2	57.7	58.1	
	Rating	38.0	38.0	38.0	38.0	38.0	38.0	38.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	
	MVA LAR		0.1	2.2	2.9	2.3	8.9	6.0										
Kentlyn	MVA	27.1	28.5	29.8	35.6	29.8	36.5	35.0	36.0	36.9	37.6	38.3	39.0	39.7	40.4	41.2	41.9	
	Rating	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	
	MVA LAR						0.5		0.0	0.9	1.6	2.3	3.0	3.7	4.4	5.2	5.9	
Macquarie Fields	MVA	26.5	27.2	27.3	30.6	27.5	32.3	32.3	29.2	30.1	30.9	31.5	32.1	32.7	33.2	33.8	34.4	
	Rating	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	
	MVA LAR																	
Minto	MVA	48.3	48.3	52.0	55.3	50.9	60.3	64.8	65.9	61.7	62.7	63.6	64.5	65.4	66.2	67.1	68.0	
	Rating	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	
	MVA LAR																	
Ingleburn TS	MVA	139.7	141.5	143.2	155.2	147.7	170.5	179.4	171.7	177.0	181.0	184.1	186.7	189.3	191.9	194.5	197.1	
	Rating	TransGrid																
	MVA LAR																	

9.1.4 Ingleburn Bulk Supply Point Winter Demand Forecast

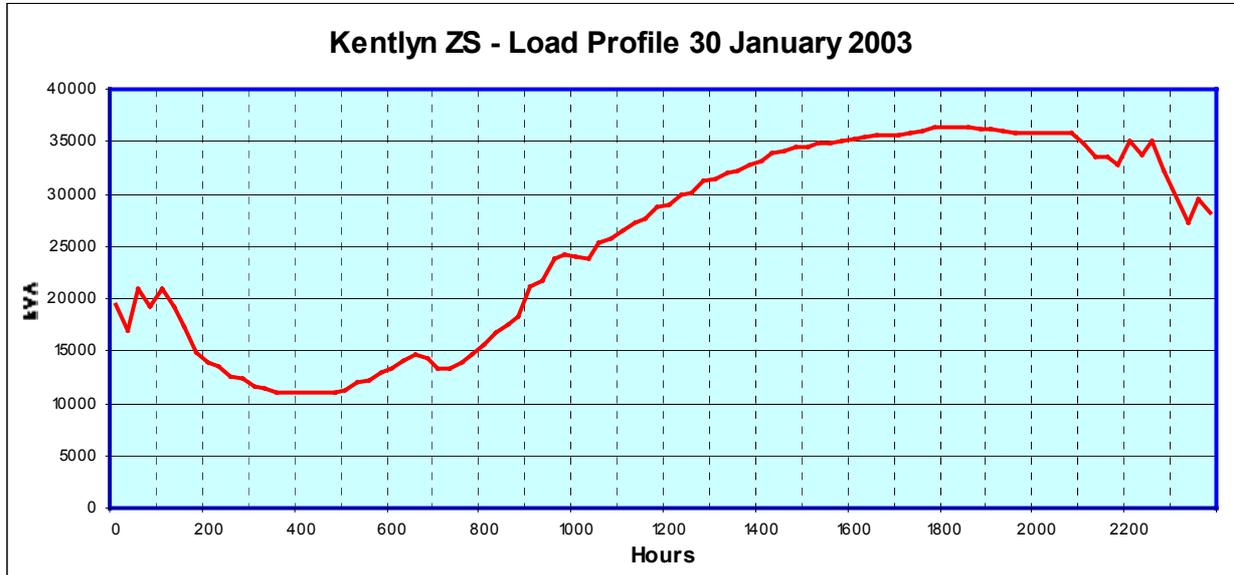
Location		Actual						Forecast										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Bow Bowling	MVA	34.2	35.0	37.2	38.4	39.5	41.9	41.9	39.5	46.4	48.7	50.2	51.0	51.8	52.7	53.5	54.4	
	Rating	38.0	38.0	38.0	38.0	38.0	38.0	38.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	
	MVA LAR				0.4	1.5	3.9	3.9										
Kentlyn	MVA	31.0	32.8	32.3	34.4	35.0	35.3	35.5	35.5	36.7	37.8	38.7	39.6	40.6	41.5	42.4	43.3	
	Rating	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	
	MVA LAR									0.7	1.8	2.7	3.6	4.6	5.5	6.4	7.3	
Macquarie Fields	MVA	27.7	31.7	29.9	32.4	31.9	34.1	34.6	34.4	31.4	32.4	33.3	34.0	34.7	35.4	36.0	36.7	
	Rating	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	
	MVA LAR															0.0	0.7	
Minto	MVA	45.0	53.3	50.7	52.6	54.6	54.9	55.6	57.6	58.4	59.1	59.7	60.2	60.7	61.2	61.7	62.1	
	Rating	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	
	MVA LAR																	
Ingleburn TS	MVA	137.1	150.2	148.1	165.8	158.6	162.7	170.7	175.1	181.0	186.1	190.1	193.2	196.2	199.2	202.2	205.2	
	Rating	TransGrid																
	MVA LAR																	

Note: LAR denotes Load at Risk

9.1.5 Constrained Zone Substation Load Profiles, Information and Options

Kentlyn Zone Substation

Load Profile



Load Characteristics

Kentlyn ZS supplies the eastern part of the Campbelltown commercial centre and the surrounding low and medium density residential areas. The load profile of this substation is summer peaking driven mainly by the coincidence of commercial and residential air conditioning loads. Kentlyn ZS has a firm rating of 33 MVA and a cyclic rating of 36 MVA. This substation is experiencing steady demand growth due to residential redevelopment and commercial activity.

Options

Network

The augmentation of Kentlyn ZS will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2007/08 (refer project item PR107 & PR152).

Non-network

A non-network option would need to reduce the hot summer day peak demands created by the coincident commercial and residential loads. The summer peak demand is 5 MVA higher than the winter peak demand. The growth rate is about 1.0 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

NEPEAN 33 kV TRANSMISSION SUBSTATION

9.1.6 Nepean 33 kV Transmission Substation Status

Nepean TS has 2 x 60 MVA 132/33 kV double-wound transformers and 2 x 120 MVA 132/66 kV autotransformers with provision for one additional 132/33 kV transformer.

The transmission substation will be limited by the Nepean 132 kV system to a firm rating of 183/201 MVA (continuous/peak cyclic) less the demand of Bringelly ZS. The 33 kV 1200 A (68.6 MVA) transformer circuit breakers and isolators will limit the 60 MVA 132/33 kV transformers to 68.6 MVA cyclic.

9.1.7 Nepean 33 kV Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Nepean 33kV TS	2 x 60	120	66
Camden	3 x 15/19/25	75	55
Oakdale	2 x 10	20	11
Warragamba	2 x 5	10	5.5

9.1.8 Nepean 33 kV Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Brimstone	MVA Rating MVA LAR	2.3	2.9	1.1													
Camden	MVA Rating MVA LAR	36.2 55.0	38.7 55.0	48.1 55.0	51.4 55.0	42.2 55.0	39.1 55.0	39.6 55.0	40.9 55.0	43.0 55.0	45.9 55.0	49.7 55.0	53.9 55.0	58.0 55.0	62.0 55.0	65.6 55.0	68.9 55.0
Nepean RIC	MVA Rating MVA LAR	7.5	6.6	7.4	5.9	5.3	4.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
Oakdale	MVA Rating MVA LAR	11.0 11.0 0.0	8.8 11.0	5.4 11.0	5.9 11.0	6.1 11.0	9.0 11.0	8.0 11.0	8.1 11.0	8.2 11.0	8.4 11.0	8.5 11.0	8.7 11.0	8.8 11.0	8.9 11.0	9.1 11.0	9.2 11.0
Warragamba	MVA Rating MVA LAR	5.8 5.5 0.3	6.0 5.5 0.5	6.8 5.5 1.3	6.8 5.5 1.3	7.2 5.5 1.7	8.4 5.5 2.9	8.4 5.5 2.9	8.7 5.5 3.2	8.9 5.5 3.4	9.1 5.5 3.6	9.3 5.5 3.8	9.5 5.5 4.0	9.8 5.5 4.3	10.0 5.5 4.5	10.2 5.5 4.7	10.4 5.5 4.9
Wollondilly	MVA Rating MVA LAR	4.8	3.8	3.5													
Nepean 33kV TS	MVA Rating MVA LAR	55.6 66.0	52.8 66.0	64.1 66.0	64.1 66.0	51.1 66.0	58.4 66.0	57.7 66.0	59.1 66.0	61.3 66.0	64.2 66.0	67.8 66.0	71.8 66.0	75.8 66.0	79.6 66.0	83.1 66.0	86.3 66.0
												1.8	5.8	9.8	13.6	17.1	20.3

Note: LAR denotes Load at Risk

9.1.9 Nepean 33 kV Transmission Substation Winter Demand Forecast

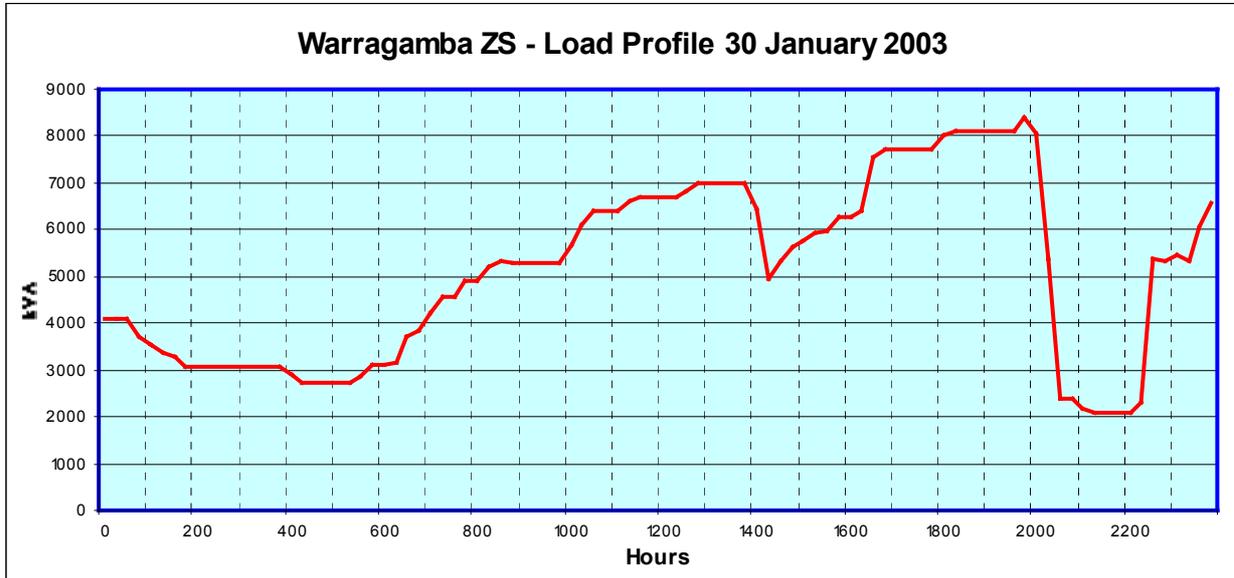
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Brimstone	MVA Rating MVA LAR	3.2	2.5	2.2													
Camden	MVA Rating MVA LAR	32.5 55.0	38.2 55.0	38.2 55.0	47.7 55.0	46.6 55.0	34.0 55.0	32.6 55.0	33.3 55.0	34.5 55.0	36.5 55.0	39.3 55.0	43.0 55.0	47.0 55.0	51.1 55.0	55.1 55.0	58.6 55.0
Nepean RIC	MVA Rating MVA LAR	7.2	6.4	7.5	5.1	5.8	5.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
Oakdale	MVA Rating MVA LAR	11.0 11.0 0.4	11.4 11.0	10.1 11.0	6.5 11.0	7.3 11.0	7.4 11.0	7.5 11.0	7.6 11.0	7.8 11.0	8.0 11.0	8.1 11.0	8.3 11.0	8.5 11.0	8.7 11.0	8.8 11.0	9.0 11.0
Warragamba	MVA Rating MVA LAR	5.7 5.5 0.2	5.9 5.5 0.4	6.1 5.5 0.6	7.0 5.5 1.5	7.5 5.5 2.0	7.2 5.5 1.7	7.1 5.5 1.6	7.3 5.5 1.8	7.5 5.5 2.0	7.7 5.5 2.2	7.8 5.5 2.3	8.0 5.5 2.5	8.2 5.5 2.7	8.4 5.5 2.9	8.6 5.5 3.1	8.8 5.5 3.3
Wollondilly	MVA Rating MVA LAR	4.7	4.9	3.8	3.1	2.9											
Nepean 33kV TS	MVA Rating MVA LAR	54.8 66.0	55.5 66.0	52.2 66.0	66.3 66.0	66.9 66.0	51.8 66.0	48.2 66.0	49.1 66.0	50.5 66.0	52.5 66.0	55.3 66.0	58.8 66.0	62.6 66.0	66.4 66.0	70.0 66.0	73.4 66.0
					0.3	0.9									0.4	4.0	7.4

Note: LAR denotes Load at Risk

9.1.10 Constrained Zone Substation Load Profiles, Information and Options

Warragamba Zone Substation

Load Profile



Load Characteristics

Warragamba ZS supplies a rural/residential area and the Warragamba township. The peak demand is in summer afternoon on hot days. The profile indicates a load curve driven by air conditioning load. Warragamba ZS has a firm rating of 5 MVA and a cyclic rating of 5.5 MVA.

Options

Network

The augmentation of Warragamba ZS will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2005/06 (refer project item PR318).

Non-network

A non-network option would need to reduce the summer afternoon peak between the hours of 15:00 to 20:00 weekdays. The summer peak demand is about 0.5 MVA higher than the winter peak demand. The summer growth rate is about 0.3 MVA per annum.

NEPEAN 66 kV TRANSMISSION SUBSTATION

9.1.11 Nepean 66 kV Transmission Substation Status

Nepean TS has 2 x 60 MVA 132/33 kV double-wound transformers and 2 x 120 MVA 132/66 kV autotransformers with provision for one additional 132/33 kV transformer.

The transmission substation will be limited by the Nepean 132 kV system to a firm rating of 183/201 MVA (continuous/peak cyclic) less the demand of Bringelly ZS. The 66 kV 1600 A (183 MVA) transformer circuit breakers are adequate for both the 120 MVA 132/66 kV autotransformers cyclic rating of 150 MVA.

Local generation is provided at Tower and Appin Collieries through committed long term energy contracts. Together, the collieries supply up to 94 MW into the local area, reducing to 65 MW under network contingency conditions on the 66 kV network. The maximum generation capacity available from Tower and Appin Collieries is also constrained to 50 MW by EPA requirements during low air quality days. However, the EPA has given dispensation for generation above 65 MW if required under contingency conditions on the 132 kV network. This generation capacity defers the need to augment incoming 132 kV capacity to Nepean TS.

9.1.12 Nepean 66 kV Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Nepean 66kV TS	2 x 120	240	130
Ambarvale	2 x 21/26/35	70	38
Appin	1 x 8	8	8
Campbelltown	2 x 22/26/35	70	38
Maldon	2 x 10	20	11
Narellan	2 x 15/20	40	22
Tahmoor	2 x 5	10	11

9.1.13 Nepean 66 kV Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Ambarvale	MVA	14.3	15.6	19.2	20.7	19.1	26.1	25.2	26.0	26.9	27.9	29.0	30.1	31.2	32.2	33.0	33.8
	Rating MVA LAR	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Appin	MVA	4.2	4.4	4.9	5.8	5.7	6.5	6.8	7.0	7.3	7.8	8.4	9.0	9.4	9.7	10.0	10.2
	Rating MVA LAR	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Appin Colliery	MVA	12.8	12.9	12.3	9.3	7.5	9.2	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
	Rating MVA LAR																
BCSC Maldon	MVA	11.8	11.8	12.1	11.2	10.7	11.2	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1
	Rating MVA LAR																
Brooks Point	MVA	2.6	2.5	2.0	2.4	2.2	0.9	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	Rating MVA LAR																
Broughtons Pass	MVA	6.7	4.9	5.0	5.1	5.1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Rating MVA LAR																
Campbelltown	MVA	28.4	30.5	28.4	32.8	28.0	31.5	32.3	38.0	39.1	40.2	41.1	41.9	42.4	42.9	43.4	43.9
	Rating MVA LAR	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Maldon	MVA	10.0	9.9	12.6	13.7	13.3	17.9	16.0	17.5	18.4	19.1	19.8	20.4	21.0	21.6	22.2	22.8
	Rating MVA LAR	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Narellan	MVA					22.4	30.1	31.1	31.6	32.3	33.3	34.6	35.8	36.8	37.6	38.1	38.5
	Rating MVA LAR					22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Tahmoor	MVA	10.8	10.3	11.2	10.0	9.5	11.8	11.5	12.6	12.9	13.3	13.8	14.3	14.7	15.1	15.4	15.7
	Rating MVA LAR	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Tahmoor Colliery	MVA	10.7	9.9	10.1	10.1	10.6	10.7	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
	Rating MVA LAR																
Tower Colliery	MVA	8.7	8.5	8.9	8.0	7.3	2.5	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
	Rating MVA LAR																
Westcliff Colliery	MVA	14.2	15.7	14.3	14.8	17.3	19.2	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8
	Rating MVA LAR																
Appin Tower generation	MVA							-94.0	-94.0	-94.0	-94.0	-94.0	-94.0	-94.0	-94.0	-94.0	-94.0
	Rating MVA LAR																
No generation With generation Guildford TS	MVA	100.0	106.5	137.8	123.9	137.6	158.4	160.9	169.7	173.5	177.7	182.1	186.4	190.1	193.2	195.9	198.4
	Rating MVA LAR	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0

Note: LAR denotes Load at Risk

9.1.14 Nepean 66 kV Transmission Substation Winter Demand Forecast

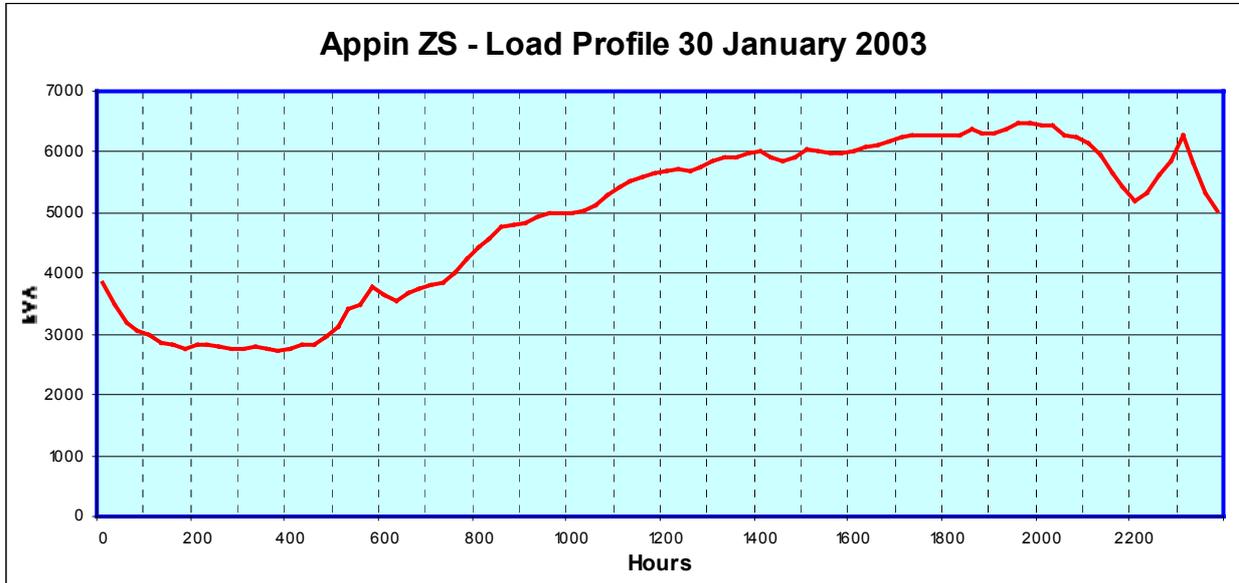
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Ambarvale	MVA	15.1	17.1	17.4	18.8	20.7	24.1	24.6	26.0	27.0	28.1	29.2	30.4	31.7	32.9	34.1	35.1
	Rating MVA LAR	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Appin	MVA	4.4	4.4	5.5	4.8	5.3	5.0	5.6	5.8	6.0	6.3	6.7	7.3	7.9	8.3	8.6	8.8
	Rating MVA LAR	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Appin Colliery	MVA	12.8	13.6	14.2	9.1	9.1	8.9	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
	Rating MVA LAR																
BCSC Maldon	MVA	11.8	12.2	12.0	11.5	10.9	11.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1
	Rating MVA LAR																
Brooks Point	MVA	2.0	2.7	2.5	2.5	2.5	2.2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	Rating MVA LAR																
Broughtons Pass	MVA	6.4	5.0	5.0	4.8	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Rating MVA LAR																
Campbelltown	MVA	21.8	21.8	24.1	23.0	24.9	23.4	23.1	23.6	28.7	29.6	30.4	31.1	31.7	32.0	32.3	32.6
	Rating MVA LAR	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Maldon	MVA	9.6	10.2	11.4	14.8	15.6	15.7	15.6	16.0	17.4	18.0	18.5	18.9	19.2	19.6	19.9	20.3
	Rating MVA LAR	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Narellan	MVA						19.5	19.2	23.0	23.4	24.0	24.8	25.9	27.0	27.8	28.5	28.8
	Rating MVA LAR						22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Tahmoor	MVA	12.0	11.4	12.7	9.3	10.2	10.4	10.7	10.8	11.9	12.1	12.4	12.7	13.0	13.3	13.5	13.7
	Rating MVA LAR	1.0	0.4	1.7						0.9	1.1	1.4	1.7	2.0	2.3	2.5	2.7
Tahmoor Colliery	MVA	10.0	12.6	10.1	11.1	11.6	10.5	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
	Rating MVA LAR																
Tower Colliery	MVA	9.0	8.8	8.7	7.8	7.4	7.1	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
	Rating MVA LAR																
Westcliff Colliery	MVA	14.5	14.9	14.0	15.5	16.3	19.2	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	Rating MVA LAR																
Appin Tower generation	MVA							-94.0	-94.0	-94.0	-94.0	-94.0	-94.0	-94.0	-94.0	-94.0	-94.0
	Rating MVA LAR																
No generation With generation Guildford TS	MVA	85.9	99.0	84.6	124.5	121.0	143.5	151.1	152.9	161.3	164.7	168.4	172.4	176.2	179.4	182.1	184.4
	Rating MVA LAR	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0

Note: LAR denotes Load at Risk

9.1.15 Constrained Zone Substation Load Profiles, Information and Options

Appin Zone Substation

Load Profile



Load Characteristics

Appin ZS supplies a rural area south of Campbelltown. The area is influenced by the hot climate of Western Sydney and consequently, has seen the summer demand overtake the traditional winter peak demand. The load profile is summer peaking driven mainly by air conditioning on hot days. The off-peak demand is also high due to the time clock load control system. Appin ZS has one 8 MVA transformer installed. This substation does not have back-up supply.

Options

Network

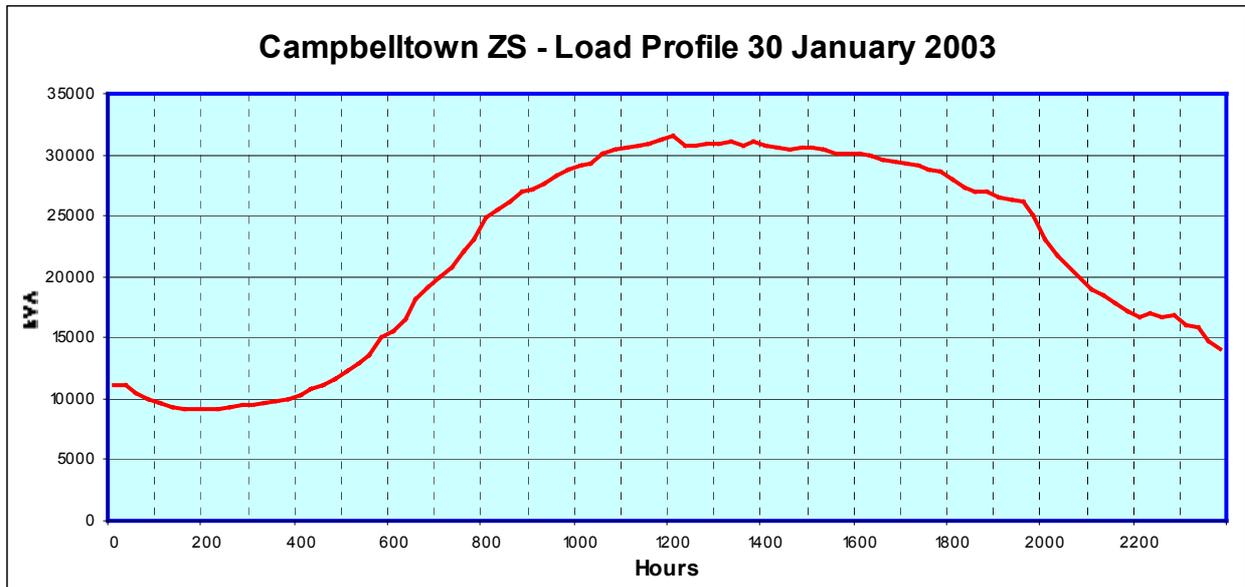
The augmentation of Appin ZS will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2008/09 (refer project item PR305).

Non-network

A non-network option would not resolve the 'security of supply' issue and is not feasible.

Campbelltown Zone Substation

Load Profile



Load Characteristics

Campbelltown ZS supplies the bulk of the Campbelltown commercial centre and the surrounding low and medium density residential areas. The load profile of this substation is summer peaking driven mainly by the coincidence of commercial and residential air conditioning loads. Campbelltown ZS has a firm rating of 35 MVA and a cyclic rating of 38 MVA. This substation is experiencing steady demand growth due to residential redevelopment and commercial activity.

Options

Network

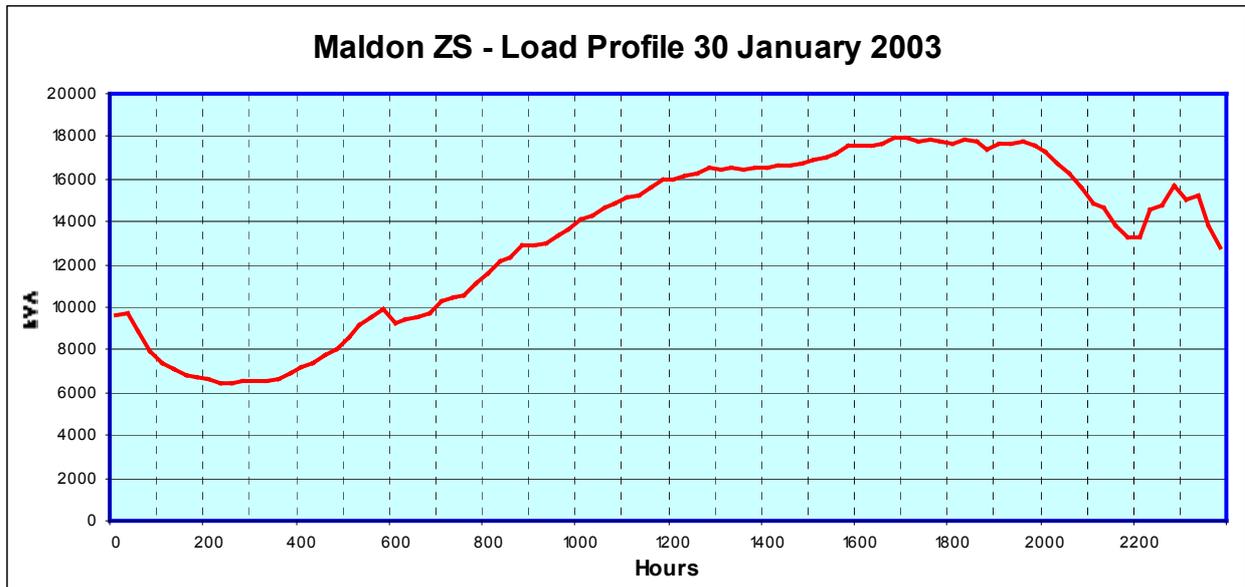
The augmentation of Campbelltown ZS will provide sufficient capacity to cater for long term load growth. The current estimated construction date is 2007/08 & 2009/10 (refer project item PR297, PR073, PR074 & PR152). Other transmission projects will increase feeder capacity to Campbelltown ZS.

Non-network

A non-network option would need to reduce the hot summer day peak demands created by the coincident commercial and residential loads. The summer peak demand is 5 MVA higher than the winter peak demand. The growth rate is about 1.0 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Maldon Zone Substation

Load Profile



Load Characteristics

Maldon ZS supplies a rural area south of Campbelltown. The area is influenced by the hot climate of Western Sydney and consequently, has seen the summer demand grow at a faster rate than the winter peak demand. The load profile is summer peaking driven mainly by air conditioning on hot days. Maldon ZS has a firm rating of 10 MVA and a cyclic rating of 11 MVA.

Options

Network

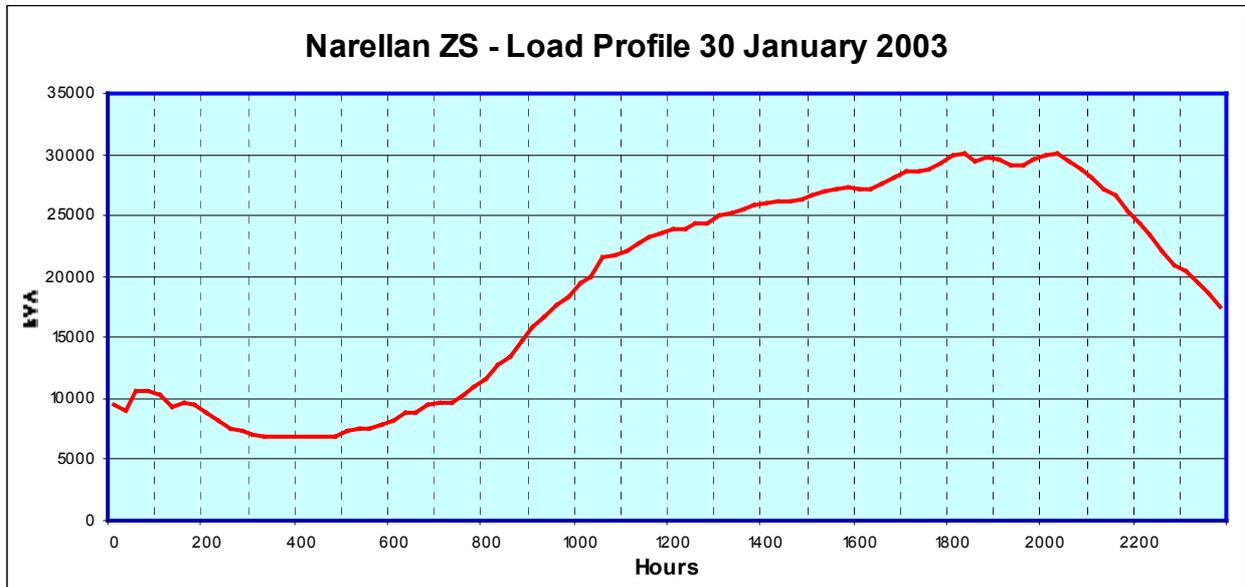
The augmentation of Maldon ZS will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2005/06 (refer project item PR051). The longer term a new zone substation is required to supply new development in the Oakdale area (refer project item PR205 & PR277).

Non-network

The augmentation of this substation has already been deferred by the implementation of a 'fuel substitution' demand management program from 1998. The summer demand has now exceeded the winter peak demand due to new development and increased air conditioning penetration. The network project must now proceed.

Narellan Zone Substation

Load Profile



Load Characteristics

Narellan ZS supplies new residential release areas and an industrial area west of Campbelltown. The area is influenced by the hot climate of Western Sydney. The load profile is summer peaking driven mainly by residential air conditioning on hot days coincident with the industrial load. Narellan ZS has a firm rating of 20 MVA and a cyclic rating of 22 MVA.

Options

Network

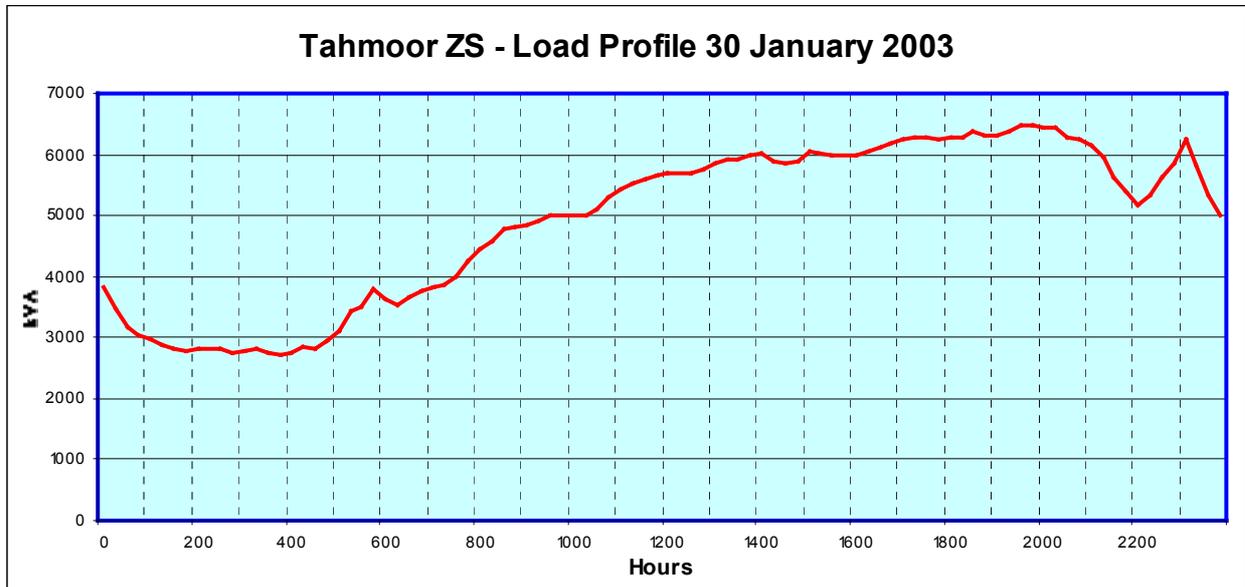
The augmentation of Narellan ZS will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2004/05 (refer project item PR238).

Non-network

A non-network option would need to reduce the hot summer day peak demands driven by both residential and industrial loads. The summer peak demand is about 10 MVA higher than the winter peak demand. The growth rate is about 0.5 MVA per annum. This is a committed project and demand management would have insufficient time to achieve the required demand reduction.

Tahmoor Zone Substation

Load Profile



Load Characteristics

Tahmoor ZS supplies a rural area and the Tahmoor township south of Campbelltown. The area is influenced by the hot climate of Western Sydney and consequently, has seen the summer demand grow at a faster rate than the winter peak demand. The load profile is summer peaking driven mainly air conditioning on hot days.

Tahmoor ZS has a firm rating of 10 MVA and a cyclic rating of 11 MVA.

Options

Network

The augmentation of Tahmoor ZS will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2005/06 (refer project item PR051).

Non-network

The augmentation of this substation has already been deferred by the implementation of a 'fuel substitution' demand management program from 1998. The summer demand has now exceeded the winter peak demand due to new development and increased air conditioning penetration. The network project must now proceed.

10.0 Liverpool Area

Guildford Transmission Substation

10.1.1 Guildford Transmission Substation Status

Guildford TS has new 33 kV circuit breakers and isolators rated at 2000 A on the transformers and bus sections. The designated firm capacity of 3 x 68.6 MVA (205 MVA) needs to be revised as the transformers are now the limiting factor. Sithe Generation supplies 160 MW and 60 MVAR onto the 33 kV busbar at Guildford TS. The normal static support arrangement is for only 20 MVAR with Sithe supplying the remaining MVAR needs. This is required to limit the voltage fluctuations on the Sithe generators, which would otherwise be prevailing with repetitive switching of the capacitor banks. Integral Energy's load allocation at Guildford TS is 190 MVA. This allocation makes allowance for Energy Australia's requirements at Leightonfield ZS, which is supplied from Guildford TS.

A new transmission substation is planned for Wetherill Park West to strengthen the supply to the industrial area, which is being supplied from the constrained networks of Bossley Park, Horsley Park and Wetherill Park ZS's. The project includes a zone substation within the transmission substation and is scheduled for commissioning in 2005. It will supply the existing zones of Bossley Park, Horsley Park, Woodpark, and parts of Wetherill Park. It also becomes the alternate supply to Smithfield ZS. Additionally, it will provide for future needs of Wakeley and Cecil Hills ZS's to offload Smithfield, Canley Vale, Bonnyrigg, Hoxton Park and Horsley Park ZS's. Currently, a demand management program is in progress assisting to defer the construction of the new Wetherill Park Zone Substation but needs to be expanded. An RFP has been issued to identify additional demand reduction opportunities.

10.1.2 Guildford Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Cabramatta	2 x 15/19/25	50	27
Carramar	2 x 15/19/25	50	27
Fairfield	3 x 17.25	51.75	37
Guildford	4 x 45/60	240	180
Sherwood	2 x 15/19/25	50	27
Smithfield	2 x 15/20/25	50	27
South Granville	2 x 15/20	40	21.5
Woodpark	2 x 15/19/25	50	27
Yennora	2 x 15 + 1 x 15/20	50	45

10.1.3 Guildford Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Cabramatta	MVA	25.3	24.8	27.5	27.7	26.6	30.8	27.3	27.7	28.2	28.6	29.1	29.5	30.0	30.4	30.9	31.3
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Carramar	MVA	14.3	15.5	16.5	17.5	16.5	18.7	19.4	19.9	20.4	20.8	21.3	21.7	22.2	22.7	23.1	23.6
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Comalco (Kaal Australia)	MVA	17.1	19.3	17.1	18.0	17.0	17.8	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
	Rating MVA LAR																
Fairfield	MVA	30.7	30.7	25.3	30.9	27.8	31.4	34.3	36.6	35.2	36.1	36.6	37.1	37.6	38.1	38.6	39.1
	Rating MVA LAR	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	0.1	0.6	1.1
Sherwood	MVA	25.9	26.4	28.4	34.1	26.5	29.9	31.0	31.3	31.7	32.0	32.4	32.7	33.0	33.4	33.7	34.0
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Smithfield	MVA	23.8	23.8	26.1	34.3	32.3	37.3	35.1	35.8	36.5	37.2	37.9	38.6	39.3	40.0	40.7	41.4
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
South Granville	MVA	17.4	17.5	17.9	14.6	17.3	17.9	21.0	22.5	23.2	23.7	24.2	24.7	25.2	25.7	26.2	26.7
	Rating MVA LAR	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
SPC	MVA	15.9	15.7	15.9	16.2	16.1	17.4	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
	Rating MVA LAR																
Woodpark	MVA					25.4	25.1	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.6
	Rating MVA LAR					27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Yennora	MVA	25.3	21.8	23.0	27.0	23.9	25.1	24.2	25.2	25.4	25.6	25.8	26.0	26.2	26.4	26.6	26.8
	Rating MVA LAR	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
EA Guildford	MVA	26.5	26.3	27.9	32.2	27.0	27.6	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
	Rating MVA LAR																
Sithe	MVA							170.9	170.9	170.9	170.9	170.9	170.9	170.9	170.9	170.9	170.9
	Rating MVA LAR																
No generation With generation Guildford TS	MVA	220.0	216.7	211.3	223.8	225.7	225.4	243.6	247.5	251.7	255.0	258.0	261.0	264.0	267.0	269.9	272.9
	Rating MVA LAR	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0

Note: LAR denotes Load at Risk

10.1.4 Guildford Transmission Substation Winter Demand Forecast

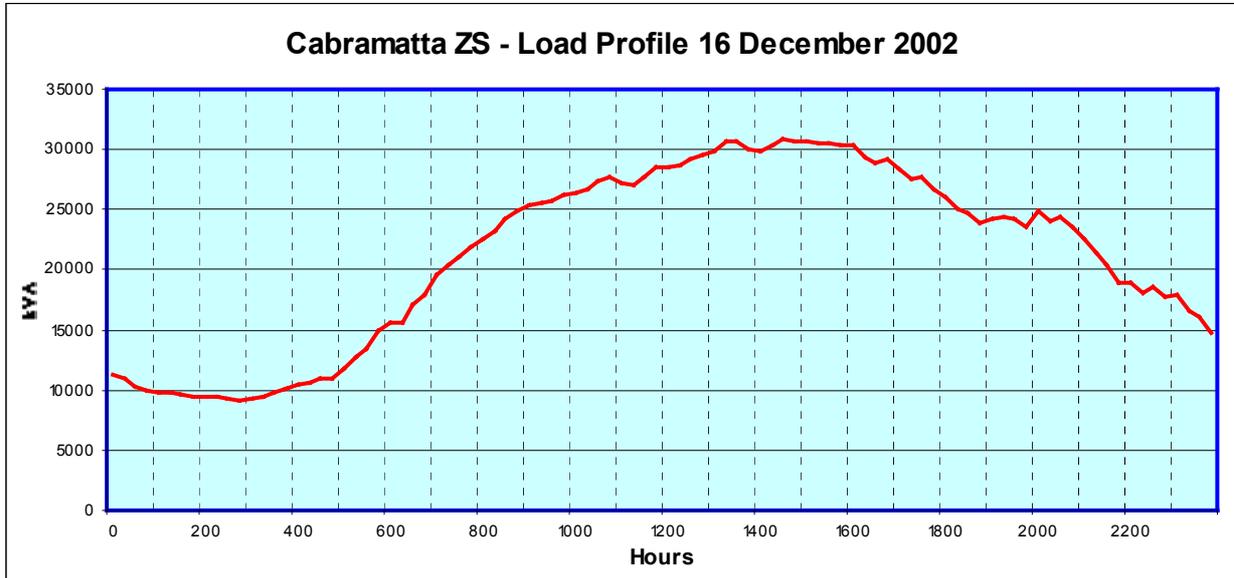
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cabramatta	MVA	24.6	24.7	25.8	24.7	25.7	23.7	24.2	24.6	25.1	25.5	26.0	26.5	26.9	27.4	27.9	31.3
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Carramar	MVA	13.2	15.0	16.1	15.9	15.6	17.3	19.0	18.4	18.8	19.3	19.8	20.3	20.8	21.3	21.8	22.2
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Comalco (Kaal Australia)	MVA	16.5	17.9	17.7	17.4	19.0	17.6	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
	Rating MVA LAR																
Fairfield	MVA	26.7	27.5	23.3	27.1	26.7	24.7	27.5	29.0	30.2	31.4	31.9	32.0	32.1	32.2	32.3	32.3
	Rating MVA LAR	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0
Sherwood	MVA	24.1	26.1	25.5	26.7	25.7	25.9	26.8	26.7	27.1	27.5	27.9	28.3	28.7	29.2	29.6	30.0
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Smithfield	MVA	24.5	23.6	24.2	24.5	28.0	29.6	29.9	30.6	31.3	32.0	32.6	33.3	34.0	34.7	35.4	36.0
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
South Granville	MVA	15.9	17.0	15.7	14.7	14.4	16.4	17.6	19.9	20.5	20.8	21.1	21.3	21.5	21.7	22.0	22.2
	Rating MVA LAR	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
SPC	MVA	17.1	16.1	16.2	16.0	16.4	16.7	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
	Rating MVA LAR																
Woodpark	MVA					23.4	25.0	26.0	24.6	24.7	24.9	25.0	25.2	25.3	25.5	25.6	25.8
	Rating MVA LAR					27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Yennora	MVA	20.9	21.6	20.5	21.3	20.3	21.2	22.1	20.5	20.7	20.9	21.1	21.3	21.5	21.7	21.9	22.1
	Rating MVA LAR	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
EA Guildford	MVA	23.9	24.5	23.5	24.0	23.7	24.2	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
	Rating MVA LAR																
Sithe	MVA							170.9	170.9	170.9	170.9	170.9	170.9	170.9	170.9	170.9	170.9
	Rating MVA LAR																
No generation With generation Guildford TS	MVA	196.8	209.3	192.0	208.2	212.7	221.8	230.3	222.6	226.4	230.1	232.9	235.4	237.9	240.4	242.9	245.4
	Rating MVA LAR	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0

Note: LAR denotes Load at Risk

10.1.5 Constrained Zone Substation Load Profiles, Information and Options

Cabramatta Zone Substation

Load Profile



Load Characteristics

Cabramatta ZS supplies a commercial centre and high/medium/low density residential areas and part of the industrial area at Chipping Norton. The load profile of this substation is summer peaking driven mainly by the coincidence of commercial and residential air conditioning loads. Cabramatta ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing steady demand growth in all sectors including the redevelopment of low to medium density residential areas.

Options

Network

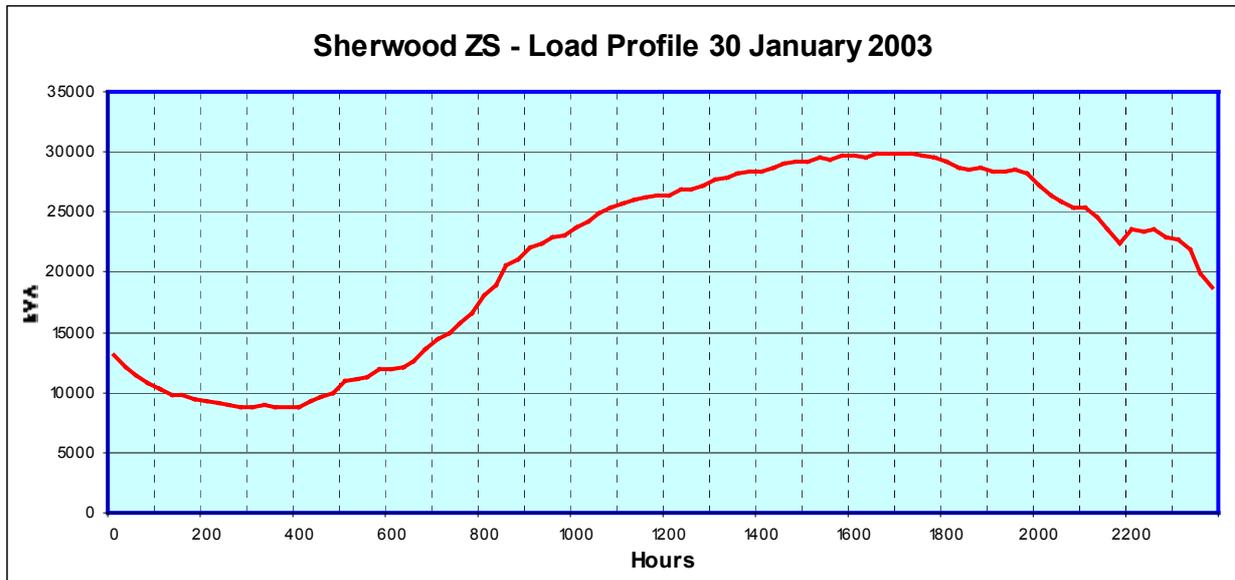
It is proposed to construct a new zone substation at Chipping Norton ZS. This will provide sufficient network capacity to offload Cabramatta ZS. The current estimated construction date is 2009/10 (refer project item PR126). An alternative to this project is the augmentation of Cabramatta ZS.

Non-network

A non-network option would need to reduce the hot summer day peak demands created by the coincident commercial and residential loads. The summer peak demand is 3 MVA higher than the winter peak demand. The growth rate is about 0.5 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Sherwood Zone Substation

Load Profile



Load Characteristics

Sherwood ZS supplies a commercial centre and high/medium/low density residential areas. The load profile of this substation is summer peaking driven mainly by the coincidence of commercial and residential air conditioning loads. Sherwood ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing steady demand growth in all sectors including the redevelopment of low to medium density residential areas.

Options

Network

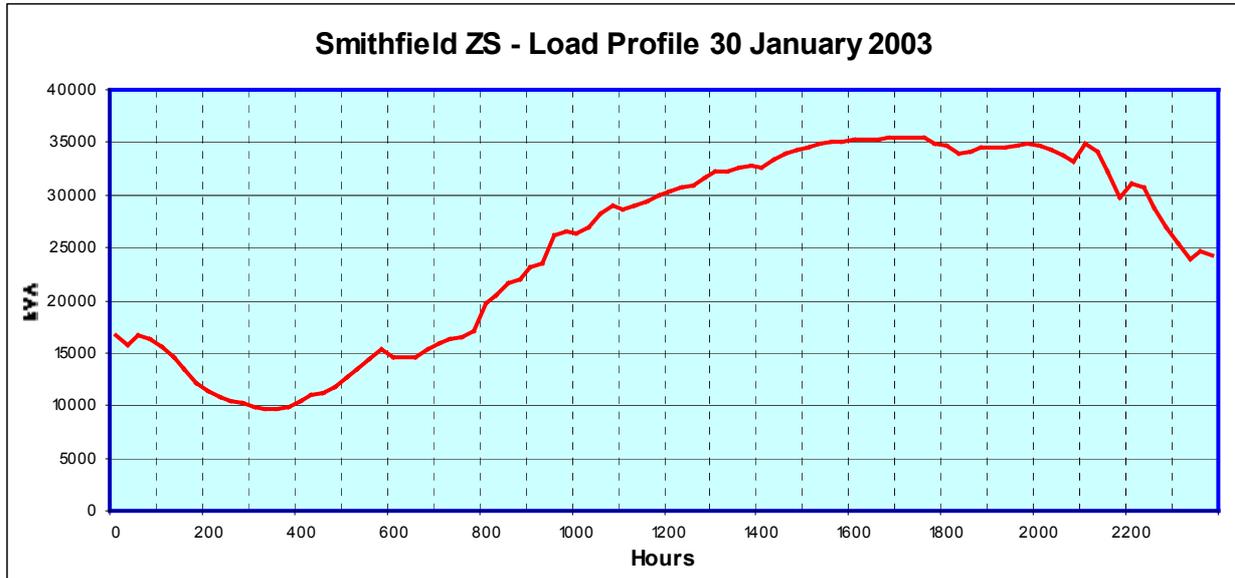
It is proposed to install a third transformer at Sherwood ZS and augment the 33kV feeder supplying Sherwood ZS. This will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2006/07 (refer project item PR144 & PR094).

Non-network

A non-network option would need to reduce the hot summer day peak demands created by the coincident commercial and residential loads. The summer peak demand is 4 MVA higher than the winter peak demand. The growth rate is about 0.4 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Smithfield Zone Substation

Load Profile



Load Characteristics

Smithfield ZS supplies a commercial centre, a large industrial area and a low density residential area. The load profile of this substation is summer peaking driven mainly by the coincidence of commercial and residential air conditioning loads and industrial loads. Smithfield ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing steady demand growth in all sectors including the redevelopment of low to medium density residential areas.

Options

Network

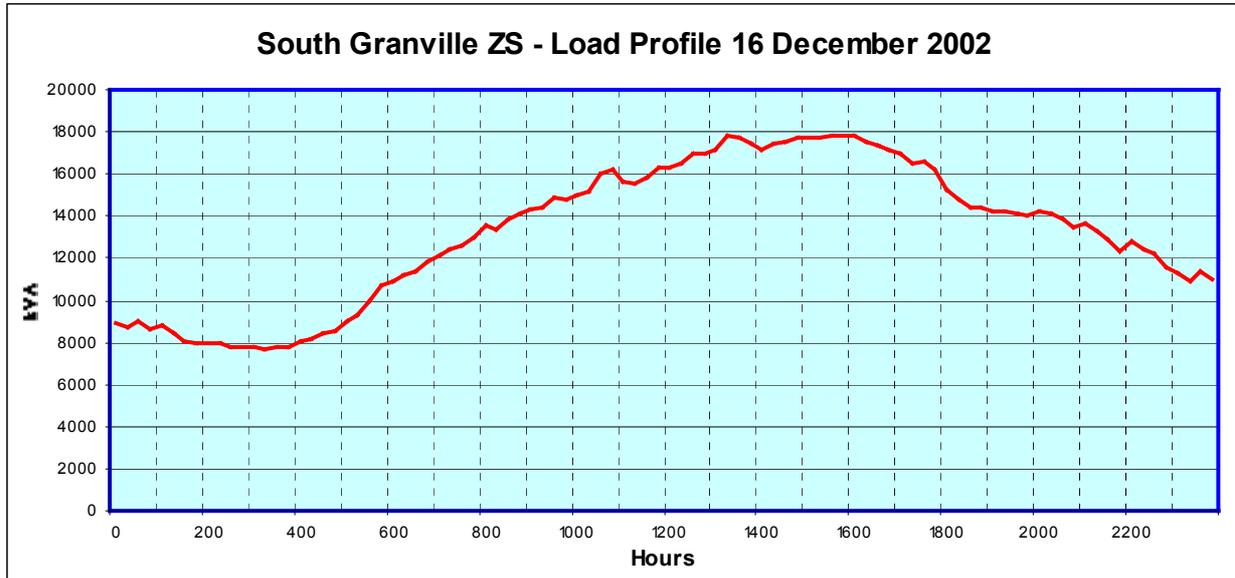
It is proposed to install a third transformer at Smithfield ZS. This will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2007/08 (refer project item PR145).

Non-network

A non-network option would need to reduce the hot summer day peak demands created by the coincident commercial, industrial and residential loads. The summer peak demand is 7 MVA higher than the winter peak demand. The growth rate is about 0.7 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

South Granville Zone Substation

Load Profile



Load Characteristics

South Granville ZS supplies an industrial area and the surrounding low density residential area. The load profile of this substation is summer peaking driven mainly by the coincidence of industrial and residential air conditioning loads. South Granville ZS has a firm rating of 20 MVA and a cyclic rating of 21.5 MVA. This substation is experiencing slow demand growth mainly in the redevelopment of low to medium density residential areas.

Options

Network

The augmentation of South Granville ZS will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2008/09 & 2006/07 (refer project item PR250, PR272 & PR273).

Non-network

A non-network option would need to reduce the hot summer day peak demands created by the coincident commercial, industrial and residential loads between the hours of 13:00 and 17:00. The summer peak demand is 7 MVA higher than the winter peak demand. The growth rate is about 0.7 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

West Liverpool Transmission Substation

10.1.6 West Liverpool Transmission Substation Status

West Liverpool TS is owned by Integral Energy. It has 3 x 120 MVA 132/33 kV transformers with provision for a fourth. The substation's 33 kV circuit breakers and isolators (2400 A) limit the substation firm cyclic rating to 2 x 137 MVA (274 MVA).

Liverpool BSP is owned by TransGrid. It supplies the West Liverpool TS 132 kV busbar through 2 x 375 MVA tail-ended transformers and feeder 93B and 93N. Mutual backup between Sydney West BSP and West Liverpool TS is supplied via normally open feeder 93U. The West Liverpool 132kV busbar also supplies Nepean TS via 93Y with the balance being supplied from Sydney West BSP via 93X. (Refer to Section 8.5 – Sydney West Bulk Supply Point).

10.1.7 West Liverpool Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
West Liverpool TS	3 x 120	360	265
Anzac Village	2 x 15/19/25	50	27
Bonnyrigg	2 x 15/17.5/25 + 1 x 15/19/25	75	55
Canley Vale	3 x 15	45	32
Homepride	2 x 15/19/25	50	55
Hoxton Park	2 x 15/18.75 + 1 x 15/20	57.5	39
Kemps Creek	2 x 10	20	11
Liverpool	2 x 22/26/35	70	38
Moorebank	2 x 15/20/25 + 1 x 15/19/25	75	55
Prestons	2 x 15/19/25	50	27

10.1.8 West Liverpool Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Anzac Village	MVA	10.6	10.8	10.9	17.7	18.8	22.7	24.3	28.2	34.0	35.9	36.8	38.0	39.5	41.3	43.5	45.9
	Rating	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
	MVA LAR								1.2	7.0	8.9	9.8	11.0	12.5	14.3	16.5	18.9
Bonnyrigg	MVA	39.9	44.0	48.3	55.8	54.3	66.0	65.6	63.9	65.0	66.0	67.0	67.6	68.2	68.8	69.4	70.0
	Rating	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
	MVA LAR				0.8		11.0	10.6	8.9	10.0	11.0	12.0	12.6	13.2	13.8	14.4	15.0
Canley Vale	MVA	26.1	25.2	26.5	28.0	26.9	29.4	28.4	26.8	27.1	27.4	27.7	28.1	28.4	28.7	29.0	29.3
	Rating	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
	MVA LAR																
Homepride	MVA	27.9	29.9	30.3	33.1	30.2	30.5	37.1	42.2	42.9	43.5	44.1	44.8	45.4	46.0	46.6	47.3
	Rating	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
	MVA LAR																
Hoxton Park	MVA	34.4	38.2	44.3	51.9	34.7	40.3	39.3	43.5	55.2	68.5	76.5	80.3	81.9	82.4	82.9	83.5
	Rating	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0
	MVA LAR			5.3	12.9		1.3	0.3	4.5	16.2	29.5	37.5	41.3	42.9	43.4	43.9	44.5
Kemps Creek	MVA	9.1	9.7	10.8	14.4	13.3	16.6	16.7	16.9	17.2	17.4	17.7	17.9	18.2	18.4	18.7	18.9
	Rating	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
	MVA LAR				3.4	2.3	5.6	5.7	5.9	6.2	6.4	6.7	6.9	7.2	7.4	7.7	7.9
Liverpool	MVA	41.9	43.1	44.3	38.6	40.1	44.2	41.6	42.1	44.6	45.8	54.2	57.6	59.8	61.6	62.8	63.5
	Rating	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
	MVA LAR	3.9	5.1	6.3	0.6	2.1	6.2	3.6	4.1	6.6	7.8	16.2	19.6	21.8	23.6	24.8	25.5
Moorebank	MVA	38.7	41.2	42.0	43.5	40.6	44.2	43.0	45.0	47.7	50.2	52.7	55.5	57.6	58.6	59.0	59.5
	Rating	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
	MVA LAR												0.5	2.6	3.6	4.0	4.5
Prestons	MVA					18.0	22.3	25.0	26.1	28.6	32.8	38.4	44.9	52.5	60.2	66.6	71.7
	Rating					27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
	MVA LAR									1.6	5.8	11.4	17.9	25.5	33.2	39.6	44.7
West Liverpool TS	MVA	205.7	235.7	249.1	273.0	255.7	305.8	306.8	320.7	347.1	371.5	398.0	416.8	432.9	446.8	458.9	469.5
	Rating	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0
	MVA LAR				8.0		40.8	41.8	55.7	82.1	106.5	133.0	151.8	167.9	181.8	193.9	204.5

Note: LAR denotes Load at Risk

10.1.9 West Liverpool Transmission Substation Winter Demand Forecast

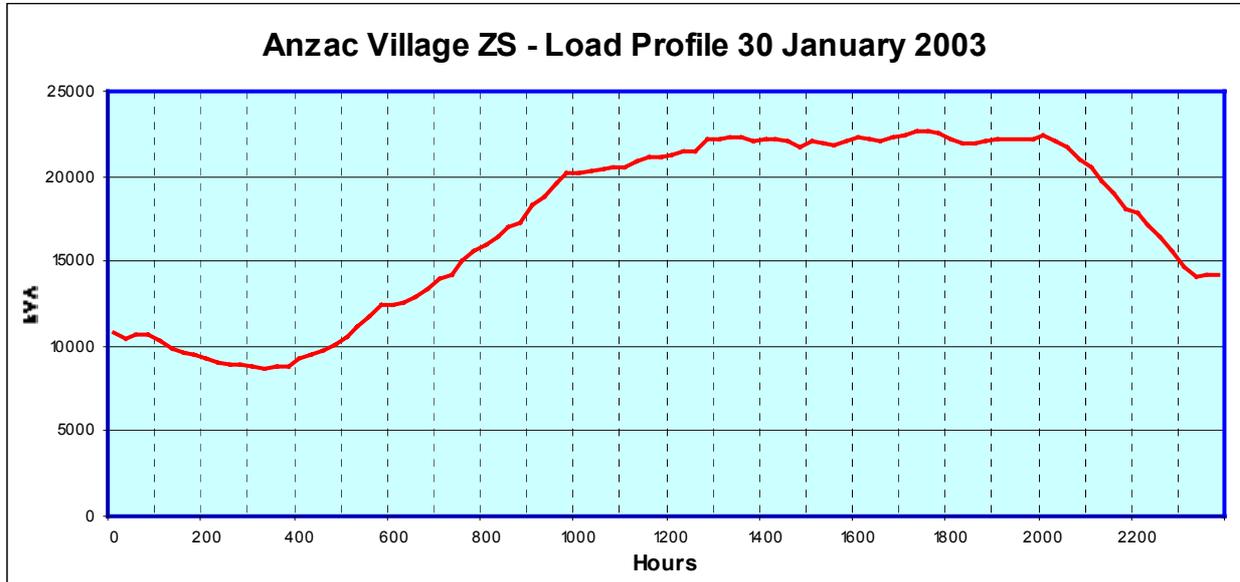
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Aerodrome	MVA Rating MVA LAR									10.4 35.0	16.2 35.0	22.0 35.0	24.1 35.0	24.3 35.0	24.5 35.0	24.7 35.0	24.9 35.0
Anzac Village	MVA Rating MVA LAR	11.6 27.0	11.4 27.0	11.0 27.0	13.0 27.0	17.2 27.0	19.4 27.0	21.6 27.0	22.3 27.0	26.3 27.0	32.2 27.0	34.2 27.0	35.2 27.0	36.4 27.0	38.1 27.0	40.0 27.0	42.2 27.0
Bonnyrigg	MVA Rating MVA LAR	38.1 55.0	40.7 55.0	43.4 55.0	47.0 55.0	49.1 55.0	50.1 55.0	51.2 55.0	51.1 55.0	52.6 55.0	53.7 55.0	54.7 55.0	55.7 55.0	56.7 55.0	57.7 55.0	58.6 55.0	59.6 55.0
Canley Vale	MVA Rating MVA LAR	26.9 32.0	27.9 32.0	27.6 32.0	27.7 32.0	27.4 32.0	27.7 32.0	28.3 32.0	27.6 32.0	26.0 32.0	26.3 32.0	26.6 32.0	26.9 32.0	27.2 32.0	27.5 32.0	27.8 32.0	28.1 32.0
Homepride	MVA Rating MVA LAR	22.8 55.0	24.0 55.0	25.5 55.0	27.3 55.0	24.6 55.0	26.2 55.0	27.3 55.0	34.9 55.0	39.3 55.0	40.2 55.0	41.1 55.0	42.0 55.0	42.9 55.0	43.8 55.0	44.7 55.0	45.6 55.0
Hoxton Park	MVA Rating MVA LAR	30.8 39.0	35.5 39.0	40.3 39.0	44.4 39.0	44.6 39.0	35.1 39.0	37.1 39.0	36.2 39.0	31.2 39.0	32.6 39.0	34.6 39.0	36.6 39.0	38.1 39.0	39.4 39.0	40.6 39.0	41.9 39.0
Kemps Creek	MVA Rating MVA LAR	8.1 11.0	8.6 11.0	10.0 11.0	14.0 11.0	13.2 11.0	13.6 11.0	14.0 11.0	14.4 11.0	14.8 11.0	15.2 11.0	15.6 11.0	16.1 11.0	16.5 11.0	16.9 11.0	17.3 11.0	17.7 11.0
Liverpool	MVA Rating MVA LAR	35.4 38.0	37.0 38.0	36.7 38.0	40.0 38.0	39.7 38.0	36.9 38.0	38.6 38.0	39.8 38.0	42.5 38.0	46.4 38.0	48.1 38.0	56.7 38.0	59.0 38.0	60.7 38.0	62.0 38.0	62.8 38.0
Moorebank	MVA Rating MVA LAR	37.4 55.0	38.5 55.0	39.5 55.0	41.2 55.0	38.2 55.0	40.6 55.0	41.1 55.0	38.8 55.0	40.8 55.0	43.6 55.0	45.7 55.0	46.8 55.0	47.4 55.0	47.9 55.0	48.5 55.0	49.1 55.0
Prestons	MVA Rating MVA LAR						17.4 27.0	17.9 27.0	19.6 27.0	18.8 27.0	21.6 27.0	26.2 27.0	32.2 27.0	39.0 27.0	46.9 27.0	54.8 27.0	61.4 27.0
West Liverpool TS	MVA Rating MVA LAR	201.7 265.0	201.6 265.0	212.5 265.0	240.0 265.0	238.2 265.0	249.7 265.0	239.6 265.0	267.5 265.0	273.8 265.0	291.0 265.0	304.5 265.0	322.7 265.0	336.2 265.0	350.3 265.0	364.2 265.0	376.8 265.0
									2.5	8.8	26.0	39.5	57.7	71.2	85.3	99.2	111.8

Note: LAR denotes Load at Risk

10.1.10 Constrained Zone Substation Load Profiles, Information and Options

Anzac Village Zone Substation

Load Profile



Load Characteristics

Anzac Village ZS supplies the residential areas of Wattlegrove, Voyager Point and Pleasure Point. It also supplies part of the Moorebank Industrial area and the Australian Defence Force Facilities. The load profile of this substation is summer peaking driven mainly by residential air conditioning loads. Anzac Village ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing strong demand growth in both the industrial and residential sectors as land is released as new residential areas or redeveloped.

Options

Network

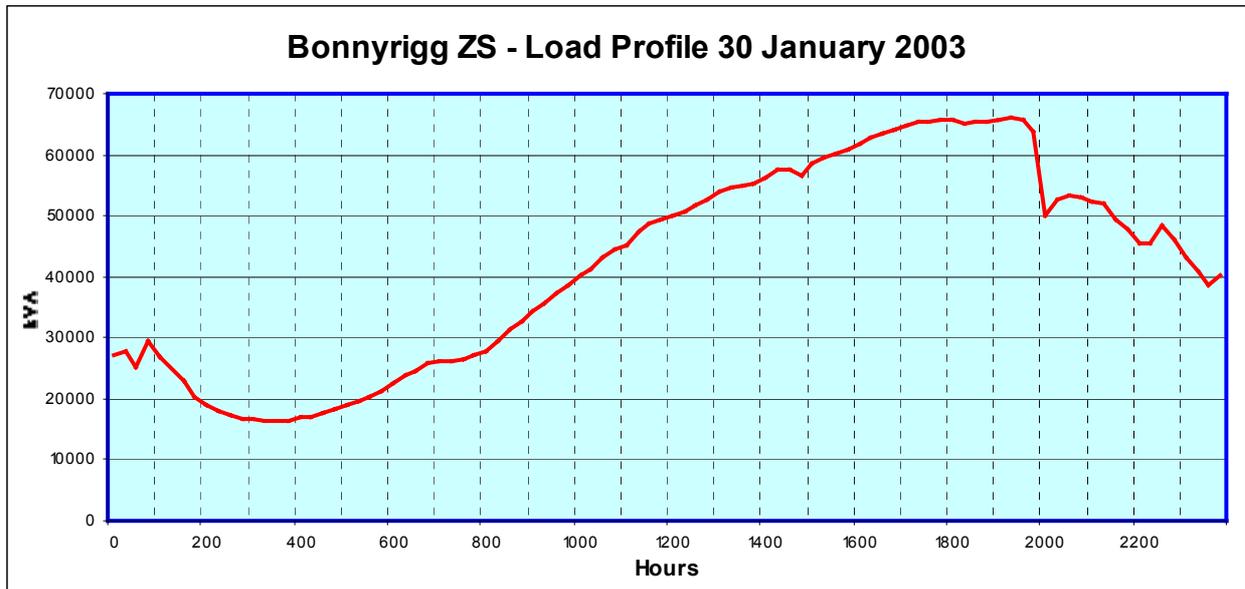
The augmentation of Anzac Village ZS will provide sufficient network capacity to cater for long term load growth. The current estimated construction date is 2006/07 (refer project item PR168). In the longer term a new zone substation will be required to supply the proposed Holsworthy development (refer project item PR170)

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the residential loads. A non-network option would also need to address the new residential release areas. The summer peak demand is 3 MVA higher than the winter peak demand. The growth rate is about 1.5 MVA per annum.

Bonnyrigg Zone Substation

Load Profile



Load Characteristics

Bonnyrigg ZS supplies newly released and established residential areas. The load profile of this substation is summer peaking driven mainly by residential air conditioning loads. Bonnyrigg ZS has a firm rating of 50 MVA and a cyclic rating of 55 MVA. This substation is experiencing strong demand growth in the residential sector as new areas are released and the penetration of air conditioning increases.

Options

Network

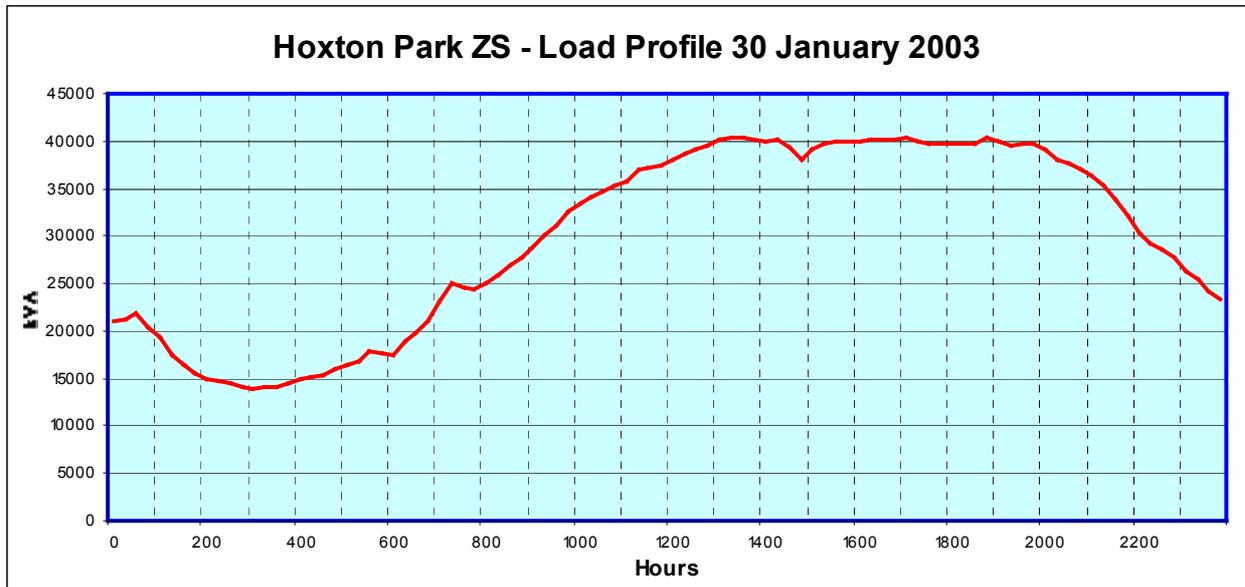
The augmentation of Bonnyrigg ZS will provide additional capacity to supply areas immediate needs. The current estimated construction date is 2005/06 (refer project item PR319 & PR320). In the longer term a new zone substation at Wakely/Abbotsbury will be constructed (refer project item PR208).

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the residential loads. A non-network option would also need to address the new residential release areas. The summer peak demand is 10 MVA higher than the winter peak demand. The growth rate is about 1 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Hoxton Park Zone Substation

Load Profile



Load Characteristics

Hoxton Park ZS supplies newly released and established residential areas and a large industrial area west of Liverpool. The load profile of this substation is summer peaking driven mainly by residential air conditioning loads. Hoxton Park ZS has a firm rating of 37.5 MVA and a cyclic rating of 39 MVA. This substation is experiencing strong demand growth in the residential sector as new areas are released and the penetration of air conditioning increases. Large spot loads are also occurring within the industrial area including commercial load such as the Liverpool Catholic Club.

Options

Network

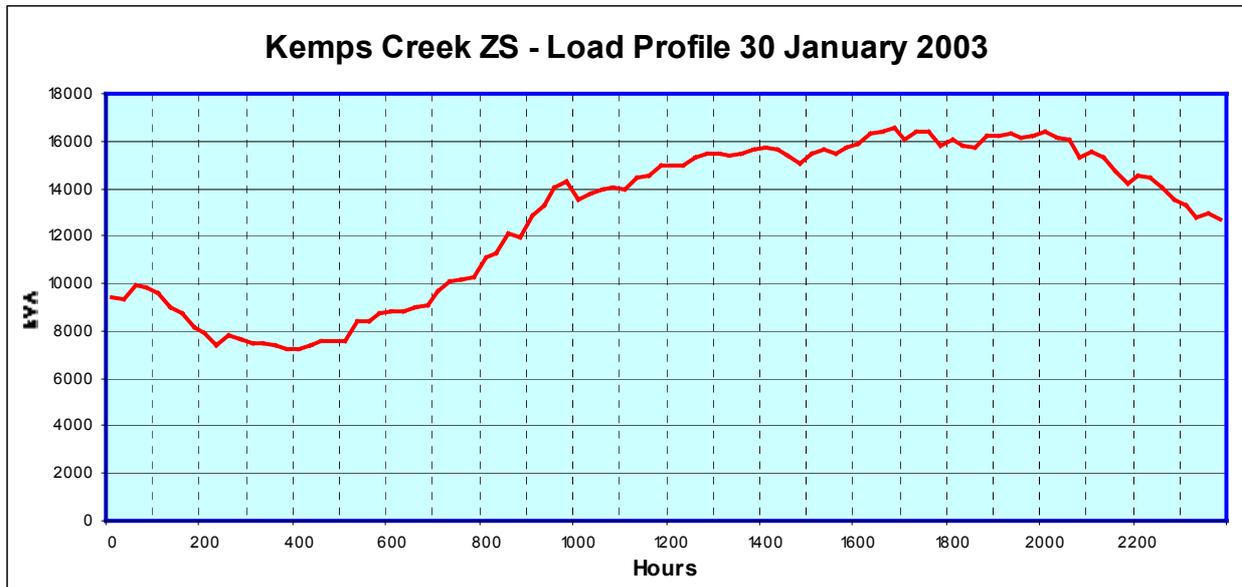
The construction of Aerodrome ZS will provide additional capacity to offload Hoxton Park ZS. This substation will also supply new release areas west of Hoxton Park Aerodrome. The current estimated construction date is 2006/07 (refer project item PR065). Hoxton Park ZS needs to be upgraded do to it reaching its end-of-serviceable-life.

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the residential loads. A non-network option would also need to address the new residential release areas and also the industrial/commercial are adjacent to the zone substation. The summer peak demand is 5 MVA higher than the winter peak demand. The growth rate is about 1.5 MVA per annum.

Kemps Creek Zone Substation

Load Profile



Load Characteristics

Kemps Creek ZS supplies established rural/residential areas west of Liverpool. The load profile of this substation is summer peaking driven mainly by rural loads coinciding with residential air conditioning loads. Kemps Creek ZS has a firm rating of 10 MVA and a cyclic rating of 11 MVA. This substation is experiencing demand growth in the rural/residential sector as large parcels of land are subdivided into smaller acreage and multiple large dwellings are being established on these smaller acreage properties.

Options

Network

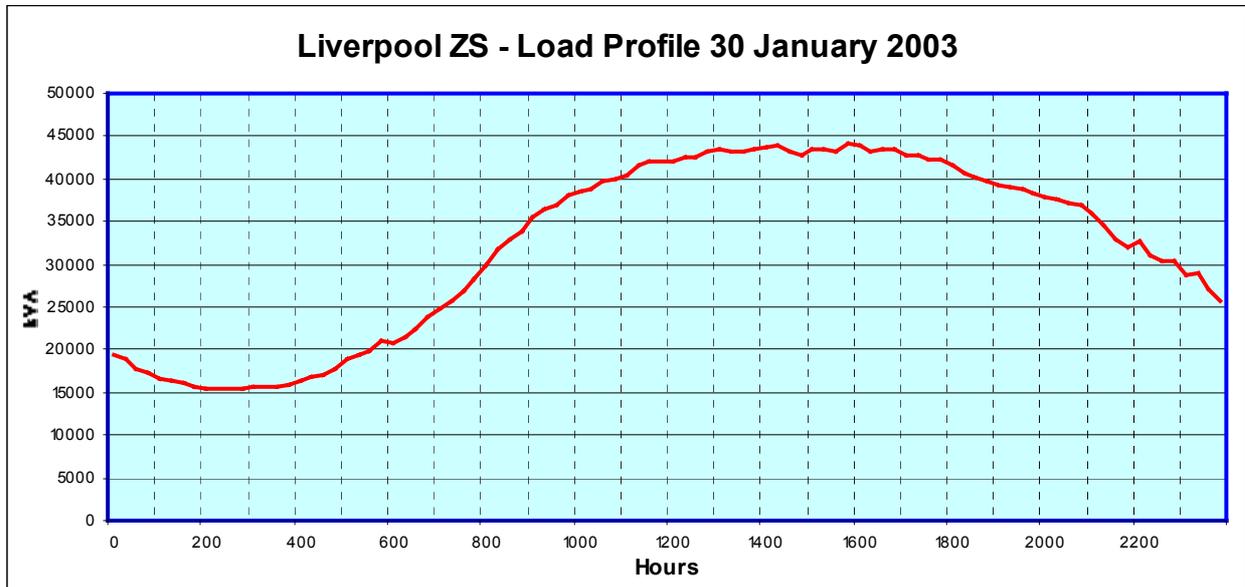
The augmentation of Kemps Creek ZS will provide additional capacity to supply the area in the short term. The current estimated construction date is 2004/05 (refer project item PR328). In the longer term, the construction of Aerodrome ZS will provide additional capacity to offload Kemps Creek ZS. This substation will also supply new release areas west of Hoxton Park Aerodrome. The current estimated construction date is 2006/07 (refer project item PR065). Kemps Creek ZS will still require augmentation to service the South West Sector Development.

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the residential loads. A non-network option would also need to address the new large dwellings on smaller acreage properties. The summer peak demand is 3 MVA higher than the winter peak demand. The growth rate is about 0.3 MVA per annum.

Liverpool Zone Substation

Load Profile



Load Characteristics

Liverpool ZS supplies a major commercial centre and surrounding high/medium/low residential areas. The load profile of this substation is summer peaking driven mainly by commercial and residential air conditioning loads. Liverpool ZS has a firm rating of 35 MVA and a cyclic rating of 38 MVA. This substation is experiencing strong demand growth in the commercial and high density residential sectors.

Options

Network

The augmentation of Liverpool ZS will provide additional capacity to supply the increase in demand in the short term. The current estimated construction date is 2004/05 (refer project item PR103). In the longer term a CBD zone substation is required as well as a transmission substation to provide subtransmission feeder capacity and to offload West Liverpool TS. The current estimated construction dates are 2006/07 & 2007/08 (refer project items PR059, PR060 & PR081).

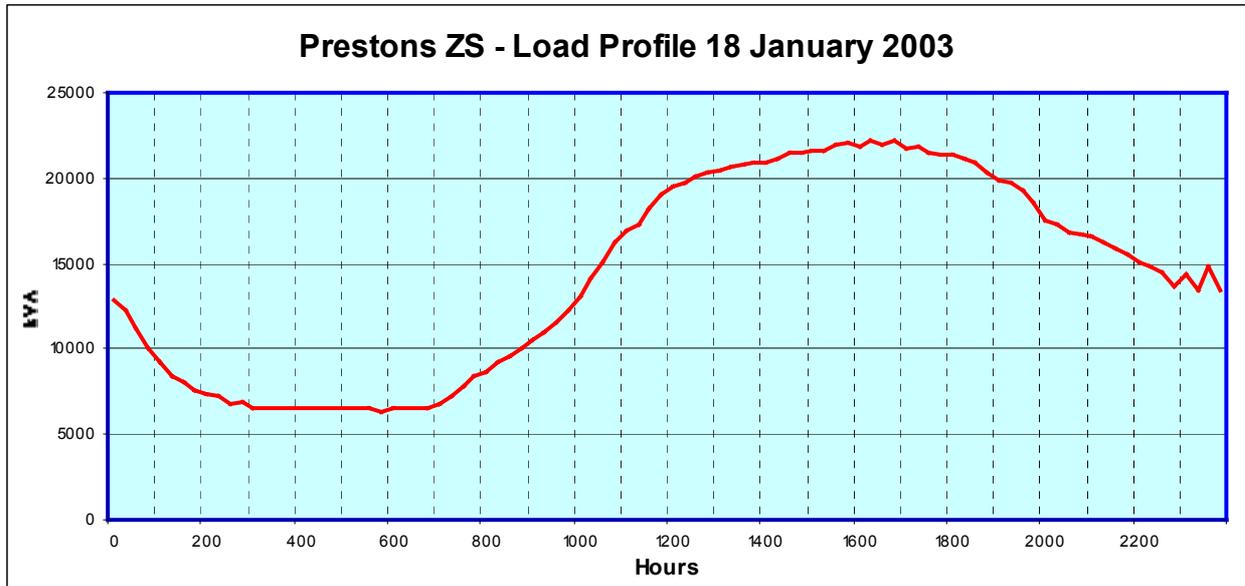
Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the coincident commercial and high density residential loads. A non-network option would also need to address the new commercial developments and proposed high/medium density residential developments. The summer peak demand is 2.5 MVA higher than the winter peak demand. The growth rate is about 1 MVA per annum.

An RFP has been issued to identify potential non-network options. Since its release the DM services market has further developed. As a result the RFP will be re-visited in the near future.

Prestons Zone Substation

Load Profile



Load Characteristics

Prestons ZS supplies newly released residential areas south west of Liverpool and the commercial centre at “The Crossroads”. The load profile of this substation is summer peaking driven mainly by residential air conditioning loads. Prestons ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing continued demand growth in the residential sector as new areas are released and the penetration of air conditioning increases. Edmondson Park residential release are will be initially supplied from Prestons ZS.

Options

Network

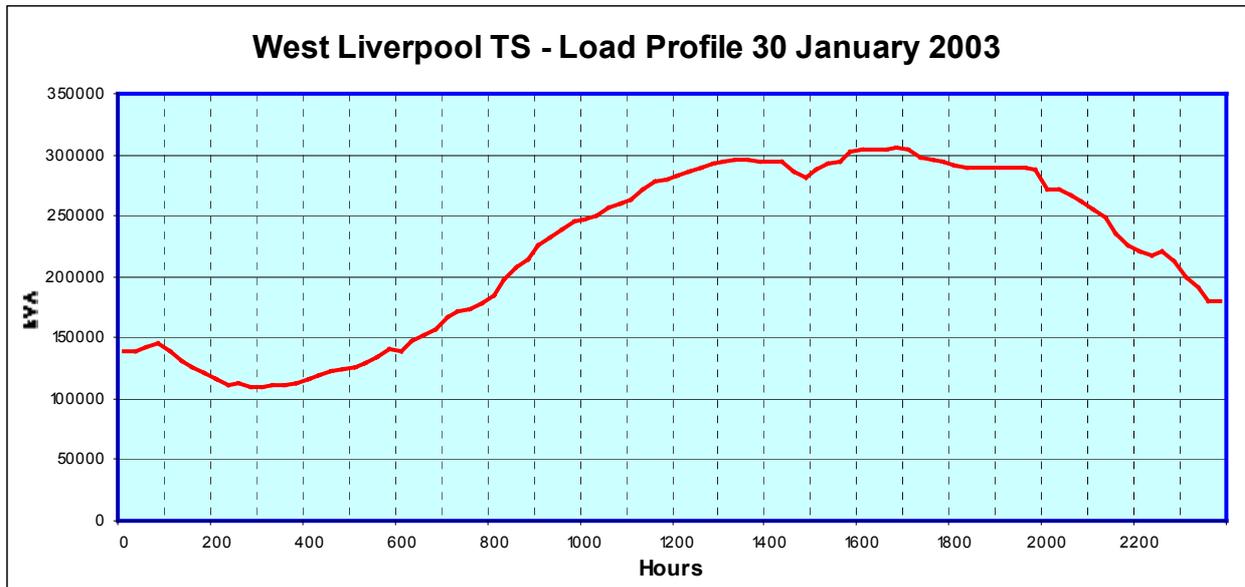
The augmentation of Prestons ZS will provide additional capacity to supply the increasing residential development. The current estimated construction date is 2006/07 & 2008/09 (refer project item PR156 & PR097). Edmondson Park ZS will need to be established to supply the new development at Edmondson Park (refer project item PR110).

Non-network

A non-network option would need to reduce the hot summer day peak demands created by the residential loads and air conditioning. A non-network option would also need to address the new residential release areas. The summer peak demand is 6 MVA higher than the winter peak demand. The growth rate is about 1.5 to 2.0 MVA per annum.

West Liverpool Transmission Substation

Load Profile



Load Characteristics

West Liverpool TS supplies the Liverpool region which includes major industrial areas at Moorebank & Prestons, the Liverpool and other commercial centres and the expanding residential areas to the west and southwest. The load profile of this substation is summer peaking driven mainly by commercial and residential air conditioning loads coincident with the industrial load. West Liverpool TS has a firm rating of 240 MVA and a cyclic rating of 265 MVA. This substation is experiencing strong demand growth in all sectors.

Options

Network

The construction of East Liverpool TS will offload West Liverpool TS and provide additional subtransmission feeder capacity to the existing substations east and south of Liverpool as well as the CBD. The current estimated construction date is 2007/08 (refer project items PR321, PR201, PR202, PR204, PR324, PR325, PR327, PR059 & PR060).

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the coincident commercial, industrial and residential loads. A non-network option would also need to address the new commercial developments and proposed high/medium/low density residential developments. The summer peak demand is 40 MVA higher than the winter peak demand. The growth rate is about 20 MVA per annum.

NORTHERN REGION

11.0 Penrith Area

Penrith Transmission Substation

11.1.1 Penrith Transmission Substation Status

Penrith TS has 3 x 60 MVA 132/33 kV transformers with provision for a fourth. The substation's firm capacity of 138 MVA is limited by the transformer 33 kV circuit breakers and isolators (rated at 1200 A).

The Penrith 132 kV busbar also supplies 2 x 65 MVA 132/11 kV transformers that are part of the 11 kV distribution supply point. This has considerably reduced the demand on the 132/33 kV substation but demand has again exceeded firm cyclic rating.

11.1.2 Penrith Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Penrith TS	3 x 60	180	132
Cambridge Park	2 x 15/19/25	50	27
Cranebrook	3 x 15/19/25	75	53
Emu Plains	2 x 15/19/25	50	27
Kingswood	3 x 15/19/25	75	55
Luddenham	2 x 6	12	7

11.1.3 Penrith Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Cambridge Park	MVA	20.4	23.1	23.6	25.3	24.9	29.4	27.7	28.5	30.4	33.6	37.6	40.4	41.7	42.4	43.0	43.7
	Rating	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
	MVA LAR						2.4	0.7	1.5	3.4	6.6	10.6	13.4	14.7	15.4	16.0	16.7
Cranebrook	MVA	40.9	39.6	42.1	46.5	40.5	49.2	52.0	52.6	50.9	51.8	52.5	52.9	53.4	53.9	54.4	54.9
	Rating	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0
	MVA LAR												0.4	0.9	1.4	1.9	
Emu Plains	MVA	27.2	27.4	29.4	26.3	29.9	34.4	33.1	33.5	33.9	34.3	34.7	35.1	35.5	35.9	36.3	36.8
	Rating	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
	MVA LAR	0.2	0.4	2.4		2.9	7.4	6.1	6.5	6.9	7.3	7.7	8.1	8.5	8.9	9.3	9.8
Glenmore Park	MVA	15.5															
	Rating	25.0															
	MVA LAR																
Kingswood	MVA	45.5	42.1	50.6	53.4	53.8	60.0	54.7	56.7	59.3	61.9	63.9	65.7	67.6	69.4	71.2	73.0
	Rating	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
	MVA LAR						5.0		1.7	4.3	6.9	8.9	10.7	12.6	14.4	16.2	18.0
Luddenham	MVA	7.0	7.1	7.1	8.6	7.6	9.7	10.0	10.2	10.4	10.6	10.9	11.1	11.4	11.6	11.8	12.1
	Rating	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
	MVA LAR		0.1	0.1	1.6	0.6	2.7	3.0	3.2	3.4	3.6	3.9	4.1	4.4	4.6	4.8	5.1
Penrith Panthers	MVA									3.4	6.7	10.1	10.1	10.1	10.1	10.1	
	Rating									15.0	15.0	15.0	15.0	15.0	15.0	15.0	
	MVA LAR																
Penrith TS	MVA	135.6	119.7	136.0	153.4	140.1	162.2	166.7	170.4	178.8	188.5	198.0	203.1	207.1	210.3	213.6	216.9
	Rating	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	198.0	198.0	198.0	198.0	198.0
	MVA LAR	3.6		4.0	21.4	8.1	30.2	34.7	38.4	46.8	56.5		5.1	9.1	12.3	15.6	18.9

Note: LAR denotes Load at Risk

11.1.4 Penrith Transmission Substation Winter Demand Forecast

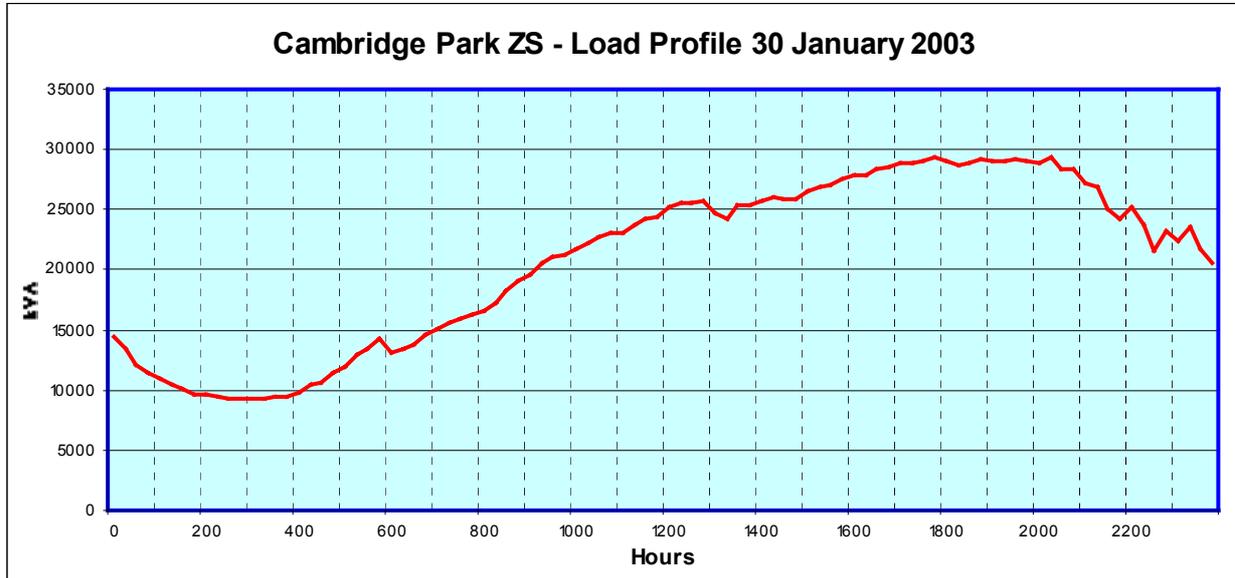
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cambridge Park	MVA	21.2	21.1	21.2	23.2	24.1	24.9	26.0	25.8	26.6	28.1	31.0	34.9	37.9	39.4	40.2	41.1
	Rating	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
	MVA LAR										1.1	4.0	7.9	10.9	12.4	13.2	14.1
Cranebrook	MVA	36.0	38.5	38.8	41.8	40.9	38.7	40.7	39.6	40.1	40.6	41.1	41.6	42.2	42.7	43.2	43.7
	Rating	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0
	MVA LAR																
Emu Plains	MVA	27.5	27.2	25.7	27.6	27.7	30.0	30.1	29.1	29.4	29.7	30.1	30.4	30.7	31.0	31.4	31.7
	Rating	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
	MVA LAR	0.5	0.2		0.6	0.7	3.0	3.1	2.1	2.4	2.7	3.1	3.4	3.7	4.0	4.4	4.7
Glenmore Park	MVA	11.9	14.3														
	Rating	25.0	25.0														
	MVA LAR																
Kingswood	MVA	37.3	40.3	39.7	45.0	45.8	49.0	49.1	47.9	48.8	49.7	50.7	51.6	52.5	53.5	54.4	55.3
	Rating	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
	MVA LAR																0.3
Luddenham	MVA	5.7	6.9	6.1	6.5	7.0	7.0	7.3	7.6	7.8	8.0	8.2	8.3	8.5	8.7	8.9	9.0
	Rating	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
	MVA LAR						0.0	0.3	0.6	0.8	1.0	1.2	1.3	1.5	1.7	1.9	2.0
Penrith Panthers	MVA										3.4	6.7	10.1	10.1	10.1	10.1	10.1
	Rating										15.0	15.0	15.0	15.0	15.0	15.0	15.0
	MVA LAR																
Penrith TS	MVA	136.4	132.7	125.2	135.8	134.9	142.1	143.8	150.4	153.0	159.1	166.5	174.9	179.4	182.6	185.2	187.8
	Rating	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	198.0	198.0	198.0	198.0	198.0	198.0
	MVA LAR	4.4	0.7		3.8	2.9	10.1	11.8	18.4	21.0	27.1						

Note: LAR denotes Load at Risk

11.1.5 Constrained Zone Substation Load Profiles, Information and Options

Cambridge Park Zone Substation

Load Profile



Load Characteristics

Cambridge Park ZS supplies established residential areas east of Penrith. The load profile of this substation is summer peaking driven mainly by residential air conditioning loads. Cambridge Park ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing demand growth in the residential sector as new areas are released and existing areas are undergoing redevelopment to medium density. The penetration of air conditioning is also increasing.

Options

Network

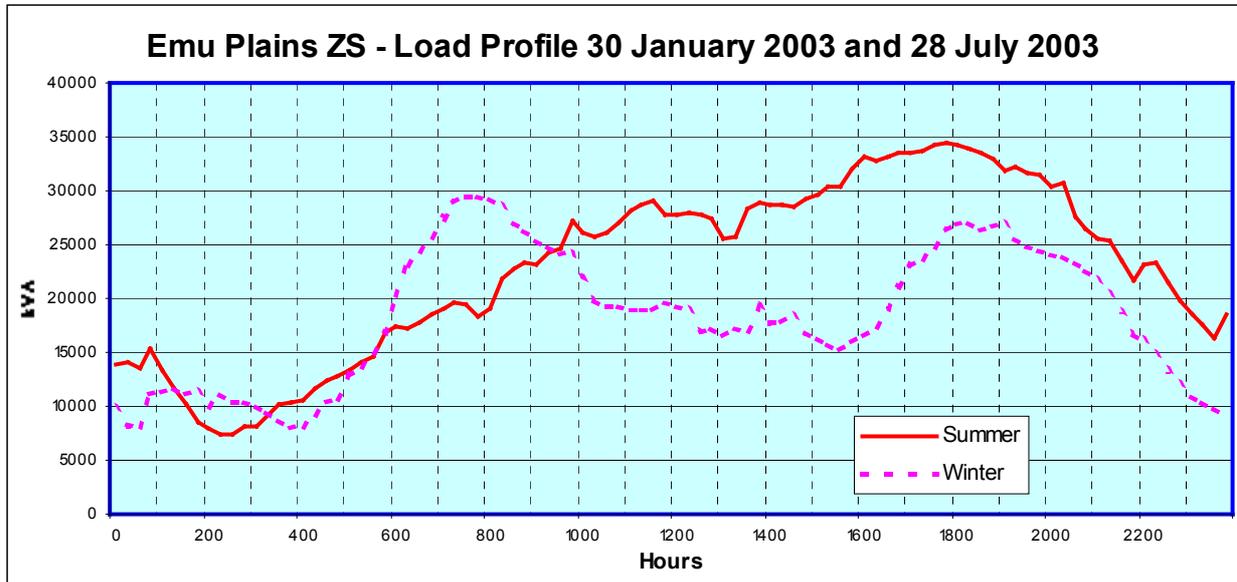
The augmentation of Cambridge Park ZS will provide additional capacity to supply the increasing demand. The current estimated construction date is 2009/10 (refer project item PR146). Depending upon development in the Claremont Meadows release area Caddens ZS may need to be established in the near future. The current estimated construction date is 2009/10 (refer project item PR070).

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the residential loads. A non-network option would also need to address the new residential release areas. The summer peak demand is 2 MVA higher than the winter peak demand. The growth rate is about 1.5 MVA per annum.

Emu Plains Zone Substation

Load Profile



Load Characteristics

Emu Plains ZS supplies established residential areas south of Emu Plains, Emu Heights, Leonay and part of Mt Riverview, a small commercial and industrial area. The load profile of this substation is summer peaking driven mainly by residential air conditioning loads. Emu Plains ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing modest demand growth in the residential sector resulting from redevelopment to medium density.

Options

Network

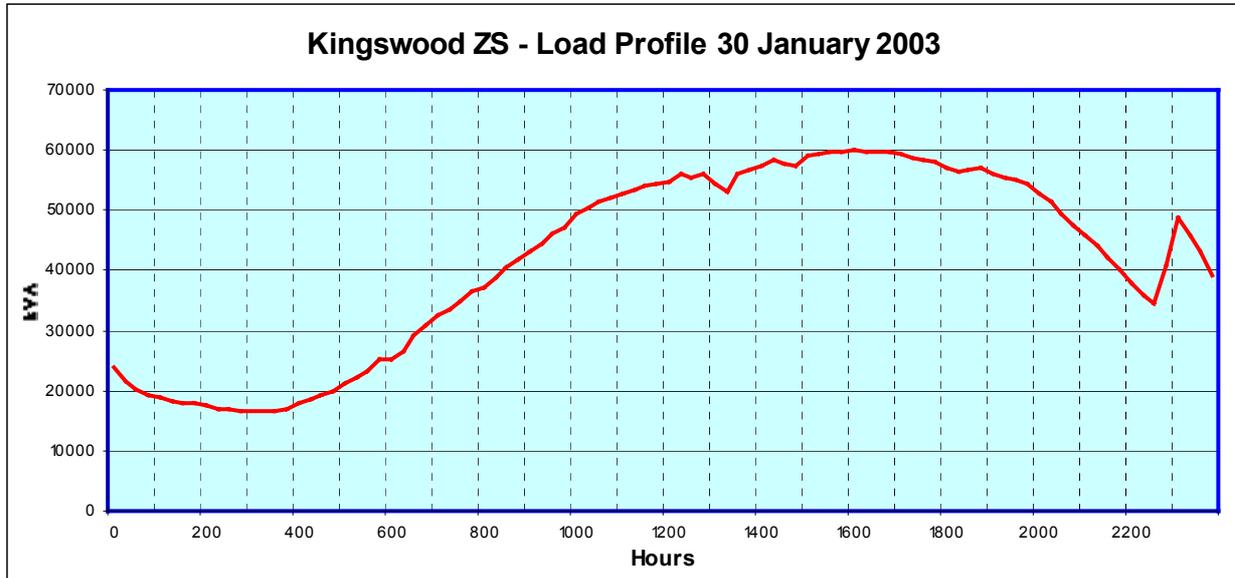
The augmentation of Emu Plains ZS will provide additional capacity to supply the increasing demand. The current estimated construction date is 2006/07 (refer project item PR143).

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the residential loads between the hours of 15:00 and 19:00 summer and 7:00 to 9:00 & 17:00 to 20:00 winter. The summer peak demand is 3 MVA higher than the winter peak demand. The growth rate is about 0.4 MVA per annum.

Kingswood Zone Substation

Load Profile



Load Characteristics

Kingswood ZS supplies established residential areas south of Penrith and a small part of the Penrith commercial centre. The load profile of this substation is summer peaking driven mainly by residential air conditioning loads. Kingswood ZS has a firm rating of 50 MVA and a cyclic rating of 55 MVA. This substation is experiencing demand growth in the residential sector resulting from redevelopment to medium density. New residential development is also occurring in the Caddens area. The penetration of air conditioning is also increasing.

Options

Network

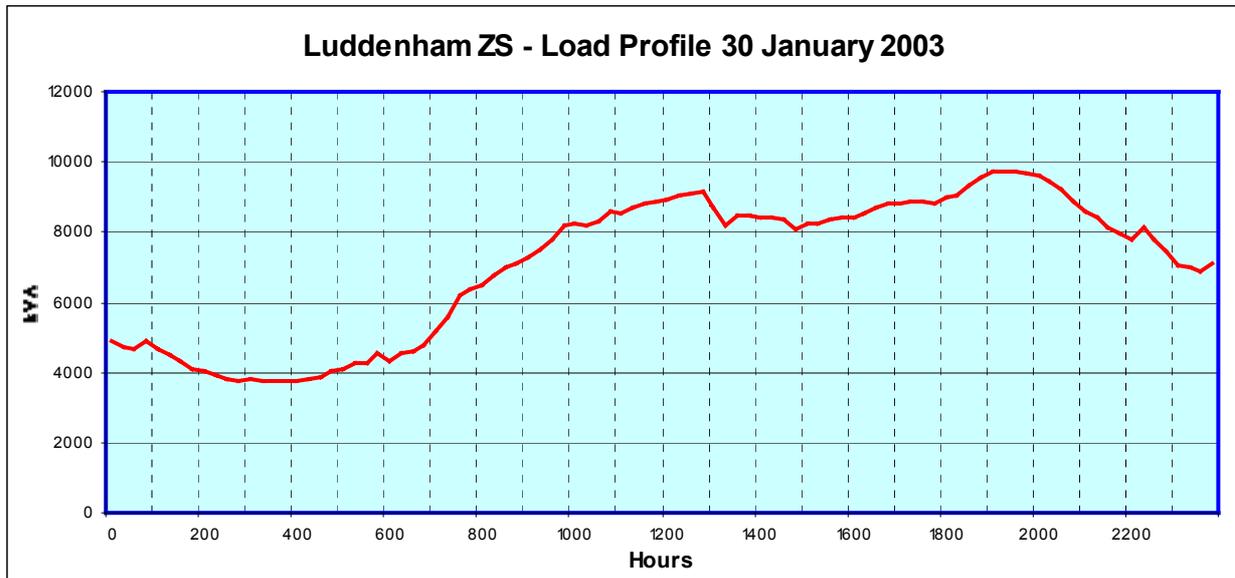
The construction of Caddens ZS will provide additional capacity to supply the increasing demand. The current estimated construction date is 2009/10 (refer project item PR070).

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the residential loads. A non-network option would also need to address the new residential release areas. The summer peak demand is 5 MVA higher than the winter peak demand. The growth rate is about 1.5 MVA per annum.

Luddenham Zone Substation

Load Profile



Load Characteristics

Luddenham ZS supplies a rural area south of Penrith. The load profile of this substation is summer peaking driven mainly by rural loads and possible farming activities. Luddenham ZS has a firm rating of 6 MVA and a cyclic rating of 7 MVA. This substation is experiencing moderate demand growth resulting from the subdivision of rural lots in smaller acreage parcels.

Options

Network

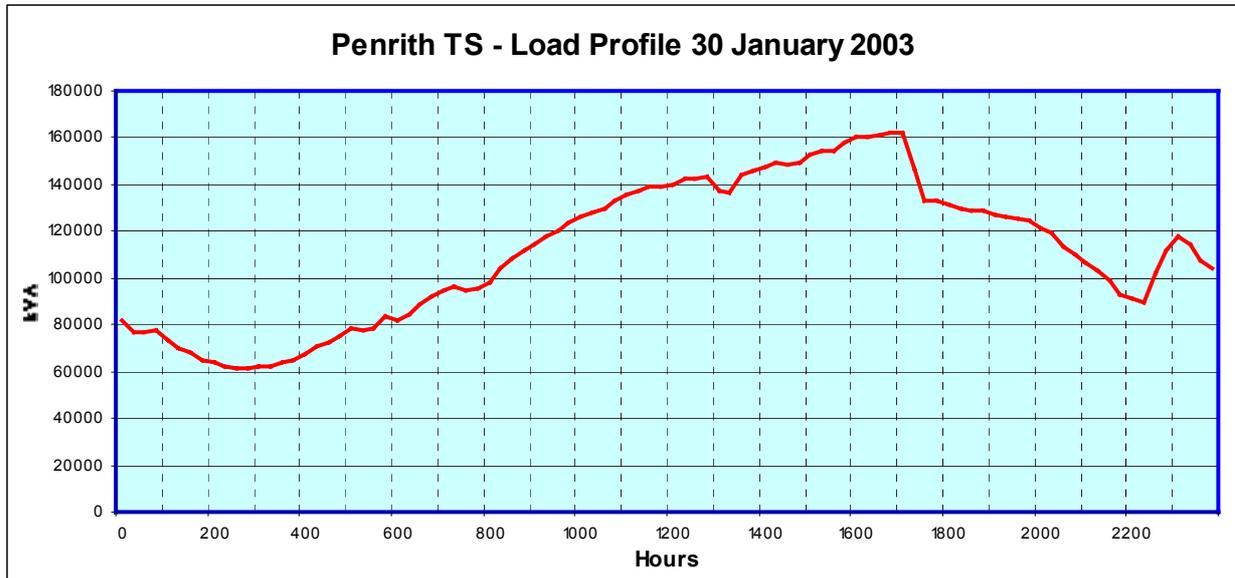
The augmentation of Luddenham ZS will provide additional capacity to supply the increasing demand. The current estimated construction date is 2004/05 (refer project item PR198).

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the rural loads, housing development and farming activities. The summer peak demand is 1 MVA higher than the winter peak demand. The growth rate is about 0.2 MVA per annum.

Penrith Transmission Substation

Load Profile



Load Characteristics

Penrith TS supplies the Penrith region, which includes major Commercial and business centres, industrial and expanding residential loads. The load profile of this substation is summer peaking driven mainly by coincident commercial and residential air conditioning loads. Penrith TS has a firm rating of 120 MVA and a cyclic rating of 132 MVA. This substation is experiencing demand growth mainly in the residential sector.

Options

Network

The augmentation of Penrith TS and provide additional capacity to supply the growth in demand. The current estimated construction date is 2005/06 (refer project items PR052).

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the coincident commercial and residential loads. The summer peak demand is 20 MVA higher than the winter peak demand. The growth rate is about 6 MVA per annum.

Regentville Bulk Supply Point

11.1.6 Regentville Bulk Supply Point Status

Regentville BSP was commissioned at the end of 1997. This allowed part of the Penrith TS load to be transferred off Sydney West BSP, which was reaching its firm capacity. In November 2000, the second 375 MVA transformer was commissioned at Regentville BSP to allow the Auto Close scheme at Penrith, which provided for possible supply failure from Regentville BSP, to be made Non-auto. Regentville BSP now supplies Penrith TS, Mt Druitt TS, Glenmore Park ZS and the Penrith 11 kV Supply Point, which replaced Castlereagh ZS. Warrimoo TS has also been transferred to Regentville BSP providing TransGrid additional capacity to supply 132 kV load from Wallerawang BSP. Lawson may also be transferred to Regentville BSP when paralleling issues on the RIC network have been resolved. The ensuing Load Forecast was prepared with Warrimoo and Mt Druitt TS transferred to Regentville BSP.

11.1.7 Regentville Bulk Supply Point Rating Details

Transmission or Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Regentville BSP	2 x 375	750	750
Glenmore Park **	1 x 15/19/25 + 1 x 10/12.5	37.5	25
Mt Druitt TS	2 x 120	240	240
Penrith TS	3 x 60	180	180
Penrith 11 kV **	2 x 34/44/52/65	130	130
Warrimoo TS	2 x 60	120	120

Note: Substations designated ** are grouped in the Forecast Section as Regentville 132 kV, as they are supplied directly of the Regentville 132 kV busbar without an intermediate subtransmission busbar. The remaining locations are TS with their individual subtransmission networks to each ZS.

11.1.8 Regentville Bulk Supply Point Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Glenmore Park	MVA		17.7	18.2	22.3	25.1	29.1	29.5	31.7	32.8	33.9	35.0	36.1	37.2	38.3	39.4	40.5
	Rating		25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
	MVA LAR					0.1	4.1	4.5	6.7	7.8	8.9	10.0	11.1	12.2	13.3	14.4	15.5
Penrith_11kV	MVA	20.8	37.7	40.4	40.6	44.6	50.3	48.6	49.4	52.5	53.3	54.0	54.8	55.5	56.3	57.0	57.8
	Rating	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
	MVA LAR																
Regentville TS	MVA	20.8	55.3	58.6	62.9	69.7	79.1	78.1	81.1	85.3	87.2	89.0	90.9	92.7	94.6	96.4	98.3
	Rating	TransGrid Substation															
	MVA LAR																

11.1.9 Regentville Bulk Supply Point Winter Demand Forecast

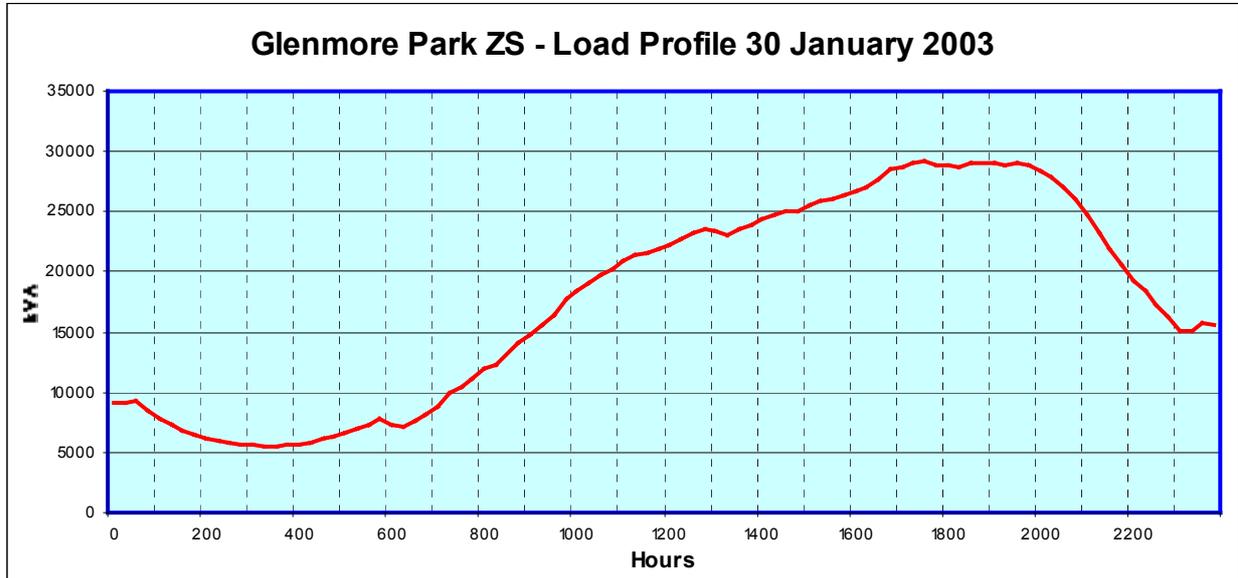
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Glenmore Park	MVA		14.3	15.2	15.6	19.3	20.7	21.0	22.4	24.6	25.7	26.7	27.8	28.9	30.0	31.1	32.2
	Rating		25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
	MVA LAR										0.7	1.7	2.8	3.9	5.0	6.1	7.2
Penrith_11kV	MVA		31.0	33.3	33.2	34.3	38.2	39.6	38.9	39.9	40.9	41.9	42.9	43.9	44.9	45.9	46.8
	Rating	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
	MVA LAR																
Regentville TS	MVA		45.3	48.3	48.8	53.6	58.8	60.1	61.2	64.4	66.5	68.5	70.6	72.7	74.8	76.9	79.0
	Rating	TransGrid Substation															
	MVA LAR																

Note: LAR denotes Load at Risk

11.1.10 Constrained Zone Substation Load Profiles, Information and Options

Glenmore Park Zone Substation

Load Profile



Load Characteristics

Glenmore Park ZS supplies established and new residential areas south of Penrith. The load profile of this substation is summer peaking driven mainly by residential air conditioning loads. Glenmore Park ZS has a firm rating of 25 MVA and a cyclic rating of 25 MVA. This substation is experiencing demand growth in the residential sector resulting from the development of new residential areas. The penetration of air conditioning is also increasing.

Options

Network

The augmentation of Glenmore Park ZS will provide additional capacity to supply the increasing demand. The current estimated construction date is 2004/05 & 2006/07 (refer project item PR048 & PR167).

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 16:00 to 20:00 weekdays created mainly by the residential loads. A non-network option would also need to address the new residential release areas. The summer peak demand is 4 MVA higher than the winter peak demand. The growth rate is about 1 MVA per annum.

12.0 Blue Mountains

Ilford Transmission Substation

12.1.1 Ilford Transmission Substation Status

Ilford TS has 2 x 132/66 kV transformers (one in service and one not connected). A new 40/60 MVA transformer has been commissioned in December 2001 to replace the transformer taken out of service in 1997. The No.2 transformer, rated at 20/30 MVA, has again been relegated to manual standby. Ilford TS is serviced by a single 132 kV feeder 94M. An outage of this feeder requires backup through the 66 kV network from Mt Piper TS.

TransGrid has indicated that the capacity available to Integral Energy from feeder 94M Mt Piper – Beryl tee Mudgee tee Ilford would be 20 MVA, which would vary from time to time. However, this may be varied subject to a review of needs, which have been questioned as part of various load inquiries. The allocation is limited by the revenue metering to 40 MVA.

12.1.2 Ilford Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Ilford TS	1 x 30	30	30
APC Kandos	Customer		
Bylong	2 x 1.5	3	1.5
Ilford Hall	1 x 2.5	2.5	2.5
Kandos	2 x 5	10	5.5

12.1.3 Ilford Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
APC Kandos	MVA Rating MVA LAR	11.6	12.1	12.1	11.1	11.1	10.8	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Bylong	MVA Rating MVA LAR	0.5 1.5	0.5 1.5	0.3 1.5	0.3 1.5	0.5 1.5	0.3 1.5	0.7 1.5	0.7 1.5	0.8 1.5	0.8 1.5	0.9 1.5	0.9 1.5	1.0 1.5	1.0 1.5	1.1 1.5	1.1 1.5
Ilford Hall	MVA Rating MVA LAR	0.3 2.5	0.3 2.5	0.4 2.5	0.3 2.5	0.4 2.5	0.4 2.5	0.4 2.5	0.4 2.5	0.4 2.5	0.5 2.5						
Kandos	MVA Rating MVA LAR	4.3 5.5	4.3 5.5	4.4 5.5	4.5 5.5	5.1 5.5	4.0 5.5	5.5 5.5	5.6 5.5	5.7 5.5	5.7 5.5	5.8 5.5	5.9 5.5	6.0 5.5	6.1 5.5	6.1 5.5	6.2 5.5
Ilford TS	MVA Rating MVA LAR	15.8 30.0	16.4 30.0	16.0 30.0	16.1 30.0	16.0 30.0	15.6 30.0	17.5 30.0	17.6 30.0	17.8 30.0	17.9 30.0	18.1 30.0	18.2 30.0	18.4 30.0	18.5 30.0	18.7 30.0	18.8 30.0

Note: LAR denotes Load at Risk

12.1.4 Ilford Transmission Substation Winter Demand Forecast

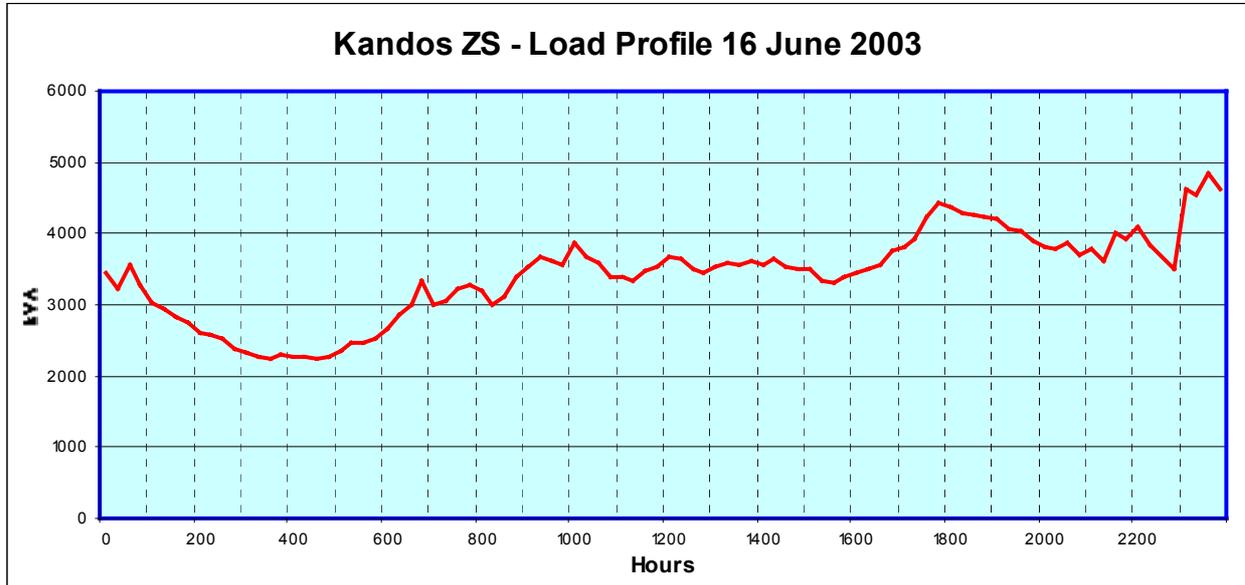
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
APC Kandos	MVA Rating MVA LAR	12.0	12.1	12.4	11.2	11.7	11.0	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Bylong	MVA Rating MVA LAR	0.4 1.5	0.3 1.5	0.3 1.5	0.3 1.5	0.4 1.5	0.3 1.5	0.4 1.5	0.5 1.5	0.5 1.5	0.5 1.5						
Ilford Hall	MVA Rating MVA LAR	0.4 2.5	0.4 2.5	0.4 2.5	0.4 2.5	0.5 2.5	0.6 2.5	0.6 2.5	0.6 2.5	0.6 2.5							
Kandos	MVA Rating MVA LAR	4.5 5.5	4.8 5.5	5.0 5.5	5.5 0.0	5.8 0.3	4.4	6.0 0.5	6.1 0.6	6.2 0.7	6.3 0.8	6.4 0.9	6.5 1.0	6.6 1.1	6.7 1.2	6.8 1.3	6.9 1.4
Ilford TS	MVA Rating MVA LAR	18.1 30.0	18.6 30.0	16.4 30.0	16.3 30.0	16.6 30.0	15.6 30.0	17.1 30.0	17.3 30.0	17.4 30.0	17.5 30.0	17.7 30.0	17.8 30.0	17.9 30.0	18.1 30.0	18.2 30.0	18.3 30.0

Note: LAR denotes Load at Risk

12.1.5 Constrained Zone Substation Load Profiles, Information and Options

Kandos Zone Substation

Load Profile



Load Characteristics

Kandos ZS supplies a rural area and township of Kandos in northern part of Integral Energy's Network area. The load profile of this substation is winter evening peaking driven mainly by rural and residential loads. Kandos ZS has a firm rating of 5 MVA and a cyclic rating of 5.5 MVA. This substation is experiencing slow demand growth.

Options

Network

There are no network options identified.

Non-network

A non-network option would need to reduce the winter afternoon peak demand between the hours of 17:00 to 20:00 weekdays created, mainly by the rural loads. A non-network option would also need to address the off-peak hot water demand. The winter peak demand is 0.5 MVA higher than the winter peak demand. The growth rate is about 0.1 MVA per annum.

Katoomba North Transmission Substation

12.1.6 Katoomba North Transmission Substation Status

Katoomba North TS has 1 x 132/66 kV 60 MVA transformer and a single 132 kV feeder Teed off feeder 941 Wallerawang BSP to Lawson TS. It supplies the upper Blue Mountains area through Blackheath, Katoomba and Wentworth Falls ZS's. Backup is provided at 66 kV from Lawson TS via feeder 804 and RIC feeder 803, which only provides a limited backup allocation to Integral Energy.

An investigation is currently being prepared to address constraints in the limited backup arrangements of feeders 803 and 804. Additionally, it will investigate the long term needs and recommend appropriate solutions for the Upper Blue Mountains by way of 132 kV injection capacity at Katoomba North and Lawson TS's. A demand management program for the Upper Blue Mountains has assisted in the deferral of the augmentation of Katoomba North TS to this point. There is currently a proposal to install a second transformer within the substation with separate incoming 132kV feeders.

12.1.7 Katoomba North Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Katoomba North TS	1 x 60	60	60
Blackheath	2 x 5/7	14	8
Katoomba	1 x 15/18.75/25 + 1 x 15/18/25	50	27
Wentworth Falls	1 x 8/10	10	10

12.1.8 Katoomba North Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Blackheath	MVA	5.0	5.0	5.6	5.2	6.0	5.1	5.4	5.4	5.5	5.6	5.6	5.7	5.8	5.8	5.9	5.9
	Rating MVA LAR	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Katoomba	MVA	13.6	14.0	14.2	15.2	14.4	14.5	15.4	15.8	16.2	16.5	16.9	17.2	17.6	17.9	18.3	18.6
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Wentworth Falls	MVA	4.7	5.6	5.6	5.6	5.9	5.7	6.0	6.2	6.3	6.5	6.6	6.7	6.9	7.0	7.2	7.3
	Rating MVA LAR	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Katoomba Nth TS	MVA	23.2	24.6	25.3	25.8	26.1	25.2	26.8	27.3	27.9	28.5	29.0	29.6	30.1	30.7	31.2	31.8
	Rating MVA LAR	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0

12.1.9 Katoomba North Transmission Substation Winter Demand Forecast

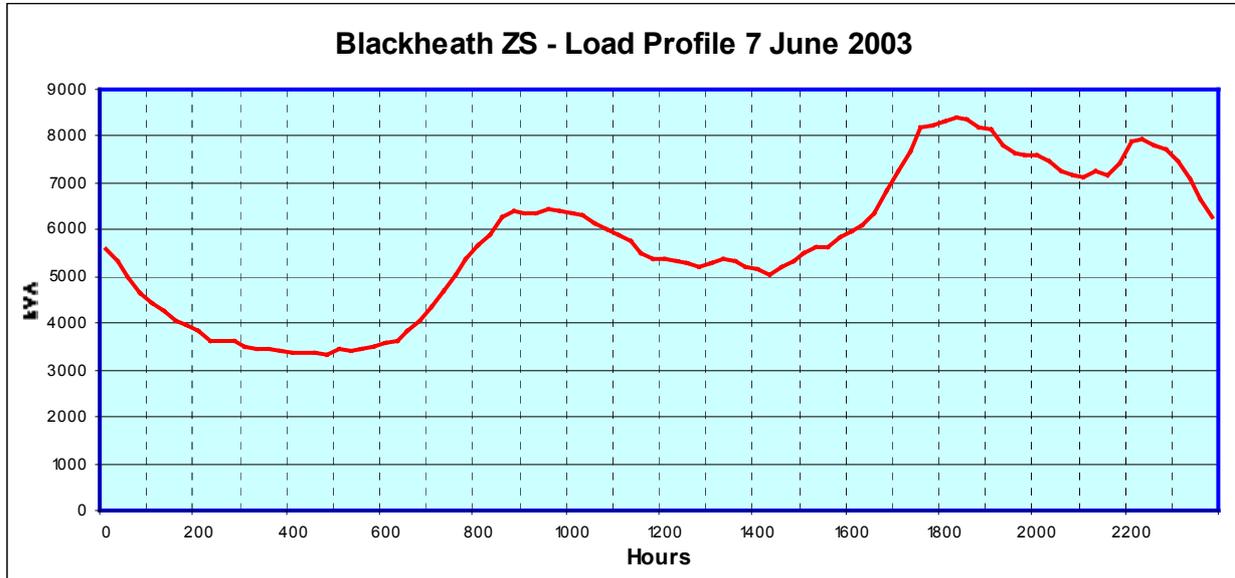
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Blackheath	MVA	8.1	8.0	7.9	8.3	8.1	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.1	9.2
	Rating MVA LAR	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Katoomba	MVA	19.7	21.1	20.7	20.6	19.8	20.9	21.7	22.2	22.6	23.0	23.3	23.7	24.0	24.4	24.8	25.1
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Wentworth Falls	MVA	7.0	6.8	7.3	6.9	8.0	8.5	8.4	8.7	8.9	9.1	9.3	9.6	9.8	10.0	10.2	10.5
	Rating MVA LAR	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	0.0	0.2	0.5
Katoomba Nth TS	MVA	33.5	34.7	36.0	35.4	33.9	35.9	36.7	37.5	38.1	38.8	39.4	40.1	40.7	41.3	42.0	42.6
	Rating MVA LAR	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0

Note: LAR denotes Load at Risk

12.1.10 Constrained Zone Substation Load Profiles, Information and Options

Blackheath Zone Substation

Load Profile



Load Characteristics

Blackheath ZS supplies the township of Blackheath in the Blue Mountains. The load profile of this substation is winter evening peaking driven mainly by residential loads. Blackheath ZS has a firm rating of 7 MVA and a cyclic rating of 8 MVA. This substation is experiencing slow demand growth.

Options

Network

The augmentation of Blackheath ZS will provide additional capacity to supply the demand of the area. The current estimated construction date is 2010/11 (refer project item PR263).

Non-network

A non-network option would need to reduce the winter afternoon peak demand between the hours of 17:00 to 20:00 weekdays created, mainly by the residential space heating. A non-network option would also need to address the off-peak hot water demand. The winter peak demand is 3 MVA higher than the winter peak demand. The growth rate is about 0.1 MVA per annum.

Lawson Transmission Substation

12.1.11 Lawson Transmission Substation Status

Lawson TS (52 MVA firm capacity) is mainly used to supply Hazelbrook ZS and the RIC Lawson Traction Substation, which in turn also supplies additional traction substations east and west of Lawson. It also provides backup to the Katoomba North TS network, as it has only one 132kV supply, and to Springwood ZS, which is normally supplied from Warrimoo TS.

An investigation is currently being prepared to address constraints in the limited backup arrangements of feeders 803 and 804. Additionally, it will investigate the long term needs and recommend appropriate solutions for the Upper Blue Mountains by way of 66 kV injection capacity at Katoomba North and Lawson TS's.

12.1.12 Lawson Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Lawson TS	2 x 52	104	52
Hazelbrook	2 x 16/18.5/25	50	27
Lawson RIC	Unknown		

12.1.13 Lawson Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Hazelbrook	MVA Rating	8.4	9.1	9.9	9.4	9.5	10.2	10.7	10.9	11.0	11.1	11.3	11.4	11.5	11.7	11.8	11.9
	MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Lawson RIC	MVA Rating	20.6	16.2	12.7	16.2	14.6	13.3	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1
	MVA LAR	20.6	16.2	12.7	16.2	14.6	13.3	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1
Katoomba Nth TS	MVA Rating	25.9	21.3	18.4	31.6	20.9	19.9	26.2	26.4	26.5	26.6	26.8	26.9	27.0	27.2	27.3	27.4
	MVA LAR	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0

12.1.14 Lawson Transmission Substation Winter Demand Forecast

Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Hazelbrook	MVA Rating	10.8	12.6	11.3	11.5	11.2	11.6	12.1	12.3	12.5	12.8	13.0	13.2	13.5	13.7	14.0	14.2
	MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Lawson RIC	MVA Rating	19.8	14.5	14.8	14.4	14.9	15.2	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1
	MVA LAR	19.8	14.5	14.8	14.4	14.9	15.2	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1
Katoomba Nth TS	MVA Rating	28.2	25.3	18.3	24.5	22.1	24.0	24.7	24.9	25.1	25.3	25.5	25.7	25.9	26.1	26.4	26.6
	MVA LAR	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0

Note: LAR denotes Load at Risk

12.1.15 Constrained Zone Substation Load Profiles, Information and Options

None

Mt Piper Transmission Substation

12.1.16 Mt Piper Transmission Substation Status

Mt Piper TS is owned by TransGrid and supplies both Integral Energy and Country Energy. The allocation to Integral Energy is limited to 45 MVA on each feeder, being the rating of the metering equipment. Mt Piper TS has 2 x 120 MVA 132/66/11 kV transformers (no provision for any additional transformers) with a cyclic rating of 150 MVA. The secondary star points of both transformers are earthed via a common neutral earthing resistor of 38.1 ohms.

12.1.17 Mt Piper Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Mt Piper TS	2 x 120	240	120
Angus PI Colliery	2 x 5	10	
Bal Bone Colliery	2 x 7.5	15	
Blackmans Flat	2 x 10	20	11
BCSC Charbon	1 x 5	5	
Clarence Colliery	2 x 7.5	15	
Hartley Vale	2 x 2.5	5	2.5

12.1.18 Mt Piper Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Angus Place Colliery a.k.a (Newcom Colliery)	MVA Rating	7.2	7.4	7.9	7.5	6.1	3.3	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	MVA LAR	Customer		Substation													
Baal Bone	MVA Rating	7.0	6.8	7.6	9.1	9.9	8.5	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
	MVA LAR	Customer		Substation													
Blackmans Flat	MVA Rating	4.7	4.0	4.3	5.1	5.3	5.3	5.7	5.8	5.9	6.1	6.2	6.3	6.5	6.6	6.7	6.9
	MVA LAR	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Charbon Coal	MVA Rating			2.8	2.8	2.7	2.9	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
	MVA LAR	Customer		Substation													
Clarence Colliery	MVA Rating	7.9	5.4	6.4	6.7	8.0	9.2	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	MVA LAR	Customer		Substation													
Hartley Vale	MVA Rating	0.6	0.6	0.7	1.0	0.7	0.6	1.4	1.5	1.6	1.7	1.7	1.8	1.9	2.0	2.1	2.1
	MVA LAR	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Invincible Colliery	MVA Rating	1.9	0.9	0.9	0.8	0.1	0.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
	MVA LAR	Customer		Substation													
Springvale Borehole	MVA Rating		0.5	0.5	0.8	1.6	1.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	MVA LAR	Customer		Substation													
Mt Piper TS	MVA Rating	22.1	21.7	19.4	27.6	27.4	27.8	28.6	28.8	29.0	29.1	29.3	29.5	29.7	29.9	30.0	30.2
	MVA LAR	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0

Note: LAR denotes Load at Risk

12.1.19 Mt Piper Transmission Substation Winter Demand Forecast

Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Angus Place Colliery a.k.a (Newcom Colliery)	MVA Rating MVA LAR	6.9 Customer	7.4 Customer	7.2 Substation	8.7 Substation	8.2	7.2	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Baal Bone	MVA Rating MVA LAR	6.0 Customer	7.0 Customer	6.8 Substation	7.6 Substation	9.1	9.9	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Blackmans Flat	MVA Rating MVA LAR	5.6 11.0	5.8 11.0	5.4 11.0	5.4 11.0	5.5 11.0	6.4 11.0	7.1 11.0	7.2 11.0	7.3 11.0	7.4 11.0	7.4 11.0	7.5 11.0	7.6 11.0	7.7 11.0	7.8 11.0	7.8 11.0
Charbon Coal	MVA Rating MVA LAR	Customer		3.0 Substation	3.0 Substation	2.9	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Clarence Colliery	MVA Rating MVA LAR	9.8 Customer	3.3 Customer	6.1 Substation	8.4 Substation	6.7	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
Hartley Vale	MVA Rating MVA LAR	1.0 2.5	0.8 2.5	0.9 2.5	0.8 2.5	0.7 2.5	1.0 2.5	1.0 2.5	1.0 2.5	1.0 2.5	1.1 2.5	1.1 2.5	1.1 2.5	1.1 2.5	1.2 2.5	1.2 2.5	1.2 2.5
Invincible Colliery	MVA Rating MVA LAR	1.9 Customer	2.1 Customer	0.9 Substation	0.6 Substation	0.8	0.9	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Springvale Borehole	MVA Rating MVA LAR	0.3 Customer	0.5 Customer	0.3 Substation	0.8 Substation	0.8	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Mt Piper TS	MVA Rating MVA LAR	23.8 120.0	21.8 120.0	22.4 120.0	29.9 120.0	28.5 120.0	36.2 120.0	35.0 120.0	35.2 120.0	35.3 120.0	35.4 120.0	35.5 120.0	35.6 120.0	35.7 120.0	35.8 120.0	35.9 120.0	36.0 120.0

Note: LAR denotes Load at Risk

12.1.20 Constrained Zone Substation Load Profiles, Information and Options

None

Wallerawang 66 kV Bulk Supply Point

12.1.21 Wallerawang 66 kV Bulk Supply Point Status

Wallerawang BSP is owned by TransGrid. It provides supply to both Integral Energy and Advance Energy at both 66 kV and 132 kV. Integral Energy owns and maintains the various transmission lines within the Integral Energy area supplying Integral Energy zone and customer substations.

12.1.22 Wallerawang 66 kV Bulk Supply Point Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Wallerawang BSP	Transgrid		
Advance Energy	Unknown		
Lithgow	2 x 15/30	60	30
Meadow Flat	1 x 2.5	2.5	2.5
Portland	2 x 10	20	10
Springvale Colliery	Unknown		

12.1.23 Wallerawang 66 kV Bulk Supply Point Summer Demand Forecast

Lithgow	MVA Rating MVA LAR	16.1 30.0	13.2 30.0	13.6 30.0	14.0 30.0	13.3 30.0	13.1 30.0	15.0 30.0	15.2 30.0	15.4 30.0	15.6 30.0	15.8 30.0	16.0 30.0	16.2 30.0	16.4 30.0	16.6 30.0	16.8 30.0
Meadow Flat	MVA Rating MVA LAR	0.6 2.5	0.7 2.5	0.7 2.5	0.7 2.5	0.7 2.5	0.8 2.5	0.8 2.5	0.8 2.5	0.8 2.5	0.9 2.5						
Portland	MVA Rating MVA LAR	2.3 10.0	2.3 10.0	2.8 10.0	2.4 10.0	2.9 10.0	2.5 10.0	2.9 10.0	3.0 50.0	3.1 50.0	3.2 50.0	3.3 50.0	3.4 50.0	3.5 50.0	3.6 50.0	3.7 50.0	3.8 50.0
Springvale Colliery	MVA Rating	5.7	5.7	6.2	5.7	6.1	6.7	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Wallerawang RIC	MVA Rating	11.9	6.8	6.4	6.4	8.0	3.0	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4
Wallerawang TS	MVA Rating MVA LAR	25.5 TransGrid Substation	21.7	21.5	24.3	23.9	19.1	30.4	30.6	30.8	31.1	31.3	31.5	31.8	32.0	32.3	32.5

12.1.24 Wallerawang 66 kV Bulk Supply Point Winter Demand Forecast

Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Lithgow	MVA Rating MVA LAR	16.5 30.0	17.5 30.0	18.0 30.0	17.7 30.0	19.0 30.0	17.3 30.0	19.8 30.0	19.9 30.0	20.1 30.0	20.3 30.0	20.5 30.0	20.7 30.0	20.8 30.0	21.0 30.0	21.2 30.0	21.4 30.0
Meadow Flat	MVA Rating MVA LAR	1.0 2.5	1.0 2.5	1.0 2.5	1.1 2.5	1.1 2.5	1.0 2.5	1.2 2.5	1.2 2.5	1.2 2.5	1.2 2.5	1.3 2.5	1.3 2.5	1.3 2.5	1.3 2.5	1.3 2.5	1.3 2.5
Portland	MVA Rating MVA LAR	2.4 10.0	2.6 10.0	2.8 10.0	2.8 10.0	2.8 10.0	2.9 10.0	3.0 10.0	3.1 50.0	3.2 50.0	3.3 50.0	3.4 50.0	3.5 50.0	3.6 50.0	3.7 50.0	3.8 50.0	3.9 50.0
Springvale Colliery	MVA Rating	5.5	2.3	6.4	6.4	6.6	7.4	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Wallerawang RIC	MVA Rating	11.4	7.3	7.2	5.8	7.7	3.1	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Wallerawang TS	MVA Rating MVA LAR	29.3 TransGrid Substation	27.8	27.2	25.5	28.8	18.7	25.0	25.2	25.3	25.5	25.7	25.9	26.1	26.3	26.4	26.6

Note: LAR denotes Load at Risk

12.1.25 Constrained Zone Substation Load Profiles, Information and Options

None.

Warrimoo Transmission Substation

12.1.26 Warrimoo Transmission Substation Status

Warrimoo TS has 2 x 60 MVA 132/66/11 kV autotransformers with no provision for additional transformers. The transformer circuit breakers are rated at 1600 A (183 MVA) and the isolators at 1250 A (143 MVA). This is adequate for the assigned cyclic rating of 78 MVA. The secondary star points of both the 132/66/11 kV transformers are earthed via a common neutral earthing resistor of 30 ohms.

12.1.27 Warrimoo Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Warrimoo TS	2 x 60	120	66
Blaxland	2 x 22/26/35	70	38
Springwood	2 x 25/35	70	38

12.1.28 Warrimoo Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Blaxland	MVA	20.9	20.3	20.6	23.7	21.3	26.7	26.4	26.7	27.0	27.3	27.7	28.0	28.3	28.6	28.9	29.2
	Rating MVA LAR	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Springwood	MVA	17.6	17.9	19.8	21.9	19.8	25.8	26.4	26.7	27.1	27.4	27.8	28.2	28.5	28.9	29.3	29.6
	Rating MVA LAR	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Warrimoo TS	MVA	41.4	41.9	42.2	41.2	42.2	55.9	53.1	53.8	54.5	55.2	55.9	56.5	57.2	57.9	58.6	59.3
	Rating MVA LAR	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0

12.1.29 Warrimoo Transmission Substation Winter Demand Forecast

Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Blaxland	MVA	23.1	23.3	24.2	25.1	26.1	24.5	26.1	26.5	26.9	27.2	27.6	28.0	28.4	28.8	29.2	29.6
	Rating MVA LAR	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Springwood	MVA	21.4	22.7	23.8	24.5	24.6	25.0	25.1	25.7	26.3	26.9	27.5	28.1	28.7	29.3	29.9	30.5
	Rating MVA LAR	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Warrimoo TS	MVA	47.6	46.7	47.8	60.3	49.0	50.4	53.7	54.8	55.8	56.9	57.9	59.0	60.0	61.0	62.1	63.1
	Rating MVA LAR	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0

Note: LAR denotes Load at Risk

12.1.30 Constrained Zone Substation Load Profiles, Information and Options

None.

13.0 Hawkesbury Area

Hawkesbury Transmission Substation

13.1.1 Hawkesbury Transmission Substation Status

Hawkesbury TS has 2 x 120 MVA transformers with provision for a third transformer. The firm cyclic rating of the substation is 137 MVA and is limited by the 2400 A rating of the 33kV transformer circuit breakers and isolators.

The development of the “North West Sector” will require Integral Energy to establish a number of new substations and subtransmission assets. These will be at 132 kV supplied from Vineyard BSP. Of particular significance is the proposed transfer of Riverstone ZS to the 132 kV network, which will offload Hawkesbury TS. An RFP is planned for the “North West Sector” to identify possible demand management alternatives. Discussions will also be conducted with Planning NSW and local councils to incorporate energy efficiency and demand management aspects into the development approval process.

13.1.2 Hawkesbury Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Hawkesbury TS	2 x 120	240	130
Cattai	2 x 6 + 1 x 10	22	11
Glossodia	2 x 10	20	11
Kurrajong	2 x 10	20	11
North Richmond	1 x 25	25	12
Richmond	2 x 15/19/25	50	27
Riverstone	2 x 15/19/25	50	27
South Windsor	2 x 15/19/25	50	27
Windsor	2 x 15/20	40	22
Wisemans	1 x 6	6	6

13.1.3 Hawkesbury Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Cattai	MVA	7.0	7.3	8.2	10.3	8.8	10.7	11.5	12.0	12.8	13.7	14.5	15.0	15.4	15.8	16.2	16.5
	Rating MVA LAR	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Glossodia	MVA	9.8	10.8	11.6	13.0	11.1	15.1	13.9	14.3	14.7	15.1	15.5	15.9	16.3	16.7	17.1	17.5
	Rating MVA LAR	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Hawkesbury RIC	MVA	3.0	2.9	3.0	3.1	2.9	3.2	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	Rating MVA LAR																
Kurrajong	MVA	8.5	7.9	8.6	11.5	9.3	11.7	13.4	13.8	14.3	14.7	15.2	15.6	16.1	16.5	17.0	17.4
	Rating MVA LAR	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
North Richmond	MVA	9.6	9.3	10.4	11.5	9.9	11.4	14.2	14.3	14.5	14.7	14.9	15.1	15.3	15.5	15.6	15.8
	Rating MVA LAR	12.0	12.0	12.0	12.0	12.0	12.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Richmond	MVA	23.8	23.8	24.2	25.8	25.0	29.1	25.3	25.6	25.8	26.1	26.4	26.6	26.9	27.1	27.4	27.7
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Riverstone	MVA	23.2	25.3	27.8	28.1	26.1	31.2	27.9	28.4	28.8	29.3	29.8	30.3	30.8	31.2	31.7	32.2
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
South Windsor	MVA	23.5	24.6	26.6	25.8	26.5	30.7	28.1	29.4	29.9	30.4	30.9	31.4	31.9	32.4	32.9	33.4
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Windsor	MVA	13.8	13.5	14.7	16.4	16.0	20.1	20.2	20.7	21.3	21.8	22.3	22.8	23.4	23.9	24.4	24.9
	Rating MVA LAR	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Wisemans	MVA	3.4	3.8	4.0	4.3	4.5	4.8	5.0	5.3	5.6	5.8	6.1	6.4	6.6	6.9	7.1	7.4
	Rating MVA LAR	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Hawkesbury TS	MVA	126.4	121.0	129.7	144.3	128.6	160.2	153.4	157.6	161.2	165.0	168.6	172.0	175.2	178.5	181.8	185.0
	Rating MVA LAR	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0

Note: LAR denotes Load at Risk

13.1.4 Hawkesbury Transmission Substation Winter Demand Forecast

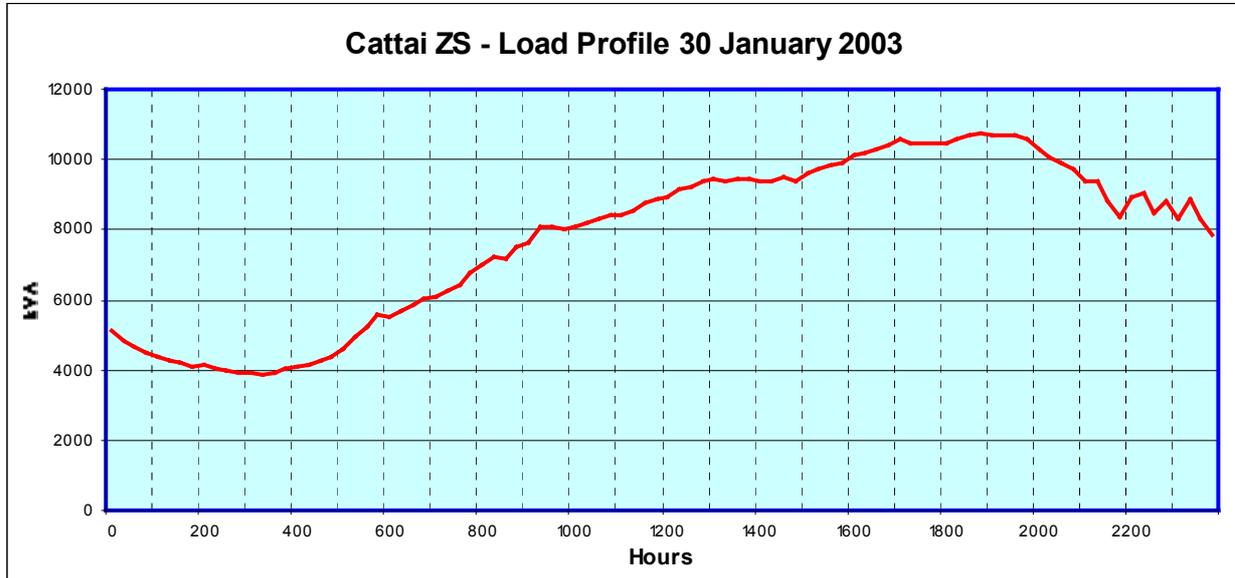
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cattai	MVA	5.9	7.1	7.1	7.6	7.8	9.6	9.5	9.8	10.0	10.2	10.4	10.6	10.9	11.1	11.3	11.5
	Rating MVA LAR	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Glossodia	MVA	9.4	9.6	10.0	10.9	10.9	11.4	8.9	8.0	8.3	8.6	8.9	9.2	9.6	9.9	10.2	10.5
	Rating MVA LAR	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Hawkesbury RIC	MVA	2.9	2.8	2.9	3.4	3.9	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	Rating MVA LAR																
Kurrajong	MVA	8.3	8.4	9.5	9.7	10.8	11.3	11.0	11.2	11.4	11.6	11.9	12.1	12.3	12.5	12.8	13.0
	Rating MVA LAR	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
North Richmond	MVA	8.1	8.2	9.3	11.1	9.0	10.7	18.0	21.0	21.3	21.5	21.7	21.9	22.2	22.4	22.6	22.9
	Rating MVA LAR	12.0	12.0	12.0	12.0	12.0	12.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Richmond	MVA	20.6	20.1	20.0	21.9	20.2	22.1	19.2	16.0	16.3	16.6	17.0	17.3	17.6	17.9	18.2	18.6
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Riverstone	MVA	20.4	22.2	23.8	24.6	23.6	24.2	25.2	23.9	24.4	25.0	25.6	26.1	26.7	27.3	27.8	28.4
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
South Windsor	MVA	19.3	22.5	22.5	23.0	23.2	24.5	24.6	24.0	24.6	25.1	25.7	26.2	26.8	27.3	27.9	28.4
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Windsor	MVA	10.0	10.7	11.0	11.0	12.0	13.5	13.6	13.9	14.3	14.6	14.9	15.2	15.6	15.9	16.2	16.5
	Rating MVA LAR	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Wisemans	MVA	3.0	3.1	3.2	3.8	3.8	4.0	4.2	4.4	4.6	4.8	5.1	5.3	5.5	5.7	5.9	6.2
	Rating MVA LAR	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Hawkesbury TS	MVA	99.3	107.4	112.8	120.7	120.1	124.4	131.1	131.2	134.0	136.9	139.7	142.6	145.4	148.3	151.1	154.0
	Rating MVA LAR	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0

Note: LAR denotes Load at Risk

13.1.5 Constrained Zone Substation Load Profiles, Information and Options

Cattai Zone Substation

Load Profile



Load Characteristics

Cattai ZS supplies the rural area and township of Cattai in the Hawkesbury region. The load profile of this substation is summer peaking driven mainly by residential/rural loads. Cattai ZS has a firm rating of 10 MVA and a cyclic rating of 11MVA. This substation is experiencing moderate demand growth due to some residential development.

Options

Network

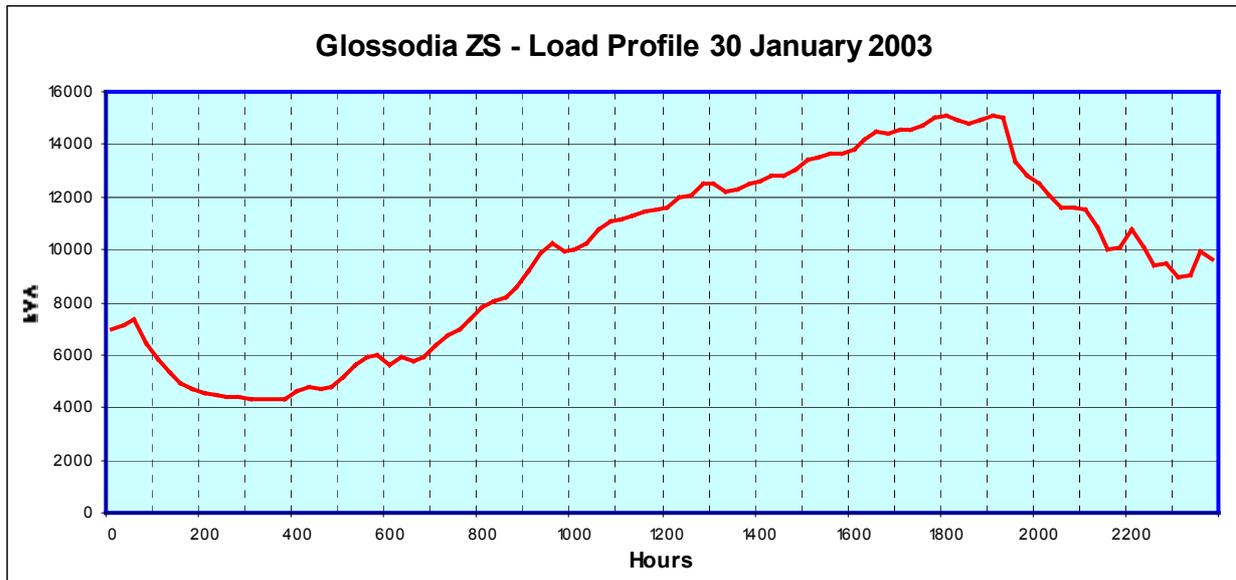
The augmentation of Cattai ZS will provide additional capacity to supply the increasing demand. The current estimated construction date is 2007/08 (refer project item PR058 & PR310).

Non-network

A non-network option would not defer the need to replace assets that reached the end of their serviceable life.

Glossodia Zone Substation

Load Profile



Load Characteristics

Glossodia ZS supplies the rural/residential area and township of Glossodia north of Windsor. The load profile of this substation is summer peaking driven mainly by residential/rural loads. Glossodia ZS has a firm rating of 10 MVA and a cyclic rating of 11 MVA. This substation is experiencing slow demand growth.

Options

Network

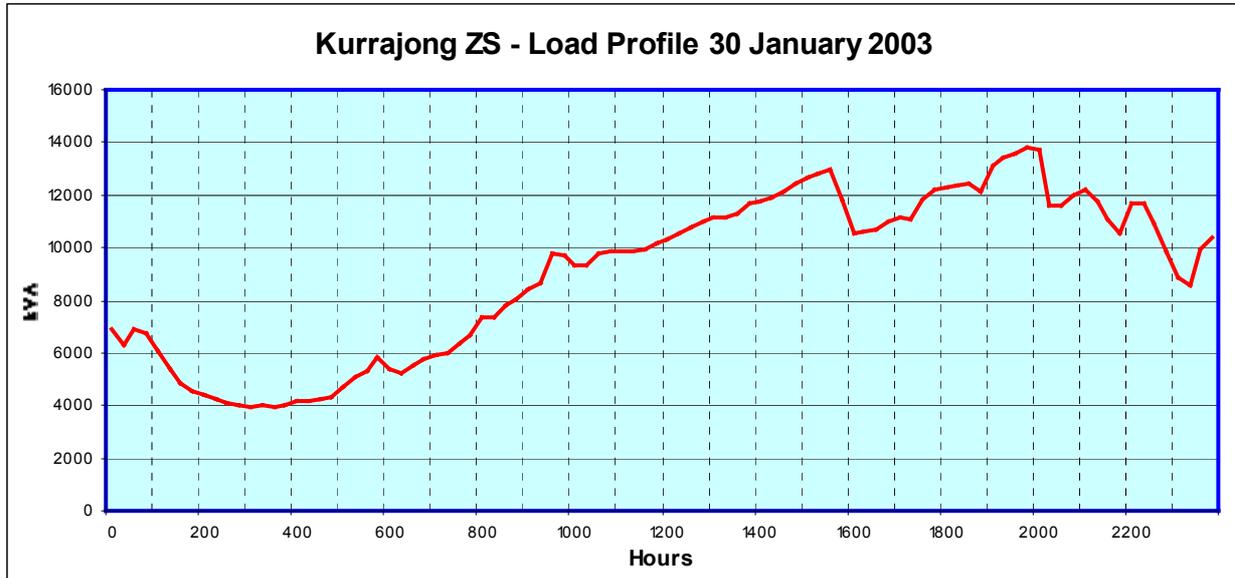
The augmentation of North Richmond ZS will provide additional capacity to offload Glossodia ZS. The current estimated construction date is 2003/04 (refer project item PR049). Glossodia ZS will still exceed network capacity limits within the next five years. Network investigations will be carried out to identify alternative options.

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 15:00 to 20:00 weekdays, created mainly by the rural/residential loads. The summer peak demand is 4 MVA higher than the winter peak demand. The growth rate is about 0.4 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Kurrajong Zone Substation

Load Profile



Load Characteristics

Kurrajong ZS supplies the rural/residential area and township of Kurrajong west of Windsor. The load profile of this substation is summer peaking driven mainly by residential/rural loads coincident with air conditioning. Kurrajong ZS has a firm rating of 10 MVA and a cyclic rating of 11 MVA. This substation is experiencing moderate demand growth due to residential development activity.

Options

Network

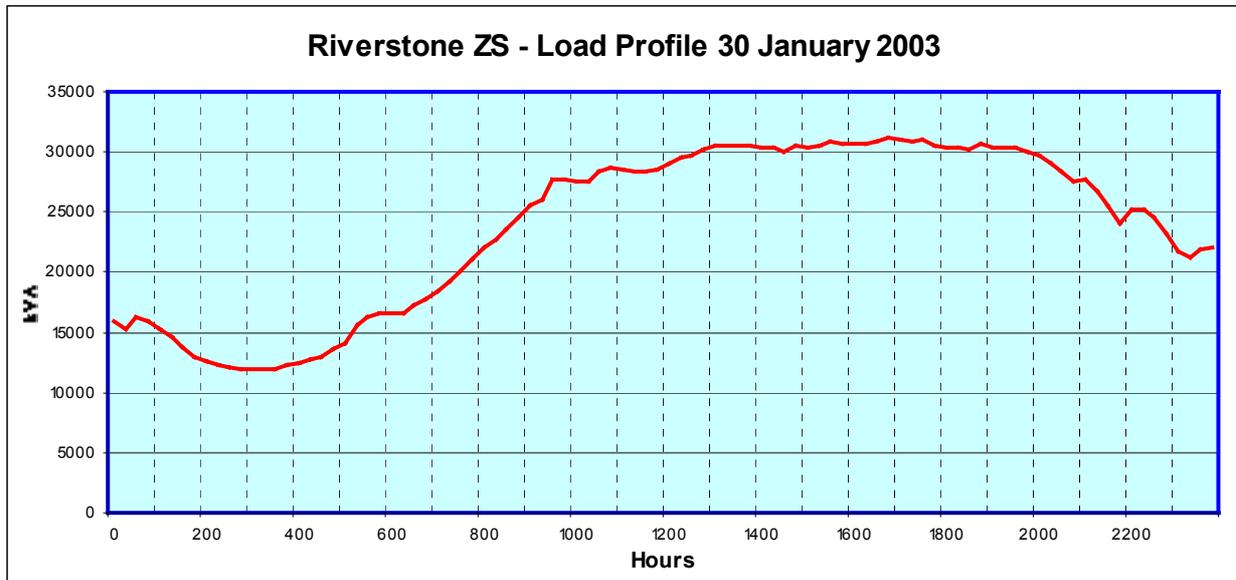
The augmentation of North Richmond ZS will provide additional capacity to offload Kurrajong ZS. The current estimated construction date is 2003/04 (refer project item PR049). Kurrajong ZS will still exceed network capacity limits within the next five years. Network investigations will be carried out to identify alternative options.

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 15:00 to 20:00 weekdays, created mainly by the rural/residential loads and the coincident air conditioning loads. The summer peak demand is 1 MVA higher than the winter peak demand. The growth rate is about 0.4 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Riverstone Zone Substation

Load Profile



Load Characteristics

Riverstone ZS supplies the residential area and township of Riverstone south of Windsor. The load profile of this substation is summer peaking driven mainly by residential and industrial loads coincident with air conditioning. Riverstone ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing moderate demand growth within the residential sector.

Options

Network

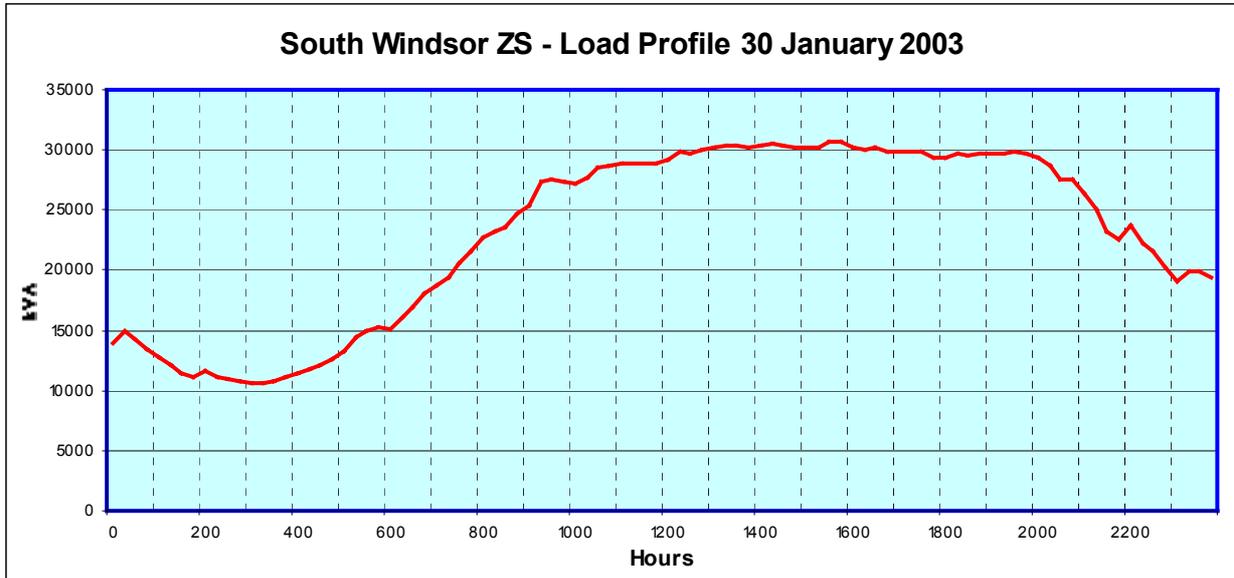
Riverstone ZS will be augmented to 132 kV operation as part of the north west sector redevelopment. This will provide additional capacity to supply the area. The current estimated construction date is 2009/10 (refer project item PR174).

Non-network

A non-network option would need to reduce the flat, summer afternoon peak demand between the hours of 12:00 to 20:00 weekdays, created mainly by the residential and industrial loads and the coincident air conditioning loads. The summer peak demand is 3 MVA higher than the winter peak demand. The growth rate is about 0.5 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

South Windsor Zone Substation

Load Profile



Load Characteristics

South Windsor ZS supplies the residential area and the commercial centre of South Windsor. The load profile of this substation is summer peaking driven mainly by residential and commercial loads coincident with air conditioning. South Windsor ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing moderate demand growth within the residential sector and to a lesser extent, the commercial centre.

Options

Network

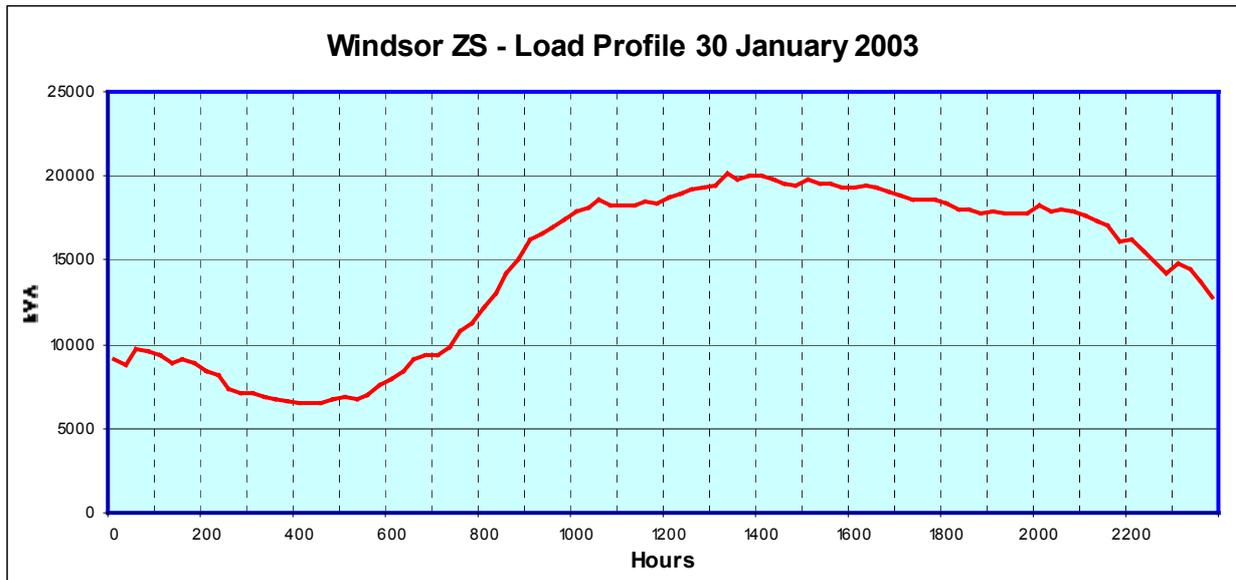
The augmentation of South Windsor ZS will provide additional capacity to supply the area. The current estimated construction date is 2005/06 (refer project item PR020). This project is currently proceeding

Non-network

The network project is currently proceeding and does not warrant further demand management investigation.

Windsor Zone Substation

Load Profile



Load Characteristics

Windsor ZS supplies the residential area and the commercial centre of Windsor. The load profile of this substation is summer peaking driven mainly by residential and commercial loads coincident with air conditioning. Windsor ZS has a firm rating of 20 MVA and a cyclic rating of 22 MVA. This substation is experiencing moderate demand growth within the residential sector and to a lesser extent, the commercial centre.

Options

Network

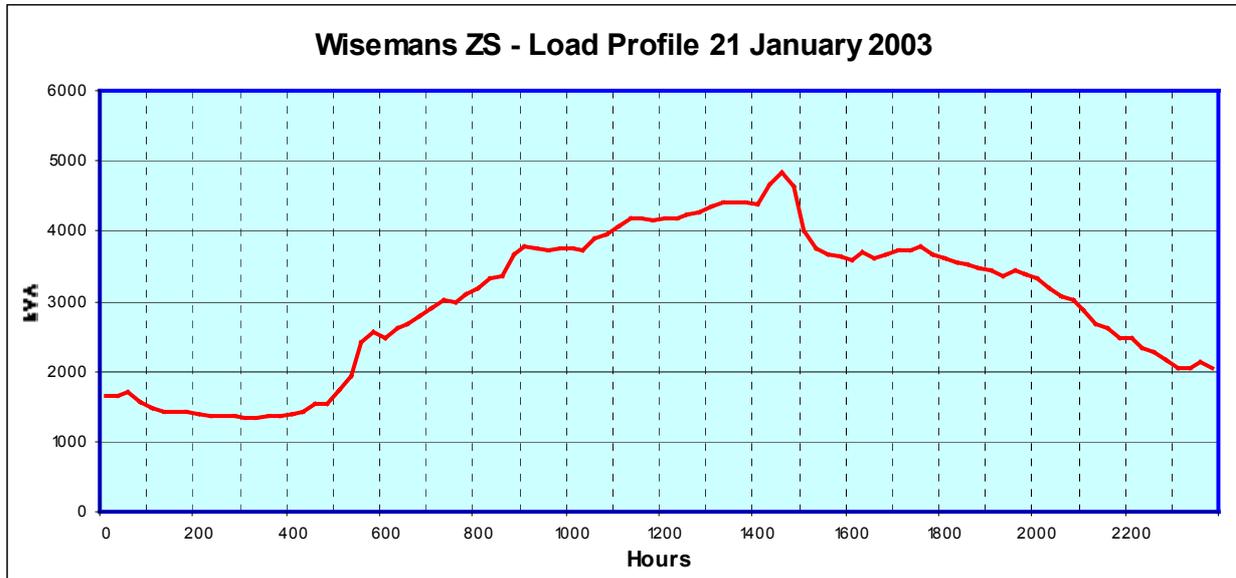
The augmentation of South Windsor ZS will provide additional capacity to offload Windsor ZS. The current estimated construction date is 2005/06 (refer project item PR020). Windsor ZS will still exceed network capacity limits within the next five years. Network investigations will be carried out to identify alternative options.

Non-network

A non-network option would need to reduce the flat, summer afternoon peak demand between the hours of 12:00 to 18:00 weekdays, created mainly by the residential and commercial loads and the coincident air conditioning loads. The summer peak demand is 5 MVA higher than the winter peak demand. The growth rate is about 0.5 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Wisemans Zone Substation

Load Profile



Load Characteristics

Wisemans ZS supplies the rural area north of Windsor. The load profile of this substation is summer peaking driven mainly by rural loads coincident with air conditioning. Wisemans ZS has a firm rating of 6 MVA and a cyclic rating of 6 MVA. This substation is experiencing slow demand growth.

Options

Network

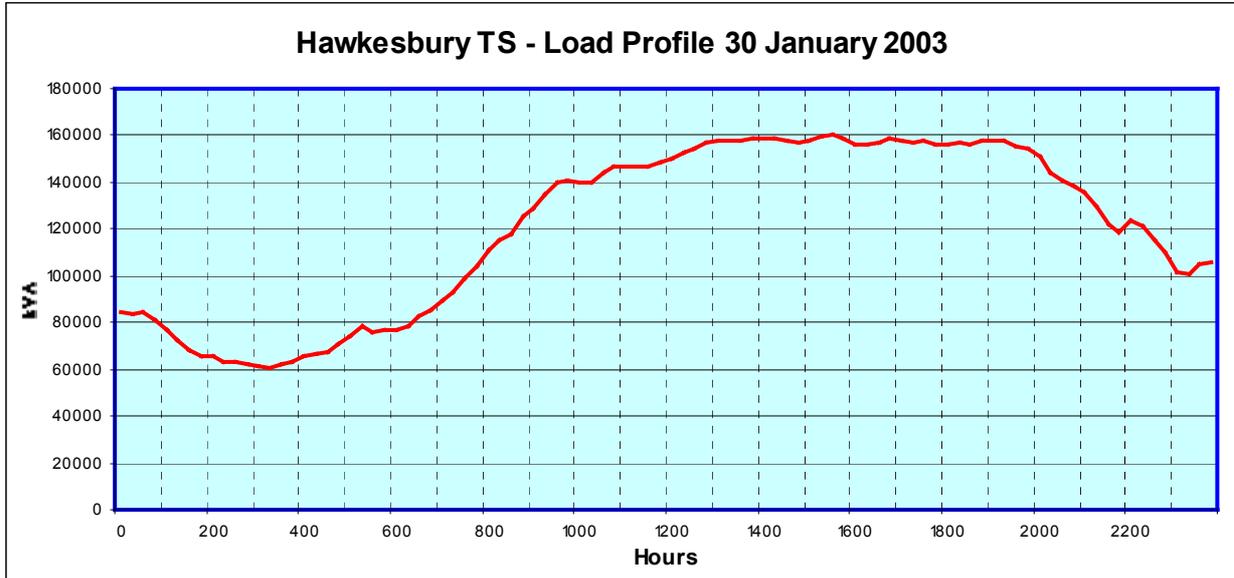
There are no network options identified.

Non-network

A non-network option would need to reduce the flat, summer afternoon peak demand between the hours of 12:00 to 16:00 weekdays, created mainly by the rural loads and the coincident air conditioning loads. The summer peak demand is 1 MVA higher than the winter peak demand. The growth rate is about 0.3 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Hawkesbury Transmission Substation

Load Profile



Load Characteristics

Hawkesbury TS supplies the Hawkesbury region, which includes commercial centres, industrial and part of the expanding residential areas of the north west sector. The load profile of this substation is summer peaking driven mainly by coincident commercial and residential air conditioning loads. Hawkesbury TS has a firm rating of 120 MVA and a cyclic rating of 130 MVA. This substation is experiencing demand growth mainly in the residential sector.

Options

Network

The augmentation of Hawkesbury TS will provide additional capacity to supply the growth in demand. The current estimated construction date is 2005/06 (refer project items PR101).

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the coincident commercial and residential loads. The summer peak demand is 20 MVA higher than the winter peak demand. The growth rate is about 4 MVA per annum.

14.0 Blacktown Area

Baulkham Hills Transmission Substation

14.1.1 Baulkham Hills Transmission Substation Status

Baulkham Hills TS has 4 x 60 MVA 132/33 kV transformers. Baulkham Hills TS and Carlingford TS are supplied by feeders 9J3 and 9J4 (Blacktown TS to Baulkham Hills TS). This system has a firm cyclic rating (one circuit outage) of 548 MVA. This rating is set by the 2400 A isolators at Baulkham Hills TS. Baulkham Hills TS has a theoretical cyclic capacity of 205.8 MVA, set by the 33 kV 1200 A transformer circuit breakers. However, 363 MVA of the total 548 MVA cyclic rating is allocated to the Carlingford TS and 185 MVA is allocated to Baulkham Hills TS.

To meet the needs of the area, the need to augment 132 kV feeders 9JA and 230 and Riverstone and Kellyville ZS's to 132/11 kV ZS's and establish Box Hill, Glenhaven, Mungerie Park, Norwest, North Castle Hill and Schofields ZS's and Rouse Hill SS has been identified.

It is proposed that in the future, Kellyville ZS would be supplied via a 132 kV network from Vineyard BSP. This would release 33 kV feeders 469 (Jasper Road ZS to Kellyville ZS) and the section of feeder 473 (Tee to Marayong to Kellyville ZS) from service at 33 kV.

14.1.2 Baulkham Hills Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Baulkham Hills TS	3 x 30/45/60 (132/33 kV) + 1 x 45/60 (132/33 kV)	240	198
Baulkham Hills 11 kV (Old Toongabbie ZS)	Future 2 x 45 (132/11 kV)	0	
Jasper Rd	2 x 15/20/25 (33/11 kV) + 1 x 15/19/25 (33/11 kV)	75	55
North Rocks	2 x 15/19/25 (33/11 kV)	50	28
Northmead	2 x 15 (33/11 kV) + 1 x 15/19/25 (33/11 kV)	55	44
Seven Hills	3 x 15/19/25 (33/11 kV)	75	45
Westmead	2 x 15/19/25 (33/11 kV)	50	28

14.1.3 Baulkham Hills Transmission Substation Summer Demand Forecast

Location		Actual						Forecast										
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Baulkham Hills 11kV	MVA									27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	
	Rating MVA LAR									50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	
Jasper Road	MVA	39.4	42.3	46.9	51.9	42.9	55.3	56.2	58.7	46.1	47.4	48.7	50.0	51.2	52.5	53.8	55.0	
	Rating MVA LAR	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	
Northmead	MVA	24.3	25.5	25.6	25.0	26.9	31.6	30.8	33.0	24.1	24.7	25.2	25.7	26.3	26.8	27.3	27.8	
	Rating MVA LAR	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	
North Rocks	MVA	19.3	18.7	19.7	24.4	18.7	23.9	23.0	23.7	24.2	24.6	25.1	25.5	25.9	26.3	26.8	27.2	
	Rating MVA LAR	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	
Seven Hills	MVA	45.5	46.0	48.1	46.3	45.4	47.1	46.5	46.8	36.8	36.9	37.1	37.2	37.4	37.5	37.7	37.8	
	Rating MVA LAR	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	
Westmead	MVA	23.7	22.3	23.5	25.7	23.9	26.1	27.5	30.3	31.5	32.0	32.5	32.9	33.4	33.9	34.3	34.8	
	Rating MVA LAR	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	
Baulkham Hills TS	MVA	123.3	138.5	137.4	150.5	145.8	165.0	164.9	172.4	174.8	177.5	180.1	182.7	185.4	188.0	190.6	193.2	
	Rating MVA LAR	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	

14.1.4 Baulkham Hills Transmission Substation Winter Demand Forecast

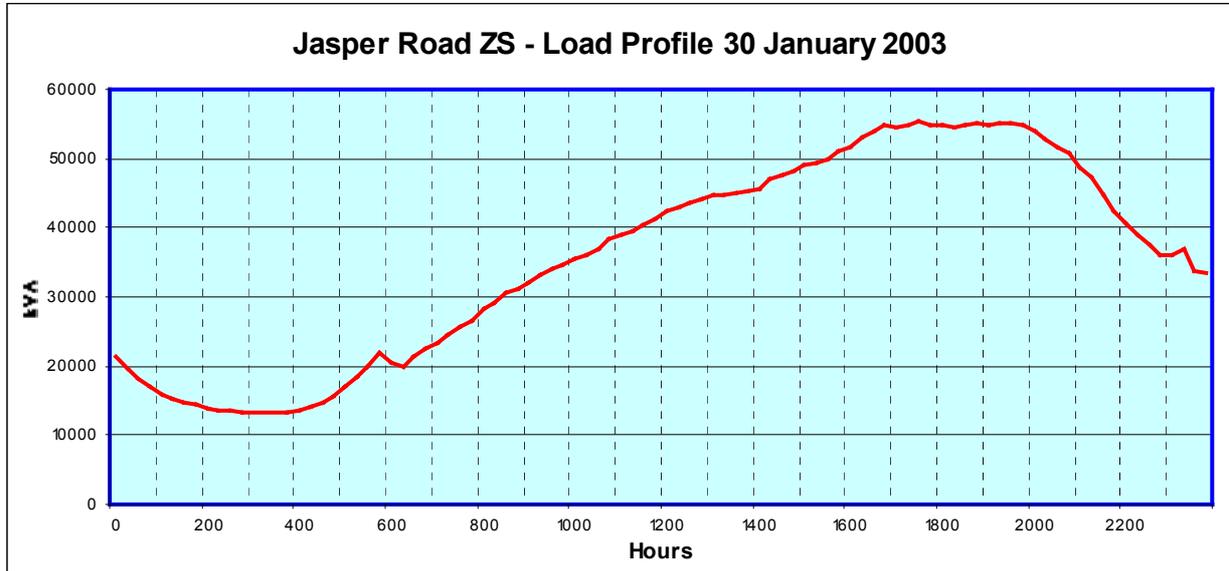
Location		Actual						Forecast										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Baulkham Hills 11kV	MVA								27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2	
	Rating MVA LAR								50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	
Jasper Road	MVA	39.0	40.9	42.7	47.3	46.8	45.1	46.7	37.0	39.4	41.0	42.3	43.6	44.9	46.2	47.5	48.8	
	Rating MVA LAR	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	
Northmead	MVA	23.7	24.8	24.1	26.7	27.2	28.5	29.1	21.3	22.1	22.9	23.5	24.0	24.5	25.0	25.5	26.1	
	Rating MVA LAR	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	44.0	
North Rocks	MVA	19.2	19.4	18.7	20.1	20.9	21.9	21.9	21.6	22.3	22.8	23.2	23.7	24.1	24.5	24.9	25.4	
	Rating MVA LAR	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	
Seven Hills	MVA	43.8	43.7	41.9	43.7	42.2	42.7	43.0	32.8	33.1	33.3	33.4	33.6	33.7	33.8	34.0	34.1	
	Rating MVA LAR	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	
Westmead	MVA	18.1	18.0	17.9	18.4	19.9	18.5	20.2	19.9	22.4	22.7	23.1	23.5	23.8	24.2	24.5	24.9	
	Rating MVA LAR	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	
Baulkham Hills TS	MVA	135.5	129.5	132.1	138.9	141.1	137.4	144.5	153.3	159.2	162.4	165.1	167.6	170.2	172.7	175.3	177.9	
	Rating MVA LAR	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0	

Note: LAR denotes Load at Risk

14.1.5 Constrained Zone Substation Load Profiles, Information and Options

Jasper Road Zone Substation

Load Profile



Load Characteristics

Jasper Rd ZS supplies the residential area and the commercial centre north of Seven Hills. The load profile of this substation is summer peaking driven mainly by residential and commercial loads coincident with air conditioning. Jasper Rd ZS has a firm rating of 50 MVA and a cyclic rating of 55 MVA. This substation is experiencing moderate demand growth within the residential sector due to re-development to medium density and the growth in air conditioning.

Options

Network

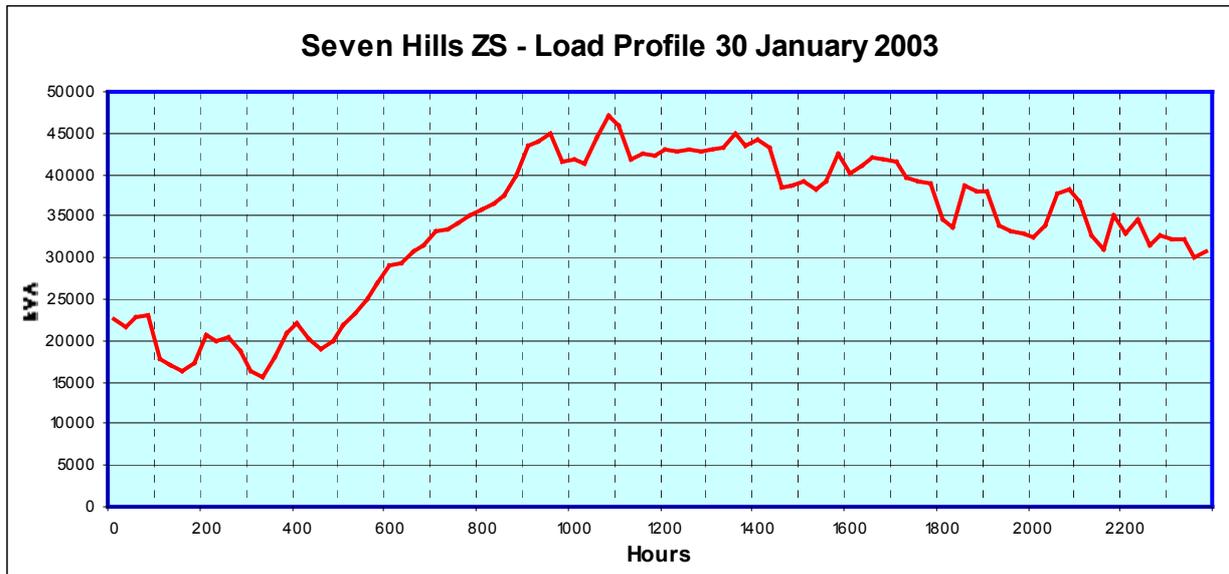
The construction of Baulkham Hills 11kV ZS will offload Jasper Rd ZS in the short term. The current estimated construction date is 2004/05, (refer project item PR035). In the longer term, Jasper Rd ZS will be augmented to supply the ultimate expected peak load. The current estimated construction date is 2009/10 & 2013/14 (refer project items PR076 & PR132)

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 15:00 to 21:00 weekdays, created mainly by the residential and commercial loads and the coincident air conditioning loads. The redevelopment of the residential area will also need to be addressed. The summer peak demand is 7 MVA higher than the winter peak demand. The growth rate is about 1 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Seven Hills Zone Substation

Load Profile



Load Characteristics

Seven Hills ZS supplies a major industrial area and the surrounding residential area of Seven Hills. The load profile of this substation is summer peaking driven mainly by industrial load coinciding with residential air conditioning loads. Seven Hills ZS has a firm rating of 45 MVA and a cyclic rating of 45 MVA. This substation is experiencing moderate demand growth within the residential sector due to re-development to medium density and the growth in air conditioning.

Options

Network

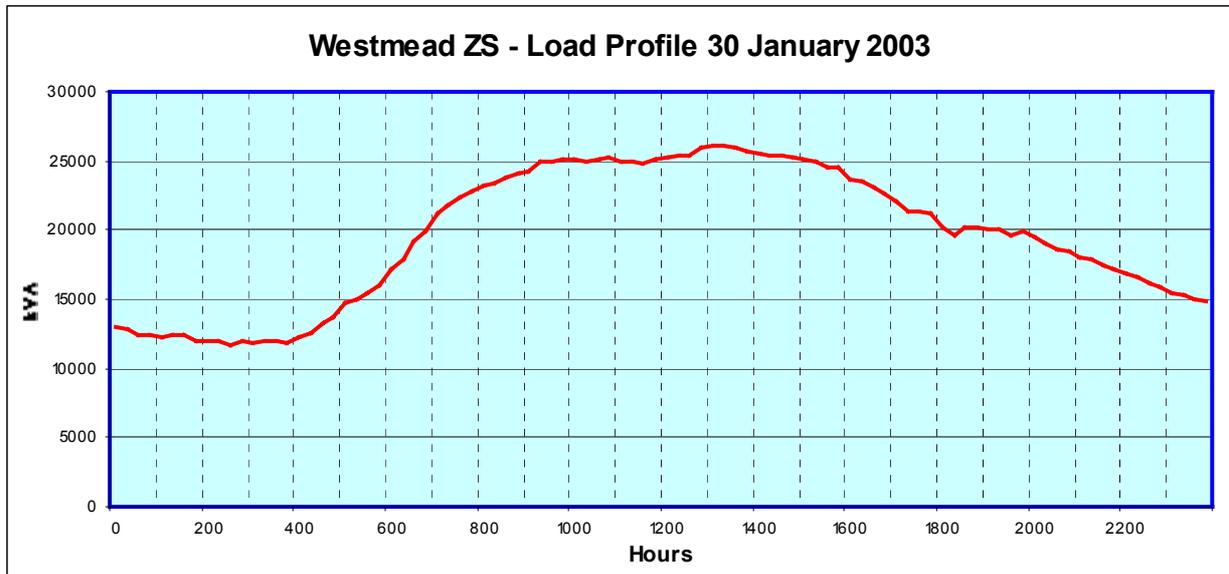
The construction of Baulkham Hills 11kV ZS will offload Seven Hills ZS. The current estimated construction date is 2004/05, (refer project item PR035).

Non-network

A customer load shedding demand management program has been in place since 1998 deferring the above network option. It is due to end at the completion on the 2004/05 summer. This program has successfully deferred the construction of Baulkham Hills 11kV ZS since 1997. This program will be re-evaluated for its potential to further defer the build option.

Westmead Zone Substation

Load Profile



Load Characteristics

Westmead ZS supplies a major Hospital the high/medium/low density residential areas and a small commercial centre west of Parramatta. The load profile of this substation is summer peaking driven mainly by the hospital load coinciding with the residential air conditioning load. Westmead ZS has a firm rating of 25 MVA and a cyclic rating of 28 MVA. This substation is experiencing demand growth within the residential sector due to re-development to medium and high density and the growth in air conditioning. The hospital is also proposing to increase load in 2006.

Options

Network

The augmentation of Westmead ZS and 33kV feeders will provide sufficient capacity to supply the areas electrical demand requirements. The current estimated construction date is 2006/07, (refer project item PR115, PR095 & PR266).

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 9:00 to 16:00 weekdays, created mainly by the hospital load coinciding with the residential air conditioning load. The redevelopment of the residential area will also need to be addressed. The summer peak demand is 7 MVA higher than the winter peak demand. The growth rate is about 0.5 MVA per annum.

Blacktown Transmission Substation

14.1.6 Blacktown Transmission Substation Status

Blacktown TS has 3 x 120 MVA 132/33 kV transformers with provision for a fourth. The substation firm capacity is limited by the transformer 33 kV circuit breakers and isolators (rated at 2400 A) to 2 x 137 MVA (274 MVA).

A fourth transformer is to be installed at Blacktown TS within the 2002/03 year to relieve present demand above firm capacity. This will provide a total of 360 MVA firm capacity.

Quarries ZS is being rebuilt over the 2002/03 and 2003/04 budget years to provide a firm 25 MVA of capacity together with a new 11 kV switchboard and a number of new feeders in the area. This has been driven by redevelopment of the area for industrial and residential usage. Discussions have been conducted with Holroyd City Council regarding new home energy efficiency standards via the NatHERS system.

A new TS is planned for Wetherill Park West to strengthen the supply to the industrial area, which is being supplied from the constrained networks of Bossley Park, Horsley Park and Wetherill Park ZS's. The project includes a ZS within the TS and is scheduled for commissioning in 2005. It will supply the existing zones of Bossley Park, Horsley Park and Woodpark, parts of Wetherill Park, and also becomes the alternate supply to Smithfield ZS. Additionally, it will provide for the future needs of Wakeley and Cecil Hills ZS's to offload Smithfield, Canley Vale, Bonnyrigg, Hoxton Park and Horsley Park ZS's.

14.1.7 Blacktown Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Blacktown TS	4 x 120	480	375
Bossley Park	2 x 22/26/35	70	37
Doonside	2 x 15 + 1 x 15/20	50	37
Greystanes	2 x 15/19/25	50	27
Holroyd	3 x 17.25	51.75	37
Leabons Lane	2 x 15/20/25	50	28
Marayong	3 x 15/19/25	75	50
Newton	2 x 15/19/25	50	27
Prospect	3 x 15	45	32
Prospect East	2 x 15/20/25	50	
Prospect South	2 x 15/20/25	50	
Quarries	2 x 10	20	
RIC Blacktown	Unknown		
Woodpark	2 x 15/19/25	50	

Note: Woodpark ZS is now normally supplied from Guildford TS.

14.1.8 Blacktown Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Blacktown RIC	MVA Rating MVA LAR	13.0	15.2	13.6	12.1	14.2	15.2	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
Bossley Park	MVA Rating MVA LAR	35.3 37.0	40.5 37.0	42.7 37.0	45.3 37.0	36.6 37.0	42.2 37.0	43.6 37.0	44.3 37.0	44.9 37.0	45.5 37.0	46.2 37.0	46.8 37.0	47.5 37.0	48.1 37.0	48.7 37.0	49.4 37.0
			3.5	5.7	8.3		5.2	6.6	7.3	7.9	8.5	9.2	9.8	10.5	11.1	11.7	12.4
Doonside	MVA Rating MVA LAR	18.1 37.0	22.9 37.0	24.6 37.0	27.1 37.0	33.5 37.0	38.3 37.0	39.1 37.0	39.9 37.0	39.0 37.0	39.7 37.0	40.5 37.0	41.3 37.0	42.0 37.0	42.8 37.0	43.5 37.0	44.3 37.0
						1.3	2.1	2.9	2.0	2.7	3.5	4.3	5.0	5.8	6.5	7.3	
Greystanes	MVA Rating MVA LAR	25.4 27.0	26.9 27.0	27.3 27.0	29.2 27.0	27.7 27.0	30.7 27.0	30.8 27.0	31.2 27.0	31.5 27.0	31.8 27.0	32.1 27.0	32.4 27.0	32.7 27.0	33.0 27.0	33.3 27.0	33.6 27.0
				0.3	2.2	0.7	3.7	3.8	4.2	4.5	4.8	5.1	5.4	5.7	6.0	6.3	6.6
Holroyd	MVA Rating MVA LAR	29.6 37.0	29.6 37.0	30.8 37.0	32.4 37.0	26.8 37.0	28.7 37.0	29.1 37.0	29.9 37.0	31.0 37.0	32.4 37.0	34.1 37.0	35.9 37.0	37.3 37.0	38.4 37.0	39.2 37.0	39.6 37.0
													0.3	1.4	2.2	2.6	
Leabons Lane	MVA Rating MVA LAR	26.5 28.0	27.3 28.0	31.5 28.0	31.2 28.0	29.9 28.0	34.7 28.0	33.4 28.0	30.3 28.0	31.1 28.0	31.8 28.0	32.5 28.0	33.2 28.0	33.9 28.0	34.6 28.0	35.3 28.0	36.0 28.0
				3.5	3.2	1.9	6.7	5.4	2.3	3.1	3.8	4.5	5.2	5.9	6.6	7.3	8.0
Marayong	MVA Rating MVA LAR	47.8 50.0	49.6 50.0	47.5 50.0	48.9 50.0	47.9 50.0	48.8 50.0	51.0 50.0	51.2 50.0	46.9 50.0	47.1 50.0	47.3 50.0	47.5 50.0	47.7 50.0	47.9 50.0	48.1 50.0	48.3 50.0
								1.0	1.2								
Newton	MVA Rating MVA LAR	23.8 27.0	21.0 27.0	21.4 27.0	22.6 27.0	19.9 27.0	22.5 27.0	23.8 27.0	34.5 27.0	34.9 27.0	35.3 27.0	35.6 27.0	35.9 27.0	36.3 27.0	36.6 27.0	37.0 27.0	37.3 27.0
									7.5	7.9	8.3	8.6	8.9	9.3	9.6	10.0	10.3
Prospect	MVA Rating MVA LAR	25.1 32.0	26.9 32.0	27.3 32.0	31.0 32.0	29.1 32.0	32.7 32.0	31.0 32.0	31.8 32.0	32.5 32.0	33.2 32.0	33.9 32.0	34.6 32.0	35.3 32.0	36.0 32.0	36.6 32.0	37.3 32.0
							0.7			0.5	1.2	1.9	2.6	3.3	4.0	4.6	5.3
Prospect East	MVA Rating MVA LAR	11.8	10.9	11.1	11.2	11.8	10.9	11.7	12.2	12.3	12.5	12.5	12.7	12.7	12.9	12.9	12.9
Prospect South	MVA Rating MVA LAR	4.5	4.7	4.1	2.6	2.6	2.6	5.0	5.1	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8
Quarries	MVA Rating MVA LAR	4.3	4.7	4.0	4.1	3.6	3.8	11.8 35.0	17.5 35.0	18.6 35.0	21.8 35.0	26.2 35.0	30.2 35.0	31.5 35.0	31.6 35.0	31.7 35.0	31.8 35.0
Woodpark	MVA Rating MVA LAR	26.9 27.0	26.8 27.0	26.4 27.0	27.9 27.0												
					0.9												
Blacktown TS	MVA Rating MVA LAR	280.9 375.0	297.4 375.0	316.5 375.0	350.8 375.0	277.0 375.0	286.2 375.0	314.8 375.0	332.0 375.0	337.3 375.0	345.4 375.0	354.7 375.0	363.7 375.0	369.9 375.0	374.8 375.0	379.3 375.0	383.4 375.0
																4.3	8.4

Note: LAR denotes Load at Risk

14.1.9 Blacktown Transmission Substation Winter Demand Forecast

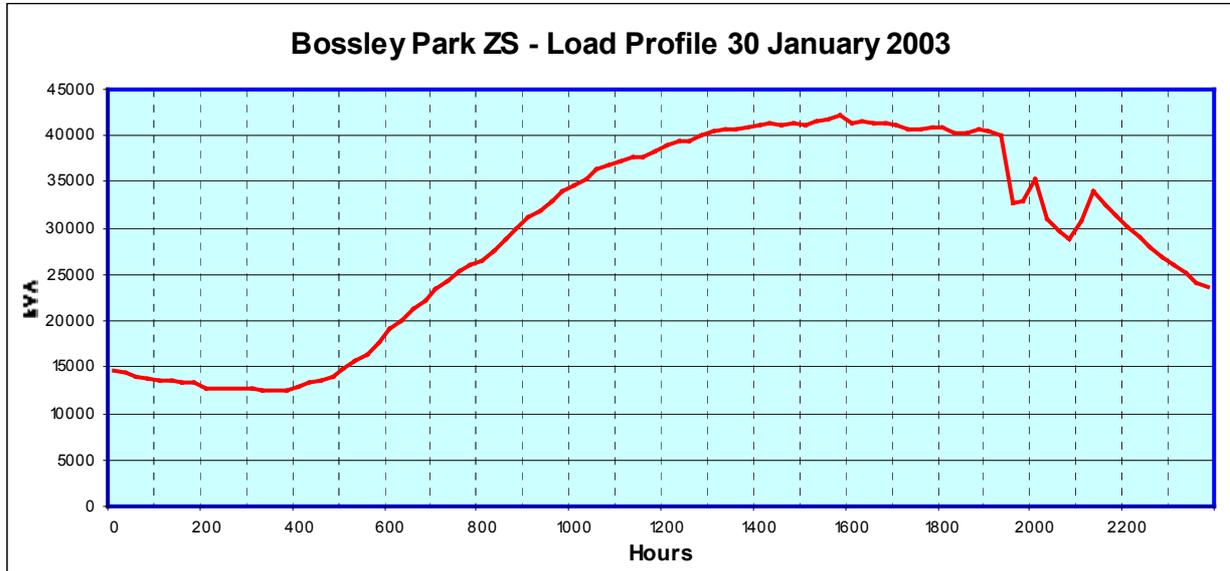
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Blacktown RIC	MVA Rating MVA LAR	13.2 37.0	11.0 37.0	11.3 37.0	12.6 37.0	11.1 37.0	12.1 37.0	13.3 37.0									
Bossley Park	MVA Rating MVA LAR	26.8 37.0	30.0 37.0	31.3 37.0	32.6 37.0	29.3 37.0	29.8 37.0	29.7 37.0	21.0 37.0	21.6 37.0	22.1 37.0	22.7 37.0	23.3 37.0	23.9 37.0	24.5 37.0	25.0 37.0	25.6 37.0
Doonside	MVA Rating MVA LAR	18.7 37.0	20.1 37.0	20.2 37.0	23.8 37.0	32.5 37.0	33.2 37.0	34.0 37.0	35.0 37.0	35.9 37.0	36.8 37.0	37.7 37.0	38.5 37.0	39.4 37.0	40.2 37.0	41.1 37.0	41.9 37.0
Greystanes	MVA Rating MVA LAR	24.0 27.0	25.6 27.0	25.1 27.0	25.8 27.0	26.4 27.0	26.4 27.0	26.6 27.0	26.9 27.0	27.2 27.0	26.5 27.0	25.8 27.0	26.1 27.0	26.4 27.0	26.6 27.0	26.9 27.0	27.2 27.0
Holroyd	MVA Rating MVA LAR	27.9 37.0	28.5 37.0	29.5 37.0	30.9 37.0	29.7 37.0	22.1 37.0	25.0 37.0	24.1 37.0	24.4 37.0	24.7 37.0	25.0 37.0	25.3 37.0	25.6 37.0	25.9 37.0	26.2 37.0	26.5 37.0
Leabons Lane	MVA Rating MVA LAR	22.7 28.0	25.0 28.0	24.3 28.0	26.1 28.0	26.7 28.0	26.6 28.0	27.4 28.0	27.0 28.0	27.8 28.0	28.5 28.0	29.2 28.0	29.9 28.0	30.6 28.0	31.3 28.0	32.0 28.0	32.7 28.0
Marayong	MVA Rating MVA LAR	39.7 50.0	43.9 50.0	44.2 50.0	45.0 50.0	43.5 50.0	43.4 50.0	47.8 50.0	46.6 50.0	47.0 50.0	47.4 50.0	47.8 50.0	48.2 50.0	48.6 50.0	49.0 50.0	49.4 50.0	49.8 50.0
Newton	MVA Rating MVA LAR	16.0 27.0	16.1 27.0	17.5 27.0	16.5 27.0	16.1 27.0	15.9 27.0	16.3 27.0	15.8 27.0	23.3 27.0	23.7 27.0	24.0 27.0	24.4 27.0	24.7 27.0	25.0 27.0	25.4 27.0	25.7 27.0
Prospect	MVA Rating MVA LAR	22.7 32.0	25.5 32.0	24.5 32.0	25.6 32.0	25.0 32.0	26.5 32.0	25.5 32.0	26.2 32.0	26.8 32.0	27.4 32.0	27.9 32.0	28.5 32.0	29.0 32.0	29.6 32.0	30.1 32.0	30.7 32.0
Prospect East	MVA Rating MVA LAR	7.0	9.3	8.3	8.4	7.0	9.5	11.7	12.3	12.3	12.5	12.5	12.7	12.7	12.9	12.9	12.9
Prospect South	MVA Rating MVA LAR	3.8	4.1	3.8	2.9	2.3	2.3	3.5	4.6	5.1	10.8	10.8	10.8	10.8	10.8	10.8	10.8
Quarries	MVA Rating MVA LAR	4.3	4.7	4.0	4.3	3.8	3.9	5.3 35.0	10.2 35.0	14.7 35.0	21.9 35.0	29.4 35.0	34.3 35.0	36.9 35.0	37.8 35.0	37.9 35.0	38.0 35.0
Woodpark	MVA Rating MVA LAR	24.9 27.0	25.3 27.0	25.8 27.0	24.7 27.0	23.4 27.0											
Blacktown TS	MVA Rating MVA LAR	234.0 375.0	261.3 375.0	240.2 375.0	258.8 375.0	245.2 375.0	247.3 375.0	250.6 375.0	238.1 375.0	253.2 375.0	267.1 375.0	276.0 375.0	283.9 375.0	289.8 375.0	294.4 375.0	298.3 375.0	302.1 375.0

Note: LAR denotes Load at Risk

14.1.10 Constrained Zone Substation Load Profiles, Information and Options

Bossley Park Zone Substation

Load Profile



Load Characteristics

Bossley Park ZS supplies part of Wetherill Park industrial area, the residential area of Bossley Park, Abbotsbury and Edensor Park and a commercial complex at Prairiewood. The load profile of this substation is summer peaking driven mainly by industrial load coinciding with the residential and commercial air conditioning loads. Bossley Park ZS has a firm rating of 35 MVA and a cyclic rating of 37 MVA. This substation is experiencing demand growth within the industrial sector and some re-development in the residential sector as well as growth in air conditioning.

Options

Network

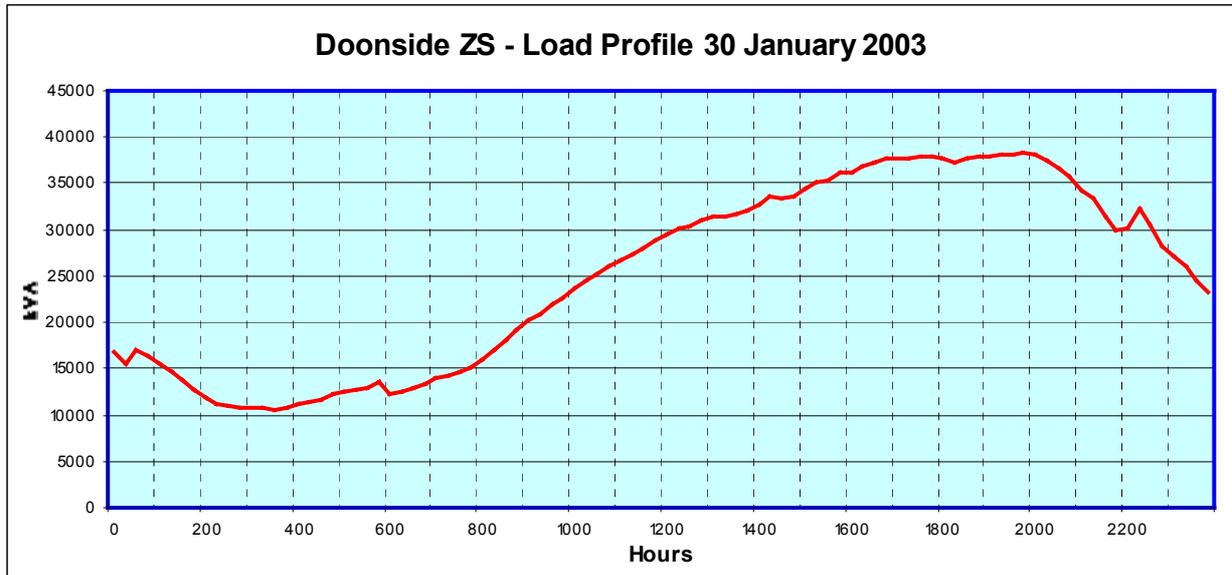
The construction of Wetherill Park West ZS will offload Bossley Park ZS in the short term. The current estimated construction date is 2005/06, (refer project item PR022). In the longer term, Abbotsbury ZS will be constructed to offload Bossley Park ZS and supply the ultimate expected peak load of this area. The current estimated construction date is 2008/09 (refer project items PR208)

Non-network

An RFP covering the Wetherill Park industrial area has been released to identify non-network opportunities. A non-network option would need to reduce the summer afternoon peak demand between the hours of 13:00 to 19:00 weekdays, created mainly by the industrial load coinciding with the residential and commercial air conditioning loads. The redevelopment of the residential area will also need to be addressed. The summer peak demand is 12 MVA higher than the winter peak demand. The growth rate is about 1 MVA per annum.

Doonside Zone Substation

Load Profile



Load Characteristics

Doonside ZS supplies the residential area of Doonside. The load profile of this substation is summer peaking driven mainly by the residential air conditioning load. Doonside ZS has a firm rating of 35 MVA and a cyclic rating of 37 MVA. This substation is experiencing demand growth within residential sector due to re-development and growth in air conditioning.

Options

Network

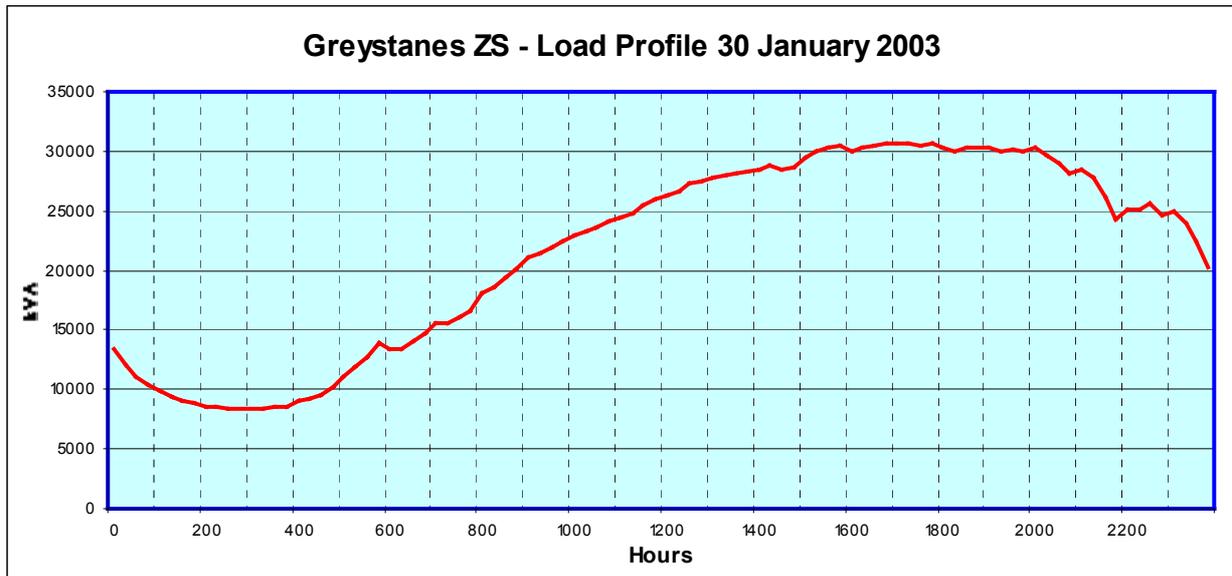
The augmentation of Doonside ZS will provide sufficient network capacity to cater for the areas long-term requirements. This project will increase the network capacity but is also required to replace assets that have reached the end of their serviceable life. The current estimated construction date is 2009/10 (refer project item PR090)

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 15:00 to 20:00 weekdays, created by the residential air conditioning load. The redevelopment of the residential area is the main driver for growth in electrical demand. The summer peak demand is 4 MVA higher than the winter peak demand. The growth rate is about 0.7 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Greystanes Zone Substation

Load Profile



Load Characteristics

Greystanes ZS supplies the residential area of Greystanes and a small commercial centre. The load profile of this substation is summer peaking driven mainly by the residential air conditioning load. Greystanes ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing demand growth within residential sector due to re-development and growth in air conditioning.

Options

Network

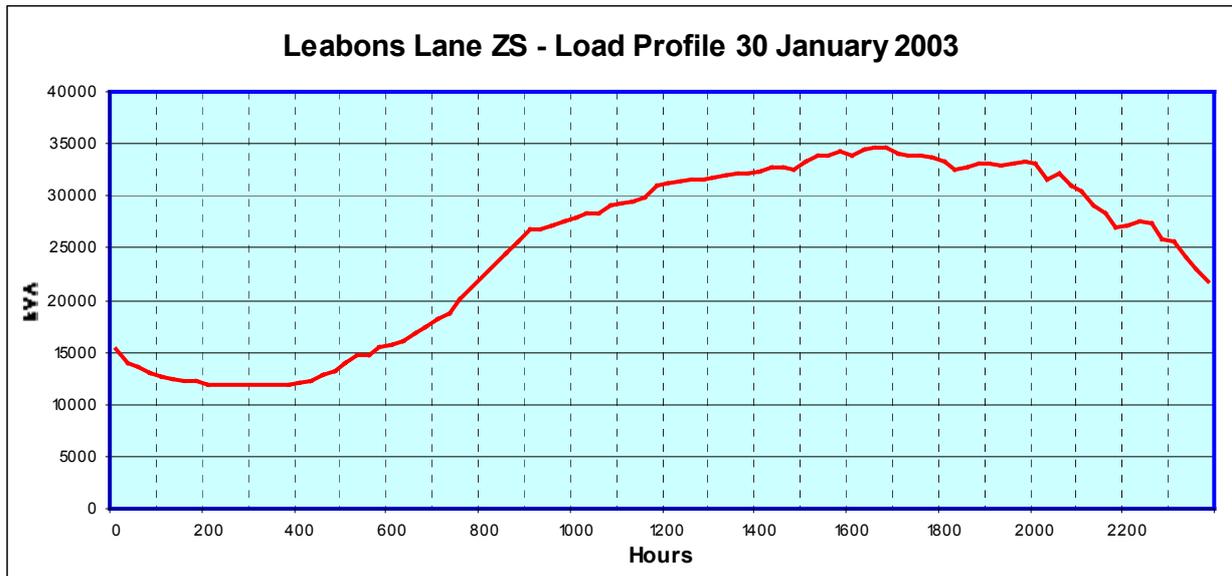
The augmentation of Greystanes ZS will provide sufficient network capacity to cater for the areas long-term requirements. The current estimated construction date is 2005/06 (refer project items PR082). Greystanes ZS may initially supply the Quarries residential development site. The existing Quarries ZS will need to be re-built to supply the long term demand of this development (refer project item PR069).

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 15:00 to 20:00 weekdays, created by the residential air conditioning load. The redevelopment of the residential area is the main driver for growth in electrical demand. The summer peak demand is 3.5 MVA higher than the winter peak demand. The growth rate is about 0.3 MVA per annum.

Leabons Lane Zone Substation

Load Profile



Load Characteristics

Leabons Lane ZS supplies the residential area of Blacktown and part of the Blacktown commercial centre. The load profile of this substation is summer peaking driven mainly by the commercial load coinciding with residential air conditioning load. Leabons Lane ZS has a firm rating of 25 MVA and a cyclic rating of 28 MVA. This substation is experiencing demand growth within residential sector due to re-development and growth in air conditioning and moderate growth in the commercial sector.

Options

Network

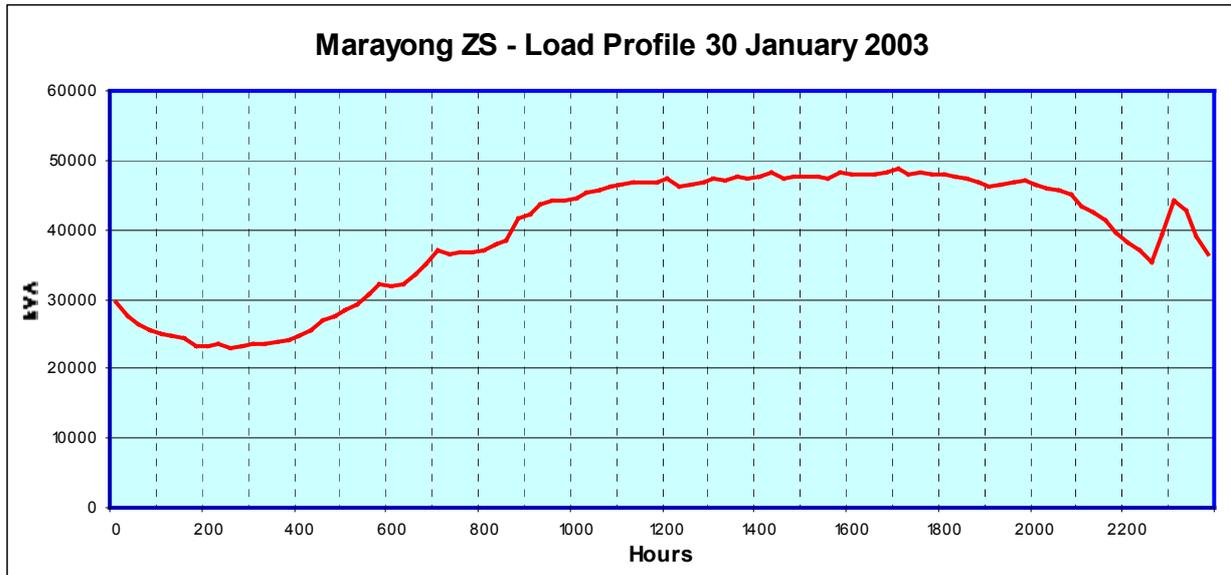
The augmentation of Leabons Lane ZS will provide sufficient network capacity to cater for the areas long-term requirements. The current estimated construction date is 2008/09, however the system requirement date is 2005/06 (refer project items PR043). A demand management project is being prepared to achieve the three year deferral.

Non-network

An RFP was issued on 26 May 2003 to identify possible DM initiatives to reduce peak demand on Leabons Lane ZS. Submissions were received and analysed. Integral is in the process of negotiations to implement a demand management program to defer the augmentation of Leabons Lane ZS from 2006/06 to 2008/09.

Marayong Zone Substation

Load Profile



Load Characteristics

Marayong ZS supplies the residential area of Blacktown, Lalor Park and Kings Park and the Blacktown industrial area. The load profile of this substation is summer peaking driven mainly by the industrial load coinciding with residential air conditioning load. Marayong ZS has a firm rating of 50 MVA and a cyclic rating of 50 MVA. This substation is experiencing demand growth within the industrial area. There is also some re-development within the residential area as well as growth in air conditioning load.

Options

Network

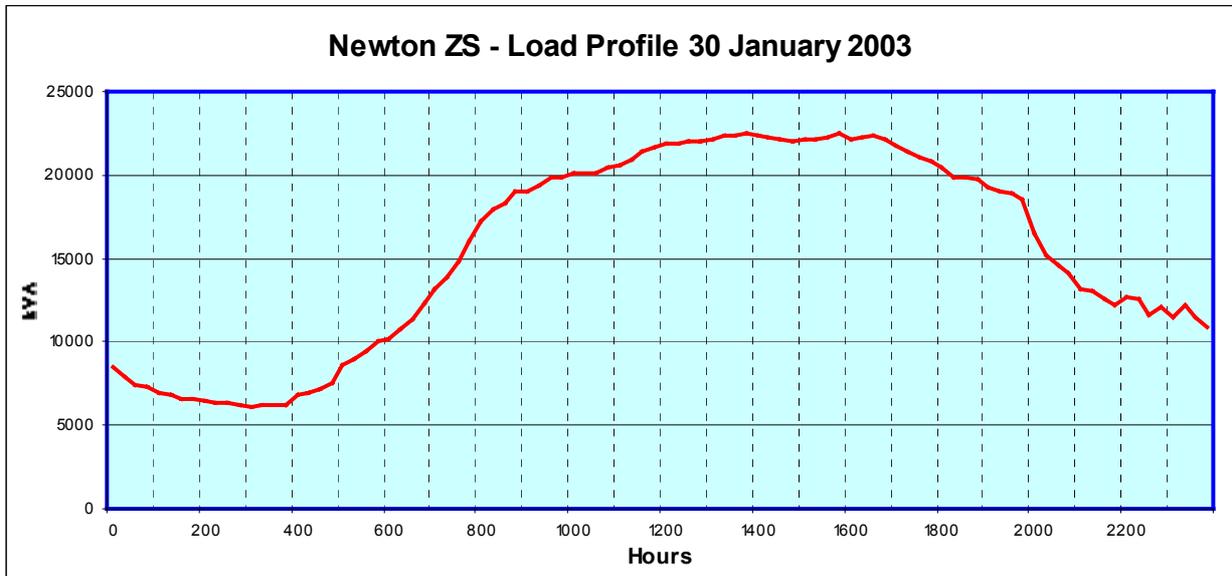
Investigations are currently being conducted into the most cost effective network option. One proposal is to establish a new zone substation to supply the industrial area and the high density residential redevelopment. Additional feeder capacity will be provided in the short term (refer project items PR046). For the longer term a new zone substation will be required in the north Blacktown area (refer project items PR317).

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 12:00 to 20:00 weekdays, created by the industrial load coinciding with the residential peak demand. The summer peak demand is 4 MVA higher than the winter peak demand. The growth rate is about 0.25 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Newton Zone Substation

Load Profile



Load Characteristics

Newton ZS supplies the majority of the Blacktown CBD and the surrounding high/medium/low density residential area of Blacktown. The load profile of this substation is summer peaking driven mainly by the commercial load coinciding with residential air conditioning load. Newton ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing demand growth within commercial sector, primarily from the expansion of Westpoint shopping complex. The residential sector is also growing due to re-development and growth in air conditioning.

Options

Network

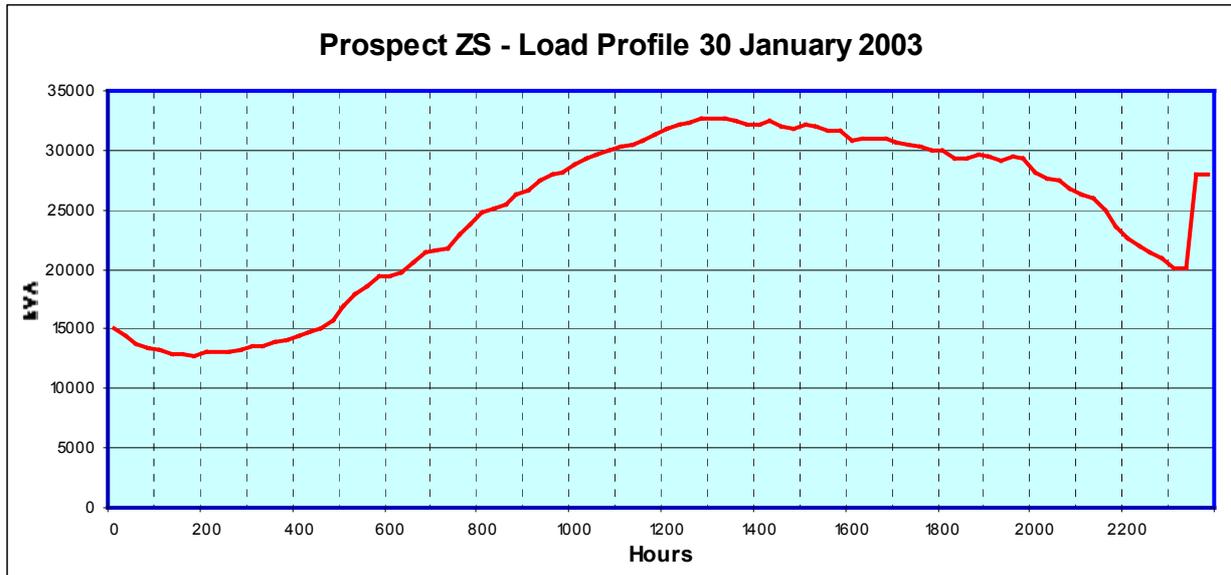
The augmentation of Newton ZS will provide sufficient network capacity to cater for the areas long-term requirements. The current estimated construction date is 2004/05 & 2005/06, (refer project items PR047 & PR133). A demand management investigation was conducted for the Blacktown CBD. Results indicate that a DM program would not defer the need to augment Newton as this is driven by the expansion of Westpoint Shopping complex but will assist in deferring the augmentation of Leabons Lane ZS.

Non-network

A non-network option would not defer the need to augment Newton ZS as additional feeder capacity is required to supply the commercial developments.

Prospect Zone Substation

Load Profile



Load Characteristics

Prospect ZS supplies the residential areas of Prospect and Girraween as well as the Girraween industrial area. The load profile of this substation is summer peaking driven mainly by the industrial load coinciding with residential air conditioning load. Prospect ZS has a firm rating of 30 MVA and a cyclic rating of 32 MVA. This substation is experiencing slow demand growth within residential sector due to re-development and growth in air conditioning and moderate growth in the industrial sector.

Options

Network

There is no identified network option to overcome this constraint. Investigations are currently being conducted to identify the most cost-effective network option.

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 12:00 to 17:00 weekdays, created by the industrial load coinciding with the residential peak demand. The summer peak demand is 4 MVA higher than the winter peak demand. The growth rate is about 0.7 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Mt Druitt Transmission Substation

14.1.11 Mt Druitt Transmission Substation Status

Mt Druitt TS has 2 x 120 MVA 132/33 kV transformers with provision for additional two transformers. The substation firm cyclic rating is limited by the transformer 33 kV circuit breakers and isolators (rated at 2400 A) to 137 MVA. However, the transmission substation firm capacity is further limited by the 33 kV transformer cable (single point re-bonded) connections to only 2117 A or 121 MVA continuous. A 2-hour emergency cable rating of 157 MVA has been assigned. However, the Horsley Park "Load Shedding Scheme" to Guildford TS will not allow a load on either transformer beyond 121 MVA.

Mt Druitt TS was reconfigured in November 2000 to be exclusively supplied from Regentville BSP via Penrith TS. This is in line with TransGrid's strategy to reduce demand on Sydney West BSP. This also limits the Mt Druitt TS firm rating to 121 MVA, being the rating of the Penrith feeders.

A 132/11 kV ZS is proposed for the Erskine Park Industrial estate, to be known as Mamre ZS. This will offload the constrained St Marys/Erskine Park 33 kV subtransmission network. An interim project has been deployed to transfer the Erskine Park Tee off the St Marys network and onto the Horsley Park network. This will diversify the load at risk whilst the property and easement issues for the Mamre ZS project are resolved.

An application has been received for a generation facility at Eastern Creek, which will use methane from the landfill site, possibly complemented by natural gas as its fuel. The generation station will be phased in over a period to provide between 4 MW to 10 MW. This will provide relief to the Horsley Park ZS subtransmission pending the transfer of Horsley Park ZS to Wetherill Park West TS.

14.1.12 Mt Druitt Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Mt Druitt TS	2 x 120	240	130
Erskine Park	1 x 12/15	15	15
Horsley Park	2 x 15/17.5/25	50	27
Plumpton	2 x 15/19/25	50	27
St Marys	2 x 15/25 + 1 x 15/19	69	48
Simsmetal	1 x 10	10	10
Werrington	3 x 15	45	33
Whalan	2 x 15/19/25	50	27

14.1.13 Mt Druitt Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Erskine Park	MVA	14.2	14.5	15.4	15.1	15.5	19.0	19.0									
	Rating MVA LAR	15.0	15.0	15.0	15.0	15.0	15.0	15.0									
Horsley Park	MVA	18.5	18.2	21.4	23.8	23.9	26.9	27.1	28.4	29.7	31.0	32.4	33.7	35.0	36.4	37.7	39.0
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Plumpton	MVA	26.6	25.9	27.0	28.4	28.5	37.4	33.3	34.0	33.1	33.7	34.3	34.9	35.4	36.0	36.6	37.2
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Simsmetal	MVA	6.0	5.6	7.7	4.6	5.0	5.2	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
St Marys	MVA	30.6	30.5	32.7	37.5	34.4	41.1	40.0	31.1	32.4	33.8	34.8	35.6	36.5	37.4	38.2	39.1
	Rating MVA LAR	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0
Werrington	MVA	22.9	23.9	23.4	25.4	26.6	28.2	29.0	30.2	32.6	35.5	37.5	38.6	39.3	40.0	40.8	41.5
	Rating MVA LAR	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Whalan	MVA	22.9	23.6	23.9	26.1	24.4	28.8	27.3	28.2	28.9	29.4	29.9	30.4	30.8	31.3	31.8	32.3
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Eastern Creek	MVA							-1.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
No generation With generation Mt Druitt TS	MVA	130.2	124.0	135.6	137.9	143.2	196.8	184.8	157.3	163.7	170.4	175.9	180.4	184.4	188.5	192.5	196.6
	Rating MVA LAR	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
								53.8	19.3	25.7	32.5	38.0	42.4	46.5	50.5	54.6	58.6

14.1.14 Mt Druitt Transmission Substation Winter Demand Forecast

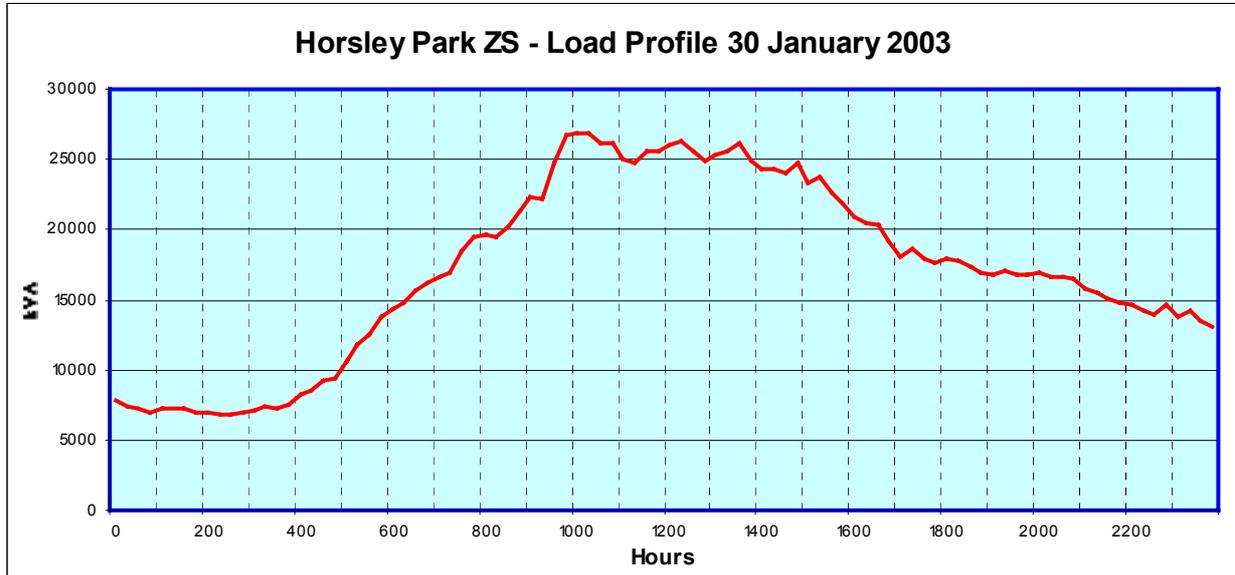
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Erskine Park	MVA	12.1	11.8	11.3	12.6	12.7	13.4	13.7	13.9								
	Rating MVA LAR	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0								
Horsley Park	MVA	17.9	17.0	18.5	20.7	21.6	22.7	22.4	21.5	14.6	15.3	16.1	16.9	17.6	18.4	19.2	20.0
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Plumpton	MVA	28.6	26.6	26.8	27.2	29.0	33.1	33.8	33.5	34.1	34.6	35.1	35.4	35.8	36.2	36.6	37.0
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Simsmetal	MVA	5.8	5.7	4.5	4.8	5.0	5.0	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
St Marys	MVA	25.4	30.4	34.4	33.9	31.6	33.5	33.7	33.4	24.3	25.0	25.7	26.3	27.0	27.7	28.4	29.1
	Rating MVA LAR	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0
Werrington	MVA	21.9	22.0	23.1	26.5	24.7	25.3	27.9	25.1	25.8	27.2	29.2	30.6	31.4	31.7	32.0	32.4
	Rating MVA LAR	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
Whalan	MVA	20.7	19.8	20.2	20.1	20.6	23.1	24.0	23.8	24.4	24.7	25.0	25.2	25.5	25.7	26.0	26.2
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Eastern Creek	MVA							-1.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
No generation With generation Mt Druitt TS	MVA	113.4	120.6	118.5	118.5	132.2	128.9	136.6	133.3	109.7	112.9	116.3	119.2	121.5	123.6	125.6	127.6
	Rating MVA LAR	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
								5.6									

Note: LAR denotes Load at Risk

14.1.15 Constrained Zone Substation Load Profiles, Information and Options

Horsley Park Zone Substation

Load Profile



Load Characteristics

Horsley Park ZS supplies the residential/rural areas of Horsley Park and Mt Vernon as well as part of the Wetherill Park industrial area. The load profile of this substation is summer peaking driven mainly by the industrial load coinciding with residential air conditioning load. Horsley Park ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing demand growth mainly from the industrial sector.

Options

Network

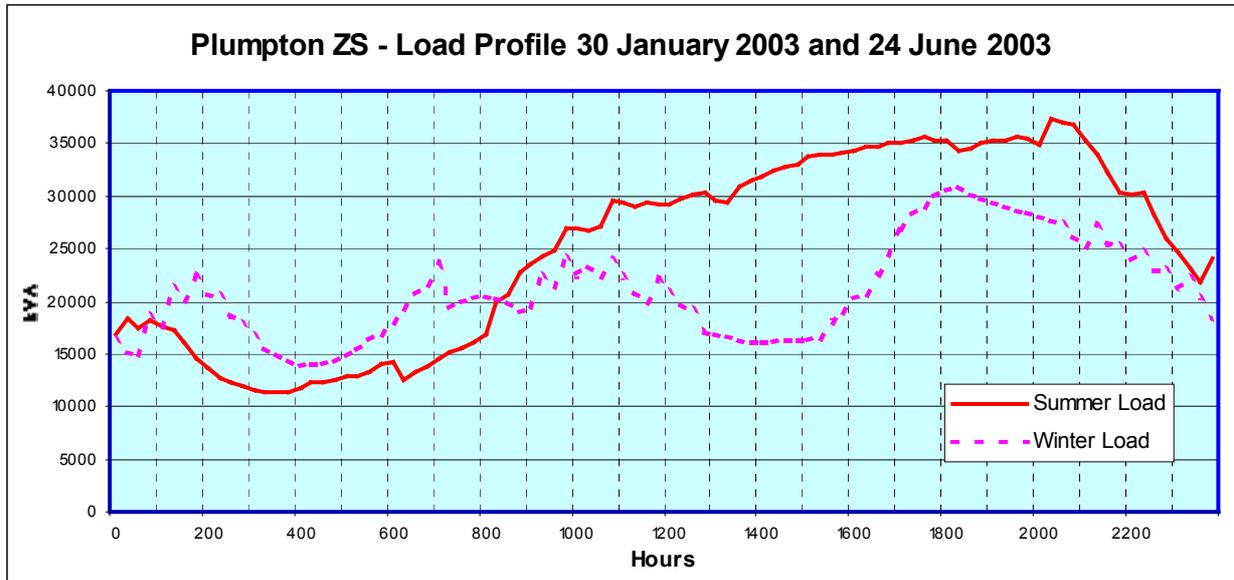
The construction of Wetherill Park West ZS will allow the industrial load to be transferred away from Horsley Park ZS. The current estimated construction date is 2005/06 (refer project item PR022).

Non-network

An RFP covering the Wetherill Park industrial area has been released to identify non-network opportunities. A non-network option would need to reduce the summer afternoon peak demand between the hours of 10:00 to 16:00 weekdays, created mainly by the industrial load coinciding with the residential air conditioning loads. The summer peak demand is 5 MVA higher than the winter peak demand. The growth rate is about 1 MVA per annum.

Plumpton Zone Substation

Load Profile



Load Characteristics

Plumpton ZS supplies the residential areas of Plumpton, Tregear, Willmot, Bidwill and all suburbs in between. The load profile of this substation is summer peaking driven mainly by the industrial load coinciding with residential air conditioning load. Plumpton ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing demand growth due to residential development and re-development.

Options

Network

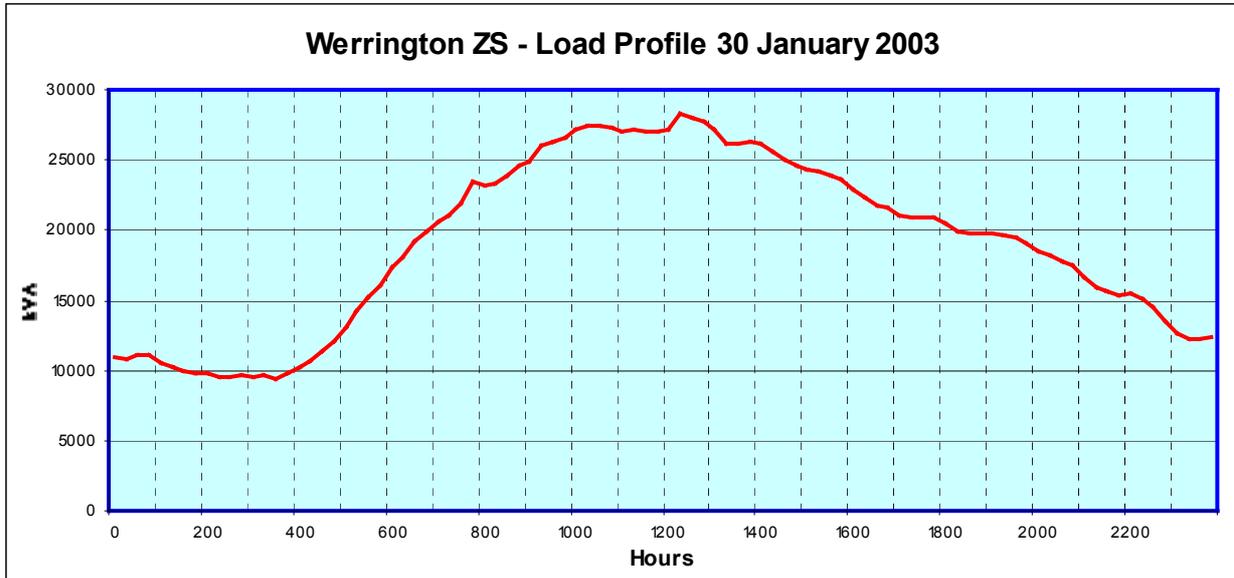
The augmentation of Plumpton ZS will provide additional network capacity to supply the areas future needs. The current estimated construction date is 2006/07 (refer project item PR189).

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 14:00 to 20:00 weekdays, created mainly by the residential air conditioning loads. The summer peak demand is only slightly higher than the winter peak demand but has been growing at a faster rate. The summer growth rate is about 0.6 MVA per annum.

Werrington Zone Substation

Load Profile



Load Characteristics

Werrington ZS supplies the residential areas of Werrington and St Marys North and the industrial areas of Dunheved and St Marys. The load profile of this substation is summer peaking driven mainly by the industrial load coinciding with residential air conditioning load. Werrington ZS has a firm rating of 30 MVA and a cyclic rating of 33 MVA. This substation is experiencing demand growth due to industrial activity and residential re-development. The proposed ADI redevelopment will initially be supplied from Werrington ZS.

Options

Network

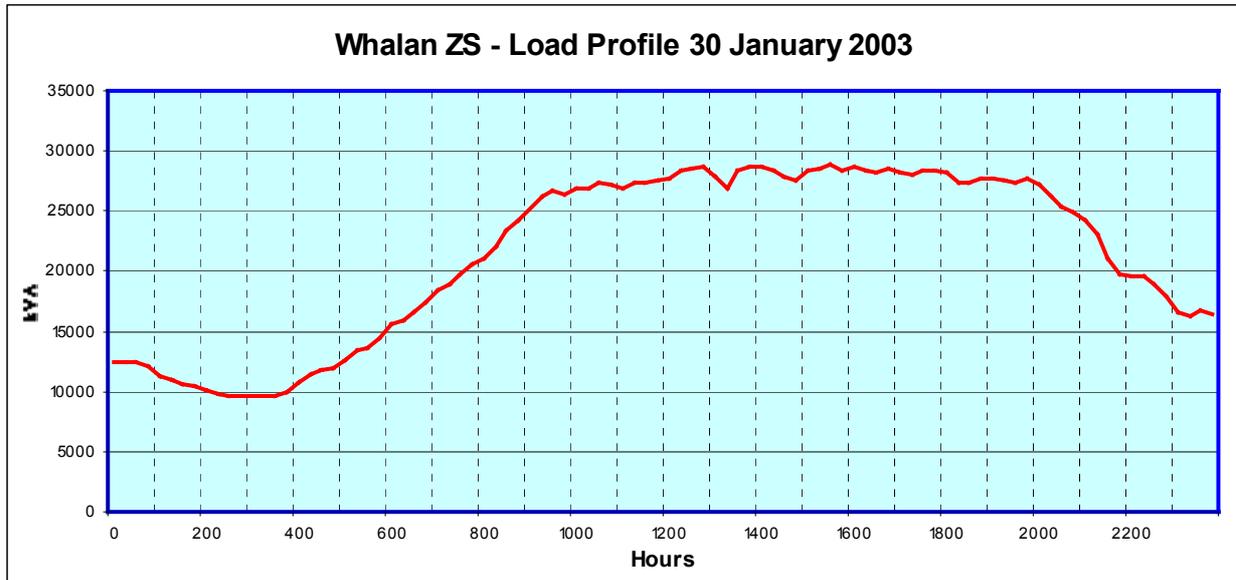
The augmentation of Werrington ZS is required as part of the end-of-life replacement strategy. Additional network capacity will be provided as part of the project. The current estimated construction date is 2004/05 (refer project item PR017). A new zone substation site will be required to supply to eastern precinct of the ADI development site (refer project item PR067).

Non-network

A non-network option would not defer the need to augment Werrington ZS as the assets have reached the end of their serviceable life.

Whalan Zone Substation

Load Profile



Load Characteristics

Whalan ZS supplies the residential areas of Whalan, Tregear and Lethbridge Park as well as the commercial centre at Mt Druitt. The load profile of this substation is summer peaking driven mainly by the commercial load coinciding with residential air conditioning load. Whalan ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing slow demand growth within residential sector due to re-development and growth in air conditioning.

Options

Network

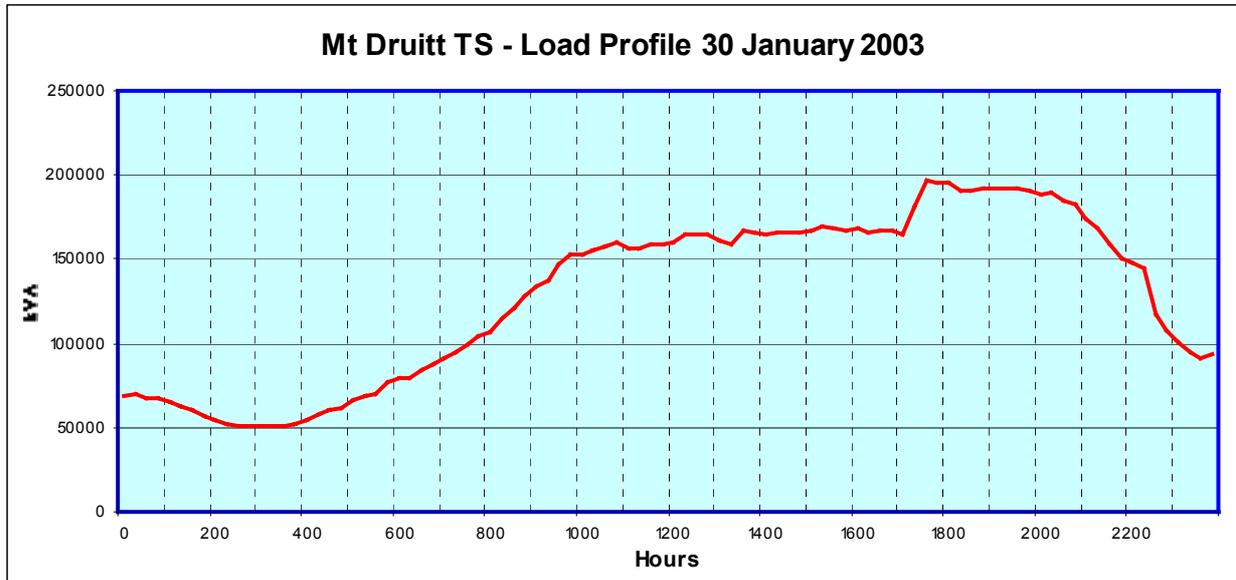
There is no identified network option to overcome this constraint. Investigations are currently being conducted to identify the most cost-effective network option.

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 12:00 to 19:00 weekdays, created by the commercial load coinciding with the residential peak demand. The summer peak demand is 4 MVA higher than the winter peak demand. The growth rate is about 0.5 MVA per annum.

Mt Druitt Transmission Substation

Load Profile



Load Characteristics

Mt Druitt TS supplies predominantly a residential load type from Horsley Park in the south to Werrington and Plumpton in the north. There are some commercial and industrial load types within this area. The load profile of this substation is summer peaking driven mainly by coincident residential air conditioning loads and other commercial and industrial loads. Mt Druitt TS has a firm rating of 120 MVA and a cyclic rating of 130 MVA. This substation is experiencing demand growth mainly in the residential sector.

Options

Network

The augmentation of Mt Druitt TS will provide additional capacity to supply the growth in demand of the area. The current estimated construction date is 2004/05 (refer project items PR018). This project is partly driven by reliability issues at the substation.

Non-network

A non-network option would need to reduce the hot summer day peak demands created mainly by the coincident commercial and residential loads. The summer peak demand is 25 MVA higher than the winter peak demand. The growth rate is about 5 MVA per annum. A non-network option would not address the reliability issue of the substation.

Sydney North Bulk Supply Point

14.1.16 Sydney North Bulk Supply Point Status

Sydney North BSP is owned by TransGrid and has 4 x 375 MVA 330/138.6 kV transformers. Integral Energy has an allocation of 40 MVA from Sydney North BSP.

To meet the needs of the area, the need to augment 132 kV feeders 9JA and 230 and Riverstone and Kellyville ZS's to 132/11 kV ZS's and establish Box Hill, Glenhaven, Mungerie Park, Norwest, North Castle Hill and Schofields ZS's and Rouse Hill SS has been identified. Also, the establishment of a second 132 kV feeder from Sydney North BSP to Kenthurst ZS may be needed, which may allow for a future ring feeder via Glenorie ZS. An RFP is planned for the "North West Sector" to identify possible demand management alternatives. Integral Energy will also encourage Planning NSW and local councils to incorporate energy efficiency and demand management aspects into the development approval process and DCP's.

It is proposed that in the future, Kellyville ZS would be supplied via a 132 kV network from Vineyard BSP. When Kellyville ZS is augmented to 132 kV, it is proposed that 33 kV feeder 476 (Kenthurst ZS to Kellyville ZS) may be rebuilt at 132 kV construction. This may provide for a cross BSP tie between Sydney North BSP and Vineyard BSP.

14.1.17 Sydney North Bulk Supply Point Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Sydney North BSP	Transgrid		
Energy Australia	Unknown		
Kellyville	2 x 15/19/25 (33/11 kV) + 2 x 12 (11/22 kV)	74	27
Kenthurst	1 x 30 (129/33 kV) + 1 x 10/19/25 (33/11 kV) + 1 x 15/18/25 (66/11 kV)	80	27

14.1.18 Sydney North Bulk Supply Point Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Kellyville	MVA	18.2	19.7	27.0	26.6	24.8	31.1	32.0	33.1	33.7	34.3	34.9	35.5	36.1	36.7	37.3	37.9
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
							4.1	5.0	6.1	6.7	7.3	7.9	8.5	9.1	9.7	10.3	10.9
Kenthurst	MVA	18.3	18.2	18.8	21.5	19.3	26.4	25.3	25.9	26.5	27.2	27.8	28.5	29.1	29.8	30.4	31.0
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
										0.2	0.8	1.5	2.1	2.8	3.4	4.0	
Sydney North TS	MVA	36.2	39.0	46.3	48.5	44.4	51.1	50.7	52.2	53.3	54.4	55.5	56.6	57.7	58.8	60.0	61.1
	Rating MVA LAR	TransGrid Substation															

14.1.19 Sydney North Bulk Supply Point Winter Demand Forecast

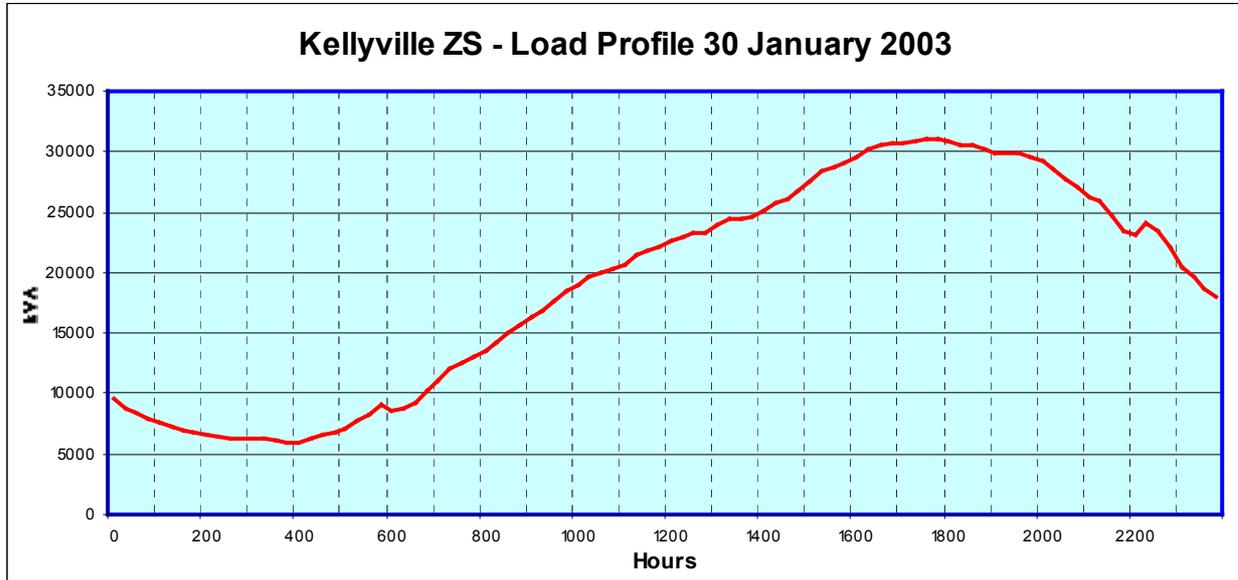
Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Kellyville	MVA	22.8	16.4	22.3	27.1	19.8	21.8	23.9	26.2	27.4	27.9	28.5	29.0	29.6	30.1	30.6	31.2
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
					0.1					0.4	0.9	1.5	2.0	2.6	3.1	3.6	4.2
Kenthurst	MVA	17.2	20.0	19.1	20.7	21.1	22.3	22.6	21.8	22.3	22.8	23.3	23.8	24.3	24.8	25.3	25.8
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Sydney North TS	MVA	40.7	36.9	42.5	48.5	39.4	42.7	44.9	46.1	47.6	48.6	49.7	50.7	51.7	52.7	53.7	54.7
	Rating MVA LAR	TransGrid Substation															

Note: LAR denotes Load at Risk

14.1.20 Constrained Zone Substation Load Profiles, Information and Options

Kellyville Zone Substation

Load Profile



Load Characteristics

Kellyville ZS supplies the expanding residential areas of Kellyville and Kellyville Ridge. The load profile of this substation is summer peaking driven mainly by the residential air conditioning load. Kellyville ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing demand growth within residential sector due to new release areas and growth in air conditioning.

Options

Network

The augmentation of Kellyville ZS will provide additional capacity to supply the growth in demand of the area. The current estimated construction date is 2011/12 (refer project items PR181). This project will also allow the development of a 132kV network as part of the north west sector network strategy.

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 15:00 to 20:00 weekdays, created by residential peak demand. The new residential release areas will also need to be addressed. The summer peak demand is 6 MVA higher than the winter peak demand. The growth rate is about 0.6 MVA per annum.

Sydney West Bulk Supply Point

14.1.21 Sydney West Bulk Supply Point Status

Sydney West BSP is owned by TransGrid and has 4 x 375 MVA 330/132 kV transformers. Integral Energy is supplied at 132 kV from Sydney West BSP. According to TransGrid's NSW Annual Planning Report 2002, it has stated that prior to summer 2000/01 Sydney West BSP was loaded close to its full capacity. Based on a conservative demand forecast, the thermal capacity of Sydney West substation is expected to be exceeded during summer 2002/03. It is expected that a fifth transformer will be commissioned by late 2002 to secure supply of Sydney West BSP. However, this only provides for a renewal program to replace the four existing transformers. A long term solution is being examined by TransGrid with a likely solution being the establishment of another new BSP at Holroyd.

TransGrid is reviewing plans to build a new BSP at Holroyd on an existing site near Guildford TS. The establishment of Holroyd BSP would cater for future major load centres in Parramatta and also provides a staging point for 330 kV cables to the inner west of Sydney. Initially, a 132 kV busbar is expected to be established at Holroyd. This busbar could become the first stage of a future Holroyd 330/132 kV substation. Its establishment would also enable the line and cable connections at Guildford TS to be revised which would permit some, if not all, of the existing 132 kV operating restrictions of the Guildford TS system to be removed. Supply to the Parramatta CBD area would progressively be transferred away from Guildford TS and onto the Holroyd 132 kV busbar.

In the long term, the establishment of Holroyd BSP will offload Sydney West BSP. This will allow the transfer of Mt Druitt TS back to Sydney West BSP and off the Regentville system. The Regentville BSP substation will reach firm capacity at the end of the forecast period, as will feeders 222 and 238 from Regentville to Penrith TS. Additionally, it will offload feeders 932/1 and 939/1 from Penrith TS to Mt Druitt TS, which are presently above firm rating.

Integral Energy is also looking at adopting plans to build a new TS and ZS at Wetherill Park West. This option would allow relief to a number of other TS's presently supplied from Sydney West BSP such as Blacktown TS and Guildford TS. It would also allow relief to a number of zone substations that are approaching or have exceeded their firm capacity. The combined establishment of Wetherill Park TS and Holroyd BSP would allow the upgrading of protection arrangements and future installation of a 132 kV busbar at the existing Wetherill Park ZS, without major works being required at Guildford TS.

Integral Energy has begun a program of installing 11 kV capacitor banks at various zone substations, including a substantial number which are supplied from the Sydney West BSP system. It is expected by summer 2004/05, with the completion of this work, a power factor of 0.95 will be returned to the 132 kV busbar at Sydney West BSP, as required by the National Electricity Code.

14.1.22 Sydney West Bulk Supply Point Rating Details

Transmission or Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Sydney West BSP	Transgrid		
Arndell Park **	2 x 33/39/45	90	45
BHP Mini Mill (One Steel)	Customer	135	
Bringelly **	1 x 15/19 + 1 x 15/18/25	44	20
Mamre **	future		
North Parramatta **	2 x 45/55	110	55
Quakers Hill **	2 x 15/19/25	50	27
Rooty Hill **	2 x 33/45	90	45
West Castle Hill **	2 x 35/44/52/65	130	65
Wetherill Park **	2 x 33/35/45	90	40

Note: Substations designated ** are grouped in the Forecast Section as Sydney West 132 kV as they are supplied directly off the Sydney West 132 kV busbar without an intermediate subtransmission busbar. The remaining locations are TS with their individual subtransmission networks to each ZS.

Mt Druitt TS has been transferred to Regentville BSP.

Nepean TS load is shared between Sydney West and Liverpool BSP's (Refer West Liverpool section of report).

West Liverpool is not normally supplied from Sydney West BSP, but can be backed up from or supply backup to Sydney West BSP (Refer West Liverpool section of report).

14.1.23 Sydney West 132 kV Substations Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Arndell Park	MVA	26.8	29.7	35.1	40.5	40.2	42.1	40.1	42.2	44.2	46.4	48.3	50.1	52.0	53.8	55.6	57.4
	Rating	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	MVA LAR				0.5	0.2	2.1	0.1	2.2	4.2	6.4	8.3	10.1	12.0	13.8	15.6	17.4
BHP Mini Mill (OneSteel Mill)	MVA	66.1	69.5	73.9	76.6	71.8	70.5	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8	75.8
	Rating																
	MVA LAR																
Bringelly	MVA	10.6	11.0	12.2	12.0	12.5	14.0	14.1	14.4	14.7	15.0	15.3	15.6	15.9	16.2	16.6	16.9
	Rating	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	MVA LAR																
Mamre	MVA								30.4	31.4	33.5	36.2	39.0	41.5	43.2	44.3	45.0
	Rating								45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	MVA LAR																
North Parramatta	MVA	31.6	32.7	34.7	35.9	36.0	41.0	41.5	42.4	40.5	41.2	41.8	42.5	43.1	43.7	44.4	45.0
	Rating	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
	MVA LAR																
Quakers Hill	MVA	29.3	31.9	32.3	37.9	32.9	41.0	39.1	40.3	41.4	42.6	43.7	44.6	45.5	46.4	47.3	48.2
	Rating	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
	MVA LAR	2.3	4.9	5.3	10.9	5.9	14.0	12.1	13.3	14.4	15.6	16.7	17.6	18.5	19.4	20.3	21.2
Rooty Hill	MVA	35.1	38.7	44.6	45.2	35.6	42.9	42.4	43.0	43.6	44.2	44.7	45.3	45.9	46.5	47.1	47.6
	Rating	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	MVA LAR				0.2								0.3	0.9	1.5	2.1	2.6
West Castle Hill	MVA		46.1	43.5	45.4	55.5	62.5	67.5	70.1	55.3	56.3						
	Rating		65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0						
	MVA LAR							2.5	5.1								
Wetherill Park East	MVA	38.2	40.1	41.3	41.6	41.9	43.6	45.2	48.5	49.3	50.1	50.9	51.8	52.6	53.4	54.2	55.0
	Rating	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	MVA LAR		0.1	1.3	1.6	1.9	3.6	5.2	8.5	9.3	10.1	10.9	11.8	12.6	13.4	14.2	15.0
Wetherill Park West	MVA																
	Rating																
	MVA LAR																
Sydney West 132kV	MVA	237.7	299.8	317.5	335.1	326.4	357.7	365.7	407.0	396.2	405.1	356.8	364.7	372.2	379.0	385.2	390.9
	Rating	TransGrid Substation															
	MVA LAR																

Note: LAR denotes Load at Risk

14.1.24 Sydney West 132 kV Substations Winter Demand Forecast

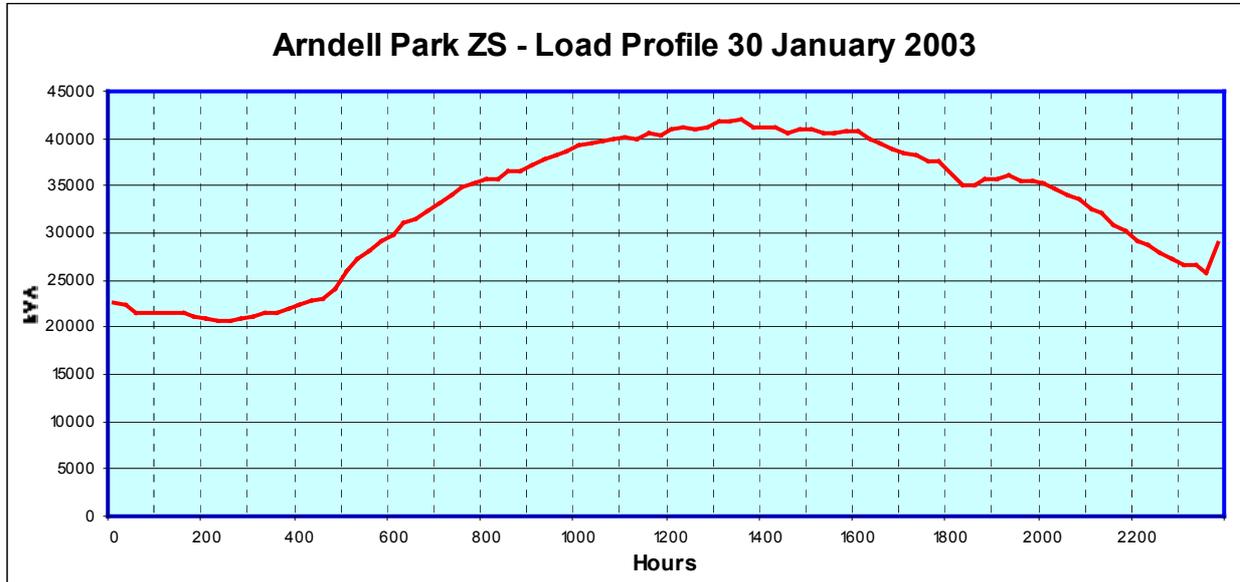
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Arndell Park	MVA	23.6	24.2	27.3	30.8	32.0	36.6	36.6	38.7	40.2	41.5	42.7	44.0	45.3	46.5	47.8	49.0
	Rating MVA LAR	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
BHP Mini Mill (OneSteel Mill)	MVA	68.2	67.6	74.3	72.5	74.4	72.2	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
	Rating MVA LAR																
Bringelly	MVA	9.4	10.5	10.1	10.9	10.7	12.6	13.1	13.3	13.6	13.9	14.2	14.5	14.8	15.1	15.3	15.6
	Rating MVA LAR	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Mamre	MVA									30.4	31.9	34.0	36.7	39.5	42.0	43.7	44.8
	Rating MVA LAR								45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
North Parramatta	MVA	31.1	28.1	29.2	30.8	31.6	32.9	36.5	34.8	35.8	36.6	37.3	38.0	38.7	39.4	40.0	40.7
	Rating MVA LAR	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
Quakers Hill	MVA	27.8	30.9	31.7	34.2	31.9	34.3	34.3	34.5	35.5	36.4	37.1	37.9	38.7	39.5	40.3	41.1
	Rating MVA LAR	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Rooty Hill	MVA	31.5	36.1	37.8	39.2	35.6	35.3	34.2	35.2	36.1	37.0	38.0	38.9	39.9	40.8	41.7	42.7
	Rating MVA LAR	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
West Castle Hill	MVA			34.5	35.5	39.2	53.4	54.6	53.2	54.6	55.8						
	Rating MVA LAR			65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0						
Wetherill Park East	MVA	35.1	37.4	38.9	40.0	39.2	39.6	41.5	42.5	36.5	37.5	38.5	39.5	40.5	41.4	42.4	43.4
	Rating MVA LAR	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
Wetherill Park West	MVA								10.0	26.0	27.0	28.0	29.0	30.0	31.0	32.0	33.0
	Rating MVA LAR								45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Sydney West 132kV	MVA	225.1	233.3	282.3	292.8	293.6	315.1	265.4	277.2	318.0	325.5	333.3	341.5	349.8	357.8	365.2	372.0
	Rating MVA LAR		TransGrid Substation														

Note: LAR denotes Load at Risk

14.1.25 Constrained Zone Substation Load Profiles, Information and Options

Arndell Park Zone Substation

Load Profile



Load Characteristics

Arndell Park ZS supplies the Arndell Park and Huntingwood industrial areas and the residential areas of Arndell Park and West Blacktown. The load profile of this substation is summer peaking driven mainly by the industrial load coinciding with residential air conditioning load. Arndell Park ZS has a firm rating of 38 MVA and a cyclic rating of 40 MVA. This substation is experiencing strong demand growth due to industrial activity and residential re-development.

Options

Network

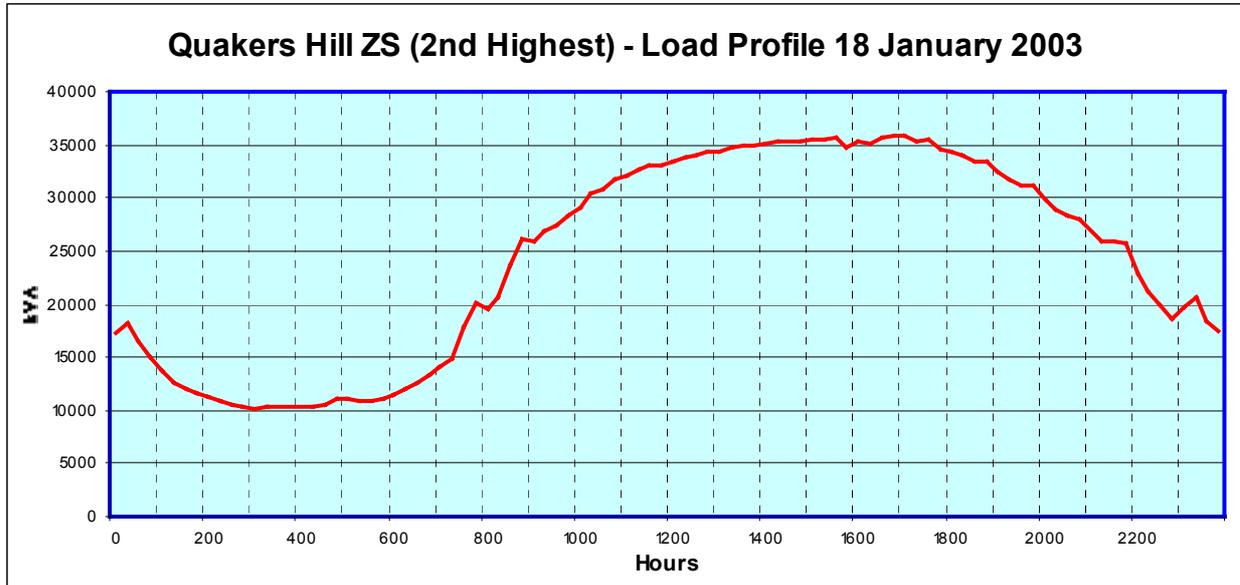
The augmentation of Arndell Park ZS will provide additional network capacity to supply the areas medium term needs. The current estimated construction date is 2004/05 (refer project item PR042). The augmentation of Doonside ZS will enable Arndell Park ZS to be offloaded in the future. The current estimated construction date is 2008/09 (refer project item PR090).

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 11:00 to 15:00 weekdays, created mainly by the industrial loads. The summer peak demand is 4 MVA higher than the winter peak demand. The summer growth rate is about 2 MVA per annum.

Quakers Hill Zone Substation

Load Profile



Load Characteristics

Quakers Hill ZS supplies the Quakers Hill residential area and other expanding residential areas to the north. The load profile of this substation is summer peaking driven mainly by the residential air conditioning load. Quakers Hill ZS has a firm rating of 25 MVA and a cyclic rating of 27 MVA. This substation is experiencing demand growth due to new residential development.

Options

Network

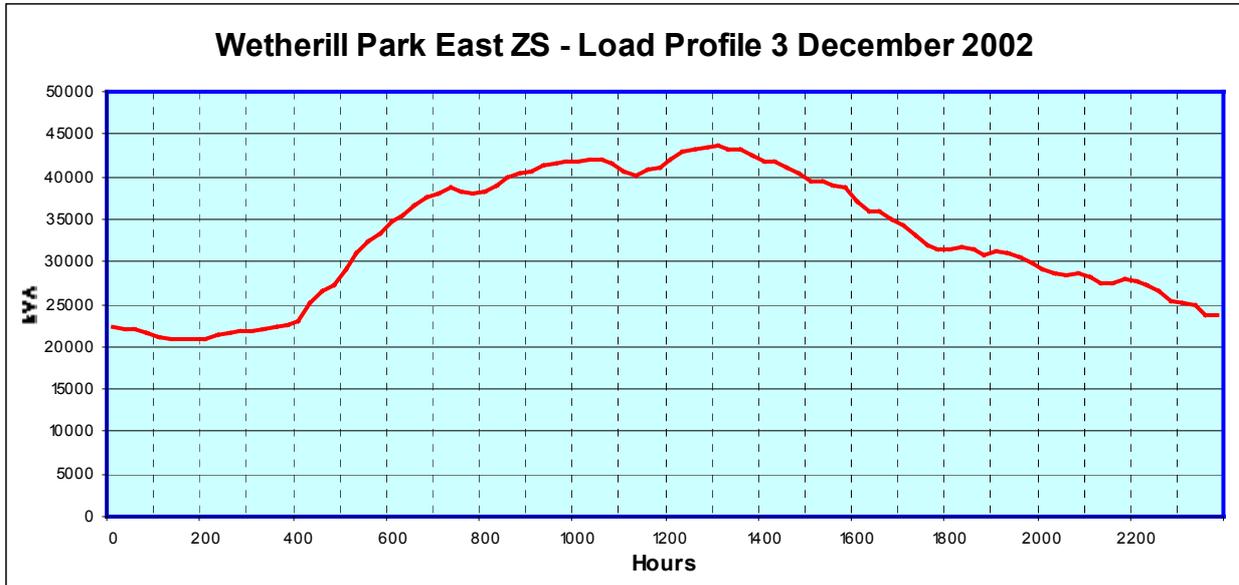
The augmentation of Quakers Hill ZS will provide additional network capacity to supply the areas medium term needs. The current estimated construction date is 2006/07 (refer project item PR054, PR311, PR312 & PR 313).

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 12:00 to 19:00 weekdays, created mainly by the industrial loads. The summer peak demand is 4 MVA higher than the winter peak demand. The summer growth rate is about 1 MVA per annum.

Wetherill Park East Zone Substation

Load Profile



Load Characteristics

Wetherill Park East ZS supplies the industrial area of Wetherill Park and a small part of the surrounding residential area. The load profile of this substation is summer peaking driven mainly by the industrial load. Wetherill Park ZS has a firm rating of 40 MVA and a cyclic rating of 40 MVA. This substation is experiencing demand growth in the industrial area.

Options

Network

The construction of Wetherill Park West ZS will provide additional network capacity to offload Wetherill Park East ZS as well as Bossley Park and Horsley Park ZSs. The current estimated construction date is 2005/06 (refer project item PR022). In the longer term a new transmission substation will be required to offload the subtransmission system (refer project item PR245).

Non-network

An RFP covering the Wetherill Park industrial area has been released to identify non-network opportunities. A non-network option would need to reduce the summer afternoon peak demand between the hours of 10:00 to 16:00 weekdays, created mainly by the industrial load. The summer peak demand is 4 MVA higher than the winter peak demand. The growth rate is about 1 MVA per annum.

15.0 Parramatta Area

Camellia Transmission Substation

15.1.1 Camellia Transmission Substation Status

Camellia TS has 3 x 120 MVA 132/33 kV transformers with no provision for any additional transformers. There is no 132 kV busbar. The substation's firm capacity is 240 MVA and has a 2-hour emergency rating of 280 MVA.

Camellia TS presently supplies Granville, Lennox, Parramatta and Rosehill ZS's which belong to Integral Energy. It also supplies customer ZS such as Shell and Capral.

Capral is currently the subject of an amended customer application, which proposes that the existing Capral site be subdivided and no longer requiring the Alcan ZS. Until the application is fully studied and a determination made, Alcan ZS load details will be included in this forecast period. The resulting load application would then add 11 kV load to Rosehill ZS.

It is also anticipated that the Shell Oil Refinery will scale down major production at their site by 2008. Therefore the 2012 summer load is estimated due to the uncertainty of Shell ZS at that time.

The Bio Mass 11 kV Generation Scheme proposes to generate up to 3.9 MW with 2 MW being used by the customer and up to 1.9 MW being exported to Integral Energy's 11 kV network. This scheme was scheduled to commence by December 2002.

Special Report No. 52 "Parramatta CBD Area Study" was prepared in 2002 for future supplies to the Parramatta CBD. It detailed that the ultimate future load of the Parramatta CBD (236 MVA) could not be supported from Camellia TS. It also stated that the Parramatta CBD would require two new ZS's in the "east" and "west" of the CBD area, with one needed by 2006/07. A demand management program has commenced and an RFP will be issued to identify demand management opportunities to defer this capital expenditure.

The special report also recommended that Camellia TS would require a 132 kV busbar in the long term to cater for new supplies to the Parramatta CBD and the new BSP that TransGrid plans to construct at Holroyd as proposed in TransGrid's New South Wales Annual Planning Report 2002.

There is also a capacitor installation program to be completed in 2003/04 at various ZS's to reduce reactive demand on the network. These works include Granville ZS (5 MVA), Lennox ZS (10 MVA), Parramatta ZS (15MVA) and Rosehill ZS (5MVA).

15.1.2 Camellia Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Camellia TS	3 x 120	360	250
Granville	2 x 16.5	33	18
Lennox	2 x 15/19/25	50	25
Parramatta	3 x 15/20/25	75	45
Rosehill	2 x 15/19/25	50	27

15.1.3 Camellia Transmission Substation Summer Demand Forecast

Location		Actual						Forecast										
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Alcan	MVA Rating MVA LAR	8.9	8.7	8.5	3.3	1.9	0.8	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
Granville	MVA Rating MVA LAR	15.5 18.0	14.6 18.0	16.4 18.0	18.3 18.0	16.8 18.0	19.3 18.0	20.6 18.0	20.8 18.0	19.5 18.0	20.2 18.0	20.7 18.0	21.3 18.0	21.8 18.0	22.4 18.0	23.0 18.0	23.5 18.0	
Lennox	MVA Rating MVA LAR	28.7 27.5	29.9 27.5	29.8 27.5	30.3 27.5	29.6 27.5	30.6 27.5	31.1 27.5	42.0 50.0	38.9 50.0	39.2 50.0	39.6 50.0	39.9 50.0	40.2 50.0	40.6 50.0	40.9 50.0	41.2 50.0	
Parramatta	MVA Rating MVA LAR	41.9 45.0	42.2 45.0	43.3 45.0	43.3 45.0	41.9 45.0	42.0 45.0	46.8 45.0	44.3 45.0	44.8 45.0	45.3 45.0	45.8 45.0	46.3 45.0	46.8 45.0	47.3 45.0	47.8 45.0	48.3 45.0	
Rosehill	MVA Rating MVA LAR	20.0 27.0	22.7 27.0	21.0 27.0	20.5 27.0	19.5 27.0	21.2 27.0	21.6 27.0	22.4 27.0	22.8 27.0	23.1 27.0	23.5 27.0	23.8 27.0	24.2 27.0	24.5 27.0	24.9 27.0	25.2 27.0	
Shell	MVA Rating MVA LAR	40.1	41.5	40.2	43.4	40.9	42.6	41.6	41.6	41.6	41.6	8.0	8.0	8.0	8.0	8.0	8.0	
Camellia TS	MVA Rating MVA LAR	158.9 250.0	162.4 250.0	161.2 250.0	160.1 250.0	153.7 250.0	155.8 250.0	162.0 250.0	166.0 250.0	168.3 250.0	170.1 250.0	135.5 250.0	137.2 250.0	139.0 250.0	140.7 250.0	142.4 250.0	144.1 250.0	

15.1.4 Camellia Transmission Substation Winter Demand Forecast

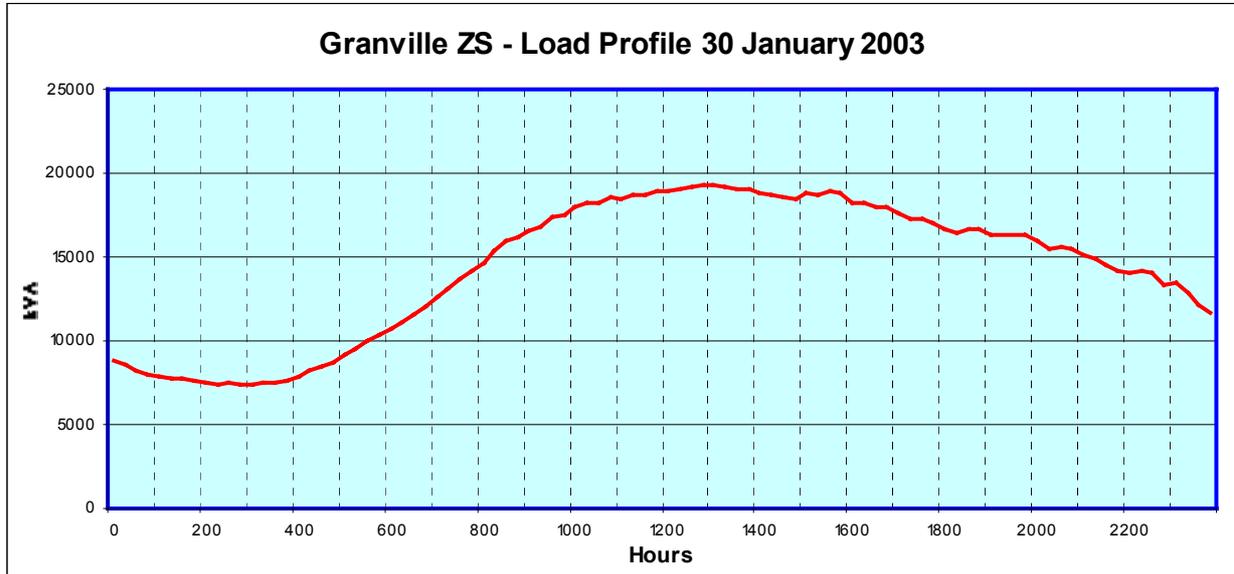
Location		Actual						Forecast										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Alcan	MVA Rating MVA LAR	9.2	9.2	10.6	8.5	3.1	0.9	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	
Granville	MVA Rating MVA LAR	14.0 18.0	14.2 18.0	15.5 18.0	15.3 18.0	16.3 18.0	15.9 18.0	17.0 18.0	15.7 18.0	16.3 18.0	16.8 18.0	17.1 18.0	17.4 18.0	17.7 18.0	18.0 0.0	18.3 0.3	18.6 0.6	
Lennox	MVA Rating MVA LAR	23.4 27.5	23.0 27.5	24.4 27.5	25.4 27.5	24.9 27.5	24.9 27.5	25.8 27.5	33.7 50.0	34.3 50.0	34.5 50.0	34.7 50.0	34.8 50.0	35.0 50.0	35.1 50.0	35.3 50.0	35.5 50.0	
Parramatta	MVA Rating MVA LAR	31.4 45.0	36.2 45.0	31.6 45.0	34.7 45.0	32.4 45.0	31.7 45.0	36.7 45.0	28.9 45.0	31.6 45.0	32.4 45.0	33.1 45.0	33.8 45.0	34.5 45.0	35.3 45.0	36.0 45.0	36.7 45.0	
Rosehill	MVA Rating MVA LAR	19.7 27.0	17.9 27.0	18.9 27.0	20.5 27.0	17.8 27.0	17.2 27.0	21.8 27.0	20.2 27.0	20.4 27.0	20.6 27.0	20.9 27.0	21.1 27.0	21.3 27.0	21.6 27.0	21.8 27.0	22.0 27.0	
Shell	MVA Rating MVA LAR	41.4	41.7	39.1	43.6	40.9	36.9	41.6	41.8	42.0	42.2	42.4	42.6	8.0	8.0	8.0	8.0	
Camellia TS	MVA Rating MVA LAR	137.3 250.0	139.4 250.0	136.2 250.0	145.2 250.0	132.3 250.0	123.6 250.0	144.9 250.0	139.2 250.0	143.4 250.0	145.2 250.0	146.8 250.0	148.3 250.0	117.3 250.0	121.8 250.0	135.0 250.0	136.5 250.0	

Note: LAR denotes Load at Risk

15.1.5 Constrained Zone Substation Load Profiles, Information and Options

Granville Zone Substation

Load Profile



Load Characteristics

Granville ZS supplies the commercial centre of Granville, a small industrial area adjacent the railway station and the established residential areas of Granville, southern part of Harris Park and the eastern side of Merrylands. The load profile of this substation is summer peaking driven mainly by the commercial load coinciding with residential air conditioning load. Granville ZS has a firm rating of 16.5 MVA and a cyclic rating of 18 MVA. This substation is experiencing slow demand growth in the industrial area and the re-development of the residential area.

Options

Network

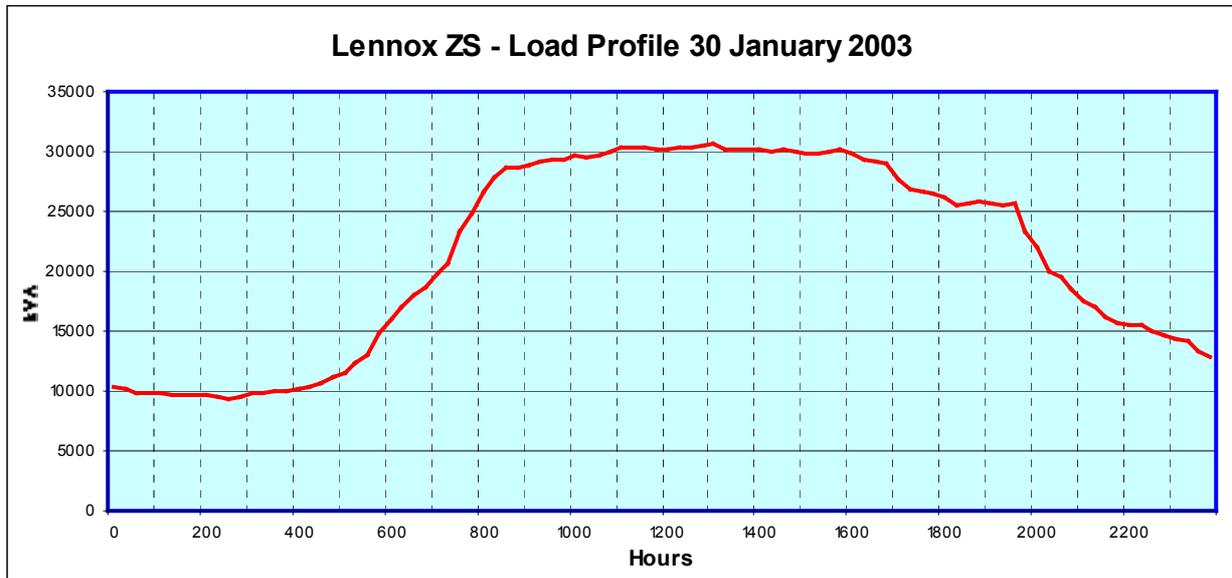
The construction of Parramatta East ZS will provide additional network capacity to offload Granville ZS. The current estimated construction date is 2007/08 (refer project item PR091). In the longer term the existing Granville ZS will be relocated and rebuilt due to 'end-of-life' asset replacement requirements (refer project item PR308).

Non-network

An RFP covering the Parramatta CBD has been released to identify non-network opportunities. A non-network option would need to reduce the summer afternoon peak demand between the hours of 10:00 to 17:00 weekdays, created mainly by the residential loads coinciding with the commercial and industrial load. The summer peak demand is 3 MVA higher than the winter peak demand. The summer growth rate is about 0.5 MVA per annum.

Lennox Zone Substation

Load Profile



Load Characteristics

Lennox ZS supplies the southern part of the Parramatta CBD and the surrounding high/medium/low residential areas. The load profile of this substation is summer peaking driven mainly by the commercial load coinciding with residential air conditioning load. Lennox ZS has a firm rating of 25 MVA and a cyclic rating of 27.5 MVA. This substation is experiencing demand growth in the commercial sector and the re-development of the residential area.

Options

Network

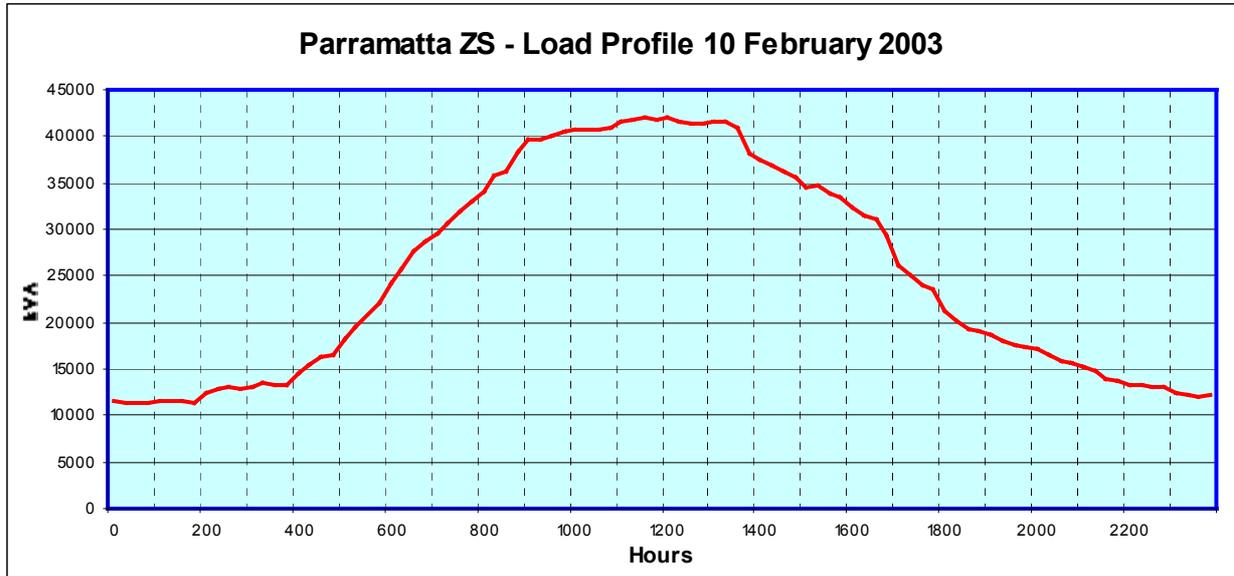
The augmentation of Lennox ZS will provide additional capacity to supply the areas needs in the short to medium term. The current estimated construction date is 2003/04 (refer project item PR019). The construction of Parramatta East ZS will provide additional network capacity to support Lennox ZS in the longer term. The current estimated construction date is 2007/08 (refer project item PR091).

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 9:00 to 17:00 weekdays, created mainly by the commercial load coinciding with the residential air conditioning load. The summer peak demand is 5 MVA higher than the winter peak demand. The summer growth rate is about 0.7 MVA per annum.

Parramatta Zone Substation

Load Profile



Load Characteristics

Parramatta ZS supplies the majority of the Parramatta CBD and the surrounding high/medium/low residential areas. The load profile of this substation is summer peaking driven mainly by the commercial load coinciding with residential air conditioning load. Parramatta ZS has a firm rating of 41.7 MVA and a cyclic rating of 45 MVA. This substation is experiencing demand growth in the commercial sector and the re-development of the residential area and construction of high rise apartments.

Options

Network

The construction of Parramatta East ZS will provide additional network capacity to offload Parramatta ZS in the medium term. The current estimated construction date is 2007/08 (refer project item PR091). The construction of Parramatta West ZS will provide network capacity to supply the Parramatta CBD in the longer term. The current estimated construction date is 2012/13 (refer project item PR092, PR093).

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 9:00 to 14:00 weekdays, created mainly by the commercial load coinciding with the residential air conditioning load. The summer peak demand is 9 MVA higher than the winter peak demand. The summer growth rate is about 0.7 MVA per annum.

Carlingford Transmission Substation

15.1.6 Carlingford Transmission Substation Status

Carlingford TS has 4 x 120 MVA 132/66 kV double-wound transformers and is capable of a firm cyclic rating of 410 MVA. The Baulkham Hills/Carlingford 132 kV system has a firm cyclic rating (one circuit outage) of 548 MVA. This limitation is due to the 2400 A 132 kV circuit breakers at Baulkham Hills TS. The cyclic rating is further reduced in summer by the line rating of 512 MVA. The Carlingford TS allocation is 363 MVA (160 MVA for Integral Energy and 203 MVA for Energy Australia).

The load indicated as RIC Carlingford is the proposed traction supply for the Parramatta to Epping Rail Link. A RIC substation is planned to be constructed adjacent to Carlingford Rail station and directly supplied from the Carlingford TS 66 kV busbar by 2005.

It is understood that this load has been deferred until 2010 at the earliest and most likely some time after this due to the State Governments publicised decision to withdraw funding of this section of rail line. Integral Energy is still seeking confirmation of this decision from Parramatta Rail Link (PRL). There is no physical evidence to suggest that commissioning of this substation can happen by 2005 as no commencement of tunnel boring for the link has occurred. For the purposes of this review, the RIC Carlingford as shown in the forecast will not be included in the analysis period.

Additionally, a temporary 6.2 MVA supply for tunnel boring equipment from Dundas ZS until 2005 was shown in the Integral Energy's summer forecast for 2001/02. For the purposes of this analysis this load will not be taken into account. These loads will be subject to review if funding is found for the Rail Link.

To meet the needs of the area, the need to augment 132 kV feeders 9JA and 230 and Riverstone and Kellyville to 132/22 kV ZS and establish Box Hill, Glenhaven, Mungerie Park, Norwest, North Castle Hill and Schofields ZS's and the Rouse Hill SS has been identified.

It is proposed that the future North Castle Hill ZS will offload Castle Hill ZS, maintaining Castle Hill ZS below its firm rating and providing load relief to 66 kV feeders 815, 818 and 825. There is currently a DM program in place in the Castle Hill area to defer these works. The future augmentation of Kenthurst ZS to a 132/11 kV ZS will release 66 kV feeder 830 from service at 66 kV. This will also provide load relief to 66 kV feeders 815, 818 and 825.

15.1.7 Carlingford Transmission Substation Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Carlingford TS	4 x 120 (132/66 kV)	480	370
Castle Hill	2 x 15/17.5 (66/11 kV) + 1 x 15 (66/11 kV)	50	35
Dundas	2 x 22/26/35 (66/11 kV) + 1 x 10 (66/11 kV)	80	45
Rydalmere	1 x 20/25/33 (66/11 kV) + 1 x 20/27/33 (66/11 kV) + 1 x 15/18.75/25 (66/11 kV)	91	58
West Pennant Hills	2 x 22/26/35 (66/11 kV)	70	37

15.1.8 Carlingford Transmission Substation Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Castle Hill	MVA	24.8	25.5	33.6	38.5	33.4	34.7	36.0	36.4	37.2	38.0	24.4	25.4	26.3	27.2	28.2	29.1
	Rating MVA LAR	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Dundas	MVA	34.9	31.9	32.5	36.7	30.2	42.4	37.8	38.6	40.5	40.7	41.0	41.3	41.6	41.8	42.1	42.4
	Rating MVA LAR	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Rydalmere	MVA	41.9	43.3	43.3	45.7	42.4	45.7	45.1	45.8	46.2	46.5	46.8	47.1	47.5	47.8	48.1	48.5
	Rating MVA LAR	58.0	58.0	58.0	58.0	58.0	58.0	58.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
West Pennant Hills	MVA	21.6	24.0	25.8	27.6	23.2	29.4	28.8	29.3	29.8	30.2	30.5	30.9	31.3	31.7	32.1	32.5
	Rating MVA LAR	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0
EA Carlingford	MVA	147.0	170.9	181.7	207.4	161.8	184.4	196.1	160.2	162.7	165.1	167.5	168.7	168.7	168.7	168.7	168.7
	Rating MVA LAR																
Carlingford TS	MVA	272.8	273.8	295.8	331.4	273.4	286.9	287.3	274.1	279.8	283.8	273.7	276.6	278.4	280.3	282.2	284.0
	Rating MVA LAR	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0

15.1.9 Carlingford Transmission Substation Winter Demand Forecast

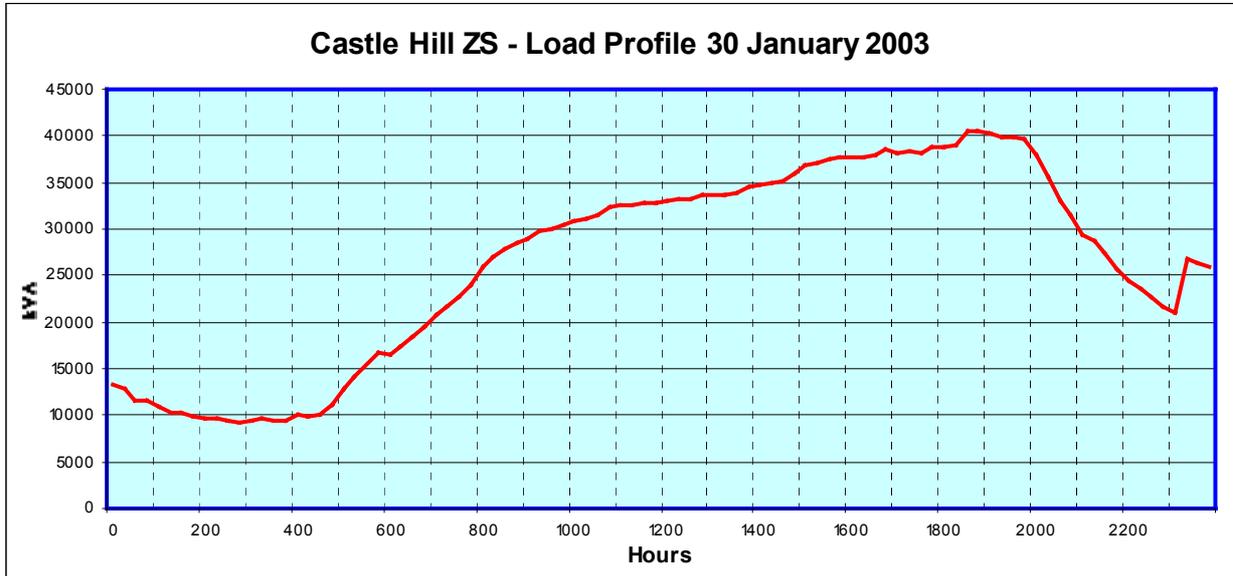
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Castle Hill	MVA	33.3	21.9	28.3	34.0	33.5	28.5	31.2	31.1	32.5	33.6	34.6	35.6	36.5	37.5	38.5	39.4
	Rating MVA LAR	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Dundas	MVA	37.1	38.7	40.4	40.9	40.9	40.9	41.9	41.8	42.9	45.3	45.9	46.6	47.3	48.0	48.7	49.4
	Rating MVA LAR	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Rydalmere	MVA	35.2	36.5	35.2	34.9	35.6	36.4	39.5	36.9	37.4	37.9	38.3	38.7	39.1	39.5	39.9	40.3
	Rating MVA LAR	58.0	58.0	58.0	58.0	58.0	58.0	58.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
RIC Carlingford	MVA	35.2	36.5	35.2	34.9	35.6	36.4	39.5	36.9	37.4	37.9	38.3	38.7	39.1	39.5	39.9	40.3
	Rating MVA LAR																
West Pennant Hills	MVA	20.6	22.4	23.5	24.3	24.8	24.6	25.5	25.2	26.0	26.8	27.4	28.1	28.8	29.5	30.2	30.8
	Rating MVA LAR	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0
EA Carlingford	MVA	164.1	157.1	168.5	187.5	183.4	153.3	210.5	166.8	166.8	171.3	175.8	180.3	184.8	189.3	193.8	198.3
	Rating MVA LAR																
Carlingford TS	MVA	304.2	281.5	280.8	303.8	300.0	274.7	304.3	273.6	277.6	286.1	301.6	308.3	315.0	321.6	347.9	354.5
	Rating MVA LAR	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0	370.0

Note: LAR denotes Load at Risk

15.1.10 Constrained Zone Substation Load Profiles, Information and Options

Castle Hill Zone Substation

Load Profile



Load Characteristics

Castle Hill ZS supplies the commercial centre at Castle Hill and the surrounding high/medium/low residential areas. The load profile of this substation is summer peaking driven mainly by the commercial load coinciding with residential air conditioning load. Castle Hill ZS has a firm rating of 32.5 MVA and a cyclic rating of 35 MVA. This substation is experiencing demand growth in the commercial sector and the re-development of the residential area to high and medium density.

Options

Network

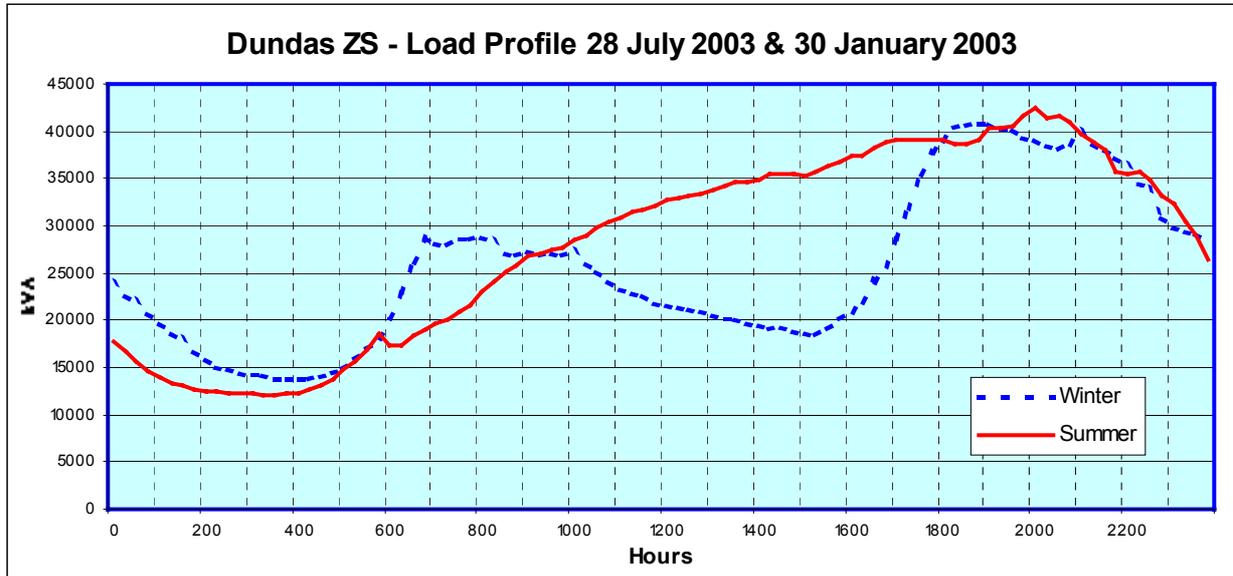
The construction of North Castle Hill ZS will provide additional network capacity to offload Castle Hill ZS. The current estimated construction date is 2009/10 (refer project item PR176 & PR117).

Non-network

A demand management program is currently being implemented with major commercial customers being signed up to demand reducing initiatives. A non-network option would need to reduce the summer afternoon peak demand between the hours of 14:00 to 20:00 weekdays, created mainly by the commercial load coinciding with the residential air conditioning load. The redevelopment of the residential area will also need to be addressed. The summer peak demand is 4 MVA higher than the winter peak demand. The summer growth rate is about 0.7 MVA per annum.

Dundas Zone Substation

Load Profile



Load Characteristics

Dundas ZS supplies the commercial centre at Dundas and the surrounding medium/low residential areas. The load profile of this substation is only just summer peaking driven mainly by the commercial load coinciding with residential air conditioning load. Dundas ZS has a firm rating of 45 MVA and a cyclic rating of 45 MVA. This substation is experiencing demand growth mainly from re-development of the residential area to medium and high density.

Options

Network

The network option to provide additional network capacity to supply the long term needs of the Dundas and Epping supply area is to either establish a new substation at West Epping or to augment Dundas ZS. The current estimated construction date is 2010/11 (refer project item PR270).

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 15:00 to 21:00 weekdays, created mainly by the commercial load coinciding with the residential air conditioning load. The winter evening demand needs to be reduced between the hours of 17:00 to 21:00 weekdays, created mainly by residential space heating and cooking. The redevelopment of the residential area will also need to be addressed. The summer peak demand is 1 MVA higher than the winter peak demand but has historically been 4 MVA lower than the winter peak demand. The growth rate is about 1.0 MVA per annum. Demand Management will be investigated and submissions will be sought from interested parties.

Vineyard Bulk Supply Point

15.1.11 Vineyard Bulk Supply Point Status

Vineyard BSP is owned by TransGrid and has 2 x 200 MVA 330/138.6 kV transformers. It has been designed to ultimately accommodate 3 x 375 MVA 330/138.6 kV transformers. Integral Energy is supplied at 132 kV from Vineyard BSP.

To meet the needs of the area, the need to augment 132 kV feeders 9JA and 230, convert Riverstone and Kellyville to 132/11 kV ZS's and establish Box Hill, Glenhaven, Mungerie Park, Norwest, North Castle Hill and Schofields ZS's and the Rouse Hill SS has been identified.

Initially, it is proposed that 132 kV feeders 9JA and 230 would be augmented and Rouse Hill SS be established. This will provide supply security to Parklea and West Castle Hill ZS's and establish pivotal infrastructure that the supply to the "North West Sector" requires.

An RFP is planned for the "North West Sector" to identify possible demand management alternatives. Integral Energy will also encourage Planning NSW and local councils to incorporate energy efficiency and demand management aspects into the development approval process and DCP's.

15.1.12 Vineyard Bulk Supply Point Rating Details

Zone Substation	Transformer Description (MVA)	Installed Capacity (MVA)	Emergency/Cyclic Rating (MVA)
Vineyard BSP	Transgrid		
Parklea **	2 x 45 (132/22 kV)	90	45
West Castle Hill **	2 x 35/44/52/65 (132/11 kV)	130	65

Note: Substations designated ** are grouped in the Forecast Section as Vineyard 132 kV as they are supplied directly off the Vineyard 132 kV busbar without an intermediate subtransmission busbar. The remaining location is a TS with its own individual subtransmission network to each ZS.

15.1.13 Vineyard Bulk Supply Point Summer Demand Forecast

Location		Actual						Forecast									
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Bella Vista	MVA Rating MVA LAR									28.2 55.0	31.2 55.0	34.2 55.0	37.2 55.0	40.2 55.0	43.2 55.0	46.2 55.0	49.2 55.0
North Castle Hill	MVA Rating MVA LAR											18.0 55.0	19.0 55.0	20.0 55.0	21.0 55.0	22.0 55.0	23.0 55.0
Parklea	MVA Rating MVA LAR				11.6 45.0	29.8 45.0	46.8 45.0	48.5 45.0	58.9 45.0	62.1 45.0	68.1 45.0	71.9 45.0	78.6 45.0	81.1 45.0	82.9 45.0	84.1 45.0	89.1 45.0
West Castle Hill	MVA Rating MVA LAR	41.0 65.0										57.3 65.0	58.2 65.0	59.2 65.0	60.2 65.0	61.2 65.0	62.1 65.0
Vineyard TS	MVA Rating MVA LAR	41.0 TransGrid Substation	0.0	0.0	10.7	27.4	43.0	44.7	54.2	79.4	87.4	159.6	169.8	176.4	182.4	187.8	196.6

Note: LAR denotes Load at Risk

15.1.14 Vineyard Bulk Supply Point Winter Demand Forecast

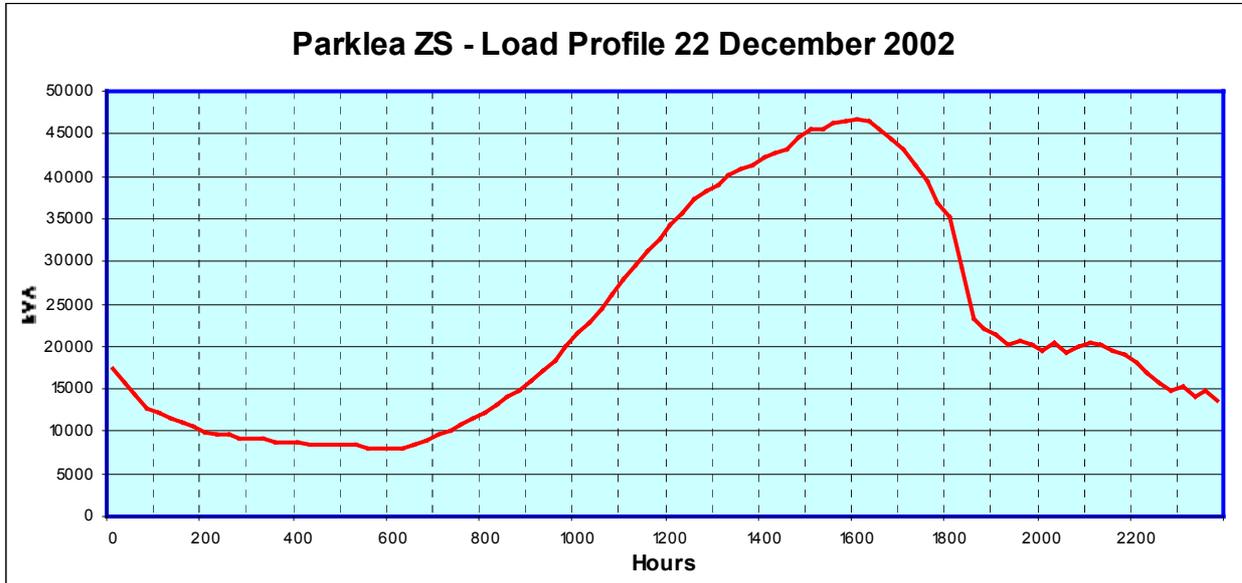
Location		Actual						Forecast									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bella Vista	MVA Rating MVA LAR										28.2 55.0	31.2 55.0	34.2 55.0	37.2 55.0	40.2 55.0	43.2 55.0	46.2 55.0
North Castle Hill	MVA Rating MVA LAR												18.0 55.0	19.0 55.0	20.0 55.0	21.0 55.0	22.0 55.0
Parklea	MVA Rating MVA LAR					21.6 45.0	28.9 45.0	36.0 45.0	36.2 45.0	47.9 45.0	51.0 45.0	57.4 45.0	61.2 45.0	68.7 45.0	71.1 45.0	72.9 45.0	74.0 45.0
West Castle Hill	MVA Rating MVA LAR	24.5 65.0	39.2 65.0									57.1 65.0	58.3 65.0	59.5 65.0	60.7 65.0	61.9 65.0	63.2 65.0
Vineyard TS	MVA Rating MVA LAR	24.5 TransGrid Substation	39.2	0.0	0.0	21.6	28.9	83.3	82.3	94.3	118.8	128.2	151.1	162.2	169.0	175.2	180.7

Note: LAR denotes Load at Risk

15.1.15 Constrained Zone Substation Load Profiles, Information and Options

Parklea Zone Substation

Load Profile



Load Characteristics

Parklea ZS supplies the industrial area at Bella Vista, several small commercial centres and the residential areas of Parklea, Glenwood, Stanhope Gardens, Acacia Gardens and Bella Vista. The load profile of this substation is summer peaking driven mainly by the industrial and commercial loads coinciding with residential air conditioning load. Parklea ZS has a firm rating of 45 MVA and a cyclic rating of 45 MVA. This substation is experiencing strong demand growth in the new residential development areas and growth in air conditioning as well as in the Bella Vista/Norwest commercial and light industrial areas.

Options

Network

The augmentation of Parklea ZS will provide additional network capacity to supply the areas medium term needs. The current estimated construction date is 2005/06 (refer project item PR172). In the longer term a new zone substation will be required to supply the expanding residential developments of the north west sector.

Non-network

A non-network option would need to reduce the summer afternoon peak demand between the hours of 13:00 to 18:00 weekdays, created mainly by residential air conditioning load coinciding with the industrial and commercial loads. The development of the new residential release areas will also need to be addressed. The summer peak demand is 8 MVA higher than the winter peak demand. The summer growth rate is about 2 to 3 MVA per annum.

16.0 PROPOSED NETWORK OPTIONS AND BUDGET ESTIMATES

Listed below are the possible Integral Energy Major capital expenditure items for a ten-year period. The majority of the projects are not approved or committed, and will all be subject to the application of the Demand Management Code reasonableness test as part of the project evaluation process. The table provides a budget estimate of costs and is separated into regions.

Project No.	Project Description	Cost \$(m)	Remarks
PR018	Mt Druitt TS 132kV busbar & 3rd Transformer	5.43	Provide busbar to connect third transformer & split fdrs 932/939
PR019	Lennox Third Transformer & 33kV Busbar	2.82	Install 3rd transformer
PR020	South Windsor ZS Augment and Re-rate fdrs 448/449	5.08	Augment firm capacity at Sth Windsor to 35MVA.
PR022	Wetherill Park West TS/ZS (Stage 1)	13.10	Provide supply to Wetherill Park West
PR023	Bow Bowling ZS Augment	0.09	Install 3rd transformer
PR029	Mamre ZS & lines to Sydney West (also PR030)	10.90	New ZS to off load St Marys/Erskine Park and supply new Industrial Area.
PR032	Glendenning 132/11kV ZS establishment	10.00	Provide capacity to 132kV Blacktown, Rooty Hill, Quakers Hill network (stage 1)
PR035	Baulkham Hills TS 11 kV supply (Old Toongabbie ZS)	7.50	New ZS deferred due to DM Program
PR042	Arndell Park additional 11kV buses + dist work	2.96	Provide firm capacity to Arndell Park ZS
PR043	Leabons Lane ZS 3rd Transformer and 11kV Bus	2.00	Augment ZS - deferred due to DM Program
PR046	Provide 3rd Fdr Baulkham Hills to Marayong via part 445 (also PR047)	2.00	Provide additional feeder capacity
PR047	Provide 2nd Feeder Blacktown to Newton via part 445 (also PR046)	1.20	Provide additional feeder capacity
PR048	Glenmore Park to full 132kV including 2nd feeder	3.97	Provide additional transformer and feeder capacity
PR049	North Richmond ZS upgrade	0.37	Provide firm capacity to North Richmond ZS & surrounding area
PR051	Tahmoor ZS augment & 2nd 66kV line + Maldon augment	13.58	Provide additional transformer and feeder capacity to Tahmoor, Maldon & Oakdale
PR052	Penrith TS transformer and Busbar Augment	6.00	Provide firm capacity
PR053	Rooty Hill ZS 132kV busbar	2.00	Rooty Hill 32kV busbar
PR054	Quakers Hill ZS augment (132kV bar + 1st 132/11kV tfr)	8.00	Quakers Hill ZS augment
PR058	Cattai Transformer Replacement (10 to 15 MVA) & Busbar	3.00	Provide firm capacity
PR059	ELTS 132kV Bus bar & Substation works (ELTS Stage 3)	4.60	New transmission substation at East Liverpool
PR060	132kV Cable Links (x2) WLTS-ELTS (ELTS Stage 2)	6.64	New transmission substation at East Liverpool
PR061	Russell Vale Trf Augment	1.50	Provide firm capacity
PR065	Aerodrome 33/11kV ZS establishment + two 33kV feeders	14.60	Provide firm capacity for new residential subdivision
PR066	Kembla Grange ZS Stage 2	0.91	Provide firm capacity
PR067	Londonderry/ADI ZS + 2 feeders	13.00	Provide firm capacity for new residential subdivision
PR069	Quarries 33/11kV ZS rebuild	8.00	Provide firm capacity for new residential subdivision
PR070	Caddens ZS (offload Kingswood, Cambridge Park and St. Marys ZSs)	10.00	Provide firm capacity for new residential subdivision
PR073	Campbelltown 66 kV Busbar and 3rd tfr (also PR074 and PR152)	2.51	Provide additional transformer and feeder capacity to Campbelltown area
PR074	Rebuild 66kV line Minto to Campbelltown (also PR073 and PR152)	1.50	Provide additional feeder capacity to Campbelltown area
PR076	Third 33 kV feeder from Baulkham Hills TS to Jasper Road ZS	1.51	Provide additional feeder capacity to Campbelltown area
PR081	Liverpool North 132/11kV ZS establishment (Stage 2)	12.00	Provide firm capacity to the Liverpool CBD and surrounding area
PR082	Greystanes ZS 3rd Transformer Augment	2.00	Provide firm capacity
PR090	Doonside 132/11kV ZS Rebuild	10.00	Provide firm capacity
PR091	Parramatta CBD East 132/11kV ZS establishment	18.00	Provide firm capacity to the Parramatta CBD and surrounding area
PR092	Parramatta CBD 132 kV overlay project (East/West + Holroyd BSP)	17.00	Provide subtransmission capacity to the Parramatta CBD and surrounding area

Project No.	Project Description	Cost \$(m)	Remarks
PR093	Parramatta CBD West 132/11kV ZS establishment	16.00	Provide firm capacity to the Parramatta CBD and surrounding area
PR094	Augment feeder 777 to twin conductor (Sherwood ZS)	0.50	Provide additional feeder capacity to Merrylands & surrounding area
PR095	Re-rate fdrs 477/466 to from Baulkham Hills TS to Westmead ZS	1.00	Provide additional feeder capacity to Westmead ZS
PR096	Berry ZS transformer augment	0.60	Provide firm capacity
PR097	Prestons ZS 2nd feeder from WLTS	1.00	Provide additional feeder capacity to Prestons ZS
PR100	Mt Ousley ZS Establishment	11.00	Provide firm capacity to North Wollongong
PR101	Hawkesbury TS 3rd transformer (from Penrith TS)	2.00	Provide firm capacity
PR103	Liverpool ZS Augment (3rd trf + 3rd 11kV bus + dist)	2.65	Provide firm capacity
PR106	Ilford TS 132kV bus + 66kV line	3.00	Provide additional feeder capacity
PR107	Kentlyn ZS transformer Augment	2.00	Provide firm capacity
PR110	Edmondson Park ZS Establishment	11.11	Provide firm capacity to the new residential development
PR111	Re-rate fdr 827 (Warrimoo TS to Blaxland)	0.50	Provide additional feeder capacity
PR113	Rebuild feeder 308 Nepean to Douglas Park to 66kV	2.00	Provide additional feeder capacity to the southern Nepean area
PR115	Westmead ZS augment to 3rd trf + 33kV Busbar	5.90	Provide firm capacity
PR117	825 feeder Augment / 132kV Feeders to North Castle Hill ZS	2.00	Provide feeder capacity to the future North Castle Hill ZS
PR121	Nowra ZS Transformer augment (also PR154)	2.00	Provide firm capacity
PR122	Helensburgh ZS augment	0.50	Provide firm capacity
PR123	Tomerong 132/33kV TS establishment (BSB included)	12.00	Provide additional subtransmission capacity to the south coast
PR124	Shellharbour ZS 3rd transformer and 11 kV bus	4.26	Provide firm capacity
PR126	Cabramatta ZS augment or Chipping Norton ZS (ELTS Stg 5)	7.50	Provide firm capacity to Cabramatta and Chipping Norton
PR132	Jasper Road ZS augment to 3 x 35MVA	3.00	Provide firm capacity
PR133	Newton ZS Transformer Augment	3.98	Provide firm capacity
PR139	Convert Kenthurst for full 132/11kV including second 132kV feeder	4.50	Provide firm capacity
PR143	Emu Plains ZS Augment	2.40	Provide firm capacity
PR144	Sherwood ZS 3rd transformer	2.00	Provide firm capacity
PR145	Smithfield ZS 3rd transformer	2.50	Provide firm capacity
PR146	Cambridge Park ZS transformer augment	2.40	Provide firm capacity
PR147	Third 66 kV feeder Ingleburn TS to Minto ZS (also PR190)	2.50	Provide additional subtransmission capacity to Minto ZS
PR148	Dapto ZS 3rd transformer & 33kV Bus Section CB's	2.00	Provide firm capacity
PR149	Gerringong ZS Transformer Augment	1.00	Provide firm capacity
PR152	Augment feeder 853 (Kentlyn ZS) (also PR073 and PR074)	1.20	Provide additional subtransmission capacity to Kentlyn ZS
PR154	South Nowra ZS Transformer Augment (also PR121) (used transformer)	0.15	Provide firm capacity
PR155	Sussex Inlet ZS augment (used transformer)	0.15	Provide firm capacity
PR156	Prestons ZS 3rd transformer	3.00	Provide firm capacity
PR157	Richmond ZS augment	1.65	Provide firm capacity
PR158	Richmond RAAF Base Busbar and new 33kV Feeder	2.70	Provide additional subtransmission capacity to Richmond ZS
PR165	Eastern Creek 132/11kV ZS Establishment	10.85	Provide firm capacity
PR167	Glenmore Park Transformer Augment	2.50	Provide firm capacity
PR168	Anzac Village ZS Augment	4.00	Provide firm capacity
PR170	Holsworthy 33/11kV ZS establishment	8.00	Provide firm capacity to the residential development at Holsworthy
PR171	Penrith TS to Cranebrook 3rd Feeder (also PR249)	2.50	Provide additional subtransmission capacity to Cranebrook ZS
PR172	Parklea ZS 3rd transformer Augment	4.44	Provide firm capacity
PR174	Convert Riverstone ZS to 132/11kV	10.00	Provide firm capacity
PR175	Norwest 132kV SS Establishment	4.50	Provide additional subtransmission capacity to the North West Sector

Project No.	Project Description	Cost \$(m)	Remarks
PR176	North Castle Hill 132/11kV ZS Establishment	12.00	Provide firm capacity to the Castle Hill area
PR177	Feeder 9JA rebuild to D/C Steel Tower	10.00	Provide additional subtransmission capacity to the North West Sector
PR178	Feeder 9JA duplication between Rouse Hill and Parklea	8.00	Provide additional subtransmission capacity to the North West Sector
PR179	Rouse Hill Switching Station Establishment	8.80	Provide additional subtransmission capacity to the North West Sector
PR180	Norwest SS to Kellyville 132kV link	7.00	Provide additional subtransmission capacity to the North West Sector
PR181	Convert Kellyville ZS to 132/11kV	10.00	Provide firm capacity
PR182	Mungerie Park 132/22kV ZS Establishment	10.00	Provide firm capacity to the North West Sector
PR183	Schofields 132/11kV ZS Establishment with 132kV links	16.00	Provide firm capacity to the North West Sector
PR184	Box Hill 132/22kV ZS Establishment	16.00	Provide firm capacity to the North West Sector
PR185	Glenhaven 132/11kV ZS Establishment	13.00	Provide firm capacity to the North West Sector
PR186	Glenorie 132/11kV ZS Establishment	10.00	Provide firm capacity to the North West Sector
PR189	Plumpton ZS augment - 3rd transformer	2.00	Provide firm capacity
PR190	Ingleburn (North Minto) 66/11kV ZS establishment (also PR147)	10.00	Provide firm capacity to the Minto area
PR198	Luddenham Transformer Augment	0.96	Provide firm capacity
PR200	Cordeaux / Figtree 33/11kV ZS Establishment	10.00	Provide firm capacity to the North Wollongong area
PR201	Anzac Village 33kV feeder reconfiguration from ELTS (ELTS Stage 4)	0.50	Provide additional subtransmission capacity to Anzac Village ZS
PR202	Moorebank 33kV feeder reconfigure from ELTS (ELTS Stage 4)	0.50	Provide additional subtransmission capacity to Moorebank ZS
PR203	Kemps Creek ZS feeder arrangement from new Kemps Creek BSP	1.20	Provide additional subtransmission capacity to Kemps Creek ZS
PR204	Homepride 33kV feeders from ELTS - part 508 (ELTS Stage 4)	2.20	Provide additional subtransmission capacity to Homepride ZS
PR205	The Oaks 66/11kV ZS establishment	9.00	Provide firm capacity to supply the development at Oakdale
PR206	Mt Hunter (West Camden) 66/11kV ZS Establishment	8.00	Provide firm capacity to supply the development at Mt Hunter
PR208	Abbotsbury 132/11kV ZS Establishment	9.00	Provide firm capacity to offload Bonnyrigg & Bossley Pk ZSs
PR238	Narellan transformation capacity upgrade	1.00	Provide firm capacity
PR240	Katoomba North TS Augment	3.80	Provide firm capacity
PR241	Wallgrove 132/11kV ZS (Temporary Eastern Creek)	0.73	Provide firm capacity to supply the development at Eastern Creek
PR244	Bellavista ZS establishment with two 132kV cable links	26.00	Provide additional subtransmission capacity to the North West Sector
PR245	Wetherill Park West TS/ZS (Stage 2)	9.00	Provide additional subtransmission capacity to the North West Sector
PR249	Penrith Lake 33/11kV ZS establishment with two 33kV links	7.00	Provide firm capacity to supply the development at Penrith Lakes
PR250	South Granville ZS augment/rebuild (TS075)	8.00	Provide firm capacity
PR253	Mt Annan BSP associated works (93Y connection)	5.00	Provide additional subtransmission capacity to the Campbelltown area
PR255	Oran Park 132/11kV ZS establishment	12.00	Provide firm capacity to supply the development at Oran Park
PR258	Menangle Park 66/11kV ZS establishment	10.00	Provide firm capacity to supply the development at Menangle Park
PR259	Menangle Park ZS - Ambervale 66kV link	3.00	Provide additional subtransmission capacity to the Campbelltown area
PR261	Huntingwood 132/11kV ZS establishment	10.00	Provide firm capacity to offload Arndell Park ZS
PR262	Bow-Bowing - Ingleburn 66kV 3km link	2.50	Provide additional subtransmission capacity to Bow Bowing ZS
PR263	Blackheath ZS reconstruction	4.00	Provide firm capacity
PR266	Feeder 480A up-rating (BHTS - Westmead ZS)	0.20	Provide additional subtransmission capacity to Westmead ZS
PR267	Baulkham Hill TS augmentation (conditional on supply to Marayong ZS)	2.50	Provide firm capacity
PR270	West Epping 66/11kV ZS establishment or Dundas ZS rebuilt	14.00	Provide firm capacity to offload Dundas ZS
PR271	Berrima 33/11kV ZS establishment	7.00	Provide firm capacity to supply the development at Berrima
PR272	Feeder 758 up-rating (Section A) (South Granville ZS)	0.30	Provide additional subtransmission capacity to South Granville ZS
PR273	Feeder 758 up-rating (Section B) (South Granville ZS)	0.80	Provide additional subtransmission capacity to South Granville ZS

Project No.	Project Description	Cost \$(m)	Remarks
PR274	Guildford 132/11kV ZS or Fairfield 33/11kV ZS rebuilt (also PR083)	12.00	Provide firm capacity to offload Fairfield ZS
PR276	Leppington East 132/11kV ZS establishment	10.00	Provide firm capacity to the South West Sector
PR277	Up-rating Feeders 303 & 309 (for The Oaks ZS, at 66kV)	0.60	Provide subtransmission capacity to the proposed The Oaks ZS
PR278	Kemps Creek new BSP associated works (also PR102 and PR203)	5.00	Provide subtransmission capacity
PR280	Wilton Park 66/11kV ZS establishment & 66kV line works	13.00	Provide firm capacity to supply the development at Wilton
PR281	Second 33kV feeder for Sussex Inlet ZS	3.00	Provide subtransmission capacity to Sussex Inlet ZS
PR283	Tomerong 132/11kV ZS establishment	7.00	Provide firm capacity
PR287	Penrith Panther 132/11kV ZS establishment	7.00	Provide firm capacity to supply the development at Penrith Panthers
PR288	Holroyd 330/132kV BSB associated works	7.00	Provide subtransmission capacity
PR289	Southwest Sector additional works	15.00	Provide firm subtransmission capacity to the South West Sector
PR290	Bellavista ZS - Parklea ZS 132kV cable link	10.00	Provide firm subtransmission capacity to the North West Sector
PR292	Marsden Park 132/11kV ZS establishment (possible 132/22kV)	8.00	Provide firm capacity to the North West Sector
PR294	Marsden Park West 132/11kV ZS establishment (possible 132/22kV)	12.00	Provide firm capacity to the North West Sector
PR296	Box Hill North 132/22kV ZS establishment with 132kV links	20.00	Provide firm capacity to the North West Sector
PR297	Campbelltown ZS transformer augment	1.50	Provide firm capacity
PR299	Rebuild Camden ZS to 66/11kV	8.00	Provide firm capacity
PR300	Convert Nepean 132/33kV to 132/66kV	4.00	Provide firm capacity
PR301	Oasis 132/11kV ZS establishment (ELTS Stage 3)	11.00	Provide firm capacity to supply the development at the Oasis
PR302	Convert Bringelly ZS to 132/11kV (SW sector)	12.00	Provide firm capacity
PR303	Mittagong ZS transformer augment	1.00	Provide firm capacity
PR304	Robertson ZS transformer augment	1.00	Provide firm capacity
PR305	Appin ZS transformer augment	2.00	Provide firm capacity
PR308	Granville ZS rebuild at new site	8.00	Provide firm capacity
PR309	Yatte Yattah ZS transformer augment	1.00	Provide firm capacity
PR310	Augment feeders 443 & 458 tee Cattai	0.80	Provide subtransmission capacity
PR311	Quakers Hill ZS Second 132kV feeder	3.00	Provide additional subtransmission capacity to Quakers Hill ZS
PR312	Quakers Hill ZS 2nd 132/11kV Transformer	1.50	Provide firm capacity
PR313	Quakers Hill ZS 3rd 132/11kV Transformer	2.00	Provide firm capacity
PR314	Douglas Park SS Rebuild	5.00	Provide additional subtransmission capacity to the South Nepean area
PR315	Douglas Park 66/11kV Customer ZS	0.50	Provide firm capacity to supply a customer development
PR317	Blacktown North 33/11kV ZS establishment	10.00	Provide firm capacity to supply developments at north Blacktown
PR318	Warragamba transformer augment	0.20	Provide firm capacity
PR319	Bonnyrigg ZS transformer augment	4.00	Provide firm capacity
PR320	WLTS - Bonnyrigg 3rd 33kV line	2.00	Provide additional subtransmission capacity to Bonnyrigg ZS
PR321	ELTS - Install Transformers & 33kV Bus Works (ELTS Stage 4)	6.00	Provide firm capacity to the Liverpool region
PR322	132kV cable loop ELTS-Oasis-Liverpool North-ELTS (ELTS Stage 2)	5.00	Provide additional subtransmission capacity to supply the Liverpool region
PR324	Third 132kV link WLTS-ELTS - part 508 (ELTS Stage 5)	6.00	Provide additional subtransmission capacity to ELTS
PR325	ELTS 3rd 120 MVA 132/33kV Tfr (ELTS Stage 6)	2.00	Provide firm capacity to ELTS
PR326	Glenfield 33/11kV ZS establishment with link to ELTS or WLTS	9.00	Provide firm capacity to the Glenfield area
PR327	ELTS 4th 120 MVA 132/33kV Tfr (ELTS Stage 7)	2.00	Provide firm capacity to ELTS
PR328	Kemps Creek ZS transformer augmentation (2x25 spares)	0.30	Provide firm capacity to Kemps Creek ZS