

Capital Expenditure: Expenditure Justification Cover Sheet

Project name	Belconnen Zone Substation third transformer augmentation
Expenditure type	Capital Expenditure
Business Group	Asset Strategy & Planning
Period	1 July 2014 to 30 June 2019
Five year total spend	\$0M
CAPEX category & Primary Drivers	<ul style="list-style-type: none"> • Deferred Augmentation Capex • Compliance with reliability and security of supply obligations <ol style="list-style-type: none"> 1. National Electricity Law Chapter 7 <i>The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to—</i> <ol style="list-style-type: none"> (a) price, quality, safety, reliability and security of supply of electricity; and (b) the reliability, safety and security of the national electricity system 2. Compliance with Utilities (Management of Electricity Network Assets Code) Determination 2013 <i>This Code requires electricity distributors to protect integrity and reliability of the electricity network and to ensure the safe management of the electricity network without injury to any person or damage to property and the environment.</i>

Version control

Date	Version	Description	Reviewed	Author
28/05/14	0.1	Final version submitted to ActewAGL	F Gotla	Jacobs
02/06/14	1.0	Reviewed for ActewAGL Approval	S. Turki	Jacobs
16/12/14	1.1	Revision and update in response to AER's draft decision on regulatory pricing proposal 2hour emergency rating increased and 2014 demand forecast added.	D Stanley	G Pallesen
22/12/14	1.2	Update summer demand forecast chart to include the visual change in 2 hour emergency forecast in 2013.	D Stanley S Devlin ¹	G Pallesen
14/01/15	1.3	Inclusion of Feeder names for load transfers	D Stanley	G Pallesen

Referenced documents

Document	Version
National Electricity Rules	Version 66
ActewAGL Peak Demand Forecast 2014	2014
National Electricity Law Chapter 7A "Revenue and Pricing Principals"	19.12.2013
National Electricity Rules Chapter 6.5.7 Forecast capital expenditure	V66
Utilities Act (ACT)	2000
Utilities (Management of Electricity Network Assets Code) Determination	2013

Approval

----- Manager Primary Systems Strategy	_____ Signature	----- Date
----- Branch Manager Asset Strategy and Planning	_____ Signature	----- Date

¹ Steve Devlin approved the recommended approach in this document in an email dated 22 Dec 2014. This is a change from previous third transformer recommendation.

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Executive Summary

This Project Justification Report investigates and recommends pursuing Demand Side Management and Load transfer Options to maintain N-1 security at Belconnen Zone Substation during the 2014-19 regulatory period.

Belconnen Zone Substation is the primary source of power supply for the Belconnen Town Centre and residential area as well as surrounding residential and commercial areas. It supplies power to a number of Australian Government department head offices, the Calvary Hospital, and Westfield Belconnen shopping centre.

For a mixed commercial / residential load such as that supplied by Belconnen Zone Substation, long term planning to meet the security and reliability of supply obligations set out in the National Electricity Rules (NER) requires that system security at the zone substation level needs to provide for a long term transformer overload criteria and rating that allows sufficient time for the replacement of a transformer. Typically this period would be four to six months.

Belconnen Zone Substation operates above its continuous rating but lower than its two hour emergency rating. The 2014 demand forecast highlights the demand on Belconnen Zone Substation will encroach upon, but not exceed the two hour emergency rating.

The ActewAGL planning criteria requires the system be designed to a two hour emergency rating, and requires that the load be reduced to the cyclic rating² within two hours and the subsequent load be maintained at a level below the cyclic rating to avoid excessive loss of transformer life.

The 2014 demand forecast results in a suppressed forecast to 2024. This suppressed forecast, in part, is caused by the unusual mild summer conditions in 2012 resulting in low demands over the forecast period.

Based on historical trends, likely medium term (2-5 year) developments in the Belconnen supply area, and a normalisation of weather conditions the Belconnen Zone Substation is forecast to approach its two hour emergency rating by 2019 as shown below in Figure 1 and Table 1.

² The cyclic rating is 115% of the nameplate or continuous rating i.e. 115% of 55MVA = 67MVA

Figure 1: Forecast Demand and emergency rating, including proposed 3rd transformer

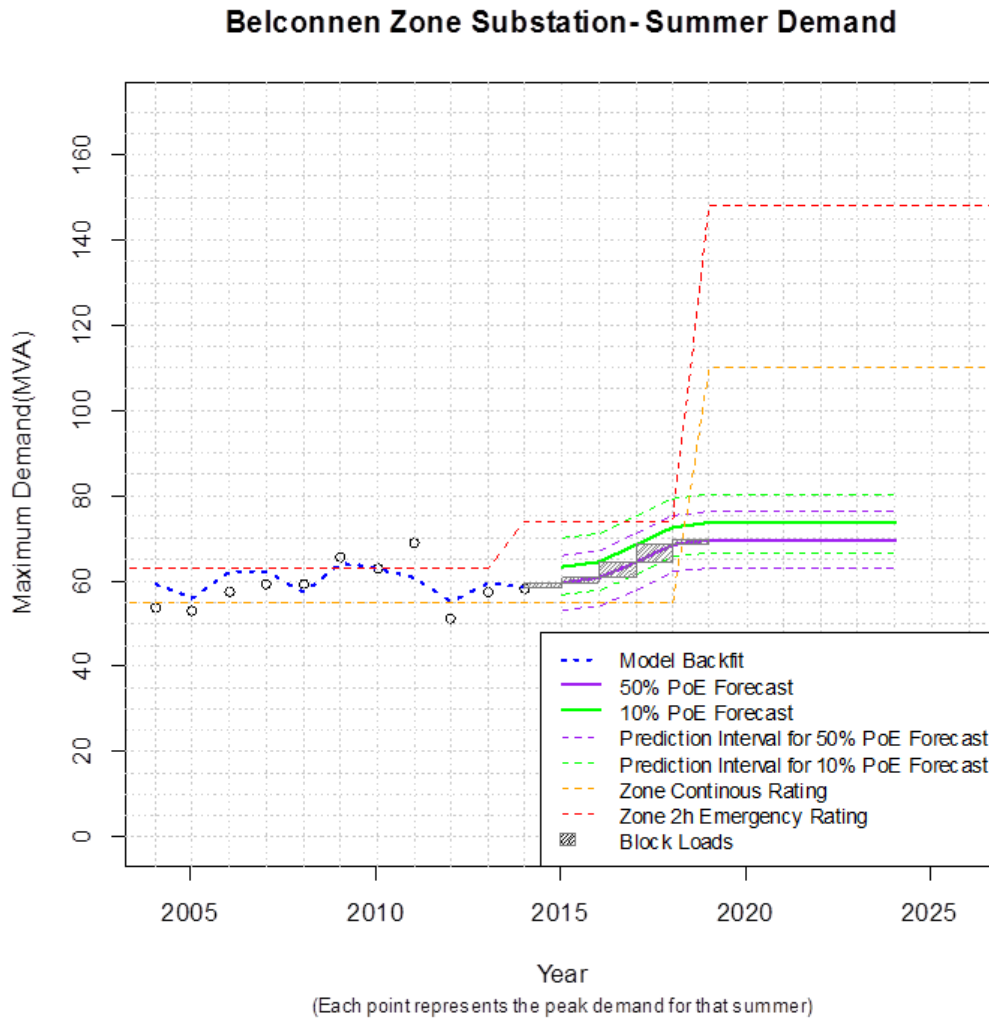


Table 1: Belconnen Zone Station 2014 forecast (including block loads)

Final Forecast (Incorporating Block Loads)		
Summer ending Feb	50% PoE (in MVA)	10% PoE (in MVA)
2015	59.5	63.4
2016	60.6	64.5
2017	64.4	68.3
2018	68.6	72.5
2019	69.6	73.5
2020	69.6	73.5
2021	69.6	73.5
2022	69.6	73.5
2023	69.6	73.5
2024	69.6	73.5

The demand forecast is reviewed annually and it is recommended that the demand growth on the Belconnen Zone Substation be closely monitored, and budget allowances be made in the upcoming regulatory period as recommended in this report.

Investigation of the options to mitigate the “approaching the two hour emergency rating in 2019” demand constraint included:

- **Option 1** - The ‘do nothing’ option considered continued supply of power from the Belconnen Zone Substation with no augmentation or demand reduction considerations. This option is marginal as it is not considered prudent for Belconnen Zone Substation to be encroaching a continuous demand that encroaches on the two hour emergency capacity rating. The monitoring of the actual demand as part of the annual demand forecast process will provide guidance to AAD as to whether the demand is remaining stable, increasing beyond forecast or declining.
- **Option 2** – Construction of a new single transformer 132/11kV substation in the vicinity of Mitchell to offload Belconnen Zone Substation, and to cater for future load growth in the suburbs to the north and east of Canberra city. A single transformer zone substation is estimated to cost in excess of \$20M.
- **Option 3** - Non-network and demand side management options were considered with an expected reduction of demand in the order of 4.5MVA. This potential load reduction is being assessed in 2014/15. Existing embedded generation in the Belconnen area is assumed to be accounted for in the demand forecast and there is no known or probable future large scale embedded generation in the Belconnen distribution area. Solar and PV installations have achieved considerable penetration in Canberra, and the impact on demand reduction in the Belconnen area is evident in historical results, and reflected in the demand forecast.
- **Option 4** - Augmentation of the Belconnen Zone Substation to include a third 55 MVA transformer was investigated and identified as not being necessary based on the current demand forecast information and the available options to either transfer load or implement a demand side management solutions. If and when this option becomes viable, it will be subject to the Regulatory Investment Test – Distribution process (RIT-D) as defined in section 5.17 of the National Electricity Rules.
- **Option 5** – Load Transfers of approx. 11.8MVA have been assessed as a viable alternative to defer the augmentation of a third transformer at the Belconnen Zone Substation until at least the next 2019-2024 regulatory period.

AAD has various regulatory obligations in the supply of electricity. These include:

National Electricity Law Chapter 7 —National electricity objective

The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for **the long term interests of consumers** of electricity with respect to

- (a) price, quality, safety, reliability and security of supply of electricity; and
- (b) the reliability, safety and security of the national electricity system. “

6.5.7 Forecast capital expenditure

(a) A *building block proposal* must include the total forecast capital expenditure for the relevant *regulatory control period* which the *Distribution Network Service Provider* considers is required in order to achieve each of the following (the *capital expenditure objectives*):

- (1) meet or manage the expected demand for *standard control services* over that period;
- (2) **comply with all applicable regulatory obligations or requirements** associated with the provision of *standard control services*;
- (3) to the extent that there is no applicable *regulatory obligation or requirement* in relation to:
 - (i) the quality, reliability or security of supply of *standard control services*; or
 - (ii) the reliability or security of the *distribution system* through the supply of *standard control services*,

to the relevant extent:

- (iii) **maintain the quality, reliability and security of supply** of *standard control services*; and
- (iv) **maintain the reliability and security of the distribution system** through the supply of *standard control services*; and
- (4) **maintain the safety** of the *distribution system* through the supply of *standard control services*.

The methodology and estimated costs are developed through the application of industry knowledge and Good Engineering Operating Practices based on historical similar projects. This approach complies with paragraphs 6 & 7 of National Electricity Law (NEL).

NATIONAL ELECTRICITY (NSW) LAW - SECT 7A

Revenue and pricing principles

When providing an estimate for a project, state that the estimate is commensurate with the economic costs and risks of the potential for under and over investment by a regulated network service in reference to Section 7A of the National Electricity Law, paragraph 6 & 7.

AAD has an obligation to comply with the Utilities Act 2000 (ACT) which imposes specific technical, safety and reliability obligations on AAD.

Utilities (Management of Electricity Network Assets Code) Determination 2013

The Management of Electricity Network Assets Code is a technical code under Part 5 of the *Utilities Act 2000* (the Act).

5.3 Safe Design, Construction, Operation and Maintenance

- (1) An electricity distributor must design, construct, operate and maintain its aerial lines, underground lines, substations, equipment and metering with reasonable care to avoid injury to any persons or damage to property or the environment and to provide a reliable and efficient power supply.

1. Strategic Context & Expenditure Need

1.1 Project Objectives

The objectives of the Belconnen Zone Substation demand constraint mitigation project are to:

- Achieve appropriate capacity for the expected demand in the Belconnen distribution area over the extent of the 2014 - 2024 forecast period
- Achieve and maintain the security of supply at the Belconnen Zone Substation for the extent of the 2014 - 2024 forecast period
- Ensure the reliability of supply to the existing and future Belconnen District customers
- Identify and select a prudent and cost efficient network or non-network augmentation solution that:
 - *meets the required network planning criteria and performance standards*
 - *complies with all relevant legislation, regulations and administrative requirements*
 - *is able to be implemented within the time required*

1.2 Belconnen Zone Substation Description

The Belconnen Zone Substation is the primary source of power supply for the Belconnen Town centre and the surrounding residential areas. It was built in 1976 and has been servicing the Belconnen District for 36 years. The substation was designed as a two 132 kV/11 kV power transformer substation with two 11 kV switchboards.

The continuous rating of this substation is 55 MVA in both summer and winter.

The two hour summer emergency capacity of the substation, which was recently increased in 2013 by the upgrading of the 11kV transformer cables, is 74 MVA. This rating represents the allowable peak load that the substation can supply for a period of two hours, while tolerating an acceptable rate of deterioration of the electrical equipment (mainly the transformers). The two hour period allows for manual load transfers to be undertaken reducing the load on the affected substation to within its longer term 6 month cyclical thermal limits.

Belconnen Zone Substation is a summer peaking station and the two hour timeframe may not always be achievable, especially during the summer months. A number of factors affect the ability to transfer load away from Belconnen including the limited number of feeder ties available (four 11kV ties with Latham, two with Civic, and two with Gold Creek), the existing loading on tie feeders, and the variation in daily and annual load curves.

1.3 Load Demographics

Belconnen is one of the original districts of the Australian National Capital and is subdivided into 25 suburbs, sections and blocks. As at the 2011 census, the district had a population of 92,444 people and was the most populous district within the Australian Capital Territory (ACT). It is situated approximately 7 km to the north-west of the central business district of Canberra.

Within the Belconnen Town Centre are a number of Australian Government department head offices including the Department of Immigration and Border Protection, the Australian Bureau of Statistics, the Australian Broadcasting Authority, the Australian Communications and Media Authority, and the Australian Taxation Office.

The Calvary Hospital is a privately operated public hospital, located in the Belconnen suburb of Bruce. Also in the suburb of Bruce are a number of sporting and education facilities including the University of Canberra (UC), the Canberra Institute of Technology (or CIT), the Australian Institute of Sport (AIS), and Canberra Stadium.

Belconnen's retail and commercial development revolves predominantly around the Westfield Belconnen shopping centre located within the Belconnen Town Centre. Additional local commerce activity includes large and smaller department stores, clothes retailers, car dealerships, homeware stores, supermarkets, and specialist grocery outlets.

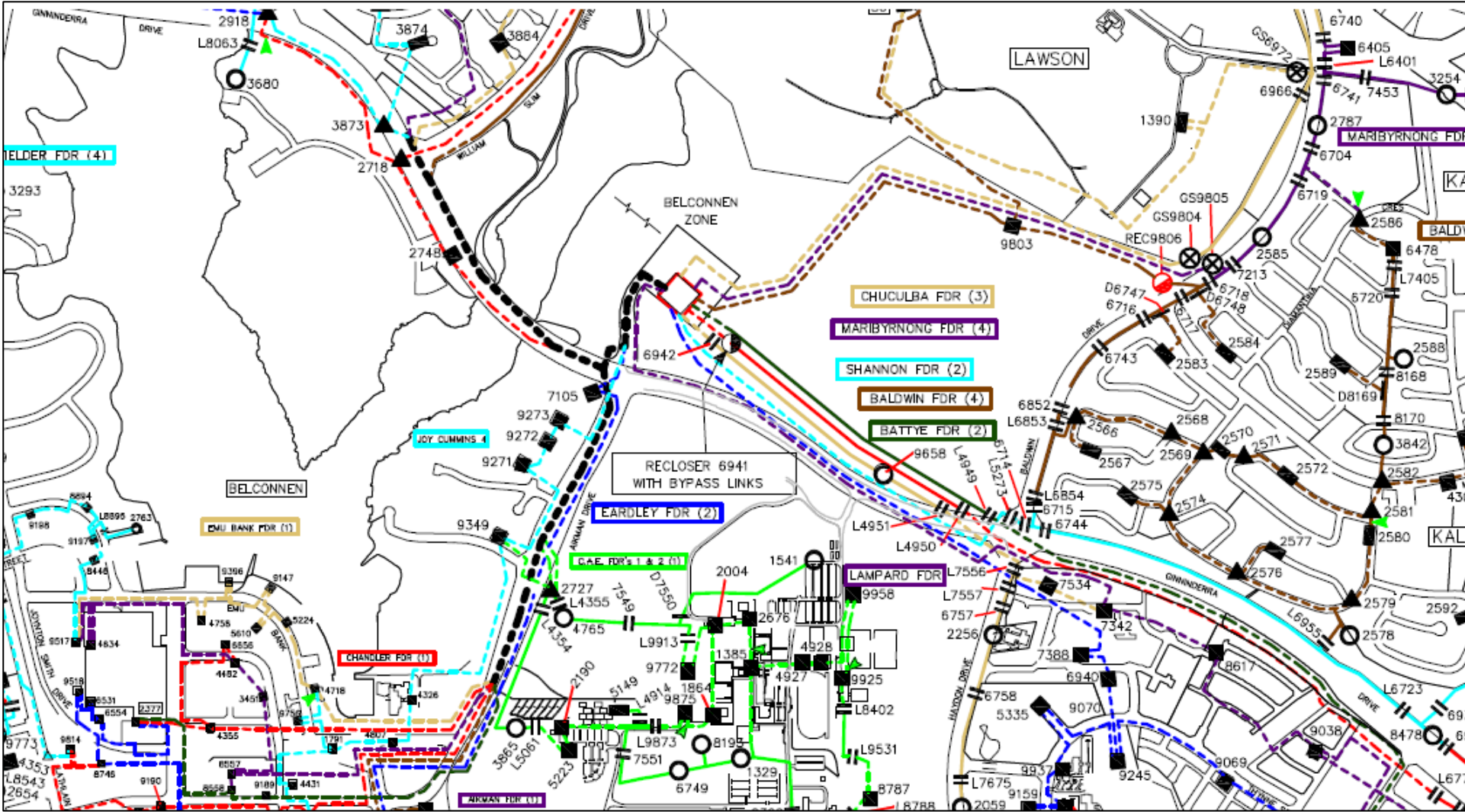
The residential and industrial development in the area is characterised by predominantly detached single family homes on suburban blocks, with pockets of medium density housing units or town houses. The most recent suburb to be gazetted, in 1986, is Lawson where infrastructure works have commenced and residential development is currently in progress.

The industrial sector of Belconnen consists of some light industry and manufacturing, including automotive repair, plumbing, electrical, building, etc. as well as small arts and crafts manufacturing and sales outlets. There is no heavy industry.

There is a significant primary industry producer nearby providing eggs to Canberra and the surrounding region.

Figure 2 shows the Belconnen distribution area and the immediate surrounding suburbs of Belconnen, Lawson, McMellar, and Bruce.

Figure 2: Belconnen Zone Substation Distribution Area



1.4 Demand growth

The demand forecast for the ActewAGL network is reviewed annually on a zone substation by zone substation basis. Known and probable customer initiated projects are analysed and where these spot loads are substantially above historical load growth the forecast is adjusted accordingly.

The summer demand forecast for the Belconnen Zone Substation is provided in Figure 1

The demand forecast considers both a 50% and a 10% PoE, and provides a prediction interval range around the base line forecast to account for demand increases which have been excluded from the baseline forecast and a minimum demand increase accounting for lower than expected demand growth.

The forecast in Figure 1 presents a suppressed projection of demand for the Belconnen District, and is impacted by the mild weather conditions in 2012/13 that resulted in the maximum summer demand at Belconnen being 26% lower than the 2011/12 maximum demand, and 18% lower than the average of the preceding 5 years. The 2013/14 peak summer demand was up from the 2012/13 demand, but still below the 2011/12 maximum demand, resulting in the demand forecast that is essentially flat over the 2014-19 regulatory period.

It is highly probable that as more normal summers and winters are experienced, positive maximum demand growth will recur. Historical trends, known and probable customer projects, and the normalisation of weather patterns are strong indicators that continued demand growth can be expected over the next five year period.

The Belconnen distribution area has been identified from the AAD database of known and probable new customer connections, as the highest demand growth area in the AAD network. The minimum demand increase by 2015 is estimated at 3.56 MVA.

Block loads identified in the 2014 Demand Forecast report, are included in Figure 1 and account for a probability weighted demand increase of around 1 MVA by the end of 2014 with further block load developments over and above the normal growth beginning in 2015 as the Lawson commercial and residential release commences. These expected block load increases are provided in Table 3 below.

Table 3: Belconnen Zone Substation block loads

Development type	Supply source feeder	Supply source zone sub	Expected ADMD Increase (MVA)	Supply Required Date	Project probability
Residential	Baldwin	Belconnen	0.02	1/10/2014	90%
Residential	Cameron South	Belconnen	0.78	1/10/2014	100%
Commercial	Haydon	Belconnen	0.0025	31/05/2014	100%
Commercial	Swinden	Belconnen	0.32	1/01/2016	100%
Community	Swinden	Belconnen	0.22	15/09/2014	100%
Commercial	William Slim	Belconnen	0.4	1/07/2015	100%
Commercial	Swinden	Belconnen	0.19	1/09/2015	50%
Commercial	Latham 3	Belconnen	0.05	1/01/2016	100%
Lawson South Stage 1	Chuculba & Baldwin	Belconnen	2.58	31/12/2015	10%
Lawson South Stage 1	Maribyrnong	Belconnen	2.58	31/12/2016	70%
Lawson South Stage 1	Maribyrnong	Belconnen	2.58	31/12/2017	20%
Lawson South Stage 2	NA	Belconnen	5.20	31/12/2016	10%
Lawson South Stage 2	NA	Belconnen	5.20	31/12/2017	70%
Lawson South Stage 2	NA	Belconnen	5.20	31/12/2018	20%
UC Hospital Expansion	NA	Belconnen	3.00	31/12/2016	50%

1.5 Effects of embedded generation in the Belconnen District

Large scale embedded generation units connected to the AAD network are required to be scheduled in accordance with AEMO as intermittent generators whereas smaller PV units are not required to be registered as all units have either automatic or small generation exemption.

The majority of future embedded generation in the ACT in the next 5 years is likely to be large scale Solar PV farms with an anticipated future total capacity of approximately 40MW.

AAD is currently not aware of any new large scale generators planned that would impact on the Belconnen supply area. There is an existing bio-gas generator (3 MVA) located at the Belconnen Waste Transfer Station that connects into the Belconnen Zone Substation. The availability of supply from this plant is uncertain and has not been included in the analysis.

Small scale solar PV panels are installed at the domestic level to low voltage (230/400V) distribution network. Information regarding small scale embedded generation connected in the Belconnen supply area is provided in Table 2

Table 2: Belconnen Domestic Embedded Generation (Solar Panels) – Sept 2013

Suburb	Sites Connected	Installed capacity (kW)
Belconnen	96	326
Belconnen District	7	89
Total	103	415

As of 30 September 2013 the total capacity of embedded generation connected in the Belconnen distribution network was 415kW and there were 103 customers with embedded PV systems connected to the distribution network.

The forecast system growth in PV installations for the next 5 years is expected to remain stable at historic trend levels. Based on these system wide historical trends the projected number of installations in the Belconnen distribution area will be approximately 157 installations with an installed capacity of 627 kW.

The power generation from solar PV systems at its peak generation is generally only approximately 75% of its nominal rated capacity. This is due to a variety of losses associated with inefficiencies and mismatches inherent in the system. The peak generation rate also varies significantly based on the time of day and the season and rarely coincide with system peak demand periods.

An analysis of the effect of solar PV generation during peak demand periods in the Belconnen District found that it has a potential to reduce demand on the Belconnen Zone Substation by only 0.7 MVA and 0.2 MVA in the summer and winter months respectively by 2017.

1.6 Network Planning Criteria

As a prudent and efficient network operator AAD is required to take all reasonable steps to maintain sufficient network capacity while protecting the integrity and reliability of supply to meet customer demands. This requirement is obligated under the Electricity Distribution (Supply Standards) Code, December 2000.

The ActewAGL Distribution Network Augmentation Criteria directs the planning standards and targets for the augmentation and expansion of the distribution network in compliance with the Code and considers all the key components of the distribution network, including zone substations. In relation to zone substations, the criteria require that an N-1 security of supply be maintained, and that network elements with N-1 security standards have sufficient capacity to carry the expected maximum load under single contingency condition with no loss of load.

To meet the required supply security, the criteria requires that the zone substations not exceed their two-hour emergency rating under 10% PoE demand conditions.

2. Regulatory Compliance

It is a legal and regulatory obligation under the NEL, NER and Utility Act (ACT) for AAD to maintain security of supply and system reliability whilst proactively promoting the national electricity objective of making efficient investments in the longer term interests of the consumers.

Based on historical trends, likely medium term (2-5 year) developments in the Belconnen supply area, and a normalisation of weather conditions the Belconnen Zone Substation is forecast to approach its two hour emergency rating by 2019.

2.1 Reliability and security of supply:

The recommended option considers it basis of being the preferred option as being the best option in the long term interests of the consumers. The 2014 demand forecast does not clearly provide a driver to augment the AAD network, but leaves AAD with the need to reduce the demand on the Belconnen Zone Substation to a level that reduces the likelihood and hence lowers the risk profile, of the load on the Belconnen Zone Substation exceeded its two hour emergency rating. The preferred option is to transfer load from the Belconnen Zone Substation to the two (2) adjacent zone substations using existing 11kV feeder infrastructure.

National Electricity Law Chapter 7 —National electricity objective

The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for **the long term interests of consumers** of electricity with respect to

- (a) price, quality, safety, reliability and security of supply of electricity; and
- (b) the reliability, safety and security of the national electricity system. “

6.5.7 Forecast capital expenditure

(a) A *building block proposal* must include the total forecast capital expenditure for the relevant *regulatory control period* which the *Distribution Network Service Provider* considers is required in order to achieve each of the following (the *capital expenditure objectives*):

- (1) meet or manage the expected demand for *standard control services* over that period;
- (2) **comply with all applicable *regulatory obligations* or requirements** associated with the provision of *standard control services*;
- (3) to the extent that there is no applicable *regulatory obligation* or requirement in relation to:
 - (i) the quality, reliability or security of supply of *standard control services*; or
 - (ii) the reliability or security of the *distribution system* through the supply of *standard control services*, to the relevant extent;
 - (iii) **maintain the quality, reliability and security of supply** of *standard control services*; and
 - (iv) **maintain the reliability and security of the *distribution system*** through the supply of *standard control services*; and
- (4) **maintain the safety** of the *distribution system* through the supply of *standard control services*.

AAD has an obligation to comply with the Utilities Act 2000 (ACT) which imposes specific technical, safety and reliability obligations on AAD.

Utilities (Management of Electricity Network Assets Code) Determination 2013

The Management of Electricity Network Assets Code is a technical code under Part 5 of the *Utilities Act 2000* (the Act).

5.3 Safe Design, Construction, Operation and Maintenance

(1) An electricity distributor must design, construct, operate and maintain its aerial lines, underground lines, substations, equipment and metering with reasonable care to avoid injury to any persons or damage to property or the environment and to provide a reliable and efficient power supply.

2.2 Cost compliance:

Cost compliance is achieved by proactively pursuing the philosophy of compliance with the national electricity objective by fully exploring and evaluating all alternatives technically and commercially so as to seek approval for a solution which provides an the grounds for an efficient investment while meeting the long term interests of the consumers.

The investment value has been determined using the 2014/15 market prices. This approach complies with paragraphs 6 & 7 of National Electricity Law (NEL).

NATIONAL ELECTRICITY (NSW) LAW - SECT 7A

Revenue and pricing principles

When providing an estimate for a project, state that the estimate is commensurate with the economic costs and risks of the potential for under and over investment by a regulated network service in reference to Section 7A of the National Electricity Law, paragraph 6 & 7.

3. Options assessment

A number of potential network and non-network alternatives have been considered for relief of the future capacity constraints at Belconnen Zone Substation, and these are discussed below:

Option 1: Do Nothing

With Belconnen Zone Substation currently operating above its continuous rating and forecast to encroach the two hour emergency rating during the 2014-19 regulatory period the 'do nothing' option would leave the substation at risk during peak demand periods of going above the two hour emergency rating. While the 'do nothing' option remains viable based on the 2014 demand forecast, AAD are planning to lower the risk profile by seeking a cost effective method of removing load from the Belconnen Zone Substation which relieves the load profile to be lower than the forecast encroachment on the two hour emergency rating.

The Belconnen Zone Substation forecast will be monitored on an annual basis to assess if there are changes to the actual and forecast demand that are of a sufficient level to drive a network augmentation capacity increase project.

Option 2: Construction of a new single transformer 132/11kV substation

Option 2 considered a new 132/11kV substation being built, most likely in the general area of Mitchell, and this substation would be used to off-load the Belconnen Zone Substation. The new substation would be equipped with a single 132/11kV transformer, and would be of a configuration similar to the proposed Molonglo Zone Substation.

Depending on the amount of load transferred from the Belconnen Zone Substation, and the subsequent load growth in the supply area of the new substation, a second 132/11 kV transformer would be installed when the total load on the substation reached approximately 15MVA.

The new zone substation could be sited in the near vicinity of the Bruce to Gold Creek 132kV transmission line, to minimize 132kV connection costs.

Under option 2, no augmentation would be required at Belconnen Zone Substation.

Option 2 is considered to be technically and operationally feasible, but is not prudent or efficient in that the capital expenditure would be well in excess of \$20M, significantly higher than a capacity expansion at the Belconnen Zone Substation.

Option 3: Non-network Demand side management

ActewAGL is investigating potential demand side solutions in order to relieve the demand on the Belconnen Zone substation thereby deferring capacity upgrade works.

A number of demand side management solutions are, and will continue to be considered, with peak demand reduction expected to be in the vicinity of 4.5 MVA. Evaluation and the preliminary assessment of potential options is scheduled to be complete by July 2015 with implementation of the preferred solution taking approximately 2 to 18 months thereafter. The implementation of these DSM options will occur after load transfers with the timing anticipated in the 2019-2024 period.

This Demand Side Management solution assists in the deferral of the Belconnen Zone Substation works and this combined with load transfers to adjacent zone substations will successfully lower the forecast demand on the Belconnen Zone Substation below the two hour emergency rating.

Option 4: Substation Augmentation: Third Transformer

The opportunity to augment the Belconnen Zone Substation with the installation of a third transformer was investigated.

The scope of the augmentation includes:

Belconnen Zone Substation Works

- Install & commission 3 x 132kV switchgear bays (line bay, transformer bay & bus section)
- Install & commission 1 x 132kV/ 11kV Power Transformer and NET
- Install & commission 1 x 11kV Switchboard
- New 11kV switch room building.
- Commission all associated protection and control for the above assets.

132kV Line Augmentation Works

- Towers and structures to connect 132kV sub-transmission line to the new line bay.

The effect of the third transformer will be to upgrade the N-1 rating of the substation to the capacity of two transformers. The revised N-1 ratings will be as follows

Nameplate Rating:	110 MVA
Cyclic Rating:	126 MVA
Two hour Emergency	148 MVA

The capital cost estimate for this option is \$12.7M (2013/14 direct costs).

Option 4 represents a technically and operationally feasible option, but based on the 2014 demand forecast is not required in the 2014-19 regulatory period as the demand forecast encroaches but does not exceed the two hour emergency rating planning criteria and further to this, there are two non-network options that reduce the load on the Belconnen Zone Substation, that being: 4.5MVA based on a Demand Side Management solution and up to 11MVA based on load transfer options.

Option 5 - Load Transfers

Load transfers between zone substations are being, and will continue to be, exploited to defer the pending overload at Belconnen Zone Substation for as long as possible prior to implementation a capacity upgrade at Belconnen Zone Substation. Discussions with AAD's Operations and Asset Strategy and Planning primary systems personnel, it is currently possible to transfer up to 11 MVA away from Belconnen Zone Substation as shown in

Table 3.

Table 3: Potential Load Transfers from Belconnen Zone Substation

Feeder	Transfer to Zone Substation	Load Transfer - MVA
<ul style="list-style-type: none"> • Swinden 	City East	2.30
<ul style="list-style-type: none"> • Benjamin • Hayden • Swinden 	Civic	3.60
<ul style="list-style-type: none"> • Maribyrnong • Meacham • Swinden • William Slim 	Gold Creek	3.60
<ul style="list-style-type: none"> • Bean • Cameron STH • Chan • Emu Bank • Laurie • McGuinness • Meacham 	Latham	2.30
Total		11.80

4. Option Comparison and Recommendation

4.1 Option Comparison

A preliminary comparison of total capital costs, and NPV evaluation has been carried out on the preferred option, and those alternative options for which sufficient information is currently available, and the results are summarised in Table 4 below:

Table 4: Estimated capital costs of options

	Options	Approx Capital \$M	Implementation Feasibility of Option
1	Do Nothing	N/A	Do nothing may be viable based on the demand forecast not exceeding the two hour emergency rating, but prudence is required in finding a solution to remove the encroachment on the two hour emergency rating in the 2014-19 regulatory period
2	New 132/11kV substation similar to Molonglo Zone Substation (inclusive of 11kV feeder costs)	\$29.2	No upgrade costs at Belconnen Zone Substation. New zone substation to support demand growth is not warranted in the 2014-19 regulatory period.
3	Demand Side Management	\$1.2 ³	4.5MVA potential reduction in load on the Belconnen Zone Substation. Recommended this is pursued in association with load transfers. This option is to occur after load transfers, with the timing in 2019-2024.
4	Belconnen Upgrade (including 11kV feeder costs)	\$16.7	Technically and operationally feasible option
5	Load transfers to existing zone substations	N/A	This is a business as usual opex cost for AAD and is the preferred option to transfer up to 11.8MVA from the Belconnen Zone Substation demand. The recommendation is to implement this in association with DSM options. This option is planned for implementation in 2014-2019.

³ AAD are completing preliminary DSM investigations in 2014/15. A notional value of \$250k per 1 MVA offset is included for comparison purposes. i.e. AAD would contribute \$250k for every MVA that could be removed from the Belconnen Zone Substation Demand on a long term commercial basis.

4.2 Recommendation

The implementation of both Option 3 Demand Side Management and Option 5 Load Transfer is considered the most prudent and efficient solution to relieve Belconnen Zone Substation of up to 16.3MVA. The timing for implementing Option 3 Demand Side Management is likely to be in the 2019-2024 regulatory period. The effect of implementing this solution will be included in the annual demand forecast process at which time the inputs of potential abnormal weather patterns or other spot loads will be considered and assessed for the need to provide a solution that considers the increase of capacity at the Belconnen Zone Substation.

This approach achieves the objectives of providing sufficient capacity for the projected demand, maintaining security of supply within the requirements of the Planning Criteria, and maintaining the reliability of supply to the Belconnen consumers. It promotes economic efficiency with respect to direct control network services in reference to National Electricity Rules Chapter 6.5.7 and to provide a solution in the long term interests of the consumer to be in compliance with the National Electricity Law Chapter 7.

The cost associated with the recommended option is provided in Table 5.

Table 5: 2014-19 Budgetary Requirement for recommended option

Option	Opex (\$2014/15)	Capex (\$2014/15)
3 - Demand Side Management	\$1.2M	\$0.0M
5 - Load Transfers	\$0.0M	\$0.0M
Total	\$1.2M	\$0.0M