REGULATORY INVESTMENT TEST

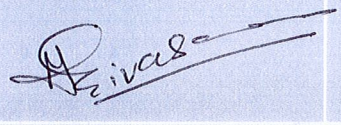
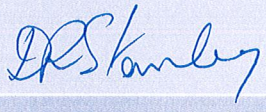
Molonglo Zone Substation

26 May 2014

Version 1.1

ActewAGL for you

Document Authorisation

Approved by (Signature)	Name	Role	Date
	Manoj Sivasane	Acting Zone Substations Planning & Performance Manager	29/05/14
	Dennis Stanley	Manager Asset Strategy & Planning	29/5/14
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EXECUTIVE SUMMARY

This application notice has been prepared to provide a basis for ActewAGL Distribution (ActewAGL) to consult with National Electricity Market registered participants, AEMO and interested parties on options for the development of a 132/11kV zone substation in the Molonglo District. The development of Molonglo Valley requires the provision of a zone substation to service the Molonglo area.

The proposed development would be classified as a new large distribution network asset under the National Electricity Rules.

This application notice is presented in the following sections:

Section 1 presents the scope and purpose of this augmentation including regulatory requirements.

Section 2 describes the limitations affecting the supply network in the area and the need for augmentation of supply to the area. The objectively measurable service standard (planning criteria), against which the need and effectiveness of augmentation options are to be assessed, is also discussed.

Section 3 presents three network augmentation options that have been identified to address the issues affecting the supply.

Option 1 Establish a new zone substation in the Molonglo District.

Option 2 Woden & Civic Zone Substations Feeder Augmentation.

Option 3 Demand Side Management.

Section 4 provides an evaluation of the options and presents an economic analysis of the preferred option. The outcome of the evaluation recommends establishing a new zone substation in the Molonglo District by 2017/18 as the preferred option.

ActewAGL recommended action is to implement Option 1 which is subject to outcomes of the consultation process.

The total capital cost of works associated with the construction of the new Molonglo zone substation is estimated to be $28.60M.

The proposed 132/11kV Molonglo zone substation is estimated to be commissioned in 2017/18.

Any enquiry relating to this Application Notice should be directed to ActewAGL using the contact details provided in Section 6.

1 INTRODUCTION

1.1 Purpose and Scope

ActewAGL owns the sub transmission and distribution networks within the ACT and is responsible for planning, developing and operating those networks. The National Electricity Rules (the Rules) require that the Distribution Network Service Provider (DNSP) consults with affected National Electricity Market (NEM) registered participants, Australian Energy Market Operator (AEMO) and interested parties on emerging limitations within its network and options considered to address the issues.

This application notice has been prepared in accordance with clause 5.15 and 5.17 of the Rules. It relates to a proposal for a new large distribution network asset that is required to meet existing and projected growth in demand in the Molonglo District in Canberra, ACT.

It includes:

- A discussion of the background and the need for the network investment;
- A description of all reasonable options that have been identified to meet the criteria;
- An analysis of these options in accordance with the Australian Energy Regulator's (AER's) regulatory test;
- A preliminary assessment of the outcome of the regulatory test application and preferred course of action; and
- An invitation to NEM registered participants, AEMO and interested parties to make submissions on this application notice.

1.2 Regulatory Requirements

1.2.1 Requirements of the National Electricity Rules

This application notice covers a proposal for a new large distribution network asset and is underpinned by clauses 5.6.2 (a), (b) and (c) of the Rules, which require network service providers to:

- Analyse their networks and conduct joint annual planning reviews to identify necessities for augmentation or extension of those networks;
- Undertake joint planning in order to determine plans that can be considered by registered participants, AEMO and interested parties.
- Carry out an economic cost effectiveness analysis of possible options to identify options that satisfy the regulatory test;
- Publish the results of the consultation and regulatory test analysis in a report that recommends the action to be taken.

1.2.2 Requirements of the Regulatory Test

The regulatory test may be applied in either one of two ways. The regulatory test, (set out in clause 5.6.5A) states that an option satisfies the test if:

(a) in the event the option is necessitated to meet the service standards linked to the technical requirements of schedule 5.1 of the Rules or in applicable regulatory instruments - the option minimises the costs of meeting those requirements, compared with alternative option/s in a majority of reasonable scenarios;

(b) in all other cases - the option maximises the expected net economic benefit to all those who produce, consume and transport electricity in the national electricity market compared to the likely alternative option/s in a majority of reasonable scenarios. Net economic benefit equals the market benefit less costs.

Thus for reliability or capacity driven augmentations clause (a) of the test should apply. That is, the option that satisfies the regulatory test is the one that minimises the cost of meeting the minimum network performance requirements set out in schedule 5.1 of the Rules or via a jurisdictional or customer requirement.

1.2.3 Material Internetwork Impact

The Rules require ActewAGL to assess whether a proposed new large distribution network asset is reasonably likely to have a material internetwork impact.

ActewAGL has determined that none of the works in the options described in Section 3 will impose power transfer constraints or adversely influence the quality of supply to adjoining transmission networks.

1.3 Existing Supply Arrangement

1.3.1 Development of Molonglo

The Molonglo District is situated in Canberra's west, approximately 10km from the Canberra Central Business District (CBD). It lies to the north of the urban areas of Weston Creek and south of Belconnen. Land servicing has commenced for the initial developments and when fully developed, the Molonglo District will support an estimated 55,000 people. Future land uses for the Molonglo District include residential, shopping centers, schools and community facilities.

There are four (4) existing zone substation facilities within 10km of the proposed Molonglo Zone Substation. These are Latham (8.5km), Belconnen (7.2km), Civic (5.3km) and Woden (5km). Figure 1 shows the geographical overview of ActewAGL 132kV network and zone substations surrounding the Molonglo District.

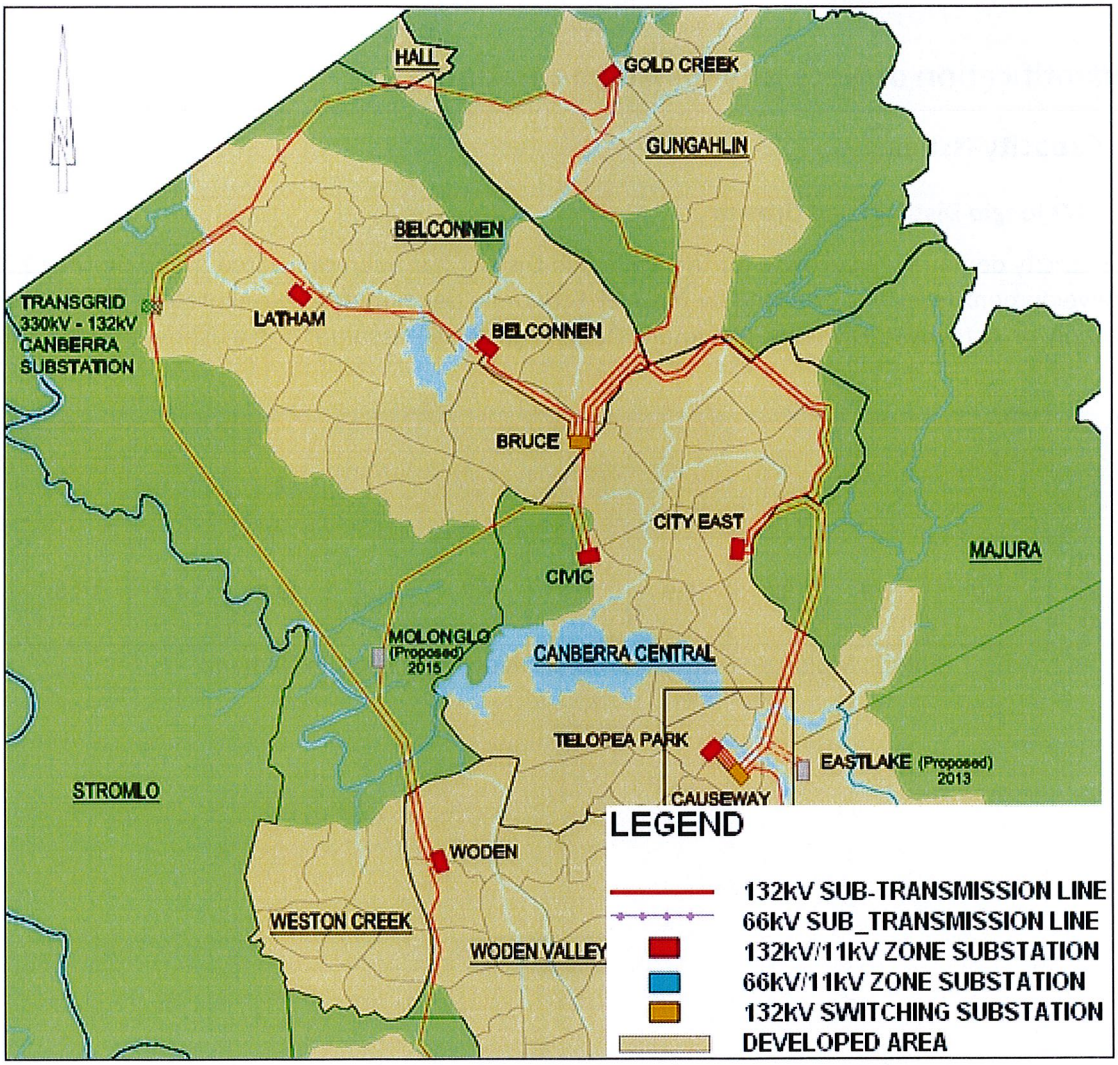

Figure 1: Geographical map of 132kV network and zone substations

Woden zone substation is presently servicing the Molonglo District by extending nearby 11kV feeders with available capacity. Augmentation works is planned for these feeders in 2015 – 2017. The load growth in the Molonglo District is forecast to exceed the augmented feeder capacity by 2017/18.

2 Identification of Necessity for Augmentation

2.1 Capacity Issues

2.1.1 Molonglo District Load Growth

The electricity demand load growth for the Molonglo District has been calculated based on May 2014 land development forecasts provided by the ACT Economic Development Directorate (EDD) and the application of ActewAGL Diversity Maximum Demand (ADMD) assumptions as shown in the table below.

Summer	May 2014	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24
Demand Forecast (MVA)	1.0	1.8	3.0	5.9	7.9	9.7	11.5	13.2	14.9	16.6	18.3

Table 1: Molonglo District Forecast Diversity Maximum Demand

2.1.2 Molonglo District Short Term Supply Strategy

The Molonglo District is presently supplied by an existing 11kV feeder (Cotter) from Woden zone substation. The network supply capacity can be increased by augmenting two additional Woden zone substation feeders (Streeton and Hilder).

This strategy enables the Molonglo District to be supplied from Woden zone substation until 2017/18. The three (3) 11kV feeders from Woden zone substation identified above have a total of 7.5MVA capacity to supply the Molonglo District. The forecast demand growth in the Molonglo District and short term supply strategy is show in table 2.

Year		14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22
Increase in Molonglo Demand (MVA)	By year	0.8	1.2	2.9	1.9	1.8	1.8	1.7	1.7
	Cumulative total	**0.8**	**2.0**	**4.9**	**6.9**	**8.7**	**10.5**	**12.2**	**13.9**
Feeder Capacity from Woden ZS (MVA)	Cotter	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Streeton		3.5	3.5	3.5	3.5	3.5	3.5	3.5
	Hilder			3.4	3.4	3.4	3.4	3.4	3.4
	Sub-total	0.6	4.1	7.5	7.5	7.5	7.5	7.5	7.5
Total 11kV Feeder Capacity (MVA)		0.6	4.1	7.5	7.5	7.5	7.5	7.5	7.5
Load at Risk (MVA)		0.2	0	0	0	1.2	3.0	4.7	6.4

Table 2: Molonglo District short term supply strategy

Woden zone substation has three (3) 132kV/11kV power transformers each rated at 50MVA. The zone substation has a continuous (N-1) rating of 95MVA and 100MVA in summer and winter respectively.

The load forecast for Woden zone substation has been analysed to consider the additional loading to service the Molonglo District. Woden zone substation does not exceed its summer or winter ratings under this Molonglo District short term supply strategy.

2.2 Requirements to meet Performance Codes

The *Electricity Distribution (Supply Standards) Code* issued by the ACT Independent Competition and Regulatory Commission (ICRC) sets out certain performance standards for the DNSP's network in the ACT. A DNSP is required to 'take all reasonable steps to ensure that its Electricity Network will have sufficient capacity to make an agreed level of supply available'.

The proposed augmentation is necessary to meet these standards and is also consistent with the design and planning guidelines established by ActewAGL management system procedure *No SR018 Network Augmentation Investment Criteria*. The processes defined in these criteria serves to limit network augmentation expenditure to instances where the increase in demand is clear and above the secure or firm capacity. The time-related components of the Criteria (for example, 'exceeding secure capacity for one per cent of the time') reflect additional risk, which is quantifiable and considered acceptable.

3 Options

3.1 Outline of Options

ActewAGL considered five options to supply the Molonglo District.

Option	Description	Evaluation
1	New Molonglo zone substation	Preferred
2	Upgrade existing 11kV Feeder from Civic (3 year deferral of Molonglo zone substation)	Not Preferred
3	Demand side management	Not Preferred
4	Construct new 11kV feeders from Latham zone substation	Discounted
5	Construct new 11kV feeders from Belconnen zone substation	Discounted

Table 3: Assessed options

Options 4 & 5 are discounted and a detailed evaluation of these options is not included in this report. In summary, 11kV feeders from Latham or Belconnen zone substations are not considered viable options as no existing 11kV feeders are in close proximity to the Molonglo District, the large distance from the zone substations prohibits suitable feeder implementation and the load forecasts for these substations are approaching the substation reliability ratings.

This section further evaluates options 1, 2 and 3.

3.1.1 Option 1: Establish new zone substation in the Molonglo District (preferred)

Option 1 proposes to establish a new 132kV/11kV zone substation in Molonglo by the end of 2017/18. ActewAGL (in consultation with the ACT Government) has identified a suitable site in the Molonglo District for the substation. This site has been granted the necessary ACT government approvals.

The new Molonglo zone substation would initially be equipped with 1 x 55MVA transformer with flexibility to add additional transformers to add redundancy, improve security of supply and substation capacity. The Molonglo zone substation would be supplied via two 132kV overhead feeders with provision for a future third underground 132kV feeder connection. The two 132kV feeders connect the substation into the ActewAGL sub transmission network by cutting into the existing 132kV line between Civic and Woden zone substations.

As described in section 2 of this report, the short term load growth until 17/18 in the Molonglo District will be met by planned augmentation works to three existing underground feeders from Woden zone substation.

In summary this option consists of the following components:

- Woden zone substation - augmentation works to three (3) existing 11kV feeders supplying the Molonglo District - 2014/15 to 2016/17.
- Build & commission Molonglo zone substation - 2015/16 to 2017/18
- Build new 11kV feeders from Molonglo zone substation 2016/17 - 2017/18

This option addresses the forecast load constraints in the Molonglo District and increases the Woden zone substation capacity by transferring the Weston Creek load from Woden to Molonglo zone substation.

The estimated capital cost of option 1 is $28.60 million. The Net Present Cost (NPC) including Operation & Maintenance costs (O&M) is $19.81 million.

Option 2: Upgrade 11kV feeder from Civic Zone Substation

Option 2 considers deferring the construction of Molonglo zone substation by a period of 3 years. This is achieved by upgrading an 11kV feeder (Blk Mtn) from Civic zone substation and extending the feeder to the Molonglo District. The table below highlights the deferral timing that is achieved.

Year		14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22
Increase in Molonglo Demand (MVA)	By year	0.8	1.2	2.9	1.9	1.8	1.8	1.7	1.7
	Cumulative total	**0.8**	**2.0**	**4.9**	**6.9**	**8.7**	**10.5**	12.2	13.9
Feeder Capacity from Woden ZS (MVA)	Cotter	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Streeton		3.5	3.5	3.5	3.5	3.5	3.5	3.5
	Hilder			3.4	3.4	3.4	3.4	3.4	3.4
	Sub-total	**0.6**	**4.1**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**	**7.5**
Feeder Capacity from Civic ZS (MVA)	Blk Mtn				3.0	3.0	3.0	3.0	3.0
Total 11kV Feeder Capacity (MVA)		**0.6**	**4.1**	**7.5**	**10.5**	**10.5**	**10.5**	**10.5**	**10.5**
Load at Risk (MVA)		0.2	0	0	0	0	0	1.7	3.4

Table 4: Molonglo District option 3 load at risk deferral timing

Civic zone substation has three (3) 132kV/11kV power transformers each rated at 55MVA. The zone substation has a continuous (N-1) rating of 110MVA in summer and winter.

The load forecast for Civic zone substation has been analysed to consider additional loading to service the Molonglo District via the Blk Mtn 11kV feeder. Civic zone substation does not exceed its summer or winter ratings using this strategy to supply the Molonglo District.

The limiting factor for this solution is the short term nature of supplying customers from adjacent development areas by feeders that are technically constrained from providing long term electricity supply growth.

In summary this option comprises the following components:

- Woden zone substation - augmentation works to three (3) existing11kV feeders supplying the Molonglo District - 2014/15 to 2016/17.
- Civic zone substation -11kV feeder augmentation works in Molonglo District - 2016/17.
- Build & commission Molonglo zone substation - 2017/18 to 2019/20
- Build new 11kV feeders from Molonglo zone substation 2018/19 - 2019/20

The estimated capital cost of option 2 is $29.86 million. The NPC including Operation and Maintenance (O&M) costs is $18.92 million.

4 Economic Analysis of Options

ActewAGL has carried out preliminary economic analysis for the period 2013/2014 to 2021/2022 on options 1 and 2.

4.1 Base Case Analysis

The options considered are ranked by NPC of the relevant area supply strategy considering a 7.7% p.a. discount rate for the base case shown in table 6. The total cost for each strategy is also shown.

Description	NPC ($M)	Cost ($M)
Option 1 – New Molonglo Zone Substation	19.81	28.60
Option 2 – Blk Mtn Feeder upgrade from Civic zone substation	18.92	29.86

Table 5: Cost comparison under base case

4.2 Sensitivity Analysis

ActewAGL has also carried out sensitivity analysis to consider the impact of varying discount rates and price variations. The outcome of the sensitivity analysis is summarised in table 7 below.

Sensitivity Scenario		Option 1 (NPC $M)	Option 2 (NPC $M)
Variation of Discount Rate	5.0% p.a.	21.49	21.51
	7.7% p.a.	19.81	18.92
	9.0 % p.a.	18.98	17.74
Substation Costs	25% increase	23.86	22.56
	25% decrease	15.80	15.28
11kV Feeder Costs	25% increase	20.70	20.01
	25% decrease	18.92	17.84
Operational and Maintenance Costs	25% increase	19.86	18.93
	25% decrease	19.76	18.91

Table 6: Cost comparison under sensitivity analysis

5 Preliminary Conclusions and Preferred Actions

The establishment of a new zone substation in the Molonglo District is the highest NPC option, however it remains the preferred option. There are intangible benefits described in the Options Assessment section that are considered to outweigh the NPC differences between option 1 and 2. ActewAGL considers option 1 to provide the greatest customer benefit, be the most practical solution, have the lowest network losses and deliver higher reliability in the electricity network.

The Molonglo Valley to the west of Canberra is being promoted by the ACT Planning and Land Authority (ACTPLA) as the centre of residential and retail development over the next 20 years. The main area of development includes the suburbs of Wright and Coombs.

The ultimate development of the Molonglo area is estimated to have a population of 55,000 over the next 20 years, with electrical demand expected to reach 15MVA by about 2020.

ActewAGL Distribution's zone substation forecasts suggest that there is adequate capacity to supply additional Molonglo load from adjacent zone substations. There are four existing zone substations within 10km of the proposed Molonglo zone substation location but supply from them is not feasible, other than in the short term, due to the nature of the terrain, the existence of other developments and infrastructure, and other construction restrictions, which suggests that it will be extremely difficult to construct additional overhead or underground feeders into the Molonglo area from adjacent zone substations. The new Molonglo substation will take over some load in Weston Creek from Woden zone substation and therefore defer the need for capacity augmentation at Woden.

These reasons support the construction of the new Molonglo zone substation by 2017/18.

Subject to the comments received during the consultation period, ActewAGL recommends option 1 is selected to meet the forecasted demand in the Molonglo District.

6 Contact Details for Submissions and Enquiries

In accordance with the National Electricity Rules, ActewAGL invite written submissions from interested parties on this application notice.

7 Appendix B

7.1 Economic Analysis of Base Case

7.1.1 Option 1 – Establish new zone substation in the Molonglo District

Description	NPC ($)	TOTAL ($) CAPEX	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Molonglo ZS Components								
Molonglo zone 132kV/11kV		23,200,000		4,640,000	11,600,000	6,960,000		
11kV Feeders		4,500,000			4,000,000	500,000		
Sub-total excluding O&M		**27,700,000**	-	**4,640,000**	**15,600,000**	**7,460,000**	-	-
O&M		300,000				60,000	120,000	120,000
Sub-total including O&M		**28,000,000**		**4,640,000**	**15,600,000**	**7,520,000**	**120,000**	**120,000**
Other		-						
11kV feeder Augmentation (Cotter, Streeton, Hilder)		600,000		600,000				
Sub-total excluding O&M		**600,000**	-	**600,000**	-	-	-	-
O&M	-	-						
Sub-total including O&M		**600,000**	-	**600,000**	-	-	-	-
TOTAL	**19,810,000**	**28,600,000**	-	**5,240,000**	**15,600,000**	**7,520,000**	**120,000**	**120,000**

Estimate base: 2012/13 dollars.

7.1.2 Option 2 – Civic Black Mountain Fdr Augmentation

Description	NPC ($)	TOTAL ($) CAPEX	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Molonglo ZS Components								
Molonglo zone 132kV/11kV		23,200,000				4,640,000	11,600,000	6,960,000
11kV Feeders		4,500,000					4,000,000	500,000
Sub-total excluding O&M		**27,700,000**	-	-	-	**4,640,000**	**15,600,000**	**7,460,000**
O&M		60,000						60,000
Sub-total including O&M		**27,760,000**	-	-	-	**4,640,000**	**15,600,000**	**7,520,000**
Other		-						
11kV feeder Augmentation (Cotter, Streeton, Hilder)		600,000		600,000				
11kV feeder Augmentation (Blk Mtn)		1,500,000			1,500,000			
Sub-total excluding O&M		**2,100,000**	-	**600,000**	**1,500,000**	-	-	-
O&M	-	-						
Sub-total including O&M		**2,100,000**	-	**600,000**	**1,500,000**	-	-	-
TOTAL	**18,920,000**	**29,860,000**	-	**600,000**	**1,500,000**	**4,640,000**	**15,600,000**	**7,520,000**

Estimate base: 2012/13 dollars.

8 Appendix C

8.1 Document Reference List

[1] National Electricity Rules Version 51

[2] Molonglo District Long-Term Load Forecast Version 2.0

[3] Zone Development Report Woden Zone Version 1.0

[4] ActewAGL Peak Demand Forecast 2013