Appendix 5.25: Second supply to the ACT PJR

Regulatory proposal for the ACT electricity distribution network 2019-24
January 2018

Disclaimer: On 1 January 2018, the part of ActewAGL that looks after the electricity network changed its name to Evoenergy. This change has been brought about from a decision by the Australian Energy Regulator. Unless otherwise stated, ActewAGL Distribution branded documents provided with this regulatory proposal are Evoenergy documents.

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Project Justification Report

Project name	**Second Supply to the ACT**
Expenditure type	Capital Expenditure
Business Group	Asset Strategy
Regulatory Period	1 July 2019 to 30 June 2024
Total Project Cost Estimate	$1,945,000 excluding corporate overheads, excluding contingency, and excluding GST
Five year total spend 2019-24	$1,546,000 excluding corporate overheads, excluding contingency, and excluding GST
CAPEX category	ENAA Transmission
Primary Driver	Compliance with ACT Electricity Transmission Supply Code
Project Number	20003857

Contents

Reference documents

Document	Version	Date
National Electricity Rules	102	
National Electricity Law		19.12.13
Utilities Act (ACT)		2000
Utilities (Management of Electricity Network Assets Code) Determination		2013
Utilities (Technical Regulation) (Electricity Transmission Supply Code) Approval 2016 (No 1)	1.0	11.7.16
ActewAGL Annual Planning Report		22.12.17
Distribution Network Augmentation Standard SM1197	1.1	12.5.15
Evoenergy Risk Assessment Tables PR4660.2	1.0	12.1.17
Evoenergy Quality of Supply Strategy SM11150	1.0	8.10.15
Evoenergy Asset Management Strategy SM1192	2.12	22.6.15
Joint Planning Report: ACT Second Electrical Supply Project - TransGrid	0.0	8.3.17
Supply Security Status Report - TransGrid	1.0	21.2.17
Stockdill Substation Power System Analysis Project Report - GHD	1.0	26.5.17

1. Executive Summary

This Project Justification Report addresses the completion of the Second Supply to the ACT Project.

Power system analysis has shown that additional reactive support equipment in the northern part of Evoenergy's network, to maintain supply voltage levels following a special contingency event. The most cost effective solution is the installation of five 11 kV capacitor banks of 10 MVAr capacity each to be installed at Evoenergy's northern zone substations. It is proposed to install an 11 kV 10 MVAr capacitor bank at each of the following zone substations:

- Latham
- Gold Creek
- Belconnen
- Molonglo (proposed)
- Strathnairn (proposed).

Other options investigated regarding reactive power support devices included a 132 kV 50 MVAr capacitor bank and a 132 kV 50 MVAr statcom. These options are both more expensive than 11 kV capacitor banks and would be used only in the event of a special contingency event affecting the whole of Canberra Substation. The 11 kV capacitors can be installed in stages and can be used continuously to improve 11 kV bus voltages and reduce MVA loads on zone substation transformers.

No non-network alternative to this project has been identified.

Installation of reactive power support devices in the form of five x 11 kV 10 MVAR capacitor banks installed at the zone substations listed above would be installed in stages. It is proposed that capacitor banks would be installed at Latham, Gold Creek and Belconnen zone substations by December 2020; at Molonglo Zone Substation by June 2022; and at Strathnairn Zone Substation by June 2040.

A preliminary cost estimate for the selected option is $1,945,000 excluding corporate overheads, excluding contingency, and excluding GST.

The proposed expenditure for the 2019-24 Regulatory Control Period is $1,546,000 excluding corporate overheads, excluding contingency, and excluding GST.

2. Strategic Context and Expenditure Need

Evoenergy and TransGrid must meet the requirements of the Utilities (Technical Regulation) (Electricity Transmission Supply Code) Approval 2016 (No 1), Disallowable instrument D12016-189.

The commissioning of TransGrid's Williamsdale 330/132 kV Substation in February 2013 introduced a second 132 kV bulk supply point into the ACT to address power system security requirements by providing two geographically independent 330 kV points of connection to the ACT network. Williamsdale Substation is linked to Evoenergy's network at Theodore and Gilmore 132/11 kV Zone Substations.

The ACT Electricity Transmission Supply Code (July 2016) states:

TransGrid must plan, design, construct, test, commission, maintain, operate and manage its electricity transmission networks and geographically separate connection points that supply customers in the ACT and that will operate at 66 kV and above, whether or not those networks and connection points are in the ACT, to achieve the following:

(a) the provision of two or more geographically separate connection points operated at 132 kV and above to supply electricity to the ACT 132 kV network;

(b) at all times provide continuous electricity supply at maximum demand to the ACT 132 kV and 66 kV network throughout and following a single credible contingency event;

(c) until 31 December 2020, provide electricity supply at 30 MVA to the ACT 132 kV or 66 kV network within one hour following a single special contingency event and 375 MVA within 48 hours of this event; and

(d) from 31 December 2020, provide continuous electricity supply at 375 MVA to the ACT 132 kV network immediately following a single special contingency event and agreed maximum demand within 48 hours of this event.

To meet the above criteria TransGrid proposes:

Item (a) is met already by Canberra and Williamsdale 330/132 kV bulk supply point substations.

Item (b) is met already by Canberra and Williamsdale 330/132 kV, and Queanbeyan 132/66 kV bulk supply point substations, all of which have N-1 security.

Item (c) can be met by supplying 30 MVA via Queanbeyan 132/66 kV (to Fyshwick 66/11 kV Zone Substation) in the event of a special contingency event affecting Canberra Substation (and consequently affecting Williamsdale Substation also as Williamsdale is connected radially at 330 kV from Canberra). The 375 MVA criteria within 48 hours requirement would be met by constructing a temporary 330 kV connection between the Upper Tumut–Canberra line and the Canberra–Williamsdale line, thus bypassing Canberra Substation.

To comply with Item (d) TransGrid proposes to construct a 330/132 kV Substation at Stockdill Drive, West Belconnen. This will have one 375 MVA transformer. The Upper Tumut–Canberra and Canberra–Williamsdale 330 kV lines will be reconnected to Stockdill Substation. A new 330 kV line section will be constructed from Stockdill to Canberra. Evoenergy will construct a new double circuit 132 kV line section from Stockdill to connect to the Canberra–Woden 132 kV line to form a Canberra–Stockdill–Woden line. This will provide the immediate 375 MVA back-up capability to the ACT. Construction of the double circuit 132 kV line section from Stockdill Substation to the Canberra–Woden line will be carried out in coordination with the construction of TransGrid's 330/132 kV Stockdill Substation with proposed completion by December 2019.

Within one hour of a special contingency event affecting Canberra Substation, TransGrid proposes to reconnect Queanbeyan 132 kV from Yass Substation (via Spring Flat Switching Station) and within 48 hours to construct a temporary connection from the Yass 330 kV line to the Canberra–Latham 132 kV line and reconnect to Yass 132 kV bus. This would provide full load capacity to the ACT.

TransGrid proposes to retire two aged single-phase 330/132 kV transformer banks at Canberra Substation.

Power systems analysis shows that under this development the originally proposed Theodore–Gilmore 132 kV line upgrade will not be required. However analysis shows that in the event of a total Canberra Substation outage, voltage levels in the northern part of Evoenergy's 132 kV network would fall below regulation levels. In order for voltage levels to be maintained, Evoenergy has investigated the installation of reactive support equipment.

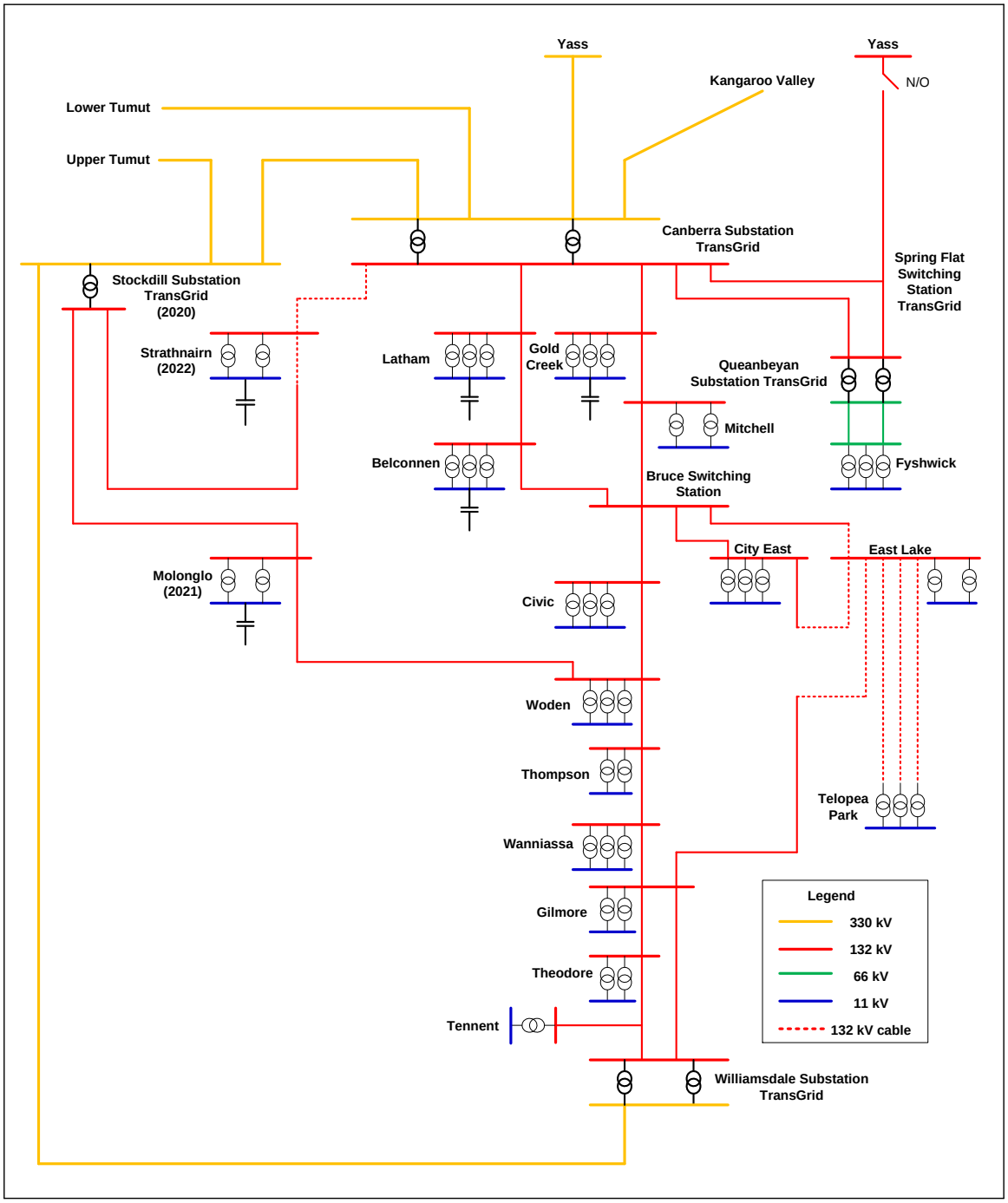
An independent power system analysis study was carried out to verify that the proposed development will meet all requirements of the Electricity Transmission Supply Code for the foreseeable future. The analysis confirmed that under a special contingency event affecting the whole of Canberra Substation, that voltage levels in the northern part of Evoenergy's network would fall below regulatory levels and that reactive support equipment would be required to mitigate this.

Analysis has shown that the most cost effective solution is the installation of five 11 kV capacitor banks of 10 MVAr capacity each to be installed at Evoenergy's northern zone substations. It is proposed to install an 11 kV 10 MVAr capacitor bank at each of the following zone substations:

- Latham
- Gold Creek
- Belconnen
- Molonglo (proposed)
- Strathnairn (proposed).

The proposed single line diagram of the ACT transmission network at the completion of this project (2040) is shown in Figure 1.

Figure 1: Proposed ACT Transmission Network (2040)



It should be noted that TransGrid proposes to convert the Canberra–Stockdill–Woden tee connection at Stockdill Substation to Canberra–Stockdill and Stockdill–Woden circuits by June 2022, by installing two 132 kV line circuit breakers at Stockdill Substation.

The planning and development of this project has been carried out via the Joint Planning Process between TransGrid and Evoenergy in accordance with Section 5.14 of the National Electricity Rules.

The key business and regulatory compliance drivers for this project are to meet the requirements of the ACT Electricity Transmission Supply Code.

3. Objectives

3.1. Corporate, asset management and key project objectives

The corporate, asset management and related key project objectives are shown in Table 1 below.

Table 1: Corporate, asset management and key project objectives

Corporate objectives	Asset management objectives	Key project objectives
Responsible	• Achieve zero deaths or injuries to employees or the public. • Maintain a good reputation within the community. • Minimise environmental impacts, for example bushfire mitigation. • Meet all requirements of regulatory authorities, such as the AER as outlined in the NER, and the ACT Utilities (Technical Regulations) Act 2014.	The selected option must ensure environment and safety standards will be met.
Reliable	• Tailor maintenance and renewal programs for each asset class based on real time modelling of asset health and risk. • Meet network SAIDI and SAIFI KPIs. • Record failure modes of the most common asset failures in the network. • Successfully deliver the asset class Program of Work (PoW) to ensure that the protection operates correctly to disconnect faulty sections in accordance with the NER.	Options evaluations to consider the value of customer reliability (VCR). In accordance with regulated requirements, the selected option must ensure access to an electricity supply.
Sustainable	• Enhance asset condition and risk modelling to optimise and implement maintenance and renewal programs tailored to the assets' needs. • Make prudent commercial investment decisions to manage assets at the lowest lifecycle cost. • Integrate primary assets with protection and automation systems in accordance with current and future best practice industry standards • Deliver the asset class PoW within budget.	Options evaluations to consider the cost effectiveness of the solution. In accordance with regulated requirements, the selected option must be the most prudent and efficient. Non-network options will be evaluated on equal merit with network solutions.
People	• Proactively seek continual improvement in asset management capability and competencies of maintenance personnel.	A post implementation review to incorporate learnings through the asset management system.

The project objectives are consistent with Evoenergy's regulatory requirements described below

3.2. Regulatory Compliance

3.2.1. National Electricity Law and National Electricity Rules

Evoenergy is subject to the National Electricity Law (NEL) and the National Electricity Regulations (NER) which regulate the National Electricity Market (NEM). Evoenergy operates in the NEM as both a Transmission Network Service Provider (TNSP) and a Distribution Network Service Provider (DNSP).

The National Electricity Objective (NEO), as stated in the NEL 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."

This objective requires Registered NEM participants to balance the costs and risks associated with electricity supply.

The planning and development process for distribution and transmission networks is carried out in accordance with the National Electricity Rules (NER) Chapter 5 Part B Network Planning and Expansion.

The primary objective of planning is to ensure that customers are able to receive a sufficient and reliable supply of electricity now and into the future.

3.2.2. Capital Expenditure Objectives and Criteria

The NER provides further guidance in terms of allowable capital expenditure via the capital expenditure objectives and criteria for standard control services. These capital expenditure objectives, specified in clause 6.5.6(a) and 6.5.7(a) of the NER describe the outcomes or outputs to be achieved by the expenditure. The objectives include:

1) *Meet or manage the expected demand for standard control services*
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 the quality, reliability or security of supply of standard control services; or the reliability or security of the distribution system through the supply of standard control services, to the relevant extent:*
    a) *Maintain the quality, reliability and security of supply of standard control services*
    b) *Maintain the reliability and security of the distribution system through the supply of standard control services*
4) *Maintain the safety of the distribution system through the supply of standard control services.*

The expenditure criteria set out in Section 6.5.6(c) and Section 6.5.7(c) of the NER, further outline requirements for the way in which expenditure must be set to achieve the objectives above. These include:

1) *The efficient costs of achieving the expenditure objectives*
2) *The costs that a prudent operator would require to achieve the expenditure objectives; and*
3) *A realistic expectation of the demand forecast and cost inputs required to achieve the expenditure objectives.*

The above criteria therefore imply that the capital expenditure, determined in line with the expenditure objectives, must be met via prudent and efficient expenditure, is to be achieved at least cost.

3.2.3. Regulatory Investment Test

Section 5.16 of the NER describes the Regulatory Investment Test for Transmission (RIT-T) and Section 5.17 describes the Regulatory Investment Test for Distribution (RIT-D). These tests must be carried out for any proposed investment where the augmentation or replacement cost of the most expensive credible option exceeds $5 million.

The regulatory investment tests provide the opportunity for external parties to submit alternative proposals to the Network Service Provider, who is obliged to consider any credible proposal objectively.

3.2.4. Utilities Act 2000 (ACT)

Evoenergy has an obligation to comply with the Utilities Act 2000 (ACT) which imposes specific technical, safety and reliability obligations via the Management of Electricity Network Assets Code and the Electricity Distribution Supply Standards Code.

The Electricity Distribution Supply Standards Code (August 2013) sets out performance standards for Evoenergy's distribution network. Evoenergy 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.

This local jurisdictional code specifies reliability standards that Evoenergy must endeavour to meet when planning, operating and maintaining the distribution network. It also specifies power quality parameters that must be met including limits on voltage flicker, voltage dips, switching transients, earth potential rise voltage unbalance, harmonics and direct current content.

The Management of Electricity Network Assets 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.

3.2.5. ACT Electricity Transmission Supply Code (July 2016)

Evoenergy has an obligation to comply with the ACT Electricity Transmission Supply Code which imposes specific reliability of supply obligations. Compliance with this code is the main driver for this project, as described in Section 2 above.

4. Options Assessment

Evoenergy has considered four options to complete the Second Supply to the ACT project as shown in Table 1.

Table 1: Options considered for completion of Second Supply to the ACT project

Option	Option type	Description	Evaluation
0	Network	Do nothing	Not selected as does not meet need
1	Network	Install 132 kV capacitor bank at Bruce Switching Station	Not selected due to higher cost
2	Network	Install 132 kV STATCOM at Bruce Switching Station	Not selected due to higher cost
3	**Network**	**Install 11 kV 10 MVAr capacitor banks at Latham, Gold Creek, Belconnen, Molonglo and Strathnairn zone substations.**	**Selected as lowest cost**
4	Non-network	Demand side management and embedded generation	Not selected as does not meet need

4.1. Options analysis

4.1.1. Do Nothing Option

The 'Do Nothing' option would not meet the requirements of the Electricity Transmission Supply Code and thus would result in Evoenergy breaching its obligations to provide a reliable and secure power supply to the ACT. This option is not a prudent or acceptable solution.

4.1.2. Option 1: Install 132 kV capacitor bank at Bruce Switching Station

Option 1 proposes the installation of a 132 kV 50 MVAr capacitor bank at Bruce Switching Station. This would be connected to the 132 kV bus via a point-on-wave 132 kV circuit breaker. This is proposed to be completed by December 2020.

The preliminary estimated cost of this option is $2,168,200 excluding corporate overheads, contingency and GST (refer cost estimate Appendix A.1).

Option 1 is not selected due to its higher cost.

4.1.3. Option 2: Install 132 kV STACOM at Bruce Switching Station

Option 2 proposes the installation of a 132 kV STATCOM at Bruce Switching Station. The installation would be an asymmetric arrangement, ± 30 MVAr STATCOM with 15 MVAr capacitor bank. This would be connected to the 132 kV bus via a point-on-wave 132 kV circuit breaker. This is proposed to be completed by December 2020.

The preliminary estimated cost of this option is $6,168,200 excluding corporate overheads, contingency and GST (refer cost estimate Appendix A.2).

Option 2 is not selected due to its higher cost.

4.1.4. Option 3: Install 11 kV 10 MVAr capacitor banks at Latham, Gold Creek, Belconnen, Molonglo and Strathnairn zone substations

Option 3 proposes the installation of an 11 kV 10 MVAr capacitor bank at Latham, Gold Creek, Belconnen, Molonglo and Strathnairn zone substations. These would each be connected to the 11 kV bus via a dedicated 11 kV 1250 Amp point-on-wave (POW) circuit breaker. There are no spare circuit breakers at Latham, Gold Creek and Belconnen zone substations, so the 11 kV switchboards would need to be extended and an additional circuit breaker installed at each. Alternatively two lightly-loaded feeders could be doubled up to one feeder circuit breaker to free up a panel space which could then be retrofitted with a POW circuit breaker. Molonglo and Strathnairn are both proposed zone substations. Their 11 kV switchboards will be specified to include a POW circuit breaker.

These capacitor bank installations would be carried out in stages as follows:

- Stage 1 (2020) – Latham, Gold Creek, Belconnen.
- Stage 2 (2022) – Molonglo.
- Stage 3 (2040) – Strathnairn.

The preliminary estimated cost of this option is $1,945,000 excluding corporate overheads, contingency and GST (refer cost estimate Appendix A.3). This expenditure would be incurred in stages as follows:

- Stage 1 (2020) – $1,147,000.
- Stage 2 (2022) – $399,000.
- Stage 3 (2040) – $399,000.

Option 3 is selected as it has the lowest cost.

4.1.5. Option 4 Non-network solution

Option 4 considers non-network initiatives including demand side management and alternative supply measures such as embedded generation.

Viable proposals from third parties that can significantly reduce maximum demand of the Evoenergy distribution network and enable Evoenergy to defer completion of the Second Supply to the ACT project have to date not been forthcoming. It is estimated that such proposals would be required to provide embedded generation and/or demand reduction capacity in excess of 300 MW. This would be in addition to all existing and currently proposed embedded generation and demand management facilities.

Any embedded generation must be fuelled by a renewable energy source to comply with the ACT Government's mandate that all electricity supplied to ACT consumers by 2020 must be generated from renewable sources. The ACT Government also has a target of achieving zero net carbon emissions by 2050. There is no viable hydro, wind or geothermal resource in the West Belconnen District or surrounding vicinity, which leaves large scale solar generation with associated large scale battery storage as the main possible alternative to network augmentation.

Evoenergy's Customer Engagement Strategy is published on our external website and a Demand Management Engagement Strategy is being prepared that will meet the requirements of the NER Section 5.13.1.

4.1.6. Summary of Options Analysis

Table 2: Summary of Options

Option	Description	Total Capital Cost	Capital Cost 2019-24	Outcome
0	Do nothing	N/A	N/A	Not selected as does not meet need
1	Install 132 kV capacitor bank at Bruce Switching Station	$2,168,200	$2,168,200	Not selected due to higher cost
2	Install 132 kV STATCOM at Bruce Switching Station	$6,168,200	$6,168,200	Not selected due to higher cost
3	**Install 11 kV capacitor banks at Latham, Gold Creek, Belconnen, Molonglo and Strathnairn zone substations**	**$1,945,000**	**$1,546,000**	**Selected as lowest cost**
4	Demand side management and embedded generation	N/A	N/A	Not selected as does not meet need

4.2. Recommendation

The selected option is Option 3, the installation of 11 kV 10 MVAr capacitor banks at Latham, Gold Creek, Belconnen, Molonglo and Strathnairn zone substations.

The new Stockdill Substation and 132 kV connection to Evoenergy's network, along with the reactive support equipment at zone substations, will enable the requirements of the Electricity Transmission Supply Code 2016 to be met in full.

Stage 1 (installation of capacitor banks at Latham, Gold Creek and Belconnen zone substations) is scheduled for completion by December 2020. Stage 2 (installation of capacitor bank at Molonglo Zone Substation) is scheduled by June 2022 (as part of the Molonglo Zone Substation project), and Stage 3 (installation of capacitor bank at Strathnairn Zone Substation) is scheduled by June 2040 (as part of the Strathnairn Zone Substation project). **Preliminary cost estimate is $1,945,000 excluding overheads, contingency and GST, with individual stage estimates being Stage 1 $1,147,000, Stage 2 $399,000 and Stage 3 $399,000.**

This option has the least cost. Refer to cost estimates and cash flows in Appendices A and B. It can be implemented in time to meet the project needs as identified, will provide a permanent solution, and will add to Evoenergy's regulated asset base. The major assets will have an economic life of 50 years.

Appendix A – Preliminary Cost Estimates

A.1 Cost Estimate Option 1 – Install 132 kV 50 MVAr capacitor bank at Bruce Switching Station

132 kV 50 MVAr capacitor bank at Bruce Switching Station.					
Preliminary Estimate ± 30% Accuracy					
Description	**Notes**	**Unit**	**$/Unit**	**Quantity**	**Cost**
132 kV 50 MVAr Capacitor Bank at Bruce Switching Station					$1,868,200
132 kV Switchgear					$443,200
145 kV Live Tank CB, 3150 A, incl support structure and accessories.	Capacitor bank CB	ea	$100,000	1	$100,000
145 kV Horizontal Double Break Disconnector (Motorised) 2500 A & Earth switch (Manual), incl structure.	With Earth Switch	ea	$23,000	2	$46,000
145 kV VT (post type). Incl structure. (1x3-ph)	Line VTs	ea	$30,000	1	$30,000
145 kV CT (post type). Incl structure. (1x3-ph)	Line CTs	ea	$54,000	1	$54,000
145 kV Surge Arrester, incl surge counter. Excl structure. (1x3-ph)		ea	$2,400	3	$7,200
132 kV jumpers/busbars	Twin Uranus per phase, incl post insulators and fittings	bay	$150,000	1	$150,000
SF6 Gas - estimate 10kg per single pole (LTCB)	Allowance for first fill and levy	kg	$1,200	30	$36,000
132 kV switchgear Test & Commission	Allowance	bay	$20,000	1	$20,000
132 kV 50 MVAr Capacitor bank					$1,000,000
132 kV 50 MVAr Capacitor Bank	Estimate only - price requested	ea	$1,000,000	1	$1,000,000
Construction					$300,000
Capacitor bank construction labour and plant	Allowance	ea	$200,000	1	$200,000
Test & Commission	Allowance	ea	$100,000	1	$100,000
Protection & Control					$125,000
132 kV Capacitor Protection Panel	1 panel incl protection & SCADA Interface	ea	$100,000	1	$100,000
P&C Secondary Cabling	per P&C panel	ea	$5,000	1	$5,000
P&C Test & Commission	Allowance	lot	$20,000	1	$20,000
Indirect Costs					$300,000
Contractor's Preliminaries, site establishment and disestablishment	Allowance	ea	$50,000	1	$50,000
Detailed design	Allowance	ea	$50,000	1	$50,000
Project management and administration	Allowance	ea	$200,000	1	$200,000
Project Sub Total without overheads					**$2,168,200**
Overheads					
Overheads at average rate 27%	Allowance	27%			$585,414
Project Sub Total with overheads					**$2,753,614**
Contingency					
Contingency at 15%	Allowance	15%			$413,042
Project total with all overheads and contingency					**$3,166,656**

A2. Cost Estimate Option 2 – Install 132 kV ± 30 MVAr STATCOM with 15 MVAr capacitor bank at Bruce Switching Station

132 kV ±30 MVAr STATCOM with 15 MVAr capacitor bank at Bruce Switching Station.					
Preliminary Estimate ± 30% Accuracy					
Description	**Notes**	**Unit**	**$/Unit**	**Quantity**	**Cost**
132 kV ±30 MVAr Statcom with 15 MVAr capacitor bank at Bruce Switching Station					$5,868,200
132 kV Switchgear					$443,200
145 kV Live Tank CB, 3150 A, incl support structure and accessories.	Capacitor bank CB	ea	$100,000	1	$100,000
145 kV Horizontal Double Break Disconnector (Motorised) 2500 A & Earth switch (Manual), incl structure.	With Earth Switch	ea	$23,000	2	$46,000
145 kV VT (post type). Incl structure. (1x3-ph)	Line VTs	ea	$30,000	1	$30,000
145 kV CT (post type). Incl structure. (1x3-ph)	Line CTs	ea	$54,000	1	$54,000
145 kV Surge Arrester, incl surge counter. Excl structure. (1x3-ph)		ea	$2,400	3	$7,200
132 kV jumpers/busbars	Twin Uranus per phase, incl post insulators and fittings	bay	$150,000	1	$150,000
SF6 Gas - estimate 10kg per single pole (LTCB)	Allowance for first fill and levy	kg	$1,200	30	$36,000
132 kV switchgear Test & Commission	Allowance	bay	$20,000	1	$20,000
132 kV Statcom					$5,000,000
132 kV ±30 MVAr Statcom with 15 MVAr capacitor bank	Estimate only - price requested	ea	$5,000,000	1	$5,000,000
Construction					$300,000
Statcom construction labour and plant	Allowance	ea	$200,000	1	$200,000
Test & Commission	Allowance	ea	$100,000	1	$100,000
Protection & Control					$125,000
132 kV Statcom Protection Panel	1 panel incl protection & SCADA Interface	ea	$100,000	1	$100,000
P&C Secondary Cabling	per P&C panel	ea	$5,000	1	$5,000
P&C Test & Commission	Allowance	lot	$20,000	1	$20,000
Indirect Costs					$300,000
Contractor's Preliminaries, site establishment and disestablishment	Allowance	ea	$50,000	1	$50,000
Detailed design	Allowance	ea	$50,000	1	$50,000
Project management and administration	Allowance	ea	$200,000	1	$200,000
Project Sub Total without overheads					**$6,168,200**
Overheads					
Overheads at average rate 27%	Allowance	27%			$1,665,414
Project Sub Total with overheads					**$7,833,614**
Contingency					
Contingency at 15%	Allowance	15%			$1,175,042
Project total with all overheads and contingency					**$9,008,656**

A3. Cost Estimate Option 3 – Install 11 kV 10 MVAr capacitor banks at Latham, Gold Creek, Belconnen, Strathnairn and Molonglo zone substations

11 kV 10 MVAr Capacitor Banks. Stage 1 (2020) at Latham, Gold Creek and Belconnen. Stage 2 (2022) at Molonglo. Stage 3 (2040) at Strathnairn.									
Preliminary Estimate ± 30% Accuracy									
Description	**Notes**	**Unit**	**$/Unit**	**Stage 1 Quantity**	**Stage 1 Cost**	**Stage 2 Quantity**	**Stage 2 Cost**	**Stage 3 Quantity**	**Stage 3 Cost**
11 kV 10 MVAr Capacitor Banks at Latham, Gold Creek, Belconnen, Molonglo and Strathnairn zone substations					$942,000		$314,000		$314,000
11 kV 10 MVAr Capacitor bank					$450,000		$150,000		$150,000
11 kV 10 MVAr Capacitor Bank	Estimate only - price requested	ea	$150,000	3	$450,000	1	$150,000	1	$150,000
11 kV Switchgear					$240,000		$80,000		$80,000
12 kV Point-on-Wave CB 1250A	Incl Duplicate Protection & SCADA Interface and installation	ea	$75,000	3	$225,000	1	$75,000	1	$75,000
11 kV Test & Commissioning	Allowance	ea	$5,000	3	$15,000	1	$5,000	1	$5,000
HV Connections					$72,000		$24,000		$24,000
11 kV Cable 1c/800mm2 Cu XLPE one per phase	For connection between 11 kV CB and capacitor bank - assume 60m each	m	$100	540	$54,000	180	$18,000	180	$18,000
11 kV Cable Termination 1c/800mm2 Cu XLPE		ea	$750	18	$13,500	6	$4,500	6	$4,500
HV Cables and connections Test & Commissioning	Allowance	lot	$500	9	$4,500	3	$1,500	3	$1,500
Construction					$180,000		$60,000		$60,000
Capacitor bank construction labour and plant	Allowance	ea	$50,000	3	$150,000	1	$50,000	1	$50,000
Test & Commission	Allowance	ea	$10,000	3	$30,000	1	$10,000	1	$10,000
Indirect Costs					$205,000		$85,000		$85,000
Contractor's Preliminaries, site establishment and disestablishment	Allowance	ea	$25,000	3	$75,000	1	$25,000	1	$25,000
Capacitor bank design	Allowance	ea	$10,000	3	$30,000	1	$10,000	1	$10,000
Project management and administration	Allowance	ea	$100,000	1	$100,000	0.5	$50,000	0.5	$50,000
Stage Sub Total without overheads					**$1,147,000**		**$399,000**		**$399,000**
Project Sub Total without overheads									**$1,945,000**
Overheads									
Overheads at average rate 27%	Allowance	27%			$309,690		$107,730		$107,730
Stage Sub Total with overheads					**$1,456,690**		**$506,730**		**$506,730**
Project Sub Total with overheads									**$2,470,150**
Contingency									
Contingency at 15%	Allowance	15%			$218,504		$76,010		$76,010
Stage total with all overheads and contingency					**$1,675,194**		**$582,740**		**$582,740**
Project total with all overheads and contingency									**$2,840,673**

Appendix B - Capital Expenditure Cash Flow for Each Option

Financial Year	Option 1	Option 2	Option 3
2019-20			$1,147,000
2020-21	$2,168,200	$6,168,200	
2021-22			$399,000
2022-23			
2023-24			
2024-25			
2025-26			
2026-27			
2027-28			
2028-29			
2029-30			
2030-31			
2031-32			
2032-33			
2033-34			
2034-35			
2035-36			
2036-37			
2037-38			
2038-39			
2039-40			$399,000
Total Cost	**$2,168,200**	**$6,168,200**	**$1,945,000**
2019-24 Regulatory Control Period Cost	**$2,168,200**	**$6,168,200**	**$1,546,000**