OPTIONS EVALUATION REPORT (OER)

Canberra 132 kV Connection of Evoenergy Strathnairn ZS

OER- 000000001443 revision 7.0

Ellipse project no(s):
TRIM file: [TRIM No]

Project reason: To meet connection point reliability requirements
Project category: Prescribed - Connection

Approvals

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Date submitted for approval	10 August 2021	

Change history

Revision	Date	Amendment
0	24/06/2016	Initial issue
1	27/10/2016	Formatting changes
2	28/10/2016	Updated load at risk
3	13/12/2016	Changed Need date based on advice from customer. Clarified all risk cost breakdowns.
4	26/07/2021	Update to new template and align with updated NOSA
5	27/09/2021	Houston Kemp comments addressed
6	1/11/2021	Minor formatting change

Executive summary

New Strathnairn area is located to the south west of Canberra Substation. Strathnairn development is a part of the West Belconnen District (forecast to reach 45 MVA over the next 30 years), and there is insufficient supply capacity in Evoenergy's network to meet the West Belconnen forecast demand.

The closest Evoenergy's zone Substation to this development is Latham ZS, approximately 7 km away from it in the north east direction.

Load forecast for Strathnairn development, provided by Evoenergy, indicates its total demand will reach 11.8 MVA by 2030 and shortfall in capacity of existing 11kV feeders is 3.2 MVA (value of unserved energy is $11.7 million)[1]. Demand for this development is expected to increase further past 2030.

Evoenergy is extending existing O'Loghlen feeder into Strathnairn area to address initial loads, but new Strathnairn Zone Substation is considered a permanent supply option for this area. Strathnairn Zone Substation (ZS) is proposed to be connected via a new (Evoenergy owned) 132 kV cable to TransGrid's Canberra 132 kV Bulk Supply Point (BSP).

Consequently, there is a compliance need to meet Evoenergy's supply requirements for new West Belconnen District.

Only one option is technically and economically feasible to meet the compliance need. It's assessment appears in **Error! Reference source not found.**.

Table 1 Evaluated options

Option	Description	Direct capital cost ($m)	Network and corporate overheads ($m)	Total capital cost[2] ($m)	Weighted NPV (PV, $m)	Rank
Option A	132 kV connection of Evoenergy's Strathnairn Zone Substation	2.55	0.44	2.99	450.33[3]	1

Option A was the only evaluated option involving TransGrid capex, as the Evoenergy network options do not address the long-term need or do not address the need in required project time frame.

The recommendation is to progress with Option A, subject to Evoenergy approving its investment for Strathnairn Zone Substation and for a new 132 kV cable to the Canberra 132 kV Bulk Supply Point.

The preferred option was selected because it has higher NPV than the base case, fully meets the need in the long term, is technically and economically feasible, and maintains regulatory compliance.

[1] This info is from e-mail correspondence with Evoenergy dated 9 September 2021.

[2] Total capital cost is the sum of the direct capital cost and network and corporate overheads. Total capital cost is used in this OER for all analysis.

[3] Unserved energy data used for economic benefit calculations were obtained from Evoenergy. Forecasted unserved energy values for years from 10 to 25, were kept the same as values given for year 10.

1. Need/opportunity

Load forecast for Strathnairn development, provided by Envoenergy, indicates its total demand will reach 11.8 MVA by 2030. Strathnairn development is a part of West Belconnen district, and there is insufficient supply capacity in Evoenergy's network to meet the West Belconnen forecast demand. The current and extended network in this area can only supply 8.6 MVA[4] and significant levels of unserved energy would occur, without addressing this shortfall in capacity. Consequently, Envoenergy is planning to establish a new Strathnairn Zone Substation (ZS),connected via a new (Evoenergy owned) 132 kV cable to TransGrid's Canberra 132 kV Bulk Supply Point (BSP).

National Electricity Rules (NER) section 5.14 requires TransGrid, as the supplier of transmission services to the ACT, to (in joint planning with Evoenergy) identify the most efficient options to address a particular need. Evoenergy has assessed their need to supply proposed West Belconnen district and decided the most efficient option to address this need is construction of Strathnairn Zone Substation.

2. Related needs/opportunities

> **1695** – Connection of Molonglo Zone Substation

  This Need is for the connection of the Evoenergy's new Molonglo zone substation to Line 9HC: Canberra to Woden Tee Stockdill line.

> **N2293 –** Improve Quality of Supply in ACT

  This Need investigates the potential options to manage the large voltage step changes in the ACT network due to capacitor bank switching at Canberra Substation.

> **N2577** – Maintain Reliability of Supply to ACT

  This Need investigates the potential options to improve the supply reliability and supply resilience to the ACT network following decommissioning of the No.2 and No.3 330/132 kV transformers at TransGrid's Canberra Substation.

3. Options

TransGrid considered four options in the NOSA of which one was progressed to the OER stage and presented below together with the base case. Three options that were considered in the NOSA but not progressed is described in section **Error! Reference source not found.**.

3.1 Base case

The base case for this project is to not facilitate the connection of Evoenergy's Strathnairn Zone Substation to TransGrid's network. This will require Evoenergy to connect new loads in the Strathnairn area via the existing subtransmission and distribution infrastructure Consequence of this include:

- Potentially causing overload of the existing assets, in particular existing 11kV feeders. Exceeding capacity of existing feeders would lead to load shedding.
- Higher costs to the customers, in case energy not being able to be supplied from Evoenergy's network is supplied from alternate sources, such as diesel generators or batteries.
- Unserved energy as shown on Figure 1 below

[4] This info is from recent e-mail correspondence with Evoenergy dated 9 September 2021.

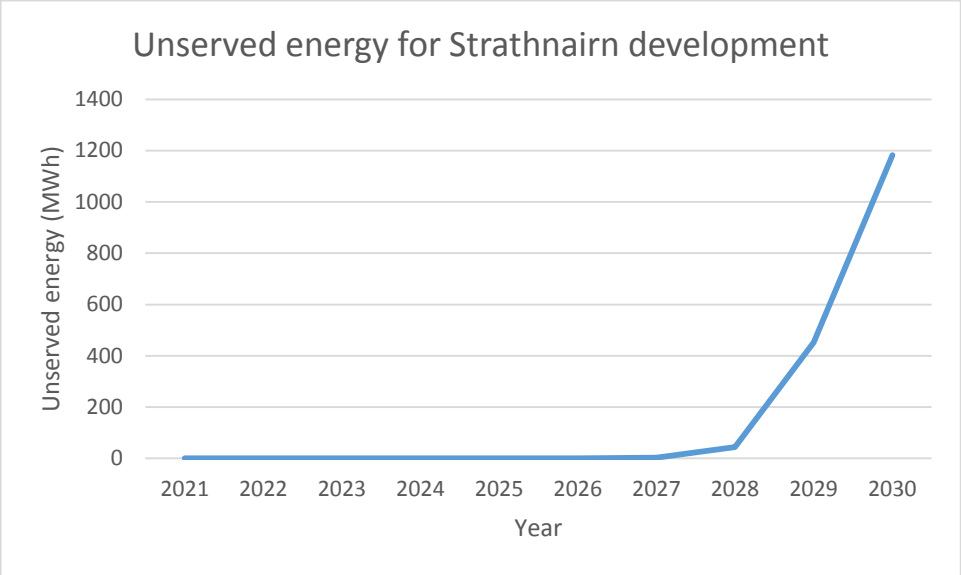

Figure 1 Unserved energy for Strathnairn development

3.2 Options evaluated

Option A — 132 kV connection of Evoenergy's proposed Strathnairn Zone Substation

This option involves Evoenergy constructing a new Strathnairn Zone Substation in the forecast load centre of the developing area. Location of the proposed ZS in the load centre will lead to relatively short distribution feeders (in targeted directions to major loads), which would decrease overall project cost. The option is expected to fully address forecast unserved energy in the area.

This option involves the provision of a new 132 kV switchbay at Canberra 330/132 Substation, and associated ancillary works, and works to connect the proposed Evoenergy 132 kV cable to this new switchbay.
The scope of works includes:

- Demolition, removal and disposal of old 132kV equipment and footings located at Bay 2J (Feeder 4X2)
- Installation of a new 132kV switchbay
- Connection of Evoenergy's new 132kV underground cable (from Strathnairn ZS) to Bay 2J (Feeder 4X2), and
- Installation and commissioning of the associated secondary systems, as required.

The proposed works are expected to be required to be completed during 2027/28. (This is subject to the timing of Evoenergy constructing the Strathnairn Zone Substation and installing a new 132 kV subtransmission cable).

The estimates in the table below include an uncertainty of ± 25% and exclude capitalised interest; they are shown in the Table 3.

Table 2 Option A expected expenditure

	Total Project Base Cost ($M)	FY2026/27 ($M)	FY2027/28 ($M)
Estimated P50 Cost non-escalated ($2020-21)	2.99	0.64	2.35

It is estimated that an amount up to $700,000, included in total project cost, is required to progress the project from Decision Gate 1 (DG1) to DG2. This is to cover activities such as site visits, development of concept design, and commencement of project approvals and early procurement of long lead-time items.

This project is expected to be completed in an estimated 22 months, following the approval of DG1.

3.3 Options considered and not progressed

Three other options were also considered but were not progressed, as they were considered not technically or economically feasible or both, or available within the required project time frame. These options are outlined in the Table 4 below.

Table 3 Options considered but not progressed

Option	Reason for not progressing
Option B – Construct 6 new 11 kV cable feeders each from Latham Zone Substation	Evoenergy[5] has confirmed Latham ZS is a significant distance from the new load (up to 7km), which would cause unacceptable voltage drop and be too high in cost to consider. Not economically or technically feasible.
Option C – Deploy mobile substation initially, followed by permanent Strathnairn Zone Substation	Evoenergy[6] has confirmed the mobile zone substation will likely still be in use in Molonglo, at the time Strathnairn substation is proposed to be built, so the option is not technically feasible within expected project time frame. Also, if permanent Strathnairn ZS with connection of a new switchbay at Canberra Substation is a final solution, introducing a mobile ZS by cutting in existing 132kV network[7] would introduce additional costs long term. Not economically or technically feasible.
Option D – Non-network Options	Evoenergy[8] has confirmed they are not expecting a non-network option to replace or defer the need for Strathnairn Zone Substation. Technically non feasible.

[5] As advised by Evoenergy e-mail dated 23/07/2021.
[6] As advised by Evoenergy e-mail dated 1/06/2021.
[7] This info is from e-mail correspondence with Evoenergy dated 11/08/2021.
[8] As advised by Evoenergy e-mail dated 1/06/2021.

4. Evaluation

4.1 Commercial evaluation methodology

The economic assessment undertaken for this project includes three scenarios that reflect a central set assumptions based on current information that is most likely to eventuate (central scenario), a set of assumptions that give rise to a lower bound for net benefits (lower bound scenario), and a set of assumptions that give rise to an upper bound on benefits (higher bound scenario).

Assumptions for each scenario are set out in the Table 4.

Table 4 - Assumptions used in commercial benefit calculations

Parameter	Central scenario	Lower bound scenario	Higher bound scenario
Discount rate	4.8%	7.37%	2.23%
Demand Growth	Medium (POE50)	Low (POE90)	High (POE10)
Capital cost	100%	125%	75%
Operating expenditure	100%	125%	75%
VCR	AER Latest VCR[9] (escalated) 100%	70%	130%
Scenario weighting	**50%**	**25%**	**25%**

Since the central scenario represents the most likely scenario to occur, it has been weighted at 50 per cent. The other two scenarios reflect extreme combinations of assumptions, designed to stress test the results. Accordingly, these scenarios are weighted at 25 per cent each.

Parameters used in this commercial evaluation are listed in Table 5:

Table 5 - Parameters used in commercial benefit calculations

Parameter	Parameter Description	Value used for this evaluation
Discount year	Year that dollar values are discounted to	FY21
Base year	The year that dollar value outputs are expressed in real terms	FY21 dollars
Period of analysis	Number of years included in economic analysis with remaining capital value included as terminal value at the end of the analysis period.	25 years

The capex figures in this OER do not include any real cost escalation.

[9] VCR value of $43,032/MWh was used in calculations for cost of unserved energy.

4.2 Commercial evaluation results

The commercial evaluation of the technically and commercially feasible options is set out in the Table 7. Details appear in 0.

Table 6 - Commercial evaluation (PV, $ million)

Option	Capital Cost PV	OPEX Cost PV	Central scenario NPV	Lower bound scenario NPV	Higher bound scenario NPV	Weighted NPV	Ranking
Option A	2.16	0.68	396	172	837	450	1

4.3 Preferred option

The preferred option is Option A, should Evoenergy determine that construction of the Strathnairn Zone Substation and connection of that zone substation via a new 132 kV cable to TransGrid's Canberra 132 kV BSP is their preferred option for meeting demand growth in the Strathnairn area.

The works required to address this need includes installation of a new 132kV switchbay, connection of Evoenergy's new 132kV underground cable and installation and commissioning of the associated secondary systems.

The preferred option was selected because it has a higher NPV than the base case, fully meets the need in the long term, is technically and economically feasible, and maintains regulatory compliance.

If Option A is not implemented, overload of existing Evoenergy's and potentially TransGrid's assets is expected to occur, with these limitations unable to be managed in the long term without alternate network augmentation investments.

Capital and Operating Expenditure

The preferred option requires total capital expenditure of $2.99 million. This figure includes direct capital cost and network and corporate overheads cost, listed in the Table 1.

The base case requires no capital or operating expenditure.

Regulatory Investment Test

As the estimated cost of the project is below the Regulatory Investment Test (RIT-T) threshold of $6 million, a RIT-T will not be required.

5. Optimal Timing

The test for optimal timing of the preferred option is not required, as timing is determined by Evoenergy and TransGrid's regulatory obligations. Based on current advice from Evoenergy, it is expected that the new Strathnairn Zone Substation will require bulk supply in 2027/28[10]. Economic analysis supports the optimal timing assessment provided by Evoenergy.

As such, the following is determined:

> Commissioning year: 2027/28

[10] Optimal timing for Strathnairn ZS has been stated by Evoenergy in recent e-mail correspondence dated 9 September 2021.

- Commissioning cannot occur before Evoenergy constructs the new 132 kV cable, assumed to be in 2026/27.
- Commissioning is to occur when requested by Evoenergy, to maintain regulatory compliance, expected to be in 2027/28.

> Commissioning year annual benefit: $1.9 million

> Annualised cost: $169,506

Based on the expected Evoenergy project timing, this project is expected to commence in the 2023-2028 Regulatory Period.

6. Recommendation

The recommendation is to progress with Option A, which includes installation of a new 132kV switchbay at Canberra Substation, subject to Evoenergy approving its investment for Strathnairn ZS and for a new 132 kV cable to the Canberra 132 kV BSP. This is on the basis that Option A is the only commercially and technically feasible option and addresses the need.

Appendix A – Option Summaries

Project Description	***Canberra 132 kV Connection of Evoenergy Strathnairn ZS***		
Option Description	Option A – 132 kV connection of Evoenergy's Strathnairn Zone Substation		
Project Summary			
Option Rank	1	Investment Assessment Period (years)	25
Asset Life (years)	40	NPV Year	2021
Economic Evaluation			
NPV @ Central Benefit Scenario (PV, $m)	397	Annualised CAPEX ($m)	0.17
NPV @ Lower Bound Scenario (PV, $m)	172	Network Safety Risk Reduction ($m)	N/A
NPV @ Higher Bound Scenario (PV, $m)	837	ALARP	N/A
NPV Weighted (PV, $m)	450	Optimal Timing	2027/2028
Cost			
Direct Capex ($m)	2.55	Network and Corporate Overheads ($m)	0.44
Total Capex ($m)	2.99	Cost Capex (PV,$m)	2.16
Terminal Value ($m)	1.4	Terminal Value (PV,$m)	0.46