OPTIONS EVALUATION REPORT (OER)

Supply to Sydney West BSP

OER- N2371 revision 2.0

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

Project reason: Reliability - To meet connection point reliability requirements
Project category: Prescribed - Augmentation-Sub Sys

Approvals

Author	Gang Cao	Senior Planning Engineer
	Dragana Hele	Senior Planning Engineer
Reviewed	Mike Tamp	Senior Engineer (Contract), Network Planning & Operations
	Jahan Peiris	Acting Manager Major Projects Planning
Endorsed	Kevin Hinkley	Manager Customer Planning
Approved	John Howland	Acting Head of Network Planning
Date submitted for approval	20 December 2021	

Change history

Revision	Date	Amendment
0	30/07/2021	Initial Issue
1	20/09/2021	Revised to address Houston Kemp Comments
2	20/12/2021	Revised to address Cutler Merz comments.

Executive summary

The latest Endeavour Energy demand forecast shows rapid load growth in the Sydney West area due to the connection of new data centres and ongoing development of commercial and residential lands and associated infrastructure in the area.

There is an emerging risk of unserved energy at Sydney West BSP due to the increasing summer demand exceeding the firm capacity at the site. The gap between the demand forecast (POE50) and firm transformer capacity is expected to increase from 62 MVA[1] in 2023/24 to 731 MVA in 2029/30. This will result in load shedding under single or multiple outages of 330/132 kV transformers, in order to contain loads within ratings of the remaining in-service transformer units.

There is therefore a compliance need to provide additional supply capacity in the Sydney West supply area to meet the expected demand and to meet connection point reliability requirements.

The assessment of the options considered to address the need/opportunity is given in Table 1.

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	Install a new 330/132 kV transformer at Sydney West BSP	18.74	1.26	20	316	1
Option B	Establish a new 330/132 kV BSP at Mt Druitt and convert existing 132 kV line 932 and 219 to 330 kV	59.3	4.3	63.6	217	2

Installing a new 330/132 kV transformer at Sydney West BSP in Option A, provides additional capacity in its supply area equal to the rating of the 375 MVA transformer.

Establishing a new 330/132 kV BSP at Mt Druitt in Option B provides 750 MVA additional capacity in its supply area, equivalent to the rating of two new 375 MVA transformers.

The preferred option based on the options evaluation presented in this report is expected to be Option A, as this meets the requirements of the need, is technically and economically feasible, and has the highest NPV.

Option A combined with the preferred option of Need 1687 Supply to Western Sydney Priority Growth Area, can provide adequate firm supply capacity at Sydney West BSP for the next 10 years.

However, the final preferred option will be determined through the RIT-T process based on detailed network analysis, further cost/benefit analysis, technical and economic feasibility. This will include consideration of any non-network options that emerge through the RIT-T process, where an Expression of Interest (EOI) is expected to be released calling for non-network solutions from the market.

[1] The analysis is based on the latest forecast information received from Endeavour Energy on 26 July 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.

1. Need/opportunity

This project is driven by the need to provide additional bulk supply capacity into the Sydney West area to meet customers' demands for electricity and to meet connection point reliability requirements.

The latest Endeavour Energy Zone Substation demand forecast shows rapid load growth in the Sydney West area due to the connection of new data centres and ongoing commercial and residential development in the area. The significant demand growth is mainly driven by spot loads including data centres, metro train lines and large commercial/residential development in the Aerotropolis. The latest Endeavour Energy POE50 summer maximum demand, including the committed Data Centre and Aerotropolis spot loads, is forecast to exceed the Sydney West BSP firm supply capability[3] from 2022/23. Consequently, Transgrid has an obligation to facilitate connection of these loads and there is a compliance need for this project.

There is an emerging risk of unserved energy at Sydney West BSP due to increasing summer demand exceeding firm capacity at the site. The gap between the POE50 demand forecast and firm transformer capacity is expected to increase from 62 MVA in 2023/24 to 731 MVA in 2029/30. This will result in load shedding under single or multiple outages of 330/132 kV transformers, in order to contain loads to within ratings of the remaining in-service units.

2. Related needs/opportunities

- Need 1687 – Supply to Western Sydney Priority Growth Area

  This Need is to address the load growth at the area surrounding new Western Sydney Airport.
- Need N2203 – Supply to Western Sydney Employment Area

  This Need is to provide a 132 kV connection at Sydney West substation for Endeavour Energy's new South Erskine Park Zone Substation.
- Need N2291 – Supply to Eastern Creek Area

  This Need is to provide two 132 kV switchbays at Sydney West substation for a new 160 MVA data centre within Endeavour Energy distribution network.
- Need N2260 – Sydney West Battery BESS installation

  This Need is to provide a 132 kV connection for a new 50 MW BESS near Sydney West substation.

3. Options

3.1 Base Case

Under the base case, where there is no network development to address the need, load curtailment is expected to be required from Summer 2024/25[4] if the contingency occurs at or near times of high demand. This will result in Expected Unserved Energy (EUE). This would have a material economic impact on the commercial and residential developments expected in the area.

3.2 Options evaluated

Option A — Install a new 375 MVA 330/132 kV transformer at Sydney West BSP

The following scope of works are associated with the installation of a new 375 MVA 330/132 kV transformer at the existing Sydney West 330 kV substation. Further detail is provided in OFS-N2371A. This option will increase firm capacity at Sydney West BSP by 375 MVA.

[3] The total transformer supply capability under the single contingency of transformer fail.

[4] The load curtailment for Summer 2023/24 can be avoided by using transformer emergency rating and cyclical rating.

Forecast load in the area supplied by Sydney West BSP is expected to increase above 375 MVA by 2029/30, but staging of the future projects is not fully known at present. This means that additional capacity at Sydney West provided in Option A can be sufficient for several years, until other transmission supply options in the area are implemented. This Option can be built by FY2025, providing the fastest supply solution.

The preferred option of Need 1687 can provide additional supply capacity to Sydney West 132 kV, to meet the forecast load growth in the area.

- Relocation of the 330 kV No.7 Capacitor Bank
- Construct a new 132 kV bay adjacent to existing bay 2E.
- Extend the 132 kV Endeavour Energy feeder cable from bay 2G to the newly constructed 132 kV bay adjacent to existing bay 2E.
- Construct a new 132 kV bay (opposite bay 2G) and connect to the 132 kV 'B' Bus Section 1.
- Installation of a new 375 MVA 330/132 kV power transformer and associated bund.

The expected optimal commissioning year for this option is 2024/25.

It is estimated that this option would cost $20 million ± 25% in $2020-21, excluding capitalised interest.

The expected expenditure profile in Table 2 for this option is obtained using TransGrid's Estimating Database (2020/21C).

Table 2 – Option A expected expenditure

	Total Project Base Cost	FY2021/22	FY2022/23	FY2023/24	FY2024/25
Estimated Cost – non-escalated ($m 2020-21)	20.0	0.8	1.5	17.2	0.5

It is estimated that an amount up to $2 million 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 cost is included in the expected expenditure.

This project is expected to be completed in an estimated 38 months following the approval of DG1. Commissioning of this option is planned for 2024/25.

Option B — Establish a new 330/132 kV BSP at Mt Druitt and convert existing 132 kV line 932 and 219 to 330 kV

Option B can provide up to 375 MVA supply capacity to existing Endeavour Energy load which are currently supplied by Sydney West BSP. Due to the space limitation, no further capacity increase can be provided by the new Mt Druitt BSP.

The following scope of works are associated with the establishment of a new 330/132 kV BSP at Mt Druitt next to existing Mt Druitt zone substation. Further detail is provided in OFS-N2371B.

- Ownership of Endeavour Energy's 219 (Mt Druitt to Mamre) and 932 (Mt Druitt to Sydney West) feeders; easements and the associated OPGW to be transferred to TransGrid;
- Property acquired for the new Mt Druitt substation and feeders reconfigured;
- Construct the new Mt Druitt 330/132 kV substation;
- Construct the additional 330 kV switchbays at Sydney West 330/132 kV substation;
- Relocate TL20 into the new 330 kV switchbay at Sydney West; and
- Prepare TL14, and carry out cut-overs

The expected optimal commissioning year for this option is 2025/26.

It is estimated that this option would cost $63.6 million ± 25% in $2020-21, excluding capitalised interest.

The expected expenditure profile in Table 3 for this option is obtained using TransGrid's Estimating Database.

Table 3 – Option B expected expenditure

	Total Project Base Cost	FY2021/22	FY2022/23	FY2023/24	FY2024/25	FY2025/26
Estimated Cost – non-escalated ($m 2020-21)	63.6	0.65	3.2	11.35	47.5	0.9

It is estimated that an amount up to $5 million is required to progress the project from DG1 to DG2. This is to cover activities such as site visits, development of concept design, and commencement of project approvals, commence property negotiations, interfacing with Endeavour Energy and early procurement of long lead-time items. This cost is included in the expected expenditure.

This project is expected to be completed in an estimated 49 months following the approval of DG1. Commissioning of this option is planned for 2025/26.

Option C – Non-network solution

This option is to investigate the potential demand management within the area supplied by Sydney West BSP, to reduce the load at Sydney West BSP to below the limit of 1500 MVA. Demand management may be able to address this need, which occurs as early as 2023/2024, by reducing the risk of unserved energy. Transgrid currently has no information on the potential costs of a demand management solution.

At this stage, it is not clear whether a demand management solution will be economically viable, and it has not been evaluated in the NPV analysis.

The least cost network option for this Need N2371 is likely to exceed $6 million and will be subject to a RIT-T, where an Expression of Interest (EOI) is expected to be released, calling for non-network solutions from the market[5]. This will enable the viability of non-network options in the area, to be fully assessed.[6]

3.3 Options considered and not progressed or evaluated

We considered two other options in NOSA-N2371 that were not progressed as they were considered not technically or economically feasible. These options are outlined in Table 4 below.

Table 4 – Options considered but not progressed

Option	Reason for not progressing
Load transfer to the new BSP to be built under Need 1687	This option is not evaluated in this report. The new BSP to be built under Need 1687 is mainly to provide the electricity supply to the area surrounding new Western Sydney airport. It can partially offload the Sydney West 132 kV load once it is completed by 2028/29 but it won't provide adequate supply for the load growth at Sydney West BSP. It follows that this option would not be technically feasible.
Endeavour Energy Load Transfer from Sydney West to Vineyard BSP	As Vineyard BSP is already experiencing high load growth and the supply capacity at Vineyard is reaching its limit, this option is not technically feasible.

[5] 50MW grid-connected battery has been committed to connect to Sydney West 132kV under NOSA N2260

[6] Non-network options may include diesel generators, grid scale batteries etc.

4. Evaluation

4.1 Commercial evaluation methodology

The economic assessment undertaken for this project includes three scenarios that reflect a central set of 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 Table 5 below.

Table 5 – Scenarios

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%
Value of Customer Reliability (VCR) [7]	100%	70%	130%
Scenario weighting	50%	25%	25%

Parameters used in this commercial evaluation are set out in the table below.

Table 6 – Parameters used in commercial evaluation

Parameter	Parameter Description	Value used for this evaluation
Discount year	The year that dollar values are discounted to	2020-21
Base year	The year that dollar value outputs are expressed in real terms	2020-21 dollars
Period of analysis	The 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.

4.2 Commercial evaluation results

The commercial evaluation of the technically and economically feasible options is set out in Table 7. Details appear in Appendix A.

[7] AER 2019 December VCR value escalated by CPI to 2020/21 dollars.

Table 7 - 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	18.3	4.5	243	61	718	316	1
Option B	56	13.4	152	-3.6	567	217	2

4.3 Preferred option

The NPV assessment shows that both credible options can be expected to deliver significant net market benefits to the NEM, when compared to the do nothing base case option, since both options have been designed to manage the risk of substantial unserved energy to the loads supplied by Sydney West BSP.

Of the network options assessed, Option A has the highest NPV. Therefore, Option A is expected to be the preferred option. The final preferred option will be determined through the RIT-T process. Under Option A, the following investments will be undertaken:

> Install a new 375 MVA 330/132 kV transformer at Sydney West BSP.

Capital and Operating Expenditure

The preferred option requires capital expenditure of $20 million. Additional operating expenditure of $0.4M per year has been identified for this option.

The base case requires no capital or operating expenditure.

Regulatory Investment Test

As the estimated cost of the project is above the Regulatory Investment Test (RIT-T) threshold of $6M, a RIT-T will be required.

The Project Specification Consultation Report (PSCR) is expected to be published by the end of 2021.

5. Optimal Timing

The test for optimal timing of the preferred option has been undertaken. The approach taken is to identify the optimal commissioning year for the preferred option where net benefits (including avoided costs and safety disproportionality tests) of the preferred option exceeds the annualised costs of the option. The commencement year is determined based on the required project disbursement to meet the commissioning year based on the OFS.

The results of optimal timing analysis is:

> Optimal commissioning year: 2024/25
> Commissioning year annual benefit: $1,214k
> Annualised cost: $1,133k

Based on the optimal timing, the project construction work is expected to commence in the 2023-2028 Regulatory Period.

6. Recommendation

The final preferred option will be determined through the RIT-T process based on detailed network analysis, market modelling, technical and economic feasibility. However, based on the option evaluations in this report, the preferred

network option is Option A – Install a new 330/132 kV transformer at Sydney West BSP. This option will add 375 MVA firm transformer capacity to Sydney West BSP. It is therefore recommended that the project be approved to proceed to a RIT-T assessment, with a view to the preferred option being implemented as soon as practicable from 2024/25.

Based on the options listed in Section 3.1, it is expected that this Project would incur a capital cost of approximately $20 million in P50 non-escalated 2020/21 dollars.

The recommendation is to progress with Option A. This option requires $2 million of capex to progress the project to DG2.

Appendix A – Option Summaries – Option A

Project Description	Supply to Sydney West BSP		
Option Description	Option A — Install a new 330/132 kV transformer at Sydney West BSP		
Project Summary			
Option Rank	1	Investment Assessment Period	25
Asset Life	40	NPV Year	2021
Economic Evaluation			
NPV @ Central Benefit Scenario (PV, $m)	243	Annualised CAPEX ($m)	1.1
NPV @ Lower Bound Scenario (PV, $m)	61	Network Safety Risk Reduction ($m)	N/A
NPV @ Higher Bound Scenario (PV, $m)	718	ALARP	N/A
NPV Weighted (PV, $m)	316	Optimal Timing	2024/25
Cost			
Direct Capex ($m)	18.7	Network and Corporate Overheads ($m)	1.3
Total Capex ($m)	20	Cost Capex (PV,$m)	18.3
Terminal Value ($m)	9.5	Terminal Value (PV,$m)	3.1

Appendix B – Option Summaries – Option B

Project Description	Supply to Sydney West BSP		
Option Description	Option B — Establish a new 330/132 kV BSP at Mt Druitt and convert existing 132kV line 932 and 219 to 330kV		
Project Summary			
Option Rank	2	Investment Assessment Period	25
Asset Life	40	NPV Year	2021
Economic Evaluation			
NPV @ Central Benefit Scenario (PV, $m)	152	Annualised CAPEX ($m)	3.6
NPV @ Lower Bound Scenario (PV, $m)	-3.6	Network Safety Risk Reduction ($m)	N/A
NPV @ Higher Bound Scenario (PV, $m)	567	ALARP	N/A
NPV Weighted (PV, $m)	217	Optimal Timing	2025/26
Cost			
Direct Capex ($m)	59.3	Network and Corporate Overheads ($m)	4.3
Total Capex ($m)	63.6	Cost Capex (PV,$m)	56.1
Terminal Value ($m)	31.8	Terminal Value (PV,$m)	10.3