Project justification: Mount Barker East – New substation

2025-2030 Regulatory Proposal

Supporting document 5.4.2.2

December 2024

SA Power Networks

Empowering South Australia

Contents

Document Control

Version	Date	Author	Notes
0.0	November 2024		
0.1	December 2024		

Glossary

Acronym / term	Definition
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ARENA	Australian Renewable Energy Agency
BCR	Benefit Cost Ratio
BESS	Battery Energy Storage System
Capex	Capital expenditure
CER	Customer Energy Resources
DLF	Distribution Loss Factor
DSP	Demand-Side Participation
EAC	Equivalent Annual Cost
EOI	Expression of Interest
EMCa	Energy Market Consulting Associates
ESOO	Electricity Statement of Opportunities
EV	Electric Vehicle
HEMS	Home Energy Management Systems
KV	Kilo Volt
ISP	Integrated System Plan
LV	Low Voltage
MWh	Mega Watt hour
MVA	Mega Volt Ampere
NER	National Electricity Rules
NSSA	Network System Support Agreements
NPV	Net Present Value
POE	Probability of Exceedance
RCP	Regulatory Control Period
RIT-D	Regulatory Investment Test for Distribution
RIT-T	Regulatory Investment Test for Transmission
SAPS	Stand-Alone Power Systems
SCADA	Supervisory Control and Data Acquisition
URD	Urban residential development
USE	Unserved Energy
VCR	Value of Customer Reliability

1 About this document

1.1 Purpose

This project justification addresses the need to manage the forecast risk of unserved energy for customers supplied by the Mount Barker Distribution substation[1].

This document describes the need, identifies and evaluates the options to address the need, and selects a preferred option for investment which is proposed to be delivered as part of SA Power Networks' capacity augmentation program for the 2025-30 Regulatory Control Period (**RCP**).

1.2 Expenditure category

- Network capex: augmentation

1.3 Related documents

Table 1: Related documents

Ref	Title
Attachment 5	Capital Expenditure Revised Proposal
5.4.2	Augex Capacity Business Case Addendum December 2024

[1] The substation is referred to as the 'Mount Barker Distribution' substation, to differentiate it from the adjacent ElectraNet Mount Barker (transmission) substation.

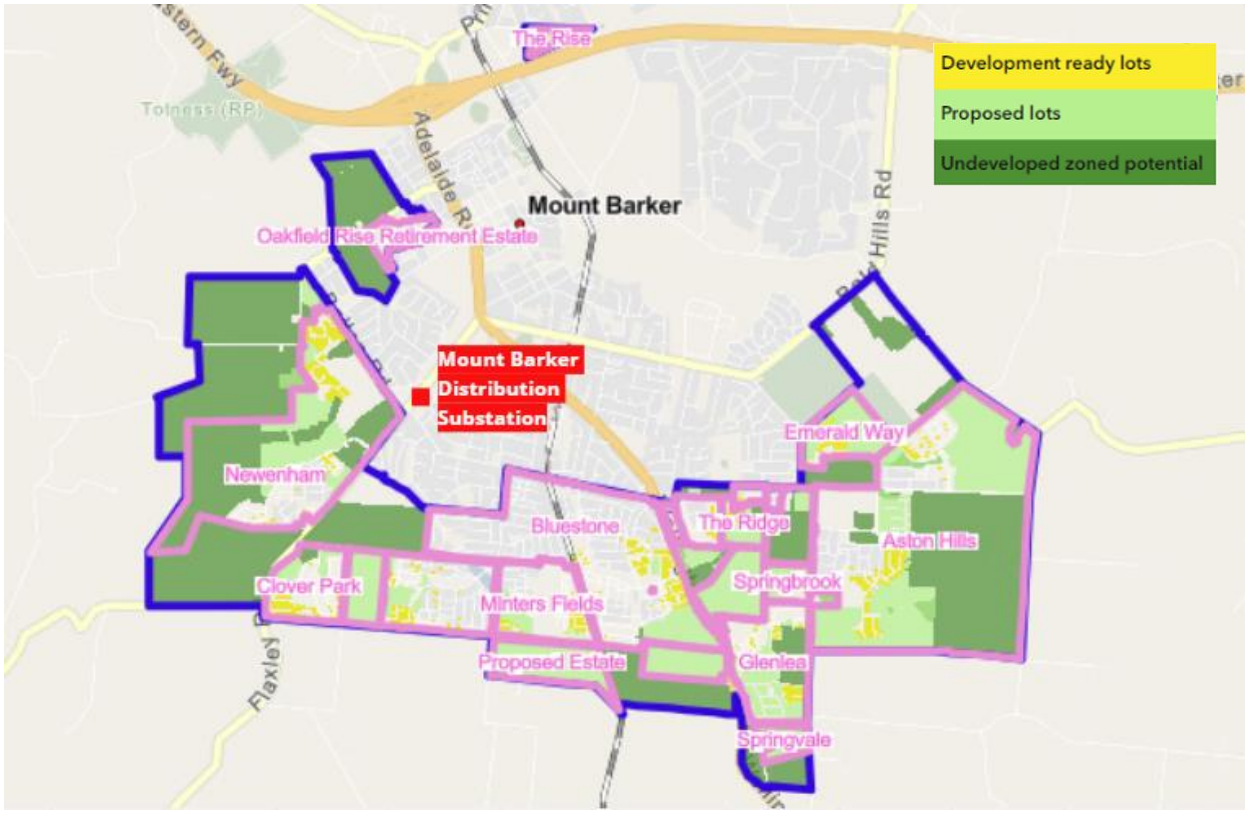
2 Background and identified need

The identified need for this project, is pursuant to the overarching identified need described in section 4 of Supporting Document 5.4.2 Augex capacity business case addendum, described in more detail below.

The Mount Barker Distribution substation is a critical infrastructure asset located in the Adelaide Hills suburb of Mount Barker. The Mount Barker region has experienced significant growth over the past 10 years, with the Mount Barker council area population having increased by 30% between 2011 and 2021[2]. The Mount Barker Distribution substation supplies electricity to approximately 14,000 customers and has seven 11kV feeders and two 34 MVA transformers.

The town of Mount Barker is forecast to become South Australia's second largest city within the next decade[3], and has experienced some of the highest development growth in the state outside of Adelaide's suburbs. PlanSA's website shows that significant portions of the land surrounding the Mount Barker Distribution substation has been re-zoned for residential occupancy[4]. Several Urban Residential Developments (**URDs**) have been established in the area, including Aston Hills, Newenham, Springvale, Bluestone and The Ridge, contributing to significant residential growth, as shown in Figure 1.

Figure 1 - Mount Barker residential re-zoning[5]

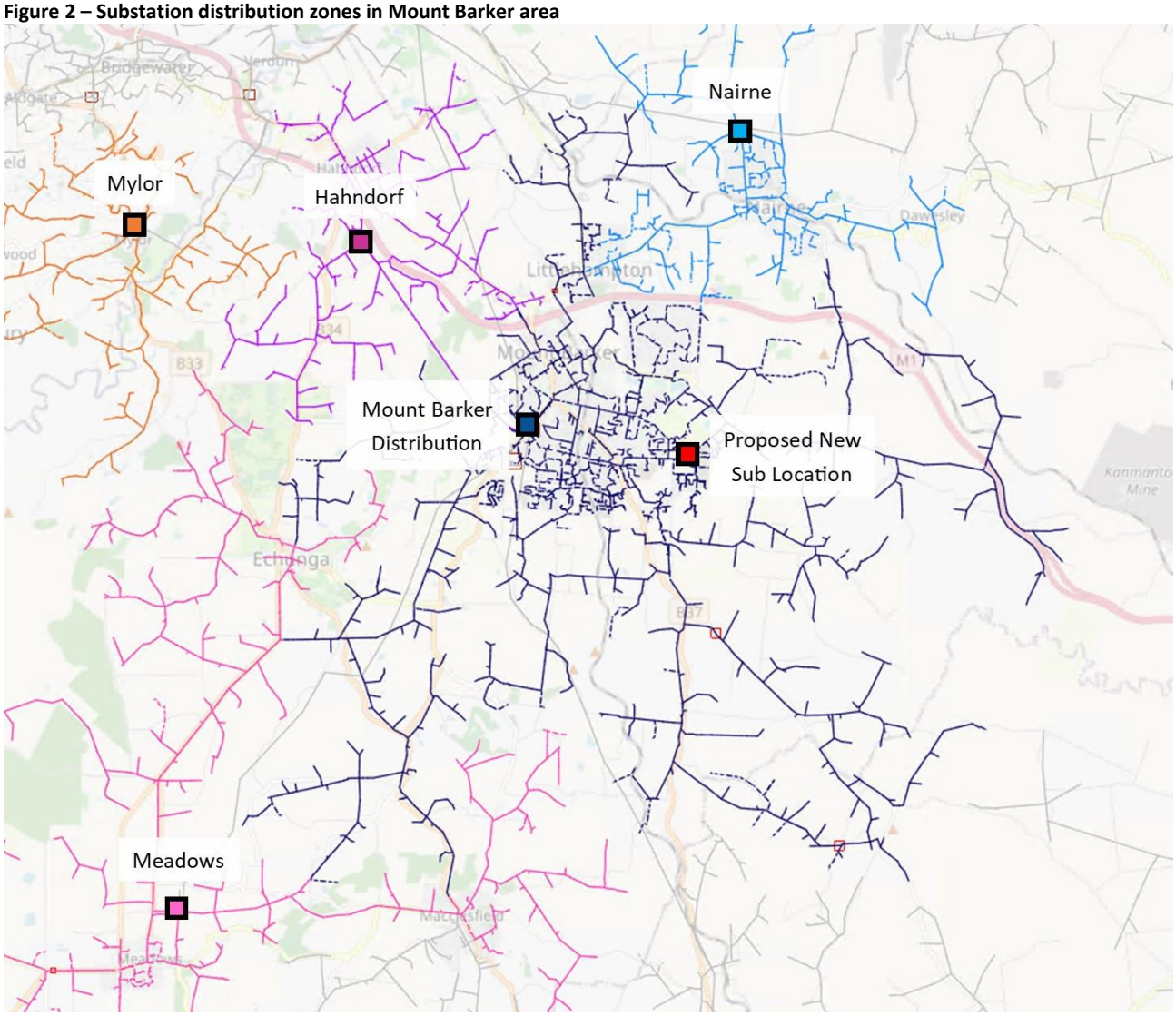


As of 2023, only 20% of the 1,300 hectares of rezoned land from 2010 has been developed. The rezoning was initially forecast to have density of about 10 dwellings per hectare, resulting in circa 26,000 additional residents. The average density of development to date has shown about 15 dwellings per hectare, resulting in an expected circa 40,000 additional residents.

[2] https://www.abs.gov.au/census/find-census-data/community-profiles/2016/401021008/download/TSP_401021008.xlsx
[3] Building-SAs-Second-Largest-City-Mount-Barker.pdf
[4] https://plus.geodata.sa.gov.au/landsupply/index.html
[5] https://plus.geodata.sa.gov.au/landsupply/index.html

From a network perspective, the Mount Barker Distribution substation is located between Hahndorf and Nairne substations to the north, and Meadows substation to the south-west, shown in Figure 2. The Mount Barker Distribution substation 11kV feeder network is connected to each neighbouring substation via small to medium sized 11kV conductors spanning a distance of five to fifteen kilometres.

Figure 2 – Substation distribution zones in Mount Barker area



SA Power Networks forecasts that, without action, demand growth will result in three of the Mount Barker Distribution feeders, MTB11, MTB13 and MTB16[6], to be overloaded in the 2025-30 RCP under a 10 PoE scenario, shown in **Table 2** (next page).

The MTB13 and MTB16 feeders will be geographically adjacent one another and run south and hence have limited ties to other feeders and no ties to other substations. MTB11 runs north with limited ties to other substations via long low-rated (low capacity) conductor.

[6] MTB16 is scheduled to be commissioned in 2026, and it is forecast to be overloaded (under 10PoE conditions) in 2030.

Table 2: Forecast Load at Risk[7]

Description		2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32
MTB11 N Overload	Limit (MVA)	7.62	7.62	7.62	7.62	7.62	7.62	7.62	7.62
	10POE Forecast (MVA)	7.26	7.55	7.85	8.17	8.49	8.83	9.18	9.55
	10POE Load At Risk (MVA)	-	-	0.23	0.54	0.87	1.21	1.56	1.93
	50POE Forecast (MVA)	6.53	6.79	7.07	7.35	7.64	7.95	8.27	8.60
	50POE Load At Risk (MVA)	-	-	-	-	0.02	0.33	0.65	0.98
MTB13 N Overload	Limit (MVA)	7.62	7.62	7.62	7.62	7.62	7.62	7.62	7.62
	10POE Forecast (MVA)	6.92	7.26	7.62	8.01	8.41	8.83	9.27	9.73
	10POE Load At Risk (MVA)	-	-	0.00	0.39	0.79	1.21	1.65	2.11
	50POE Forecast (MVA)	6.22	6.54	6.86	7.21	7.57	7.94	8.34	8.76
	50POE Load At Risk (MVA)	-	-	-	-	-	0.32	0.72	1.14
MTB16 N Overload	Limit (MVA)	7.62	7.62	7.62	7.62	7.62	7.62	7.62	7.62
	10POE Forecast (MVA)	3.20	7.11	7.21	7.31	7.41	7.52	7.63	7.75
	10POE Load At Risk (MVA)	-	-	-	-	-	-	0.01	0.13
	50POE Forecast (MVA)	2.88	6.40	6.49	6.58	6.67	6.77	6.87	6.97
	50POE Load At Risk (MVA)	-	-	-	-	-	-	-	-

Based on probabilistic modelling, the total energy at risk in the 2025-30 RCP is 14.4MWh under 10 PoE conditions. The total energy at risk in the following 2030-35 RCP is 599MWh under 10 PoE conditions.

The new 11kV feeder MTB16 (planned for construction in 2025/26), will enable an improved distribution of load across the Mount Barker Distribution substation feeders. However, this additional feeder will not be sufficient to avoid further feeder N constraints occurring during the 2025-30 RCP.

In addition, multiple feeder transfers have already been completed over the past five years to balance load between feeders and alleviate N feeder constraints. These load transfers will also be insufficient to address the forecast feeder N constraints occurring during the 2025-30 RCP, as all feasible transfers have already been fully utilised.

[7] All forecasts reflect a network configuration after the construction of the new MTB16 11kV feeder, a project which is also included in the 2025-30 RCP proposal.

3 Comparison of options

3.1 The options considered

SA Power Networks has evaluated options to increase capacity and ensure security of supply for our customers in the Mount barker region, including deferral of investment, a new zone substation, new 11kV feeders, and the installation of a battery. These options are set out in Table 3.

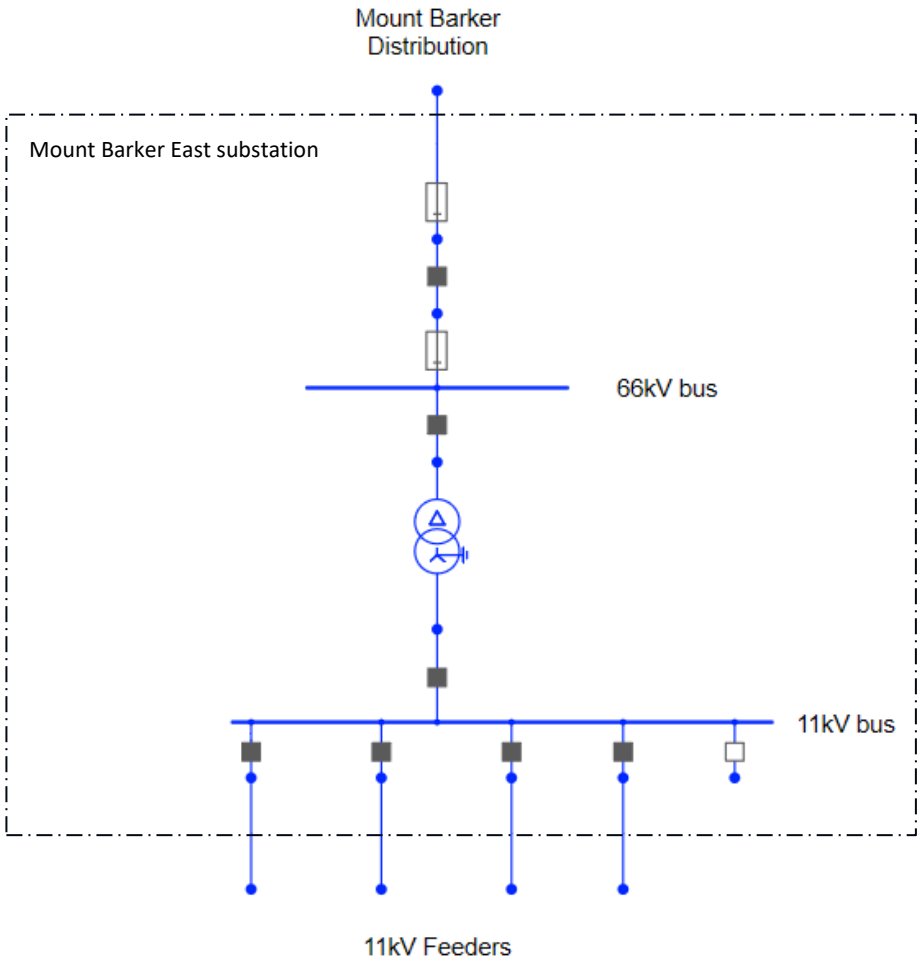
Table 3: Summary of options considered

Option	Description
Option 0 – Defer upgrade	Option 0 entails the extended transfer of load to other substations and the deferral of the substation upgrade. The available load transfers are very minimal due to the three feeders having minimal feasible ties to other feeders. Option 0 will be inadequate to mitigate risk of unserved energy in the 2025-30 RCP or beyond. The breaching of an N constraint under the 10 PoE forecast is inconsistent with SA Power networks' Planning Criteria and what it considers good industry practice. 2025-30 RCP Capex: $0 Total Capex: $0
Option 1 – New Substation	Option 1 entails the construction of a new substation located east of the Mount Barker Distribution substation. The substation will include a single 32MVA 66/11kV transformer and 6x circuit breaker switchboard. New feeder exits will be constructed which will connect to the existing backbone conductor that has been built in anticipation of the new substation. Option 1 is shown in Figure 3 below. This Option will alleviate all three forecast feeder N constraints, removing all energy at risk upon project completion. Design and site preparation of this option is planned to begin in 2029, with construction commencing in 2030. Note that this option does not address the constraints within the 2025-30 RCP, however this has been deemed appropriate due to the relatively small amount of energy at risk under 10 PoE[8] and high project cost. It will however be able to address 599MWh of energy at risk forecast in the 2030-35 RCP under 10 PoE conditions, once completed. The overload risk within the 2025-30 RCP will be managed with consideration for probability of development connections, or non-network services as a short term backup solution. The primary risks associated with Option 1 are those relating to implementation, potential cost overruns and managing short term energy at risk. 2025-30 RCP Capex: $6,609,000 Total Capex: $16,523,000
Option 2 – Deferral Two New Feeders	Option 2 involves deferring all costs for the new substation (Option 1) beyond the 2025-30 RCP by constructing two new 11kV feeders out of the Mount Barker Distribution to alleviate load from MTB13, MTB16 and MTB11. One feeder will address the constraint on MTB11 while the other new feeder will address the constraints on MTB13 and MTB16. Construction of the new feeders in this option would begin in 2026 and complete in 2027. This option defers the timing of the feeder constraints by several years but does not resolve the need for a new substation in the area. MTB13 is forecast to become constrained again in the 2031/32 summer and would therefore be typically resolved in 2031. However, to defer all costs for the new substation to beyond the 2025-30 RCP, and with consideration for the low energy at risk over the 2031/32 summer, the new substation upgrade is deferred until 2032.

[8] Providing MTB16 is constructed in 2025/26.

	The primary risks associated with Option 2 are those relating to implementation and potential cost overruns. 2025-30 RCP Capex: $5,053,000 Total Capex: $21,576,000
Option 3 – Deferral network support battery	Option 3 proposes to install 2MWh of battery storage on the 11kV feeder MTB11. The 11kV feeders MTB13 and MTB16 would not benefit from the battery support and energy at risk would still be present on these feeders. Construction of network support batteries within this option would begin 2026 and complete in 2027. As this battery would not fully address the constraint, and the N constraints would continue to grow after the construction of the battery, augmentation works for a new substation (Option 1) would still be required, but deferred one year[9], beyond the 2025-30 RCP. The primary risks associated with Option 3 are those relating to implementation, potential cost overruns and managing short term energy at risk. 2025-30 RCP Capex: $4,892,000 Total Capex: $21,415,000

Figure 3 - Option 1 Mount Barker East substation line diagram



[9] One year further than the deferral already considered for Option 1

3.2 Options investigated but deemed non-credible

A network support battery to fully mitigate the risk of all unserved energy was considered as a non-network solution. However, the substantial cost to establish the required energy storage capacity to address the forecast overload in the 2025-30 RCP, is not economical. In addition, continual investment would be required to meet future demand growth in the 2030-35 RCP.

SA Power Networks is working to continuously innovate and identify opportunities for the various technologies. Currently in partnership with Australian Renewable Energy Agency (**ARENA**), SA Power Networks plans to deliver network support batteries in the South East and Murraylands aimed at deferring costly network augmentation. The network support service provided by the batteries will assist to manage network constraints and defer traditional augmentation. The proposed network support batteries have provided insights to improve internal structures and develop industry knowledge that streamline implementation of future utility scale battery storage.

SA Power Networks plans to issue an expression of interest to seek potential non-network solution providers offers for addressing the constraint. Assessment of the submissions received will occur as part of the Regulatory Investment Test - Distribution (**RIT-D**) process.

3.3 Evaluation of options

3.3.1 Quantified benefits and risks

The costs and the net present value (**NPV**) of alternative options relative to the base case over the 20-year assessment period, are shown in Table 4. These options are based on the Australian Energy Market Operator's (**AEMOs**) "Central" scenario parameters (i.e., demand and discount rate). Information on the planning and evaluation methodology is provided in '*SAPN 2025-30 Reset Business Case – Augex Capacity*' submitted with our Original Proposal and the '*SAPN 5.4.2 Augex capacity - Business case addendum'* submitted with our Revised Proposal.

Table 4: Costs and NPV over the 20-year forecasting period[10]

OPTIONS	Cost (25-30 RCP $k)	Cost (Total $k)	NPV ($k)	BCR	Ranking
Option 0 - Defer Augmentation	$0	$0	$0	-	Does not meet min requirements
Option 1 - Mount Barker East new sub	$6,609	$16,523	$36,550	3.69	1
Option 2 – Deferral 2x Feeders	$5,053	$21,576	$34,155	2.890	2
Option 3 – Deferral Battery	$4,892	$21,415	$32,195	2.81	3

3.3.2 Project selection

Per our internal financial evaluation process, the benefit cost ratio (**BCR**) of this project exceeds 1.2, therefore a deferral test has not been undertaken, and we consider this a no-regrets investment. That aside, all feasible deferral options have already been implemented.

[10] All costs expressed in Jun $ 2022 without overheads.

3.3.3 Scenario and sensitivity analysis

The sensitivities of the NPV with respect to the forecast growth in demand and discount rate are reflected in the three scenarios as shown in Table 5.

Table 5: Sensitivity Analysis

		NPV ($k)					NPV ($k)		
% Cost	Option 0	Option 1	Option 2	Option 3	Discount Rate	Option 0	Option 1	Option 2	Option 3
70%	$0	$39,113	$37,576	$35,971	3.50%	$0	$40,107	$37,803	$35,687
100% (Central)	$0	$36,550	$34,155	$32,195	4.05% (Central)	$0	$36,550	$34,155	$32,195
130%	$0	$33,986	$30,733	$28,418	4.50%	$0	$33,871	$31,411	$29,567

Option 1 demonstrates the highest NPV for all sensitivities considered.

3.3.4 Unquantified benefits

The Mount Barker Distribution substation currently presents operational complexity as most of the feeders are highly loaded and are unable to be offloaded for planned maintenance. There are limited windows in spring and autumn where maintenance can be undertaken, which are expected to reduce over time. Option 1 will address this complexity, improving the ability to perform planned maintenance.

The installation of a new substation accords with the long-term strategic plan for the network. High rated (capacity) conductor has already been installed in the vicinity of the new substation location which will become new feeder backbones.

3.3.5 Risks

The preferred option 1, building the Mount Barker East substation, will still place the network at risk for a period of time.

SA Power Networks' Planning Criteria specifies that projects should avoid breaching an N constraint under a 10 PoE forecast load, when applying a feeders' normal capacity. Under a 10 PoE forecast, three feeders (MTB11, MTB13 and MTB16), are forecast to be constrained by 2027, 2028 and 2030 respectively.

SA Power Networks has taken into consideration the significant cost of this project balancing prudency against risk. Undertaking design and site preparation in the 2025-30 RCP, will allow construction to commence in 2030. This defers the higher portion of cost into the 2030-35 RCP. Deferring the construction portion of the project beyond 2030 will see risks significantly increase year on year.

Also noting the current 10 PoE forecast is based on the AEMO's central scenario. It is plausible that the load growth in the Mount Barker region will exceed this scenario, further exacerbating the risk at load.

4 Recommendation

The recommended option based on the options evaluation presented in this report is Option 1, as this meets the requirements of the need, is technically and economically feasible, and has a greater NPV than Option 2 and 3 under all sensitivity scenarios. Option 1 mitigates significant unserved energy risk by preventing the breaching of a three feeder N constraints under the 10 PoE forecast.

Option 2, comprising of two new feeders in addition to the MTB16 feeder, has a lower BCR and NPV than Option 1 in all scenarios, as well as a higher total cost. Although the two new feeders address the feeder N constraints in the 2025-30 RCP, beyond 2030 the N constraints return and require the new substation in Option 1 to eventually be built. Option 3, the battery deferral, has a similar cost to Option 2 however has a lower BCR and NPV in all scenarios. Therefore Option 1 is preferred over Option 2 and Option 3.

Option 0 would lead to unacceptably high levels of unserved energy, and has the lowest NPV, and is therefore not in the interests of SA Power Networks' customers.