Project Justification: Salisbury South - New Substation

2025-2030 Regulatory Proposal

Supporting document 5.4.2.3

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 document addresses the need to manage the forecast risk of unserved energy for customers supplied by the Salisbury Substation.

This document describes the need, identifies and evaluates 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

2 Background and identified need

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

The Salisbury substation is a critical infrastructure asset supplying the surrounding suburbs of Salisbury, Salisbury South and Brahma Lodge, located in the northern suburbs of the Adelaide metropolitan area. As the most heavily loaded zone substation in our network[1], it has reached its design capacity, supplying electricity to over 18,000 customers through ten 11kV feeders, two 21MVA 66/11kV transformers and one 24MVA 66/11kV transformer.

The region is experiencing steady load growth due to infill housing, with significant development anticipated as part of the Greater Adelaide Regional Plan[2]. Areas within Salisbury have been flagged for Neighbourhood and Centre Regeneration investigation with the number of dwellings forecast to increase by 4,300 from 2021 to 2036[3].

In the past 24 months, the region has also seen significant interest in commercial and industrial connection requests, with 17.2MVA from 11 different applications (four of which exceed 2MVA), 14.1MVA of which are now committed. Some of these customers have provided indications of additional ultimate load, totalling a further 10.4MVA, resulting in a total of 27.6MVA of prospective industrial spot load growth. These connections are aggregated in Figure 1 (next page). Only material committed connections have been included in our forecast, with appropriate diversity factors applied and adjustments made[4]. The 10PoE forecast for the Salisbury substation indicates a conservative of growth of 2.1MVA per annum, as shown in Table 2. It is anticipated the actual growth will be much higher.

The connection requests are all located on the 11kV feeders running south-east of the Salisbury substation, in an area which forms a 'gap' between the surrounding Golden Grove, Ingle Farm, Parafield Gardens, Cavan and Salisbury substations. These feeders are all very highly loaded with limited options to transfer load between feeders, meaning that it is extremely difficult to accommodate future connections on any Salisbury feeder, such as those described above.

This lack of capacity is resulting in expensive and inefficient extension works to connect customers, an example includes the necessity of a 1km cable extension to connect a single customer. Additionally, in 2024, a feeder tie project was constructed to enable a 1.5MVA load transfer between the SA14 and SA13 Salisbury feeders, to facilitate another new customer connection.

[1] Salisbury substation supplies significant commercial customers, including a large warehouse retail precinct along Main North Road adjacent the Parafield Airport, very large manufacturing industries and a South Australian Police compound.

[2] https://plan.sa.gov.au/regional-planning-program/summary-of-the-discussion-paper/urban-infill-growth.html

[3] *City of Salisbury: Population, households and dwellings* report by Informed Decisions, available from City of Salisbury | Community

[4] Diversity factor practice and additional adjustments to diversity factors made for the 2025-30 RCP Proposal are detailed in the Augex Capacity – Business Case Addendum.

SA Power Networks forecasts that, without establishing a new substation, demand growth will result in the Salisbury substation being overloaded in the 2025-30 RCP under a 10 PoE scenario. In addition, a contingency (N-1) constraint is forecast on the SA12 feeder, should the feeder exit fail under 50 PoE conditions. Furthermore, the SA17 feeder is forecast to be overloaded just beyond the 2025-30 RCP under 10 PoE scenario, any further commercial connections will further exacerbate the situation. These three constraints are shown below in Table 3. Further constraints are expected, with eventuation of the customer connections mentioned above.

Table 2: Forecast Load at Risk[5]

Salisbury Substation N	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34
N Rating (MVA)	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3
10POE Forecast (MVA)	59.9	60.5	63.8	67.0	71.0	72.7	74.3	76.0	77.5	79.1
10POE Load At Risk (MVA)	-	-	-	-	-	1.3	3.0	4.6	6.2	7.8
50POE Forecast (MVA)	55.6	56.5	59.9	63.1	67.0	68.8	70.5	72.3	74.0	75.8
50POE Load At Risk (MVA)	-	-	-	-	-	-	-	1.0	2.7	4.4

SA12 Feeder N-1	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34
N-1 Rating (MVA)	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4
10POE Forecast (MVA)	11.2	11.3	13.3	13.4	13.5	13.6	13.7	13.7	13.8	13.9
10POE Load At Risk (MVA)	-	-	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.5
50POE Forecast (MVA)	10.1	10.2	12.0	12.1	12.1	12.2	12.3	12.4	12.4	12.5
50POE Load At Risk (MVA)	-	-	0.6	0.6	0.7	0.8	0.9	0.9	1.0	1.1

SA17 Feeder N	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34
N Rating (MVA)	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
10POE Forecast (MVA)	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5
10POE Load At Risk (MVA)	-	-	-	-	-	-	-	0.1	0.2	0.3
50POE Forecast (MVA)	7.8	7.9	7.9	8.0	8.1	8.2	8.3	8.3	8.4	8.5
50POE Load At Risk (MVA)	-	-	-	-	-	-	-	-	-	-

Based on probabilistic modelling, the total energy at risk in the 2025-30 RCP under 10 PoE conditions is 3.6MWh, increasing to 53.0MWh in the 2030-35 RCP.

[5] Forecast values include the impact of block load adjustments described in the Augex Capacity – Business Case Addendum, including an 80% block load factor and 2-year connection delay, and as such, the values presented in Table 1 do not precisely match published forecasts. Only committed connections are included in these block loads, and excludes ultimate loads or uncommitted prospective connections.

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 Salisbury region, including deferral of investment, a substation upgrade, further feeder works and the installation of a battery.

Table 3: Summary of options considered

Option	Description
Option 0 – Defer upgrade	Option 0 entails deferral of the new substation, and the load shedding of customers via remote switching when the actual load exceeds network limits. 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. As such, this options is not considered as a viable solution. 2025-30 RCP Capex: $0 Total Capex: $0
Option 1 – Substation upgrade	Option 1 entails the installation of a new Salisbury South substation located south-east of Salisbury substation. The substation will include a single 32MVA 66/11kV transformer and a six circuit breaker switchboard, and a Para-Salisbury South 66kV sub-transmission line. This sub-transmission line will utilise the existing de-energised Para-Ingle Farm 132kV line, which has previously been acquired from ElectraNet in anticipation of the new substation. Option 1 is shown below in Figure 2. This Option will alleviate all forecast constraints, addressing all energy at risk. Design of this option is planned to begin in 2028, with commissioning of the substation in 2029. The primary risks associated with Option 1 are those relating to implementation and potential cost overruns. 2025-30 RCP Capex: $18,183,000 Total Capex: $18,183,000
Option 2 – Deferral new feeder	Option 2 involves deferring the new substation (Option 1) one year by constructing a new feeder out of Parafield Gardens substation with 2.4km of new conductor, allowing load to be transferred from the Salisbury substation to the Parafield Gardens substation. This new feeder will address the Salisbury substation N constraint, but *not* the SA17 feeder N or SA12 feeder N-1 constraint. SA17 is over 3km from the nearest substation, with the path to this substation consisting of green areas with no existing 11kV network, making it infeasible to construct a new feeder to alleviate both the SA17 feeder and Salisbury substation N constraints. This option would be constructed in 2029. This option does not prevent an interruption to supply or alleviate the SA17 feeder N constraint that is forecast just beyond the 2025-30 RCP. Therefore, the substation upgrade is still required, but deferred to 2029 and 2030, pushing some of the cost outside the 2025-30 RCP. Additionally, it does not fully mitigate the substation N constraint, and energy at risk would continue to grow from 2034 onwards. 2025-30 RCP Capex: $16,258,000 Total Capex: $21,713,000
Option 3 – Deferral network support battery	Option 3 consists of a 2MW network support battery, with a total storage capacity of 2MWh, to defer new substation works. This option addresses the risk of unserved energy at Salisbury substation, but only for one year, after which further energy at risk is not addressed. It also addresses all energy at risk from the SA17 feeder N constraint.

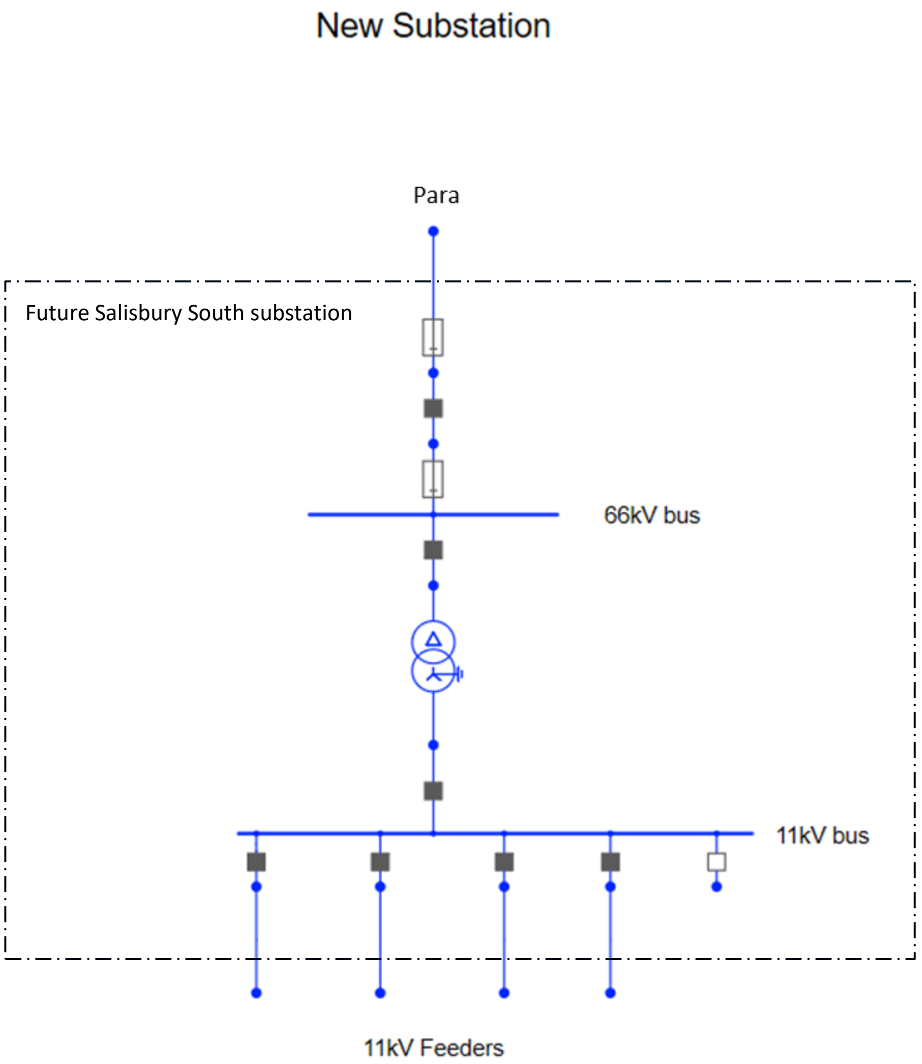
This option would be constructed in 2029. As this option only addresses one year of growth for the substation constraint, Option 1 works would still be required, but deferred one year, with design and construction over 2029 and 2030, partially outside the Reset period.

Due to significant risk of unserved energy and the capital investment to establish the system, this option would not be economical to pursue. Additionally, the battery would not provide the same long-term benefits as in Option 1. A battery solution is both expensive and ineffective for a constraint such as at Salisbury substation, which sees significant year-on-year growth.

A battery to defer the new substation further than 1 year was considered but deemed infeasible due to the significant size and associated expense required.

2025-30 RCP Capex: $17,728,000
Total Capex: $23,183,000

Figure 2 - Option 1 Salisbury South substation line diagram



3.2 Options investigated but deemed non-credible

SA Power Networks assessed a network support battery to fully address the substation and feeder constraints. A substantial capital investment would be required to meet forecast demand and risk of unserved energy. The storage capacity required to meet the forecast demand would be considerably more expensive than all other options, requiring frequent investment to meet the growing demand of about 2.1MVA each year, requiring more than 2MVAh of battery capacity to be installed each year. Due to the initial capital costs and short-term network benefit, this option was not considered a credible solution for addressing the identified network constraint.

SA Power Networks plans to issue an expression of interest to seek potential non-network solutions from market participants to address the constraint. Assessment of the submissions received will occur as part of the Regulatory Investment Test – Distribution (**RIT-D**) process.

In addition, SA Power Networks is working with the Australian Renewable Energy Agency (**ARENA**) to deliver network support batteries at regional locations to defer costly network augmentation. The network support function provided by the batteries will assist in managing network constraints. The proposed network support batteries are currently in progress and will provide insights to improve internal structures and develop industry knowledge that will improve efficiency and streamline implementation of future utility scale battery storage. SA Power Networks is working to continuously innovate and identify opportunities for the technology.

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 a 20-year period, are shown in Table 4, 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 '*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[6]

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 - Salisbury South Sub & Line	$18,183	$18,183	-$5,395	0.65	1
Option 2 – Deferral New Feeder	$16,258	$21,713	-$6,604	0.63	2
Option 3 – Deferral Battery	$17,728	$23,183	-$8,919	0.54	3

3.3.2 Project selection

Given that the benefit cost ratio (**BCR**) for Option 1 is less than 1.2, a deferral test has been undertaken. As shown in Table 5, under a low growth sensitivity, the Salisbury substation N constraint arises in 2030, resulting in more than half the project cost falling into the 2025-30 RCP, meaning that the project passes the deferral test.

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

Table 5: Deferral Test

	Step 1 - First Pass		Step 2 - Deferral Test		
Project	BCR	Timing	Timing	Cost ($k) in 25-30 RCP	Outcome
Salisbury South Sub & Line	0.65	2029.2	2030.2	$10,001	Pass

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 three scenarios as shown in Table 6. Of all feasible solutions, Option 1 is the preferred option for all sensitivities considered.

Table 6: Sensitivity Analysis

% Cost	NPV ($k)					NPV ($k)			
	Option 0	Option 1	Option 2	Option 3	Discount Rate	Option 0	Option 1	Option 2	Option 3
70%	-	-$2,215	-$3,070	-$4,690	3.50%	-	-$4,747	-$5,965	-$8,405
100% (Central)	-	-$5,395	-$6,609	-$8,919	4.05% (Central)	-	-$5,395	-$6,609	-$8,919
130%	-	-$8,575	-$10,149	-$13,148	4.50%	-	-$5,864	-$7,070	-$9,281

Option 1 demonstrates the highest NPV for all sensitivities considered.

3.3.4 Unquantified benefits

The construction of the Salisbury South substation is in line with the long-term strategic plan for the network. Another benefit that has not been quantified, is that Salisbury South will relieve load from the Parafield Gardens – Salisbury 66kV sub-transmission line. This line is expected to be overloaded under an N-1 condition in the next 15 years, and may experience this constraint sooner, depending on several prospective large connections which have not been included in the forecast.

Constructing the new line will allow a future north-east sub-transmission tie to be built in the future from Salisbury South to Ingle Farm, utilising the same de-energised 132kV Para – Ingle Farm line. This will provide further redundancy for the north and east sub-transmission systems.

The Salisbury South substation also fills a 'gap' in the existing network, as can be seen in

Figure 1 above, and will bolster the capacity of neighbouring substations, including Salisbury, Golden Grove, Ingle Farm and Cavan. Based on the substantial interest in the area, it is likely that additional industrial load will connect that is unaccounted for in our forecasts. The only solution that can adequately facilitate these connections is a new zone substation to fill the existing capacity gap. As such, we expect that the new substation will be a no-regrets investment.

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 the greatest BCR and NPV for all sensitivities. Option 1 mitigates significant unserved energy risk by preventing the breaching of a substation N constraint and feeder N constraint under both the 10 PoE and 50 PoE forecasts.

Option 2, the deferral feeder, has a lower BCR than Option 1 and lower NPV in all sensitivities, and only addresses the substation N constraint, resulting in a higher ultimate cost. Option 3, the battery deferral, is only sufficient to defer the substation N constraint one year, resulting in lowest NPV, and highest ultimate cost. Therefore Option 1 is preferred over Option 2 and Option 3.

Option 0 would result in significant unserved energy risks and additionally would fail to meet SA Power Networks customer's expectations in terms of reliability and is therefore not considered a viable option.