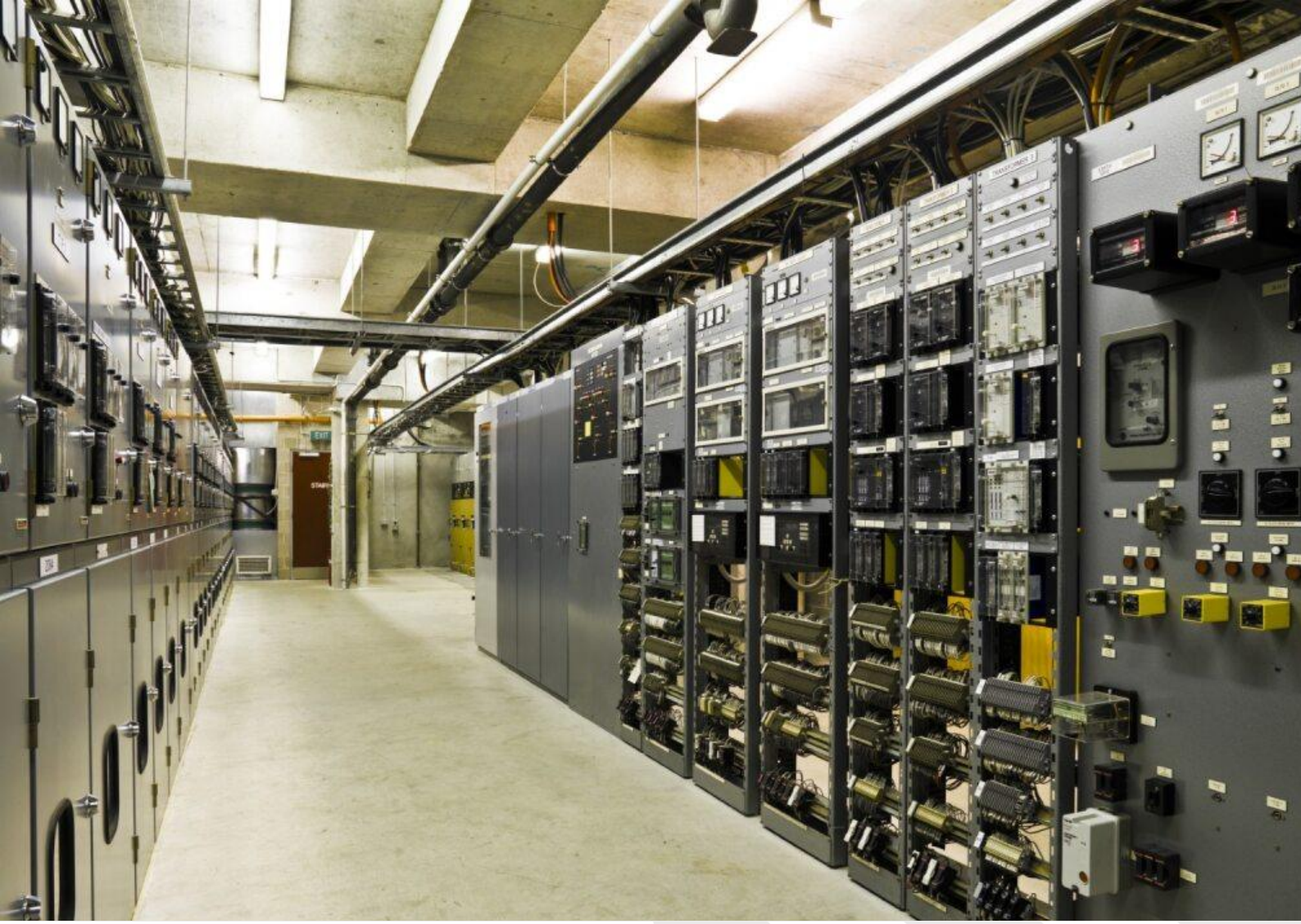

# Business case: Augex Strategic

## 2025-2030 Regulatory Proposal

Supporting document 5.8.2

January 2024

SA Power Networks

Empowering South Australia

# Contents

# Glossary

| Acronym / term | Definition |
|---|---|
| **AER** | Australian Energy Regulator |
| **AUG026** | Substation Condition Monitoring Equipment |
| **AUG036** | UFLS Emergency Standards Program |
| **AUG041** | Protection Cyber Security |
| **Augex** | Augmentation capital expenditure |
| **CAB** | Community Advisory Board |
| **Capex** | Capital expenditure |
| **CER** | Customer energy resources |
| **DER** | Distributed energy resources |
| **DUFLS** | Dynamic Under Frequency Load Shedding |
| **ICT** | Information and Communication Technology |
| **LV** | Low voltage |
| **NPV** | Net present value |
| **Opex** | Operating expenditure |
| **OTR** | Office of the Technical Regulator |
| **PD** | Partial Discharge |
| **PV** | Photovoltaics |
| **RCP** | Regulatory Control Period |
| **SACOSS** | South Australian Council of Social Service |
| **Technical Regulations** | South Australian Electricity (General) Regulations 2012 |
| **UFLS** | Under Frequency Load Shedding |
| **VM&UFLS** | Voltage Management and Under Frequency Load Shedding |
| **VM&UFLS Emergency Standards** | Technical Regulator Emergency Standards – Voltage Management and Under Frequency Load Shedding |

# 1 About this document

## 1.1 Purpose

This document provides a business case to support forecast expenditure for the 2025-30 Regulatory Control Period (**RCP**) for SA Power Networks' strategic related augex program, which comprises one input to our overall network augmentation expenditure. This strategic component includes specific one-off programs to manage key network risks and compliance issues and optimise long term expenditure. The following programs of work are included within the strategic related augex program:

- Under Frequency Load Shedding Emergency Standards Program
- Substation Condition Monitoring
- Protection Cyber Security

## 1.2 Expenditure category

- Network capex: augmentation (strategic augex)

## 1.3 Related documents

**Table 1: Related documents**

| Ref | Title | Author | Version / date |
|---|---|---|---|
| 5.4.1 | Augmentation Expenditure (Augex) Forecasting Approach | SAPN | |

# 2 Executive summary

This business case recommends $4.5 million[1] in strategic augmentation capital expenditure (**augex**) for the 2025-30 RCP. The strategic augex programs include:

- UFLS Emergency Standards Program (AUG036) $3.0 million;
- Substation Condition Monitoring Equipment (AUG026) $0.9 million; and
- Protection Cyber Security (AUG041) $0.6 million.

# 3 UFLS Emergency Standards program (AUG036)

SA Power Networks has an obligation to meet compliance with the Technical Regulator Emergency Standards – Voltage Management and Under Frequency Load Shedding (**VM&UFLS Emergency Standards**)[2] under regulation 55H of the South Australian *Electricity (General) Regulations 2012* (**Technical Regulations**) The VM&UFLS Emergency Standards place explicit obligations solely on SA Power Networks for the installation of protection relays at specific points in the distribution network. The protection relays must be compliant with functionality stated in the VM&UFLS Emergency Standards, including the ability to measure power system frequency, measure the direction of power flow and activate underfrequency protection elements conditional on the direction of power flow.

[1] Represents the capex in real $m June 2022, excluding corporate overheads.
[2] Technical-Regulator-Emergency-Standards-Voltage-Management-and-Under-Frequency-Load-Shedding.PDF (energymining.sa.gov.au)

The initial VM&UFLS Emergency Standards were published in December 2021. SA Power Networks received regulatory funding in the 2020-25 RCP through a Cost Pass Through to achieve compliance with the 2021 VM&UFLS Emergency Standards.

SA Power Networks expect the VM&UFLS Emergency Standard to be updated in 2024 and will be required to invest a further $3.0 million in the 2025-30 RCP to meet additional sites stipulated in the revised VM&UFLS Emergency Standards[3].

## 3.1 Background

In 2021, the Technical Regulations were amended to include a new Division 1A in Part 10 of the Technical Regulations regarding the publication of emergency standards to apply to certain electricity infrastructure and electrical installations in South Australia. Division 1A, clause 55H (1) empowers the Technical Regulator to publish technical and operational standards that must be applied so that electricity infrastructure and electrical installations are installed, maintained and operated in a manner that facilitates the taking of effective emergency action (i.e. "emergency standards").

Pursuant to regulation 55H(1), the Technical Regulator published the "Technical Regulator Emergency Standards – Voltage Management and Under Frequency Load Shedding"[4]. These VM&UFLS Emergency Standards apply solely to SA Power Networks and have been designed to address two distinct power system security issues impacting upon the SA distribution network as a result of the popularity and growth in the connection of solar PV in South Australia:

1. the need to disconnect Distributed Energy Resources (**DER**) quickly when there are high electricity exports at low net system load times, in order to maintain a minimum operational demand on the power system and to maintain a secure system; and
2. the need for under frequency load shedding (**UFLS**) in an emergency where there is a need to ensure that those circuits on which there is a net export of power must not be disconnected in an under-frequency event.

Following publication of the VM&UFLS Emergency Standards in December 2021, SA Power Networks received regulatory funding in the 2020-25 RCP through a Cost Pass Through[5] to achieve compliance with the 2021 VM&UFLS Emergency Standards.

It is anticipated that with the continual growth of solar PV in South Australia additional work will be required in 2025-30 RCP to satisfy a revised VM&UFLS Emergency Standard which will incorporate additional sites that are exhibiting reverse flows.

## 3.2 Our performance to date

The Appendix 3 of the VM&UFLS Emergency Standards lists the network locations where dynamic under frequency load shedding (**DUFLS**) must be implemented. It specifies the locations (substation and feeder) where relays are required to be installed or modified in accordance with the requirements set out in Section 5 of the revised VM&UFLS Emergency Standard as well as the required dynamic arming level (feeder/line/bus).

[3] Note at the time of writing this business case, the update of the Technical Regulator Emergency Standards – Voltage Management and Under Frequency Load Shedding which is expected in 2024 has not been published. This business case is contingent on this standard being released.

[4] Technical-Regulator-Emergency-Standards-Voltage-Management-and-Under-Frequency-Load-Shedding.PDF (energymining.sa.gov.au)

[5] AER, *Determination – April 2022 emergency standards cost pass through: SA Power Networks*, September 2022.

It is expected all of the locations specified in the current VM&UFLS Emergency Standard (2021) will be commissioned by September 2024.

## 3.3 Drivers for change

The Office of the Technical Regulator (**OTR**) is expected to update the VM&UFLS Emergency Standards from time to time subject to the changing nature of the South Australian energy system, particularly with increased Customer Energy Resources (**CER**)[6]. The Emergency Standards are highly prescriptive in nature, with no discretion, stipulating the precise solution required and locations throughout the network.

SA Power Networks has identified feeders that are experiencing reverse flows. The OTR will publish the locations (substation and feeders where applicable), where relays are required to be installed or modified to meet the requirements of VM&UFLS Emergency Standard. These locations can be found, in the VM&UFLS Emergency Standard (Appendix 3).

Based on the analysis undertaken by SA Power Networks, we anticipate 42 additional feeder exits will require protection relay replacement in the 2025-30 RCP to meet the requirements of the VM&UFLS Emergency Standard. SA Power Networks anticipates the OTR will update the VM&UFLS Emergency Standard in 2024 to include feeders requiring remediation. This business case is contingent on this standard being released.

## 3.4 The identified need

SA Power Networks is obligated to comply with the requirements stipulated by the OTR in its VM&UFLS Emergency Standard, published in December 2021. It is anticipated that the OTR will be updating the VM&UFLS Emergency Standard in 2024, which will trigger the need for SA Power Networks to undertake further augmentation to its distribution network by installing additional relays at specific points on the network.

We considered the regulatory framework under the National Electricity Rules (NER) and the National Electricity Law (**NEL**) and, in particular how the expenditure is required to achieve the capex objectives and reasonably reflects the capex criteria, having regard to relevant capex factors. We also considered our regulatory obligations and requirements under the NER, the NEL and jurisdictional instruments. As a result of these considerations, the identified need is to ensure that we can prudently and efficiently comply with all applicable regulatory obligations or requirements associated with the provision of standard control services,[7] Which in this case includes complying with:

- the Voltage Management and Under Frequency Load Shedding Emergency Standards which is expected to be revised in 2024 by the OTR which will require SA Power Networks to amend or install relays at specific points on the distribution network to have the following characteristics:
  - the ability to measure power system frequency;
  - the ability to measure the direction of power flow with a minimum sampling rate of not less than one measurement every 5 minutes; and
  - programmability such that the relay will only automatically disconnect a circuit for an under frequency event, if the circuit is a net load to the system.

## 3.5 Approach to forecasting network strategic expenditure

To forecast network strategic related augex for the 2025-30 RCP, we use a modelled approach for the VM&UFLS Emergency Standards Program expenditure.

6 We are progressing to use CER instead of DER however the meaning is the same.

7 This is pursuant to clause 6.5.7(2) of the National Electricity Rules (NER).

Our planning assessment includes observing feeders which are experiencing reverse power flows and assessing the existing protection system capability, to identify suitable sites that can be provided to the OTR for consideration. The number of sites identified for inclusion is multiplied by the averaged historic unit rate per site.

Our detailed forecasting approach is outlined in *Document 5.4.1 Augmentation Expenditure (Augex) Forecasting Approach*.

## 3.6 Comparison of Options

The VM&UFLS Emergency Standards are highly prescriptive in nature, stipulating the location and solution required, leaving no discretion for options analysis. As a consequence, options have not been considered.

SA Power Networks is proposing expenditure to address the minimum obligations in the updated version of VM&UFLS Emergency Standards[8] expected to be released in early 2024.

## 3.7 Costs

As outlined in Section 3.5 the VM&UFLS Emergency Standards Program expenditure is based on a modelled approach where the number of sites requiring work is multiplied by the historic unit rate per site.

Based on historic expenditure, the cost per unit ranges from approximately $40k to $125k (for a feeder exit protection relay replacement). The unit cost varies depending on the relay that is currently installed on site. Electromechanical relays requiring replacement to modern digital relays will cost approximately $125k per unit replacement and legacy digital relays requiring upgrades with modern digital will cost approximately $40k per unit replacement.

42 feeder exits require protection relay replacement, requiring SA Power Networks to invest $3.0M in the 2025-30 RCP to meet compliance for these additional locations.

## 3.8 Recommendation

SA Power Networks' VM&UFLS Emergency Standards Program is required to meet compliance with the VM&UFLS Emergency Standards published by the OTR. SA Power Networks recommends investing $3.0 million in the 2025-30 RCP to meet and maintain compliance for the additional locations, to be stipulated by the OTR, in response in the updated version of the VM&UFLS Emergency Standards.

# 4 Substation condition monitoring equipment (AUG026)

The substation condition monitoring equipment program is a long-term ongoing program to ensure adequate equipment and systems are available to provide asset condition information for high voltage primary substation assets. Condition monitoring equipment and systems enable SA Power Networks to efficiently monitor the condition of these critical assets.

SA Power Networks are proposing $0.9 million for substation condition monitoring equipment over the 2025-30 RCP.

## 4.1 Background

SA Power Networks have a range of high value substation assets including High Voltage power transformers and switchgear.

[8] The revised Technical Regulator Emergency Standards – Voltage Management and Under Frequency Load Shedding will be published in 2024

Substation condition monitoring equipment and systems provide a means to collect health information on these high value assets which improves prediction of failure. This reduces the risk of in-service asset failure and thus maximises the life of these high value assets.

SA Power Networks employ both online and offline condition monitoring equipment for substation assets. Online condition monitoring equipment provides rich data in real-time but has higher cost than offline alternatives. One example is SF6 gas sensors for HV switchgear, selectively deployed on known fast-leaking switchgear. Offline equipment, such as portable Partial Discharge (**PD**) detectors, are manually used by personnel to sweep substations for lead indicators of asset failure.

## 4.2 Our performance to date

Augex is routinely prioritised across substation budget categories to minimise risk and optimise value. Often, minor cost activities such as this program are undertaken when other site works are being conducted, therefore the total program of work is not always accounted for under the specific budget line. SA Power Networks is forecasting to spend $0.4 million in the 2020-25 RCP.

## 4.3 The identified need

This expenditure is required to ensure we efficiently manage our high value substation assets to prudently maintain the reliability, safety and security of the distribution system.

## 4.4 Recommendation

SA Power Networks recommends $0.9 million for substation condition monitoring equipment over the 2025-30 RCP.

# 5 Protection cyber security (AUG041)

This section sets out SA Power Networks' proposal for AUG041 to enable substation relay password protection. Our distribution system protection systems are a key capability that enable the essential operational, safety and system security (stability), functions across our network.

SA Power Networks are proposing $0.6 million to enable password protection on our substation relays to mitigate cyber security threats over the 2025-30 RCP.

## 5.1 Background

The continuing transformation of the distribution network to support a much greater dynamic operating range with the two-way network also extends the needs of the supporting technologies including our distribution network protection systems.

Protection relays provide critical functionality for the safe and reliable network operation, with their ability to detect and isolate damaged sections of our network with the appropriate autonomous capability to do so. As part of this operation the relays can also configured with different responses when different operating profiles are selected providing an even greater level of protection as operating situations change. As part of this transformation there is a modernisation of the protection relays to digital types providing services and capabilities to enable safe operation of our network. Many relays installed on our network have remote engineering access capabilities, which we utilise to enable efficient protection settings management. This functionality carries its own inherent risks in that the protection systems can be compromised if the devices are not password protected.

With this modernisation, there is a requirement to improve our operating tools and processes to ensure safe and secure operations of the protection systems. These system upgrades will enable and implement improved security practices across our protection relays along with supporting management processes and tools ensuring safe and reliable network operation.

This business case recommends expenditure in the 2025-30 RCP for our Protection System Operating Enhancements. This involves the implementation of a password protection tool that will manage passwords for relays within substations. This will secure the protection relays that enable the essential operational and safety functions across our network.

## 5.2 The identified need

The nature of the threat to ongoing secure operations is evolving and it is important that our security measures also continue to be enhanced as our key systems and infrastructure also modernise. Deploying digital protection relays brings significant benefits with additional functions that allow a broader range of operating modes and fault detection capabilities within a single relay. This provides for effective safety measures under broad range of network operating conditions and the ability to remotely configure in response to temporary conditions.

Digital relays are configured using vendor specific software and as a digital device typically provide means to secure this access with passwords or other security measures, however SA Power Networks has not seen the need to implement a password system to date. With the additional requirements with the Security of Critical Infrastructure Act and the continued focus on improving both physical and cyber security, has highlighted the need for more robust management processes and tools to enable password security for our digital substation relays.

SA Power Networks plans to target 40 substations that pose the greatest threat to Network security. After the successful implementation of the substation relay's password management tool at these 40 substations, SA Power Networks, will continue to implement substation relay's password management as part of standard design.

## 5.3 Costs

The expenditure is based on a modelled approach where the number of sites requiring work is multiplied by a unit rate per site.

The unit cost for the substation relay's password management tool is approximately $15k per substation.

40 substations require the password management tool, requiring SA Power Networks to invest $0.6 million in the 2025-30 RCP to provide secure access for protection relays.

## 5.4 Recommendation

SA Power Networks recommends $0.6 million to implement a protection password management tool at 40 substation to mitigate cyber security threats over the 2025-30 RCP.

# 6 Alignment to consumer and stakeholder engagement

The identified need of this business case was not specifically deliberated on as part of our consumer and stakeholder engagement process, on the basis that it was not considered, together with our Community Advisory Board (**CAB**) to be priority topic for engagement.

However, throughout our engagement program, our customers were consistently concerned with the need for us to comply with regulatory obligations and to ensure that the distribution network and distribution system remains stable and secure as a foundation for the future.

Further, the costs of this program were included in the total expenditure figures that were presented to consumers throughout each stage of our engagement program, so that customers understood the totality of the service and price outcomes that they were deliberating on.

Subsequent to our People's Panel process, we also published a Draft Proposal to play back how we have given effect to customer recommendations and to confirm that those recommendations remain valid given continued cost of living pressures and to obtain further input to refine our Regulatory Proposal. Submissions received on our Draft Proposal did not specifically comment on the investment needs addressed via this business case. However, SACOSS outlined their support for SAPN seeking expenditure to maintain current core reliability and service levels and to meet its obligations.[9]

# 7 Deliverability

SA Power Networks has developed a plan to ensure that it can deliver the recommended project in this business case together among all the increased volume of work reflected in the programs that comprise our total network expenditure forecast in our Regulatory Proposal. This plan considers the detailed implications of our proposed overall uplift in total network expenditure for our required workforce and supporting internal services of information technology, feet, property and human resources.

We consider that our plan is realistic and achievable over the 2025-30 RCP. The details of our approach are set out in our accompanying document, 'Resourcing Plan for Delivering the Network Program'.

[9] SACOSS, *South Australian Council of Social Service Submission on SA Power Networks' 2025-30 Draft Regulatory Proposal*, September 2023.