



Emergency Standards cost pass through application

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Empowering South Australia

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1. Introduction

On 4 November 2021, the South Australian *Electricity (General) Regulations 2012 (Electricity Regulations)* were amended to include a new Division 1A in Part 10 of the Electricity Regulations regarding the publication of emergency standards to apply to certain electricity infrastructure and electrical installations in South Australia.

Regulation 55H(1) of new Division 1A empowers the Technical Regulator appointed under section 7 of the South Australian *Electricity Act 1996 (Electricity Act)* 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 (called "emergency standards" in regulation 55H(1)).

The enactment of new Division 1A and the subsequent development and publication of the first Emergency Standards by the Technical Regulator in December 2021, represents the output from a process which commenced in early 2018 when it was first identified that the increasing number of Solar PV generating units connecting to the South Australian distribution network may have unintended impacts upon the maintenance of power system security and, in particular, the traditional mechanisms for dealing with under-frequency events.

Pursuant to regulation 55H(1), the Technical Regulator prepared and published the "*Technical Regulator Emergency Standards – Voltage Management and Under Frequency Load Shedding*" (**VM&UFLS Emergency Standards**) on 21 December 2021. The 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 South Australian distribution network as a result of the popularity and growth in the connection of Solar PV embedded generating units to the South Australian distribution network:

- One issue is 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.
- The other issue relates to 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.

The publication of the VM&UFLS Emergency Standards is a service standard event, and therefore a pass through event, for the purposes of clause 6.6.1 of the National Electricity Rules (**NER**). The occurrence of this pass through event has resulted in, and will result in, SA Power Networks incurring materially higher costs in providing direct control services than SA Power Networks would have incurred but for the occurrence of the pass through event. The pass through event is therefore a positive change event for the purposes of clause 6.6.1 of the NER.

This document is an application to the Australian Energy Regulator (**AER**) for approval to pass through to Distribution Network Users the increase in the costs of providing direct control services that have been, and will be, incurred by SA Power Networks arising from compliance by SA Power Networks with the new VM&UFLS Emergency Standards.

SA Power Networks estimates it will incur \$30.5 million (June 2020) in capital expenditure during the 2020-25 regulatory control period in order to meet and satisfy the requirements of the VM&UFLS Emergency Standards. None of this capital expenditure was funded under the SA Power Networks distribution determination for the 2020-25 regulatory control period. All of this capital expenditure will be categorised as augmentation expenditure and pertains to the replacement of

substation protection relays with new protection relays with greater functionality. These assets will have a regulatory life of 15 years.

SA Power Networks proposes to commence recovery of these costs over the last two years of the current regulatory control period through an increased revenue allowance of approximately \$3.4 million in each regulatory year. This will increase the average annual residential bill by approximately 0.2% or \$2.20 per annum.

2. Background to development and publication of the VM&UFLS Emergency Standards

2.1 Lead up to the development and publication of the VM&UFLS Emergency Standards

In recent years, there has been an enormous uptake and growth in the extent of DER (or embedded generation) connected to the distribution network in South Australia. This trend will continue into the future, with significant resulting benefits for many South Australian electricity consumers. However, this continuing growth in DER connected to the South Australian distribution network also presents serious power system security and security of supply issues. These issues could adversely affect the standard and continuity of the delivery of standard control services by the South Australian distribution network unless these issues are appropriately and expeditiously addressed.

This is the first time that the Australian electricity industry has had to consider the impact of high levels of DER upon the operation of traditional mechanisms for dealing with under-frequency events. The rate of the increase in the connection of DER to the South Australian distribution network has meant that these potential power system security issues have emerged with little or no prior indication. The exact extent of those issues and their likely impact upon the South Australian power system needed to be urgently assessed.

The assessment process was further complicated by the continued increase in the level of DER connected to the South Australian distribution network over the assessment period and the cumulative impact of this increase upon the traditional mechanisms for maintaining power system frequency and responding to under-frequency events.

In addition, both AEMO and SA Power Networks were concerned to ensure that possible responses were appropriately assessed and the most efficient solutions identified and implemented. Both AEMO and SA Power Networks were cognisant of the need to avoid an overly conservative response whilst ensuring that the potential risks to power system security were minimised and where possible avoided.

2.1.1 AEMO investigations and reports

AEMO and SA Power Networks engage in regular and ongoing collaboration with respect to power system security issues as part of their respective operational responsibilities.

As part of this ongoing process, AEMO identified a number of emerging power system security issues relating to the integration of DER in South Australia. In August 2018, AEMO requested that SA Power Networks provide a range of operational data concerning its distribution network and the manner in which DER was impacting upon and interacting with its distribution network. This information was required in order for AEMO to commence preliminary modelling concerning these emerging power system security issues.

With the continued proliferation of DER connected to the South Australian distribution network and the consequential increase in its potential impact on power system security, a targeted and formal industry collaboration process was initiated in late 2018.

2.1.2 Initiation of broader Government and industry consultation

The South Australian Energy Transition Steering group was established in early 2019 and met for the first time on 14 January 2019. The group included representatives from the South Australian Department of Premier and Cabinet, Department of Energy and Mining, the Essential Services Commission of South Australia, AEMO, ElectraNet and SA Power Networks.

Ongoing collaboration across the electricity industry and between members of the South Australian Energy Transition Steering group then continued to take place. Further work continued to be undertaken by AEMO, ElectraNet and SA Power Networks to understand and model the implications of DER projections on power system security and to explore the options for avoiding and minimising those potential implications. This ongoing collaboration and work resulted in the publication of the following reports:

- In April 2020 AEMO published a report titled '*Renewable Integration Study: Stage 1' (RIS Stage 1 Report)*¹. The report outlined that the increasing volume of uncontrolled DER required new techniques and potentially new services to adequately manage system security. The report provided a summary of the identified challenges and proposed a number of actions be undertaken to mitigate the risk posed by increasing uncontrolled DER. Recommendations included, the establishment of DER curtailment capability, adding additional load sources to the UFLS scheme, and dynamically arming UFLS relays to discriminate based on the direction of energy.
- In May 2020 AEMO, at the request of the South Australian Government, undertook investigations and published a report titled '*Minimum operational demand thresholds in South Australia, May 2020, Technical Report, Advice prepared for the Government of South Australia' (Minimum Operational Demand Thresholds Report)*². That report identified the need for action to maintain a secure power system in South Australia, taking into account the continued proliferation of DER connected to the South Australian distribution network. Some of the actions canvassed by this report included dynamic arming of UFLS relays, alternative sources of under-frequency response and DER feed-in management.
- In June 2020 AEMO published a report titled '*Draft 2020 Power System Frequency Risk Review – Stage 1' report (PSFRR Stage 1 Report)*³. That report reviews the potential for 'non-credible' power system contingency events to cause frequency swings large enough to initiate uncontrolled plant disconnections, that could in turn result in widespread transmission outages or a black system. The report again identified an urgent requirement for distributed PV curtailment capability and recommended adding more load onto the South Australian UFLS scheme and the introduction of dynamic arming for UFLS relays.

¹ The RIS Stage 1 Report appears on the AEMO website at <https://aemo.com.au/-/media/files/major-publications/ris/2020/renewable-integration-study-stage-1.pdf?la=en>

² The Minimum Operational Demand Thresholds Report appears on the AEMO website at [https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2020/Minimum-Operational-Demand-Thresholds-in-South-Australia-Review#:~:text=AEMO%20estimates%20that%20under%20some,with%20four%20synchronous%20condensers%20installed\).](https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2020/Minimum-Operational-Demand-Thresholds-in-South-Australia-Review#:~:text=AEMO%20estimates%20that%20under%20some,with%20four%20synchronous%20condensers%20installed).)

³ The PSFRR Stage 1 Report appears on the AEMO website at https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2020/psfr/stage-1/psfr-stage-1-after-consultation.pdf?la=en

Collectively, the three AEMO reports, identified the need for:

- changes to the South Australian UFLS Scheme;
- the implementation of new DER shedding capability in South Australia; and
- the implementation of 'enhanced voltage management' (**EVM**) across the distribution network in South Australia.

In the Minimum Operational Demand Thresholds Report, AEMO specifically recognised the need for urgency, and recommended that a range of actions be '*delivered prior to Spring 2020 if possible (or as soon as feasible)*'⁴. One of AEMO's recommended actions was the introduction of EVM across the distribution network⁵.

Following further investigations by AEMO and SA Power Networks with respect to the implementation requirements for dynamic arming of UFLS protection, AEMO published a detailed report in May 2021 titled '*South Australian Under Frequency Load Shedding – Dynamic Arming*'⁶ setting out its findings concerning the implementation of dynamic arming of UFLS protection in South Australia. That report detailed the amount of load required for UFLS protection in South Australia, the need for dynamic arming of the UFLS protection and an indicative dynamic arming design.

The South Australian Government was a concerned observer during these investigations and was regularly updated by AEMO and SA Power Networks concerning the outcomes from the investigations and modelling. The South Australian Government was particularly concerned to ensure that an appropriate response to the emerging power system security issues was identified and implemented as soon as reasonably possible.

Consistent with this objective, the South Australian Government met regularly with SA Power Networks to receive updates concerning the investigation and modelling processes and actively encouraged SA Power Networks to consider whether the investigations and modelling had identified any actions which could be safely and efficiently implemented prior to the finalisation of the AEMO investigations. The South Australian Government's primary objective was to ensure that whatever preliminary actions could be taken were taken as soon as that was reasonably possible.

To that end, SA Power Networks acceded to the South Australian Government's request to commence the implementation of EVM at 138 zone substations which the investigations by AEMO and SA Power Networks had identified as having the highest DER connection penetration. This acceptance was based on the understanding that the requirement to complete this work would be mandated as part of the overall response to the power system security issues.

The completion of this work had been identified earlier in the investigation process as a key component of the likely final response to the power system security issues being investigated by AEMO and SA Power Networks. The requirement to complete this work was eventually reflected in the detailed requirements of the VM&UFLS Emergency Standards published in late December 2021.

⁴ Minimum Operational Demand Thresholds Report, page 8.

⁵ Minimum Operational Demand Thresholds Report, page 9.

⁶ A copy of that report appears on the AEMO website at <https://aemo.com.au/-/media/files/initiatives/der/2021/south-australian-ufls-dynamic-arming.pdf?la=en&hash=C82E09BBF2A112ED014F3436A18D836C>

Prior to SA Power Networks agreeing to the South Australian Government's request to commence the implementation of EVM at the 138 zone substations most impacted by the increase in DER connections to the South Australian distribution network, SA Power Networks discussed with the Government the need for the new requirements to be documented in the regulatory arrangements governing the operation of the South Australian power system. It was clear at that time that a South Australian specific regulatory response was required to deal with this uniquely South Australian power system security issue. Past history had demonstrated the need for the South Australian regulatory arrangements to lead the National Electricity Market regulatory arrangements due to the high levels of intermittent renewable generation connected to the South Australian transmission and distribution network.

It was not possible or appropriate at that time to proceed to determine and implement the most appropriate regulatory mechanism for implementing the final recommendations from the investigation and modelling processes. However, the potential consequences of delaying the commencement of the initial EVM work pending the enactment of a regulatory mechanism for implementing the final recommendations, were so serious that SA Power Networks was prepared to agree to undertake this initial EVM work prior to finalisation and enactment of the emergency standards regulatory mechanisms.

The South Australian Government's concerns about power system security were realised, and its desire for SA Power Networks to implement EVM work prior to finalisation and enactment of the emergency standards regulatory mechanisms were vindicated when, on the 14 March 2021, AEMO had to issue a market intervention notice⁷ which required SA Power Networks to invoke EVM. Had the EVM work not been undertaken until after the finalisation and enactment of the emergency standards regulatory mechanisms, there would have been serious implications on power supplies in South Australia with AEMO unable to maintain power system security.

2.2 Development of the VM&UFLS Emergency Standards

2.2.1 Response of the South Australian Government to the AEMO findings

Prior to the enactment of the *Electricity (General) (Technical Standards) Variation Regulations 2021 (Technical Standards Regulations)*, SA Power Networks met with representatives from the South Australian Department of Premier and Cabinet, Department of Energy and Mining and the Essential Services Commission of South Australia to discuss the possible mechanisms for implementing the recommendations from the AEMO investigations and reports. A number of potential options were identified and considered by this group. These included modifying licence conditions, enacting new regulations under the Electricity Act and modifying relevant South Australian Electricity Codes.

In the end, it was determined that the most appropriate method for:

- implementing the recommendations from the AEMO reports; and
- ensuring that the outcomes from those recommendations were appropriately tailored to suit the unique characteristics of the South Australian power system,

was to vary the Electricity Regulations to include a specific right for the Technical Regulator to prepare and publish technical and operational standards aimed at facilitating the taking of an effective emergency action.

⁷ AEMO Electricity Market Notice, Market Intervention 83319: <https://aemo.com.au/market-notices?marketNoticeQuery=83319&marketNoticeFacets=>

One of the reasons for adopting this approach was to ensure that the regulator, who was best placed to respond to emerging South Australian specific power system security and reliability of supply issues, was given a flexible regulatory mechanism which could be used to quickly respond to emerging issues and facilitate the taking of effective emergency action.

On 4 November 2021, the Technical Standards Regulations were made by the South Australian Government.

The Technical Standards Regulations inserted new regulation 55H into Division 1A of Part 10 of the Electricity Regulations, which new regulation immediately came into effect.⁸

Regulation 55H(1) provides that:

'The Technical Regulator may prepare and 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 (**emergency standards**).'

Regulation 55H(2) provides, amongst other things, that emergency standards may:

- specify requirements and standards for electricity infrastructure and electrical installations, including in relation to the nature or operation of such infrastructure or installations;
- specify activities a relevant entity must undertake (and the timeframes for completing those activities) in order to comply with emergency standards; and
- provide for the Technical Regulator to determine that activities comply with the emergency standards and were undertaken for the purpose of complying with the emergency standards.

2.2.2 Publication of the VM&UFLS Emergency Standards

Following the enactment of the Technical Standards Regulations in November 2021, the Technical Regulator worked with AEMO and SA Power Networks to finalise the detail that would be included in the initial emergency standards. SA Power Networks had been working with AEMO for some time on identifying the South Australian zone substations that would provide the most effective EVM capability. This identification process was partly driven by the desire to ensure that the response to the need for increased EVM capabilities was proportionate to the cost of implementing this solution and the benefits that would accrue from the implementation of this solution at the identified zone substations.

A similar approach was adopted in relation to identifying the locations where dynamic UFLS relays should be installed. Once again, the list provided to the Technical Regulator represented the outcome from extensive and detailed assessment by AEMO and SA Power Networks concerning the locations where the installation of dynamic UFLS relays would deliver the greatest benefit for the associated cost.

The Technical Regulator also consulted with the South Australian Government concerning the content and form of the emergency standards.

⁸ A copy of the Technical Standards Regulations 55H 2021_072 appears in Attachment A.

On 21 December 2021, the Technical Regulator published the VM&UFLS Emergency Standards⁹ pursuant to the power given to the Technical Regulator by regulation 55H(1) of the Electricity Regulations. These standards impose new and specific requirements on SA Power Networks with respect to its electricity infrastructure.

2.2.3 Requirements of the VM&UFLS Emergency Standards

The VM&UFLS Emergency Standards are aimed at addressing two distinct security of supply issues for the distribution network in South Australia caused by the popularity of, and growth in, DER connected to the South Australian distribution network:

- One issue results from high electricity exports at low net power system load times. When this occurs, DER may need to be disconnected from the distribution network within a very short timeframe in order to maintain a secure power system.
- The second issue occurs when UFLS is required to operate in an emergency. To ensure the effective operation of UFLS, those circuits where there is a net export of power to the broader power system must not be disconnected during an underfrequency event.

The VM&UFLS Emergency Standards impose obligations on SA Power Networks to address both of these security of supply issues. The VM&UFLS Emergency Standards do this by requiring SA Power Networks to:

- implement and maintain a scheme of last resort which enables the effective curtailment of DER via management of distribution network voltage levels. This scheme of last resort must be available to automatically control network voltages within the SA Power Network electricity infrastructure listed in Appendix 2 to the VM&UFLS Emergency Standards;
- amend or install relays within the SA Power Networks electricity infrastructure listed in Appendix 3 to the VM&UFLS Emergency Standards so that the relays have the following characteristics:
 - be able to measure the power system frequency;
 - have the ability to measure the direction of power flow with a minimum sampling rate of not less than one measurement every 5 minutes; and
 - be programmable such that they will only automatically disconnect a circuit in an under frequency event, if the circuit is a net load with respect to the overall power system; and
- amend or install relays within the specific SA Power Networks electricity infrastructure listed in Appendix 4 to the VM&UFLS Emergency Standards so that the relays have the following characteristics:
 - be able to measure the power system frequency; and
 - disconnect feeders at such frequency as determined in consultation between SA Power Networks, the Technical Regulator and the AEMO.

In total, SA Power Networks is required to install an estimated 480 new protection and control relays and configure and re-commission a further 230 existing protection and control relays at zone substations.

⁹ A copy of the VM&UFLS Emergency Standards appears in Attachment B.

3. Works carried out, and to be carried out, by SA Power Networks

3.1 Works carried out prior to publication of the VM&UFLS Emergency Standards

3.1.1 Nature of prior works, and why they were undertaken

In late 2019 the South Australian Government asked AEMO to conduct a preliminary investigation concerning the operational challenges under low load, high DER generation periods on the South Australian transmission and distribution networks. That request led to AEMO producing its Minimum Operational Demand Thresholds Report (the final version of which was published in May 2020, after an earlier draft was provided to the Government). The report identified two key challenges:

- disconnection of distributed PV; and
- minimum load required to operate under islanded conditions.

In particular, AEMO identified that when the South Australian power system is operating as an island, it will be near impossible to maintain the frequency operating standard for certain credible fault events if they cause distributed PV disconnections. This means that AEMO may no longer have the means to operate a South Australian island securely at times of high distributed PV generation. Power system security risks will grow rapidly as more distributed PV is installed¹⁰. As a result, AEMO strongly recommended to the South Australian Government that EVM, and other measures, be implemented prior to Spring 2020 if possible (or as soon as feasible).¹¹

In April 2020, AEMO published its RIS Stage 1 Report. In Appendix A of this report AEMO noted that, as distributed PV penetration increases, there may be operational challenges associated with insufficient load to maintain power system security.¹² AEMO reiterated in this report the urgent need to have available sufficient generation shedding capability over the distributed PV fleet as a back-stop mechanism for maintaining power system security in the South Australian region.¹³

In July 2020, AEMO published its PSFRR Stage 1 Report. This report specifically recommended that SA Power Networks should pursue EVM. AEMO noted that SA Power Network's initial trials of this capability had indicated that it was effective, safe, and has minimal impact on customers. AEMO recommended that EVM should be rolled out across SA Power Networks' distribution network as extensively as possible unless otherwise indicated by the SA Power Networks further trial outcomes.¹⁴ AEMO noted that these actions were presented as part of its holistic plan for DER integration set out in AEMO's RIS Stage 1 Report.

Following the successful completion of the EVM trials by SA Power Networks (which confirmed the initial findings that EVM was effective, safe and has a minimal impact on customers), SA Power Networks consulted with AEMO, the South Australian Government and the Technical Regulator concerning the timing for the roll out of EVM to zone substations.

¹⁰ Minimum Operational Demand Thresholds Report, page 4

¹¹ Minimum Operational Demand Thresholds Report, page 8

¹² RIS Stage 1 Report Appendix A: High Penetrations of Distributed Solar PV, page 47 Link:

<https://www.aemo.com.au/-/media/files/major-publications/ris/2020/renewable-integration-study-stage-1.pdf>

¹³ RIS Stage 1 Report Appendix A: High Penetrations of Distributed Solar PV, page 50

¹⁴ PSFRR Stage 1 Report, page 115

As noted in paragraph 2.1.2 above, SA Power Networks acceded to the South Australian Government's request to commence the implementation of EVM at 138 zone substations which the AEMO and SA Power Networks investigations had identified as having the highest DER connection penetration. This acceptance was based on the understanding that the requirement to complete this work would be mandated as part of the overall response to the power system security issues.

The completion of this work had been identified earlier in the investigation process as a key component of the likely final response to the power system security issues being investigated by AEMO and SA Power Networks. The requirement to complete this work was eventually reflected in the detailed requirements of the VM&UFLS Emergency Standards published in late December 2021.

SA Power Networks completed these works in July 2021 at a total cost of \$9.1 million (June 2020).

3.1.2 Treatment of prior works under Technical Standards Regulations and VM&UFLS Emergency Standards

As noted in paragraph 2.1.2 above, it was identified early in the investigation process that certain activities would likely form part of the final response to the power system security issues being investigated by AEMO and SA Power Networks. This was confirmed during the preparation of the AEMO reports and the completion of the SA Power Networks EVM trials.

It was also recognised by the South Australian Government that there existed compelling reasons for undertaking some of these activities prior to the completion of the detailed investigations and the identification of the optimal overall solution to address the emerging power system security issues.

It is for this reason that the South Australian Government requested SA Power Networks to commence the implementation of EVM for the zone substations identified by AEMO and SA Power Networks prior to the completion of the investigation and optimal solution identification processes for changes to UFLS. As noted above, SA Power Networks' acceptance of this position was based on the understanding that the requirements to complete this work were to be mandated as part of the overall response to the power system security issues.

This background and intention is reflected in the drafting of the Technical Standards Regulations and the VM&UFLS Emergency Standards as outlined below. In both cases, the relevant legislative and administrative responses included provisions which specifically contemplated that activities undertaken by a relevant entity to comply with the requirements of an emergency standard could include activities commenced or even completed before the commencement of the regulatory requirement with respect to that emergency standard.

In particular, sub-regulation 55H(2)(c) of the Electricity Regulations, provides that emergency standards may:

"provide for the Technical Regulator to determine—

- (i) that activities undertaken by a relevant entity comply with a provision of the emergency standards, including activities commenced or completed before the commencement of the provision; and
- (ii) that activities undertaken by a relevant entity were undertaken solely for the purposes of compliance with a provision of the emergency standards and, in the case of activities commenced or completed before the commencement of the provision, that such activities will be treated as having been undertaken after that commencement.'

Section 7 of the VM&UFLS Emergency Standards also provides as follows:

" For the purposes of regulation 55H(2)(c) of the *Electricity (General) Regulations 2012*, the Technical Regulator has determined that all activities already commenced or completed by the relevant entity prior to the commencement of these emergency standards that are consistent with the requirements of Section 4 of this document and Appendix 2, or Section 5 of this document and Appendix 3, or Section 6 of this document and Appendix 4:

- comply with these emergency standards; and
- were undertaken solely for the purpose of compliance with these emergency standards; and
- will be taken to have been, and will be treated as having been, undertaken after the commencement of these emergency standards."

SA Power Networks is the "relevant entity" referred to in section 7 of the VM&UFLS Emergency Standards.

All of the works described in paragraph 3.1.1 above that were either commenced, or commenced and completed, prior to 21 December 2021 (being the date that the VM&UFLS Emergency Standards were published and took effect), are consistent with the requirements of Section 4 and Appendix 2 of the VM&UFLS Emergency Standards.

Accordingly, it is clear that:

- all works commenced, or commenced and completed, prior to the date of the *pass through event* on 21 December 2021, are deemed for the purposes of the Technical Standards Regulations and the VM&UFLS Emergency Standards to have occurred on or after that date and solely for the purpose of complying with the VM&UFLS Emergency Standards; and
- therefore, all costs that were incurred by SA Power Networks prior to 21 December 2021 are deemed for the purposes of the Technical Standards Regulations and the VM&UFLS Emergency Standards to have been incurred on or after that date and solely for the purpose of complying with the VM&UFLS Emergency Standards.

The mechanism adopted in regulation 55H(2)(c) of the Technical Standards Regulations, and in section 7 of the VM&UFLS Emergency Standards, to deem activities undertaken in anticipation of the commencement of an emergency standard to being carried out in accordance with, and for the purposes of complying with, that emergency standard is not an uncommon mechanism to adopt in relation to the regulatory arrangements governing the Australian electricity industry. For example, there are numerous references to this type of mechanism in Chapter 11 of the NER. In most cases, this mechanism takes the form of a provision which expressly states that actions taken by a nominated person prior to the commencement of a particular regulatory requirement in anticipation of the commencement of that regulatory requirement are deemed to:

- have been taken for the purposes of the regulatory requirement; and
- continue to have effect for that purpose.

The rationale for adopting this type of mechanism is to permit and ratify actions taken in preparation for the commencement of a regulatory requirement which are necessary in order for

the regulatory requirement to operate effectively and expeditiously. This is particularly important when dealing with a complex and rapidly changing industry.

The power system security issues highlighted in this document are indicative of the types of unexpected issues that can arise as the Australian electricity system transitions to a future which includes significant volumes of intermitted renewable generation connected at the distribution network level. A number of State governments have also recognised the need to introduce flexible mechanisms for dealing with emerging power system issues expeditiously and in a manner that reflects the particular characteristics of the relevant States power system and its stage in the transition process.

As noted in paragraph 4 below, one of the issues that must be satisfied in order to pass through a positive pass through amount is that the increase in cost making up the positive pass through amount has occurred solely as a consequence of the positive change event. Whilst in many cases, this would require the increase in cost to follow the occurrence of the positive change event, this is not a pre-condition for satisfying this requirement.

The wording of clause 6.6.1(c)(6)(ii) of the NER focuses on the fact that the increase in cost must be solely as a consequence of (i.e. solely related to) the positive change event. In this case, the work that SA Power Networks was requested by the South Australian Government to complete prior to the enactment of the Technical Standards Regulations and the VM&UFLS Emergency Standards was clearly intended to be a direct consequence of the enactment of the Technical Standards Regulations and the VM&UFLS Emergency Standards. This is expressly acknowledged in the drafting of the Technical Standards Regulations and the VM&UFLS Emergency Standards.

This outcome is further supported by the fact that the same costs would have been incurred as a consequence of the enactment of the VM&UFLS Emergency Standards even if SA Power Networks had waited to commence this work until after the enactment of the VM&UFLS Emergency Standards.

The EVM work at the 138 zone substation was expressly required to be done under the VM&UFLS Emergency Standards and it would have been inconsistent with the best interest of South Australian customers to delay implementing this work until the completion of the investigation and optimal solution identification processes for the broader power system security issues. This was certainly the clear view of the South Australian Government.

3.2 Works carried out, and to be carried out, after publication of the VM&UFLS Emergency Standards

The VM&UFLS Emergency Standards specify work in relation to 'Under Frequency Load Shedding (Dynamic Arming)' and 'Under Frequency Load Shedding (Inaugural Installation)'.

Technical Standard – Under Frequency Load Shedding (Dynamic Arming)

For compliance with the VM&UFLS Emergency Standards, SA Power Networks is required to amend or install relays at specific points in the distribution network. These relays require the following minimum characteristics:

- Must be able to measure power system frequency.
- Must be able to measure the direction of power flow at a sampling rate of at least 5-minutes.
- Must be programmable such that the relay will only trip a circuit for an under-frequency event, if that circuit is a net load on the South Australian power system.

The VM&UFLS Emergency Standards specify the specific substations and trip points within those substations (designated as either the feeder, bus, or line level within that substation site). These are prescriptive substation site-specific requirements on SA Power Networks.

The UFLS scheme that is currently in service, largely utilises electromechanical relays that are incapable of measuring the direction of power flow and cannot be programmed to trip for a given direction of power flow. These relays will need to be replaced with modern electronic equivalent relays to provide the necessary functionality.

Furthermore, the vast majority of existing UFLS relays in service only operate at the bus level within a substation. For those substation sites specified in the VM&UFLS Emergency Standards as requiring feeder level tripping, the existing relays will need to be removed from service and replaced with compliant protection relays on each of the specified feeder exits.

There is a subset of substation sites where there is an existing protection relay in service that meets the minimum requirements specified in the VM&UFLS Emergency Standards. In these substation sites, the protection relay will be configured and re-commissioned to deliver the required functionality.

In total, SA Power Networks is required to install an estimated 350 new protection relays and configure and re-commission a further 200 existing protection relays to meet the UFLS (dynamic arming) requirements.

Under Frequency Load Shedding (Inaugural Installation).

For compliance with the VM&UFLS Emergency Standards, SA Power Networks is required to include additional sites in the UFLS scheme and to amend or install relays meeting the required performance standards at those additional sites.

The VM&UFLS Emergency Standards specify the specific substations and trip points within those substations (designated as either the feeder, bus, or line level within that substation site).

These are prescriptive substation site-specific requirements on SA Power Networks.

The following substations are new sites that need to be added to the UFLS scheme:

- Cleve
- Coromandel Place
- East Terrace
- Elizabeth South
- Flinders Park
- Kent Town
- Keswick
- Kincaig
- Morphett Vales East
- Panorama
- Port Stanvac
- Whyalla Terminal.

4. Regulatory framework and requirements

4.1 Introduction

Clause 6.6.1 of the NER sets out the mechanism for a Distribution Network Service Provider (**DN**SP) to seek the approval of the AER to pass through to Distribution Network Users certain increases in costs related to the provision of direct control services and resulting from the occurrence of a pass through event.

A pass through event occurs if the requirements for:

- a nominated pass through event specified in a distribution determination; or
- one of the four pass through events listed in clause 6.6.1(a1) of the NER,

are satisfied.

There is no nominated pass through event specified in the current distribution determination for SA Power Networks that would apply in respect of the VM&UFLS Emergency Standards. However, SA Power Networks considers the publication of the VM&UFLS Emergency Standards to be a service standard event for the purposes of clause 6.6.1(a1) of the NER.

For SA Power Networks to then be entitled to recover the increased costs incurred, and/or to be incurred, as a result of the occurrence of that service standard event, the service standard event must also meet the requirements for a positive change event.

Each of the above matters and requirements are briefly addressed in this section 4. If each of the above requirements are met, then the amount that SA Power Networks may pass through to Distribution Network Users, once approved by the AER, is the positive pass through amount in respect of the positive change event. This issue is addressed in section 5 below.

4.2 Service standard event

4.2.1 Definition

A service standard event is defined in the NER¹⁵ as being (relevantly):

'A legislative or administrative act or decision that:

(a) has the effect of:

- (i) substantially varying, during the course of a regulatory control period, the manner in which a ... Distribution Network Service Provider is required to provide a direct control service; or
- (ii) imposing, removing or varying, during the course of a regulatory control period, minimum service standards applicable to ... direct control services; or

¹⁵ Chapter 10 (Glossary).

- (iii) altering, during the course of a regulatory control period, the nature or scope of the ... direct control services, provided by the service provider; and
- (b) materially increases or materially decreases the costs to the service provider of providing ... direct control services provided by the service provider.'

SA Power Networks submits that the preparation and publication of the VM&UFLS Emergency Standards by the Technical Regulator is a service standard event.

4.2.2 'Legislative or administrative act or decision'

Neither the National Electricity Law (NEL) nor the NER define this phrase or any of these terms. Accordingly, these words are required to be given their ordinary meaning¹⁶ (i.e. something that is done, performed, determined or resolved and which is of an administrative or legislative character meets the requirements for a 'legislative or administrative act or decision').

The Technical Regulator is appointed by the Minister and is an agency of the Crown. The functions of the Technical Regulator include such functions as may be prescribed by regulation or assigned to the Technical Regulator by or under the Electricity Act or any other Act.

The VM&UFLS Emergency Standards were prepared and published by the Technical Regulator under regulation 55H(1) of the Electricity Regulations (i.e. the regulations giving the Technical Regulator the express power to prepare and publish 'emergency standards'). Therefore, the preparation and publication of the VM&UFLS Emergency Standards is clearly a 'legislative or administrative act' for the purposes of the definition of '*service standard event*'.¹⁷

4.2.3 Effect of the act or decision

The VM&UFLS Emergency Standards have the effect of imposing, and in some cases varying, during the course of the current regulatory control period the minimum service standards applicable to direct control services. Assisting AEMO to manage the frequency and voltage of the South Australian power system, including by establishing voltage management and UFLS capabilities necessary to comply with the power system voltage and frequency requirements specified in the NER and the South Australian regulatory arrangements, clearly forms part of the activities comprised within the provision of direct control services.

The VM&UFLS Emergency Standards impose an additional minimum service standard with respect to this component of the activities comprised within the provision of direct control services. By imposing this additional standard, the VM&UFLS Emergency Standards are also operating to vary the existing standards under the NER and the South Australian regulatory arrangements with respect to these issues.

Given that the VM&UFLS Emergency Standards have the effect referred to in paragraph (a)(ii) of the definition of "service standard event", it is not necessary to consider whether the VM&UFLS

¹⁶ The ordinary meaning of 'act' is anything done or performed, the doing of a thing, or the formal product of a body such as a decree, edict, law, statute, judgement, or award, in particular by the legislature, ruler, court or other authority, and the ordinary meaning of 'decision' is a determination arrived at after consideration, official judgment (e.g. legal) or resolution. - Macquarie Dictionary online; Merriam-Webster Dictionary online.

¹⁷ '*Service standard event*' is defined to include both legislative and administrative acts. As a result, it is unnecessary to consider whether the making and publication of the VM&UFLS Emergency Standards is an exercise of delegated legislative power (and therefore a legislative act) or an exercise of administrative power (and therefore an administrative act).

Emergency Standards also have either or both of the effects referred to in paragraph (a)(i) and (iii) of the definition of "service standard event". However, it is likely that the VM&UFLS Emergency Standards also have the effect of substantially varying the manner in which SA Power Networks is required to provide direct control services and altering the nature and scope of direct control services provided by SA Power Networks.

4.2.4 'Materially' increases costs of providing direct control services

To meet the requirements for a service standard event, paragraph (b) of the definition of that term requires that the costs to SA Power Networks of providing direct control services be increased materially in complying with the legislative or administrative act or decision.

The term 'materially' is defined by the NER as being (relevantly):

'For the purposes of the application of clause 6.6.1, an event results in a Distribution Network Service Provider incurring materially higher or materially lower costs if the change in costs (as opposed to the revenue impact) that the Distribution Network Service Provider has incurred and is likely to incur in any regulatory year of a regulatory control period, as a result of that event, exceeds 1% of the annual revenue requirement for the Distribution Network Service Provider for that regulatory year.'

Consistent with recent cost pass through determinations of the AER¹⁸, SA Power Networks submits that, 'costs' in the definition of 'materially' is to be interpreted as being the sum of actual and forecast capital and operating expenditure incurred or expected to be incurred in relation to the relevant event.

On that basis, SA Power Networks has incurred, and will incur, materially higher costs in complying with the VM&UFLS Emergency Standards.

Details of those costs and their magnitude are set out in Attachment C, and have been summarised below:

Emergency standards actual and forecast capital expenditure \$ million (real 2020)

	2019/20	2020/21	2021/22	2022/23	2023/24
EVM/UFLS Emergency work	0.101	9.103			
DUFLS/UFLS			1.332	10.421	9.644
Smoothed revenue	758.7	744.9	731.6	718.5	705.6
1% threshold	7.587	7.446	7.316	7.185	7.056

4.3 Occurrence of a positive change event

As discussed above, SA Power Networks considers the publication of the VM&UFLS Emergency Standards to be a service standard event. However, to be entitled to pass through resulting costs to Distribution Network Users, the service standard event must also meet the requirements for a positive change event.

To be a positive change event, the service standard event must¹⁹:

¹⁸ AusNet (September 2020); AusNet (November 2020); AusGrid (December 2020); Endeavour Energy (February 2021).

¹⁹ Chapter 10 (Glossary).

- entail SA Power Networks incurring materially higher costs in providing direct control services than it would have incurred but for that event; and
- not include a contingent project or an associated trigger event.

These matters are addressed below, together with the date on which the positive change event occurred.

4.3.1 Materially higher costs but for the event

As explained in paragraphs 2.1.2 and 3.1.2 above, SA Power Networks commenced works ahead of the VM&UFLS Emergency Standards being published at the express request of the South Australian Government and in contemplation of those VM&UFLS Emergency Standards being imposed on SA Power Networks.

Accordingly:

- the consequence of the service standard event, is that SA Power Networks has, and will, incur costs in providing direct control services that it would not have incurred but for that service standard event (this is explained in more detail in paragraph 3.1.2 above); and
- the magnitude of those costs are material (as noted in paragraph 4.2.4 above).

4.3.2 Does not include a contingent project or an associated trigger event

The definition of positive change event excludes from the definition of pass through event a contingent project or an associated trigger event. In other words, if the enactment of the VM&UFLS Emergency Standards in late December 2021 fell within any of the contingent projects or their associated trigger events referred to in the SA Power Networks distribution determination for the current regulatory control period, the enactment of the VM&UFLS Emergency Standards would not qualify as a pass through event (and therefore would not also qualify as a positive change event).

The only relevant contingent project and associated trigger event under the current SA Power Networks distribution determination is the 'Electricity System Security' contingent project described in Attachment 5 of the AER's final decision dated June 2020. However, whilst the Electricity System Security contingent project refers to:

- changes to emergency frequency control schemes; and
- other measures that AEMO determines are required to ensure AEMO's continued ability to maintain security and reliability of the supply within South Australia with increasing levels of DER,

the Electricity System Security contingent project (and in particular, the associated trigger event) was linked to SA Power Networks receiving a notification from AEMO which required SA Power Networks to implement any of the above options in order to comply with the applicable regulatory obligations or requirements.

SA Power Networks has not received such a notification from AEMO. Rather, the South Australian Government (and subsequently the Technical Regulator) decided to address the UFLS issues resulting from increasing levels of DER connected to the distribution network by enacting the Technical Regulations and making the VM&UFLS Emergency Standards. In other words, the

changes to the South Australian EVM scheme and UFLS scheme have been mandated by the Technical Regulator and the terms of the VM&UFLS Emergency Standards.

The scope of the work referred in the Electricity System Security contingent project was also broader than the scope of the work specified in the VM&UFLS Emergency Standards. This reflects the fact that both AEMO and SA Power Networks have spent considerable time and resources refining the scope of the EVM scheme and the modifications to the existing UFLS scheme so as to appropriately balance the benefits that will be derived from implementation of these schemes against the cost of implementing the scheme.

This has resulted in a defined list of specific activities which have been thoroughly reviewed and assessed by not only SA Power Networks but also AEMO, the South Australian Government and the Technical Regulator.

4.3.3 Date on which the positive change event occurred

The VM&UFLS Emergency Standards were published by the Technical Regulator on 21 December 2021 and came into effect immediately on that date.

Accordingly, the positive change event occurred on 21 December 2021.

5. Eligible/Positive Pass Through Amounts

5.1 Eligible pass through amount

Clause 6.6.1(c)(3) of the NER requires SA Power Networks to specify the eligible pass through amount in respect of the positive change event.

5.1.1 Definition

The term ‘eligible pass through amount’ is defined by the NER as being (relevantly):

‘In respect of a positive change event for a Distribution Network Service Provider, the increase in costs in the provision of direct control services that, as a result of that positive change event, the Distribution Network Service Provider has incurred and is likely to incur (as opposed to the revenue impact of that event) until:

- (a) unless paragraph (b) applies – the end of the regulatory control period in which the positive change event occurred; or
- (b) if the distribution determination for the regulatory control period following that in which the positive change event occurred does not make any allowance for the recovery of that increase in costs (whether or not in the forecast operating expenditure or forecast capital expenditure accepted or substituted by the *AER* for that regulatory control period) – the end of the regulatory control period following that in which the positive change event occurred.

The eligible pass through amount refers to the increase in costs in the provision of direct control services as a result of the pass through event. It covers all expenditure incurred, including actual and forecast capital expenditure and operating expenditure.

5.1.2 Actual and likely increase in costs included in the eligible pass through amount

Clause 6.6.1(c)(6)(i) of the NER requires SA Power Networks to provide evidence of the actual and likely increase in costs included in the eligible pass through amount.

Details of the eligible pass through amount, including the actual and likely increase in costs included in that eligible pass through amount, are set out in Attachment C and have been summarised below:

Emergency standards eligible pass through amount (\$m June 2020)

	2020/21	2021/22	2022/23	2023/24	TOTAL
VM/UFLS Emergency work	9.103				9.103
DUFLS/UFLS		1.332	10.421	9.644	21.396
					30.499

5.1.3 Evidence that the costs occur solely as a consequence of the positive change event

Clause 6.6.1(c)(6)(ii) of the NER requires SA Power Networks to provide evidence that the costs described above occur solely as a consequence of the positive change event.

That evidence takes two forms:

- First, as a matter of fact, the costs were incurred solely as a consequence of the positive change event. The evidence for that is set out in Attachment B.
- Secondly, as explained in paragraph 3.1.2 above, the costs were incurred solely as a consequence of the positive change event.

5.2 Positive pass through amount

Clause 6.6.1(c)(4) of the NER requires SA Power Networks to specify the positive pass through amount that it proposes in relation to the positive change event.

5.2.1 Definition

The positive pass through amount is defined by the NER as an amount not exceeding the eligible pass through amount.

5.2.2 Proposed positive pass through amount

SA Power Networks proposes a positive pass through amount of \$30.5 million (June 2020).

Details as to how that amount has been determined are set out in Attachment C.

5.2.3 Proposed positive pass through amount for each regulatory year

Clause 6.6.1(c)(5) of the NER requires SA Power Networks to specify the amount that it proposes to pass through to Distribution Network Users in the regulatory year in which, and in each regulatory year after that in which, the positive change event occurred.

SA Power Networks proposes to recover the proposed positive pass through amount of \$6.78 million in the 2023/24 and 2024/25 regulatory years as follows:

Positive pass through revenue smoothed (\$m Nominal)

	2020/21	2021/22	2022/23	2023/24	2024/25
Expected revenue (smoothed)	0	0	0	3.38	3.40

5.2.4 Determination by the AER of the approved pass through amount

5.2.4.1 *Clause 6.6.1(j)(3) of the NER*

In making a determination under clause 6.6.1(d)(1) as to the approved pass through amount and the amount to be passed through to Distribution Network Users in each regulatory year, clause 6.6.1(j)(3) of the NER requires the AER to take into account the efficiency of the decisions and actions of SA Power Networks in relation to the risk of the positive change event. That includes whether SA Power Networks has failed to take any action that could reasonably be taken to reduce the magnitude of the eligible pass through amount in respect of that positive change event, and whether SA Power Networks has taken or omitted to take any action where such action or omission has increased the magnitude of the amount in respect of that positive change event.

As noted in paragraph 4.3.2 above, the final scope of the activities listed in the VM&UFLS Emergency Standards:

- reflects the outcome from detailed reviews by both AEMO and SA Power Networks and consultation with the South Australian Government and the Technical Regulator; and
- set out the final view of the Technical Regulator concerning the scope of the activities required to be undertaken at this point in time.

In the end under the terms of the VM&UFLS Emergency Standards, SA Power Networks is obliged to undertake the specific work identified in the standards.

SA Power Networks submits that it has acted efficiently in determining the actual and forecast cost for the required activities and has taken all possible steps that could reasonably be undertaken in the circumstances to reduce the magnitude of the eligible pass through amount in respect of this positive change event.

SA Power Networks has also used its standard unit costings (competitively sourced from the market taking into account the current economic and supply conditions) to develop its forecast of the cost to complete the required works.

Finally, the joint assessment undertaken by AEMO and SA Power Networks prior to the compilation of the list set out in the VM&UFLS Emergency Standards has removed from the potential scope of the activities those locations where it was determined that the benefits of installing emergency voltage management schemes or modifying the UFLS schemes did not outweigh the costs of that work.

5.2.4.2 Clause 6.6.1(j)(7) of the NER

In making a determination under clause 6.6.1(d)(1) of the NER as to the approved pass through amount and the amount to be passed through to Distribution Network Users in each regulatory year, clause 6.6.1(j)(7) of the NER requires the AER to take into account whether the costs of the pass through event have already been factored into the calculation of SA Power Networks' annual revenue requirement for the regulatory control period in which the pass through event occurred or will be factored into the calculation of SA Power Networks' annual revenue requirement for a subsequent regulatory control period.

The costs of this pass through event have not already been factored into the calculation of SA Power Networks' annual revenue requirement for the current regulatory control period. This is supported by the fact that the Electricity System Security contingent project approved by the AER in its final decision concerning SA Power Networks distribution determination for the 2020-25 regulatory control period included contingent capital expenditure related to some of the activities which are now required to be implemented under the VM&UFLS Emergency Standards. Any costs related to work which will be undertaken during the next regulatory control period will be addressed in the distribution determination process for the next regulatory control period.

6. Regulatory compliance

The table below provides a summary of the requirements imposed on SA Power Networks by the NER for the making of a cost pass through application, and where the relevant information is provided in this application.

NER clause	Requirement	Where provided in application
6.6.1(a1)	Identify the relevant pass through event	Sections 2 and 4.2
6.6.1(c)(1)	Specify details of the positive change event	Section 4.3
6.6.1(c)(2)	Specify the date on which the positive change event occurred	Section 4.3.3
6.6.1(c)(3)	Specify the eligible pass through amount in respect of the positive change event	Section 5.1.2
6.6.1(c)(4)	Specify the positive pass through amount proposed in relation to the positive change event	Section 5.2.2
6.6.1(c)(5)	Specify the amount of the positive pass through amount proposed to be passed through in the regulatory year in which, and each subsequent regulatory year in which, the positive change event occurred	Section 5.2.3
6.6.1(c)(6)(i)	Provide evidence of the actual and likely increase in costs referred to in clause 6.6.1(c)(3)	Section 5.1.2 and Attachment C
6.6.1(c)(6)(ii)	Provide evidence that the costs referred to in clause 6.6.1(c)(3) occur solely as a consequence of the positive change event	Section 5.1.3
6.6.1(c)(6)(iii)	Not applicable as this application does not relate to a retailer insolvency event	Not applicable
6.6.1(c)(7)	Provide such other information as may be required under any relevant regulatory information instrument	Not applicable as no relevant regulatory information instruments