Network Resilience Mobile Generation Forecasting Approach

2025-30 Regulatory Proposal

Supporting document 5.8.4

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SA Power Networks

Empowering South Australia

Contents

Glossary

Acronym / term	Definition
ABC	Aerial Bundled Cable
AER	Australian Energy Regulator
Augex	Augmentation capital expenditure
CAB	Community Advisory Board
Capex	Capital expenditure
CER	Customer energy resources
CESS	Capital Efficiency Sharing Scheme
CFS	Country Fire Service
DNSP	Distribution Network Service Provider
EBSS	Efficiency Benefit Sharing Scheme
ESCI	Electricity Sector Climate Information
GSL	Guaranteed Service Level
MED	Major Event Day
NER	National Electricity Rules
NPV	Net present value
Opex	Operating expenditure
RCP	Regulatory Control Period
Resilience Program	Network Resilience Mobile Generation program
SAPS	Stand Alone Power Systems
SES	State Emergency Service
STPIS	Service Target Performance Incentive Scheme
VCR	Value of Customer Reliability
WALDO	Widespread and Long Duration Outages

1 Program overview

The purpose of the Network Resilience Mobile Generation program (**resilience program**) is to address a key resilience issue around long duration, widespread outages in regional and remote areas identified as part of our customer engagement. The resilience program will form part of our augmentation capital expenditure (**augex**) forecast in our 2025-30 Regulatory Proposal.

The primary service improvement to be achieved by this program is the reduction in the number of customers having long interruptions due to network faults caused by extreme weather events or other issues. Our rural customers, particularly those supplied from our Long Rural feeders, are the most vulnerable to these long duration interruptions to their electricity supply, and therefore, this program should improve supply reliability for these customers.

The resilience program is a new program, which has been brought into greater focus by recent extreme weather events affecting supplies in SA and across the NEM, and the effects of climate change, which is expected to increase the frequency or severity of some extreme weather events. Through our consumer engagement process, our customers have indicated a strong preference for us to improve the resilience of our network to guard against the effects of extreme weather on their electricity supplies, as well as highlighting the existing resilience issues impacting on customers supplied by long, radial networks.

Important note on the scope of this document and its purpose

This document provides an overview of the methodology we are applying to forecast expenditure for the resilience program, including an explanation of the 'needs' it could address and some regulatory considerations. The purpose of this document is to aid in the understanding of the processes and techniques we are applying to prepare this forecast and ensure it accords with regulatory requirements.

This document does not provide any quantification of the 'needs' driving this program or the findings of the evaluation of options to address these needs (eg expenditure and benefit forecasts). This information is included in the business case for this program, which together with this document will form supporting documents to our Regulatory Proposal.

2 Explanation of the 'needs' driving this program

The primary 'need' being addressed through this program is reducing the number and extent of 'long-duration' interruptions to SA Power Networks' distribution services due to extreme weather events and other faults impacting on long, radial networks.

SA Power Networks services customers over a wide area of South Australia, with 70% of our assets dedicated to serving 30% of our customers. As a result, many of these customers are therefore serviced by long radial lines to minimise costs.

Restoration times in these areas can be extended due to the following factors:

- Inability to restore supply from alternative parts of the network,
- Increased exposure of long powerlines to both weather-related and non-weather-related faults,
- Extended efforts required to locate faults,
- Increased chance of weather events (such as lightning storms) impacting a large proportion of the network in a region, placing pressure on locally available resourcing, and
- Challenges associated with obtaining safe access for repairs, which can be impacted by bushfire damage, flooding, heavy rainfall making access tracks inaccessible for vehicles, and high winds impacting on the ability to safely work at heights.

This has led to increasing inequity in the experience of our metropolitan and regional customers. In regional areas supplied by long radial lines, widespread and long duration outages can occur frequently as a result of both extreme weather events and other causes such as vehicle impacts and asset failure. The community's experience of these outages also differs in regional areas. In our customer engagement, we heard that the flow-on impacts of a power outage on other critical services, such as telecommunications, food and fuel, can often be as inconvenient as the power outages themselves. Given the large geographical area covered by these outages, it can be difficult to obtain these services from outside the outage area.

In contrast, metropolitan areas, long duration and widespread outages are often able to be mitigated through automated or manual restoration of supply from alternative sources. As a result, these outages occur rarely and generally only during the most severe storms, when extensive network damage requires a long and resource-intensive response to make the network safe and rebuild lines. In addition, when these outages occur, key community services are more likely to be available in nearby areas. As the impact of storms on metropolitan areas was not as strongly emphasised in our customer engagement, these events are rare (two in the last six years), and the mitigation options are costly (~$2-5 million to underground a single feeder supplying ~1,000 customers), this business case does not address long duration and widespread outages in metropolitan areas. Innovative solutions to improving network and community resilience in metropolitan areas will be explored through the Innovation Fund.

Categorizing the 'needs' to be addressed by the programs

The 'needs' to be addressed by the programs are summarised in Table 1, indicating the importance of the 'need' in defining reasonable options and evaluation of options. The needs have been classified into three categories where:

- primary needs, are essential and must be addressed by all options, and their quantification is necessary;
- secondary needs, although not mandatory to be addressed by the options, are quantified whenever possible; and
- indirect needs are acknowledged to exist, but they do not require to be quantified or addressed.

Table 1: Identified needs and classification

Need	Comment on classification of the needs
Reducing the extent of long-duration customer interruptions	The primary need to be addressed by these programs concerns reducing the number of customers vulnerable to long-duration interruptions. As noted above, our rural customers supplied nearer the ends of our long rural feeders are particularly vulnerable to interruptions due to extreme weather events and other faults. All options should reduce the number of customers vulnerable to long-duration outages during extreme weather events.
Reducing response and repair costs	A secondary need concerns reducing the costs associated with the restoration and repair of the network due to the faults caused by extreme weather events. This is a matter we have regard to in our evaluation of any options. But it is not considered a requirement that all reasonable options must materially reduce these costs. That said, we include some options that will reduce this need.
Reducing SA Power Networks and public safety risks (excluding bushfire risks associated with fires started by our network)	Reducing SA Power Networks and public safety risk is not considered a direct 'need' driving this program. However, it is an issue that we should have regard to in the overall evaluation of any options. Therefore, there is no requirement that any reasonable option must materially reduce safety risks (we can control) associated with extreme weather events. Rather, we should consider how these safety risks could change (for better or worse) in our evaluation of any option. Further, unless the change in safety risk is considered material dependant on the selection of the preferred option, we have no requirement that this risk should be quantified through the forecasting methodology. It is important to note that this need and its forecasting requirement excludes the 'need' to mitigate the safety risk associated with bushfires that could be started by our network, which is specifically addressed through our bushfire risk mitigation programs.
Other issues associated with the effects of extreme weather events on our network and our operations	There are various other issues impacting our network and operations caused by extreme weather events that options could address. However, these other issues are either addressed elsewhere in our Regulatory Proposal or are not considered to be sufficiently material to be classified as a 'need' to be explicitly considered in defining or evaluating options. That said, the impact of options on these other issues could be considered – in a more opportunistic way – in the selection of the preferred options, if the net-benefits between competing options are similar. Other extreme weather impacts on our network and operations include: • heatwaves resulting in asset derating and asset overloading – these issues are considered through our capacity augex forecasts; • the effects of extreme weather increasing the stress on our assets causing accelerated aging of some assets – this issue is considered through the replacement expenditure forecast; and • increased need for office and some field-based resources in anticipation of extreme weather events and following these events (eg customer call centres, network control room, emergency management coordination) – these issues are considered through the operating expenditure forecast.

It is important to note that the distinction between primary and secondary 'needs' discussed above could be different to other Distribution Network Service Provider's (**DNSP's**) 'needs' that drive their equivalent resilience programs. Our use of stobie poles tends to mitigate major and extensive catastrophic damage to our network due to extreme weather events (compared to wooden pole networks). We still suffer the effects of high winds and lightning, causing extensive network faults, but typically this does not result in a large number of fallen poles, requiring expensive repair or replacement of large sections of our overhead lines. The total costs to respond and repair following these events is still much higher than usual, but typically not to the extent that we require ex-post pass-throughs to recover these costs (although, there is still a possibility this could be required). For example, over the last 10 years, we have never required a pass-through event to cover response and repair costs due to this type of weather event – and we are not anticipating the need for this due to recent storm and flood events that have affected our network this year.

So – possibly different to other DNSPs – we consider that the primary 'need' to be addressed through this program is to mitigate the likelihood of long-duration interruptions to customers' supplies due to extreme weather events, rather than reducing repair costs associated with these events. We still consider these costs in our evaluation and have considered options that should reduce these costs. But it is important to note this distinction in the primary driving 'need' for this program, which is likely different to some other DNSPs.

This distinction is also in line with concerns expressed by our customers during our consumer engagement, where the interruptions of supply due to extreme weather was their major concern, rather than the network repair costs associated with these weather events.

3 Regulatory considerations and the principles underlying our approach

SA Power Networks has sought to align its approach to forecasting the Resilience Programs with industry good practice, the National Electricity Rules (**NER**) and the Australian Energy Regulator's (**AER's**) published guidance on preparing Regulatory Proposals. Most notably, we have sought to align the forecast methodology with the guidance in the AER's note on network resilience (**AER note**)[1].

The following summarises how we have addressed the key matters raised in the AER note.

Reliability, resilience and the AER STPIS and ex-ante revenue allowance

The AER note indicates the AER view that there is a 'close relationship between [network] resilience and [service] reliability because resilience is an input that contributes to the achievement of reliability – the service level outcome'. However, the note also indicates the limitation in the current Service Target Performance Incentive Scheme (**STPIS**) to provide the necessary funding to improve the resilience of the network to extreme weather events, whereby extreme weather events tend to result in Major Event Days (**MEDs**) which are then excluded from the measure of supply reliability within that scheme. In addition, other safety-related exclusions (Force Majeure) can also apply to STPIS and contribute to some long-duration outages not being incentivised under STPIS.

Although the aim would be that works under this program would only include elements that have a net-benefit under Value of Customer Reliability (**VCR**), it would not be expected that the STPIS rewards would be sufficient to fully fund this program. That said, it is expected that most options aimed at addressing the above resilience 'needs' associated with extreme weather events could still result in some improvement to the reliability measure captured by the STPIS, and we allow for the value of this improvement in the cost-benefit analysis. But more importantly, our forecasting methodology will estimate the impact of the program on future STPIS targets and calculate the necessary adjustments (ie either to these targets or the ex-ante allowance).

Our methodology also considers the impact of our program on our historical and future payments through our jurisdictional Guaranteed Service Level (**GSL**) scheme, which could be impacted by this program. Further, if considered material for an option, our forecasting methodology will also consider the effect of the program on other incentive mechanisms such as the Efficiency Benefit Sharing Scheme (**EBSS**) and Capital Efficiency Sharing Scheme (**CESS**).

Network resilience and community resilience

The AER note indicates the AER view that there is a distinction between network resilience and community resilience, as community resilience can cover other factors and services beyond those provided by or under the control of DNSPs.

We agree with that view on the important distinction between these types of resilience. To address this, we have sought to classify options as:

1. options primarily intended to address the direct network needs (discussed above) – ie the benefits would be primarily associated with improving those needs, and therefore, the full cost of the option would be covered by the program – note, this is equivalent to how we would value other reliability improvements
2. options where it is reasonable to assume that there could be additional material community benefits, in addition to the needs (discussed above) - ie a significant portion of the benefits could be related to other community needs, and therefore, it is reasonable to assume that the costs would only be a partial component of the overall options.

[1] AER, *'Network Resilience - a note on key issues'*, April 2022, available via [https://www.aer.gov.au/industry/registers/resources/guidelines/aer-note-network-resilience], last accessed 25 January 2024

It is important to note that for the second option type, we have not attempted to quantify the additional community benefits; rather, we just recognise that they exist in the overall evaluation of those options.

Uncertainties and determining network resilience needs

The AER note discusses the effects of uncertainty on determining future resilience needs.

One element of uncertainty concerns uncertainty in future customer needs and the availability of new technologies (eg as an alternative supply or alternative network approach). These types of uncertainty can favour shorter-terms solutions, which will not have long-lived effects on prices or benefits.

Our approach on this matter is two-fold:

- we consider some short-term options involving enhancements to our operating and maintenance practices - these options can be readily applied in the next period, but could change again, depending on changing circumstances in future periods
- for longer-lived capital options, that could extend across multiple regulatory periods, we assume an upper asset life limit in our cost-benefit evaluation. This upper limit is set at 15 years for the resilience program in order that we can have reasonable confidence that the benefits of these options will be realised before major changes in customer needs or technology have occurred.

Another element of uncertainty discussed in the AER note concerns the likelihood or consequence of extreme weather events. These events are rare by their nature, and therefore, the number that can occur during any regulatory period and the consequence of any event is volatile (even setting aside the effects of climate change, discuss further below).

In our forecasting approach, we have based extreme weather parameter assumptions (eg frequency and severity of events) on weather and network activity over the past 10 years. Our approach includes the identification and analysis of these past weather events within our supply interruption database to estimate extreme event likelihood and consequence assumptions, and where feasible, the reasonable bounds on these assumptions (eg confidence limits). Further, for the base case evaluation, we do not include any further margin to allow for additional uncertainty (ie we do not add in an additional margin to allow for ‘unknown knowns’ or ‘unknown unknowns’).

The aim here is to produce long duration outage event probabilities that drive the risk calculations that should provide reasonable certainty that the events could occur in the medium term (ie a five to 10 year period) and the benefits most likely would be realised over that period. This in turn allows us to have some confidence that an ex-ante allowance for the program expenditure is most likely appropriate ie the long term net-benefit should be maximised.

Effect of climate change

It is uncontroversial that climate change is likely to result in more extreme events in the future (either in terms of the frequency increasing or the severity increasing). The AER note highlights this as a factor driving the greater focus on improving resilience.

As part of our proposal development process, we have been assessing available climate change model data and using this where feasible as part of our evaluation process. However, the readily available climate model data (ie Electricity Sector Climate Information (**ESCI**) datasets[2]) are not well suited to readily estimating likelihoods of the types of extreme weather events and their severity in the future[3]. As such, directly allowing for climate change in our methodology is not feasible without considerably more climate modelling work. Note, we do not consider that this effort is warranted, given the likely scale of our resilience program.

In our approach, we do not apply any additional margin to cover uncertainty in the expected worsening due to climate change. Rather, the probabilities estimated from the last 10 years of recorded interruption history (discussed above) are assumed to be the best short-term predictor of the effects of climate change. We will use sensitivity analysis to test these assumptions, where the scale of the change could be guided by our

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[2] Available via: [https://climatechangeinaustralia.gov.au/en/projects/esci/esci-climate-data/], last accessed 3 March 2023

[3] For example, the model data available for download does not provide direct predictions of future wind speeds, lightning strikes or flood events.

analysis of climate change models and the bounds we calculate from our analysis of recent history weather events and interruption data.

The appropriate value of customer reliability

The AER note raises the concern that there is not currently an appropriate VCR-type parameter agreed and published, suitable for valuing customer interruptions due to extreme weather events. The AER note states that the VCR values published by the AER (which we typically use for reliability assessments) may not be appropriate for these types of interruption, given they tend to be a much longer duration than usual and can affect a wide area. It is worth mentioning that the AER has previously contemplated implementing a value comparable to the VCR for Widespread and Long Duration Outages (**WALDO**). Nevertheless, this is a complicated undertaking that the AER was unable to come to a definitive stance on.

We consider that there are competing arguments as to whether the appropriate VCR could be higher or lower than the AER's published VCR (which we use for reliability assessments); for example, there could be some argument that the VCR value reduces as outage duration increases past a certain point (ie customers will find alternative solutions to the interruption), but the value could be much higher at times of extreme weather as public safety risks can be much higher at this time compared to usual.

Our approach is to use the current AER published VCR as the best estimate at this time for cost-benefit analysis, but we test this assumption through sensitivity analysis.

Options considered

The AER note indicates that DNSPs should cover a range of options, and these should consider the impact of emerging investment in Stand Alone Power Systems (**SAPS**) and other non-traditional network options like community batteries.

We have considered a range of options covering:

- traditional network-focused operating and capital solutions (such as undergrounding);
- alternative permanent and temporary, and dedicated and back-up supply solutions (such as SAPS, microgrids and mobile generation); and
- a novel community-led funding option (which could provide partial funding for initiatives such as community batteries).

Cost-benefit analysis and willingness-to-pay

The AER note indicates the AER's preference for cost-benefit analysis to demonstrate that benefits should outweigh costs, and the preferred option achieves the greatest net-benefit. However, it discusses difficulties with this analysis, given many of the matters discussed above. Therefore, it also encourages DNSPs to demonstrate consumer preference for the program, for example through consumer engagement and willingness-to-pay studies.

Our approach allows for these matters. Our evaluation of the options, involves a two-stage process:

- The first stage involves an initial qualitative / pseudo-quantitative screening of all options. The aim of this stage is to rule out some options – or the scale of their suitability – where it becomes clear that they are very unlikely to provide a net-benefit.
- The second stage involves the more detailed evaluation of the remaining options, including the cost-benefit analysis where this is feasible. The aim of this stage is to determine the preferred options, and the volumes of these options that should reasonably realise net-benefits given the uncertainty.

In deciding when formal cost-benefit analysis can be applied to an option, it is important to recognise that this is only applicable for options where the benefits can be easily attributed to matters directly controllable by SA Power Networks (ie interruptions to supply, response and repair costs). This type of analysis is not feasible (without considerably more effort) for options that could be strongly driven by indirect community resilience benefits (eg options aimed at securing community critical services, or community-led initiatives).

Therefore, in these circumstances we may elect to not undertake formal cost-benefit analysis for that option, or apply a cruder (possibly qualitative) approach to estimate the component of direct benefit achieved by that option.

Additionally, to support the cost-benefit analysis and evaluation of options, we have also conducted a willingness-to-pay study with consumers. The intention is that our program will only include elements where we can have confidence they will realise a positive net-benefit AND the overall program is in accordance with the findings of the willingness-to-pay study.

Community engagement

The AER note indicates that customers should be fully informed of the options and implications stemming from these options and are supportive of program expenditure, and this consultation should include talking to affected communities, associated disaster management agencies, and the broader customer base.

We have engaged extensively with our consumers on the proposed resilience program. This has involved a series of meetings with a broad range of customers and stakeholders. This engagement has involved:

- Engaging with customers – both the likely effected communities, disaster agencies, such as the Country Fire Service (**CFS**) and State Emergency Service (**SES**), and the broader customer base through our 'broad and diverse' program with residential and small business customers.
- Bilateral engagement with key service providers such as emergency services, health, water and telecommunications utilities, and some local councils to discuss possible initiatives and opportunities for collaboration.
- Targeted engagement with regional Councils, including Councils on the Eyre Peninsula.
- Dedicated workshops with community advocates, industry experts and other stakeholders on the resilience needs, discussing options and their pros and cons, and seeking customer views on initiatives for the 2025-30 regulatory period.
- As noted above, conducting a quantitative willingness-to-pay study across a representation of our broader customer base, which included questions on their willingness-to-pay for improving the resilience of our network, with a specific element looking at reducing 'long-duration' interruptions due to extreme weather events.

More detail on the engagement process is covered on our Talking Power website.[4]

Concluding statement on striking the right balance of modelling complexity to account for uncertainty

As noted above, there is uncertainty on many matters associated with developing forecasts for resilience to extreme weather events. There are various analysis/modelling approaches to allow for this uncertainty, from simple high-level approaches where cost and benefits are qualitatively estimated largely from judgement to complex stochastic approaches (requiring the development of probabilistic models for many of the uncertain parameters and then using approaches such as Monte Carlo analysis to estimate costs and benefits and place confidence bounds on these).

In defining a reasonable approach for our purposes, it must be recognised that it is important to balance the complexity of the modelling approach to account for uncertainty (and the effort to apply and its accuracy) against the scale of the program expenditure and the scale of the risks associated with the uncertainty.

We consider that our approach strikes the right balance on model complexity, employing what is sometimes referred to as a 'deterministic' probability approach. This approach calculates risks based on average annual outcomes we calculate from the last 10 years of recorded data. These averages can be viewed as a reasonable estimate of the medium-term *likelihood* and *consequence parameters* suitable for estimating

[4] Available via: [https://www.talkingpower.com.au] , last accessed 25 January 2024

expected costs, risks and benefits, which are the key inputs to the cost-benefit analysis. These results are then tested via sensitivity analysis based on reasonable bounds for some of the key uncertainties.

This approach is equivalent in nature to the method, often termed ‘probabilistic planning’ within the industry, when applied to planning replacements and upgrades of distribution networks. We consider that this approach is reasonable for the scale of this program’s expenditure, the type of options being considered and level of risk, where the effort to use more complex stochastic probabilistic methods could be significantly more onerous to apply in a way that would provide more accurate estimates.

4 Overview of the forecasting methodology process and tasks

4.1 Needs identification and quantification

The primary aim of the 'needs identification and quantification' step is to develop the assumptions necessary to estimate the current value of the 'needs'. This includes estimating the likelihood and consequence assumptions, which are used to translate the 'needs' into cost and risk values.

The two key tasks in this step are as follows:

- Network review – A qualitative engineering review of our network arrangements to identify customers and communities vulnerable to extreme weather events in terms of feeder exposure length, regional features affecting exposure severity and response times, and community size.
- Historical interruption data analysis – The quantitative analysis of historical customer interruption data records, including cross referencing to weather conditions, to identify extreme weather events, weather characteristics associated with that event (eg wind speeds, temperature, rain, etc) and their impact on the network (eg network faults, affected feeder, fault causes and customer interruptions), in order to develop estimates of probability assumptions (ie likelihood and consequence assumptions associated with weather events and the key 'needs'). This analysis integrates with the findings of the network review to estimate parameters relevant to identified vulnerable customers/communities, and draws in other business information, such as event response and repair costs.

4.2 Option evaluation

The primary aim of the 'options evaluation' step is to identify the preferred option, and generate the forecast outcomes associated with this option, including its scope and expenditure, benefits outcome, and vulnerable communities addressed.

The two key tasks in this step are as follows:

- Option development – Development of a set of options to address the needs (discussed above), including the high-level scope of the option (ie works necessary to implement the option), the cost estimate of the option, the assumed improvements to the needs achieved by the option, and delivery risks associated with that option (which could be relevant to some options that we do not have significant experience implementing).
- Option evaluation – The evaluation of the options using cost-benefit analysis techniques and the results of our consumer engagement and willingness-to-pay survey (discussed below) to develop a preferred option(s) that maximizes the net-customer benefit of the program.

This option evaluation step is conducted in two stages:

1. Stage 1 – The first stage involves the high-level development and evaluation of all options (set out in the following section), in order to determine the set of credible options for a more detailed analysis in stage 2. This first stage uses simplified analysis and assumption to evaluate each option in order to rule out those options where the likelihood that it will realise a positive net-benefit is low or the net-benefit is clearly lower than other options.
2. Stage 2 - The second stage involves the more detailed development and evaluation of the remaining options to determine the preferred option and its forecast outcomes.

Further details of the options being considered and the options evaluation methodology are discussed below.

4.3 Preferred option regulatory review

In this step we consider other matters that can affect how we incorporate this program and its expenditure forecast into our Regulatory Proposal to the AER.

The key tasks in this step are as follows:

- STPIS and GSL payment analysis – The analysis of the STPIS and GSL implications of the preferred program to determine the proportion of the program expenditure that could be covered by these mechanisms and the relevant adjustments to the settings of these mechanisms.
- Reconciliation with other programs – The preferred program and benefits are cross-checked with other programs to ensure there is no double counting of program elements and the expected benefits of the program or the other programs have been allowed for. An important program for this review will be the reliability improvement program, where it could be expected there is the greatest possibility for a cross-over in benefits.
- Deliverability review – A review of the proposed scope to consider its deliverability is conducted, in the broader context of our overall proposal, in order to produce a proposed program plan and associated annual expenditure forecast that should be deliverable over the next regulatory control period.

4.4 Consumer and stakeholder engagement and research

We have engaged with consumers and stakeholders to understand their opinions and preferences regarding enhancing the resilience of our network during extreme weather conditions. The previous steps of identifying and quantifying the needs and option evaluations have been developed based on stakeholder and customer feedback throughout this engagement and research phase.

The key tasks in this step were:

- Customer and stakeholder meetings –several meetings were held with our customers and relevant stakeholders on network resilience throughout our consumer engagement process. As part of this engagement, we discussed on the ‘needs’, options and benefits associated with the resilience program. An Issues and Opportunities document was developed to help our consumers understand resilience, in the context of this program, and possible options to improve this resilience. Further details of these meetings and our broader consumer engagement process are covered and provided on our Talking Power website.[5]
- Customer value research – Quantitative willingness-to-pay research with SA Power Networks customers was conducted to quantify the value they place on improving the resilience of network services to extreme weather events. Further details of this research and its findings are covered in the Customer Values Research Final Report.[6]

[5] Available via: [www.talkingpower.com.au], last accessed 25 January 2024

[6] **Supporting Document 0.2 - Customer values research - Consultant Report**

5 Program options for evaluation

The set of options to be evaluated through the two-stage process are shown in Table 2 below, including summary comments on the options and its cost, the extent that it addresses the needs discussed above, and other benefits/costs that could be relevant to its evaluation.

Note, the qualitative comments provided in the table are only to provide indicative explanation of the options. These matters are considered in more detail through the evaluation process and could change due to that process. The business case for this program will expand upon these views for each option, indicating the basis of this view and how it has affected the evaluation of the option.

Table 2: Evaluation process

Focus	Aim	Scope	Cost and implementation comments	needs' and benefits comments
Network (assets and operations)	Avoid network faults and damage	Undergrounding	Very high capital cost solution, but low risk as experience of implementing. But likely to be limited amount of feeders that could be upgraded in next Regulatory Control Period.	Very high addressing of all three key needs. Plus high additional benefits via other reduced network costs (eg line inspection and maintenance) and broader reliability improvements. But only improves needs for those customers downstream of upgraded feeders.
		Covered conductor / aerial bundled cable (ABC)	Moderate capital cost solution, but low risk as experience of implementing. But likely to be limited amount of feeders that could be upgraded in next regulatory period.	Moderate addressing of all three key needs, as only avoids certain vegetation faults, and only improves needs of customers downstream of upgrades. Plus additional benefits in broader reliability improvements.
		Other piecemeal asset upgrades	Low capital cost solution, and low risk as experience of implementing. But expect limited circumstances where upgrades needed, beyond those occurring through reliability program.	Low addressing of all three key needs due to low applicability. Plus low additional benefits in broader reliability improvements.
		Enhanced vegetation practices	Moderate operating cost and low risk solution, which could be applied across all relevant feeders. But will only address certain vegetation faults - not addressed through the existing program.	Low/moderate addressing of all three key needs, as only avoids certain vegetation faults. But could be applied across all relevant feeders, so could improve supply across all vulnerable customers / communities. Plus additional benefits in broader reliability improvements.
	Improve fault response / repair time	Enhance response and repair practices	Moderate operating cost plus capital solution with moderate risk, which could have effect across all vulnerable customers/communities.	Low/moderate addressing of 'long duration interruption' need as only increases rate that some faults can be responded and repaired. But could increase response/repair costs and safety needs.

Focus	Aim	Scope	Cost and implementation comments	needs' and benefits comments
	Reduce customers interrupted, following fault	Upgrade protection and switching	Low capital cost solution, and low risk as experience of implementing. But expect limited circumstances where upgrades needed, beyond those occurring through reliability program.	Low/moderate addressing of 'long duration interruption' need due to limited applicability. No improvement in response/repair costs and limited improvement in safety risks. Low additional benefits in broader reliability improvements.
		Increase network redundancy	Very high capital cost solution, with moderate risk due to ability to plan, approve and construct necessary new lines.	Moderate addressing of 'long duration interruption' need as still possibility that both supply paths could be faulted due to extreme weather event. Would likely increase response/repair costs and safety risks due to additional line exposed to weather. Plus additional network costs due to additional lines to be inspected and maintained.
Alternative supply arrangements	**Removing network supply, thus avoid network faults**	Alternative dedicated local supply - sub options of generation/storag e technology	Very high capital costs solution to construct dedicated local supply with sufficient redundancy, plus high risk as little experience planning and constructing. Depending on customer make-up along feeders could require multiple dedicated and distinct supply arrangements.	Very high addressing of 'long duration interruption' need. Plus potential for high community benefits. But extend that reduces response/repair costs and safety risk depends on extent that it allows some line sections to be decommissioned/de-energised.
	Reduce customers interrupted, following fault	Alternative back-up local supply - sub options of generation/storag e technology	Moderate/high capital costs solution, plus moderate risk as limited experience planning and constructing. Depending on customer make-up along feeders could require multiple dedicated and distinct supply arrangements.	Very high addressing of 'long duration interruption' need. Plus potential for moderate community benefits. But no reduction in response/repair costs and limited reduction in safety risk.
	Reduce interruption duration, following fault	Mobile generation, with sub-options based on technology	Low/moderate capital costs solution, with low risk as experience of using mobile generation for these purposes.	High addressing of 'long duration interruption' need. Plus potential for other network benefits, such as use during planned works and following other faults. But no reduction in response/repair costs and limited reduction in safety risks.
	Reduce customers interrupted or duration - possibly remove network supply	**Innovation Fund**	Low/moderate capital costs solution, with moderate risk as cannot control some community and/or partner processes and plans. This option would only provide partial funding of larger community projects and partnerships, so likely to be only applicable in limited cases.	Low/moderate addressing of 'long duration interruption' need due to limited applicability. No improvement in response/repair costs and limited improvement in safety risks, unless the community project allows the decommissioning / de-energisation of some line sections. High additional community benefits and benefits to other parties, but it is assumed that these benefits are covered by the community's and other parties' contribution to the project cost.

6 Option evaluation criteria

6.5 Cost-benefit analysis and its role in the evaluation

The broad aim of evaluation will be to only include program elements, where we can demonstrate it is reasonable to assume that they will provide a (positive) net-benefit and the program maximises the net-benefit across available options.

Quantitative cost-benefit analysis is used, where feasible, as part of the evaluation of each option and the determination of the preferred option, particularly for the options that advance into the second stage of the evaluation (see above)[7]. The extent that this analysis guides the evaluation of each option depends on the extent that quantifiable and none-quantifiable benefits/costs are likely to significantly effect the net-benefits of that option.

As noted in the 'needs' section above, quantifiable benefits cover the reduction in customer interruptions (primary need) and reductions in response and repair cost (secondary need). They may also include other direct network costs and benefits (eg improved reliability more generally, reduction in inspection and maintenance costs) where this can be readily estimated.

The non-quantifiable benefits/costs cover matters such as the reduction in safety risk, options implementation risk and other community benefits. Where these non-quantifiable benefits are considered a small portion of the overall benefits of an option, then cost-benefit analysis for that option is still an important guiding element of the evaluation (with qualitative assumptions on the extent of the non-quantifiable benefits used in the broader weighing of options with similar quantifiable net-benefits).

However, where the non-quantifiable benefits/costs are likely to be a major portion of the overall net-benefit of the option, then we are less reliant on formal cost-benefit analysis to evaluate the option. At this stage, we consider that the options where this is most likely to be the case are:

- alternative dedicated or back-up local supply options
- Innovation Fund option.

In both these cases, we expect additional community benefits provided by the option to be a significant portion of the overall benefits (eg alternative energy pricing arrangements, system support services, ability to manage critical community infrastructure).

Additionally, the Innovation Fund option, by its nature, does not have specific projects and intended outcomes assigned to it at this stage. Therefore, we use a higher-level approach to define the overall cost of this fund and its intended overall outcome (eg this could be a $*x* million fund, which should allow for support to *y* communities/customers, improving their resilience by *z*%), where we will show the basis of this cost and assumed outcome in the program business case.

6.6 Sensitivity analysis and its role in the evaluation

Given the uncertainty in many parameters affecting the option costs and benefits, discussed above, we test key uncertain assumptions through sensitivity analysis – rather than attempting to develop complex probabilistic models.

However, to avoid transferring the price risk due to this uncertainty to our customers, we use a conservative approach in applying the findings from this sensitivity analysis on determining the preferred program. This means, we are more likely to reject a program element if the sensitivity analysis suggest net-benefits may

7 Note – simplified analysis is used in the first stage of the evaluation to assess cost and benefits, and estimate whether an option is likely to provide a net-benefit or the net-benefit is likely to be much lower than a completing option.

not be realised, given a reasonable range for key assumptions, rather than including additional elements based on the results of the analysis.

Key ‘uncertain’ assumptions to be tested through this analysis include:

- the VCR, where we use the published AER value for the base case
- significant extreme weather event likelihood and consequence assumptions, including the implications of climate change, where base case assumptions are estimated from the last 10-years of network performance.

Other assumptions may also be tested through this analysis, including the option cost and discount rate.

6.7 Willingness to pay study results and their role in the evaluation

As noted above, we have conducted a willingness-to-pay study with our customers, and this has specifically examined their willingness-to-pay for this program in terms of the bill impact they would be willing to pay for various numbers of customers improved.

The findings from this study play an important role in setting the resilience program expenditure forecast, where the overall resilience program forecast must satisfy the following criteria:

1. All elements of the program should be reasonably likely to provide a positive net-benefit (ie the cost of that element should be lower than the benefits it’s reasonably likely to realise over its life – allowing for the upper life limit noted above).
2. The overall program is reasonably likely to maximise the net-benefit, compared to other credible options (ie other competing options are unlikely to provide greater net-benefits).
3. The overall program expenditure and its expected outcome should be within the findings of the willingness-to-pay study (ie the impact of the program expenditure on customer bills should be lower than the level found through the relevant willingness-to-pay study for the expected outcome of the program).
4. The overall program expenditure aligns with initiatives supported by stakeholders, as indicated through stakeholder feedback received from our Focused Conversation and People’s Panel recommendations.