

# Network resilience

## A note on key issues

April 2022

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# 1 About this note

We recognise that climate change is a global issue with localised impacts that can profoundly affect communities. These localised impacts – severe bushfires, storms and floods – have devastated communities, raising the awareness about the role that different entities have in supporting community resilience to prepare, plan and recover from natural disasters. Network Service Providers (NSPs) have an important part to play in understanding the needs and preferences of consumers in responding to these challenges.

We are aware of ongoing discussions on network performance and particularly the degree of “resilience” of networks to adequately perform their functions during disruptive events. Energy is an essential service for consumers and an important input into the responses of communities in the wake of disruptive events such floods and bushfires. We acknowledge the efforts undertaken by some NSPs to consult with customer groups and other stakeholders on a proposed definition of network resilience, how this definition applies under the National Electricity Rules (NER), as well as the role that NSPs play in supporting communities.<sup>1</sup> We are also cognisant of the Victorian Department of Environment, Land, Water and Planning’s appointment of an expert panel as part of Phase 2 of its Distribution Network Resilience Review that will consider long term reforms stemming from the storms in June and October in 2021.

There has also been increased awareness and activity to better understand how different entities can assist communities prepare, plan and respond to natural disasters. A number of inquiries have looked into responses to natural disaster events, such as the NSW Bushfire Inquiry and the Royal Commission into National Natural Disaster Arrangements (the Royal Commission). Recommendations from these inquiries focus on actions to address future preparedness for, response to, and recovery from, natural disasters. These inquiries highlighted the importance of “community resilience” – the ability of communities to withstand and recover from the impacts of natural disasters<sup>2</sup> – and the role that different entities need to play to support community resilience.

Several bodies such as Resilience NSW and the National Recovery and Resilience Agency have also been set up to assist in supporting communities affected or likely to be affected by natural disasters.

Like many other entities, the AER is also thinking about the future effects of climate change. We are especially interested in the impact on electricity networks among the community more broadly and the way we regulate in this uncertain environment.<sup>3</sup> To support broader discussions around network resilience, the AER has developed this note to assist NSPs, consumer groups and advocates understand how resilience-related funding would be treated under the NER. This may assist in discussions on resilience-related issues in developing

<sup>1</sup> NSW/ACT/TAS/NT Electricity Distributors, *Network Resilience - 2022 Collaborative Paper on Network Resilience*, January 2022.

<sup>2</sup> *Royal Commission into Natural Disaster Arrangements*, Final Report, 2020, p. 396.

<sup>3</sup> Other regulators have also sought to engage on climate change and the role of the regulator – see IPART <https://www.ipart.nsw.gov.au/documents/news/climate-change-prioritised>.

regulatory proposals. Consumers are at the heart of our work and we want to make sure that they are fully informed when expressing preferences about network investment to address weather-related uncertainties.

This guidance note considers the four questions below which are central to the on-going discussion around network resilience:

- What is network resilience?
- Does the NER accommodate funding related to network resilience?
- If the NER does accommodate network resilience funding, what evidence should NSPs provide to demonstrate that the funding is in the long term interests of consumers?
- What is an NSP's role in supporting community resilience?

We appreciate that the dialogue on network resilience has not just focused on climate change or weather-related risks but also encompassed system strength and under-frequency related risks, including cyber security risks. Though we touch briefly on these other types of network risks, the focus of this note is on network resilience to address weather-related risks.

The rest of this paper is structured as follows:

- Chapter 2 discusses what network resilience is and whether the NER accommodates network resilience funding
- Chapter 3 discusses the evidence that we expect NSPs to provide to demonstrate that the funding is in the long term interests of consumers
- Chapter 4 discusses the NSPs role in supporting community resilience.

## 2 What is network resilience?

Following recent extreme weather-related events that impacted electricity network performance, stakeholder interest in network resilience has grown. The question of what is network resilience and what it means for businesses and consumers has been discussed widely.

Network resilience is not explicitly mentioned in the NER, hence, there has been some debate about what it is and whether the NER accommodates funding related to network resilience.

### 2.1 Does the NER accommodate resilience-related expenditure?

Network resilience has been defined in different ways. We appreciate that network resilience can have a different meaning depending on the context. From the economic regulator's point of view, our focus is on how network resilience seeks to achieve service level outcomes (namely, maintenance of reliability, safety, and network security) in the NER, as these service level outcomes align with the long term interest of consumers.

We define network resilience as ***a performance characteristic of a network and its supporting systems (e.g. emergency response processes, etc.). It is the network's ability to continue to adequately provide network services and recover those services when subjected to disruptive events.***

As a characteristic or feature of a network that directly influences (brings about) service level outcomes, we consider that resilience-related funding is accommodated by the NER even though it is not explicitly mentioned in the NER.

#### Reliability vs resilience

The relationship between reliability and resilience is being discussed in various forums. Under the NER, reliability is defined as:<sup>4</sup>

The probability of a system, device, plant or equipment performing its function adequately for the period of time intended, under the operating conditions encountered.

This definition reflects that reliability is about continuous adequate supply of electricity under different conditions – in effect, that electricity that consumers want is available when they need it. In this regard, the service level outcome aligns with consumers' interests.

There is a close relationship between resilience and reliability because resilience is an input that contributes to the achievement of reliability – the service level outcome. While improved reliability is generally referred to as the service level outcomes from a more resilient network, other service-level outcomes like maintenance of safety and network security of the network can also be affected. For instance, undergrounding more of an electricity network would make the network more resilient, resulting in a more reliable provision of services for

<sup>4</sup> NER, Chapter 10, p. 1379.

consumers. It may additionally lead to a safer network if the probability and consequence of failure decreases from undergrounding.

### **Network resilience and community resilience**

Network resilience has sometimes been used interchangeably with community resilience. These are different but related concepts.

A resilient electricity network can assist in building community resilience. But many different entities have a role in supporting communities to withstand and recover from the impacts of natural disasters. Government bodies, individual themselves and several critical infrastructure operators (beyond electricity networks) have a role to support community resilience.

## **2.2 Mechanisms under the NER to enable NSPs to invest, manage the risks and respond to extreme weather events**

The regulatory framework recognises that network risks should be efficiently allocated to parties that are best able to manage them. To manage network risks from a weather-related event, an NSP can request funding:

- in its revenue proposal, forecasting the likely costs to be incurred in the upcoming five year regulatory control period (ex-ante funding)
- after a revenue determination, applying for the recovery of actual costs incurred after extreme weather-related events through the cost pass through mechanism (ex-post funding).<sup>5</sup>

We appreciate that while an ex-post arrangement would allow for cost recovery, it may not redress the adverse outcome of extreme weather events for consumers, like a prolonged outage.

These arrangements recognise where weather-related events are foreseeable and smaller, it may be efficient for NSPs to be funded ex-ante to manage these risks as part of good industry practice. NSPs are expected to prudently anticipate and efficiently manage these events themselves. Such ex-ante funding could include funding to prevent or mitigate risks to the network.

However, the timing and costs of extreme weather events are far less predictable. In those cases, it may be more efficient for network repair costs to be passed through as damage actually occurs, rather than paying for higher costs that may not be required (or may not be sufficient) through the ex-ante funding. Under this arrangement, consumers pay only when the damage occurs and pay no more than necessary as they are paying actual rather than

<sup>5</sup> Typically, NSPs will include costs from damage from extreme weather events as a cost pass through in their revenue determination. The triggers for a cost pass through are predefined in the NER, or are approved as part of an NSP's revenue determination. The NER provides for costs incurred or expected to be incurred which exceed 1 per cent of the Maximum Allowable Revenue to be recovered from consumers via cost pass throughs.

forecast costs. Even so this does not guarantee that the costs of this approach, including the impacts on energy consumers, will be less than targeted ex-ante funding to reduce the impact of severe weather events.

In an environment where the impacts of climatic change on the frequency and severity of major events is uncertain, it is important that there is an optimal balance of ex-ante and ex-post funding (or balance of risk allocation) to maintain service level outcomes so that it is consistent with the needs and preferences of consumers. We are aware that the right balance may need to change over time if we are seeing a material shift in more reactive outcomes that are higher cost than a proactive response to limiting the damage from extreme weather events.

### **Can the Service Target Performance Incentive Scheme (STPIS) be used as a mechanism to manage risks from unforeseen extreme weather events?**

Distribution Network Service Providers (DNSPs) have an incentive to improve reliability of supply through the use of the STPIS. The STPIS applies a reward or penalty to DNSPs' regulated maximum allowed revenues each year, depending on whether they have over- or under-performed against a benchmark level of reliability (which is based on past performance).

In calculating the STPIS reward/penalty, certain extreme weather events, known as major event days (MEDs), are excluded from the calculation. In this regard, the STPIS is not designed to incentivise improvements in managing the impact of unforeseen extreme weather events. It is designed to incentivise reliability improvements under standard conditions. Since its introduction in 2008, most DNSPs have been outperforming their reliability benchmark targets demonstrating improved power supply reliability over time.

It is worth noting that if weather events are becoming more volatile and result in more adverse outcomes, through a partial feedback loop, the STPIS is likely to gradually incorporate the effect of these events.<sup>6</sup>

Except for this feedback loop, current service incentives under STPIS do not cover the impact of major events. However, there is scope to consider incentives in regard to major events within the NER. Better understanding the value of reliability in such events is an important first step – as discussed below.

<sup>6</sup> The feedback loop is because the reliability target is based on previous performance. If there is more volatility of adverse outcomes, this may move the mean towards the direction of the volatility. The feedback is partial (and therefore gradual) because there is a MEDs cut-off boundary, and not all volatility will result in adverse outcomes that will move the mean.



### 3 Assessing resilience funding

We recognise that climatic conditions are changing over time and that there is uncertainty of the impact this will have on electricity networks and Australians more generally in the coming years. We will therefore have regard to the following factors when assessing any funding for network resilience:

- future network needs may not be the same as they are today
- there is uncertainty as to what the future network needs are
- there is also uncertainty from other related areas like changes in demand and energy mix as well as technological advances
- consumer and community preferences will be very important in our consideration.

We consider that our assessment framework is sufficiently flexible to include consideration of these factors. Below we explore the supporting material we expect from NSPs that propose resilience-related expenditure in their regulatory proposals.

The uncertainties noted above can make the assessment of the proposed resilience responses more difficult and this may need to be reflected in our approach. For example, the assessment of the benefits and future costs could be subject to greater margins for error (up and down) than normal. Furthermore, the impact of climate change is not static and may be expected to grow overtime. This may increase the value of flexibility and scaling in the responses to resilience.

#### 3.1 Requirements under the NER

Network resilience funding can take the form of operating<sup>7</sup> and capital expenditure.<sup>8</sup>

The AER provides capital and operating expenditure funding to regulated business to meet the following capital and operating expenditure objectives under the NER:

- to meet or manage expected demand
- to comply with regulatory obligations or requirements
- maintain the safety, quality, reliability, and security of supply of the network.

<sup>7</sup> Operating expenditure includes a wide range of non-capital costs incurred by a network business serving its customers, such as vegetation management, maintenance, emergency response, network support, and corporate overheads. In contrast to capital expenditure, which is recovered over the asset life, operating costs are recovered as they are incurred. In this way operating expenditure, for a given dollar amount, has a more immediate impact on network revenues than capital expenditure.

<sup>8</sup> Capital expenditure refers to the money required to build, maintain, or improve the physical assets needed to provide the network's services, which the NER call standard control services. As most capital assets have very long lives, network businesses recover capital expenditure over several regulatory control periods.

These objectives focus on the service level outcomes that the network provides to consumers.

We assess whether proposed capital and/or operating expenditure is the prudent and efficient costs required to achieve the expenditure objectives, as well as whether the business has applied a realistic expectation of future demand and cost inputs to achieve these objectives.

In assessing the prudence and efficiency of costs, we must have regard to a set of factors. Examples of these factors are assessing the forecast against historical expenditure and whether the forecast includes expenditure to “address the concerns of distribution service end users.”<sup>9</sup> The *AER’s Better Resets Handbook – Towards Consumer-centric Network Proposals*<sup>10</sup> sets out our expectations on consumer engagement.

We recommend that stakeholders also review the AER’s *Expenditure Forecast Assessment Guidelines*<sup>11</sup> and *Industry Practice Application Note for Asset Replacement Planning*<sup>12</sup>, which sets out our assessment approach in more detail.

### **Values of Customer Reliability – measuring the value customers place on reliable electricity**

The Values of Customer Reliability (VCRs) seek to reflect the value different types of customers place on reliable electricity under different conditions. VCRs are usually provided by NSPs to support proposed expenditure intended to maintain reliability of the network. We consider that the VCRs we published in our review in 2019 may not be appropriate to estimate the value which customers would place on avoiding or reducing the severity of larger unplanned outage events that have specific localised impacts. The 2019 values were based on customer survey responses that tested the value customers placed on unplanned outages of up to 12 hours duration and had a limited geographic impact (a few blocks for a CBD/suburban customer and an entire town for rural and more remote areas).<sup>13</sup>

We also consider that the VCRs for widespread and long duration outages (WALDO), which the AER published in September 2020, has limited application at this stage.<sup>14</sup> The WALDO model was not supported by stakeholders in its draft form, mainly due to concerns about how certain costs like the social costs were estimated in the model. We are considering ways of revisiting VCRs for WALDO to accommodate longer unplanned outages with localised impacts.

<sup>9</sup> NER, cl. 6.5.7 (e)(5A)

<sup>10</sup> <https://www.aer.gov.au/networks-pipelines/better-resets-handbook>.

<sup>11</sup> <https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/expenditure-forecast-assessment-guideline-2013>.

<sup>12</sup> <https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/industry-practice-application-note-for-asset-replacement-planning>.

<sup>13</sup> AER, *Value of Customer Reliability – Final Report on VCR values*, December 2021.

<sup>14</sup> AER, *Widespread and Long Duration Outages – Values of Customer Reliability: Final Conclusions*, September 2020.

In the absence of this work, we encourage NSPs to demonstrate consumer preferences for proposed resilience-related expenditure using other supporting evidence such as through willingness-to-pay studies, which is discussed further below.

## **3.2 Evidence to support ex-ante resilience-related funding**

We appreciate that network risks change over time, and may do so if a network is materially affected because of increased climatic events. To support evidence that resilience funding is prudent and efficient to achieve the expenditure objectives, the AER expects NSPs to demonstrate, within reason, that:

1. there is a causal relationship between the proposed resilience expenditure and the expected increase in the extreme weather events
2. the proposed expenditure is required to maintain service levels and is based on the option that likely achieves the greatest net benefit of the feasible options considered
3. consumers have been fully informed of different resilience expenditure options, including the implications stemming from these options, and that they are supportive of the proposed expenditure.

We discuss each of these elements below.

### **A causal relationship between the proposed expenditure and the expected increase in the extreme weather events**

We acknowledge that climate change has increased the severity and frequency of extreme weather events. To support resilience-related funding, we expect NSPs to, as far as possible, provide evidence that:

- extreme weather events are expected to affect the network, including an assessment of probability of the event, which parts of the network are most likely to be impacted, the likelihood of the consequences and cost of consequences on the network
- its proposed resilience-related expenditure will limit the cost of damage from extreme weather events
- ex-ante expenditure is more efficient than ex-post expenditure, having sufficient regard to the inherent uncertainties in forecasting the timing, location and scale of the impacts of extreme weather events.

### **The proposed expenditure is required to maintain service levels and is based on the option that likely achieves the greatest net benefit of the feasible options considered**

We understand that given the nature of the risks, the networks may propose more flexible, scaleable and innovative solutions that may be challenging to evaluate against the criteria of the long term interest of the consumer. However, over the years, we have approved ex-ante funding to NSPs to maintain the service levels of networks to address weather-related events. This ex-ante funding has contributed to the resilience of the network. Some examples of these are:

- ICT systems like Geographic Information Systems (GIS), Supervisory control and data acquisition (SCADA) and Advanced Distribution Management Solutions (ADMS) to

better monitor an NSP's network and shorten its reaction/recovery time from climatic and other uncertain events

- replacement programs that target certain assets in bushfire and coastal areas such as steel mains replacement in coastal areas with its modern equivalents, and pole replacement in bushfire prone areas
- mobile substations, generators and emergency spares to aid in the restoration of power during and after extreme weather events
- bushfire obligations including summer preparedness programs
- undergrounding in certain circumstances and specific areas
- asset replacement with modern equivalents that have higher design specification or more functional capability.

We expect proposals for resilience-related expenditure to demonstrate:

- there is or likely to be an increase in network risk
- the benefit of the resilience-related funding (for instance, further avoiding or reducing the frequency or duration of outages) outweighs the costs of the investment
- the preferred funding option provides more net benefit against other feasible options.

In testing the different options available to address the change in network risk, we expect NSPs to consider the impact of emerging investment in stand-alone power systems (SAPS)<sup>15</sup> and other non-traditional network options like community batteries. We are seeing support for, and the development of, alternatives like SAPS to the traditional 'poles and wires' supply to communities to provide reliable power supply.

### **Consumers have been fully informed of different resilience expenditure options**

High quality consumer engagement is essential for ensuring that networks provide the services that meet the needs of their consumers, at a price that is affordable and efficient. Our expectations on customer engagement are set out, amongst other things, in the Better Resets Handbook. It provides guidance on our expectations regarding the nature, breadth and depth, and evidenced impact of engagement.<sup>16</sup> For resilience-related proposals, we expect NSPs to:

- engage with their consumers on how its ex-ante funding proposal will ensure any risks to manage extreme weather events are allocated efficiently between consumers and businesses. Businesses should also demonstrate that the proposed project/program does not make consumers worse off by bearing the risk to manage weather uncertainties twice. It would not be in consumers' interest for them to be funding a

<sup>15</sup> SAPS are not connected to the national electricity grid but may include local microgrids supplying electricity using any mix of energy resources (solar, battery, wind etc) to supply multiple or individual customers. There are currently no regulatory barriers to network providers using SAPS on a temporary and permanent basis to respond to short-term need, including during natural disasters. In particular, the NER is technology-agnostic and accommodates non-like-for-like solutions to restoring network services.

<sup>16</sup> AER, *Better Resets Handbook: Towards Consumer-centric Network Proposals*, December 2021.

business's recovery of actual costs from an unpredictable event (i.e. through a cost pass through) as well as funding the same risk up-front in a business's revenue proposal

- work collaboratively with affected communities, and other responsible entities involved in disaster management, to understand what the communities' genuine needs are to plan and prepare for, as well as recover from a natural disaster. We are also interested in the degree of input these stakeholders have had in developing the proposed resilience-related expenditure
- consult with its wider consumer base on their preferences for bearing resilience-related costs to address localised impacts. We would expect NSPs to explain to its customer base that the benefits associated with upfront investment in resilience expenditure to address a localised low probability, high consequence event outweigh the costs.

We would also be interested in evidence of customers' willingness to pay for the proposed expenditure. We expect these studies to be based on genuine engagement where different feasible options to address the network are explained to customers, as well as any trade-offs, and they are satisfied that the proposed expenditure should be prioritised over other proposals by the business.

## 4 Supporting community resilience

We recognise that climate change is a global issue with localised impacts that can profoundly affect communities. These localised impacts – severe bushfires, storms and floods – have devastated communities, raising the awareness about the role that different entities have in supporting community resilience to prepare, plan and recover from natural disasters.

### 4.1 What is community resilience?

Community resilience has been defined in different ways. The Royal Commission defines it as:<sup>17</sup>

The ability of communities to withstand and recover from the impacts of natural disasters.

There is an emerging body of work around community resilience – inquiries, research<sup>18</sup>, local<sup>19</sup> and empirical studies<sup>20</sup> – looking at different aspects of community resilience. A consistent theme in much of this work has been the importance of community-led approaches to disaster preparedness to move the focus for planning, decision-making and action from a top-down to a more collaborative approach.

As noted by the Foundation for Rural and Regional Renewal in its collaborative work with Resilience NSW:<sup>21</sup>

Community-led resilience building sees communities are active partners in building their capacity and capability to adapt and respond to the impacts of natural disasters.

### 4.2 The role of NSPs in supporting community resilience

NSPs play an important role in the provision of essential services to communities in the lead-up to, during and after a natural disaster. There are regulatory and statutory requirements that prescribe minimum service levels or standards to ensure continued supply and restoration of services following unplanned outages.

It is important to note that the role of NSPs in supporting network resilience is a collaborative one with other responsible entities. For instance, the 2021 Regional Telecommunications Review observed the importance of improved information sharing and disaster management

<sup>17</sup> *Royal Commission into National Natural Disaster Arrangements*, Final Report, 2020, p. 396.

<sup>18</sup> For example, Charles Stuart University collaborated with the Blue Mountains community to examine its experiences after the 2013 Blue Mountain bushfires. [https://cdn.csu.edu.au/\\_data/assets/pdf\\_file/0005/3452180/Community-disaster-resilience-NEW-BRANDING-converted.pdf](https://cdn.csu.edu.au/_data/assets/pdf_file/0005/3452180/Community-disaster-resilience-NEW-BRANDING-converted.pdf).

<sup>19</sup> See Foundation for Rural and Regional Renewal (FRRR), *Supporting community-led approaches to disaster preparedness – Summary research report*, <https://frrr.org.au/wp-content/uploads/FRRR-DRFR-Report-Summary-FINAL-for-WEB.pdf>.

<sup>20</sup> See Twigger-Ross C et al. UK study: *Community Resilience to climate change: an evidence review*, <https://core.ac.uk/download/pdf/84146112.pdf>.

<sup>21</sup> Foundation for Rural and Regional Renewal (FRRR), *Supporting community led approaches to disaster preparedness – summary research report*, September 2021, p.4.

planning between government entities, the telecommunications sector and the energy sector to make sure regional communities have access to reliable communications when they need them.<sup>22</sup>

The Royal Commission also emphasised the shared responsibility that government, critical infrastructure operators, individuals and communities all play in supporting community resilience.<sup>23</sup>

Resilience to natural disasters, including with respect to critical infrastructure and essential services, is a shared responsibility. Governments, critical infrastructure operators and individuals and communities all have a role to play in understanding the risks of disruptions to critical infrastructure, ensuring that others are aware of these risks as appropriate, and managing the consequences of outages.

In this regard, we would consider the delineation of roles that different entities have in supporting network resilience when assessing proposed resilience-related funding for the community.

<sup>22</sup> The 2021 Regional Telecommunications Independent Review Committee, *2021 Regional Telecommunications Review*, p.7.

<sup>23</sup> *Royal Commission into National Natural Disaster Arrangements*, Final Report, 2020, p. 230.

## Shortened forms

This note uses the following shortened forms.

Term	Definition
ADMS	Advanced Distribution Management Solutions
AER	Australian Energy Regulator
DNSP	Distribution Network Service Provider
GIS	Geographic Information Systems
ICT	Information and Communications Technology
MEDs	Major Event Days
NER	National Electricity Rules
NSP	Network Service Provider
SCADA	Supervisory Control and Data Acquisition
STPIS	Service Target Performance Incentive Scheme
VCRs	Values of Customer Reliability
WALDO	Widespread and Long Duration Outages