

Essential Energy

6.02 Resilience Plan 2024–29

January 2023

Table of Contents

1. Introduction.....3

2. Purpose4

3. Scope4

4. Context4

5. Climate Change Network Impact Assessment12

6. Organisational approach to resilience management.....16

7. Resilience investment for 2024–2920

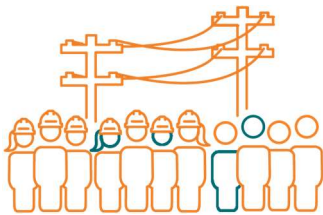
Reference documents23

Glossary.....24

1. Introduction

The concept of resilience is not a new one, but it is an increasingly important topic in Australia and globally. In any industry, a resilient service is one that can continue to provide its intended function in the face of an external shock, or if interrupted, can recover from that shock and return to its normal service in a timely manner. For an electricity network service provider (NSP), resilience is indicative of prudent energy system planning practices.

We have collaborated with other NSPs to consider a common definition for resilience in the context of electricity distribution. The adopted definition has roots in the definitions formulated by entities such as the United Nations Office for Disaster Risk Reduction (UNDRR) and Resilience NSW. The words are further defined to provide relevance for our network and customers, as shown below.



“The ability to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard”

(Resilience NSW, UNDRR)



Resist

- Building our capability to **withstand** impacts or **avoid** network destruction



Absorb / Accommodate

- Minimising **disruptions** to networks and customers and **supporting communities** during these events



Adapt / Transform

- Use **learnings** to identify **opportunities** or **anticipate** hazards to ensure lived experience is acceptable to customers



Recover

- Ensuring plans and processes provide energy **supply restoration** as **quickly** as possible



Hazard

- Major disruptive event or chronic risk such as extreme weather events, cyber-attacks or losses in power supply from fluctuations in intermittent energy sources outside of normal operating parameters

We consider network resilience to extend to the provision of electricity as an essential service to communities. This ensures our ability to continue to provide safe and reliable supply in the ways customers expect before, during and after a disruptive event.

2. Purpose

The purpose of this plan is to define how we consider resilience and detail our resilience investments for the 2024–29 period.

3. Scope

This plan explores our current and forecast operating environment and identifies practical actions and investments for the upcoming regulatory period. Our aim is to boost network and community resilience to continue our delivery of services at standards expected by our customers.

4. Context

Recent unprecedented climate events

In recent years, Essential Energy and our customers have been impacted by many large-scale, severe climate events.

2019–20 Black Summer bushfires

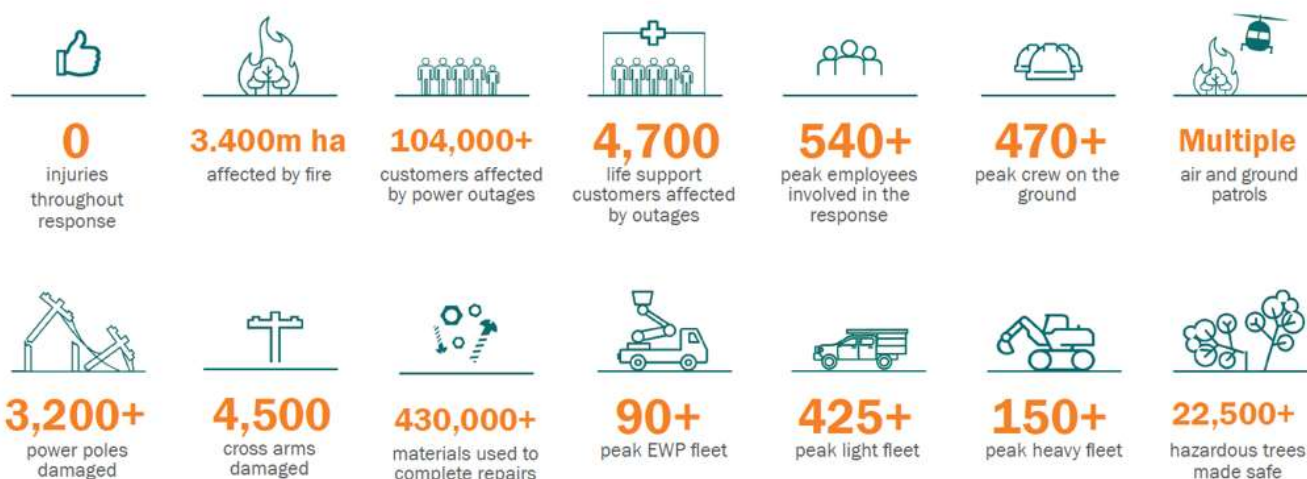
The 2019–20 bushfires impacted over 5 million hectares of land.

'The total extent of the area burnt during the Black Summer bushfires was about four times greater than previously recorded in forested areas during any bushfire season in NSW history.'

(Source: NSW State of the Environment 2021 report)

The following impacts were experienced by Essential Energy and its customers:

2019-20 consolidated bushfire statistics for Essential Energy

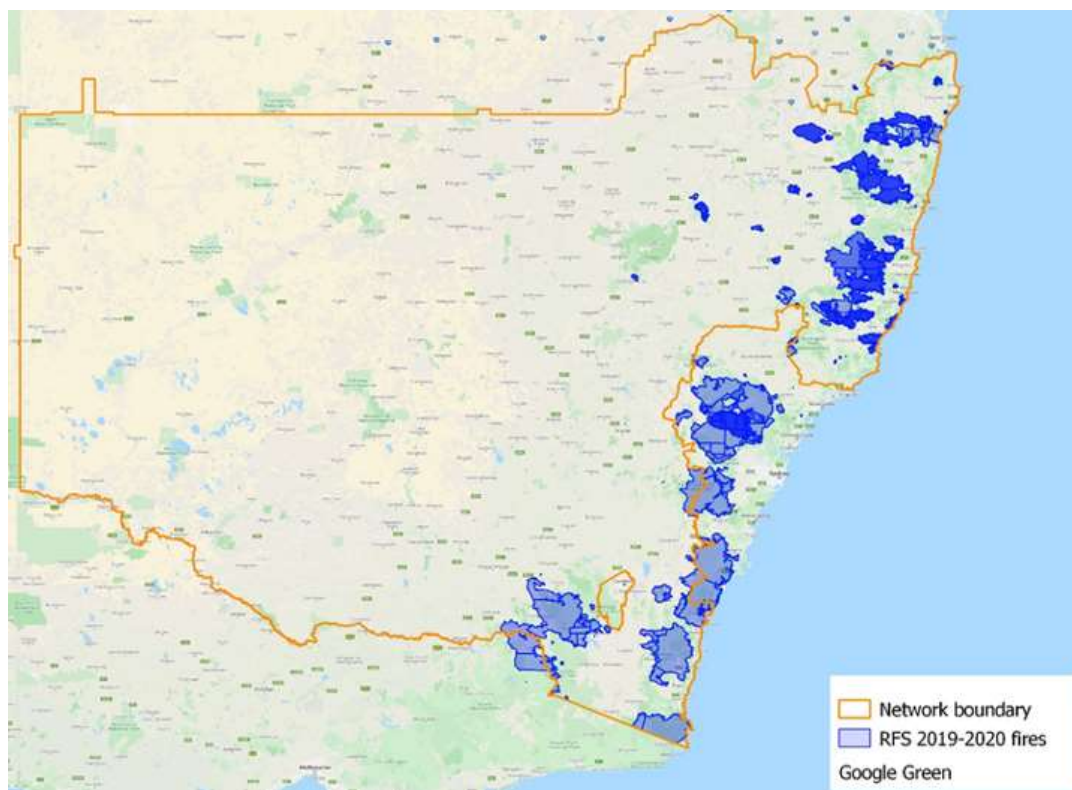


Throughout the 2019-20 bushfire season over 10 million hectares of land was burnt across Australia. More than 3.4 million hectares was burnt in Essential Energy's network area alone – this was more than 60% of the total firegrounds across the whole of New South Wales (NSW). The Commonwealth Scientific and Industrial Research

Centre (CSIRO)¹ has explained that this season was so significant because of weather and vegetation as contributing common factors.

Other than the scale of the impacts, the extended duration of response efforts across the network footprint posed a logistical and safety challenge. As shown in the map below, fires started in the northern part of the state (near Rappville) in October 2019, and continued south to the Bega Valley, where some were still burning in February 2020.

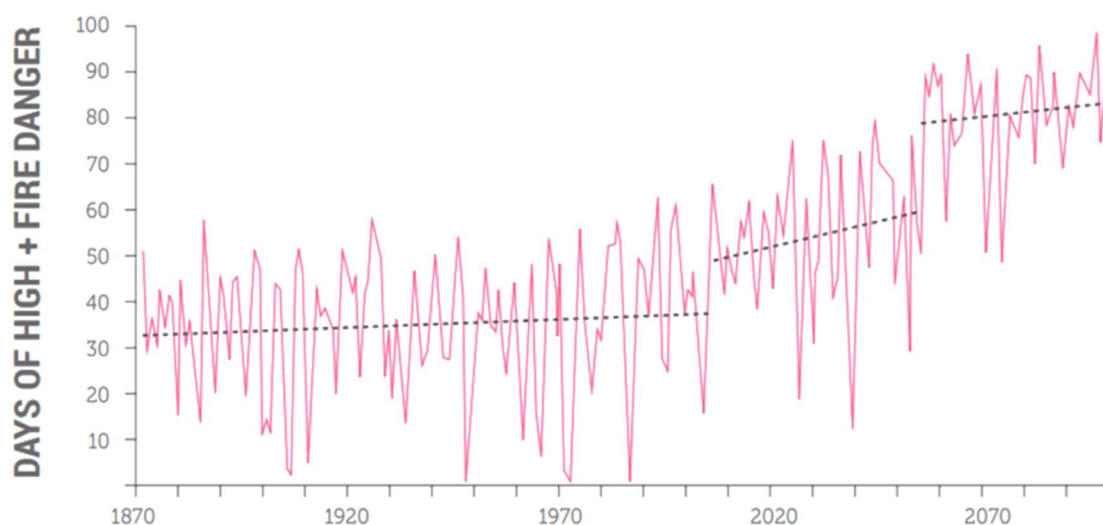
Map of the 2019-20 bushfire impacts on Essential Energy's network



Twenty per cent (187,677) of our power poles are located within the footprint of areas previously impacted by bushfires. Since 2008–09, the frequency and severity of bushfires has increased. As mean temperatures rise, the threat of bushfires is expected to increase further, and heightened fire danger days are also expected to increase (as shown below).

¹ The 2019-20 bushfires: a CSIRO explainer [Link](#)

Australian fire danger day frequency (source: Climate Change Council 2019)

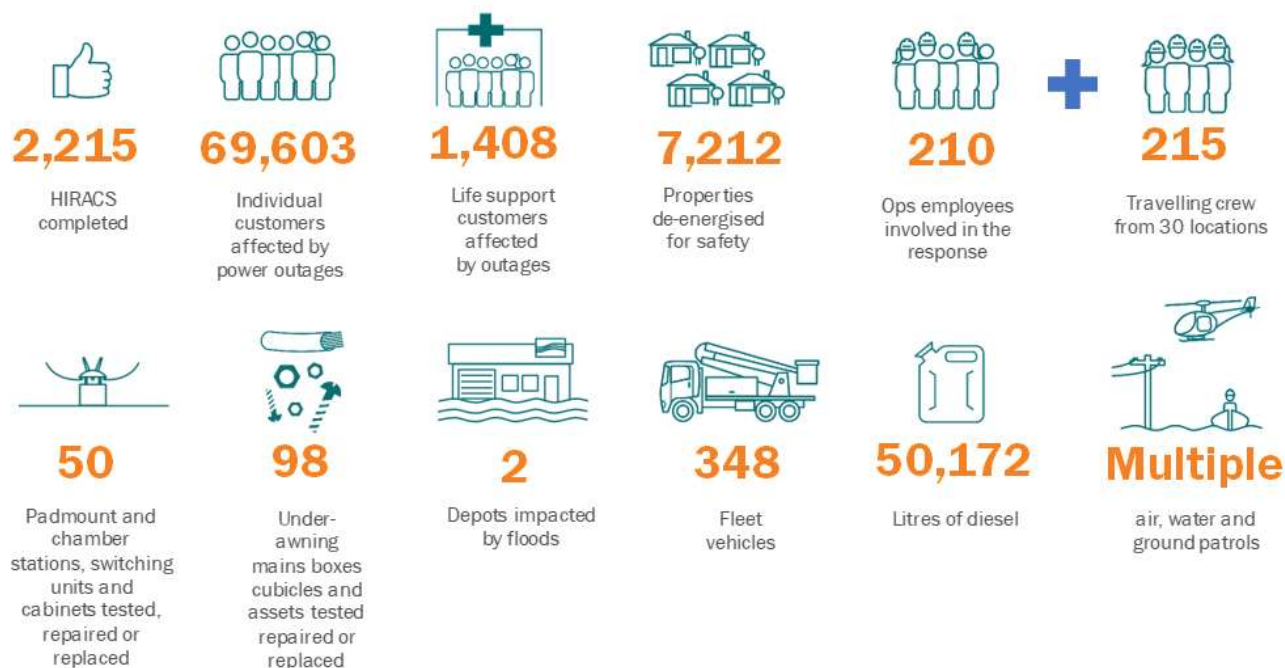


2020–21 and 2021–22 flood events

Other unprecedented climate events were the floods of 2020–21 and 2021–22. These resulted in further significant loss of electrical assets and disrupted the service of substations and key operational infrastructure such as depots (see picture below).

Flooding is not uncommon across much of the coastal area in which we operate. We plan for flood events in line with planning guidelines and historical data. The occurrence of such events can be reasonably anticipated within the limits of historical precedence and resilience management. However, recent North Coast flooding was extraordinary both in severity and in the magnitude of its impact on our customers, network and services.

North Coast NSW flood response



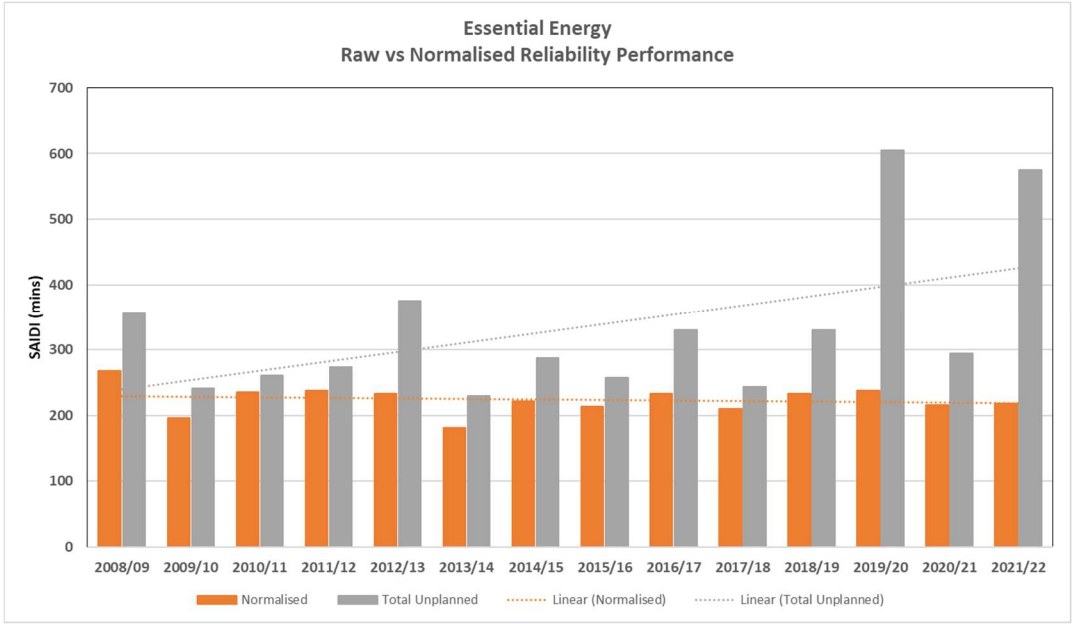
Flooded zone substation (March 2022)



Customer experiences masked by reliability reporting exclusion requirements

We have successfully maintained acceptable levels of ‘normalised’ unplanned supply interruptions since 2008–09, depicted by the orange-coloured columns in the chart below. However, this trend does not accurately represent the customer outages experience in some areas, due to the required exclusion of significant supply interruptions caused by climate events.

Trend in raw (total) and normalised unplanned supply interruptions between 2008–09 and 2021–22



Supply interruptions caused by major climate events (grey-coloured columns) are excluded from normalised results. The lived experience by which customers rightly gauge their sense of electricity supply reliability is significantly deteriorating in some areas due to climate-caused unplanned outages.

Our resilience plan and associated investments seek to address this upward trend and assist communities in recovery.

Industry and key stakeholders

In the face of a changing climate, we engaged with Resilience NSW and other networks on the same regulatory proposal timeline to develop a joint discussion paper on network resilience (**Supporting document 6.02.01**). Following this, a joint public forum was hosted with 116 participants to uncover how networks can best support the communities they serve in adapting to an unpredictable climate over the next decade.

Essential Energy received seven submissions to the joint paper, most of which focused on supporting local resilience planning and community education. Other suggested focus areas included:

- > using available partnership opportunities
- > improving communication and responsiveness during large-scale events
- > improving network resilience to adapt and transform with communities.

Customer and community expectations

We have engaged with our customers and stakeholders on a range of our services to assess and meet community expectations.

Topics included network resilience when natural disasters cause major service disruptions, and consideration of preparation, response and recovery.

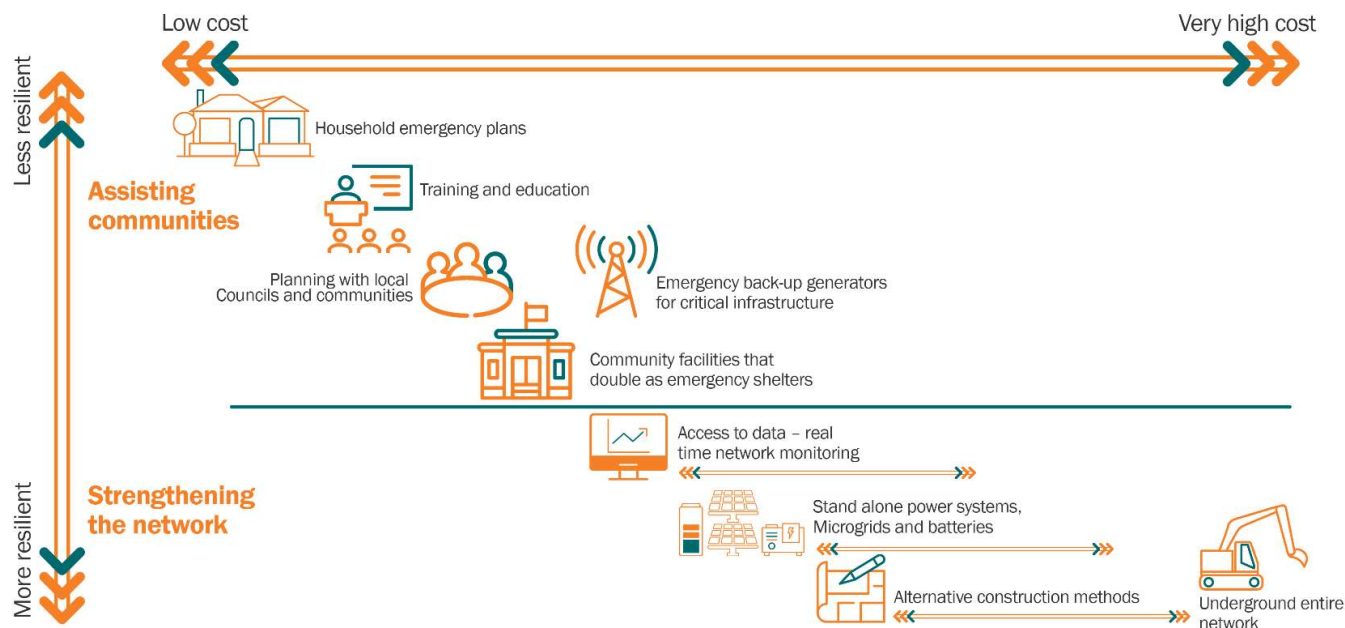
The engagement process and outcomes are explained in **Chapter 4, Appendix A** and **Attachment 4.02 – How engagement informed our proposal** of the 2024–29 regulatory proposal.

On the topic of network resiliency and investment, customer engagement shows strong support for a more proactive approach to preventing and responding to climate-related outages. Customers expressed concern that recent experiences of prolonged supply interruptions due to severe weather, fires and flooding could become more frequent and intense in the future.

Phases 2 and 3 of the engagement program specifically discussed resilience with the Stakeholder Collaboration Collective, and small to medium-sized businesses across seven locations. In addition, we conducted in-depth interviews with Aboriginal and Torres Strait Islander customers; culturally and linguistically diverse customers who speak a language other than English at home; large businesses and other commercial and industrial customers; and a critical infrastructure provider. Group discussions were also held with youth, renewable developers, new technology providers, councils, retailers and aggregators, and consumer and industry advocates.

With an understanding of the impact and trade-offs of investment to improve network and community resilience, customers and stakeholders strongly supported investments in both areas, across the full spectrum of investment cost and complexity, as shown below.

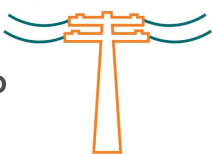
An example of potential resilience investments, as discussed with our customers



The proposed investments supported from Phase 3 of the engagement program included:

Composite poles

67%
Option D



- > Broader use of composite poles
- > 25,000 proactive replacements in high risk areas
- > 27% of all poles composite by 2040

Annual Bill increase



\$2.32
residential



\$10.11
small business

Undergrounding

66%
Option C



- > Convert ~40 kilometres of poor condition network to underground in very high, risk areas
- > New residential developments undergrounded

Annual Bill increase



\$0.22
residential



\$0.94
small business

SAPS & Microgrids

91%
Option C



- > Up to 400 SAPS and 10 microgrids
- > Complete the roll-out to 1,200 identified SAPS sites by 2038

Annual Bill increase



-\$0.97
residential



-\$4.24
small business

Community resilience

90%
Option C



- > Continue BAU
- > 3 community resilience staff
- > 1,000 small, 20 medium and 20 large generators
- > 20 portable SAPS
- > 50 portable streetlights
- > Portable community hub and depot

Annual Bill increase



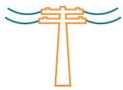






\$0.29
residential



\$1.25
small business

Support for these investments was further tested in Phase 4 of the engagement program and did not waiver, even in the face of increased cost of living pressures from rising interest rates and inflation. In conducting the customer and stakeholder engagement program, customer sentiment and investment priorities were key to our

organisational approach to resilience management. Our proposed investments (including overheads) to improve resilience that are supported by our customers and make economic sense are shown below.

	Investment 2024-29	Investment plans supported by customers	Benefits	Pace of change
 Composite poles	\$138M	<ul style="list-style-type: none"> > Use composite poles for all future risk-based replacements (11,000 over the 2024–29 period, reduced from 15,000 following economic evaluation) > Gradually increase our usage of composite poles for condition-based pole replacements. 	<ul style="list-style-type: none"> > Fireproof and immune to rot, termites and corrosion > Longer life and less expensive to maintain > Safer for workers and community 	Slow to moderate Composite poles installed in all high-risk areas by 2055
 Under-grounding	\$30M	<ul style="list-style-type: none"> > Convert 40 km of poor condition network to underground in very high-risk areas to minimise exposure to bushfires and storms. 	<ul style="list-style-type: none"> > A small subset of customers will see an improvement in outages 	Very slow Due to the high-cost undergrounding will be risk prioritised
 SAPS	\$84M	<ul style="list-style-type: none"> > Install SAPS at up to 400 locations initially targeting areas that are hard to access and have a high cost-to-serve. 	<ul style="list-style-type: none"> > Remote and hard to access customers benefit from improved resilience and reliability > Moderate long term cost savings for all customers > Reduced network bushfire risk exposure 	Moderate 25% of currently suitable SAPS sites completed by 2029
 Microgrids	\$27M	<ul style="list-style-type: none"> > Commission microgrids at six sites initially targeting long radial sub-transmission feeders with the highest benefit. > One further site will be delivered in this current regulatory period, so the total count during 2024–29 is lower than the numbers supported by our customers 	<ul style="list-style-type: none"> > Reduce asset failures due to fire and large storms at sites with a history of long unplanned outages due to these events. 	Moderate All identified sites completed by 2029
 Solar and battery backup	\$3M	<ul style="list-style-type: none"> > Install solar and battery backups at key radio sites > This was also a recommendation from Infrastructure Australia Advisory Paper, <i>A Pathway to Infrastructure Resilience</i>, released in August 2021.² 	<ul style="list-style-type: none"> > Improve our ability to restore service to customers during long duration outages. 	Moderate 50 sites completed by 2029
 Portable community resilience assets	\$32M	<ul style="list-style-type: none"> > Acquire portable assets that can be transported to different locations (portable streetlighting, community hub, depot, solar panels, batteries, switchboards and generators to support community resilience). 	<ul style="list-style-type: none"> > Allow for temporary supply until permanent repairs can occur. > Increased engagement with community 	Moderate 1,123 portable assets available by 2029
 Resilience plans	\$3M	<ul style="list-style-type: none"> > Hire three additional staff to work with councils, communities and critical infrastructure asset providers to help them develop resilience plans 	<ul style="list-style-type: none"> > Assist in developing coordinated resilience plans allowing communities to better adapt, withstand and recover from climatic events 	Moderate Resilience plans in all high-risk locations by 2029

² Infrastructure Australia (2021) '[A Pathway to Infrastructure Resilience](#)'.

Regulatory framework

We prioritise the safety of our customers and the safety of our network.

We have an obligation under the *Electricity Supply (Safety and Network Management) Regulation 2014* (NSW) to take all reasonable steps to ensure that the design, construction, commissioning, operation and decommissioning of our network is safe. This regulation also enforces the application of Australian Standard AS 5577—2013 *Electricity network safety management systems*, which states that ‘the Network Operator cannot delegate its accountability for the safety and integrity of the electricity network’. This requires DNSPs to consider network operations for abnormal conditions, such as those experienced due to climate change.

As part of our operating licence as a NSW NSP, we have an additional obligation to maintain certification to ISO 55001:2014 *Asset management*. This international standard for asset management systems requires effective allocation and management of resourcing and materials to deliver risk management practices and optimise lifecycle value from assets.

Under the National Electricity Law (NEL) framework, distributors are regulated to advance the National Electricity Objective (NEO). The NEO is to ‘promote efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers of electricity with respect to: (1) price, quality, safety and reliability and security of supply of electricity, and (2) the reliability, safety and security of the national electricity system’.

The AER uses the measures of electricity price, quality, safety, reliability and security of supply to assess the long-term customer impact of electricity network investment proposals. Significant and unforeseen deviations from proposed investments, such as increased costs incurred by unprecedented bushfires or flooding, are managed through a ‘cost pass through’ process that increases customers’ electricity prices directly to cover this cost shortfall. While this process is effective in customers only incurring true additional costs and no overheads, efficient network resilience investment can reduce the frequency of these costs and result in overall customer benefit.

In forecasting the impact of climate change on network safety and integrity, we recognise the need for proper resilience management. In doing so, we have identified prudent and efficient investment cases to meet customer expectations and ensure the delivery of the NEO.

Asset criticality

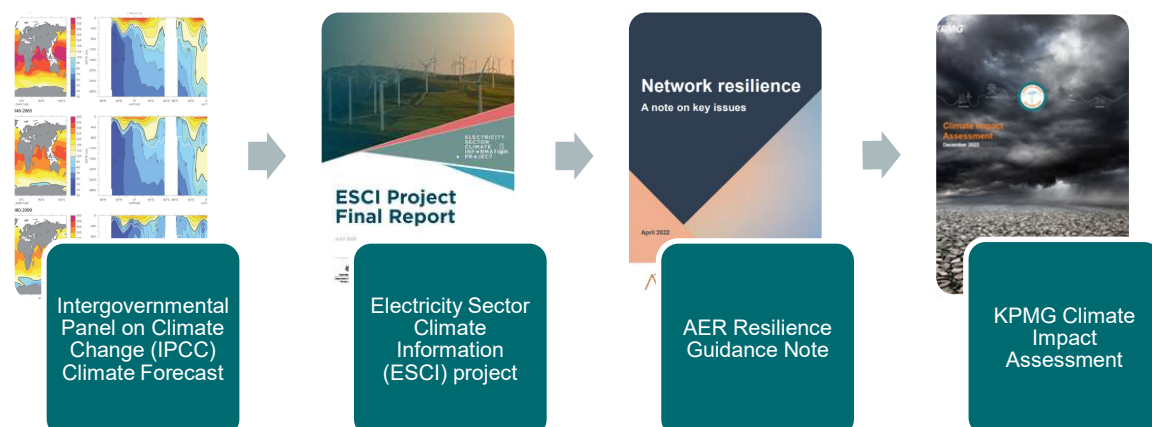
Electrical distribution infrastructure is critical for maintaining the effective operation of health, defence and community services. While major emergency facilities, such as hospitals, may have backup alternative energy in the case of natural hazard—events, many other facilities do not or may only have limited temporary energy supply.

The *Security Legislation Amendment (Critical Infrastructure Protection) Act 2022* (Cth) obligates us and other entities responsible for critical infrastructure to effectively manage risks to service interruption. Measures are in place to abide by this legislation to ensure risk management, preparedness, prevention and resilience are part of our everyday business.

Industry guidance

We have used comprehensive reference material to understand the social, technical and economic impacts of a changing climate to our customers. The graphic below illustrates the combination of international, national and local guidance referenced. Essential Energy engaged KPMG and Risk Frontiers to apply industry guidance to localised environmental conditions and network design to create a Climate Impact Assessment (**Attachment 6.01**).

Industry guidance referenced by the Resilience Plan



5. Climate Change Network Impact Assessment

We have engaged Risk Frontiers and KPMG to model the expected impact of climate change on network assets and customer experience. Comprehensive forecast models were produced for bushfires, floods and windstorms. We combined historic asset failure data with expert judgement and a literature review to provide key insights. Please see **Attachment 6.01** to our Regulatory Proposal.

The expected impacts of climate perils on the volume of our network assets each year is summarised below. Areas where we expect to see the greatest change are represented in the maps below.

Anticipated network asset exposure under the Representative Concentration Pathway (RCP) 4.5 scenario

Average number of assets exposed annually to perils under RCP 4.5				
Year	2022	2050	2070	2090
Bushfire exposure	6,200	6,900	7,600	8,500
Flood exposure (1.0 m)	600	600	600	600
Windstorm exposure (90 km/h)	118,400	189,500	155,400	172,300

Anticipated change in annual network asset exposure to climate perils under the RCP 4.5 scenario



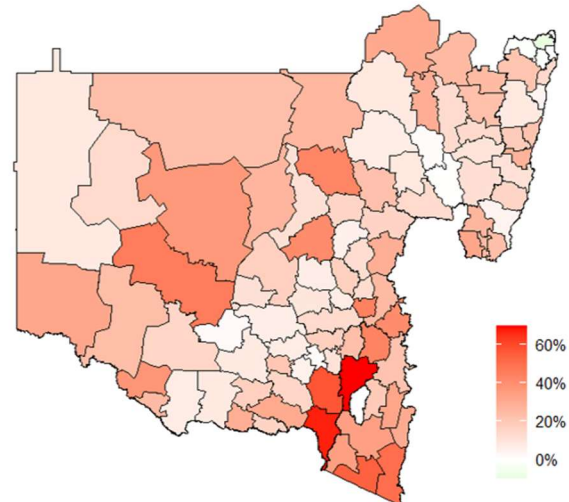
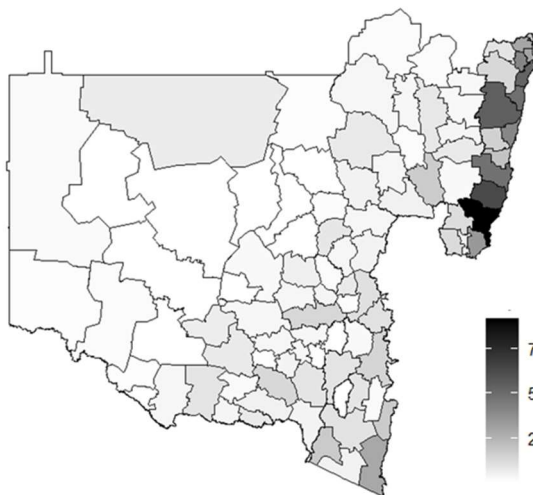
The maps reveal that coastal locations with a high density of network assets exposed to fire, flood and storms will experience the most significant impacts from climate change. The red map below shows almost all locations will require higher levels of asset replacement into the future, as part of the recovery process from more frequent, and potentially more extreme, fires, floods and windstorms.

As shown below, changing patterns in locations exposed to fires, floods and windstorms will see customers' experiences change. To maintain the current reliability and quality customers expect into the future, we must immediately begin to invest in network resilience. This climate change impact assessment will be used to guide the network and community resilience investment business cases.

Expected number of replaced assets due to the combined impact of bushfire, flood, and windstorm:
(L) under current climate conditions; (R) Change in expected asset replacements from 2022 to RCP4.5 2070

Expected number of replaced assets due to the combined impact of bushfire, flood, and windstorm under 2022

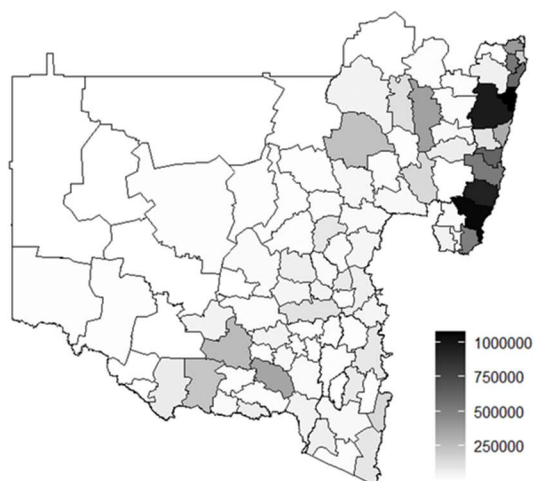
Change in expected number of replaced assets due to the combined impact of bushfire, flood, and windstorm from 2022 to RCP4.5 2070



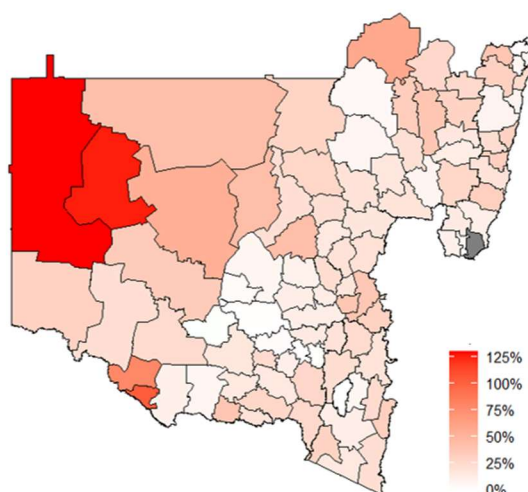
Key findings – value of unserved energy (Value of Customer Reliability)

Expected VCR due to the combined impact of bushfires, floods, and windstorms:
(L) under current climate conditions; (R) Change in expected VCR from 2022 to RCP4.5 2070

Expected VCR due to the combined impact of bushfire, flood, and windstorm under 2022



Change in expected VCR due to the combined impact of bushfire, flood, and windstorm from 2022 to RCP4.5 2070



Where a customer was without energy, a value of unserved energy could be determined as the aggregation of customer numbers by customer downtime by energy at risk by value of customer reliability.

In the table below, the current total modelled value of unserved energy due to bushfires, floods and windstorms is presented, along with a description of how it will change over time, in Representative Concentration Pathway 4.5.

Value of unserved energy under RCP4.5 conditions

Value of Unserved Energy RCP4.5 (\$m)				
Year	2022	2050	2070	2090
Bushfire	5.5	6.3	7.0	7.9
Flood	5.5	5.8	5.8	5.8
Windstorm	0.5	0.5	0.4	0.3

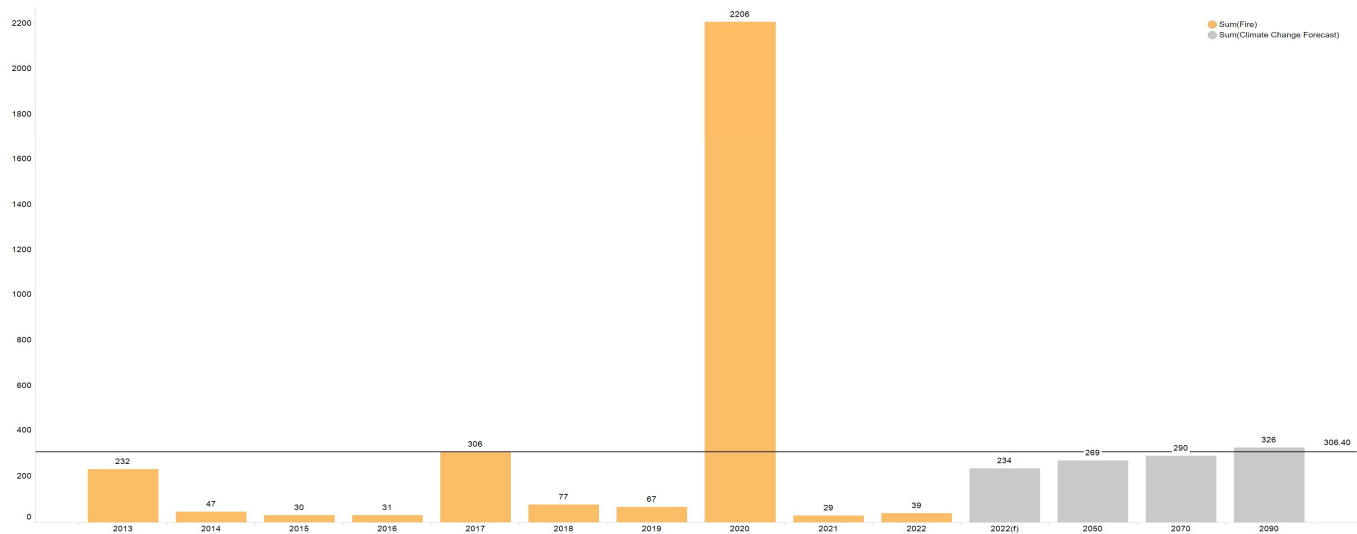
RCP 4.5 is forecast to lead to changes in the value of unserved energy. The assumptions for energy at risk and value of customer reliability were constant, making the value of unserved energy proportional to the total customer downtime.

Network failure forecast

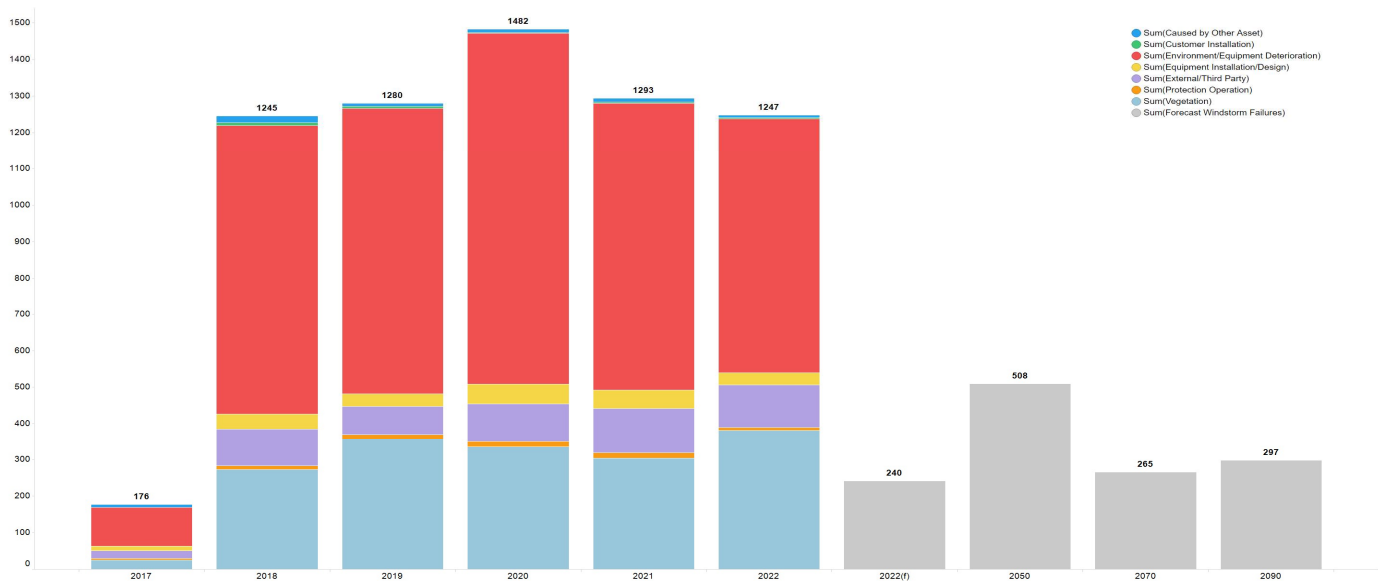
Functional failures of our assets contribute to electricity supply outages, bushfire ignitions and other public safety hazards. Asset failure as a percentage of total assets is currently managed appropriately. However, as

shown below, we expect functional failure rates of some key types of assets to rise as the severity and frequency of natural hazards increase.

Functional failures of poles due to fire; experienced and forecast
(Supporting document 10.06.01 Resilience risk-based pole replacement investment case)



Conductor failures historic causes and windstorm forecast
(Supporting document 10.06.01 Resilience risk-based pole replacement investment case)

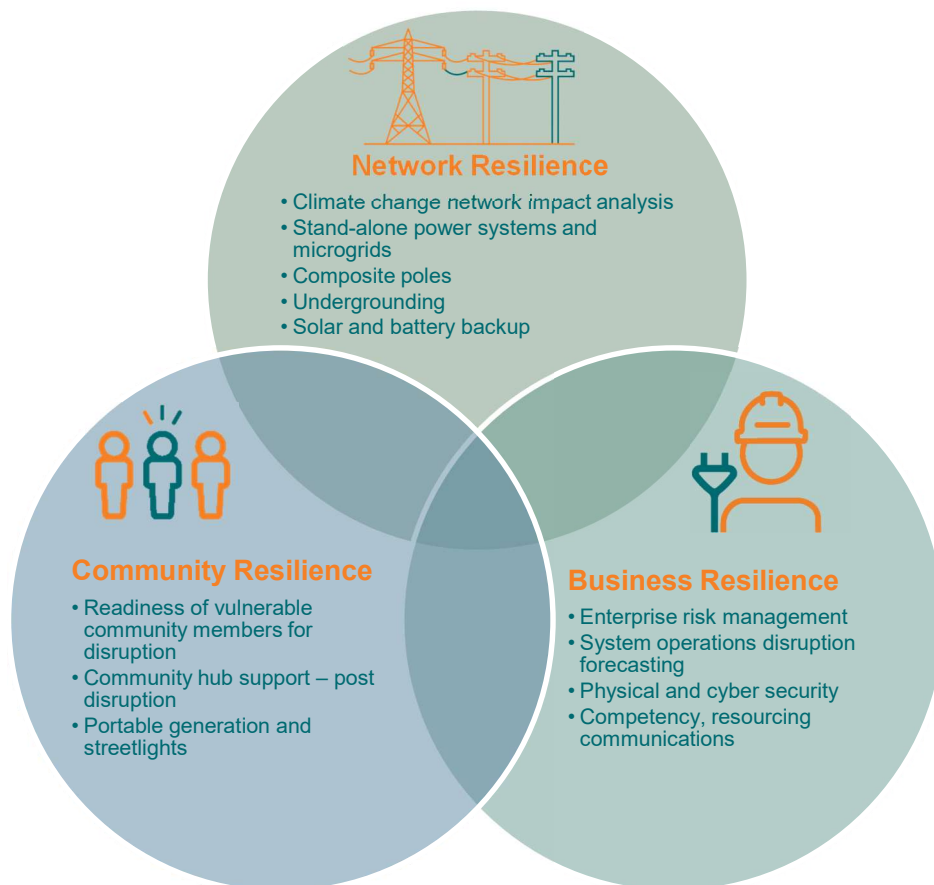


6. Organisational approach to resilience management

We have an integrated approach to business resilience, network resilience and community resilience. This integration is important to ensure consistency of direction and alignment to the Corporate Strategy.

Investments and actions contained within this Resilience Plan are primarily related to network investment to counter changing climate impacts and ensure that we continue to deliver the service customers want. However, the plan also contains important measures to connect network resilience to community resilience. Core business resilience functions and considerations, such as enterprise risk management and security, are not considered in depth in this plan as they are addressed in a separate business resilience plan aligned to ISO 22313 – Business Continuity Management Systems.

Organisational approach to resilience



Community resilience – assisting communities

In our engagement program, customers made it very clear that they expect us to invest in our network to make it more resilient in the face of more frequent and extreme weather events brought about by climate change.

Our customers also expect us to invest in non-network solutions such as generators, SAPS and portable solar streetlights to help our communities become more resilient and recover quickly when their normal electricity supply service is disrupted. Customers also supported the hiring of three new staff members to work with councils, communities and other critical infrastructure providers to help them develop and implement resilience plans.

In Phase 3 of our customer engagement, we discussed the options to help our communities become more resilient. The options discussed are shown below.

Over 90 per cent of customers surveyed supported Option C. Under this option we will invest in:

- > 1,000 domestic (3 kVA) generators
- > 20 medium (200 kVA) generators
- > 20 large (500 kVA) generators
- > 20 portable SAPS
- > 50 portable solar streetlights
- > a communications and community hub van
- > a portable depot which will enable us to respond more effectively and efficiently
- > three full-time employees who will work with our customers and stakeholders to help build resilience.

The generators and SAPS will help minimise impact of customer outages. The portable solar streetlights will play an important role in keeping our communities safe and secure. The communications van will become a community hub where customers can receive the information and other support they need, and the portable depot will enable our crews to respond in a quicker and more effective manner.

The total cost of this investment over the 2024–29 period is forecast to be approximately \$15 million, plus a further \$0.7 million per annum to fund the three new employees. In addition, we will provide customers with fuel vouchers to help cover the cost of running the domestic generators. Residential customers overwhelmingly indicated their willingness to pay the incremental cost of \$0.29 per annum (for the life of the asset) to fund this program. The cost for the average business customer will be \$1.25 per annum.

These assets will be used when extreme weather events cause extended outages on our network but may also be used when planned maintenance of our network is expected to result in extended network outages. In all scenarios, the objective is the same – to reduce outage times for customers and help them be more resilient.

The generators and portable SAPS will enable customers to keep their refrigerators and freezers working when there is an extended outage and will also allow other essential services that are dependent on electricity, such as telecommunications and water providers, to continue to function during or immediately after extreme weather events.

Using the AER's VCR method, and based on forecast asset utilisation rates, we have calculated that these assets will provide customers with about \$94 million in value over the 2024–29 period, and net benefits of almost \$76 million over this regulatory period.

Support for these investments was further tested in Phase 4 of the engagement program and did not waiver, even in the face of increased cost of living pressures from rising interest rates and inflation.

Please see supporting document **10.06.11 - Community Resilience Investment Case** – for more detail on this.

Network Resilience – Strengthening the Network

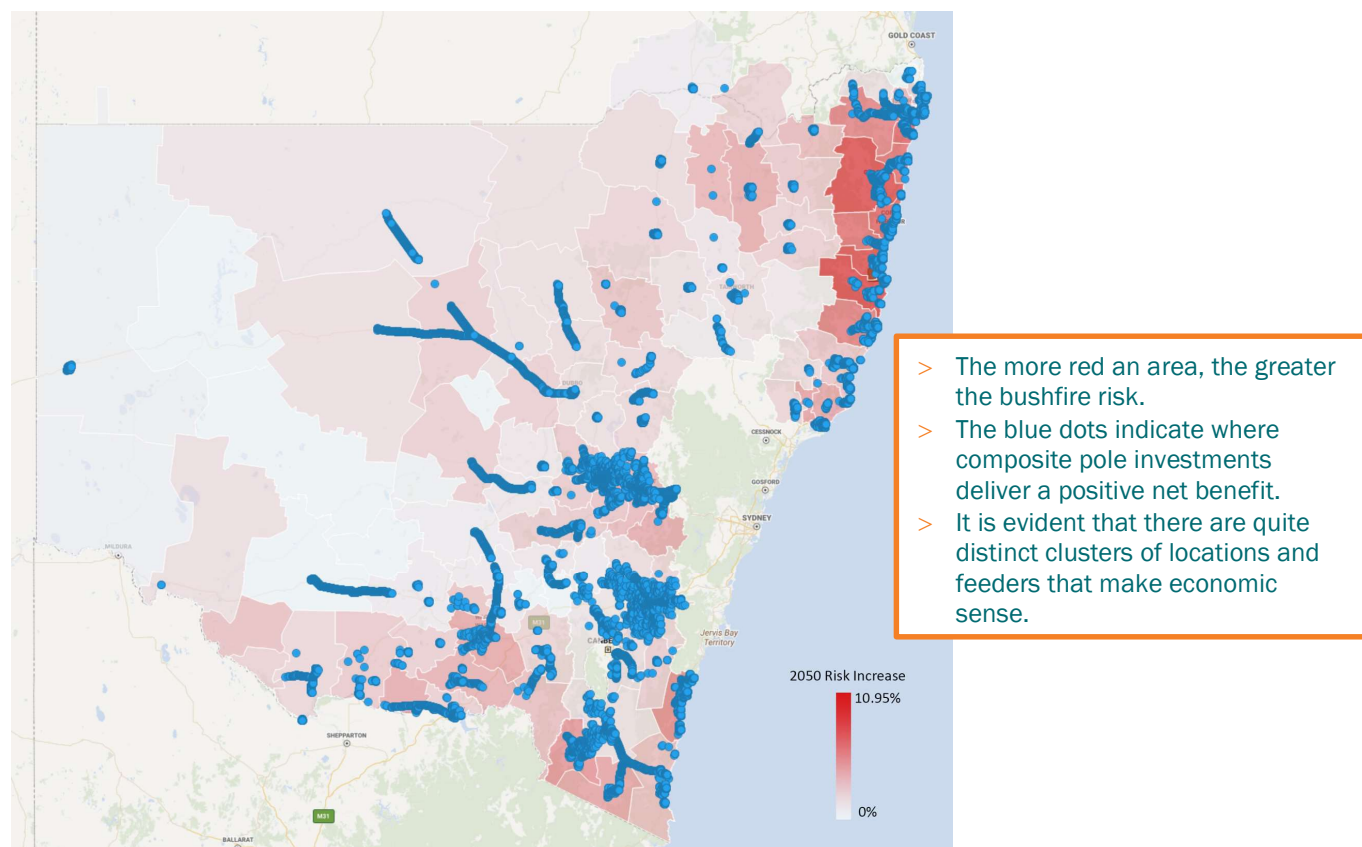
Using the insights gained from the climate change network impact assessment, we will prioritise network investments and performance reporting towards those areas and assets most impacted by environmental perils today and into the future.

Composite fibre poles

In our transition away from timber poles, the installation of composite fibre poles in locations most affected by bushfires (see map below) is expected to greatly improve network reliability for customers in these areas. Lower asset lifecycle costs and installation efficiencies combine with reliability benefits to achieve a positive net present value (NPV) of \$67.4 million.

Overall, customers and stakeholders supported a move to composite poles in higher-risk areas. Advantages included their longevity, fire resistance and Australian manufacturing origin, though it was recognised that they would not necessarily withstand floods or landslides. There were also concerns with their end-of-life, given the recycling technology is still evolving. Sixty-seven per cent of customers wanted to see all 25,000 poles in areas with high bushfire risk replaced with composite poles by 2040, demonstrating strong support for accelerated transition. Supply limitations and results from climate change modelling will see a reduced, yet motivated, rollout of up to 11,000 composite poles in these areas.

Locations prioritised for composite fibre pole installation



Network undergrounding

Undergrounding of powerlines is a reasonably practicable approach to resilience improvement in locations where costs of continued maintenance or replacement of overhead assets are exceptionally high due to frequent or severe fires or windstorms. We have identified 1,800 kilometres of overhead network that can be converted to underground network to appropriately mitigate risks and reduce operating costs.

During customer engagement forums, we explained the pros and cons of an overhead versus underground network. Undergrounding high-risk areas of the network was appealing in that it reduced risks to the network from fires and would reduce maintenance costs and increase aesthetic appeal. We recognise that undergrounding is not necessarily a solution for flooding and that there would likely be some areas suited to composite poles.

Based on the strong guidance from customer representatives (66 per cent), we plan to invest in undergrounding 40 kilometres of poor-condition overhead network during the 2024–29 period in areas most impacted by climate change perils with NPV of \$37.7M.

Portable substation equipment

Zone substations are critical infrastructure to our network. There are 37 sites across the footprint that are classed as single transformer zone substation sites, meaning there is no backup if the equipment fails. When connected to radial subtransmission lines, damage to a zone substation can mean several townships would lose power, affecting a significant number of customers. Mobile portable substation equipment can be transported at short notice to provide a temporary power supply to our customers following major weather events.

Multiple simultaneous natural hazards across our network footprint are causing a shortage of portable zone substation equipment. During a recent flood event in Lismore, required portable equipment was already in use for a different emergency in the south of the state. As such, the required equipment had to be built on site in

Lismore, which took considerable time. Purchase of additional portable zone substation equipment has been assessed as having a NPV benefit of \$7.8 million.

Radio sites solar and batteries

The Royal Commission into National Natural Disaster Arrangements and the NSW Bushfire Inquiry identified that communication via radio and phone during natural hazard events can be critical for coordination of recovery activities. During our recent customer engagement, customers also endorsed a proactive approach to providing backup power to radio sites as a good value investment because it would result in shorter outages for customers.

We have identified 50 radio sites as critical communication hubs for the operation and restoration of our electrical network assets. This assessment included identifying the consequence of the site becoming unavailable, then determining if access can be limited during fire or flood events or if the site is critical to re-energising the electricity network.

Through installing either a combined solar (photovoltaic) and battery system, or only a battery system, at each of the 50 sites during the 2024–29 period, we have forecast a NPV benefit of \$15.1 million over the life of the assets.

Microgrids

During customer engagement efforts, we described the features of SAPS and microgrids, and the roles they could play in our network. Participants could see these solutions benefiting downstream communities and customers through improved resilience and reliability.

There were some concerns with the environmental impact of batteries given their relatively short life. Some customers questioned why something that delivered a bill saving even needed to be deliberated in a forum. They expressed that they would happily pay for the privilege of having a SAPS or microgrid solution.

Customers were presented with three options: slow, slightly more proactive and extra proactive. Ninety-one per cent of those surveyed supported an extra proactive rollout of SAPS and microgrids.

In addition to the rollout of SAPS for customers in remote and hard-to-reach locations, six microgrid locations (see map below) have been identified for installation of backup power supply systems during the 2024–29 period. This allows these communities to operate as a microgrid during network outages.






Tibooburra, Gresford, Bonalbo, Crookwell, Murrurundi and Lake Cargelligo are all currently supplied by overhead subtransmission lines that experience higher than average impacts from fires and windstorms. Instead of strengthening the overhead network, better supply performance and lower asset lifecycle costs can be achieved by installing backup generation for times when the overhead network supply is interrupted. A combined NPV benefit of \$34.8 million can be achieved through this microgrid program, over the life of the assets.

We have identified a number of immediate investment actions. This is in recognition of the increasing disruption climate change will cause on electricity supply if sufficient mitigative measures are not established now. These actions relate to the provision of resilient distribution standard control services and are intended to be implemented in a coordinated effort.

- > improve asset solutions to provide a distribution network less susceptible to extreme events
- > facilitate the continuation of supply to customers through temporary generation where distribution assets were unable to be supplied during and immediately after extreme events
- > improve supply restoration response through investment in resilient network asset communications
- > improve restoration response through investment in mobile communications for use by our field crews during extreme events.

Principles for resilience investment

We have adopted the general principles developed by joint DNSP collaboration for application when designing investment plans for improving resilience. These principles received strong support from customers during consultation.

	Targeted	Resilience investments will be targeted at the assets and areas most at risk.
	Customer benefits	Decisions to invest or not invest will be based on what unlocks the most net economic benefit.
	Risk-based approach	Economic benefits will be calculated by comparing forecasted costs and the monetised value of risk, as part of our value appraisal framework.
	Evidence-based approach	The probability of events driving resilience investments will be informed by evidence.
	Time horizon	Costs and benefits associated with an investment will be assessed over the life of the asset (40 or more years).

Value Framework for investment benefit calculation

Calculations of costs and benefits for proposed investments are subject to our Network Risk Management Manual (**Supporting document 6.03.02**) and Appraisal Value Framework (**Supporting document 6.03.03**), the probability of failure, the likelihood of consequence, and a risk factor sensitivity analysis.

The Appraisal Value Framework sets out the fundamental cost of consequence assumptions used to determine risk benefit. It is used as a tool to guide monetised risk calculations. Consequence assumptions are based on historical data as well as industry-recognised consequence estimates for various consequence types such as bushfire ignition, safety impact, network reliability, environmental impact, and financial impact.

Probability of failure analysis is based on historical data as well as best practice forecasts. Our recent work with KPMG and Risk Frontiers has provided a forecast of the impacts of climate change on network assets and supply reliability. The severity and frequency of bushfires, floods and windstorms due to climate change is factored into investment benefit calculations to ensure network resilience is considered for composite poles and undergrounding at this stage. Further development of value calculators is required to include the impact of climate forecasts for other asset types.

Sensitivity analysis identifies which form of risk (such as bushfire ignition or network reliability) is driving the investment value. The primary form of risk driving the outcome is then further tested to understand if assumptions used for the probability of failure, likelihood of consequence, or consequence cost are appropriate and/or could be mitigated using alternative investments to bring the total benefit significantly lower.

Regulatory proposal business cases 2024–29

Projects contained within this plan require additional investment within the 2024–29 period, each supported by investment cases that demonstrate positive return on investment and alignment to the above investment principles.

Summary of 2024–29 resilience investment requirements

Reference	Project	Benefits and net present value (NPV)	FY24 direct capital (\$M)
Assisting communities			
10.06.11	Community resilience – generators, etc	Assisting communities with backup supply during or after major weather events	14.1
10.06.11	Community resilience – solar trailer, hub and communications van	Supporting and assisting communities and local staff in recovery effort after major weather events	1.0
Chapter 6 and 9	Opex – fuel voucher program	Fuel vouchers for running generators	0.3
	Overhead – three additional employees	Coordination of resilience planning and response to events across the network	0
Strengthening the network			
10.06.01	Resilience risk-based pole replacement	Reduced outage frequency and impact of major weather events NPV + \$67.4M	85.3
10.06.02	Resilience undergrounding high-risk locations	Reduced outage frequency and impact of major weather events NPV + \$37.7M	18.3
10.06.03	Portable switchboards and transformers	Reduced outage time for customers and community services following natural hazard events NPV + \$7.8M	4.7
10.06.04	Radio sites solar and batteries	More reliable communications to assist in restoration of electrical network and improved staff safety NPV + \$15.1M	1.7
10.06.05	Tibooburra microgrid	Reduced outage duration and impact from major weather events NPV + \$4.2M	16.6
10.06.06	Gresford microgrid	Reduced outage duration and impact from major weather events NPV + \$7.3M	

Reference	Project	Benefits and net present value (NPV)	FY24 direct capital (\$M)
10.06.07	Bonalbo microgrid	Reduced outage duration and impact from major weather events NPV + \$5.0M	
10.06.08	Crookwell microgrid	Reduced outage duration and impact from major weather events NPV + \$3.7M	
10.06.09	Murrurundi microgrid	Reduced outage duration and impact from major weather events NPV + \$4.1M	
10.06.10	Lake Cargelligo microgrid	Reduced outage duration and impact from major weather events NPV + \$10.5M	

Reference documents

6.01	Climate Impact Assessment (KPMG)
6.03.02	Network Risk Management Manual
6.03.03	Appraisal Value Framework
10.06.01	Resilience Risk Based Pole Replacement Investment Case
10.06.02	Resilience Undergrounding High Risk Locations Investment Case
10.06.03	Resilience Portable Switchboards and Transformers Investment Case
10.06.04	Resilience Radio Sites Solar and Batteries Investment Case
10.06.05	Resilience Tibooburra Network Investment Case
10.06.06	Resilience Gresford Network Investment Case
10.06.07	Resilience Bonalbo Network Investment Case
10.06.08	Resilience Crookwell Network Investment Case
10.06.09	Resilience Murrurundi Network Investment Case
10.06.10	Resilience Lake Cargelligo Network Investment Case
10.06.11	Community Resilience Investment Case

Glossary

Term	Description
AER	Australian Energy Regulator
Community resilience	The ability of communities to withstand and recover from the impacts of natural disasters
DNSP	Distribution Network Service Provider
NSP	Network Service Provider
Major event	A significant weather event which has the potential to impact the network sufficiently to result in a Major Event Day
Major event day	Interruptions beyond the control of Essential Energy, or because they are not representative of a normal day in terms of reasonable network resource availability and goes beyond a pre-defined threshold for organisational SAIDI
Microgrid	A small, local network of electricity customers with a local source of power that may, or may not, be connected to the main Network during normal Network operation.
NEL	National Electricity Law
NEO	National Electricity Objective
NPV	Net Present Value - NPV is a method of valuing the costs and benefits of a proposal over a time scale, considered in today's monetary value
Network resilience	The ability to provide safe and reliable electricity supply in the ways customers expect before, during and after a disruptive event.
RCP	Representative Concentration Pathway - RCP scenarios include time series of emissions and concentrations of the full suite of greenhouse gases and aerosols and chemically active gases, as well as land use/land cover (Moss et al., 2008). The word representative signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics. 'The term pathway emphasises that not only the long-term concentration levels are of interest, but also the trajectory taken over time to reach that outcome (Moss et al., 2010). (Source: International Panel on Climate Change)
Resilience	The ability to resist, absorb, accommodate, adapt to, transform or recover from the effects of a natural hazard (Source: Resilience NSW, UNDRR)
SAIDI	System Average Interruption Duration Index, the sum of the durations of all the sustained interruptions (in minutes), divided by the customer base. Momentary interruptions of three minutes or less are excluded from the calculation of unplanned SAID
SAIDI (normalised)	SAIDI less approved exclusions, including impact of major event days
SAIDI (unnormalised)	SAIDI inclusive of all interruptions, including major event days
SAPS	Stand Alone Power Systems
VCR	Value of Customer Reliability