30 November 2023

Ausgrid's 2024-29 Revised Proposal

Attachment 5.5:

Climate Resilience Business Case

Empowering communities for a resilient,

affordable and net-zero future.

For Official use only

Summary of how we have responded to the AER's Draft Decision

Overview			
Climate Resilience Business Case	The identified need ('program objective') is to maintain current customer and community service outcomes by enhancing the resilience of electricity distribution services in line with the projected growth in risk of disruptive climate events across the period FY25-50.		
FY25-29 $M, real FY24	**Initial Proposal**	**Draft Decision**	**Revised Proposal**
Capex	$193.6M	$25.7M	$113.7M
Opex	$8.4M	$0.0	$5.9M
Total	**$202M**	**$25.7M**	**$119.6M**

Trend Analysis	Why our Revised Proposal meets the needs of customers
Our revised proposal is: • **41% less than initial proposal**	The investments have been co-designed with customers using the decision-making framework *Promoting the long-term interests of consumers in a changing climate: A decision-making framework.*

AER Draft Decision	Ausgrid Response
Ausgrid must demonstrate: **-the reasons for climate scenario selection**	We have adjusted our modelling to consider only climate scenario RCP4.5 (100% weighting) in line with other Distribution Network Service Providers (DNSPs).
-a causal link between the expected increase in climate risk and the impact on Ausgrid's network	We have developed an end-to-end probabilistic model that takes climate forecasts, simulates asset failures and impacts, and identifies the optimal investments required to maintain current service levels.
-the investments are prudent and efficient and have the greatest net benefit to consumers	Ausgrid's revised proposal seeks to make investments that mitigate currently projected climate risk growth to 2050 within twenty years, enabling us to prioritise the most cost-effective investments for FY25-29. This is the most prudent and efficient path forward considering the growing risk. The High Voltage Network investments have a BCR of 3.14 and Net Present Value of $178.4M. We have tested a range of feasible options to inform the proposal. These options assessments are detailed in an investment case for each project.

Additional information	
Stakeholder feedback during the AER's predetermination conference	At the AER Predetermination Conference, we heard stakeholder concerns that we needed to consider extreme heat resilience. We engaged further with customers and experts to develop a heat resilience project in this revised proposal.
Affordability	Ausgrid tested affordability in late October 2023, and have responded to cost-of-living pressures by staging investments within four regulatory periods to keep pace with the growth in climate risk and manage affordability.

Executive Summary

Targeted investment in resilience is needed to protect the long-term interests of customers and maintain current levels of resilience in the face of climate change.

The program objective is to maintain current customer and community service outcomes by enhancing the resilience of electricity distribution services in line with the projected growth in risk of disruptive climate events across the period FY25-50.

Ausgrid has an obligation under the Security of Critical Infrastructure (SOCI) Act to minimise material risks, including those exacerbated by climate change, so far as it is reasonably practicable.

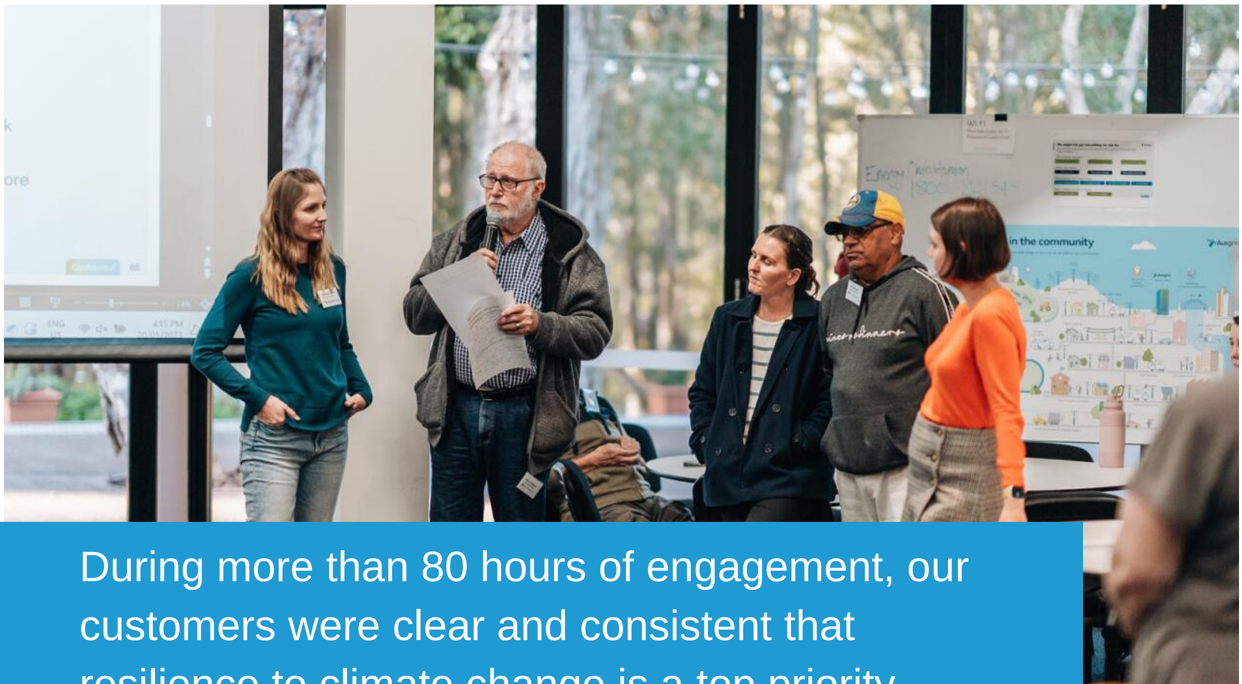
This business case applies the investment framework we co-designed with the Reset Customer Panel entitled *Promoting the long-term interests of consumers in a changing climate: A decision-making framework.*

Throughout our community consultations over the last 18 months, investment in climate resilience has been a consistent priority for our customers. Balancing their recently heightened affordability concerns, Ausgrid has chosen to manage climate risk over multiple regulatory periods, prioritising the most efficient and prudent investments to deliver greatest net benefit for FY25-29. These investments deliver:

Benefit-Cost Ratio: 3.14[1]

Net Present Value: $178.4M[1]

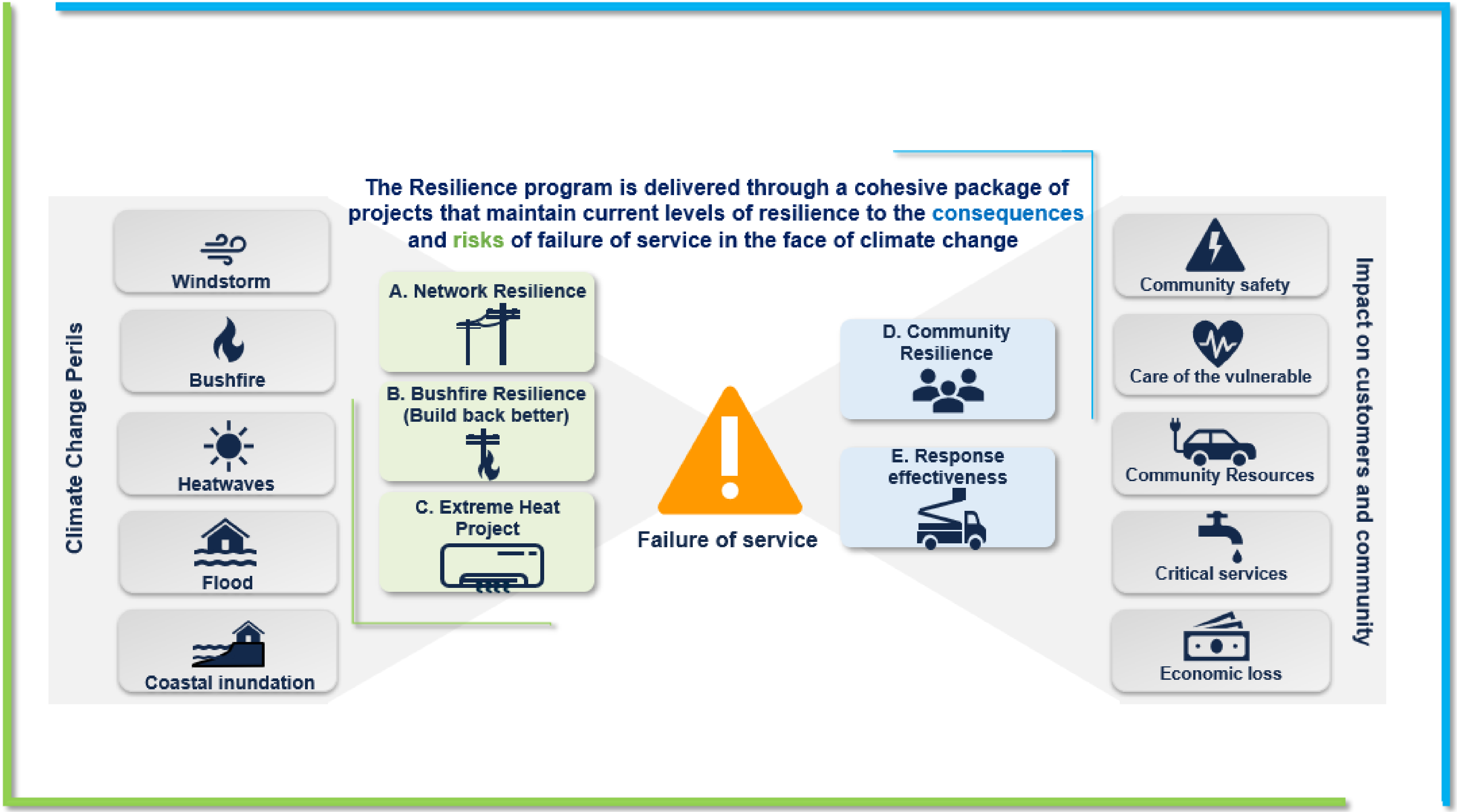
The business case also addresses the feedback provided in the AER's Draft Decision to ensure that investments promote the long-term interests of consumers.



During more than 80 hours of engagement, our customers were clear and consistent that resilience to climate change is a top priority.

[1] High Voltage Network Investments which account for $83.1M of the $119.6M proposal. Climate scenario used is RCP4.5 (100%)

Summary of Climate Resilience Program



Summary of Climate Resilience Program

PROGRAM OBJECTIVES

To maintain current customer and community service outcomes by enhancing the resilience of electricity distribution services in line with the projected growth in risk of disruptive climate events across the period FY25-50 through a combination of:

- Prudent and efficient, no-regrets investment designed to maintain resilience to expected climate change related perils.
- Systems and processes to provide vulnerable communities with the capacity to withstand and recover from disruptive weather events
- Develop corporate knowledge of material climate risks and impacts to inform future community consultation and the identification of future potential resilience investment needs

PROJECT OBJECTIVES

Title & Link to Summary	Objective	Investment Case and Models Provided	OPEX ($M, real FY24)	CAPEX ($M, real FY24)	TOTEX ($M, real FY24)
A. Network Resilience	Deliver prudent and efficient, no-regrets investment in order to maintain resilience to the expected wind peril to 2050, at current levels	Investment Case Top Down Model HV End to End Model LV Spreader Bar Model	$0.35M	$90.02M	$90.37M
B. Bushfire Resilience (Build Back Better)	Deliver prudent and efficient, no regrets investment to maintain resilience to the expected bushfire peril to 2050, at current levels	Investment Case	$0.20M	$6.60M	$6.80M
C. Heat Resilience	Develop a knowledge base of the heat peril and its potential impacts on Ausgrid's assets, including the need to co-exist with third party green-infrastructure investment, and the needs of vulnerable customers. This knowledge will provide a credible evidence base for community consultation and future potential investment needs	Investment Case	$1.75M	$6.00M	$7.75M
D. Community Resilience	Ensure vulnerable communities can develop additional capacity over time to withstand and recover from expected climate change impacts to electricity services to 2050	Investment Case	$3.15M	$0.21M	$3.36M
E. Response Effectiveness	Maintain the response time for all hazards to 2050, at current levels	Investment Case Top Down and Bottom Up (Response Effectiveness Models)	$0.40M	$10.89M	$11.29M
			$5.85M	**$113.73M***	**$119.58M***

*Totals may not sum due to rounding

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Attachments:

NOTE TO READERS:

Sections 1 – 3 provide contextual information on the Ausgrid resilience program.

New information responding to the AER Draft Decision begins in **Section 4**.

How this revision responds to AER feedback and key questions is summarised in **Section 5**.

1. Introduction

The program objective is to maintain current customer and community service outcomes by enhancing the resilience of electricity distribution services in line with the projected growth in risk of disruptive climate events across the period FY25-50.

Resilience is defined as *the network's ability to continue to adequately provide network services and recover those services when subjected to disruptive events,* and is an essential element in promoting the long-term interests of consumers with respect to price, safety, quality and security of supply. This program specifically targets maintaining resilience, and day-to-day 'reliability' improvements are out of scope (as illustrated in Figure 1).

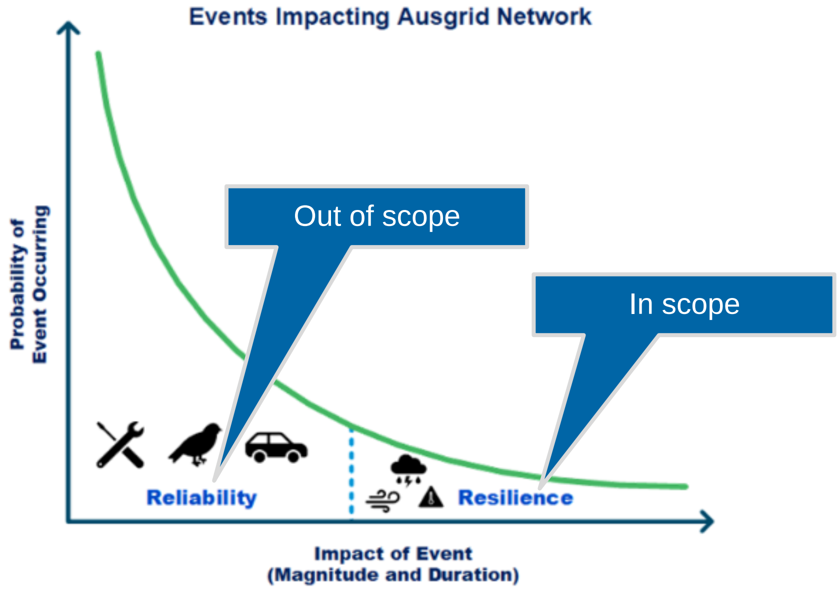


Figure 1: Scope of Climate Resilience Program

Climate resilience is central to Ausgrid's role as a DNSP and a Critical Infrastructure Provider, in particular:

- The National Electricity Objective (NEO) requires us to promote the long-term interests of consumers with respect to price, quality, safety and security of supply**.**
- The Security of Critical Infrastructure (SOCI) Act requires us, as far as it is reasonably practicable, to minimise material risks, including those hazards exacerbated by climate change.
- NSW State Infrastructure Strategy (2022) places an onus on us to *"Develop place-based resilience adaptation strategies that assess local risk and incorporate infrastructure and non-infrastructure solutions for vulnerable locations."*
- To meet the expectations of customers, who over 18 months of extensive engagement, have consistently supported resilience as a key priority for them.

2. Ausgrid's climate risk profile

To understand Ausgrid's climate risk profile to 2050, climate scientists completed a climate risk assessment which showed our most significant exposures are in the coastal regions (windstorms) and the Upper Hunter (heatwave and bushfire).[2]

Baseline of our current climate resilience

Ausgrid's resilience investments seek to maintain our climate resilience to current levels. While our network performance has remained relatively stable for non-weather-related events, network outages related to disruptive climate events can vary from year to year as shocks and stress occur and have significant customer impacts. Over the 15-year period to FY23, 12% of outage events on our overhead network were caused by disruptive climate events, yet this same 12% of outages accounted for 62% of customer minutes interrupted (Figure 2).

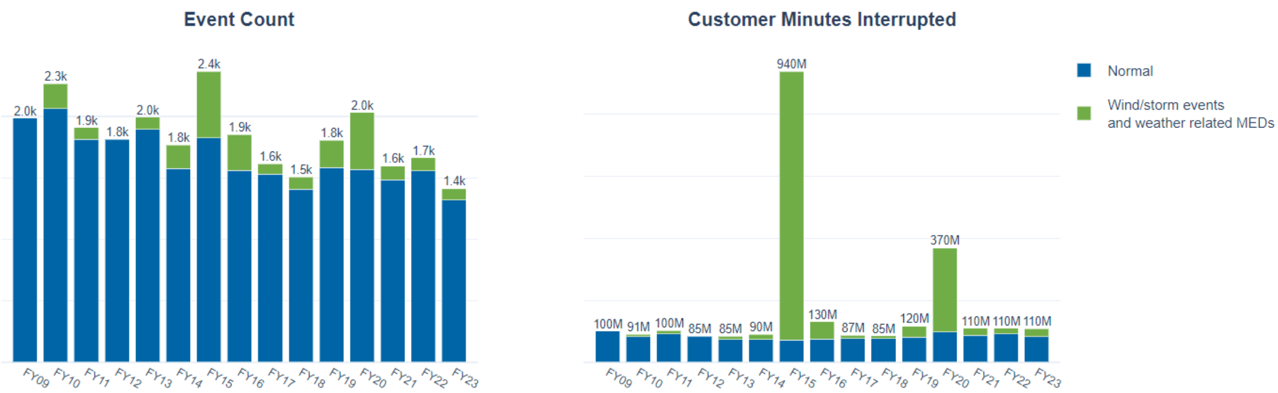


Figure 2: Disruptive climate events over the past 15 years (FY09-23)

We have applied a mid-range climate change scenario – RCP4.5

We have used a 100% weighting on mid-range RCP4.5[3] (Figure 3) to inform this proposal. We acknowledge that this underestimates the likelihood RCP8.5[4] and differs from our earlier proposal.

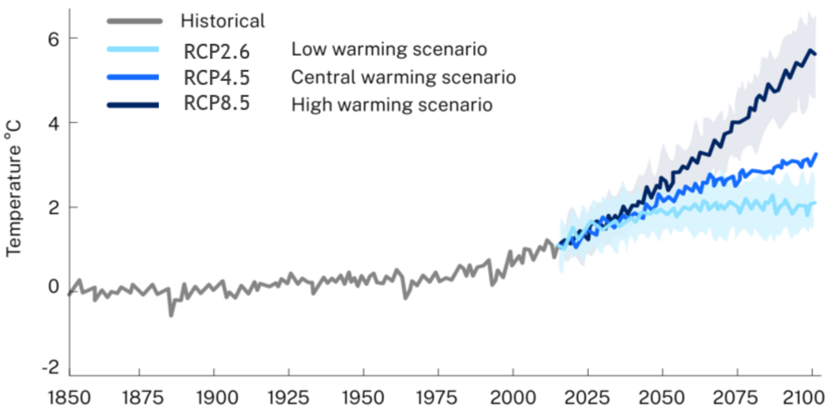


Figure 3: Average surface temperature change for Eastern Australia under different climate scenarios

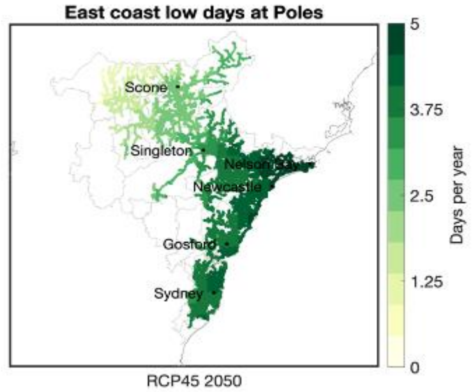
[2] Risk Frontiers (2022) Ausgrid Climate Change Risk Assessment.
[3] NSW climate change adaptation strategy.
[4] As recommended to us by climate scientists and supplied to the AER in Information Request IR048.

The assessment rated the frequency and severity of climate shocks and stresses

The United Nations reported a significant increase in the number of extreme weather events in the last 20 years, with 7,348 major events recorded from 2000-2019, compared to 4,212 in the previous 20-year period[5]. To understand forward projections, Risk Frontiers completed a Climate Risk Assessment to assess the impacts of climate change on Ausgrid's network. The key findings, together with Ausgrid's historical insights, are described below.

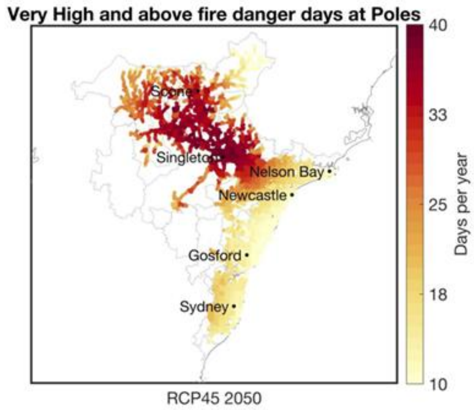
Windstorms have historically been the peril that has impacted Ausgrid the most and are expected to grow by ~1% per annum

Recent windstorms in Ausgrid's network have resulted in outages for between 100-500k customers, in some cases for up to 10-12 days. Windstorms were evaluated using two parameters: frequency of East Coast Lows (ECL), and maximum windspeed. The increasing speed of maximum wind gusts and rising frequency of major storm events to 2050 due to climate change, when combined with Ausgrid network and load data, has been shown to result in a ~1% per annum increase in asset repair and unserved energy costs across Ausgrid's distribution network.



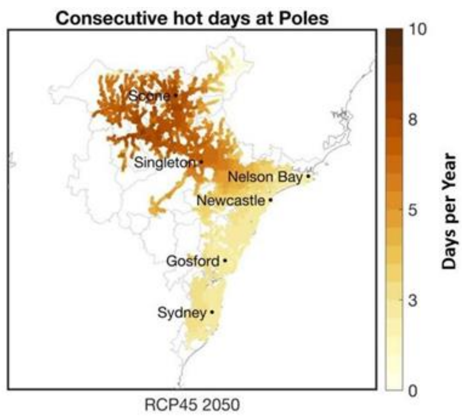
Bushfire – a 13% increase in the frequency of severe bushfire is expected[5]

Bushfire risk is evaluated in terms of the frequency of dangerous fire weather days. This considers landscape dryness and the daily weather conditions that can exacerbate fire (windspeed, temperature, and humidity) to assess bushfire risk. For the Ausgrid network area, projections for 2050 under RCP4.5 show an increase in the frequency of severe bushfire weather of ~13%, with impacts particularly occurring in the Northwest of our operating area.



Heatwave risks are expected to increase by 22% by 2050[6]. Heat-related hospitalisation costs are estimated to grow to $506M in Sydney by 2050[7]

Heatwave is when it is hotter than 35ºC on three or more consecutive days. 473 Australians died from heat related causes between 2001 to 2018[8] resulting in an increasing stakeholder expectation that our infrastructure should coexist with the green infrastructure (trees) required to cool urban environments. Ausgrid does not yet have a body of evidence to know how heat will impact our ability to operate.



[5] United Nations Office for Disaster Risk Reduction (2020), The Human Cost of Disasters, p. 6.
[6] Risk Frontiers (2022), Ausgrid Climate Change Risk Assessment.
[7] Tong et al. (2021), Heat-attributable hospitalisation costs in Sydney, p.1.
[8] Coates et al. (2022), Heatwave fatalities in Australia, 2001-2018, p.1.

To understand the changing consequences of climate impacts, we assessed the variability of impacts on communities and individuals.

A customer's location has a significant influence on the electricity service they experience during and after disruptive weather events. Further, those already considered vulnerable or disadvantaged on other metrics like socio-economic status, age and mobility tend to be less resilient to the social, economic, and physical shocks of outages from disruptive weather events. This is demonstrated by comparing average annual outage minutes from climate related MEDs with indices of Socio-economic Advantage and Disadvantage from the Australian Bureau of Statistics (Figure 4).

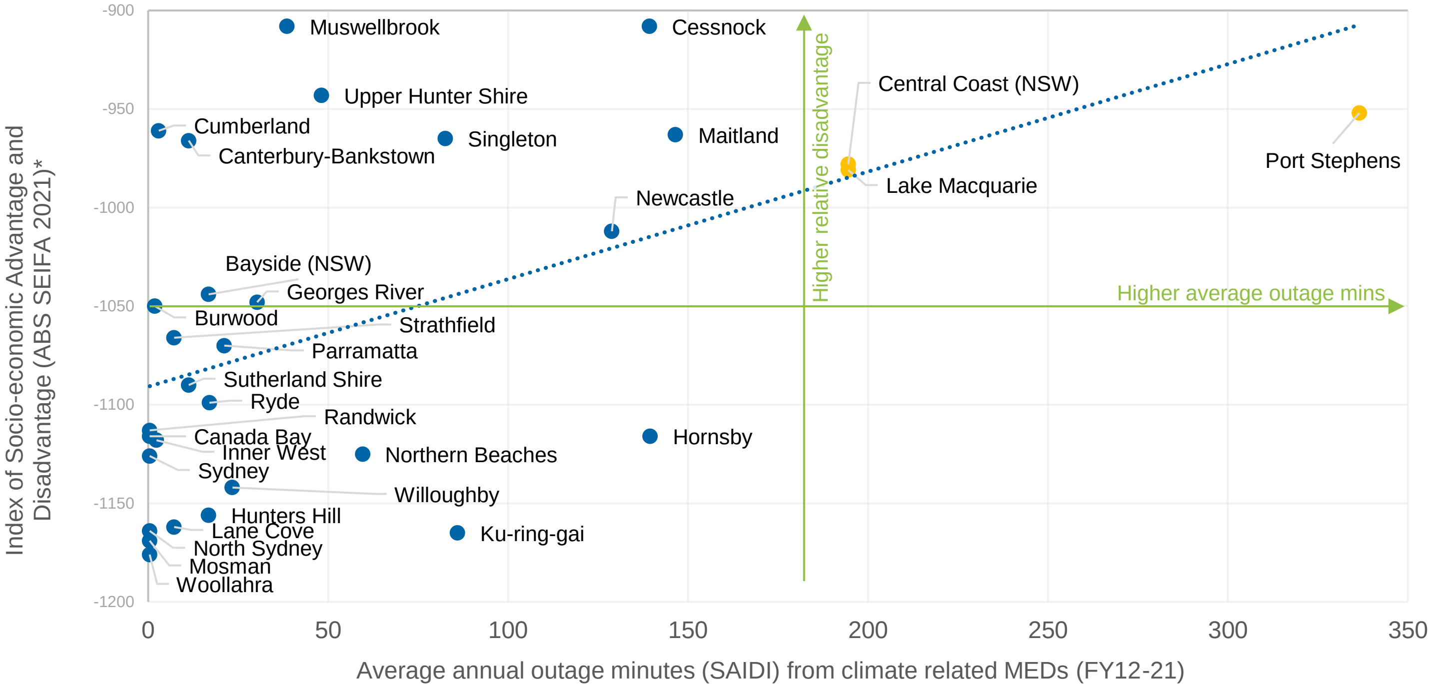


Figure 4: Many LGAs that rank lower on measures of advantage and disadvantage (ABS SEIFA 2021[9]) also experience more climate related outage minutes each year than other more advantaged LGAs. This is most pronounced for the Central Coast, Lake Macquarie, and Port Stephens.
(*SEIFA Scores inverted to aid interpretation)

The experience of customers is highly variable at an even more local level and within a single LGA a severe storm causes a wide range of customer impacts, from no outage at all through to multiple days and even weeks. Storms like the East Coast Lows that occurred in April 2015 (max wind speed 135 km/h) and Feb 2020 (111 km/h) caused outages for between 100-500k customers, in some cases for 14 days or more (Figure 5).

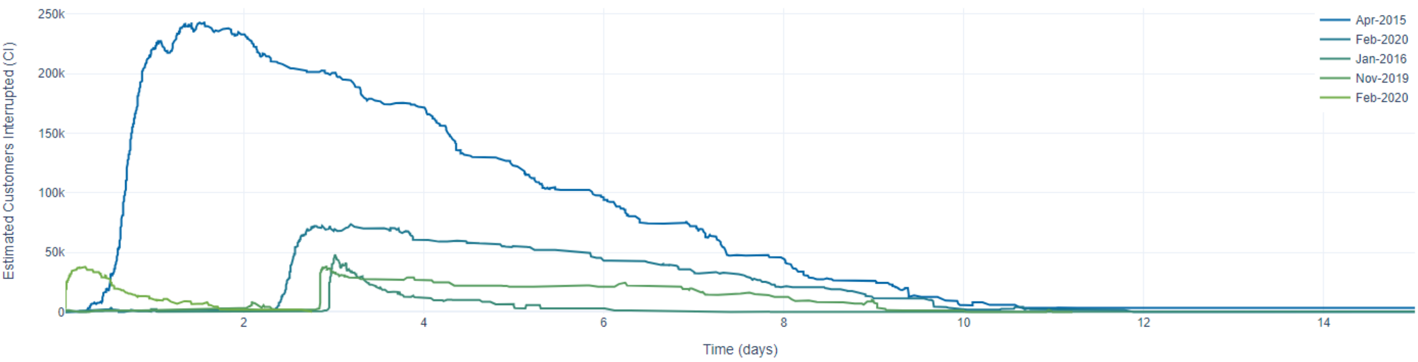


Figure 5: Estimated customers interrupted for the largest five storms in Ausgrid's network since 2008

[9] Australian Bureau of Statistics (2021), Socio-Economic Indexes for Areas, Index Data Cubes download.

3. Resilience is a customer priority

Ausgrid's consideration of targeted climate resilience investment responds to the expectations and priorities of our customers. Customers have remained supportive of climate resilience investments throughout our engagement process, even as cost of living pressures have increased. Our customers have told us they expect Ausgrid to respond to the emerging risks of climate change and have urged us to act now for our most vulnerable communities and customers.

Throughout our community consultations over the last 18 months, investment in climate resilience has been a consistent priority for our customers. The Voice of Community Panel in 2022 asked us to consider these investments according to three prioritisation criteria:

Areas where the biggest increase in outages is expected due to extreme weather	**Areas most impacted by extreme weather**	**Areas where people are vulnerable and less able to cope with impacts**

With these criteria, Ausgrid identified the **Central Coast, Lake Macquarie,** and **Port Stephens** as priority areas for a comprehensive pilot of climate resilience investments.

Deliberative engagement with our customers

Ausgrid chose a deliberative engagement approach to co-design resilience investments with our customers. The engagement design created a transparent feedback loop with our local representative groups in the three LGAs and our Voice of Community panel (Figure 6). This gave us a rigorous mechanism to deeply understand the unique needs of communities facing the localised impacts of climate change and balance these with broader expectations on affordability and efficiency.

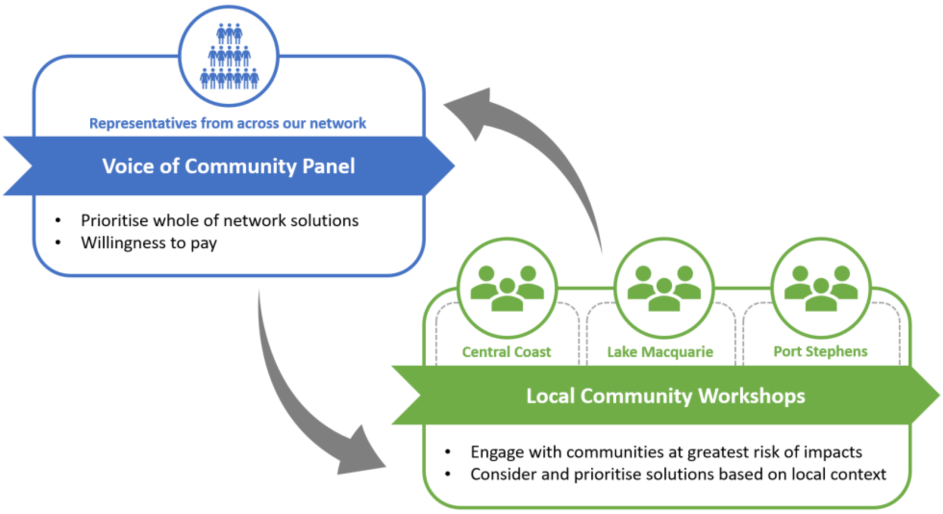


Figure 6: Engagement was designed to ensure Ausgrid delivered on the AER's expectation that customers have been fully informed of different resilience expenditure options and were willing to pay for proposed investments. Local communities (green) considered and prioritised options based on their local needs, the VoC Panel (blue) considered the resilience program as a whole and gave feedback on affordability.

Our deliberative engagement produced bespoke packages of investment to deliver on the unique needs of customers in the Central Coast, Lake Macquarie and Port Stephens as well as our broader customer base (Figure 7). Ausgrid has taken these packages and the solutions in them and developed them into the more efficient, consolidated projects described in this revised business case. Ausgrid has continued to engage with our customers since the draft decision, the outcomes of which are detailed in Attachment 5.5.5: LGA Workshop 4 Outcomes Report.

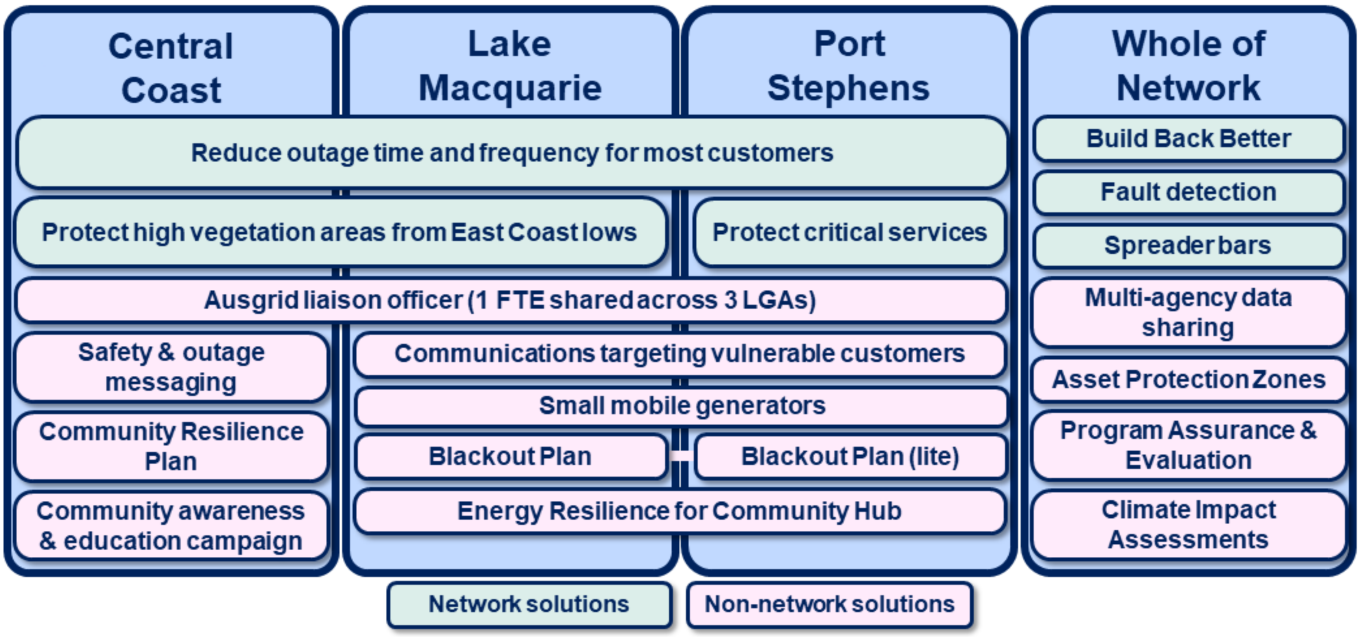


Figure 7: Final packages of solutions for each area, supported by a 'super-majority' of 80% or more participants. Each package includes a mix of complementary network and non-network solutions.


Regulatory Proposal
Jan 23
Feb 23
LGA Workshop 1
Unmet needs
LGA Workshop 2
Options assessment
Mar 23
Apr 23
VoC23 Day 1
Whole of network prioritisation
LGA Extra Session
May 23
May 23
LGA Workshop 3
Trade-offs and prioritisation
Jun 23
VoC23 Day 2
Willingness to pay & prioritisation
Resilience Business Case
Jul 23
Sept 23
Draft Decision
LGA Workshop 4
Update on draft decision and next steps
Oct 23
Oct 23
VoC23 Day 3
Re-test affordability
Nov 23
Revised Business Case
(this document)

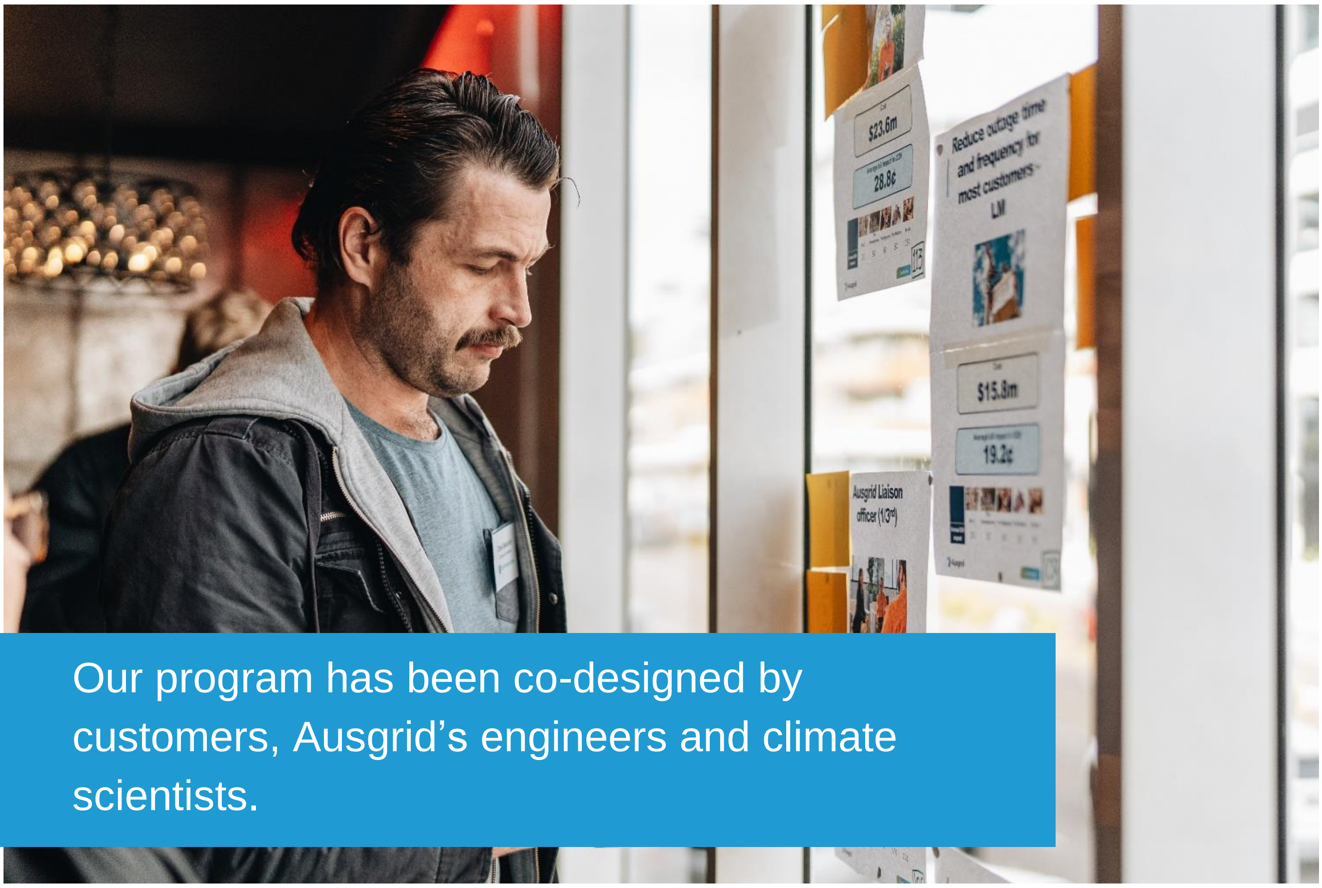
4. Program design

We have taken the carefully considered priorities of our customers and developed these into a cohesive suite of projects that will collectively achieve the program objective. This ensures prudent, efficient investment while delivering on the unique local priorities and needs of our most vulnerable communities.

Ausgrid’s overarching program design holds the objective to maintain current customer and community service outcomes by enhancing the resilience of electricity distribution services in line with the projected growth in risk of disruptive climate events across the period 2024 to 2050.

To achieve this, Ausgrid has identified the need to:

- invest prudently and efficiently, staging investments at the right time to provide resilience to expected climate change related perils whilst avoiding overinvestment; and
- establish systems and processes to engage with vulnerable communities and support their capacity to withstand and recover from climate change related outages; and
- develop corporate knowledge of material climate risks and impacts to inform identification of future potential resilience investment needs.



Our program has been co-designed by customers, Ausgrid’s engineers and climate scientists.

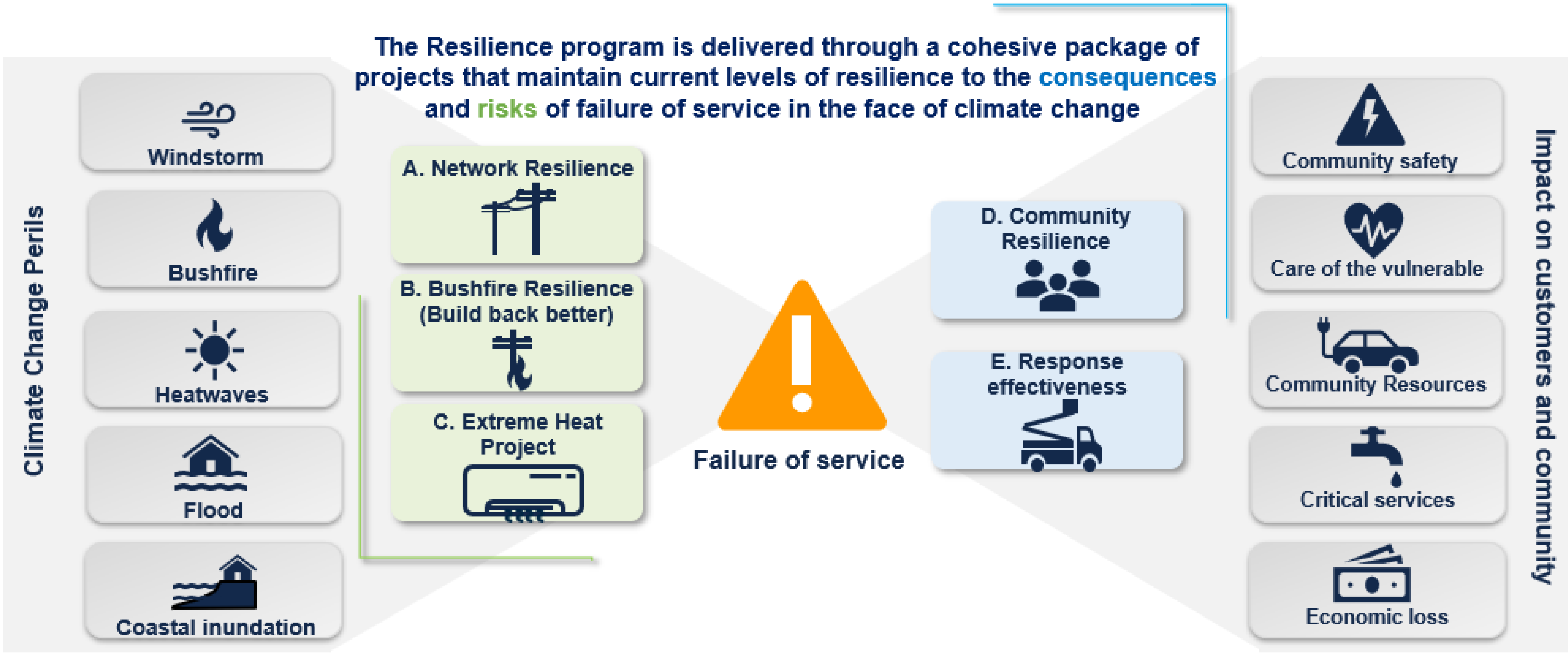
The program objectives are delivered through a cohesive package of projects.

The projects work together to maintain current customer and community service outcomes. The Network, Bushfire and Heat Resilience Projects provide resistance to the wind, bushfire, and heat perils respectively. These projects require large capital investment. The Community Resilience Project enables us to stage this capital investment over four regulatory periods, as it manages the risk of delay for our most vulnerable communities in a way that works for them. When we do have a failure of service, Ausgrid wants to effectively respond, and be partners with other Emergency Service Providers, which we will achieve through Response Effectiveness Project. The trade-offs between resisting impacts from climate change and managing the consequences have been carefully considered by our customers to design the package. To monitor project outcomes and enable adaptive planning, investment in program assurance has been apportioned across each of the projects, ensuring a holistic and balanced review and evaluation of the program against its objectives.

The table below contains the cohesive projects that make up the program, and their objectives.

Project Name	Project objectives
A. Network resilience	Deliver prudent and efficient investment in order to maintain resilience to the expected wind peril to 2050, at current levels.
B. Bushfire resilience	Deliver prudent and efficient investment to maintain resilience to the expected bushfire peril to 2050, at current levels.
C. Heat Resilience	Develop a knowledge base of the heat peril and its potential impacts on Ausgrid's assets, including the need to co-exist with third party green-infrastructure investment, and the needs of vulnerable customers. This knowledge will provide a credible evidence base for community consultation and future potential investment needs.
D. Community Resilience	Ensure vulnerable communities can develop additional capacity over time to withstand and recover from expected climate change related impacts to electricity services to 2050.
E. Response Effectiveness	Maintain the response time for all hazards to 2050, at current levels

Logic of the Climate Resilience Program



A. Network Resilience Project

Project Objective

Deliver prudent and efficient investment to maintain resilience to the expected wind peril to 2050, at current levels.

Key Points

- To balance affordability whilst managing a growing risk profile, these investments are proposed to be staged over 20 years, with only the FY25-29 tranche included in this business case.

How does this revised proposal respond to the draft decision?

- A revised investment case is in Appendix A.
- We have modified analysis to weight climate scenario RCP4.5 at 100%, aligning with other DNSPs.
- Three models have been provided (HV End to End model, Network Top Down model, and LV Spreader Bar Model)
- Six investment options have been compared to ensure that that the proposed solutions provide the greatest net benefits.

	Initiative	Benefits	Opex	Capex
A.1	High Voltage Network Investments in prioritised LGAs of the Central Coast, Lake Macquarie, and Port Stephens	✓ Benefits Cost Ratio is 2.82		$67.39M*
A.2	High Voltage Network Investments in the rest of the network	✓ Benefits Cost Ratio is 4.53[10]		$15.80M
A.3	Low Voltage Network Investments	✓ Benefits Cost Ratio is 1.34		$6.09M
A.4	Substation Protection Zones at 24 additional Major Substations in non-bushfire zones.	✓ Protect all major substations from falling vegetation in high winds.	+($0.49M absorbed)[11]	
A.5	Performance Monitoring and Independent Reviews	✓ Monitors benefits of program against objectives and provides customer and expert scrutiny to build trust.	$0.10M	$0.50M
A.6	Update Climate Risk Assessment	✓ Continue to build transparency of approach	$0.25M	$0.25M
	Total		**$0.35M**	**$90.02M**

*Note: The AER Draft Decision approved $16.7M in capex for local network solutions.

[10] The Combined BCR of A1 and A2 for the High Voltage Network resilience is 3.14.
[11] These are costs required for the program that Ausgrid expects to be able to absorb, and so are not included in this business case.

B. Bushfire Resilience Project (Build Back Better)

Project Objective

Deliver prudent and efficient investment to maintain resilience to the expected bushfire peril to 2050, at current levels.

Key Points

- Uses a build back better approach to upgrade to bushfire resilient poles in bushfire prone areas. This leverages existing replacement cycles and includes only the uplift costs.

How does this revised proposal respond to the draft decision?

- A revised investment case is in Appendix B.
- The prudency and efficiency requirements are demonstrated by comparing 3 options in the investment case.
- We have more clearly articulated that capability and process uplift is a prerequisite to enable build back better methods.

	Initiative	Benefits	Opex	Capex
B.1	Build back better with bushfire resistant poles (upgrade costs only)	✓ Reduces the costs of upgrading to bushfire resilience by leveraging normal replacement cycles and including uplift costs only.		$6.00M*
B.2	Establish standards and processes to enable build back better	✓ Is a critical enabler to building back better program described in B.1.	$0.20M + ($0.30M[12] absorbed)	$0.60M
B.3	Establish bushfire resistant pole inventory	✓ One off cost to establish inventory.		+ ($0.40M absorbed)[12]
	Total		**$0.20M**	**$6.60M**

*Note: The AER Draft Decision approved $6M in capex for bushfire resilient (composite) poles

[12] These are costs required for the program that Ausgrid expects to be able to absorb, and so are not included in this business case.

C. Extreme Heat Resilience Project

Project Objective

Develop a knowledge base of the heat peril and its potential impacts on Ausgrid's assets, including the need to co-exist with third party green-infrastructure investment, and the needs of vulnerable customers. This knowledge will provide a credible evidence base for community consultation and future potential investment needs.

Key Points

- Research results will be shared with other DNSPs, stakeholders and the public.

How does this revised proposal respond to the draft decision?

- Responds to stakeholder feedback heard at the AER's Predetermination Conference
- An investment case is in Appendix C.
- The proposal is prudent and efficient by comparing 3 options for each initiative
- That the approach has been tested with customers

	Initiative	Benefits	Opex	Capex
C.1	Complete research to understand the impacts of extreme heat on Ausgrid's assets.	✓ Will gain an understanding of asset limitations to inform future substation and network strategies.	$1.10M	
C.2	Complete research to understand the impacts of extreme heat on vulnerable and life support customers to inform our future servicing strategies.	✓ Will gain an understanding of how life support customers will need to be considered in future strategies.	$0.40M	
C.3	Complete research to quantify benefits to Ausgrid of participating in Urban Heat Projects. Coinvest with councils in ABC cables for urban cooling priority precincts to enable our infrastructure to coexist with the green infrastructure up to $6M.	✓ Will enable the NSW Government's Urban Heat Priority projects to progress in communities that are most vulnerable to heat and enable monitoring of real-life benefits.	$0.25M +($0.20M absorbed)[13]	$6.00M
	Total		**$1.75M**	**$6.00M**

[13] These are costs required for the program that Ausgrid expects to be able to absorb, and so are not included in this business case.

D. Community Resilience Project

Project Objective

Ensure vulnerable communities can develop additional capacity over time to withstand and recover from expected climate change related impacts to electricity services to 2050.

Key points

- Agile, cost-effective investments to increase communities' capacity to cope with impacts from residual climate risk and avoid over or under investment in capital solutions.
- Community designed investments designed to meet local needs and deliver on customer expectations.

How does this revised proposal respond to the draft decision?

- The investment case for this project is in Appendix D
- This project is directly informed by Ausgrid's deliberative engagement described in Section 3 above.
- These initiatives are driven by community value. Through our deliberative engagement process, customers have considered the costs and benefits of a range of options and thought carefully about affordability in their prioritisation of these.
- To test this combination of initiatives delivers greatest net benefit, it has been considered alongside three other feasible options

	Initiative	Benefits	Opex	Capex
D.1	Targeted energy resilience communications to ensure customers are prepared for outages	✓ Mitigates residual risk of customer impacts from risk growth not addressed by network investments. ✓ Cost-effective and flexible way to support program objective to maintain resilience, in a way that aligns with customer expectations and need. ✓ Proper investment now will establish high quality resources and processes that can be rolled out more efficiently in future regulatory periods. ✓ Builds an evidence base to inform future decisions, for example opex/capex trade-offs.	$1.85M	
D.2	Flexible energy sources like small mobile generators and generator-ready connection points at local hubs			$0.21M
D.3	Liaison and planning to ensure coordination, leverage existing functions and resources to benefit energy resilience and ensure new investments are appropriately targeted and delivered efficiently.		$1.20M +($0.10M absorbed)[14]	
D.4	Performance Monitoring and Independent Review		$0.10M	
	Total		**$3.15M**	**$0.21M**

[14] These are costs required for the program that Ausgrid expects to be able to absorb, and so are not included in this business case.

E. Response Effectiveness Project

Project Objective

Maintain the response time for all hazards to 2050, at current levels

Key points

- Works collaboratively across organisational boundaries
- Promotes the use of data for better response decision making and effective deployment of resources

How does this revised proposal respond to the draft decision?

- A revised investment case is in Appendix E.
- Top Down and Bottom-up models have been provided for Response Effectiveness
- The greatest net benefits requirement is demonstrated by comparing 3 options in the investment case.

	Initiative	Benefits	Opex	Capex
E.1	Multi-Agency Coordination	✓ Exchange of information with emergency services partners for better situational awareness and decision making.	$0.35M	$3.50M*
E.2	Fault Detection and Location Sensors	✓ Benefit Cost Ratio of 3.18 to ensure safety, and security of supply by managing the risk that there are not enough operational resources to respond	+ ($0.40M absorbed)[15]	$7.29M
E.3	Performance Monitoring and Independent Review	✓ Monitor effectiveness of solutions	$0.05M	$0.10M
	Total		**$0.40M**	**$10.89M**

*Note: The AER Draft Decision has already approved $3.0M in capex for data sharing program for multi-agency response.

[15] These are costs required for the program that Ausgrid expects to be able to absorb, and so are not included in this business case.

5. Responding to the AER's draft decision

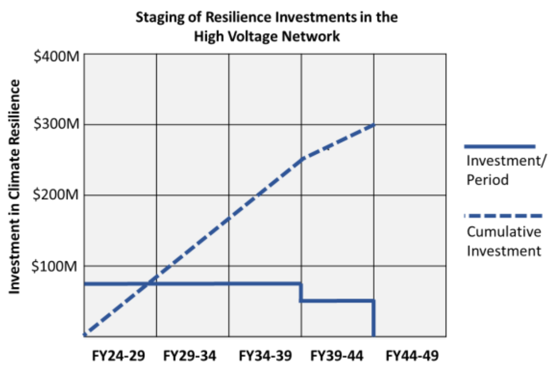
To guide our appraisal of the program and ensure we have responded to the AER's feedback in the Draft Decision, we have considered our program against a series of key questions. These cover our regulatory obligations, customer preferences and economic priorities to ensure a balanced, efficient and cohesive program.

Is the proposed expenditure based on the option that is likely to achieve greatest net benefits of the feasible options considered?

We are proposing investments that unlock greatest net benefits in FY25-29, and investments that will develop our knowledge base to continue to identify prudent and efficient investment levels in FY30-34 & beyond. When assessing greatest net benefits our options analysis included consideration of the feedback we received from customers on the importance of affordability. This led us to smooth our planned investment over four regulatory periods. By implementing our climate resilience program over four regulatory periods, we can adaptively address the incremental growth in climate risk over time while balancing customer bill impacts.

Staging of investments over four regulatory periods

For example, we have staged our proposed High Voltage Network Resilience Program over four regulatory periods, proposing \$83.20M in FY25-29 of a total of \$302M required to address risk growth. We achieve a Benefit Cost Ratio of 3.14 with a Net Present Value of \$178.4M by targeting investments that deliver greatest net benefit first.



Building evidence to inform future decisions

In FY25-29 we are investing in quantifying the evidence to make informed decisions in FY30-34 and beyond. For example, we are establishing a body of evidence of how extreme heat will impact our assets and vulnerable customers, enabling the best adaptation steps to occur in the next period and avoiding over or under investment in future periods.

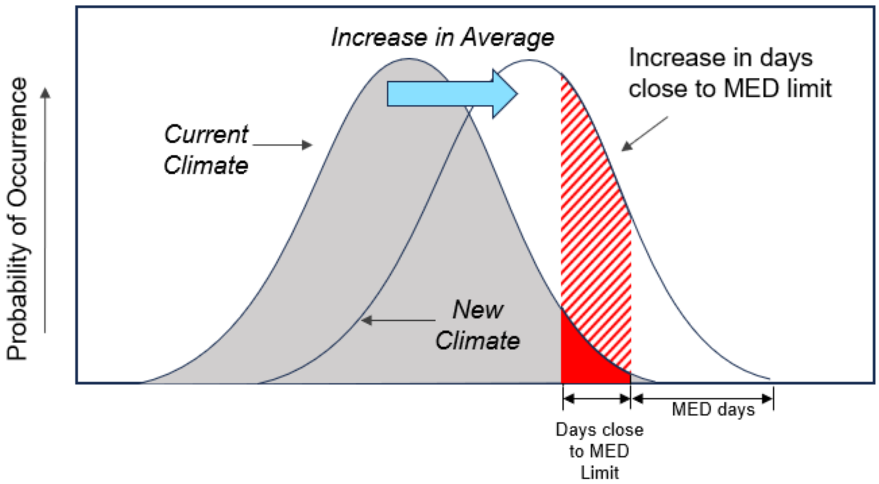
Comparison of options

A range of feasible options has been tested for each project (see Investment Cases in Appendices A-E) to ensure that the proposed option delivers the greatest net benefit against the program objectives.

	Ausgrid has also collaborated with other resilience actors to ensure that our investments complement and build on those of other contributors to maximise the benefit that the community can receive from the investments and are appropriate to our role as a DNSP. Collectively these factors ensure that the proposed investments promote the long-term interests of consumers with respect to price, quality, safety, and security of supply of electricity services.
Is there a causal link between the proposed resilience expenditure and the expected increase in extreme weather events?	In response to the AER's feedback to better demonstrate the causal link between forecast increases in disruptive weather events and the proposed resilience expenditure, for network investments addressing the wind peril Ausgrid has: • Applied 100% weighting to the mid-range climate scenario (RCP4.5) to align with other DNSPs. • Developed an End-to End to model that transparently models risks to the high voltage network from high wind risks bottom-up. This is a probabilistic model that inputs global wind climate models, simulates conductor and pole failure, and identifies optimal resilience investments to maintain service outcomes at current levels. By taking a probabilistic approach, our modelling accounts for the inherent uncertainties associated with the timing, location, and scale of the impact of extreme weather events. • Used this model to establish a clear causal link between our investments and the growth in climate risk by: o Using 3 globally recognised climate models to input forecasts for East Coast Low (ECL) frequency and sustained maximum wind, and applying statistical distributions to model 3 second wind gusts, as recommended to us by climate scientists. o Input this to calculate conductor failure and related faults (applying normally distributed vulnerability curves) and calibrated so that a 1-in-20 year event results in pole failures equal to the ECL in 2015. The wind data is applied at a post code level to determine impacts at a feeder level. o Calculating the costs and benefits of different combinations of covered conductor (CCT), reclosers and undergrounding for each HV feeder in Ausgrid's network and selecting combinations that reduce the most risk efficiently. • Tested the outputs from the End-to-End model using a Top-Down approach using methods provided by the AER.

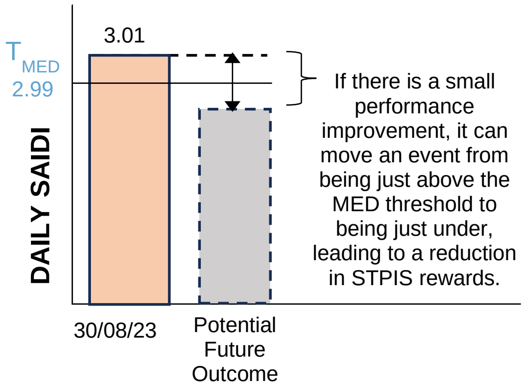
Do the investments maintain current customer and community service outcomes in line with the projected growth in risk of disruptive climate events across the period FY25-50?	The disruptive climate events are expected to grow incrementally over the period FY25-50, so Ausgrid is proposing to stage investments in a way that maintains overall resilience across the period. For the different perils this is approached differently: • For wind, we have staged network resilience periods across four regulatory periods. • For bushfire, we are proposing a build back better approach to take advantage of normal replacement activities so that only the incremental costs are incurred by the program, reducing the cost of building bushfire resilience up to 85% compared to proactive approaches. • For heat, we are investing in FY25-29 in building our knowledge base to avoid over or under investment in FY30-44 and beyond. As we are staging the required network investments over four regulatory periods, there is a risk of investing too late. We are managing this risk through our Response Effectiveness and Community Resilience projects. The Community Resilience Project manages the risk of delay for our most vulnerable communities – they have co-designed packages of initiatives that they know will work to protect their communities. In this way, the projects in the Climate Resilience Program work as a package to manage the risk of climate change, that together maintain current customer and community services outcomes in line with the projected growth in disruptive climate events across the period FY25-50.
Do the investments address the needs of the most vulnerable?	Targeting the most vulnerable was one of the customer criteria that informed Ausgrid's prioritisation of Central Coast, Lake Macquarie and Port Stephens for targeted investment. These LGA's over-index on a range of vulnerability metrics, summarised by ABS Socio-economic Indexes for Areas 2021 data (see Section 3, Figure 4). Through our deliberative engagements, each group has considered the diverse needs of their communities and prioritised a mix of community resilience solutions that complement network investments and target additional resilience for especially vulnerable customers (e.g. communications specifically designed for and targeted at cohorts like life support customers). Our network investments also support the needs of the most vulnerable first, by prioritising faster delivery faster delivery in these especially vulnerable LGA's (risk buy down by 2035 vs 2044 for the rest of the network).
Have customers been fully informed of options and do the investments reflect	Ausgrid worked collaboratively with our customers through the deliberative engagement process described in Section 3 to design the proposed Climate Resilience Program. A deliberative approach ensured customers had the time and resources necessary to understand how Ausgrid operates, our role in the energy

community preferences?	supply chain and the range and nuance of options to address climate change impacts. By establishing a 'super-majority' threshold of 80% support for solutions and testing affordability at multiple points, we're confident that the investments reflect community preferences, and the proposal is driven by genuine engagement.
Do the investments balance the long and short term needs of customers?	Ausgrid has staged the network investments that are required to maintain current customer and community service outcomes over four regulatory periods. The staging of investments seeks to balance bill impacts over multiple regulatory periods whilst still adapting fast enough to offset the growth in risk from disruptive climate events.
Are the proposed investments deliverable?	Ausgrid is confident to deliver the Climate Resilience Program. We have been proactive in FY25-29 planning our resources and worklists to ensure that for FY25-29, our resourcing is adequate to meet delivery. We are increasing and optimising Ausgrid's workforce via key initiatives and continue to optimise our workforce through multi-skilling/cross skilling initiatives to enable redeployment of resources to support the work plan where practicable. We are also expecting transformation programs will deliver further productivity benefits as we progress through the FY25-29 regulatory period.
Should there be adjustments for STPIS?	Ausgrid considers that no adjustments are necessary to the STPIS Performance targets. Although day-to-day reliability has not been targeted in this business case, it has the potential to be influenced by some of these investments, but it is also likely to be negatively impacted by climate change. The diagram below shows that the likelihood of a climate event close to, but below, a MED-day will increase in frequency even more than for MED days, putting pressure on reliability if not mitigated.



There are also potential issues with the Major Event Day (MED) exclusion rule. As climate events are typically large in scale, they often result in daily performance that is near the Major Event Day Threshold (T_{MED}). Counterintuitively, performance measures may actually decline as days that would have been excluded due to being MEDs may now be below the threshold due to the interventions.

As an example, on 30 August 2023, Ausgrid experienced a daily SAIDI of 3.01. The threshold at the time was 2.99. A marginal reduction in daily SAIDI would have in fact added almost 3 minutes to the performance measure. Due to the complexity and sensitivity of these interactions, it is not possible to determine whether the resulting performance measures will increase or decrease as a result of the program.



In any case, the benefits of the investments in this business case will only begin toward the end of the period, as it takes time for planning and construction, and then for benefits to be realised. So, any adjustment in this period is not appropriate, and future adjustments likely to be adequately addressed by the normal STPIS target setting mechanism.

For these reasons, Ausgrid does not consider that there is a need to adjust the STPIS. To ensure this can be validated and refined for future regulatory periods, we remain committed to providing transparency to the AER and customers, through monitoring and independent review of the program (included as a line item in the investment case).

How is realisation of the program benefits being assessed?

As the Climate Resilience Program is a new category of investment, Ausgrid recommends transparent performance monitoring and independent reviews, both by industry experts and through continuing engagement with the community. The intention is to develop processes that enable us to adapt to changing circumstances, evolving science and learnt experience from climate events, to ensure that we continue to serve the long-term interests of consumers.

Investment in program assurance has been apportioned across each of the projects under the category *"Performance Monitoring and Independent Reviews"*, ensuring a holistic and balanced review and evaluation of the program against its objectives and intended benefits.

Ongoing customer and stakeholder engagement will build trust, transparency, and accountability in how investment decisions are made and applied.

	We welcome the continued involvement of the AER through the period as we continue to navigate the challenge of climate change.
Is an opex step change justified?	We have responded to the AER's feedback in the Draft Decision to demonstrate where proposed costs are not capable of being otherwise managed through our forecast opex and are additional to BAU. We've done more work to detail costs and identify where it's possible to absorb costs. Examples of costs we have absorbed are: • \$0.49M in strategic vegetation management for 24 substations • \$0.90M in opex costs related to the implementation of new investments, including training, coordination and processes • \$0.35M for community resilience planning and uplift in outage messaging Market testing and scope refinement has delivered \$0.9M in cost reductions from new efficiencies. In response to concerns raised by stakeholders at the AER Predetermination Conference, we have included a new heat resilience program (\$1.75M). There remains \$5.85M across the resilience program that are new costs driven by climate change (major external factor) that cannot be absorbed into forecast opex without compromising deliverability and undermining our capacity to deliver a cohesive program that meets customer expectations and maximises long-term benefit. Climate change will continue to drive new costs not reflected in our forecast opex across most or all aspects of our business. These cost pressures are also not captured in the output and real price growth factors of the opex forecasting approach.

6. Our Revised Forecast

Our Climate Resilience Program has been developed to promote the long-term interests of consumers, and we consider the associated forecast for the FY25-29 is the prudent and efficient amount required to meet the capital expenditure objectives in the context of a changing climate.

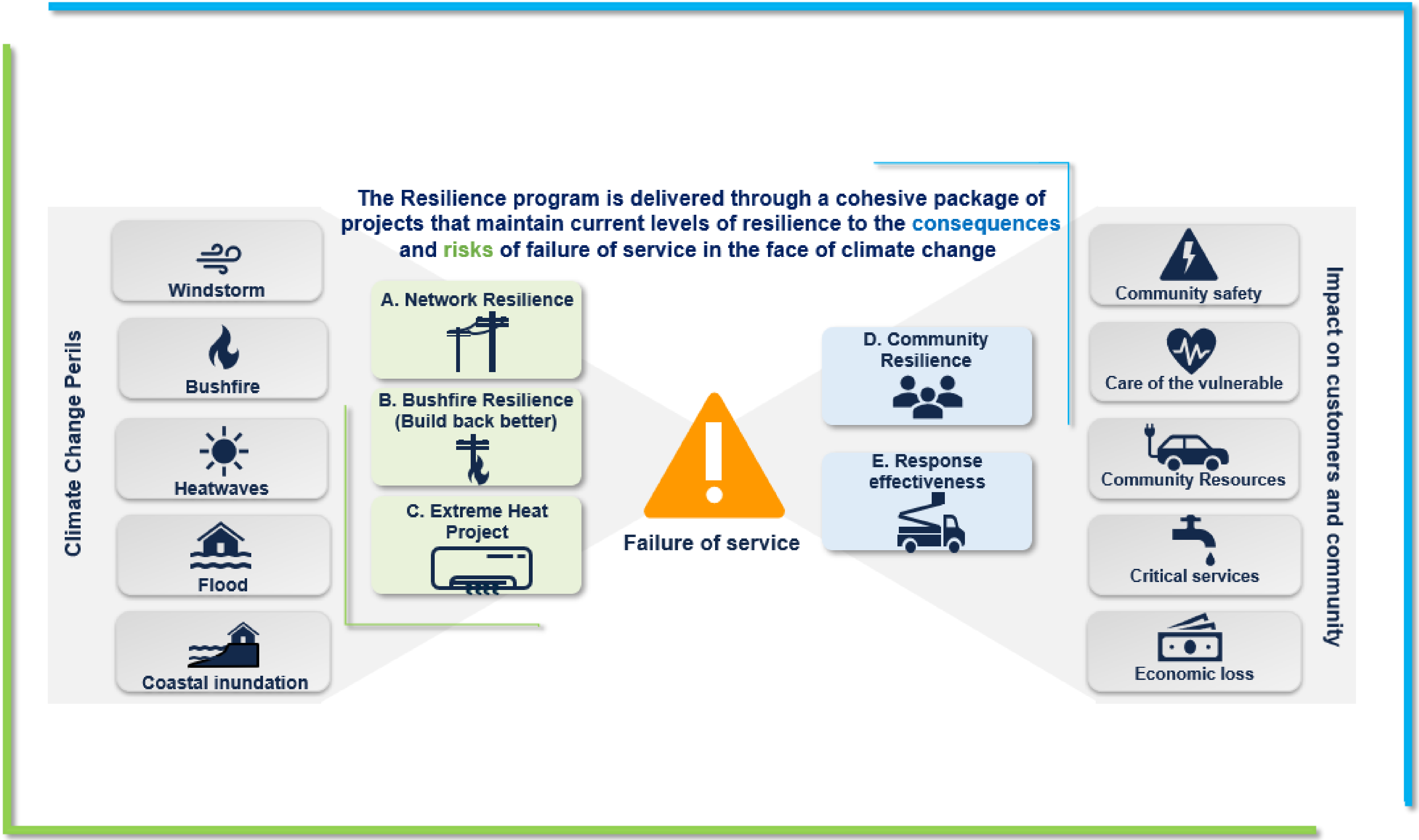
Ausgrid's encourages the AER to consider this Climate Resilience Program in its entirety, because the projects work together to promote the long-term interests of consumers with regard to price, safety, quality, and security of supply.

The package of projects allows us to:

- ✓ Meet the program objective, to maintain current customer and community service outcomes y enhancing the resilience of electricity distribution services in line with the projected growth in risk of disruptive climate events across the period of FY25-50.
- ✓ Meet Ausgrid's obligations under the SOCI Act to identity and, so far as it is reasonably practicable to do so, minimise material climate change-related risks.
- ✓ Balance the priority that customers place on resilience with the current cost of living pressures by staging investments and managing the risk of delay by protecting the interests of the most vulnerable through community resilience initiatives.
- ✓ Is economically prudent and efficient, with the projects with the highest return on investment delivered in the first regulatory period.
- ✓ Balances the needs of today's customers with those of future customers
- ✓ Enable and promote learning and adaptive cycles to ensure so that we can continue to make prudent future resilient decisions, and actively share learnings with the AER and other DNSPs.

Ausgrid welcomes continued engagement with the Australian Energy Regulator throughout the regulatory period to continue to build transparency of our approach.

Summary of Climate Resilience Program



A. Network Resilience Project

The objective is to deliver prudent and efficient, no-regrets investment in order to maintain resilience to the expected wind peril to 2050, at current levels.

A. Network Resilience

Executive Summary

Damaging winds can result in widespread conductor failure and related faults in Ausgrid's network, including from vegetation branches falling or blowing in. Historically, windstorms have been the climate peril that has affected Ausgrid's network the most, with impacts concentrated along the coast. To determine prudent and efficient investment in network resilience to maintain our climate resilience to the wind peril to 2050, Ausgrid has engineered an End-to-End model to assess risk and identify the option that delivers greatest net benefit in FY25-29. We have balanced investments in resilience with current cost of living pressures and propose to:

- ✓ Maintain High Voltage Network resilience with $83.18M of capex (BCR 3.14)
- ✓ Maintain Low Voltage Network resilience with $6.09M of capex (BCR 1.3)

NOTE: The AER draft decision has already approved $16.7M in local network solutions. This amount is included within the total proposed investments described below.

Investment objective

Deliver prudent and efficient investment in order to maintain climate resilience to the expected wind peril to 2050, at current levels.

Climate scenarios modelled

RCP4.5 (100% weighting).[16]

Models supplied to support this investment case

Ausgrid has supplied the modelling used to identify the required investments. These models are:

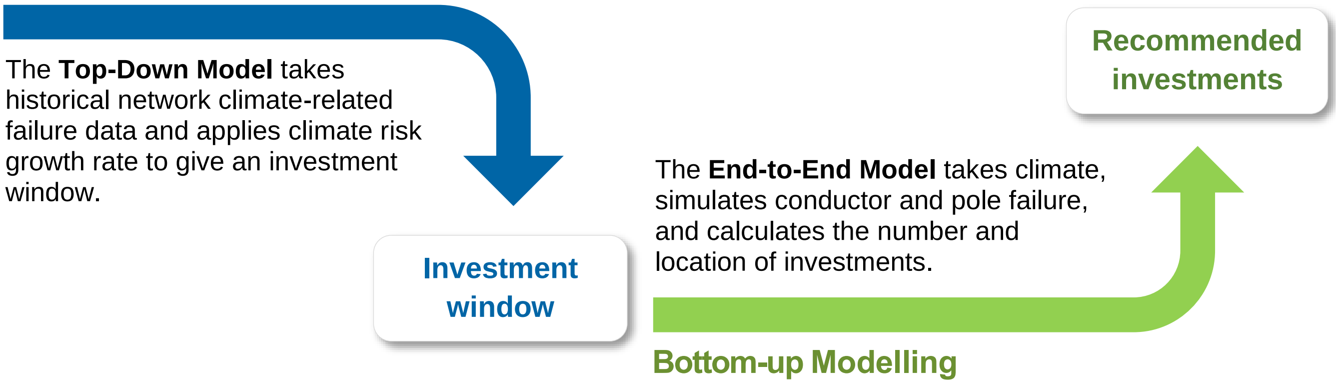
- **Climate Resilience Model 1 – HV End to End**: This is a bottom-up model used to identify optimal investments in HV Network in both the vulnerable LGAs and the rest of the network. It is called the End-to-End model because it takes global climate models, simulates conductor failure and related faults, and calculates investments required to maintain resilience.
- **Climate Resilience Model 2 – Network Top Down:** This model is adapted from the model developed by the AER to inform the Draft Decision. It is used to verify the outputs of Ausgrid's End-to-End model.
- **Climate Resilience Model 3 – LV Spreader Bar**: This model is used to identify optimal investments for spreader bars in the Low Voltage Network.

[16] Our climate scientists recommended that we provide a higher weighing to RCP8.5 and have provided those recommendations as part of Information Request IR048. We have acknowledged the AER's feedback that other DNSPs are applying RCP4.5 and aligned with this.

Risk 1: High Voltage Network is impacted by high wind (both in the vulnerable LGAs and in the rest of the network)

To quantify the change in risk to Ausgrid's High Voltage Network from the wind peril to 2050, Ausgrid has utilised a Top-Down model to determine the total investment window, and a bottom-up End-to-End model to determine the quantum and location of investments.

Top-Down Modelling

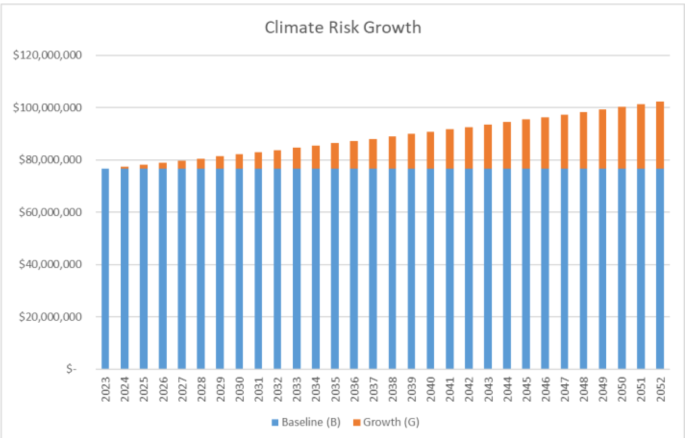


Top-Down model to determine investment window

The AER developed a Top-Down model to inform its Draft Decision. Ausgrid has adapted and refined this for the Top-Down model supplied with this revised business case. The model takes the historical annual average outage cost from climate related events ($76.6M year related to storms) and grows the risk at 1% per year to 2050 to give a total risk growth of $23.6M. This is then multiplied by the Annual Benefit Multiplier of 15 to provide a total capex window of $354M.

Growth in risk from Wind Peril at 2050 = $23.6M

Limit of capex available to mitigate the risk = $23.6M x 15 = $354.0M



S = **$23.6M**

Total Capex = **S** x Annual Benefit multiplier
= $23.6M x 15
= $354M

Figure A1: Baseline risk (based on current levels) is shown in blue, risk growth to 2050 in orange.

The objective of this investment case is to maintain climate resilience to the expected wind peril to 2050, at current levels. The means that we need to increase resilience to mitigate the risk growth (orange bars) shown in Figure A1 above, or $354M by 2050.

End-to-End Model to identify optimal asset investments

Ausgrid developed an End-to End model to understand the risks to the high voltage network from the wind peril from the bottom-up. The model enables each Local Government Area within our operating area to be considered separately, so we can assess different investment strategies for the vulnerable LGAs of Central Coast, Lake Macquarie and Port Stephens. These LGAs were prioritised based on criteria set by our Voice of Community Panel in 2022 (Section 3), namely their high historical exposure to climate outages and increased vulnerability (Figure 4, Section 2) and exposure to increased climate risk (Section 2, p. 9).

Inputs and Assumptions to the End-to-End Model

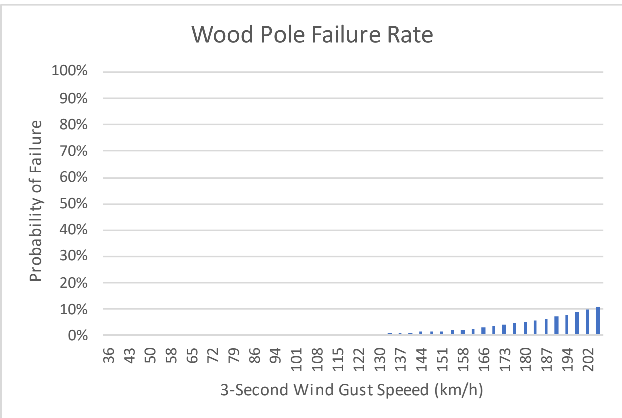
Global Climate Models

The global climate models used were recommended by Risk Frontiers and are shown below.

Model Code	Scenario ID	Model Name
MOHC-HadGEM2-ES	26A	Met Office Hadley Centre (MOHC) HadGEM2-ES
MPI-M-MPI-ESM-LR	26B	Max Planck Institute Earth System Model
NCC-NorESM1-M	26C	Norwegian Climate Centre (NCC) NorESM1-M
ACCESS1-0	45A	Australian Community Climate and Earth System Simulator Coupled Model
ACCESS1-3	45B	Australian Community Climate and Earth System Simulator Coupled Model
CCCma-CanESM2	45C	Canadian Earth System Model
ACCESS1-0	85A	Australian Community Climate and Earth System Simulator Coupled Model
ACCESS1-3	85B	Australian Community Climate and Earth System Simulator Coupled Model
CCCma-CanESM2	85C	Canadian Earth System Model

Vulnerability of Conductors and Poles[17]

The vulnerability of poles and conductors are each considered separately by the model. Both failure modes have probabilistic failure simulated using a normal distribution. These distributions have been calibrated to historical losses in Ausgrid's network. The vulnerability curves are shown below, and more detail is available in the model.



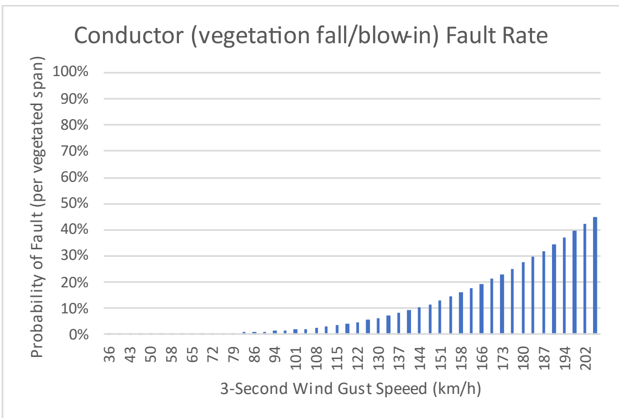


Figure A2: Vulnerability curves for pole failure and conductor faults

[17] **Note:** These vulnerability curves are not the same as those used in the previous KPMG model and discussed in the EMCA report.

Solution effectiveness:

The model calculates the costs and benefits of different combinations of covered conductor (CCT), reclosers and undergrounding for each HV feeder in Ausgrid's network. The benefits for combinations that contain a recloser utilise outputs of Ausgrid's Reliability Model, which determines the percentage reduction in unserved energy for an average fault from adding a recloser at various positions along a feeder. Benefits from CCT and undergrounding are based on the effectiveness of the solution (detailed in the table below) and the distance of overhead conductor that is replaced. For each feeder, the combination that reduces the most risk while also having the highest benefit-cost-ratio is selected as the preferred solution.

Solution	Effectiveness
Covered Conductor (CCT)	CCT has no effect on failure of poles during windstorms and the repair and unserved energy costs that result from pole failures. CCT has no effect on unattributed faults (mostly lightning strikes) during windstorms and the unserved energy costs that result from these faults. CCT is assumed in the modelling to mitigate 75% of faults caused by vegetation blow-in and fall-in. This is a low-end estimate of the percentage of vegetation related faults where a branch causes the conductors to come together and clash, causing an outage, but where the branch can be easily removed by an Ausgrid crew (if it does not clear on its own). In these cases the covered conductor would prevent the clash occurring and the branch would sit on the conductors. The remaining 25% are cases where larger branches cause the conductors to break/fall to the ground, which cannot be mitigated by covering the conductor. CCT also prevents the vast majority of faults caused by conductor clashing in high speed winds, which is not explicitly modelled but is bundled with vegetation caused faults (it is often not possible for inspectors to differentiate between these causes, especially during major events when time to inspect individual faults is limited). For each avoided fault 25% of the conductor repair cost is avoided (as these faults would have required a ground crew inspection only and not a conductor re-stringing) and all of the unserved energy costs. The effective of CCT applied by Ausgrid for the wind peril is less than that published in literature. In 2022, Pacific Corp stated that CCT was 90% effective against the wind peril[18].
Reclosers	Reclosers have limited or no effect on asset repair costs caused by asset failures during windstorms but can reduce the unserved energy costs caused by faults of all causes. Reclosers only provide a benefit to customers upstream of the recloser when a fault occurs downstream of the recloser – customers downstream of the recloser will not receive any benefit. Recloser effectiveness at reducing unserved energy costs is estimated for each feeder using Ausgrid's Network Reliability Model. The effectiveness of the recloser depends on existing reclosers on the feeder, the location of the proposed recloser, the location of loads along the feeder and branching of the feeder. Considering the above, the average effectiveness of adding one new recloser to an 11kV feeder in Ausgrid's network is an average 49% reduction in unserved energy caused by faults.
Under-grounding	Undergrounding mitigates all risks caused by windstorms. This has been modelled as a 99% reduction in repair and unserved energy costs. The remaining 1% is retained to account for cases where storm damage disrupts the cable, such as uprooting of trees breaking cables.

[18] Pacific Corp (2022), 2022 WMP Update Progress Report, pp.11-12.

High Voltage Network End-to-End model logic

This model is called the End-to-End model because it takes global wind climate models, simulates conductor failure and related faults, and calculates the number and location of investments required to maintain resilience. It is a probabilistic model. A summary of the logic of Ausgrid's End-to-End is explained in the adjacent flow chart.

The model compares different combinations of CCT, reclosers and undergrounding to ensure the proposed investments are optimised.

Note: a more detailed flow chart is supplied within the End-to-End model documentation.

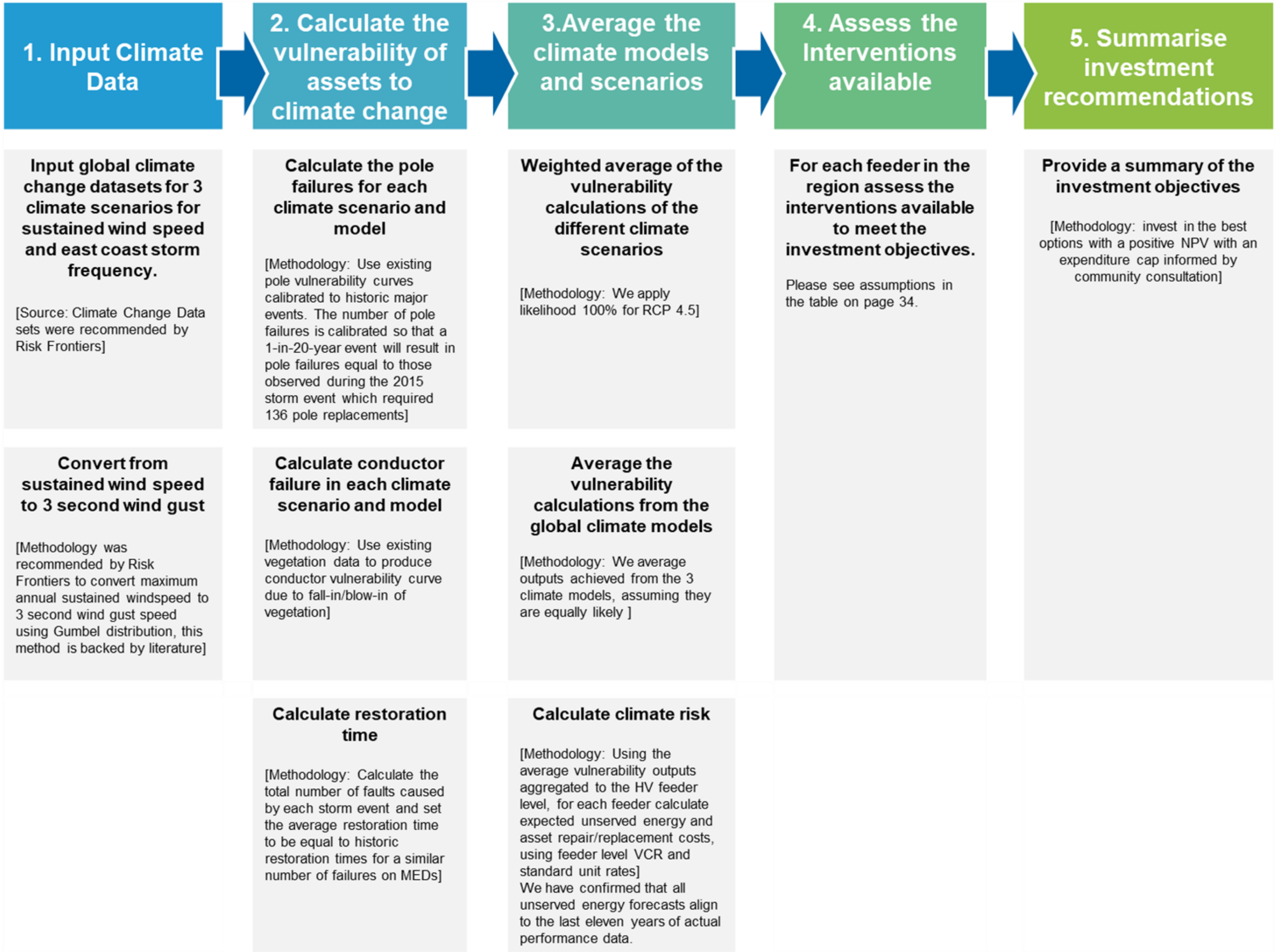


Figure A3: High Voltage Network End-to-End model logic

Model outputs

The climate model determines that the probabilistic increase in speed of maximum wind gusts and rising frequency of major storm events to 2050 due to climate change, when combined with Ausgrid network and load data, results in a ~1% per annum increase in asset repair and unserved energy costs across Ausgrid's 11kV distribution network. The model determines that $302M (FY24 real) is required in the High Voltage Network to maintain current customer and community service outcomes by enhancing the resilience of electricity distribution services in line with the projected growth in risk of disruptive climate events across the period FY25-50.

Options identification and assessment

Ausgrid has analysed the base case (do nothing additional) plus six different feasible options to deliver the program objective.

The options differ in the way they consider:

- The cadence of investment. Some options involve investing upfront in FY25-29 to maintain resilience to 2050, and some build resilience over 20 years, managing affordability while keeping pace with risk growth.
- The preference given to vulnerable LGAs or the projects with the highest BCRs, regardless of location.

Option			Investment Profile						Economic Metrics			
	Description	Capex Proposed in FY24-29	WHERE	FY24-29	FY29-34	FY34-39	FY39-44	FY44-49	NPV (FY25-29)	BCR (FY25-29)	NPV (FY25-49)	BCR (FY25-49)
A	Base Case - No additional investments in resilience	$0.00m	LGA	0	0	0	0	0				
			Other	0	0	0	0	0				
			Total	0	0	0	0	0	0	0	0	0
B	Upfront Investment	$301.84m	LGA	137	0	0	0	0				
			Other	165	0	0	0	0				
			Total	302	0	0	0	0	376	2	376	2
C	Clear LGA risk before starting in rest of the network	$136.60m	LGA	137	0	0	0	0				
			Other	0	55	55	55	0				
			Total	137	55	55	55	0	151	2	333	2
D	Do all projects with a BCR > 2 in first period	$280.06m	LGA	123	13	0	0	0				
			Other	157	8	0	0	0				
			Total	280	22	0	0	0	372	2	376	2
E	Seek Bill Balance across four regulatory periods. Do highest BCR projects first	$87.54m	LGA	40	44	21	32	0				
			Other	48	45	41	31	0				
			Total	88	90	62	63	0	264	4	352	2
F	Seek Bill balance across 4 regulatory periods. Clear LGA risk by 2035	$83.18m	LGA	67	67	2	0	0				
			Other	16	16	81	52	0				
			Total	83	83	83	52	0	178	3	330	2
G	Hybrid between E and F	$85.37m	LGA	54	56	11	16	0				
			Other	32	31	61	42	0				
			Total	85	86	72	58	0	222	4	344	2

Analysis of Options

The options were compared against the selection criteria (detailed on p.38):

- Option A is ruled out because it does not meet the program objective to maintain resilience at current levels.
- Options B, C and D are ruled out because the investment is higher than what was tested with our customers.
- Option F is preferred over Options E and G as it better meets the needs of the priority LGAs, as per the customer engagement preferences.

Option			Assessment Criteria Rank							Comments
	Description	Capex Proposed in FY24-29	Maintain climate resilience to 2050 at current levels?	Balances current cost of living concerns	Meets customers objectives to prioritise LGAs	NPV (FY25-29)	BCR (FY25-29)	NPV (FY25-49)	BCR (FY25-49)	Comments
A	Base Case - No additional investments in resilience	$0.00m	7	1	7	7	7	7	7	Rejected due to not meeting the program objectives
B	Upfront Investment	$301.84m	1	7	1	1	5	1	6	Rejected due to affordability concerns
C	Clear LGA risk before starting in rest of the network	$136.60m	3	5	1	6	6	6	4	Rejected because of affordability concerns
D	Do all projects with a BCR > 2 in first period	$280.06m	2	6	5	2	4	1	5	Rejected due to affordability concerns
E	Seek Bill Balance across four regulatory periods. Do highest BCR projects first	$87.54m	4	2	6	3	1	3	1	Rejected as it does not weight the needs of the LGAs
F	Seek Bill balance across 4 regulatory periods. Clear LGA risk by 2035	$83.18m	4	2	3	5	3	5	3	Preferred solution as it provides a balance across all the selection criteria
G	Hybrid between E and F	$85.37m	4	2	4	4	2	4	2	Reserve solution. Does not meet the needs of the vulnerable LGAs as well as Option F, but has a greater NPV and BCR in this period

Assessment Criteria

The assessment criteria used to compare options is shown in the table below. These seek to ensure that investments are correctly timed by considering both risk growth, customer affordability and the vulnerabilities of LGAs.

Assessment Criteria	Exceeds criteria (Green in assessment table)	Meets criteria (Blue in assessment table)	Does not meet criteria (Orange in assessment table)	Rank
Does the solution maintain customer and community service outcomes to 2050 at current levels?	Solutions enable service outcomes to be maintained to 2039	Solutions enable service outcomes to be maintained to 2029	Does not meet the program objective	Numbers in cells in assessment table (p.37) show the rank from best (1) to worst (7)
Balances current cost of living concerns	There is a zero bill impact to customers	Bill impact is less than what was endorsed by Voice of Community Panel	Bill impact is greater than what was endorsed by the Voice of Community Panel	
Meets customer preference prioritise the vulnerable LGAs (Port Stephens, Lake Macquarie & Central Coast)	As a portion of the total investment on HV Network Solutions, at least 75% is prioritised to vulnerable LGAs (as per the VOC preference)	As a portion of the total investment on HV Network Solutions, at least 50% is prioritised to vulnerable LGAs (as per the VOC preference)	As a portion of the total investment on HV Network Solutions, less than 30% is prioritised to vulnerable LGAs (as per the VOC preference)	
Economic Analysis FY25-29 NPV (FY25-29) BCR (FY25-29)	 NPV>$320M BCR>3	 NPV>$160M BCR>2	 NPV<$160M BCR<2	
Economic Analysis FY25-44 NPV (FY25-29) BCR (FY25-29)	 NPV>$375M BCR>2.4	 NPV>$300 BCR>1	 NPV<$300 BCR<1	

Comparison of Top-Down Model and Ausgrid's End-to-End Model

The Top-Down model identifies that the total investment needed to build resilience to balance the growth in risk is $354M to 2050, in comparison to Ausgrid's End-to-End model which suggests investment requirements of $302M to 2050. To balance affordability concerns with this growing risk, Ausgrid is staging this investment across 20 years, and the proposed investment in FY25-29 of $83.18M is well under the investment cap of $354M suggested by the Top-Down Model. The proposed investment passes the top-down test.

Details on Option F (Preferred Option)

Staging - Option F achieves the investment objective over four regulatory periods with the staging as follows, acknowledging that this proposal is only for the FY25-29 investments.

	FY25-29	FY30-34	FY35-39	FY40-44
Vulnerable LGAs	$67.39M	$67.39M	$1.80M	-
Rest of Network	$15.80M	$15.80M	$81.40M	$52.24M
Total	$83.18M	$83.18	$83.20M	$52.24M

Prudency and Efficiency of Option F during FY25-29 Regulatory Period:

	BCR	Net Present Value (NPV)
Vulnerable LGA's	2.82	$122.7M
Rest of Network	4.53	$55.7M
Overall	**3.14**	**$178.4M**

Components of investment: Option F includes the following investments:

	Reclosers	CCT (km)	Undergrounding (km)
Central Coast	47	132.14	10.80
Port Stephens	17	57.44	2.67
Lake Macquarie	26	87.78	1.24
Rest of Network	21	41.44	5.513
Total	111	318.81	20.23

Revised Forecast:

For the period FY25-29, Ausgrid proposes **Option F** is the prudent and efficient amount required to promote the long-term interests of consumers and ensure that the safety, quality, and security of supply is maintained in the facing of increasing climate risk.

This investment is for $83.18M in the High Voltage network, consisting of $67.39M in the vulnerable LGAs and $15.80M in the rest of the network. The overall BCR is 3.14 with a NPV of $178.40M.

Risk 2: Low Voltage Network is interrupted during high winds and delays the repair of service for the whole network

The typical restoration process for a major disruptive event involves three stages (Figure A4):

1. Make the network safe: during a major event, most hazards are on the Low Voltage (LV) Network, as there is more of it and it is typically located close to the public
2. Restore and repair High Voltage (HV) Network: prioritised as it serves most customers
3. Restore and repair LV Network: serves fewer customers and must have upstream HV restored first to provide benefit.

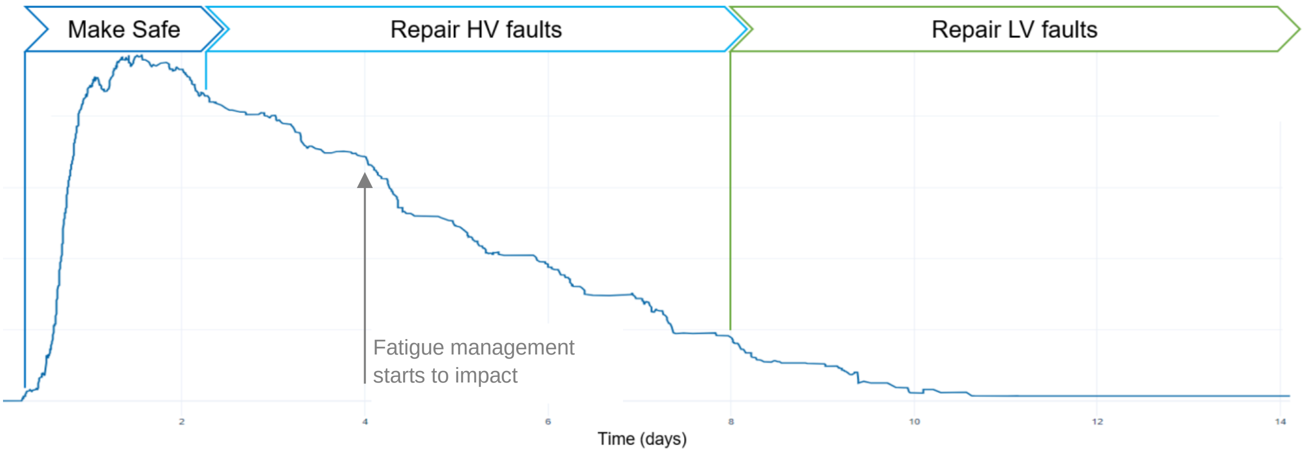


Figure A4: Illustrative depiction of typical Major Event Day response phases (not to scale)

This approach means failure of the LV Network has multiple impacts during a major windstorm. At the start, efforts to make the LV network safe for the public consume response resources, delaying repair of the HV network. By the time response resources become available to repair the LV network, the organisation is managing resource fatigue and has less capacity available.

Historically, 21% of LV supply interruptions that happen during disruptive weather events occur on bare mains due to wind and 31% due to vegetation. Bare LV mains represents almost 9,000km of the total 13,000km (67%) of LV mains (excluding service wires).

Ausgrid Low Voltage Spreader Bar Model

This is a top-down model used to determine the effectiveness of investment in spreader bars in mitigating wind related risk. The model logic is shown in Figure A5.

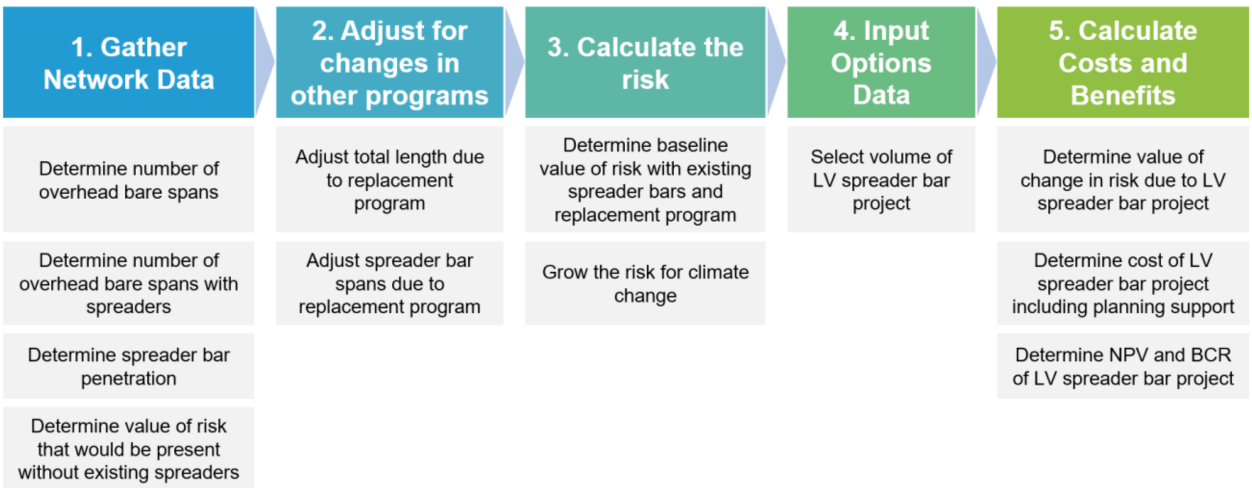


Figure A5: Low Voltage Spreader Bar Top-Down Model Logic

Model Assumptions

Assumption	Rational
98% bare spreader penetration (bushfire area)	Significant work has been put into ensuring high penetration of spreader bars in bushfire areas.
5% bare spreader penetration (non-bushfire area)	Non-bushfire areas have significantly lower spreader penetration.
284km of bare mains replacement with ABC for FY25-29 period	Total LV spans and number of spreaders will decrease each year as mains are reactively replaced by Aerial Bundled Cable (ABC) that no longer requires spreaders.
Bare mains replaced by ABC has the average spreader penetration	At the global level it is not possible to know which spans will be replaced with ABC, so it is reasonable to assume that the spreader penetration is the average.
90% effectiveness of spreader bars for wind	Spreader bars reduce the risk of interruptions due to wind.
50% effectiveness of spreader bars for vegetation	Spreader bars reduce the risk of interruptions due to vegetation by preventing conductor clashing due to light branches.
$412 unit rate for installation of each spreader bar	Unit rate based on historical delivery of similar scope.
60% efficiency factor (i.e. 40% reduction) for bundling work	Reduced unit rate based on efficiency of bundling work.
1 spreader bar per span	Most LV spans only require one spreader bar
3.44% WACC	As per rest of the submission
1/5 FTE @ $220k pa	One fifth of an FTE to manage the program and identify spans that require spreader bars
$212M Base VoEUE Risk	Based on EUE calculations for historical outages.
17% percentage of EUE from outages that are LV	Based on historical EUE calculations to determine LV component.
21% of LV interruptions during climate events are caused by wind	Relevant Event Triggers of Adverse Weather / Environment and Self Clearing Trigger on OH LV bare network
31% of LV interruptions during climate events are caused by vegetation	Relevant Event Trigger of Vegetation on OH LV bare network
1% Risk Growth Rate	In line with other Resilience risk growth rates

Options identified

Risk	Option A Base Case	Option B Consider LV climate risk growth only	Option C Consider LV risk with event response process
Low Voltage network is interrupted during high winds	No investment in additional spreader bars. Some risk mitigated by LV mains replacement program	Moderate investment to maintain climate risk at current levels	Targeted investment support staging of HV investments and manage major event response
	Opex $0.0M **Capex $0.0M**	**Opex $0.0M** **Capex $4.2M**	**Opex $0.0M** **Capex $6.1M**

Option A: Base Case – business as usual

No Investment in additional spreader bars. The base case replacement program for FY25-29 includes the largely reactive replacement of 284km of bare wire with Aerial Bundled Cable (ABC).

This replacement program will mitigate some of the risk growth as ABC eliminates the risk that spreader bars would also address.

Option B: Consider LV Risk in isolation of event response

In this option, we use consider the Low Voltage risk in isolation to the overall event response. Using the model, we take the current baseline risk to the Low Voltage Network and grow the risk at the rate of climate growth, adjusting for benefits that might be delivered by other programs. We seek to maintain current risk (i.e. only adjust for the growth in risk).

Option C: Consider LV Risk integrated with event response

In this option, we consider both the LV climate risk growth and the impact that the LV Network has on Ausgrid's major event response process. We are staging HV network investments across our whole network over four regulatory periods, and therefore won't have initially invested everywhere there is increasing climate risk for customers. With targeted deployment of additional spreader bars through a one off (one period only) investment on the LV network, Ausgrid can manage outage response time for customers. This will maintain safety for customers at the onset of a major event, bring forward HV repair, and reduce the impact of crew fatigue management constraints as the event progresses. This option seeks to *maintain outcomes overall* for customers. This impact is illustrated in Figure A6.

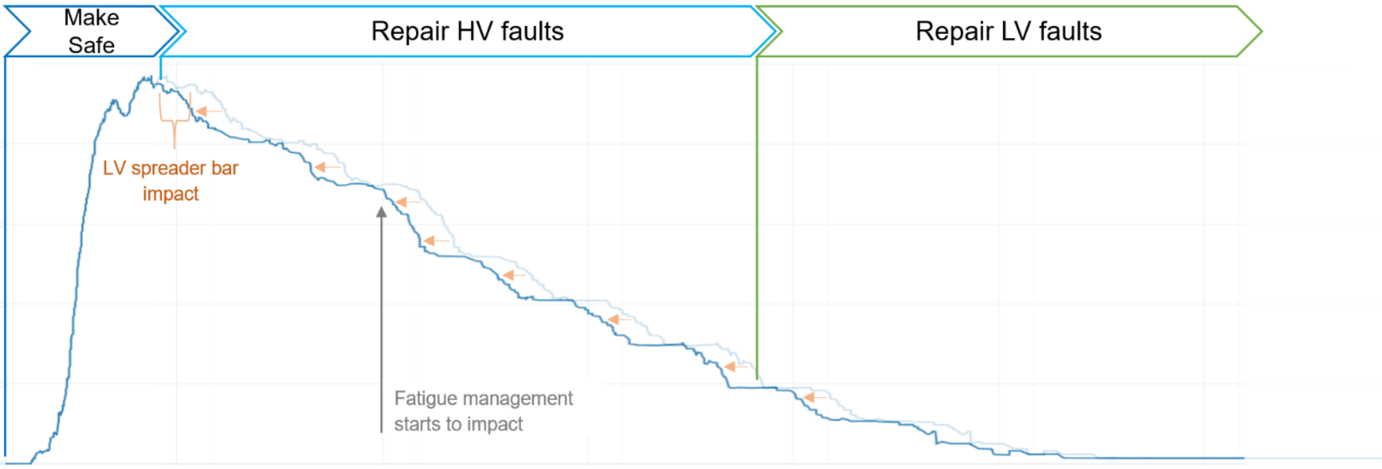


Figure A6: Indicative impact of LV spreader bars on typical Major Event Day response phases (not to scale)

Analysis of Options

Economic Analysis

Option C has the highest Net Present Value of $2.1M and BCR of 1.34. Importantly it also enables staging of the High Voltage Network program over four regulatory periods, by reducing delays in the disruptive event response process.

	Option A Base Case	Option B LV risk growth only	Option C LV risk growth + event response
Net Present Value	0	$1.4M	$2.1M
BCR	0	1.32	1.34

Voice of Customer

We presented the community with an investment of spreaders greater than Option C, and this was supported by the VOC. The VOC sessions held in April 2023 acknowledged this program as a priority initiative. The community verbatims were that they liked this solution because it was a 'proactive measure to stop outages', that represented 'value for money', and are 'relatively quick and easy to implement'.

Safety

Option C provides better safety outcomes for the general public and Ausgrid staff. Compared to Option B, Option C will reduce the volume and time at the start of an event where customers are exposed to live wires, and delivers better fatigue management outcomes throughout the event for Ausgrid staff.

Options Assessment

Option		Assessment Criteria		
		Affordability	Greatest net benefit (BCR & NPV)	Safety of supply
A	Base Case – business as usual	No costs incurred in this period	No investment	Customer and Ausgrid staff safety likely to deteriorate with more LV outages
B	LV risk growth only	Very small investment with minimal bill impact	BCR of 1.32, $1.4M NPV	Some safety benefit from avoided community exposure to live wires, not sufficient to impact fatigue in event response
C	LV risk growth + event response	Moderate investment but may avoid future costs	BCR of 1.34 and delivers best NPV of $2.1M	Investment provides best safety benefit in avoided community exposure to live wires and Ausgrid fatigue benefit in event response

Key	Meets Criteria	Partially Meets Criteria	Does not meet criteria

Revised Forecast:

For the period FY25-29, Ausgrid proposes Option C is the prudent and efficient amount required to promote the long-term interests of consumers and ensure that the safety, quality and security of supply is maintained. This investment is for $6.09M capex for spreader bars on the Low Voltage network. It has BCR of 1.34 and NPV of $2.1M. Importantly it also helps to facilitate the staging of the High Voltage investments over four regulatory periods.

Continuous development – Climate Risk Assessment and Modelling

Performance Monitoring and Independent Reviews

Ausgrid acknowledges that the Climate Resilience Program is a new category of investment, and recommends transparent performance monitoring and independent reviews, both by industry experts and through continuing engagement with the community. We welcome the involvement of the AER. The intention is to develop processes that enable us to adapt to changing circumstances, evolving science and learnt experience from climate events, to ensure that we continue to serve the long-term interests of consumers.

Climate Risk Modelling

Ausgrid has learnt valuable lessons in the preparation of the FY24-29 Climate Resilience Regulatory Proposal, especially the importance of providing modelling that is transparent and accessible for regulatory scrutiny. In the next period, we want to continue on this journey, ensuring that we are utilising the latest science in our models, and are producing further evidence of effectiveness of the network solutions.

Cost breakdown of recommended investments:

Project Detail	Opex	Capex
High Voltage Network Resilience		
Central Coast High Voltage Network Resilience		$38.20M
Lake Maquarie High Voltage Network Resilience		$13.23M
Port Stephens High Voltage Network Resilience		$15.96M
Rest of Network High Voltage		$15.79M
Sub-Total	**$0.00M**	**$83.18M**
Low Voltage Network		
Invest in 23,750 Spreader Bars		$5.87M
Project Management and Engineering (1/5 FTE x 5 years)		$0.22M
Sub-Total	**$0.00M**	**$6.09M**
Substations		
Establish Asset Protection Zones around 4 Transmission Substations and 20 Zone Substations.	+($0.49M absorbed)[19]	**$0.00M**
Continuous Development		
Performance Monitoring and Independent Reviews	$0.10M	$0.50M
Update the Climate Risk Assessment	$0.25M	$0.25M
Sub-Total	**$0.35M**	**$0.75M**
Project Total	**$0.35M**	**$90.02M**

[19] This cost has been absorbed in Ausgrid's BAU Vegetation Management program.

B. Bushfire Resilience Project

(Build Back Better)

The objective is to deliver prudent and efficient, no regrets investment to maintain resilience to the expected bushfire peril to 2050, at current levels

B. Bushfire Resilience Project

Executive Summary

Bushfire risks are expected to grow by 13% (RCP4.5) in Ausgrid's distribution area, with the most risk growth being in the northwest of our operating area. Ausgrid is adopting an adaptive approach to maintain resilience to 2050 at current levels, starting in the FY25-29 regulatory period by upgrading to bushfire resilient poles during normal replacement cycles. We propose an investment of $0.20M opex and $6.60M in capex to:

- ✓ Upgrade poles in bushfire zones following damage in bushfire events and normal replacement cycles (only delta costs between standard and composite poles is included)
- ✓ Establish new processes and standards to enable build back better principles.

NOTE: The AER accepted $6.00M in the draft determination for this program, but did not approve the funding required to develop the supporting build back better processes.

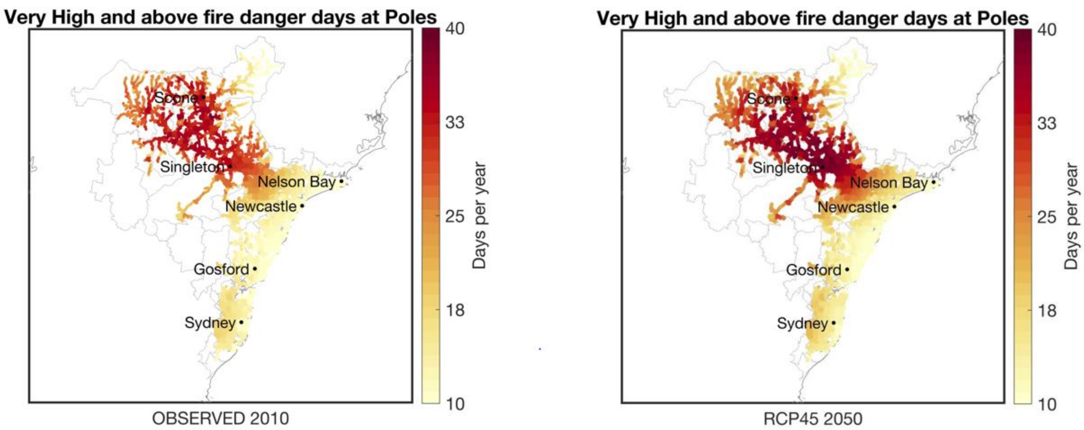
Objective

Deliver prudent and efficient, no regrets investment to maintain climate resilience to the expected bushfire peril to 2050, at current levels.

Climate change impact

Bushfire: Severe bushfire weather days are projected to grow by 13%

Bushfire risk is evaluated in terms of the frequency of dangerous fire weather days, as defined by the McArthur Forest Fire Danger Index (FFDI). The FFDI integrates information across multiple timescales to describe the landscape dryness and the influence of daily weather conditions (windspeed, temperature, and humidity) known to promote the ignition and rapid spread of fires. For the Ausgrid network area, projections for 2050 under RCP 4.5 show an increase in the frequency of severe bushfire weather days (FFDI > 50) by ~13%.



Risk assessment

A 13% increase in severe bushfire weather days by 2050 may cause premature pole failure. Ausgrid has approximately 40,000 poles identified as being at risk from bushfire, with 15,800 of these located in the Upper Hunter, Muswellbrook and Singleton. The photo on the right shows recent damage at Scone in October 2023 from bushfire

Market and industry research has shown composite construction provides enhanced resilience against bush fires compared to their timber equivalents. Survival rates can far exceed those of timber poles following bushfires without significant strength reduction. Further the maintenance inspection regime for timber poles would not apply to the same extent for composite poles as they are not subject to termite attack and have higher resistance to damp and rot.

To mitigate the risk, we are targeting 40% of poles in bushfire areas (16,000 poles) to be bushfire resistant.

Risk 1: Growth in bushfire risk causes poles to fail

Three options were considered to mitigate the increase in risk from bushfire:

Risk	Option A Base Case	Option B Build Back Better	Option C Proactive
Growth in bushfire risk in the northwest of Ausgrid's operating Area causes poles to fail.	Base Case – Business as Usual	Deploy composite poles during normal asset replacement programs in high risk areas.	Proactively replace composite poles to achieve the target of 40% composite poles over 3 periods.
	Opex $0.00M **Capex $0.00M**	**Opex $0.20M** **Capex $6.60M**	**Opex $0.2M** **Capex $44.8M**

Option A: Base Case (Business as Usual)

There is no additional investment in bushfire resilience. In this case, Ausgrid would maintain its current standard of poles, and continue our readiness processes for the bushfire seasons.

Option B: Build back better, and evaluate at the end of the regulatory period

In this option, Ausgrid proposes increasing deployment of composite poles both as part of normal asset replacement programs and during reactive maintenance and emergency events. The cost estimates reflect only the **delta increase** in the material costs associated with the composite rebuild. The cost assumptions are based upon 600 poles per annum which is the level of replacement in bushfire zones. The nature of this work is unlikely to be related to pass through events.

The build back better approach will be integrated across programmed, reactive, and emergency replacement programs. It is more difficult to do a build-back better approach compared to a like-for-like replacement, and it is necessary to improve process particularly when a quick restoration is required. Specific aspects required to establish build back better practices require include:

- Standards development or augmentation as well as “ready reckoners” and “decision trees” to facilitate rapid design decision making during emergencies.
- Establishment of the digital twin structural design components to enable quick decision making.
- Re-defining roles such as engineering support roles during emergencies
- Data acquisition services (e.g., satellite analytics) for post storm to support network rebuilds
- Alternate power sources (e.g., generators) to service customers during longer outages
- Training of appropriate Engineering and Field Operations staff.

Poles that can be upgraded during normal replacement cycles	
Number of planned replacements in FY25-29	3,000 (600 per annum)
Delta Cost (upgrade from standard only)	$2000/pole
Cost of Uplift only	**$6.00M capex**
Uplift in standards and workprocesses to allow build back better	
See cost breakdown on page 51	$0.20M opex and $0.60M capex
Total Investment of Option B	**$0.20M opex $6.60M capex**

Option C: Proactively invest to achieve 40% of composite poles identified as at risk from bushfire by 2040

In this option, we have identified 40,000 poles at risk from bushfire, and seek to upgrade 16,000 of them to be bushfire resistant by 2040. This is divided over 3 regulatory periods, which means that 5,300 poles would be upgraded in this period.

Number of poles to be upgraded FY25-29	5,300

Poles that can be upgraded during normal replacement cycles	
Number of planned replacements in FY25-29	3,000 (600 per annum)
Delta Cost (upgrade from standard only)	$2000/pole
Cost of Uplift only	**$6.00M (capex)**
Poles that need to be replaced proactively	
The remaining number need to be	2,300
Costs of replacement	$14,000
Cost of poles that need to be replaced	**$38.20M (Capex)**
Uplift in standards and workprocesses	
As per option B	$0.20M Opex and $0.60M Capex
Total Investment of Option C	**$0.20M (Opex) and $44.80M (Capex)**

Discussion

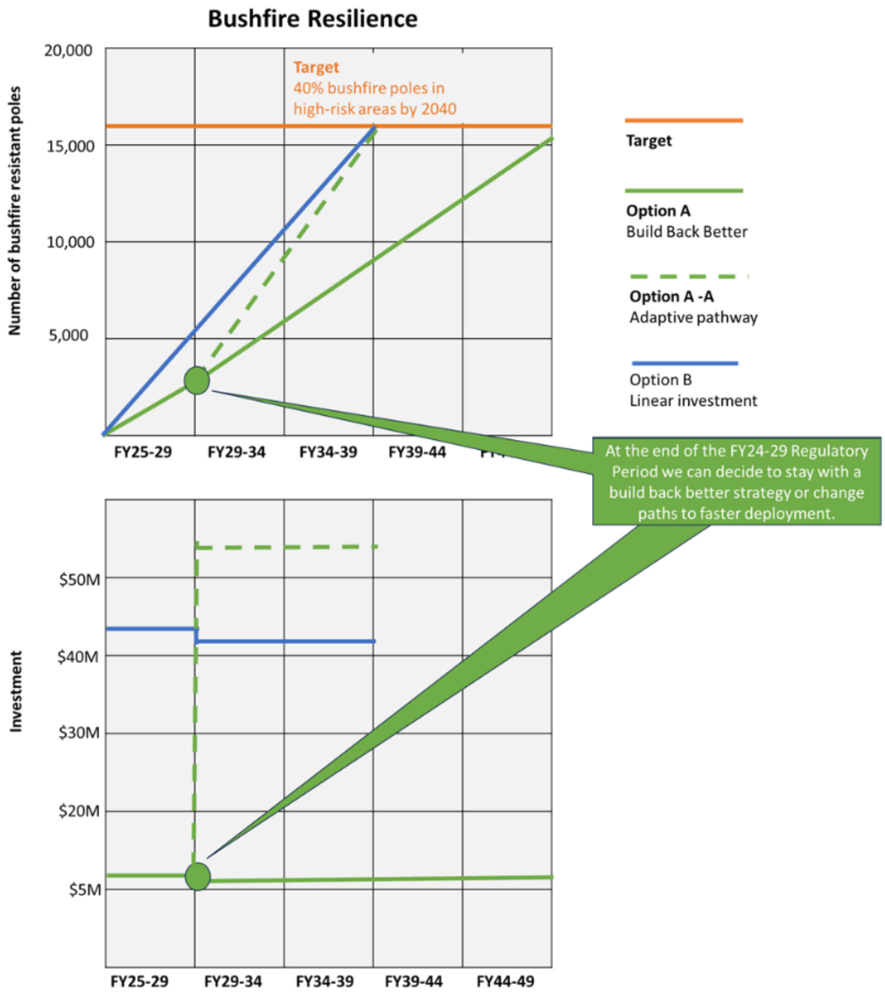
Voice of Community

The Voice of Community Panel expressed broad support for a Build Back Better approach to bushfire resilience. The VOC stated that strengthening Ausgrid's ability to Build Back Better is their equal highest priority. In the April 23 VOC nine participant groups voted this as their most important initiative (equal highest ranked initiative), and no groups voted it as 'least important'. The community voiced that this enabled the network to be updated to better standards that would reduce the chance of subsequent outages. Ausgrid discussed with the community that this would only be applied in those parts of the network considered at higher risk of climate impacts, in way that is gradual and cost effective.

Opportunities for adaptive pathways

Option B enables us to begin working toward the target of 16,000 bushfire resistant poles gradually during normal replacement cycles, with the resilience business case only covering the difference between a traditional pole and a bushfire resistant pole ($2,000/pole). For this to be possible, the development of systems and processes is an important enabler.

At the same time, the growth in bushfire risk can continue to be monitored so at the end of the regulatory period, we can decide either to continue with a build back better approach or alternatively change course to proactively achieve 40% composite poles in the high risk LGAs to deliver equivalent outcomes to Option C.



Analysis of options

Description		Assessment Criteria			Comments
		Costs in this period FY25-29	Costs to achieve goal of 40% of bushfire resistant poles in high-risk areas by 2039	Enables the goal of 40% bushfire resistant poles in high-risk areas by 2039	
A	Base Case - No additional investments	There are no costs incurred in this period.	This approach does not achieve the program outcome	The base case does not achieve the program outcome	This is rejected as it does not achieve the program outcome.
B	Build Back Better $6.80M	Only the delta increase between a traditional wooden pole and a bushfire resistant pole are included in costs	$6.00M capex per regulatory period will allow completion by 2049, however adaptive pathways are available to go faster.	Yes, there is an adaptive pathway available if we need to rollout faster in FY30-34.	This is the preferred solution. Taking advantage of normal replacement cycles means that only the difference in costs between a wooden pole and bushfire resistant pole are incurred.
C	Proactive Approach $44.80M	The cost of $44.80M is prohibitive and was not endorsed by customers.	This approach will require $44.2M in the regulatory periods FY30-34 and FY35-39	Yes, the proactive rollout will complete in FY39	This option is rejected because of the bill impact.

Key	Meets criteria	Partially meets criteria	Does not meet criteria

Revised Forecast:

For the period FY25-29, Ausgrid proposes Option B is the prudent and efficient amount required to promote the long term interests of consumers and ensure that the safety, qualtiy and security of supply is maintained. Progressing on a build back better approach, means that customers are only required to fund the difference in costs between a traditional pole and the bushfire resistant pole. The development of processes and standards is a key enabler, and can not be eliminated from the package. At the end of the regulatory period there is an opportunity to assess the situation and change pathways to a more proactive approach if the build back better strategy is not sufficient.

Breakdown of forecast investment requirements

The breakdown of the proposed investments is explained in Table B1.

Table B1 - Breakdown of Costs

Project Detail	Opex	Capex
Build back better with bushfire resistant poles (Upgrade costs only)		
Emergency: Delta increase (annual) material costs based upon 20 poles p/a and delta of $2,000 per pole		$0.20M
Programs: Delta increase (annual) material costs based upon 500 poles p/a and delta of $2,000 per pole		$5.00M
Reactive pole replacement: Delta increase (annual) material costs based upon 80 poles p.a. and delta of $2,000 per pole		$0.80M
Sub-Total	**$0.00M**	**$6.00M**
Develop new protocols to enable 'build back better' upgrades to bushfire resistant poles in recovery repairs		
Operational processes defining build back better mandatory considerations during emergencies		$0.20M
Standards Development and maintenance		$0.10M
Establishment of the digital twin structural design components to enable quick decision making		$0.30M
Software – data acquisition services	$0.20M	
Training and change management of appropriate Engineering and Field Operations staff	+($0.30M absorbed)[20]	
Sharing of insights with other DNSPs		In kind
Sub-Total	**$0.20M**	**$0.60M**
Establish new bushfire resistant pole inventory		
Increase inventory holding of composite poles and cross arms		+($0.40M absorbed)[21]
Sub-Total	**$0.00M**	**$0.00M**
Project Total	**$0.20M**	**$6.60M**

[20] Costs identified as reasonably absorbable in forecast opex.
[21] Cost to be absorbed in business as usual capex categories as appropriate.

C. Extreme Heat Resilience Project

The objective is to develop a knowledge base of the heat peril and its potential impacts on Ausgrid's assets, including the need to co-exist with third party green-infrastructure investment, and the needs of vulnerable customers. This knowledge will provide a credible evidence base for community consultation and future potential investment needs.

C. Extreme Heat Project

Executive Summary

Between 2012 and 2022, Ausgrid has recorded double the number of outages on heatwave days compared to non-heatwave days. By 2050, climate change is expected to increase the frequency of heatwaves by 22% in Ausgrid's operating area[22].

Heat waves also impact our responsibilties to vulnerable (including life support) customers. Heatwaves have killed more Australians than bushfires, floods and storms combined,[23] and between 2001 and 2018, 473 Australians died from heat related causes[24]. By 2050, heat-related hospitalisation costs in Sydney are estimated to rise $506-570 million[25] due to climate change.

To prepare for this rise in extreme heat, Ausgrid is proposing an evidence led-approach, investing $1.75M opex and $6.00M capex to:

- ✓ Research the impacts of heat on operating assets and update standards
- ✓ Assess how Ausgrid's services should counter the increasing vulnerability of customers, including Life Support Customers, during the heatwaves expected with climate change.
- ✓ Enabling Ausgrid to operate in an adapting urban landscape, that has resulted in a need for our infrastructure to co-exist with the green infrastructure (trees) that are central to the NSW Government's urban heat policies.

Ausgrid will work collaboratively with other DNSPs and share findings where appropriate.

Objective

Develop a knowledge base of the heat peril and its potential impacts on Ausgrid's assets, including the need to co-exist with third party green-infrastructure (trees) investment, and the needs of vulnerable customers. This knowledge will provide a credible evidence base for community consultation and future potential investment needs.

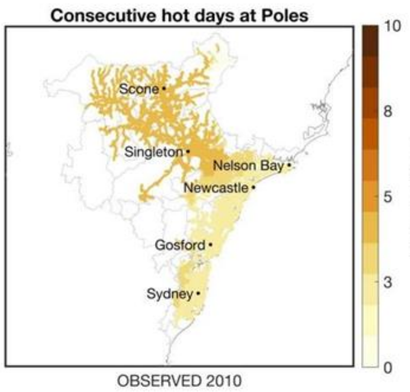
Stakeholder views expressed in the AER's Predetermination Conference

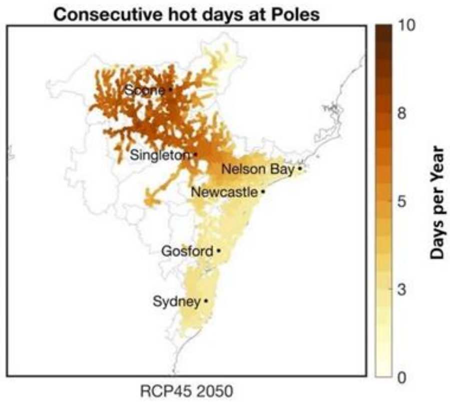
Ausgrid is responding to the stakeholder concerns presented at the AER Predetermination Conference and directly to Ausgrid in October 2023. Since the conference we have sought advice from extreme heat experts, engaged with stakeholders, and discussed the proposed investment case with our Voice of Community Panel. Insights from these engagements have enabled Ausgrid to understand the need to include extreme heat resilience in our revised business case.

[22] Risk Frontiers (2022), Ausgrid Climate Change Risk Assessment.
[23] Coates et al (2014), Exploring 167 years of vulnerability: An examination of extreme heat events in Australia 1844–2010, pp.33–44.
[24] Coates et al. (2022), Heatwave fatalities in Australia, 2001-2018, p.1.
[25] Tong et al. (2021), Heat-attributable hospitalisation costs in Sydney, p.1.

Climate change impacts: By 2050, heatwaves in Ausgrid's operating area are expected to increase by 22%[26]

Heatwave is an instance where the temperature threshold of 35ºC is exceeded on three or more consecutive days. The risk assessment completed by Risk Frontiers shows that the expected growth in heatwave events will be most intense in the north-west of Ausgrid's operating area.





Ausgrid has identified two risks factors of how extreme heat may impact our ability to maintain current customer and community service outcomes across the period FY25-50:

1. Ausgrid's body of knowledge about how extreme heat impacts both the 'operation of assets' and the 'servicing needs of vulnerable (including life-support customers)' is inadequate, resulting in poor planning for the likely future with climate change.

2. Ausgrid needs to operate in a changing urban landscape where our infrastructure must co-exist with the green infrastructure (trees) that are central to the urban heat policies of the NSW government.

Risk 1: Ausgrid's body of knowledge about how extreme heat impacts both the 'operation of assets' and the 'servicing needs of vulnerable (including life-support customers)' is inadequate, resulting in poor planning for the likely future with climate change.

Ausgrid does not currently have sufficient insight into how our Network Strategy should mitigate the anticipated increase in extreme heat, if at all. Although we know that there is a correlation between extreme heat and the number of outages (between 2012 and 2022, Ausgrid recorded double the number of outages on heatwave days compared to non-heatwave days), we do not know how extreme heat will impact asset operation and life.

We also need to establish how a changing climate may impact our most **vulnerable customers, including Life Support Customers,** and how we adapt to their future needs to maintain our quality of service. Climate change extreme heat events are expected to have adverse health effects, especially in vulnerable groups[27]. Health vulnerability to heatwaves is distributed unequally across and within societies, with the elderly and chronically ill identified as the most susceptible subgroups[28]. Protective factors identified are independence, social support, education and community safety, and working air conditioning[29].

[26] Risk Frontiers (2022), Ausgrid Climate Change Risk Assessment
[27] Parsons, K (2014), The Effects of Hot, Moderate and Cold Environments on Human Health, Comfort, and Performance.
[28] Astrom, D (2015), The effect of heat waves on mortality in susceptible groups, p.1.
[29] Bouchama, A (2007), Prognostic factors in heat wave related deaths: a meta-analysis.

Regulatory obligations already require Ausgrid to take additional care with respect to Life Support Customers, particularly in relation to planned outages.[30] Taking steps to better understand the impacts of climate change on vulnerable community members aligns to the policy intent of these existing obligations.

To understand how Ausgrid should establish a knowledge base to better plan for extreme heat in the future, 3 options were assessed:

	Risk	Option A Base Case	Option B Develop Knowledge Base	Option C Develop Knowledge Base and begin to adapt infrastructure
1.1	**Growth in extreme heat has an impact on** **assets ability to operate**	Maintain current standards with no adjustment for extreme heat.	Research the impacts of heat on Ausgrid's assets and update standards.	As per Option B *plus* begin to upgrade assets up to a value of $5.00M[31].
1.2	**Growth in extreme heat changes the servicing needs of vulnerable customers (including those on life support)**	Forecast customer needs without considering climate change induced health impacts.	Assess how Ausgrid's services should counter the increasing vulnerability of customers, including Life Support Customers, during the heatwaves expected with climate change	Assess how Ausgrid's services should counter the changing community needs (for both the general population and the vulnerable) due to heatwaves expected with climate change
		Opex $0.00M **Capex $0.00M**	**Opex $1.50 M** **Capex $0.00M**	**Opex $1.70M** **Capex $5.0M**

Option A: Base Case

The base case uses business as usual processes to plan the future grid. Specifically:

- There will be no focused research on the impact of heat on assets. No updates will be made to specifications and procurement processes. Ausgrid will act reactively when failures occur.
- Ausgrid's current processes will be used to plan for customer needs, and won't consider climate change induced health impacts.

Option B: Build a knowledge base to determine the impact of heat on Ausgrid's assets, and servicing needs of vulnerable (including Life-Support Customers)

Asset's ability to operate

Ausgrid will conduct a literature review, field data analysis and laboratory research to determine the impact of heat on asset performance and failure. The findings of these studies will be used to inform revision of standards and negotiations with suppliers where it is appropriate. Several assets have been identified for inclusion in this study, as per the table below.

[30] AEMC, National Energy Retail Rules, cl. 124B(2)
[31] $5M is derived from forecasts of when the results of the initial studies would be complete (FY27), and the delta costs of upgrading assets in FY28 and 29 only.

Equipment Description	Potential Failure Modes to be investigated
Substation Equipment	
Tripping batteries - Zone / STS / LC	Reduced life of batteries due to sustained higher temperature exposure.
Protection relays / SCADA	Heat cycling causes failure of electronic components and connections due to cracks, expansion and structural deformation.
Primary Equipment (Switchgear and Transformers)	Change in ambient temperatures may impact equipment ratings.
Distribution Networks	
Overhead HV/LV Bonds + other pole components	Heat cycling causing fatigue on bonds. Thermal cycling causing stress on connecting components.
HV cable terminations + U/G joints	Heat cycling increasing fatigue. Condensation in end boxes increasing corrosion.
Fuse fatigue	Elevated temperatures increase fuse fatigue.

Vulnerable Customer Impacts

Ausgrid will partner with public health experts to apply their epidemiological models to understand the changing needs of vulnerable and life support custoemers, and apply this to Ausgrid's future service strategy. Several Ausgrid processes have been identified for inclusion in this study:

- Updated vulnerability classifications to ensure our services capture the right customers
- Investment decisions for heat resistance (including those identified in Risk 1)
- Operational decisions such as planned outages
- Resilience standards

Ausgrid will share findings with other DNSPs where appropriate.

Option C: Option B *plus* begin to upgrade assets to a value of $5M

Option C will accelerate the research desribed in Option B above to understand **assets ability to operate** and **vulnerable customer impacts** and complete both components by FY27. In FY28-29, having had the insights from the research, capital investments to maintain quality of service could commence, with up to $5M in capex funding for delta uplift costs only. Ausgrid would only proceed with upgrades if necessary to meet new standards. Taking this approach allows us to start addressing the heat risk for customers earlier, as we won't need to wait for the next regulatory period to enact research recommendations.

Option	FY25	FY26	FY27	FY28	FY29	FY30-34
Option B	Research asset and vulnerable customer impacts & update standards and service strategies					Act on new standards
Option C (Option B + $5M capex)	Research asset and vulnerable customer impacts & update standards and service strategies		Act on new standards and recommendations (delta increase only, up to $5M)			Re-assess and adapt strategy

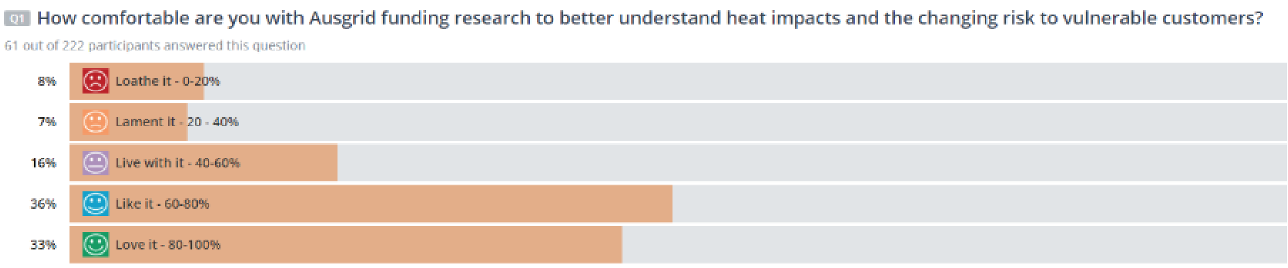
Analysis of Options

	Description	Assessment Criteria			Comments
		Affordability	Will manage mis-investment in FY25-29	Will manage mis-investment in FY30-34?	
A	Base Case - No additional investments	There are no costs incurred in this period.	There are no investments made in this period	In FY29-34, decisions will need to be made about adapting to heat without a knowledge base. Risks mis-investment.	Not preferred. Without a knowledge base there is a significant risk that investments in FY30-34 will be maladaptive or mis-investment.
B	Develop Knowledge Base into impact of extreme heat on assets and vulnerable and life support customers	The investments are focussed on establishing knowledge base. There are no capital investments.	The investments are focussed on establishing knowledge base. There are no capital investments.	Decisions on investments in FY30-34 will be made with an adequate knowledge base. This will ensure investments are correct and appropriately timed.	This is the preferred solution. In return for investments in expanding the knowledge base in this period will more than compensate for
C	Develop Knowledge Base plus begin to invest in capital	There is $5M additional capex compared to Option B, increasing bill impacts for customers.	Although the $5M in capital will made after research is complete, there is a chance it is not required, or not required now.	Decisions on investments in FY30-34 will be made with an adequate knowledge base. This will ensure investments are correct and appropriately timed.	Not preferred, as there is a risk that the capital investments are not required, or not required now.

Key	Meets criteria	Partially meets criteria	Does not meet criteria

Voice of Community Panel – 85% support for Option B

In October 2023 we took the recommended option to the Voice of Community Panel to understand customer views. There was strong support for the initiative as described in the graph below.



Revised Forecast

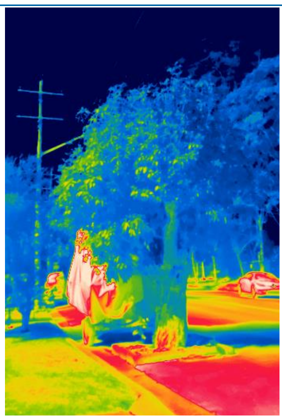
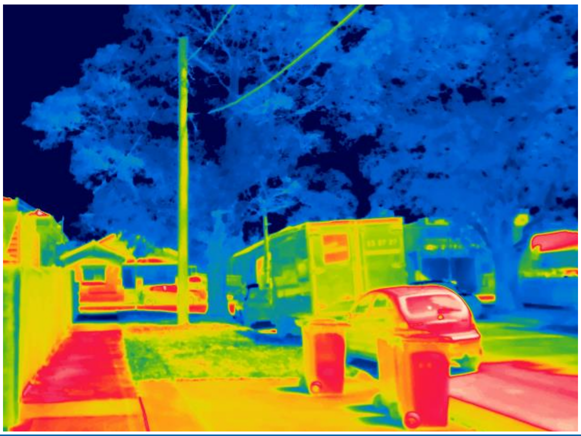
For the period FY25-29, Ausgrid proposes Option B as the prudent and efficient amount required to promote the long-term interests of consumers and maintain the quality, safety and security of supply. Option B enables the development of knowledge base, both to determine the impacts of heat on our asset's ability to operate, and the servicing needs of vulnerable and life-support customers. This knowledge base will mean that investment decisions in FY29-34 will be based on evidence. The knowledge base that is developed in this project will be shared with other DNSPs.

Risk 2: Ausgrid needs to operate in a changing urban landscape where our infrastructure coexists with the green infrastructure (trees) that are central to the urban heat policies of the NSW government.

Trees can have a significant cooling effect, so much so that every 10 percent increase in tree canopy can reduce land surface temperatures by 1.13° C. To reduce the impact of heat, resilience actors are working towards increasing tree canopy, for example:

- The NSW Government has a strategy to achieve 40% canopy cover by 2036[32].
- The NSW Reconstruction Authority is sponsoring the Greater Sydney Heat Taskforce. The Taskforce will facilitate various contributors (such as water utilities, councils etc) to work together to address urban heat.
- A Local Government Workshop held in March 2022 on 'Electricity Networks and investing for community resilience' recommended that DNSPs should consider including co-funding for aerial bundled cabling in their regulatory submission for 2024-29 to enable urban cooling.

Example: Brush Trees ABC wire enable 10 times more shade than bare wire – Photos courtesy of Western Sydney University

Bare Wire	Urban Canopy with ABC is ten times greater
	
	

[32] DPE (2023), Greener neighbourhoods.

There is an increasing expectation from the Greater Sydney Urban Heat Taskforce and Councils that Ausgrid's infrastructure should enable green infrastructure to coexist in the street landscape.

Whilst Ausgrid acknowledges the benefit of urban heat initiatives, there are a number of considerations to be worked through:

- As the electricity infrastructure has traditionally been given priority in the street landscape, who should pay to enable green infrastructure to coexist?
- The collective community benefit of urban greening is acknowledged, however Ausgrid isn't able to factor in these wider economic and community benefits into investments cases. These benefits are factored in by others in their roles (e.g. councils, government).
- Similarly, Councils' ability to invest in an asset that they do not own is limited by legislation. Whilst Federal Government grants are available to councils, they require co-contribution from the asset owners to meet their guidelines.
- There are acknowledged benefits to Ausgrid to tree pruning from installation of ABC which are likely to grow as the tree canopy increases. However, these have not been quantified, and a suitable contribution (10%, 25%, 50%) has not been determined.
- Enabling policy changes would be required across a complex array of partners in the Greater Sydney Heat Taskforce requiring considered focus.

Three options have been considered:

	Risk	Option A	Option B	Option C
3	**The Urban Heat policies of NSW Govt and Councils has an impact on Ausgrid's assets.**	Business as Usual – Upgrade to Aerial Bundled Cable (**ABC**) at a rate of 0.8% per year.	Establish evidence to support the role that Ausgrid should play in Urban Heat Collaborations.	Establish evidence to quantify ABC network benefits and Ausgrid's role and enable growth in urban canopy by co-funding the rollout of ABC with councils 50:50, up to a maximum of $6M[33].
		Opex $0.00M **Capex $0.00M**	**Opex 0.25M** **Capex $0.00M**	**Opex $0.25M** **Capex $6.00M**

[33] $6M is derived to match the indicative interest of councils based on preliminary consultation.

Option A: Maintain Business as Usual

In the Business-as-Usual Scenario, Ausgrid will replace approximately 0.8% of low voltage bare wire each year with ABC. We would work with councils on where this investment is located, to facilitate the urban canopy projects where it can be achieved.

Option B: Establish evidence to support the role that Ausgrid should play in Urban Heat Collaborations

Whilst Ausgrid acknowledges the benefits to the community of urban greening programs, it is necessary to determine the contribution that Ausgrid should make that is commensurate with our role as a DNSP, and to set in place processes that other collaborators are progressing urban heat programs in a way that is most efficient to the collective contributors. In this option, we would establish the evidence base to support a meaningful contribution to Urban Heat Programs, and ensure any programs were planned in the best interests of customers. Ausgrid would:

- Evaluate the vegetation management benefits to Ausgrid from investments in ABC and make recommendations about the contribution that Ausgrid can make to ABC investments as well as determine the co-contribution we would need from others to be able to progress ABC investments.
- Work with policy owners across government and regulators to reach alignment of policies that enable collective impact in the most effective way for all, including promoting practises that encourage planting of trees away from infrastructure where it is appropriate.
- Share findings with other DNSPs

This will enable Ausgrid to make meaningful contributions to the Urban Heat Collaborations commensurate with our role and obligations under the National Electricity Objective as well as provide stakeholders with clarity about the contribution that Ausgrid can make.

Option C: Co-fund ABC with Councils

In addition to the items in Option B, this option will involve co-funding the installation of low voltage aerial bundled cabling (ABC) with councils (50:50), to a maximum contribution of $6M, in councils identified by the NSW Government’s Urban Heat Taskforce as vulnerable to heat to enable our infrastructure to coexist with green infrastructure (trees) The 50:50 contribution is in line with previous discussions with councils, and the $6M is a minimum indication of what councils would be willing to co-contribute with Ausgrid based on these discussions. This will also enable us to establish better quality evidence for the role that Ausgrid should play because it will enable us to study actual outcomes, and not theoretical outcomes.

Discussion

Corporate Social Responsibility

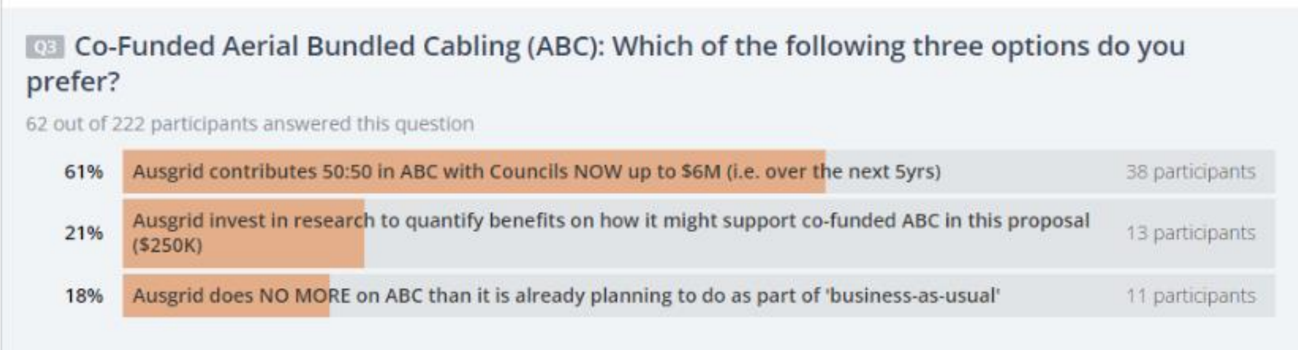
Ausgrid acknowledges that our infrastructure can prevent the creation of an urban tree canopy at the levels that is being promoted by councils and the State Governments Urban Heat Taskforce. Councils and the State Government’s Urban Heat Taskforce have an expectation that Ausgrid contributes to enable the tree canopy to grow, by modifying our infrastructure to coexist with tree canopy. The investments in ABC would be targeted at LGAs vulnerable to urban heat.

Other Economic Benefits

There are economic benefits to Ausgrid (to be quantified through the project) in way of reduced maintenance costs, that are not yet quantified but are expected to be approximately 25% of the cost of ABC.

Customer Views

Ausgrid tested with customers what they felt our role was in the October 2023 Voice of Community Panel session. The results are below:



Stakeholder views

There are mixed views from stakeholders. There is increasing pressure from councils and other resilience collaborators who have strong opinion that Ausgrid's infrastructure should be able to coexist with green infrastructure through Ausgrid co-funding ABC.

Revised Forecast:

For the period FY25-29, Ausgrid proposes Option C as the prudent and efficient expenditure required to promote the long-term interests of consumers in the context of increasing heat risks. Option C enables Ausgrid's infrastructure to coexist with the green infrastructure (trees) required for urban cooling in vulnerable LGAs that have been prioritised by the NSW Govt Urban Heat Taskforce. By studying outcomes, this will also enable us to establish better quality evidence for the role that Ausgrid should play because it will enable us to study actual outcomes, and not theoretical outcomes.

Breakdown of forecast investment requirements:

The breakdown of the proposed program is explained below. Ausgrid will work collaboratively with other resilience actors, DNSPs and regulators for collective impact.

Project Detail	Opex	Capex
Complete research to determine the impact of heat on Ausgrid's assets		
University engagment to collate and compile existing research on heat failure modes of identified assets.	$0.2M	
Analyse field data	$0.1M	
Laboratory studies of asset failure	$0.4M	
Analyse data, determine strategy and consult with stakeholders	$0.3M	
Uplift Standards & negotiate them with suppliers	$0.1M	
Share findings with other DNSPs	In kind	
Sub-Total	**$1.1M**	**$0.0M**
Assess how Ausgrid's services should counter the increasing vulnerability of customers, including Life Support Customers, during the heatwaves of the future		
University engagment to collate and compile existing research on impact of heat on vulnerable groups	$0.2M	
Establish delta change for customers and interface with Ausgrid's role to deliver quality of service, and determine what impact this would have for Ausgrid.	$0.2M	
Share findings with other DNSPs	In kind	
Sub-Total	**$0.4M**	**$0.0M**
Enable electricity and green infrastructure to coexist		
For the precincts identified as priorities under the NSW Government's Urban Heat Taskforce, co-fund (50/50) with councils ABC cable to a maximum of $6M		**$6.0M**
Quantify benefits from enabling electricity and green infrastructure to coexist		
Fund a University research project to assess the impact from ABC on tree canopy over time using a time series of high-res aerial images to inform cost-benefits study of vegetation management, cooling and other benefits.	**$0.25M**	
Work with the stakeholders to determine the role that Ausgrid should play in subsequent regultory periods in a data-informed way.	+ ($0.2M absorbed)[34]	
Share findings with other DNSPs	In Kind	
Sub-Total	**$0.25M**	**$6.0M**
Project Total	**$1.75M**	**$6.0M**

[34] If required, this investment will be absorbed by Ausgrid's forecast opex.

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D. Community Resilience Project

Ensure vulnerable communities can develop additional capacity over time to withstand and recover from expected climate change related impacts to electricity services to 2050

D. Community Resilience Project

Executive Summary

The NSW Critical Infrastructure Strategy views community resilience as a necessary component to deliver improved critical infrastructure resilience and to support communities to prepare, respond and recover to climate shocks and stresses[35]. By supporting our customers to manage the *consequences* of infrastructure failure, we can establish flexible, cost-effective ways to manage residual climate risks and avoid network mis-investment. In line with our customers preferences, this Community Resilience Project prioritises Ausgrid's most vulnerable customers, with a suite of initiatives that work harmoniously to benefit the most customers possible and build their self-resilience.

Ausgrid will complement BAU activities with targeted and purposful new investment to ensure vulnerable communties develop the capacity to withstand and recover from climate related impacts. This project complements other resilience investments by proactively testing and establishing new mechanisms to respond to future unknowns, such as the complex impacts of multi-peril scenarios, and will build evidence to inform future investment efficiencies.

Ausgrid forecasts a requirement to invest $3.15M opex and $0.21M capex for:

- ✓ Targeted energy resilience communications to encourage customers to prepare
- ✓ Flexible energy sources to support the most vulnerable through major events
- ✓ Dedicated liaison staff (1 FTE) to ensure efficient delivery and coordination

Project Objective

Ensure vulnerable communities can develop additional capacity over time to withstand and recover from expected climate change related outages and MEDs.

Investment drivers

Community resilience gives us a mechanism to meet customer expectations and build resilience to variable and multiple impacts of climate perils.

Community resilience is recommended by the NSW State Infrastructure Strategy (2022) and the NSW Critical Infrastructure Resilience Strategy (2018)

The NSW State Infrastructure Strategy (2022) makes a number of recommendations on embedding resilience in critical infrastructure, including an immediate priority to 'develop place-based resilience adaptation strategies that assess local risk and incorporate infrastructure and non-infrastructure solutions for vulnerable locations'[36]. This reinforces the NSW Critical Infrastructure Resilience

[35] Resilience NSW (2018), NSW Critical Infrastructure Resilience Strategy, p.9.
[36] Infrastructure NSW (2021), NSW State Infrastructure Strategy 2022-2042 – Chapter 5, p. 87.

Strategy[37] and accompanying community resilience specific guidance[38] that a focus on physical infrastructure alone won't deliver adequate critical infrastructure resilience (see Figure D1). It must be accompanied by improved community resilience which focuses on the role the community plays in building and maintaining its own resilience and this requires an integrated approach by business and government (information and warnings, managing service disruptions and community partnerships).

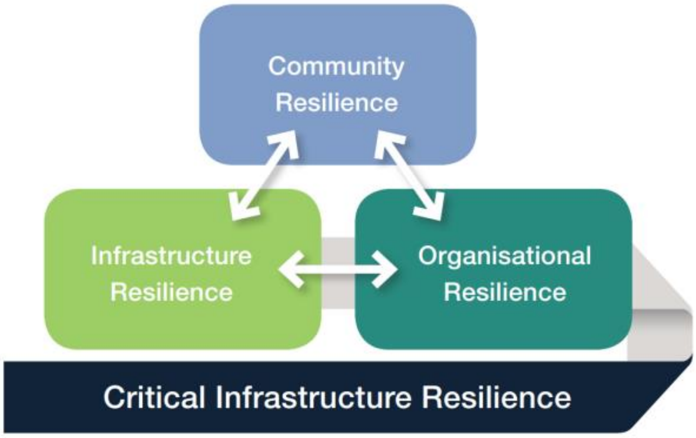


Figure D1: Community resilience is a key component of an integrated approach to enhance resilience of critical infrastructure[38], including electricity distribution.

Community resilience is proven effective in crisis situations

Over recent years, New South Wales has experienced a range of disasters, including drought, bushfire, severe windstorms, thunderstorms and flood. There is a growing body of evidence that non-infrastructure solutions have been complementary with infrastructure solutions and often more adaptable to changing contexts. For example, in the 2017-2020 Sydney drought, the infrastructure plan was found inadequate as engineering lead times had not anticipated the unprecedented low rainfall whereas community resilience, via water conservation programs, were more adaptable and able to be more easily brought forward[39]. Likewise, in the NSW Northern Rivers Floods, it was the community response that was most effective in adapting quickly to the changing circumstance.

Manage local variability of climate related impacts and prepare for emerging risks

Driven by our Voice of Community Panel preference, Ausgrid has prioritised network investment in the Central Coast, Lake Macquarie, and Port Stephens to address the climate risk for our vulnerable customers first. Network investments will be selected based on the most economically efficient options, keeping overall risk to current levels. This approach delivers greatest net benefit but means at a very local level some customers will face increasing risk over time, while for others it will decrease.

This is part of a multi-period approach across the network to buy down identified climate change-related risks to 2050 while balancing affordability. In addition to localised variability, customers may also experience residual consequences of increasing climate change-related risks driven by:

- The impacts of emerging climate change-related risks, such as extreme heat, or unknown multi-peril impacts on Ausgrid's network, and
- The potential for climate-change related risks to manifest differently to that indicated by the current climate science and modelling (for example, climate scientists have advised RCP4.5

[37] Resilience NSW (2018), NSW Critical Infrastructure Resilience Strategy, p.9.
[38] Resilience NSW (2021), NSW Critical Infrastructure Resilience Strategy Guide, p.4.
[39] NSW Government (2022), Greater Sydney Drought Response Plan Overview.

is becoming increasingly unattainable) and change expectations as to how, when and where climate change-related risks may manifest).

The Community Resilience Project investments align with customer expectations and preferences for effective ways to support them to withstand and recover from climate related outages and reduce the consequences of failure. These types of investments are agile and adaptable, allowing Ausgrid to effectively manage the variability and unknowns of climate perils as they emerge.

Base Case

Under the base case there is no investment in community resilience. Without increased capacity to cope and better community resilience, customers are more likely to feel the long-term social costs and impacts from climate shocks and stresses that prevent Ausgrid delivering our service.

Options Comparison

Options A and B were designed through the deliberative engagement process described in Section 3. This iterative process means Ausgrid has worked with customers to progressively consider costs and benefits and prioritise, or discount solutions based on customer value. To ensure investments deliver greatest net benefit, these options have also been tested against two additional options (C and D) that we consider feasible and aligned with realistic ways a DNSP might manage these issues.

Option A: Broad customer preference

<table>
<tr><th colspan="2">Resilience Communications</th><th colspan="2">Flexible Energy Sources</th><th>Option Description</th></tr>
<tr><td colspan="2">Blackout Plan with specific risk app
Broad campaign in Central Coast
Vulnerable comms in Lake Macquarie and Central Coast
Significant uplift in outage and safety messaging during storms</td><td colspan="2">~40 x small mobile generators
4 x energy resilience at existing community hubs</td><td rowspan="6">This option aligns with local community preference in our priority LGA’s. It includes options that many customers strongly supported but did not achieve a super majority (>80% support).

This option makes no adjustment for affordability concerns.

Voice of Community

This option answers key concerns raised by participants in our LGA workshops, including:
Three liaison roles needed for the area’s size and population
Lake Macquarie needs three hubs to give enough customers access
Concerns that Central Coast lacked flexible energy sources</td></tr>
<tr><td>Opex $2.6M</td><td>Capex $0M</td><td>Opex $0</td><td>Capex $0.4M</td></tr>
<tr><th colspan="4">Coordination and Planning</th></tr>
<tr><td colspan="4">3 FTE x resilience liaison and coordination staff
Community resilience planning for Central Coast</td></tr>
<tr><td colspan="2">Opex: $4.0M</td><td colspan="2">Capex: $0.0M</td></tr>
<tr><td>FY25-29: $7.0M</td><td colspan="2">Opex: $6.6M</td><td>Capex: $0.4M</td></tr>
</table>

Ausgrid

Option B: Customer super majority with affordability adjustments

<table>
<tr><th colspan="2">Resilience Communications</th><th colspan="2">Flexible Energy Sources</th><th>Option Description</th></tr>
<tr><td colspan="2">Blackout Plan with web app
Targeted local comms leveraging Blackout Plan material
Uplift in messaging during storms (cost absorbed in Ausgrid BAU).</td><td colspan="2">20-30 small mobile generators
2 x energy resilience investments at existing hubs</td><td rowspan="7">This option aligns with local community preference in priority LGA's. It only includes solutions that achieved a super majority of >80% support.

The package responds to affordability feedback from our Voice of Community Panel in June and Oct 23.

Refinements and efficiencies achieved since July 23 are detailed below.

Voice of Community

This package is co-designed and strongly supported by customers in our priority LGA's and across the network and balances affordability.</td></tr>
<tr><td>Opex $1.85M</td><td>Capex $0.0M</td><td>Opex $0.0</td><td>Capex $0.21M</td></tr>
<tr><th colspan="4">Coordination and Planning</th></tr>
<tr><td colspan="4">1 FTE x resilience liaison and coordination staff
Energy resilience planning (Central Coast) (absorbed)</td></tr>
<tr><td colspan="2">Opex: $1.2M (+ $0.1M absorbed)</td><td colspan="2">Capex: $0.0M</td></tr>
<tr><td>FY25-29: $3.26M</td><td colspan="2">Opex $3.05M</td><td>Capex $0.21M</td></tr>
</table>

Option C: Broad communications focused approach

<table>
<tr><th colspan="2">Resilience Communications</th><th colspan="2">Flexible Energy Sources</th><th>Option Description</th></tr>
<tr><td colspan="2">Blackout Plan with specific risk app
Broad campaign in Central Coast
Vulnerable comms in Lake Macquarie and Central Coast
Significant uplift in outage and safety messaging during storms
Uplift in seasonal storm communications</td><td colspan="2">No new investment in flexible energy sources</td><td rowspan="7">This option aligns with how Ausgrid communicates in relation to safety.

This includes investment in developing and testing of new materials and rolling these out as part of seasonal campaigns and reactively when big events are forecast.

Voice of Community
This option does adequately deliver on customer expectation and value.

Communities prioritised solutions that would support 'self-resilience' and many saw communications as an element of this this but only if effective integrated with other complementary work.

This is supported by analysis on social impact costs: "Mass market, broadly targeted awareness programs…do not by themselves effectively motivate"[40]</td></tr>
<tr><td>Opex $2.07M</td><td>Capex $0.0M</td><td>Opex $0</td><td>Capex $0</td></tr>
<tr><th colspan="4">Coordination and Planning</th></tr>
<tr><td colspan="4">No new investment in coordination and planning</td></tr>
<tr><td colspan="2">Opex: $0.0M</td><td colspan="2">Capex: $0.0M</td></tr>
<tr><td>FY25-29: $2.07M</td><td colspan="2">Opex $2.07M</td><td>Capex $0.0M</td></tr>
</table>

[40] Deloitte (2016), The economic costs of the social impact of natural disasters, p. 57.

Option D: Flexible energy sources focused approach

<table>
<tr><th colspan="2">Resilience Communications</th><th colspan="2">Flexible Energy Sources</th><th>Option Description</th></tr>
<tr><td colspan="2">• No targeted investment
• Passive awareness raising of flexible energy sources through existing channel</td><td colspan="2">• 300 x small mobile generators
• 8 x large mobile generators
• 1 x mobile community centre</td><td rowspan="6">This option aligns with one-way Ausgrid has traditionally supported vulnerable customers, in particular through small mobile generators for life support customers.

Voice of Community
This option does not align with customer expectation and value.

None of our community groups prioritised large mobile generators or mobile community centres, seeing these as having a too high a bill impact relative to their impact.

Our customers also strongly supported solutions that would support long-term self-resilience and felt Ausgrid operated generators would not do this in isolation.</td></tr>
<tr><td>Opex $0M</td><td>Capex $0</td><td>Opex $0.5M</td><td>Capex $4.7M</td></tr>
<tr><th colspan="4">Coordination and Planning</th></tr>
<tr><td colspan="4">- 1 x community resilience liaison to work with local stakeholders to coordinate flexible energy sources and contribute to local community resilience planning.</td></tr>
<tr><td colspan="2">Opex: $1.2M</td><td colspan="2">Capex: $0.0M</td></tr>
<tr><td colspan="4">FY25-29: $6.4M Opex $1.7M Capex $4.7M</td></tr>
</table>

Options assessment

To test options and determine greatest net benefit, each option is assessed against three criteria:

- **Affordability:** Does it respond to customer feedback on affordability and bill impact?
- **Community preference:** Is it aligned with our engagement outcomes?
- **Collaboration:** Does it enhance our capacity to collaborate and contribute appropriately?

Option	Assessment Criteria		
	Affordability	Community preference	Collaboration
A – broad customer preference	Does not respond to VoC affordability & bill impacts feedback, risk overinvestment in opex	Reflects options co-designed and supported by a wide customer base	Multiple liaisons to work with other actors and leverage comms and sources to integrate with other activities
B – super majority customer support + affordability	Responds to VoC affordability and willingness to pay feedback	Only includes solutions that achieved a 'super-majority' of 80% of support or more	Liaison to work with other actors and leverage other package components to co-deliver where appropriate
C – broad communications focus	Lower opex investment than other options limits bill impact	Customers saw comms activities as largely ineffective in isolation	Centralised comms approach limits collaboration capacity
D – flexible energy sources focus	Largest investment but longer-lived capex manages immediate bill impact	Customers largely prioritised solutions that increased their self-reliance such as planning tools	Liaison to work with other actors and leverage other package components to co-deliver where appropriate

Key	Meets criteria	Partially meets criteria	Does not meet criteria

Based on this assessment, Ausgrid has taken Option B through to more detailed design and costing.

How this revised investment case responds to AER feedback

Prudent and efficient costs

In developing this revised investment case we have undertaken further analysis, customer engagement and market sounding to refine the community resilience program and find efficiencies:

- Communications activities streamlined into a single integrated program of work and tested with the market, reducing proposed costs from $2.1M in July proposal to $1.85M (-$0.25M).
- Community liaison role detailed and costed at $150,000 per annum with 23% oncosts and 30% overheads, resulting in a cost increase to $1.2M (+$0.2M from July proposal).
- Scope of Central Coast Community Resilience Plan refined with other resilience actors to specify energy resilience components, reducing investment to $0.1M (from $0.4M), absorbable in forecast opex.

Ausgrid has refined scopes and worked with other actors and the market to ensure we can both deliver on pressing local needs and create resources for efficient future BAU integration:

- By streamlining communities unique prioritised activities into a single program of work, Ausgrid will establish a flexible Blackout Plan that can be used more broadly on-going. In order to do this well, it is critical we invest meaningfully now to create high-quality materials that will fill the gaps, align with our role as a DNSP and stand the test of time.
- Community resilience planning (cost absorbed) in the Central Coast fills a specific gap to enable more efficient delivery of both community and network resilience initiatives. It has been refined to ensure the outputs can also benefit other councils through our BAU engagement.

Step change criteria, materiality and BAU costs

In its draft decision the AER recognised the climate resilience opex costs (including for community resilience) are driven by a major external factor (climate change) but did not accept we had demonstrated the costs were not capable of being otherwise managed through our forecast opex and saw these as an absorbable extension of BAU activities. Ausgrid has undertaken further analysis across our opex step change, including community resilience, to identify where this is possible and where new funding is essential to enable us to realise the customer benefits:

- **Limited absorbable costs:** Ausgrid has reviewed the opex step change and analysed what can feasibly be absorbed in forecast BAU. These opportunities predominantly occur in other investment categories where we have more established existing workstreams (e.g. vegetation management, workforce training). In this community resilience project, we are able to accommodate the community resilience plan ($0.1M) and an uplift in safety and outage messaging (reduced to $0.25M from $0.75M in July) (dependent on leveraging components of the Blackout Plan).
- **Existing communications budget insufficient:** Ausgrid dedicates a small amount of communication funding annually to meet our safety obligations (~$300-400K). Some of this funding is contributed from other project specific sources (e.g. online asset development) and we do not seek a specific communication allowance like some other regulated entities do.

  Purposeful and effective delivery of the climate resilience communications requires a 126% increase on communications expenditure according to our market testing, an increase not absorbable in our BAU. Average annual communications budget has reduced 47% between the 2014-19 and 2019-24 periods, significantly reducing our capacity to absorb new costs. We anticipate a similar or better efficiency gain over time with resilience comms, acknowledging that establishment and set-up costs should be once-off if done well.

- **Future opex/capex trade-offs:** Coupled with Performance Monitoring and Independent review (see cost breakdown below), this investment will contribute to an evidence base that will enable Ausgrid and others to better quantify the benefit of community resilience investments and potentially inform efficient future opex/capex trade-offs.

Though the costs may seem relatively immaterial in isolation, the preferred option achieves its efficiency and impact through delivery as an integrated package. We have found efficiencies and identified opportunities to streamline, and wherever possible absorb, each component of this work and wholesale absorption under forecast BAU would significantly undermine our ability to deliver on customer expectations and realise long-term benefits.

Climate change will continue to drive new costs not reflected in our forecast opex across most or all aspects of our business. By making an efficient, purposeful and direct investment in this period, Ausgrid can establish the resources to play our role in supporting our customer to navigate a changing future.

Revised Forecast:

For the period FY25-29, Ausgrid proposes Option B as the prudent and efficient expenditure required to promote the long-term interests of consumers in the context of increasing climate risks. It provides a balanced, complementary mix of investments to support our customers and community prepare for climate outages. It will ensure we can maintain quality of service and enable safety during major climate shocks and stresses through better community understanding. Importantly, it is also the option best aligned with community preference.

Breakdown of forecast investment requirements:

Project Detail	Opex	Capex
Energy Resilience Communications		
Blackout Plan development	$0.15M	
Local Safety and Outage messaging	($0.25M absorbed)	
Vulnerable customer comms (Lake Macquarie, Port Stephens)	$0.24M	
Broad awareness campaign (Central Coast)	$0.21M	
Advertising and media buy ($200-300K per annum)	$1.25M	
Sub-Total	**$1.85M**	**$0.0M**
Flexible Energy Sources		
Small mobile generators		$0.04M
Energy resilience for existing community hubs		$0.17M
Sub-Total	**$0.0M**	**$0.21M**
Coordination and Planning		
Community resilience planning (energy component)	($0.1M absorbed)	
Community liaison and coordination staff (1 x FTE)	$1.20M	
Sub-Total	**$1.20M**	**$0.M**

E. Response Effectiveness Project

Maintain the response time for all hazards to 2050, at current levels

E. Response effectiveness

Executive summary

The 2020 Royal Commission into Natural Disasters called for organisations who respond to emergencies, including electricity providers, to prepare for "*increased frequency and intensity of natural disasters*" from climate change that result in "*more complex, concurrent and compounding events*". To maintain the overall response effectiveness across all hazards (including bushfire, windstorm, floods and other climate events) in the context of climate change, Ausgrid recommends $0.40M opex and $10.89M capex to:

- ✓ Enable **multi-agency coordination effectiveness** by sharing more data between Ausgrid and Emergency Services, leading to less disruption for customers.
- ✓ Enable **effective use of crews during emergencies (BCR 3.18)** by increasing fault detection capabity, to maintain effectiveness of response.

NOTE: The AER Draft Decision $3.00M for Data Sharing for Multi-Agency Response.

Investment objective

To maintain the response time for all hazards to 2050, at current levels.

Climate change is increasing the frequency, intensity and complexity of response[41]

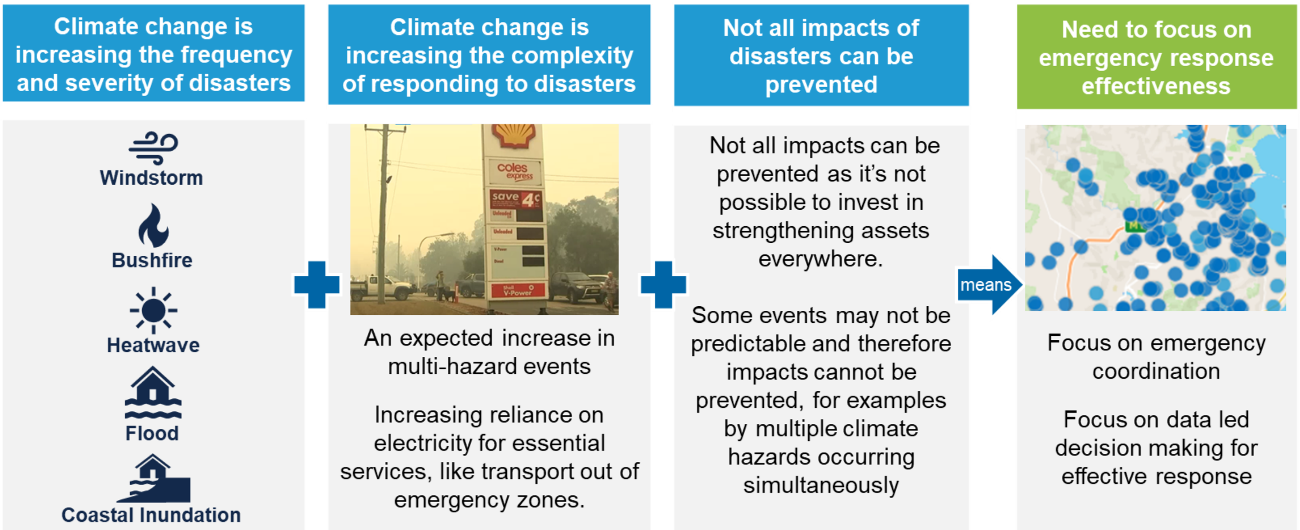


Figure E1: Case for change for the need to focus on emergency response capability

On major event days there are many faults that need to be responded to quickly and safely, and the effective deployment of resources is critical. Ausgrid has identified two risks that might impact our ability to respond to the increasing number of climate driven outages that impact customers:

1. Multi-agency response is disrupted or delayed by poor data transfer between agencies

[41] Australian Government (2020), Royal Commission into National Natural Disasters Arrangements.

2. Increasing number and intensity of major event days means that there is not enough operational capacity to respond, extending outages for customers

Risk 1: Multi-Agency response is disrupted or delayed by poor data transfer between agencies

Inquiries into the Lismore Floods and the Black Summer Bushfires made recommendations to ensure the coordination of multi-agency response through sharing of intelligence and allocated specific actions to Critical Infrastructure Providers. This need was reinforced by Ausgrid's internal debriefs on incidents in our operating area - the recent Hunter flooding events and the large building fire in Sydney's CBD in May 2023.

Three options have been considered to ensure multi-agency coordination through data transfer between agencies:

Risk	Option A	Option B	Option C
Multi-Agency response is disrupted or delayed by poor data transfer between agencies	Business as Usual - representatives attend Emergency Management Committees & publish outages on website	Focused investment in Data and Information with key Emergency Service Partners	Investment in Data and Information sharing with wider group of response partners
	Opex $0.0M **Capex $0.0M**	**Opex $0.35M** **Capex $3.50M**	**Opex $1.0M** **Capex $6.0M**

Option A: Business as Usual

We would continue to attend multi-agency Emergency Management Committees and connect into state processes via the Energy and Utilities Functional Area (EUSFA) within the Office of Energy and Climate Change. Ausgrid would continue to publish live outage data so customers can get information on outages. During major events, our systems often crash when overwhelmed by external parties, some of whom have developed algorithms to scrape this data from Ausgrid's site to feed into their own systems.

Option B: Focused Investment in Data and Information Sharing with key partners

In this option Ausgrid can share more data with key partners, such as the State Emergency Operations Centre and other critical infrastructure providers. We would work collaboratively with these agencies to focus on coordination and streamline response and recovery for communities interacting with multiple agencies. The exact solutions will be scoped by comprehensive needs analysis and a collaborative design process with other agencies, and may include:

- Produce APIs to feed Ausgrid live outage data into other agencies systems. Ausgrid could co-invest with agencies to develop this work. The cloud-based infrastructure is already in place, so once cyber security assessments are complete, it's a relatively straightforward.
- Establish a new portal to share data with relevant agencies by subscription.
- Invest in capacity of Ausgrid's digital twin or other existing systems like Network Viewer to

model resilience data, including predictive models. This can reduce duplication of effort during emergency response. While the two solutions described above focus on 'pushing' Ausgrid data out to other agencies, this solution looks to increase Ausgrid's capacity to respond safely and efficiently by 'pulling' resilience data into our existing systems.

- Increase other agency's understanding of our network is managed so that during an emergency event we are better positioned to coordinate response.

Option C: Expand sharing of emergency response data with a wider group of Emergency Response Partners

In this option, Ausgrid would provide critical asset and response data to a wider range of response partners, such as supermarket chains. This option is not recommended because under the Security of Critical Infrastructure Act (2018), spatial data is considered a risk. Also, data should only be shared with those who have the capacity to interpret it appropriately especially during a major event. It will not be possible to train up large groups of people to interpret the data.

Analysis of Options

Option	Assessment Criteria		
	Affordability	Community preference	Faster response times
A – Business as usual	No directs costs however costs may emerge in other areas and during major events due to inadequate data sharing capacity	Does not deliver on community priority for increased coordination	With not investment in data sharing, Ausgrid's response time will likely deteriorate as climate change increases
B – Focused investment in data and info sharing	Targeted investment that delivers significant uplift with critical partners and manages affordability	Delivers on community expectation for improved coordination to deliver faster, streamlined multi-agency response	Integrated data sets (for example predictive fire modelling from RFS linked with Ausgrid's digital twin) will deliver greater coordination and maintain response time)
C – Increase emergency response data with broad group	Level of investment and bill impact not supported by customers or stakeholders, risks mis-investment.	Delivers on community expectations to increase coordination but risks overinvestment from Ausgrid where community wanted to see delineation of roles and role appropriate contributions	As above, option C will enable even more sharing but it is unclear how much additional benefit this delivers

Key	Meets criteria	Partially meets criteria	Does not meet criteria

Voice of Community Panel

Improving multi-agency data sharing was an equal top priority for both the Newcastle and Sydney Voice of Community sessions. Verbatim comments included that "coordination between agencies is essential" and other agencies should have information to make better decisions

Revised Forecast:

For the period FY25-29, Ausgrid proposes Option B as the prudent and efficient expenditure required to maintain the safety, quality and security of supply. Multiple inquiries into emergency response, have found that better data sharing across emergency response partners will enable multiagency coordination, and therefore Option A is discounted. Option C will result in security of data concerns. Option B is identified as the most prudent investment, resulting in the most benefit.

Risk 2: Increasing number and intensity of major event days means that there is not enough operational capacity to respond, causing extended outages for customers

In adverse climate events, the number of faults can exceed the available control and restoration resources (Figure E2) creating a safety risk to the public and leaving some customers with excessive restoration times. The consequence of these outages is set to increase as society electrifies, for example, to power vehicles to exit emergency zones.

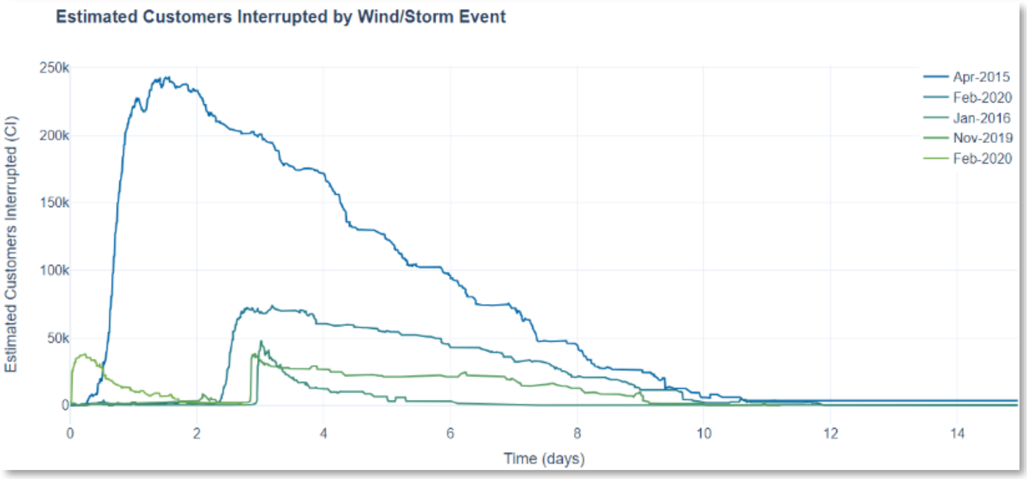


Figure E2: Estimated customers interrupted for the largest five storms in Ausgrid's network since 2008

The strain that climate change is having on Australia's capacity to respond has been well documented by emergency services. The 2020 Royal Commission into National Emergency Response Capability found that there is a need "*for a step change in how Australia coordinates the insufficient emergency resources we have to deal with the threat of climate change*", and further that their "*findings were relevant for all organisations who play a role in Emergency Response*"[42] including "*electricity services*".

As climate change increases the number of climate events, concurrent events and expands geography of each event, the effectiveness of other mutual aid agreements, such as with DNSPs, will also be tested. Already, the Australian Defence Forces have declared that the increasing number of climate disasters, and the community's reliance on them to respond, has put pressure on them and they shouldn't be relied on as a back-up resource.

Objective statement:

To maintain the response time for all hazards to 2050, at current levels.

Models Provided:

Response Effectiveness Model - it contains in the Zip File the following:

- Top-Down Model (Response Effectiveness)
- Bottom-Up Model (Response Effectiveness)
  - Overview Document
  - Python Code
  - Output Files

[42] Royal Commissions (2020), National Natural Disaster Arrangements, Chapter 6.

Options considered:

The options are designed target the “Repair HV Faults” component of the major event response process (Figure E3). Options target Overhead Transmission (OT) Network only.

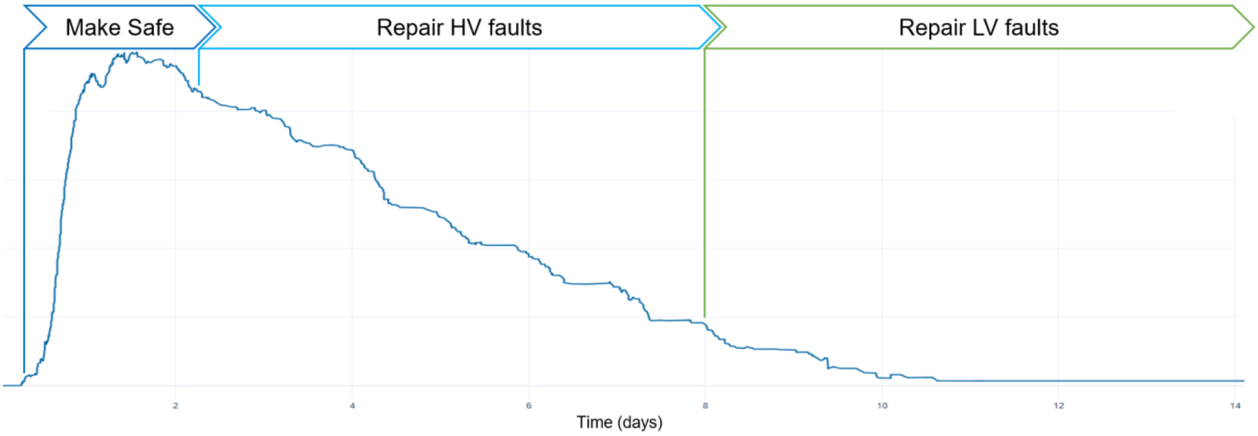


Figure E3: Illustrative depiction of typical major event response phases (not to scale)

Three options have been assessed:

Risk	Option A Base Case	Option B Fault Detection Sensors	Option C Increase Resourcing
Rising number of climate impacted days puts pressure on operational capacity to respond	Business as Usual – Use the available resource, and existing MOUs, to respond.	Invest in Fault Sensors and Location Detectors with remote monitoring to ensure effectiveness of response.	Invest in more operational resources to maintain operational response.

Option A: Base Case

In this Business-as-Usual approach, we use our available resources, and existing MOUs with other DNSPs, to respond safely.

Option B: Fault Detection Sensors with remote monitoring – invest in technology to ensure response effectiveness

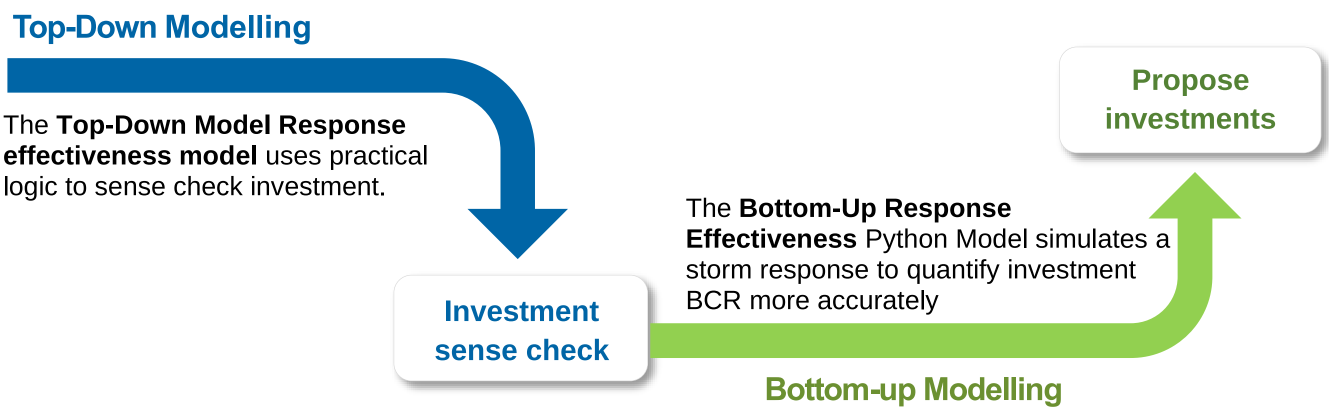
As these events often result in the number of events exceeding the available patrol and restore resources, fault detectors with monitoring ensure only faulted sections of line need to be isolated and patrolled. The benefit of fault location devices is significantly greater during adverse weather events that impact a large area. This option would provide approximately 1,200 line fault indication devices (with monitoring) on the 11kV distribution network, to be installed in overhead locations where there is an increased risk from climate change.

Option C: Increase Resourcing - Invest in more operational response resources

In this option, the number of operational resources to support response are increased to achieve the same outcomes as Option B.

Modelling

The modelling is used to determine the economics of Option B. We used two approaches.



Top-Down Modelling

This Top-Down Model tests the high-level assumptions for the Fault Detection and Location Sensor project. It models an average overhead feeder with typical load, lengths, fault rates and Fault Detection and Location Sensor impacts on patrol time, adjusting for the segmentation reclosers proposed in Appendix A. The value of the EUE reduction due to the patrol time reduction can then be calculated to determine the NPV and BCR.

Top-Down Model Logic

Gather network data of a typical feeder

- Determine effect of Fault Detectors on feeders with 0 and 1 existing device
- Enter unit cost
- Determine average load and power factor
- Determine average feeder length
- Determine average fault rate for OH network
- Enter VCR

Calculate the risk per feeder

- Calculate patrol time
- Calculate expected unserved energy
- Calculate EUE reduction
- Calculate the value of EUE per year
- Adjust for the HV Network Investments (Appendix A)

Calculate costs and benefits

- Enter WACC
- Calculate NPV and BCR

Bottom-Up Modelling

Ausgrid uses a Response Effectiveness Model to assess the impact of resources and the control and monitoring systems.

The 'Response Effectiveness bottom-up model' is a simulation model that uses a control module to assess the impacts of storms of varying intensity, control and protection device penetration (including fault location and monitoring devices), resourcing of operators and field crews and restoration policies and processes. The simulation has a display, where the user can watch the storm response unfold – a screen capture is in Figure E4.

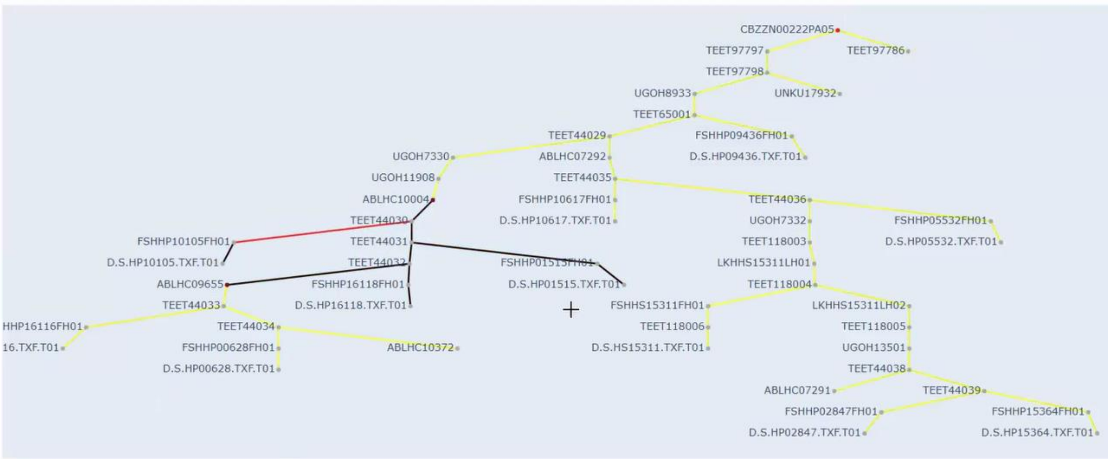


Figure E4: Simulation interface screen capture of fault detection model

Model logic - The Response Effectiveness Model is a system of component models; an Ausgrid connectivity model, a storm model, a resource pool model of agents such as spotters, operators and repair crews, and a control monitoring and protection model.

Storm Simulator	Connectivity Model	Control and Protection Operation	Resource Pool	Event Controller
The storm model applies N number of faults over a given duration to the connectivity model. This allows us to control the intensity of the storm and stress test our network and resources.	Contains the network connectivity, customers, control and protection devices, fault location and monitoring devices. The faults from the storm model are applied probabilistically using overhead section length.	Mimics the operation of control and protection devices like circuit breakers and reclosers. Provides fault indication to the model.	The resource pool consists of agents for system operators, field operators, spotters, and repair crews.	The available resources, number of faults, fault location and monitoring devices and network connectivity are implemented in the event controller. The event controller record fault events, monitors the network for protection operation and dispatches resources.

Figure E5: Responsive Effectiveness Model Logic

Accessing the model

This is an object-oriented simulation model. The code is supplied in Python, an idiomatic programming language designed to be understandable by non-programmers. We acknowledge this is a less conventional modelling approach and can provide demonstrations if required. The results are also confirmed by the Top-Down model sense check.

Inputs and Assumptions

Assumption	Rational
Time between faults is determined by applying a normal distribution to the mean time between faults. The mean time between faults is calculated from the number of events and duration of the storm.	The distribution of time between faults during the start of a storm event is expected to be normal. This assumption is expected to have little to nil impact on the outcome of results.
Faults are applied to the network model using the total overhead length of the sections in the connectivity model.	We use overhead length as the weight when we randomly select spans to be faulted because we only want to model events that result from storms. Storms typically impact the overhead network only.
The resource pool includes Spotters as an agent.	Spotters are typically not used in day-to-day restoration of events, however we implement them here as we're modelling events with a significant magnitude
Feeders are restored from the main circuit breaker only.	In large storm events with many faults, and constrained resources, restoration of the main feeder trunk is the priority.
Automatic Fault Restoration has not been implemented.	Automatic fault restoration policy has not yet been established at Ausgrid, while we expect it to have a meaningful benefit in the future it's not possible to model with certainty at the time of this model implementation.
Partial patrol and remote restore is implemented.	It is Ausgrid policy for system operators to restore feeder trunk sections from the feeder head once a fault has been located and isolated. The remainder of the feeder is not patrolled unless a secondary fault causes the restoration to fail.
A simplified patrol and restoration policies has been implemented.	Patrol from the upstream protection or monitoring device, isolate the first fault located, attempt restoration from the main circuit breaker. If the restoration fails, dispatch a new patrol resource and repeat. Repair all faults on the faulted span, restore isolated network, restores downstream networks. If any of the restoration steps fail, dispatch a new patrol resource and repeat the process.
Feeder patrols start from the tripped/flagged control device.	This is the policy of the Ausgrid control room and where the benefit from fault location devices is realised.
To model the impacts of fault location and monitoring devices we use an infinite resource pool.	By using an infinite resource pool, we eliminate the resourcing variable in determining the benefit of additional monitoring devices. Resources are available on demand; this reduces the variables impacting restoration time to patrol time and fault repair time.
Fault repair times are determined using a normal inverse gaussian distribution with a median of 4 hours, alpha of 1.25 and beta of 1	The normal inverse gaussian distribution is a reasonable representation of the fault repair times we could expect during a storm.
Spans patrol speed is set at 10km/h	10km/h is consistent with advice from subject matter experts and numbers used historically.
Operators require 20 minutes per isolation	A nominal value used to distinguish between manual isolation and remote isolations.
A system operator requires 10 minutes to action a feeder restoration after a fault has been isolated.	A nominal value to acknowledge a resource and time is required to restore remotely when the restoration is done manually and not by an automatic controller.

Comparing the results of the top-down model and bottom-up model (for Option B)

The results from the Top-Down and Bottom-up models for Response Effectiveness are compared in the table below. Both models demonstrate a compelling investment case. We take forward the Bottom-Up numbers to subsequent sections of the investment case, as the detail in the modelling approach makes it more accurate.

This program complements the HV Network investment in Appendix A (segmentation) that work to prevent the impacts because they are targeted to be:

- implemented to work in conjunction with those devices to assist customers who are still impacted downstream,
- in locations that are difficult to patrol, and
- in locations where the reclosers cannot be justified.

To account for the complementary nature of this and the HV network investments in segmentation, Ausgrid has applied an 80% reduction in effectiveness of this solution.

Option B	Top Down	Bottom Up
NPV	$65.8M	$23.2M
BCR	10.82	3.18

Analysis of options and discussion

Option		Assessment Criteria			
		Economics	Manages risk that there are not enough resources to respond	Customer preference	Deliverability
A	Base Case – Business as Usual	No investment	Will not maintain response effectiveness at current levels in the face of increasing climate impacts	Customers strongly supported investments to maintain response effectiveness	No investment to deliver
B	Fault Detection Sensors	Useful life of 15 years, delivers: BCR 3.18 NPV $23.2M	Maintains response effectiveness at current levels to current. Instantaneous response info.	Fault detection sensors were customers highest priority in considering broad network solution	Technology well understood, resources in play with skills and capacity to deliver
C	Increase resourcing	Significant bill impact from increased operational expenditure. Need to resource a minimum level of resources that are only fully utilised infrequently during major events	Resource pool is still impacted by fatigue during extended events. Manual intervention approach delay information transfer and can't reach unsafe or inaccessible locations.	Bill impact for resources too high	Long recruitment and skills development lead times will delay impact. Staff turnover could increase costs (re-training)

Key	Meets criteria	Partially meets criteria	Does not meet criteria

Voice of Community

Managing the risk of there not being enough resources to respond was discussed with the Voice of Community panel in both Newcastle and Sydney. When compared to all other resilience options, Fault Detection and Location Sensors were the equal top priority (alongside Multi-agency Data Sharing). The reasons that the customers gave were captured in these verbatims - “Fault detectors save time searching for locations” and that they are a “big result for small investment”.

Revised Forecast:

For the period FY25-29, Ausgrid proposes Option B – to invest in Fault Detection and Location Sensors as it has a BCR of 3.18 and will help maintain the quality, safety and security of supply in the face of climate change. This will enable feeder reclose to be performed before patrolling remote or difficult to access feeders, and manage the risk that there are not enough operational resources to respond to the increasing frequency, geographic boundaries and duration of disruptive events.

Breakdown of forecast investment requirements:

Project Detail	Opex	Capex
Multi-Agency Data Sharing		
Program and Change Management	$0.35M	$0.5M
Develop better data integration functionality to share data bewteeen Ausgrid and Emergency Service Partners		Capped at $3.0M
Work with other DNSPs to ensure consistency with the way our sector works with Emergency Services Sector	In kind	
Sub-Total	**$0.35M**	**$3.50M**
Fault Detection and Location Sensors		
Install 1,200 Fault Detection and Location Sensors and establish monitoring	$0.00M	$7.29M
Monitoring of Fault Line Indicators	+ ($0.4 absorbed)[43]	
Sub-Total	**$0.00M**	**$7.29M**
Performance Monitoring and Independent Review	**$0.05M**	**$0.10M**
Project Total	**$0.40M**	**$10.89M**

[43] Operational monitoring of sensors will be integrated in BAU processes within Ausgrid forecast opex