

31 January 2023

Attachment 5.5: Climate resilience program

Ausgrid's 2024-29 Regulatory Proposal

Empowering communities for a resilient, affordable and net-zero future.



Contents

1.	Introduction	3
2.	Executive Summary	4
PAR	T 1 – Climate Resilience Strategy	6
3.	Background	7
4.	Climate Modelling	9
5.	Climate Impact	13
6.	Stakeholder Engagement	15
7.	Case for Investment	19
8.	Future Strategy 2023 – 2029	20
Part	2 – Climate Resilience Program	25
1.	Context	26
2.	Investment approach	31
3.	Options	34
4.	Recommendation	42
5.	Document Governance	43
Арре	endix A – Resilience Solution Examples	44
Арре	endix B – Review of Repex	51



1. Introduction

1.1 This document's purpose

This document provides the basis for Ausgrid's climate resilience related expenditure forecast within the 2024-29 regulatory period (**2024-29 period**).

It outlines Ausgrid's approach to mitigating the risks to its network and community posed by an increase in the frequency and severity of climate related hazards as a result of climate change.

1.2 This document in context

This document supports the resilience section of the Regulatory Proposal. It outlines the overall strategy, and approach Ausgrid has taken to understand and mitigate the risk of climate change and should be read in accompaniment with the documents listed below.

1.2.1 Related documents

Document	Description	Relevant sections
Attachment 5.5.c – Climate resilience framework	Co-designed investment framework for Ausgrid to follow regarding resilience related expenditure. Document was developed by Ausgrid and relevant customer advocates.	All
Attachment 5.5.b – Climate impact assessment	Climate modelling and projected impacts on Ausgrid network area and assets.	All
Attachment 5.5.a – Resilience implementation plan	Implementation plan that supports the application of the Climate resilience framework	All

1.3 Document overview

This document is broken into Part 1 and Part 2. Part 1 is Ausgrid's overall Climate Resilience Strategy. It outlines the background, historical climate data, and climate modelling completed to date, engagement, case for investment, and next steps. Part 2 is the Climate Resilience Program and outlines Ausgrid's investment approach to resilience and various options that were considered when developing the proposal.



2. Executive Summary

The climate is warming, and the frequency and intensity of extreme weather events will continue to increase as a result. As climate risks increase over time, the service we deliver to our communities will be impacted. Our customers and stakeholders have made it clear that they expect Ausgrid to take appropriate action to mitigate this change in risk.

We have commissioned modelling experts to establish a granular and localised understanding of the climate risks faced in our service area, and how much those risks are likely to change over the coming decades. This modelling has shown that by 2050, on average we can expect a 26% increase in exposure to climate risks across our network area, and 31% by 2090¹. From a network perspective, our impact analysis shows that by 2050, we can expect a 24% increase in climate related asset failures and 24% increase in climate related interruptions experienced by our customers as a result.

As the provider of an essential service, there are opportunities available to us to mitigate or otherwise reduce the impact of this climate risk growth on our customers and communities. In considering these opportunities we have engaged extensively with customers and stakeholders to understand their expectations. Led by the AER's guidance note², we have also collaborated with industry to understand our role in supporting communities in their resilience goals, and our role within the context of the National Electricity Objectives (**NEO**).

Several options have been considered in terms of Ausgrid's potential response to this changing risk, including support, coordination, and response during extreme events, community support services, research and collaboration with other resilience actors, and proactive network investment. The proposed investment portfolio for the 2024-29 period represents a 'least-regrets' approach that incorporates community and stakeholder feedback to utilise network and non-network strategies and support intergenerational equity.

This portfolio of resilience enhancing solutions has been prepared to address the most acute differences in equity of outcomes for today's customers, while also addressing projected performance deterioration in those areas of the network predicted to experience the highest growth in risk. The portfolio also targets investments in areas where complimentary resilience planning by communities and local governments is advanced and gives adequate time to test new technologies (via the innovation program) before considering broader rollouts. Our resilience related capital expenditure (**capex**) and operating expenditure (**opex**) forecasts for 2024-29 to address increasing climate risks is outlined below.

To inform our assessment approach to potential resilience related investments, we have co-designed a resilience framework with our Reset Customer Panel. Attachment 5.5.c – Climate resilience framework (the Framework) promotes balanced investment in resilience, supported by evidence of risks and benefits, done in consultation with communities. Resilience related investments will be assessed through the Framework and will follow the Attachment 5.5.a – Resilience implementation plan which provides context and a plan for how Ausgrid will implement both the AER's resilience guidance note, and the Framework in alignment with customer expectations.

² AER guidance note – *Network Resilience* – *A note on key issues* April 2022



¹ Climate modelling results are under medium emissions scenario RCP 4.5

^{4 |} Climate resilience program Attachment 5.5

Executive summary								
	During the 2024-29 period, the program will deliver a balanced investment portfolio to:							
	 Maintai 	n overall climate	e risk to 2050 to	o existing leve	els;			
Key Obiective(s) of	 Improve equity of network performance during major climate events for different customer groups; 							
the program	 Assess commu 	intergeneration nities today, wit	hal equity by ba th the costs and	lancing costs I risk faced by	and risks face / future gener	ed by custome ations;	ers and	
	 Maximise overall community benefit through engagement and collaboration with communities and other resilience actors. 							
	Maintain overall climate risk to 2050 to existing levels;							
Customer	 Improve equity of network performance during major climate events; 							
benefits	 Assess intergenerational equity; 							
	Maximise overall community benefit.							
Regulatory	National Electricity Objective;							
requirements	• AER guidance note – Network Resilience – A note on key issues.							
Expenditure		FY25	FY26	FY27	FY28	FY29	Total	
forecast	CAPEX	25.2	38.7	48.4	42.6	38.7	193.6	
Direct only	OPEY	4.4	4 7	2.4	1.0	17	о <i>и</i>	
(\$m, real FY24)	UPEA	1.1	1.7	2.1	1.9	1.7	0.4	
	Total	26.3	40.4	50.5	44.4	40.4	202.0	

Figure 1 – Summary table of climate resilience business case



PART 1 – Climate Resilience Strategy

Empowering communities for a resilient, affordable and net-zero future.



3. Background

3.1 Background

Globally, there is recognition that climate change presents an increasing risk to economies and societies that will continue to worsen in generations to come. Seven of the world's hottest years have occurred in the last decade and there is growing evidence to link an increase in frequency and intensity of extreme weather and natural hazard events, including heatwaves and windstorms, to anthropogenic climate change. The effects of climate change profoundly impact communities, especially those most vulnerable. The effects have recently prompted communities, organisations, and government to look at improving resilience to climate change.

It is important that as an essential service provider and given the increasing drive for electrification, Ausgrid looks at resilience and how to best promote the long-term interests of consumers. Resilience is something that networks have always considered as part of our obligations under the National Electricity Law (**NEL**). It is embedded in how we design our network and the prudent levels of investment we make, including where some parts of the network are considered more at risk than others from the impacts of extreme weather.

The need for a change to this approach arises when the frequency and severity of those climate events starts to change and increasingly impact customers. When the past is no longer a reliable predictor of the future, not accounting for climate change impacts through investment planning models can be expected to result in deterioration of the performance of the electricity supply system which in turn affects communities.

To manage this increasing risk and maintain the quality of life for our customers there is a need to understand the risk climate change presents to our network and operations, how it will impact current and future customers, and what we can do about it. We have heard from our stakeholders, including customers, employees, shareholders, and partners that we need to respond to a changing climate. They have told us that they want us to invest in resilient network infrastructure, be more innovative and data driven, provide better backup power sources, improve communications during events, create community-based solutions, and build stronger strategic relationships with other first responders and resilience actors.

3.2 Problem/opportunity

As climate risks increase over time, it will become increasingly challenging to maintain the current service we deliver to our communities. Our customers and stakeholders have made it clear that they expect Ausgrid to take appropriate action to mitigate this change in risk.

In developing Ausgrid's response to changing climate risks, we must acknowledge and consider the challenges in taking action to promote the long-term interests of consumers:

- Traditional network investment economic tests exclude consideration of the risks and impacts of extreme weather events;
- The degree to which climate warming will occur, and hence the degree of increase in risk of climate perils is uncertain, as are the exact locations that future climate perils will materialise;
- Ausgrid's approach to valuing the impact for customers of wide area long duration outages (WALDO) typical of extreme weather events is not as well established as 'normal' network risks;
- Changes to the network to adapt to changing threats can be costly, and can take many decades to enact;
- Some communities are already experiencing climate impacts orders of magnitude higher than others;
- Ausgrid's role in responding to changing climate risks is still being defined in both a regulatory context, and the way in which customers expect us to support them;
- What the community actually wants (and is willing to pay for) in terms of risk mitigation is not clear, and may change from place to place as is the expectation on Networks as opposed to other 'resilience actors'



The key question that our climate resilience response seeks to answer is:

"How can we meet customer and community expectations and our objectives under the NEO, maintaining service levels over the long term (in terms of safety, reliability, quality, and security) in the context of an uncertain but changing climate, while also managing affordability for current and future generations?

3.3 Resilience principles

Ausgrid is planning a 'least regrets' approach to managing the impacts of climate change while balancing risk, affordability and equity, which requires cautious but active investment. We are proposing a balanced investment portfolio which allows Ausgrid to meet its obligations prudently and efficiently under the NEO, while managing intergenerational equity and the inherent uncertainty involved in mitigating current and future risks linked to a changing climate. The portfolio follows the Framework and AER guidance note on resilience.

The derivation of the Climate Resilience portfolio is centered off four key elements which are based off scientific evidence and backed by stakeholders.





4. Climate Modelling

4.1 Historic Climate Impacts

Ausgrid's current network performance is susceptible to the impacts of extreme weather events. Our historical network data from the last 10 years demonstrates that while our non-climate related network performance is relatively stable, our network is quite susceptible to weather related interruptions. There is variability in year-on-year weather, resulting in variability in the network performance our customers experience.



Figure 2 – 10-year historic climate and non-climate related network performance

27% of outage events on our network are caused by weather and account for 66% of outage minutes experienced by our customers. 56% of climate related outage minutes are excluded from consideration in traditional investment justification as they occurred on a Major Event Day (**MED**).





Reliability management targets compliance to reliability standards and provides a baseline performance level across the network year-round, which is calibrated to past volumes of events or incidents. It excludes the impacts of MEDs despite these being part of the customer experience. A traditional reliability focus also does not account for forward looking climatic impacts on outage numbers, severity, and community impact.



4.2 Climate modelling

Ausgrid has undertaken its first climate impact assessment to understand possible climate futures and the climate risks our network distribution infrastructure and customers can expect to experience over the next 70 years.

4.2.1 Emissions scenario analysis

To understand future climate scenarios, climate scientists' model potential carbon emissions futures or representative concentration pathways (**RCP**).

Global carbon dioxide emissions are heavily influenced by external factors including economics and geopolitics. Given inherent uncertainty in external influences, it is prudent to explore multiple climate futures.

In assessing possible climate futures, we engaged climate scientists and assessed three potential climate futures – reflecting low, medium and high emissions scenarios over a 70-year period to 2090.

- Low RCP 2.6 rapid decarbonisation, global warming is kept to below 2°C
- Medium RCP 4.5 modest action on climate change, where global warming would be limited to approx. 3°C
- High RCP 8.5 a fossil fuel intensive future where global warming could exceed 5°C by the end of the century.

Current pledges under the Paris Agreement suggest approximately 3°C warming is the most likely of these three scenarios (RCP 4.5).

Figure 4 – Global average temperature increases for low, medium, and high RCP scenarios to 2090



For each modelled emissions scenario, climate risks for extreme heat, bushfire, windstorms, and floods were granularly modelled by longitude and latitude to provide Ausgrid with yearly data and projections for each climate risk until the end of the century.



4.2.2 Climate modelling results

Our climate impact assessment has shown that by 2050 under the 'most likely' of the three modelled emissions scenarios (RCP 4.5), on average we can expect a 26% increase in exposure to climate hazards across our network area, and 31% by 2090. The change in risk is not uniform across our network, with some areas more exposed than others. This study shows extreme heat and heatwaves present the biggest increase in climate risk posed to communities. Detailed geographic analysis of climate risks for extreme heat, bushfire, windstorms, and floods can be found in Attachment 5.5.b Climate impact assessment.

Metric	What this means	Change 2050	Change 2070	Change 2090	Confidence
Consecutive Hot Days – Total	The total number of heatwave days, where a heatwave is defined as three or more consecutive days > 35 deg C	103%	123%	123%	Very High
Consecutive Hot Days – Maximum	The longest run of consecutive hot days > 35 deg C	22%	24%	29%	Very High
Windspeed maximum	Speed of sustained wind gusts in m/s	3%	3%	3%	Medium
Windstorm	Primarily related to days where more intense East Coast Lows make landfall	23%	30%	30%	Medium
Very heavy Precipitation Days	Days with more than 30mm of precipitation which is linked to flooding	20%	-4%	4%	Medium
High Fire Danger Days	Days with a forest fire danger index between 2024-29	0%	23%	17%	High
Extreme (and above) Fire Danger Days	Days with a forest fire danger index above 50	13%	21%	11%	High
Average across network	(26%	31%	31%	n/a

Tabla	1_Δι	iearid'e	averade	futuro	network	climate	evnosure	15
rable	I - AL	isgna s	average	luture	network	cimate	exposure	4.0

Table 1 Note: Sea level rise in Ausgrid's network area under RCP 4.5 is expected to rise above present-day levels to 0.24m by 2050, 0.35m by 2070, and 0.47m by 2090 with medium confidence to these projections. Although it is virtually certain that the Greenland and West Antarctic Ice sheets will collapse, adding an extra ~10m to global sea levels, the timing for this is uncertain, and is excluded from sea level rise projections³.

4.2.3 Confidence and tipping points

A level of confidence, as defined in the table below from the IPCC Guidance Note on Confidence⁴, can be used to characterise uncertainty that is based on expert judgment as to the correctness of a model, an analysis, or a statement. This is distinct from likelihood, which refers to a probabilistic assessment of a defined outcome having occurred or occurring in the future. IPCC addresses reporting on uncertainties in their guidance note, with scales of confidence described Table 2.

Table 2 -	IPCC	guidance	notes	table	on	confidence

Confidence Level	Degree of confidence in being correct	Chance that outcome is in line with or worse than forecast
Very high confidence	At least 9 out of 10 chance	95%

³ Dr. Stuart Browning, Climate Scientist, Risk Frontiers

⁴ <u>https://www.ipcc.ch/site/assets/uploads/2017/08/AR5</u> Uncertainty Guidance Note.pdf



^{11 |} Climate resilience program Attachment 5.5

Confidence Level	Degree of confidence in being correct	Chance that outcome is in line with or worse than forecast
High confidence	About 8 out of 10	90%
Medium confidence	About 5 out of 10	75%
Low confidence	About 2 out of 10	60%
Very low confidence	Less than 1 out of 10	50%

The current generation of climate model scenario simulations do not consider the potential impact of tipping points within the climate system. A tipping point is a threshold that when crossed can lead to large irreversible changes in the climate system. Some of the main possible tipping points identified include the potential collapse of the Greenland and West Antarctic Ice sheets, slowdown of the Atlantic Meridional Overturning Circulation, Amazon rainforest dieback, or permafrost melting and associated methane release. It is now considered inevitable that many of these thresholds will be crossed, but it is not known if this will occur this century and what their impacts would be.



5. Climate Impact

5.1 Climate impact assessment

Ausgrid have undertaken a climate impact assessment to understand the impacts of specific climate risks to our network and assets, our customers, and our business.

The extreme weather events modelled were:

- Extreme heat;
- Bushfire₅;
- Windstorms (primarily related to intense East Coast Low storms);
- Riverine Flooding and Coastal Inundation.

The impact analysis was broken into three primary sets of results: asset failure rates, costs, and customer minutes without supply. These results were calibrated against historical data, external databases, international research, and expertise from Ausgrid engineers, and show the anticipated average costs each year.





5.2 Climate impact results

Our climate impact assessment has shown that by 2050 under the 'most likely' of the three modelled emissions scenarios, RCP 4.5, there will be an average 23.9% increase in climate related asset failures on our network. The change in risk is not uniform across our network, with some areas more exposed than others.

Our modelling demonstrates that an increased exposure to climate related extreme weather events, leads to an increase in the number of climate related asset failures over time. The study has shown that across all emissions scenarios, windstorms is our greatest climate peril in terms of value of unserved energy to customers. Our modelling around windstorms focuses on high impact windstorms. Bushfire, extreme heat days, and heatwaves will also impact on our network. Although some of the perils modelled have a less significant or minimal impact on our network,



⁵ Network initiated bushfires were not included in the modelling and is not covered in this business case. Refer to Repex. 13 | Climate resilience program Attachment 5.5

Ausgrid acknowledges that these extreme events can have a very large impact on communities – especially those most vulnerable within the community.



Figure 6 - Ausgrid's predicted annual climate related asset failures by peril and RCP scenario

5.3 Climate impact assessment next steps

Ausgrid will continue to deepen its understanding of how climate change will impact our network and communities. We will be update our climate impact assessment in each regulatory period with refreshed modelling and updates to our base knowledge. Further information about Ausgrid's approach to climate modelling, exclusions, and results can be found in Attachment 5.5.b – Climate impact assessment.



6. Stakeholder Engagement

Ausgrid is committed to providing the best outcome for its customers now and in the future. We are aligning our climate resilience response with customer and stakeholder expectations. We are doing this through strong consultation with customers, communities, and industry to understand their current experience and what they value moving forward.

6.1 Customer Experience

Currently, customers located across our network area experience differing levels of service. Customers in our worst served local government areas (LGA) experience up to three times more climate related outages than the network average, and 10 times more than those within inner Sydney.

Figure 7 - Climate vs. non-climate outage durations per customer by LGA



6.2 Role of the community

Robust engagement and listening to our communities is fundamental to developing Ausgrid's climate resilience response. We acknowledge the importance of understanding the specific needs of the different communities that are supported by the Ausgrid network.

Through the Framework, Ausgrid has committed to partnering and has commenced a robust engagement program with other resilience actors and providers of essential services. Building climate resilience is a shared responsibility and Ausgrid is engaging with partners to better understand where its role starts and stops within the broader resilience discussion.

Before Ausgrid looks to provide resilience related investments or support to a community, Ausgrid will:

- Understand the needs and values of the specific community;
- Look for partnership opportunities (including co-funding);
- Support communities to develop their own local resilience plans;



• Work collaboratively with local communities on the design of community responses and any investments Ausgrid is intending.

6.3 Stakeholder perspectives

We have undertaken deep and thorough engagement with our key stakeholders. We have heard from our customers, employees, shareholders, partners, and Indigenous communities that we need to respond to a changing climate. They have told us that they want us to invest in community-based solutions, resilient network infrastructure, be more innovative and data driven, provide better backup power sources, improve communications and build stronger strategic relationships with other resilience actors, including exploration of co-funding opportunities.

We have undertaken a range of stakeholder engagement activities to understand our stakeholder perspectives:

Industry

- Joint distribution network service provider (**DNSP**) consultation paper, forum, and working group (those on the same regulatory cycle as Ausgrid, and others such as the Victorian DNSPs, TransGrid etc);
- Energy Networks Australia weather forecasting tools, resilience working group;
- Resilience NSW, Department of Environment and Planning forums;
- Critical infrastructure relationship building (e.g., Sydney Water, NBN, Optus etc.);
- First responders' relationship building (e.g., NSW SES, Regional and Local Emergency Management Committees);
- AER;
- Summer Readiness Forum(s) with ASPs and other first responders;

Customer / community collaboration

- Ausgrid customer advocate group(s);
- Customer needs and aspirations research;
- Lived experience community resilience focus group(s);
- Resilience and microgrids focus group(s);
- Voice of Community deliberative forum(s);
- Post Narrabeen holiday storm customer survey;

Councils

- Council and large organisation resilience plan gap analysis interview(s);
- 13 Councils have a resilience plan in place, 13 are in draft, and seven have not started;
- Council resilience forums hosted jointly with Endeavour Energy/Resilient Sydney;
- Proposed Aerial Bundle Cabling program forum;
- Lake Macquarie, Central Coast, Port Stephens Council engagement;

Other resilience actors

- Minderoo Foundation Fire and Flood Initiative partnership;
- Resilient Sydney;
- Committee for Sydney;
- Indigenous Energy Australia;
- Energy Charter #bettertogether;
- Energy Consumers Australia.



16 | Climate resilience program Attachment 5.5

Employees

Employees are excited about opportunities to support Ausgrid in a resilient future and this is reflected in our refreshed Corporate Strategy. They would like Ausgrid to:

- Support a sustained workforce to respond to increasing storms;
- Provide opportunities to upskill and drive the energy transition;
- Facilitate relationships with customers to manage the energy network in partnership.

Shareholders

Our shareholders need us to:

- Cost effectively manage climate related risk growth;
- Support strong ESG disclosure and TCFD reporting on climate response activities.

Indigenous Communities

This strategy seeks to support our vision for reconciliation and commits Ausgrid to incorporate engagement with Indigenous communities as part of the infrastructure planning process, to enable knowledge sharing of the local area, to build our understanding of traditional land management practices, their stories, and the significance of the land that we utilise to deliver services. This strategy has been developed to align with and support Ausgrid's Reconciliation Action Plan.

Additional work on how Indigenous communities will shape Ausgrid's response to resilience will be a key aspect of work over the 2024-29 period and will require significant trust and relationship building exercises that are still in the early stages of progression.

Through our extensive resilience engagement, Ausgrid has found that stakeholders broadly want:

- 1. **Resilient network infrastructure**: Customers expect Ausgrid to consider all options for cost-effective investment in improving the resilience of network infrastructure;
- 2. **Community based solutions**: Customers want to be empowered to become more resilient during extreme events;
- 3. **Backup power sources**: Customers would value greater access to backup power sources during disruptive events;
- 4. **Improved communication**: Customers expect personalised communication about the expected duration of unplanned power outages;
- 5. **Increased strategic engagement**: First responders want increased engagement with Ausgrid around planning for disruptive events.

6.4 Community capacity to cope

Ausgrid's approach towards climate resilience has been shaped by understanding our role in supporting community resilience (which is increasing due to electrification), alongside other resilience actors and communities themselves. A community's resilience is inherently limited to people's 'capacity to cope', which is influenced by the availability of skills and resources they have access to during disruptive events.

In addition to our approach to modelling the impacts of climate change on our network assets, we have also developed a 'capacity to cope' index which utilises key socio-economic indices for various geographic areas⁶. The index collects key statistical vulnerability measures across our service area and assesses relative community socio-economic advantage and disadvantage. The results of the index have given Ausgrid an understanding of the highest risk LGAs from a capacity to cope perspective. We have considered community capacity to cope in our resilience investment approach, outlined in Part 2 – Climate Resilience Program.



 ⁶ Statistics | Australian Bureau of Statistics (abs.gov.au)
 17 | Climate resilience program Attachment 5.5

6.5 Climate Resilience Framework

Ausgrid understands that getting the balance right between risk and equity for current and future generations is challenging. Attachment 5.5.c – Climate resilience framework is co-designed by Ausgrid and its Reset Customer Panel to inform our assessment approach to resilience related investment.

The Framework has been developed as a response to the AER's guidance note Network resilience: A note on key issues⁷, and is designed to build upon the section outlining the assessment of resilience funding and expected supporting material.

The Framework includes a commitment from Ausgrid for extensive community engagement to understand the specific needs of the different communities that rely on the Ausgrid network. It further commits Ausgrid to engage with partners to better understand where its role starts and stops within the resilience discussion.

The Framework promotes balanced investment in resilience, supported by evidence of risks and benefits. This approach is intended to ensure intergenerational equity is achieved by increasing the probability that investment decisions today will not result in future generations paying materially more or less than current generations, both in terms of direct cost and risk of climate disruption to the essential services on which they rely.

To facilitate alignment with the AER's guidance note, Ausgrid has committed to following the co-designed Framework and will do so over the upcoming year, and into the 2024-29 period through the co-designed Resilience implementation plan. Further details can be found in the Framework (Attachment 5.5.c) and Resilience implementation plan (Attachment 5.5.a).



⁷ https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/aer-note-on-network-resilience 18 | Climate resilience program Attachment 5.5

7. Case for Investment

7.1 Balancing long-term climate risk growth, equity and timing

In responding to increasing climate risk and by using the guiding principles of the Framework, a range of solutions is required to address risks before, during, and after climate events. Proactive solutions must be economically viable, decrease the risk growth profile, and supported by communities to be considered. Ausgrid has developed its approach to balancing the equity and timing of its climate risk mitigation strategy through the following steps.

Figure 8 – Approach to balancing equity and timing of climate risk mitigation



7.2 Strong economic business case

Our portfolio of resilience investments seeks to ensure resilience solutions with a positive benefit to cost ratio (**BCR**) are adopted to address the climate risk growth. In our future looking strategy, a portfolio of investments with the highest BCR will be addressed in the early periods, to ensure that the greatest risk growth can be addressed first. These investments will be tested and backed by customers. Further details in Part 2 – Climate Resilience Program.

7.3 Resilience solutions

Resilience investment solutions are being assessed against the Framework to ensure a balanced suite of solutions is deployed to efficiently improve community and network resilience through proactive investments, support and response during extreme events, and investments to recover quickly and lessen the impacts of future events. Partnering and co-funding opportunities will be explored to facilitate cost effective investments that are valued by the community. Further details about these solutions can be found in



Appendix A – Resilience Solution Examples. Assessed network and non-network solutions include:

- Innovation trial new types of technologies or solutions that have resilience benefits.
- Community support services provide extra support to communities for better preparation before, during, and after events e.g., community education campaigns or hubs with backup generators for basic necessities.
- Network infrastructure traditional network infrastructure measures to address increased risk beyond businessas-usual investments.
- Network infrastructure (co-funded) traditional network infrastructure measures to address increased risk beyond business-as-usual investments that is co-funded between Ausgrid and a partner organisation.
- Opex (network related) increases to operations related to things such as better PPE for field workers and better maintenance on emergency tracks.
- Contingency as Ausgrid continues to engage with the community and continues to progress modelling work in FY23 funds may need to be shifted.

8. Future Strategy 2023 – 2029

8.1 Engagement approach

A key aspect of the Framework and Ausgrid's commitment to resilience expenditure is community engagement. Resilience is not one size fits all solution, and many of Ausgrid's customers and stakeholders may face cultural, resource, knowledge, or structural barriers to participating in engagement processes. Some customers are familiar with the energy sector, have the resources to participate and will be readily able to contribute. Others will have a lower level of understanding of energy issues and may not even be aware of Ausgrid's relevance to them. They may also be less confident to participate in traditional ways, or have limited time, may not speak English as a first language or have limited access to technology. Consistent and regular community engagement and Ausgrid's commitment to partner with others in the community is essential.

In 2023, as part of our commitment laid out in the Framework and Implementation Plan, Ausgrid will gather LGA specific feedback on the proposed resilience components of the plan and seek to understand what the unique needs are of individual communities are – starting with the highest risk LGAs. In 2024-29, Ausgrid will continue engagement with high-risk communities to ensure solutions are fit for purpose and will begin engagement and planning with other higher risk communities (including beginning consultation for the 2029-34 period).

How we will engage

- Ausgrid has undertaken extensive consultation during the development of the plan, the purpose of this future engagement is meet with Council and residents in the area, in (initially) three high risk LGAs to:
 - Have the events to be facilitated by independent facilitator;
 - Identify a diverse range of Council and community stakeholders that are representative of demographics from each LGA and invite to them participate;
 - o Leverage any other engagement activities also taking place i.e., Council Forums;
 - o Set up a minimum of two x full day sessions and two x half day sessions in each LGA;
 - o Outline Ausgrid's role and the regulatory reset process;
 - o Share what we have heard and learnt to date about resilience ;
 - o Learn what experiences these LGAs have had with extreme weather and prolonged outages;
 - o Understand communities priorities and potential resilience solutions;



- Refine portfolio of solutions and consult on proposed mix and willingness to pay (at Voice of Community);
- o Analyse and incorporate feedback into the plan and future resilience activities;
- Engagement will take place over the next 12 months and will continue into the 2024-29 period.

Who we will engage

- Internal stakeholders;
- Customer Advocates;
- Councils (to start):
 - o Central Coast;
 - o Port Stephens;
 - o Lake Macquarie;
- Community:
 - o Youth groups;
 - o Senior citizen groups;
 - o CALD community groups;
 - o Indigenous groups;
 - o Climate related groups;
 - Local business chambers;
- Internal stakeholders (and customer advocates).

When we will engage

- 2022 Develop engagement and implementation plan, and rank LGAs in order of engagement priority;
- 2023 Engage with top three LGA for resilience solutions prioritisation and design;
- 2024 –29:
 - o Continue engagement with top three LGAs with feedback loop of solutions to test what is working;
 - Engagement with next level priority LGAs for resilience solutions prioritisation and design;
- 2029 Begin plans for regulatory period resilience engagement and execute.

8.2 Approach to extreme heat and heatwaves

Ausgrid has done extensive climate modelling into the future climate projections on our network area. The outcomes from our climate impact assessment tell us that extreme heat and heatwaves will be one of the biggest climate risks for communities in our franchise area. We also know from research that heat is also the leading cause of extreme weather-related deaths within communities⁸ and severe heatwaves, worsened by climate change, cause thousands of deaths worldwide. Specifically in Australia, heatwaves have killed more Australians than any other extreme weather event⁹.

8.2.1 Human health risks



⁸ https://www.epa.gov/climate-indicators/climate-change-indicators-heat-related-deaths#:~:text=Heat%20is%20the%20leading%20weather,heat%2Devents%2Dguidebook).
⁹ Climate Council, The Silent Killer: Climate Change and the Health Impacts of Extreme Heat

^{21 |} Climate resilience program Attachment 5.5

Extreme heat days, and in particular prolonged heatwaves can have severe effects on human health. The health impacts of heat include both direct heat illnesses such as heat stroke, and indirect illnesses. As extreme heat events worsen due to climate change, the risk of adverse human health impacts is increasing¹⁰.

During events such as heatwaves body temperature is usually regulated using behavioural responses (e.g., using the air conditioning, or moving to a cooler place). When people are unable to maintain a safe body temperature which could be due to a multitude of reasons, they are at risk of suffering from heat illnesses or of triggering or exacerbating pre-existing conditions, such as angina. The worsening of heatwaves due to climate change is likely to put these people at greater risk¹¹.

8.2.2 Network impact modelling

Although we have modelled high level network impacts of heat, the modelling is not mature. The assessment of chronic risk for heat utilised a different approach to that of acute or event driven risks. Heatwaves have been analysed by applying an approximate probability of impact which was the estimated frequency of distribution substation failure during heatwave conditions - as a guiding estimate only. This primarily assisted in identifying the changes in Ausgrid's exposure to the risk, rather than the specific quantification of impacts. Within the modelling, there was no inclusion of increased network load due to increased use of air conditioning, other asset classes impacted by heatwaves, asset ratings, and impairment to ratings under the conditions. Cables and sensitive electronic equipment (secondary systems) were also not part of the original climate impact assessment modelling.

8.2.3 Community feedback on heat

The Councils and communities in Ausgrid's network are highly cognisant of the need to prioritise actions that build resilience for specific at-risk communities to ensure their safety, health and wellbeing. Extreme heat is some of our communities' biggest concern – specifically the perceived risk of future power outages occurring due to damaged infrastructure or pressure on the network.

The key at-risk communities identified through our resilience plan gap analysis include:

- Older community members, particularly in aged care homes;
- Social housing residents, particularly in poorly built housing;
- Life support customers in apartment buildings;
- Culturally and linguistically diverse (CALD) communities who may be unable to access emergency communication in their language.

8.2.4 Next steps

Based on our climate modelling for future heat projections, human health heat impacts, and what our communities have told us, Ausgrid is highly cognisant of the need to prioritise actions that build resilience around extreme heat and continue investing in heat related modelling. During the upcoming 2024-29 period Ausgrid will continue to invest in understanding heat:

- Progress and update its network modelling around increased demand due to heat, chronic impacts around the degradation of assets, ratings, and other secondary systems;
- Continue program of work on demand response trials to incentivise customers to lower demand during heavy demand times and continue research into controllable load shedding that integrates of real time weather data;
- Trees can have a significant cooling effect, so much so that every 10 percent increase in tree canopy cover can
 reduce land surface temperatures by 1.13°C¹². Ausgrid will be developing a co-funding scheme for Councils and
 other partners to cross subsidise the installation of low voltage aerial bundle cabling (ABC) to improve the effects
 of urban cooling and reduce the cost of vegetation management;
- Ausgrid is currently trailing the installation of a community hub that would be powered by a microgrid in Merriwa. The microgrid would be able to be islandable from the rest of the network during outages and potentially would



¹⁰ Climate Council, The Silent Killer: Climate Change and the Health Impacts of Extreme Heat

¹¹ Climate Council, The Silent Killer: Climate Change and the Health Impacts of Extreme Heat

 ¹² Greater Sydney Commission 2021, Urban tree canopy is decreased
 22 | Climate resilience program Attachment 5.5

be able to do things such as power the community hall. In FY23 we will be working with the community to understand what basic amenities that would be best suited for a prospective community hub. Amenities may include things such as air conditioning, hot showers, clothes washers, cooking facilities, and a place to charge a phone;

• In addition to increasing modelling capability relating to extreme heat, we will invest in a program of research to better understand community vulnerabilities to extreme heat and ways to understand network performance under extreme heat conditions.

8.3 Future Network Considerations

As the network continues to digitise and become smarter, future network considerations are imperative when looking at resilience related longer term investments. Behind the meter technology such as demand management and consumer energy resources (**CER**) is a key aspect of the future grid. These technologies can reduce costs and improve the resilience of our communities long term.

As energy resources become more distributed, the customer, Ausgrid may be able to offer both network innovation solutions and non-network solutions to improve resilience leveraging these technologies.

8.3.1 Network innovation examples

- Standalone power systems (SAPs)/microgrids:
 - o Provides alternative local solutions for customers who live in hard-to-reach areas;
 - Islandable systems improve the resilience of communities during extreme weather events for select customers;
 - May enable the removal of remote poles and wires reducing the risk of bushfires to assets, and reducing costs for all customers by not having to repair and maintain remote parts of the network;
 - Ausgrid has been trialling SAPs in selected areas and will roll out on a larger scale based on costbenefit analysis.
- Community batteries:
 - Make access to energy storage more equitable for customers who cannot afford behind-the-meter (BTM) batteries, are renting, or live in an apartment building;
 - o In the future may potentially provide energy support for essential services during emergencies;
 - o Ausgrid has been trialling three community batteries which will provide insights for future applications.
- Smart meters:
 - Roll-out will better support demand management schemes, and operational insights during responses to extreme events.
- Innovative network pricing:
 - Options would look at controlled load, two-way residential, flexible load, etc.

8.3.2 Non-network solutions

Based on AEMO step change scenario¹³, our forecasts of CER uptake in Ausgrid network area indicate that rooftop solar uptake will nearly double and home batteries will increase by around 113,000 by 2029. The uptake details can be found in **Error! Reference source not found.** the CER integration program (Attachment 5.7).

Figure 9 – CER uptake forecast in Ausgrid network area based on AEMO Step Change scenario



¹³ https://aemo.com.au/-/media/files/major-publications/isp/2022/2022-documents/2022-integrated-system-plan-isp.pdf?la=en 23 | Climate resilience program Attachment 5.5



- Households with rooftop solar and BTM batteries:
 - Excess solar generation can be stored in a battery system for self-use. An increasing use case is back-up power during outages and is something that can provide resilience solutions in the future;
- Vehicle to Home (V2H) and Vehicle to Grid (V2G);
- V2H/V2G technologies have also been explored to improve energy resilience:
 - The battery banks in electric vehicles (**EVs**) can supply essential services during blackouts (although the technologies are not anticipated to be ready for wider community before 2030);
 - o Ausgrid will monitor closely their developments and conduct trials when necessary;
- Demand management, efficient pricing and Dynamic Operating Envelopes (**DOEs**):
 - Incentivising customers to shift load during peak solar generation times and away from peak demand periods reduces the risk of asset failures that impact network resilience;
 - Energy appliance efficiency and coordination of customer devices through DOEs improves network performance in times that it matters most such as heatwaves.

8.3.3 Next steps

Ausgrid will continue to understand the resilience value brought by CER and demand management and build up a model to assess and validate the effectiveness of these future network solutions in increasing resilience:

- Continue SAPs and microgrids trials and collect data to feed into the resilience investment economic model;
- Explore the potential services of future CER/community batteries capabilities of improving resilience;
- Continue to explore cost-effective demand management solutions during extreme weather events.



Part 2 – Climate Resilience Program

Empowering communities for a resilient, affordable and net-zero future.



1. Context

1.1 Background

Not accounting for climate change in investment planning models can be expected to result in deterioration of the performance of the electricity supply system. Ausgrid, backed by its Board, customers, and stakeholders has actively been working to investigate the optimal balance of resilience solutions

The climate resilience program has been developed to manage the increased risk posed by climate change to our network and the communities we serve. This program responds to the increasing number of extreme weather events Ausgrid (and other networks) have experienced which has caused severe damage to our network assets, and significant impacts to our customers.

A high-level portfolio of proactive resilience enhancing solutions has been developed to build resilience before events happen, provide increased support during, and to recover quickly and lessen the impacts of future events. Solutions will be both network and community based and where possible, partnerships will be used in delivering resilience solutions. All solutions will be tested with community for input, support, and prioritisation. Other vulnerabilities such as community capacity to cope have been considered in shaping the program. To inform our assessment approach to resilience related funding, we will be using our co-designed Framework and Resilience Implementation Plan, which aims to promote balanced investment in resilience with intergenerational affordability, supported by evidence of risks and benefits.

Building resilience to the impacts of climate change during the 2024-29 period, and beyond, is imperative for future generations. Without accounting for climate change impacts when making network investments today, we will inevitably be locking in higher costs and greater risk for the customers being served by that network over its 50-year life. As it stands now, the resilience of the assets that provide our current electricity supply is dictated by the decisions and design principles adopted over the last 40 years. Likewise, the communities being supplied by the electricity network in the future will be living with the risk and cost implications of the investment decisions we make today. It is therefore critical that Ausgrid, use science-based data to consider our current and future climate risks when assessing our investment decisions over the coming regulatory period.

Due to the inherent uncertainties around future climate modelling, including climate tipping points and geo-political factors which influence global carbon emissions reductions, Ausgrid will take a cautious approach to managing our risk growth while maintaining intergenerational equity. As we continue to plan for the future, Ausgrid will aim to incrementally address the climate risk modelled to 2050 over upcoming regulatory periods. The intention behind this approach is that future generations will not end up paying materially more or face considerably higher risks than current generations.

1.2 **Problem / opportunity**

A changing climate means the historic threshold of prudent network investments is shifting. Maintaining a resilient network requires consideration of the evolving nature of the environment in which it operates and doing so while also considering the needs of a community and how it is best placed to support it. Key considerations to balanced and prudent network investment are valuing resilience, balancing equity, mitigating climate risk growth and right timing the mitigation.







1.3 Investment objectives

Under the proposed resilience program of work for the 2024-29 period Ausgrid is aiming to:

- Reduce climate related outages and impacts for the LGAs most exposed to climate change;
- Target three of the highest risk LGAs within the network to trial focused investment (supported by the Framework and Implementation Plan);
- Have better support services available to all customers before, during and after events;
- Provide additional support services to vulnerable customers.

High level investments that will contribute to meeting these objectives are listed below, and further details about these investments can be found in Appendix 1. All proposed investments must meet the requirements of the Framework, the Resilience Implementation Plan, and the AER's guidance note on Network Resilience.

- Innovation
- Community Support Services
- Network
- Network (co-funded)
- Innovation
- Operating costs
- Contingency

1.4 Customer outcomes

During the 2024-29 period the climate resilience program will deliver a balanced investment portfolio that will deliver benefits to customers through:

- Maintaining overall climate risk to 2050 to existing levels;
- Improving equity of network performance during major climate events for different customer groups;

27 | Climate resilience program Attachment 5.5



- Assessing intergenerational equity by balancing costs and risks faced by customers and communities today, with the costs and risk faced by future generations;
- Maximising overall community benefit through engagement and collaboration with communities and other resilience actors.

1.5 Business drivers

Noting that resilience is not something that can be built over night, nor over one regulatory period, by the end of the 2029, Ausgrid will be on track to:



1.6 Compliance requirements

As a provider of an essential service, Ausgrid has many legislative and regulatory obligations that we must comply with that specifically relate to resilience, including:

- NEL;
- Critical Infrastructure legislation;
- AER Network Resilience Guidance Note;
- Industry standards; and
- Environmental Protection Authority.

1.6.1 National Electricity Law

Under the NEL framework, distributors are regulated to advance the NEO:

"To promote efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers of electricity with respect to:

- price, quality, safety and reliability and security of supply of electricity
- the reliability, safety and security of the national electricity system"

Ausgrid

28 | Climate resilience program Attachment 5.5

Through the NEO, Ausgrid must balance the four aspects of performance with affordability over the long term. Resilience is an integral part of this balance, concerned with lower probability and higher impact threats to those performance outcomes.

Figure 11 – Balancing Price and Performance Outcomes



1.6.2 Critical Infrastructure legislation

The Security of Critical Infrastructure Act will impose the obligations for critical infrastructure providers to implement and keep up to date a risk management program designed to manage a broad suite of risks, specifically including natural hazard risks. Risk management obligations ensures that the entity:

Identifies each hazard where there is a material risk that the occurrence of the hazard could have a relevant impact on the asset:

- So far as it is reasonably practicable to do so—minimises or eliminates any material risk of such a hazard occurring;
- So far as it is reasonably practicable to do so-mitigates the relevant impact of such a hazard on the asset.

The provisions are set out in the Risk Management Program Rules which are an integral part of the Act. The Rules were released for consultation on 4 October 2022 and the consultation window closed on 18 November 2022.

Once consultation has concluded the rules will be finalised to take account of input received. The Minister will then approve the Rules and 'switch-on': there will then be a 6-month phase-in period to implement the rules. On that basis the earliest possible full effective date would be 21 May 2023. Annual Reporting on adherence to the Rules is required, with Ausgrid's inaugural Report due 30 Sept 2023.

Section 3 of the Draft Rules defines 'Natural Hazards' as including "*a bushfire, flood, cyclone, storm, heatwave, earthquake, tsunami or health hazard (such as a pandemic)*."

Section 11.2 of the Draft Rules states that an entity must:

- establish and maintain a process or system in the entity's program to identify the parts of the asset that are critical to the functioning of the asset (the critical sites); and
- minimise or eliminate a material risk of, or mitigate, a relevant impact of a natural hazard on the asset.

Section 11.3 of the Draft Rules states that:

- When implementing, reviewing or varying the risk management program, an entity must have regard to:
 - whether the asset's critical sites are described in the program;
 - whether the natural hazards, the occurrence of which could have a relevant impact on the asset, are described in the program.

1.6.3 AER guidance note – Network Resilience – a note on key issues

From a regulatory perspective, resilience is not explicitly mentioned within the National Electricity Rules (NER), however, in the guidance note on *Network resilience: A note on key issues*, they *"consider that resilience-related funding is accommodated by the NER even though it is not explicitly mentioned in the NER, as [it is a] characteristic...* 29 | Climate resilience program Attachment 5.5



of a network that directly influences service level outcomes [and that]... resilience funding can take the form of operating and capital expenditure".

The AER's guidance note acknowledges that Network Service Providers (**NSP**s) play an important role in the provision of essential services to communities in the lead-up to, during, and after a natural disaster. It also takes the view that network and community resilience are related concepts, and a resilient network can assist in building community resilience. The note provides guidance for NSPs in considering resilience within the regulatory framework.

Ausgrid meets the requirements of the AER's guidance note for investment in Network Resilience through the development and delivery of its Climate Resilience Framework and Resilience Implementation Plan.

1.6.4 Industry standards

Ausgrid is obligated to consider and address natural hazards and extreme weather events through legislative requirements relating to their Electricity Network Safety Management Systems (**ENSMS**).

More specifically, the NSW Electricity Supply Safety Regulation 2014 part 7 (1)(a) requires Ausgrid to have an ENSMS in accordance with AS 5577:2013 Electricity Network Safety Management Systems. This Australian Standard in turn requires a horizon scanning of hazards to the network and effective risk assessments (Formal Safety Assessments) as well as treatment plans. Whilst the ENSMS and AS 5577 fall under safety legislation, the assessments and plans must include consideration of risks to the environment, property and supply loss.

1.6.5 Environmental Protection Authority

Under Ausgrid's license conditions, we have our obligations to have an environmental management system which is compliant with ISO 14000.

Our environmental management system aims to achieve our environmental goals through both consistent and effective control of our operations. Benefits of our environmental management system includes improved environmental performance, compliance, customer relationships and continual improvement. The environmental management system defines our responsibilities, practices, procedures, processes, systems and resources for environmental management.



2. Investment approach

2.1 Balancing long-term climate risk growth, equity and timing

In responding to increasing climate risk and by using the guiding principles of the Framework, a range of solutions is required to address risks before, during, and after climate events. To be considered proactive solutions must be economically viable, decrease the risk growth profile and be supported by communities. Ausgrid has developed its approach to balancing the equity and timing of its climate risk mitigation strategy through the following steps.

Figure 12 – Approach to balancing equity and timing of climate risk mitigation



2.1.1 Aggregate growth in climate risk

To assess prudent investment levels to address increasing climate risk, we sought to understand the changing risk due to climate change from our 2020 baseline through a detailed climate impact assessment. A top-down assessment has been undertaken to ensure that our overall portfolio of proposed investments is 'right-sized' to address the change in risk due to a changing climate. To do this, our initial localised scenario-based climate risk modelling has established a 'baseline' forecast of unserved energy and damage to the network in a 'do nothing' scenario.

Top-down cost benefit modelling informs the scale and scope of network investments that can be applied in each LGA, and where these investments would make economic sense. Applying the optimal investment type to each LGA, with a BCR of 1.2, to address climate 85% risk growth would constitute a network investment program of up to \$319 million capex per regulatory period for the next five regulatory periods to 2050.

This assessment utilised climate modelling of a low, medium and high emissions scenario to identify the changing risk profile of climate perils including windstorms, bushfires, floods/coastal inundation, extreme heat, and heatwaves¹⁴. The approach combines climate models, geospatial information of asset data, failure models, and time and costs to repair/replace asset to help understand the financial and non-financial impacts on both the network and the customers it serves. Further details can be found in Attachment 5.5.b – Climate impact assessment.

Given the inherent uncertainties around future climate modelling, including climate tipping points, and geopolitical factors, it is important to understand, and where possible make investment decisions that are robust to multiple RCP scenarios. To achieve this, an 'estimated RCP' has been calculated, which weights outcomes across the three modelled scenarios (RCP 2.6, RCP 4.5 and RCP 8.5), with the strongest weighting towards the 'central' RCP 4.5 scenario, and equal weighting to the other two scenarios (reflecting their relative probabilities based on the levers and triggers available to achieve them). **Error! Reference source not found.**Table 4 below shows the weighting probabilities applied to the three RCP scenarios to derive this 'estimated RCP'.



¹⁴ the changing climate conditions related to extreme heat and heat waves were included in our initial risk modelling exercise, however the impact on the network from these perils is yet to be modelled – it is expected that this will be addressed in future phases of work.

^{31 |} Climate resilience program Attachment 5.5

RCP Scenario	Probability weighting
RCP 4.5	70%
RCP 8.5	15%
RCP 2.6	15%

Table 3 – Estimated RCP scenario weighting for Ausgrid modelling

The estimated RCP is the basis upon which climate related risks and benefits have been assessed. Using this hybrid scenario as the basis, a quantified risk value has been calculated which represents the cost of the growth in climate risk at a whole of network, and an LGA level for the investment period.

2.1.2 Valuing community and non-network solutions

The impacts for loss of electricity supply are typically measured using the value of customer reliability (VCR) to reflect the value different types of customers place on reliable electricity. Ausgrid recognises that VCR may not be appropriate to estimate the value which customers would place on mitigating the risks associated with extreme weather events. Noting that a WALDO value is not readily available, Ausgrid has sought feedback from customers through our Voice of Community (VoC) deliberative forum and other forms of stakeholder engagement to help us understand how customers and communities value resilience. In the interim, VCR has been used, and the directional results from the VoC provided Ausgrid with an approximate 40:60 opex to capex investment split, where the split is assessed in terms of bill impact to customers.

Community engagement on resilience investment

Early modelling indicated to us that proactive spend of around \$40 million per annum could be justified based on our historical experiences in recent years (two of our biggest East Coast Low storms in 2015 and 2020). We understood that this was something that would need further research and both climate modelling and customer support was required.

Ausgrid wanted to understand if this was also a concern for customers, communities, and other stakeholders - and subsequently tested the topic through various channels of engagement outlined in PART 1 – Climate Resilience Strategy. Through the many channels of engagement, there was strong customer support for Ausgrid to manage the impacts of climate change and invest to mitigate changing climate risks.

In 2021, Ausgrid set up the VoC panel, which included 45 customers representative of population demographics in Ausgrid's service area. Ausgrid ran several workshops to assess the level of investment that the VoC considered prudent for Ausgrid to make in the 2024-29 period, noting that investment would span multiple regulatory periods. Through the workshops, the VoC considered ~\$40m per annum over the forthcoming regulatory period on resilience related expenditure would be prudent (and were shown varying bill impacts depending on the split between operating and capital investments). There was strong support from the VoC for Ausgrid to propose resilience solutions that comprised of both capex and opex related investments.

In 2022, we continued with our engagement with the VoC, and they were asked about what climate risks they were most concerned about and why, what outcomes they value most, and where Ausgrid should be investing. Key learnings from VoC on climate risks include:

- All climate risks are of concern, climate change is an overall issue;
- VoC value education, communications, and plans in different languages;
- VoC are concerned around network-initiated bushfires¹⁵, long outages, and regional areas being more exposed to climate risks and therefore needing more resilient solutions;
- Maps of high-risk areas and up to date modelling data should be used;



 ¹⁵ Network initiated bushfires are covered in the Repex business case.
 32 | Climate resilience program Attachment 5.5

- VoC are concerned around flood risk including community access to electricity, damage to houses/infrastructure, access issues, and better planning for backup power in flood prone areas;
- Concerns around heat risk including building standards, animals, and vulnerable people such as the elderly or people with disabilities. They believed that there should be investment in 'community resilience hubs';
- Communications from Ausgrid during storms is important, and we should be investing in early warning systems and harder assets for areas exposed to more frequent damaging wind events.

Table 4 - VoC feedback on desired resilience outcomes¹⁶

Outcomes	Weighting allocated based off importance to VoC
Significantly reduce climate related outages and impacts for those most exposed (small # of customers benefit)	30% of customer dollars on resilience should be spent on this
Moderately reduce climate related outages and impacts for a higher number of people (medium # of customers benefit)	30% of customer dollars on resilience should be spent on this
Have better support services available to all customers before, during, and after climate events (high # of customers benefit)	40% of customer dollars on resilience should be spent on this

Table 5 - VoC feedback on desired investment focus17

Areas	Weighting allocated based off importance to VoC
Areas where extreme weather impacts the most	34% of customer dollars on resilience should be focused on these areas
Ares where there is expected to be the biggest increase in outages due to extreme weather	28% of customer dollars on resilience should be focused on these areas
Areas where people are vulnerable and less able to cope with the impacts of increasingly extreme weather	38% of customer dollars on resilience should be focused on these areas

The directional results from the VoC provided Ausgrid with an approximate 40:60 split of bill impacts to be spent 40% opex, which would typically be more community related, and 60% on capex which would result in more network investments, though there would be some overlap of network vs. community investments in both categories e.g., community hubs may cross over into both expenditure categories.

¹⁶ Results are from September 17th, 2022 VoC Meeting

¹⁷ Results are from September 17th, 2022 VoC Meeting



^{33 |} Climate resilience program Attachment 5.5

3. Options

3.1 Overview

Four investment options beyond the 'do-nothing' base case scenario were considered to mitigate the projected growth in risk. All options target the same benefit, i.e. mitigating the change in climate risk between 2020 and 2050, with some options getting closer to this goal than others.

Each of the options explored below seek to reduce the growth in community and network risk through proactive investment, support, coordination, and response during extreme events. However, their relative benefits have been assessed by identifying one single optimal network investment type, and the optimal penetration level of that investment type, for each LGA. The selection of this optimal investment type has been informed based on the climate profile, customer base, and network topography and construction in each LGA. The actual investments in each area will be subject to further community engagement and more refined modelling to identify the right *mix* of investments, both capex and opex, for each LGA and globally across the Ausgrid service area. As such the NPV against each option presented herein can be considered a conservative and robust estimate but is indicative in the sense that they will be refined through the engagement process outlined in the Resilience Implementation Plan, and further detailed design that will occur in period. The options also assume that any opex expenditure incurred will be *at least* as cost effective in mitigating risk growth as the equivalent capex investment.

As we constrain focus to a small number of LGAs to facilitate meaningful community engagement, the overall NPV may shift in the other direction.

None of the options examined below can cost effectively mitigate all the growth in risk projected by 2050 within the upcoming regulatory period. Some climate related risk growth will remain, and is likely to need to be addressed in future regulatory periods. The recommended investment option for the 2024-29 period is a 'least regrets' approach that focuses on the areas of highest 'known' risk first and incorporates community and stakeholder feedback to include both network and non-network options, trialing different approaches, and supporting intergenerational equity.

Option	Description	Expenditure (2024-29) (\$m, real FY24)	Expected growth in risk to 2050 mitigated (%)	NPV (\$m, real FY24)
Option 1: Base case – do nothing new	No investment in resilience in 2024-29 period. Use existing risk management strategies to reactively respond to climate events e.g., cost pass throughs – and upgrading assets to modern standards when they are replaced. Results in largely unmitigated growth in risk in terms of customer outages and safety incidents, with subsequent high asset replacement cost leading to volatility in customer bill impacts.	0	0	0
Option 2 Longer-term risk mitigation approach	Resilience capex for 2024-29 period set at a level to mitigate as much risk as is economically justifiable to mitigate from 2020 to 2050, assuming equal spend in each reg period to 2050, with investments exhibiting the highest BCR projects done first.	319.0 capex	16.3	0.6

Table 6 - Summary of options



Option	Description	Expenditure (2024-29) (\$m, real FY24)	Expected growth in risk to 2050 mitigated (%)	NPV (\$m, real FY24)
Option 3: Longer-term risk mitigation approach, with customer driven cap	As per Option 2, but investment in 2024-29 period capped at \$202m totex (with a mix of capex and opex solutions in line with customer preference). Projects with highest BCR will be done first and consider the growth in risk to 2050.	193.6 capex 8.4 opex	10.9	12.6
Option 4: Balanced risk mitigation approach	Resilience capex for 2024-29 period set at a level commensurate with projected risk growth from 2020 to 2029, and what is economically justifiable to mitigate. This may result in a small portion of the 2024-29 investments being sub-optimal solutions in later years but allows broader and more robust testing of alternative solutions to occur in this period.	224.3 capex 9.6 opex	16.4	115.2
Option 5: Balanced risk mitigation approach, with customer driven cap (Preferred)	As per Option 4, but with investment capped at \$202m totex (in line with customer preference).	193.6 capex 8.4 opex	14.9	88.6

3.2 Option 1: Base case – do nothing new

3.2.1 Description

Under this option, Ausgrid would not make any dedicated resilience investment, but would continue to maintain its BAU approach to weather risk management. If an extreme weather event occurs, Ausgrid will repair the infrastructure and restore the grid back to its previous BAU state (or the most up to date standard applicable).

Ausgrid would not perform any targeted network upgrades in anticipation of more frequent extreme weather events, to improve resilience during climate events No additional support would be provided to communities before, during, and after events, and there is no additional support or tools for Ausgrid to get customers back on faster during events.

3.2.2 Base case assumptions

This option has been estimated based on the assumptions presented below, which is in line with our existing measures.

- No dedicated resilience investment for the 2024-29 period;
- The existing Ausgrid response plan used during major events;
- The existing community and climate vulnerability in each area is only considered in line with Ausgrid's existing customer support programs; and
- Climate risk is allowed to grow without direct mitigation measures.



3.2.3 Costs and risk growth forecast

There is no specific resilience investment cost for Option 1. With no resilience investment, recovery period from loss of supply, higher cost in the asset replacement cost, and exacerbated customer impacts can be expected.

Option 1 is not supported as it does not allow Ausgrid to meet its obligations under the NEO.

Table 7 – Option 1 investment and risk reduction

Description	Investment	Reduction in risk	NPV
	(\$m, real FY24)	(%)	(\$m, real FY24)
Option 1	0.0	0.0	0.0

3.3 Option 2: Longer-term risk mitigation approach

3.3.1 Description

In this option, Ausgrid aims to mitigate the annual risk growth in the next five regulatory periods to 2050 with equal economic investments in each period of \$319.0m per period. This approach aims to facilitate longer term bill smoothing for customers, as later periods will face higher levels of risk growth than earlier periods. Based on our current forecasts, this option generates a more optimal result longer term, however the investment is not necessarily well matched to benefits or timing needed for investments. In addition, this approach is not conducive for diversity of investment or trials.

3.3.2 Inputs and assumptions

Option 2 aims to mitigate risk growth to 2050 with constant economic expenditures over the next five regulatory periods using highest BCR projects and achieving the risk reduction target based on best long term investment option. This option further targets investing in capex only network solutions designed to mitigate increase in risk growth.

The expected impact of the risk growth on Ausgrid's network were modelled, and the risks were broken down by LGA. The information was used to determine the highest-risk suburbs within the network areas in two formats:

- The locations most at risk by a specific hazard parameter-present day and in 2050; and
- A list of the most impacted suburbs.

Impact ranking was assessed using two metrics - asset replacement cost and value of unserved energy. This is assessed for each of the acute perils¹⁸ modelled in the analysis.

The option aims to target risk growth over 25 years and to find the corresponding network solutions that limit the risk growth over the regulatory period. This option allowed Ausgrid to understand what the maximum expenditure of network solutions in each LGA in Ausgrid's network area would be by using only high BCR projects. The option aims to target risk growth over 25 years and to find the corresponding network solutions that limit the risk growth over the regulatory period. The projects in this option must have a BCR of at least 1.2.

From the analysis of this option, a total investment of \$319.0m would be spent on capex solutions, and no spend on opex. Through consultation, stakeholders advised that they wanted Ausgrid to only invest in cost effective solutions and to balance affordability with risk mitigation.

3.3.3 Costs and risk reduction forecast

With a total investment of \$319.0m per regulatory period, the climate change related risk growth in the regulatory period to 2050 is mainly mitigated. Table 8 shows the risk reduction over the regulatory period, while Table 9**Error! Reference source not found.** shows the impact of this option on an average customers bill¹⁹.



¹⁸ In carrying out an assessment of the physical impact of climate change on our network, the acute perils modelled were windstorm, bushfire and riverine flood, while the chronic perils modelled were heatwave (and other temperature related metrics) and coastal inundation.

¹⁹ The bill impact is the average impact across all customer types (from Low users with less than 1500 to small businesses of 10000)

^{36 |} Climate resilience program Attachment 5.5

Table 8 - Option 2 investment and risk reduction

Description	Investment	Expected growth in risk	NPV
	(\$m, real FY24)	to 2050 mitigated (%)	(\$m, real FY24)
Option 2 (2024-29)	319.0	16.3	0.6

Table 9 – Customer bill impacts of Option 2

Totex (\$m, real FY24)	319.0
Capex (\$m, real FY24)	319.0
Opex (\$m, real FY24)	0
Average bill impacts per annum, incl GST (\$)	2.61

Maintaining long term risk growth aims to prevent bill shocks of major events and cost pass throughs compared to Option 1. In Option 2, the average expected representative customer bill impact is \$2.61 per annum.

Option 2 is not preferred because of the following associated risks:

- It is not aligned with customer and stakeholder sentiments around bill impacts or types of solutions;
- It does not consider any community support service solutions which may be viable solutions to offset network investments;
- While the annual risk growth is reasonably maintained, investing in network only solutions will limit Ausgrid's ability to support the communities before, during, and after extreme weather events;
- Does not effectively target communities with a lower capacity to cope;
- Does not follow co-designed Framework; and
- Is not conducive to trials and testing of solutions.

3.4 Option 3: Longer-term risk mitigation approach, with customer driven cap

3.4.1 Description

In this option, Ausgrid aims to mitigate the annual risk growth in the next five regulatory periods to 2050 to with only long-term capex solutions being selected.

Customer advised through VoC that their preference was a resilience program that included both capex and opex solutions and were comfortable with a resilience totex of \$204m.

Led by the guidance of the VoC and other stakeholders, we capped investment in the model at \$204m and prioritised projects with highest BCR. The model forecast that a resilience investment of \$195.6 million over 2024-29 period will achieve the desired risk mitigation. We then reduced the reduced the value by \$1.95m to account for overlapping repex and arrived at an investment value of \$193.6m – further details about this can be found in Appendix B. Listening to our customers and stakeholders request that we also look at opex solutions, we have then applied the VoC preferred opex to capex (40:60) spend ratio for bill impacts resulting an investment of \$193.6m capex and \$8.4m opex.

Table 10 – Option 3 total expenditure

Totex (\$m, real FY24)	202.0
Capex (\$m, real FY24)	193.6
Opex (\$m, real FY24)	8.4



3.4.2 Inputs and assumptions

The input and assumptions for network solutions in this option is the same as Option 2, where the target benefit is described in terms of the longer-term risk growth over five years, and the selected network solutions have a BCR greater than 1.2. For the non-network solutions, Ausgrid does not have a mechanism to measure benefits of non-network/community investment in resilience. With that, Ausgrid developed a draft portfolio of investments based on workshops and investment analysis with Councils, Reset Customer Panel, VoC and other industry stakeholders. Example investments were given to stakeholders, and the recorded responses were used as a proportion to determine the split between capex and opex solutions. Solutions will be refined, tested, and trialed through the process outlined in the Framework and Resilience Implementation Plan.

3.4.3 Costs and risk growth forecast

With a total investment of \$ 202m, the projected total climate risk growth out to 2050 can have mitigation towards future risk. Table 11 shows the average bill impact over the 2024-29 period.

Table 11 – 0	Customer	bill im	pacts of	of O	ption	3
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Totex (\$m, real FY24)	202.0
Capex (\$m, real FY24)	193.6
Opex (\$m, real FY24)	8.4
Average bill impacts per annum, incl GST (\$)	2.30

Table 12 shows the annualised risk reduction from capex solutions only.

Table 12 – Option 3 investment and risk reduction

Description	Investment	Expected growth in risk	NPV
	(\$m, real FY24)	to 2050 mitigated (%)	(\$m, real FY24)
Option 3 (2024-29)	193.6 capex	10.9	12.6

In this option, an approach is adopted to mitigate the risk growth in the entire network. The non-network and community solutions will further provide communities with support services before, during and after events. It also allows Ausgrid to invest in better tools and research in managing events. In Option 3, the average expected residential bill impact is \$2.30 per annum.

Option 3 is not the preferred option as it:

- Invests in solutions that are more expensive relative to the expected risk during the period;
- Is less diverse in resilience "network solutions" for this period which is not aligned with customer expectations as it focuses on the best long-term solution;
- Is not conducive to trialing and piloting new technology and solutions; and
- Solutions do not mitigate as much expected growth in risk during period as other options.

3.5 Option 4: Balanced risk mitigation approach

3.5.1 Description

In this option, Ausgrid aims to invest in the highest BCR projects for the upcoming regulatory period. This results in a high NPV for this period and allows Ausgrid to test a diverse range of solutions. There is some risk that a small portion of the 2024-29 investments may need to be replaced in later years to address future risk, however, this option allows for diversity and trialing of investments.



This option considers a capex only investment of \$224.3m to mitigate risk in the next regulatory period. The projects in this option must have a BCR of at least 1.2. The VoC highlighted the importance of both network and community solutions, as such \$9.6m opex was included for community support services like hubs and education, and research into vulnerability, taking totex for this option to \$233.9m.

Table 13 - Option 4 total expenditure

Totex (\$m, real FY24)	233.9
Capex (\$m, real FY24)	224.3
Opex (\$m, real FY24)	9.6

3.5.2 Inputs and assumptions

The inputs and assumptions for network solutions in this option targets benefits described in terms of the risk growth over five years, and the selected network solutions have a BCR greater than 1.2.

Programs with the highest BCRs are invested in in this regulatory period to buy down the risk. Opex heavy community based programs were added to this option using the same VoC led bill impact ratio described in Option 3.

3.5.3 Cost risks and growth forecasts

With a total investment of \$233.9m in this regulatory period, targeting highest BCR projects, a greater level of initial risk can be mitigated in the 2024-29 period. Table 14**Error! Reference source not found.** below risk reduction in this the regulatory period.

Table 14 - Option 4 investment and risk reduction

Description	Investment	Expected growth in risk	NPV
	(\$m, real FY24)	to 2050 mitigated (%)	(\$m, real FY24)
Option 4 (2024-29)	224.3	16.4	115.7

Table 16 – Customer bill impacts of Option 4

Totex (\$m, real FY24)	233.9
Capex (\$m, real FY24)	224.3
Opex (\$m, real FY24)	9.6
Average bill impacts per annum, incl GST (\$)	2.65

In Option 4, the average expected residential bill impact is \$2.65 per annum.

This option is not the preferred option as it is:

- Not aligned with investments in resilience that have been tested with stakeholders and customers; and
- The highest bill impact option, and Ausgrid is aiming to balance future climate risk with affordability.

3.6 Option 5: Balanced risk mitigation approach, with customer driven cap

3.6.1 Description

In this option, Ausgrid aims to invest in the highest BCR projects for the upcoming regulatory period with a customer led investment cap. This results in a high NPV for this period, the ability for Ausgrid to test and trial and pilot a diverse range of solutions, with the potential that a small portion of the 2024-29 network investments may need to be replaced in the future to mitigate risk.



This option uses the same approach as Option 4 to mitigate risk in the next regulatory period. The projects in this option must have a BCR of at least 1.2. Customer advised through VoC that their preference was a resilience program that included both capex and opex solutions and were comfortable with a resilience totex of \$204m. The VoC also indicated that rather than attempting to mitigate climate risk growth across all Ausgrid's supply area, their preference was to target investment within a few LGAs that were particularly at risk in the short term. It is proposed through the Resilience Implementation Plan to focus on the three highest risk LGA's²⁰.

Led by the guidance of the VoC and other stakeholders, we capped investment in the model at \$204m and prioritised projects with highest BCR. The model forecast that a resilience investment of \$195.6m over 2024-29 period will achieve the desired risk mitigation. We then reduced the reduced the value by \$1.95m to account for overlapping replacement expenditure (**repex**) and arrived at an investment value of \$193.6m – further details about this can be found in Appendix B. Listening to our customers and stakeholders request that we also look at opex solutions, we have then applied the VoC preferred opex to capex (40:60) spend ratio for bill impacts resulting an investment of \$193.6m capex and \$8.4m opex.

Table 15 - Option 5 total expenditure

Totex (\$m, real FY24)	202.0
Capex (\$m, real FY24)	193.6
Opex (\$m, real FY24)	8.4

3.6.2 Inputs and assumptions

The inputs and assumptions for network solutions in this option targets benefits described in terms of the risk growth over five years, and the selected network solutions have a BCR greater than 1.2 the same as Option 4.

Programs with the highest BCRs are invested in in this regulatory period to buy down the risk with the customer led investment cap. Community based programs which are opex heavy were added to this option using the same VoC led bill impact ratio described in Option 3 and 4.

We will continue to with the AER and stakeholders to model the community benefits to accurately determine the risk to be reduced in the regulatory period based on the adopted community support services.

3.6.3 Cost risks and growth forecasts

With a total investment of \$202m in this regulatory period, targeting highest BCR projects, a greater level of initial risk can be mitigated in the 2024-29 period. Table 14**Error! Reference source not found.** below outlines the risk reduction in this the regulatory period.

Table 16 - Option 5 investment and risk reduction

Description	Investment	Expected growth in risk to	NPV
	(\$m, real FY24)	2050 mitigated (%)	(\$m, real FY24)
Option 5 (2024-29)	202.0	14.9	88.6

Table 16 – Customer bill impacts of Option 5

Totex (\$m, real FY24)	202.0
Capex (\$m, real FY24)	193.6

²⁰ The model can currently only choose one solution per LGA and therefore this view is global to the network but will be applied to 3 LGA's. As Ausgrid continues to engage with our customers and further progress modelling, our revised model will be able to optimise investments to choose the best mix of solutions for LGAs with highest underlying risk and lowest capacity to cope.



Totex (\$m, real FY24)	202.0
Opex (\$m, real FY24)	8.4
Average bill impacts per annum, incl GST (\$)	2.30

In Option 5, the average expected indicative customer bill impact is \$2.30 per annum.

This option is the preferred option as it balances:

- Listening to what customers want relating to investment levels and a mix of types of solutions;
- Is more equitable as it will focus investment on higher risk areas;
- Deliverability of investing in targeted LGAs;
- Investments in this option are diverse and allow Ausgrid to test and trial a selection of technologies while still buying down comparable risk to that of solutions in Option 2 and 4;
- Costs through balancing short-term affordability with investments that address future risk while, taking an intergenerational perspective of whole-of-life investments to result in an overall longer-term bill smoothing;
- Deliverability through proactive approach of addressing a buy down of risk now and still allowing for innovative technology to progress; and
- Follows approach outlined in the Framework.



4. Recommendation

Ausgrid recommends Option 5 as its preferred solution, as it combines network, non-network, and community-based solutions with a mix of capex and opex. It better prepares the network and the community for climate events, by helping the community build resilience, supporting the community during an event, helping the network and the community recover more quickly from an event, and lessening the impact of the next event. Option 5 supports sustainable investment in climate risks between now and 2050, allows Ausgrid to trial and learn more with communities about resilience, and facilitates delivery of benefits in the period that the investment is made.

In line with customer and stakeholder feedback, Ausgrid proposes to invest a \$202.0m totex in resilience initiatives which will be subject to testing against the Framework in 2023.

Table 17 Option 5 Proposed capex expenditure

Сарех Туре	Reduction in risk (\$m, real FY24)
Replacement	\$154.9
Growth/Augmentation	\$29.1
Non-network	\$9.7
Total	\$193.6

Customers and stakeholders were clear that they wanted Ausgrid to invest in community style solutions which are typically more opex investments. Ausgrid proposes to invest \$8.4m opex in resilience initiatives which will be subject to testing against the Framework in 2023.

Table 18 Option 5 Proposed opex expenditure

Орех Туре	Reduction in risk (\$m, real FY24)
Community focused	\$6.4
Network focused	\$2.0
Total	\$8.4



5. Document Governance

5.1 Related documents

Document	Author
Attachment 5.5.c – Climate resilience framework	Ausgrid/Reset Customer Panel
Attachment 5.5.b – Climate impact assessment	KPMG/Risk Frontiers/Ausgrid
Attachment 5.5.a – Resilience implementation plan	Ausgrid/Reset Customer Panel

5.2 Document history

Date	Version	Comment	Person
04/10/2022	V4.0	Feedback incorporated	Jess Hui

5.3 Approval(s)

Name	Position	Date
Junayd Hollis	Executive General Manager, Asset Management	17/1/2023



Appendix A – Resilience Solution Examples

Outlined in Appendix A are some resilience solutions examples that Ausgrid has developed through engagement with customers and stakeholders. Resilience solution development will occur through the process outlined in the Framework and Resilience Implementation Plan.

Innovation

Ausgrid has a long history of innovation, and the current Network Innovation Program builds on this experience to identify, develop and integrate into core corporate systems and processes a range of new and innovative solutions to both existing and emerging problems in a fast-changing industry.

Through the 2019-24 period, Ausgrid has successfully operated an innovation process in close collaboration with our customers, through the Network Innovation Advisory Committee (**NIAC**). This forum has guided and refined our innovation program to ensure maximum benefit to customers and other stakeholders – ensuring we put them first in the decision-making process.

For the 2024-29 period, we are proposing a continuation of that model with an expanded scope, with the NIAC continuing to provide guidance and advice on the composition and focus of our resilience innovation expenditure that may expand to also include opex.

Figure 13 – Governance approach to climate resilience activities



It is expected that some activities will transition along this spectrum over the next 7 years

The program will use a portfolio approach, where the focus will be on delivering the benefits and outcomes identified under each workstream rather than targeting specific technology trials. With resilience operating as its own workstream, innovative resilience solutions will be investigated, developed, and approved in accordance with this approach. It is anticipated that not all projects will progress beyond initial investigations, and therefore a large portfolio of potential activities will be progressed and rationalised as outcomes and benefits from each solution are evaluated.

In line with this portfolio approach, it is anticipated that high benefit solutions will be progressed through the deployment of large-scale pilots and trials within the scope of this program – thereby allowing rapid realisation of the identified benefits within the regulatory period.

This program is designed to achieve the following specific objectives:

- Test and understand the best balance between network, non-network, and community resilience solutions;
- Test and understand investment before, during, and after events;
- Develop the capability to integrate new resilience related technology into the network to drive efficiency in energy distribution over the long-term;
- Modernise the network to improve service levels and facilitate the adoption of new technology and equipment;
- Improve the resilience of customer energy supply in the face of a changing climate and increasingly societal dependency on electricity;
- Deploy enabling technology, devices, and systems to facilitate the transition towards a less carbon intensive energy system; and



• Utilise the NIAC as a channel to gain knowledge to ensure future activities and investments are the most prudent option.

Example Build Back Better

A key part of understanding innovative resilience solutions will be learning about when to invest, the types of standards applied, and subsequent technologies that are in line with the standards.

Ausgrid proposes to work with communities more exposed to climate risks through the 2024-29 period in a Build Back Better trial. This trial would involve engagement with communities to understand if they would be willing to trade off a potentially longer outage for the opportunity for Ausgrid to build back better.

This would involve a trial update to network standards applied to the specific area, and emergency network spares ready to go that are in alignment with the enhanced standard. The trial would effectively wait until that area of the network is impacted by an extreme weather or natural hazard event, and then the crews would repair the network to the higher standard. It is likely that other community-based resilience solutions would be tested in parallel with this trial e.g. mobile community hubs.

Table 19 Build back better solution

Program	Target Audience	Success Criteria	Resilience Benefit
Build back better	 Local Councils Local government associations Indigenous land councils 	Customers are not negatively impacted by prolonged outage but increase network resilience implemented	 Network built to increased standard in cost effective approach Providing customer support and amenity during extreme weather events and prolonged outages Allows innovation and ideas to be trialled

Community support

As societies continue to decarbonise and electrify, the importance of building resilience increases. Ausgrid recognises that community resilience and network resilience are separate concepts but intrinsically related. We also recognise that although we have a role to play in building community resilience, there is a need for partnerships with government, local councils, essential services, and other resilience actors.

Ausgrid has a role to play in facilitating services to enable communities to support themselves, and subsequently has developed several initiatives to support community resilience programs that will be tested with various communities and LGAs on what is most suitable to build their community resilience. Below are a sample of the community support programs which Ausgrid looks to engage with communities over the coming years.

Example Community Grants

Communities need resources to help prevent and prepare for climate risks and build local resilience through collaborative, community-driven approaches. Although many community groups recognise that climate change is becoming a bigger issue for them to manage, they may not have funds to do so.

The program will fund projects in partnership with other resilience actors that build community resilience and capacity to withstand climate-related hazards.

In considering applications for grant funding, Ausgrid would consider a variety of aspects to assess the suitability of proposals including, but not limited to:

 Community need – Proponents need to demonstrate a clear community need including the climate-related hazard, its potential impact on the community, and how the funds would be used to prevent and/or mitigate its consequences. The needs of the community in terms of their vulnerability and sensitivity to the hazard should be clearly articulated;



- Stakeholder engagement Proposals need to detail a process for identifying and engaging with stakeholders. Ideally, proponents will have already carried out some level of stakeholder engagement to inform the outcome being sought;
- **Impact** Proposals should describe the desired impact of the initiative and how success will be measured. This should consider the extent to which community resilience will be enhanced;
- Roles and responsibilities Key roles and responsibilities in delivering the initiative should be clearly defined. Any partnerships with other entities should be identified, with delineation between Ausgrid and their roles. Proponents should also explain why it would be appropriate for Ausgrid to fund the initiative;
- **Feasibility** Proposals need to outline the feasibility of the project. This should include consideration as to whether the budget and timeframe are appropriate and realistic. A value-for-money assessment will also be required. Where possible, community resilience benefits should be quantified and weighed against costs.

Table 20 Community resilience grant program solution

Program	Target Audience	Success Criteria	Resilience Benefit
Community resilience grant	 Local Councils Indigenous land councils Community Groups 	 Grant program fully subscribed Up to 20 media pick-ups (x 2 per grant) 	 Reduction in pressure on Ausgrid and other bodies Providing customer support and amenity during extreme weather events and prolonged outgages
program	 Non-profits Universities or tertiary education 	2 per grant)	 Reduced pressure on vulnerable communities Allows innovation and ideas to be trialled Reputation Increased public safety Avoided food spoilage Animal welfare

Example Education Campaigns

Through the various channels of community engagement Ausgrid has done over the last few years, a key topic that has repeatedly come up as a need from communities is increased education. Along with other community initiatives that will be tested with customers, Ausgrid proposes a community resilience education campaigns:

- Public education campaigns through television, radio or print about resilience in targeted high-risk areas on the importance of emergency preparedness;
- Awareness in schools including extension of the existing Electricity Safety Week to include climate change impacts and the importance of emergency preparedness planning; and
- Public and emergency workers training, building on current electrical safety program, on how climate change will impact how they should plan for extreme weather events.

Table 21 Community preparedness education campaign solution

Program	Target Audience	Success Criteria	Resilience Benefit
Community preparedness education campaign	 Residential, and small commercial customers in high climate risk areas Local Councils Indigenous land councils Community Groups 	 Residential customers reached Small commercial customers reached Councils engaged Indigenous groups reached Local schools visited 	 Reputational Customers aware of risk and are better prepared during prolonged outage and extreme weather events. Customers are more prepared and less reliant on Ausgrid, and other first responders during events. Reduction in pressure on Ausgrid and other bodies Increased public safety



Example Community Resilience Plans

Community local resilience plans are typically prepared by Councils but might also be developed by ad-hoc local community groups or Indigenous Land Council groups. Their purpose is to identify potential shocks and stressors that the community may face and outline different vulnerabilities. The plans also outline ways that the local communities can prepare and respond to those shocks and stressors.

Targeted investments by Ausgrid in local communities should be informed by local resilience plans to ensure that optimal benefit can be derived through complimentary resilience investment.

33 councils across Ausgrid's network area are at different stages in the development of their own resilience plans. Some councils do not have a resilience plan, others have draft plans, while others again have well developed plans with a robust framework to ensure plans are maintained. Other communities such as local Indigenous Land Councils do not have resilience plans developed.

Ausgrid proposes to support communities to develop resilience plans for high-risk communities. We propose to do this through partnerships with local councils, non-profits, infrastructure providers, and other relevant resilience actors.

An initial gap analysis on the status of community resilience plans across Ausgrid's network area shows 13 Councils have community resilience plans, 13 Councils have draft plans or documents in development, and seven Councils do not have resilience plans.

Table 22 Community resilience plan solution

Program	Target Audience	Success Criteria	Resilience Benefit (non-energy benefits)
Community resilience plans	 Local Councils Local government associations Indigenous land councils Ad-hoc community groups Other relevant organisations 	 Full subscription to program Funding partnerships @ 50% minimum e.g., Minderoo Foundation Fire and Flood Initiative we have currently partnered with at this funding rate 	 Reduction in pressure on Ausgrid and other bodies Providing customer support and amenity during extreme weather events and prolonged outages Reduced pressure on vulnerable communities Allows innovation and ideas to be trialled Reputation Increased public safety Avoided food spoilage Animal welfare

Network Infrastructure

We know from both historical and future climate impacts that we have modelled, that extreme weather events cause prolonged outages on our network. We are exploring a range of network solutions to address climate risk growth for each geographic region and for each climate peril. Solutions aim to mitigate risks, reduce the number of customers impacted, or improve our response times.

While some resilience solutions are similar to our BAU investments in reliability, replacement, and augmentation, resilience investments would target at the delta from the baseline risk, including risks that are typically beyond the scope of standard programs, such as MEDs.

With any network infrastructure upgrades, Ausgrid would look for opportunities to find economical ways to install assets e.g., in higher risk areas, working with Council's who are already doing road upgrades, Ausgrid would consider opportunistically undergrounding assets. Network infrastructure examples for insulated conductors and network segmentation are considered below.

Example Insulated Conductors

The majority of Ausgrid's overhead network is built with exposed bare conductors. These conductors were originally constructed to a particular physical strength, able to resist stresses from storms, heat and some intermittent contact with vegetation.

Our baseline replacement program targets the replacement of assets with reduced strength caused by asset deterioration over time, however, it does not account for the additional stresses placed on these assets under future climate scenarios.



47 | Climate resilience program Attachment 5.5

Conductor failures are one of the most common events that can occur during storm events. When these occur one of two outcomes may result:

- 1. Network supply is interrupted by the upstream protection device resulting in an outage to all customers downstream of this protection.
- 2. Supply remains on at and upstream of the point of failure, leaving live electrical conductors on the ground and within reach of the public creating public safety risks.

While replacing conductors like-for-like will improve the conductor strength and mitigate some impacts from climate events, insulated or covered conductors provide additional benefits. Insulated or covered conductors are able to help resist and absorb the impacts of climate events by:

- 1. Reducing the likelihood of customer supply interruptions from intermittent vegetation contact (blown into the mains).
- 2. Eliminate conductors clashing from high winds and potential conductor failures or fire starts as a result.
- 3. Reducing the likelihood of a public safety incident due to inadvertent contact in the event conductors still fall.
- 4. Significantly reduce the likelihood of conductors breaking (even if they do fall), enabling accelerated restoration.

Our analysis done in Part 2, enables us to review the construction of the network in the areas most impacted by climate events, and propose a postcode-based investment that seeks to mitigate the risk through the upgrade of deteriorated assets.

Example Network Segmentation

For each outage, the number of customers impacted is defined by the size of the protection zone of the upstream device that isolates the faulted section from the healthy network.

To mitigate the risk of loss of supply, the network segmentation can be altered to balance the likelihood and consequence of faults on the network.

Our baseline reliability program targets compliance to reliability standards and provides a minimum performance level across the network. The reliability program does not account for forward looking reliability performance and excludes the impacts of MEDs.

While some of the options for delivering resilience are similar to typical reliability investments, resilience actions will be targeted at risks that are typically beyond the scope of existing reliability programs. Given this differing emphasis there is not a conflict nor an overlap between the focus areas of resilience and reliability.

Solutions to manage the number of customers impacted may include:

- Segmenting the feeder through network rearrangement with new:
 - o Feeders;
 - o Reclosers;
 - Sectionalisers;
 - o Fuses;
- Additional redundant supplies; and
- Zone or STS auto closing.

During major weather events, not only will less customers be impacted per fault, but the length of feeder to be patrolled will also be reduced, resulting in faster identification of defective and healthy sections of the network.

Network Infrastructure (Co-funded)

Where benefits from an investment can be derived from multiple parties or may not make economic sense if one organisation goes at the investment alone, Ausgrid will be seeking co-funding partnerships to facilitate investments to support local community resilience.

Ausgrid is pursuing co-funding partnerships for investment in infrastructure upgrades to address resilience risks identified both by Ausgrid and by communities. Infrastructure investments that may be considered for co-funding opportunities would be things such as undergrounding, aerial bundle cabling and other opportunities that may arise. Below we have outlined an example of a co-funding arrangement.



48 | Climate resilience program Attachment 5.5

Example co-funding for Aerial Bundled Cabling (ABC)

Community planning and network planning often have different issues they are attempting to resolve by various solutions. Communities across NSW (and globally) have aggressive targets set to increase their urban forest canopy cover. There are significant community benefits from an increased urban forest that include healthier people who are less exposed to stressors such as heat, an increase in biodiversity, overall provide a cooling effect in urban areas, retain water in the soils, absorb carbon dioxide, and improve air quality.

Vegetation can cause significant issues for Ausgrid from a reputational and network perspective. During storms if vegetation debris comes in contact or a tree branch drops on the overhead main this can cause an outage. Similarly, if vegetation comes in contact with the overhead mains, there is also a risk of fire start. Ausgrid currently spends \$40m per annum on vegetation management to clear tree branches from power lines. Our climate modelling indicates an increase in both the number of storms and bushfires. This operating cost is expected to increase if urban canopy cover also increases.

With the installation of ABC, vegetation coming into contact with mains are less likely to cause a network outage. Our current outage management system (**OMS**) data tells us that low voltage (**LV**) ABC accounts for only 9% of our vegetation driven outages, even though they account for 24% of spans. ABC also allows for increased urban forests as it allows trees to have a bigger canopy and creates an urban cooling effect by reducing the need for tree trimming.

Ausgrid would like to introduce streamlined co-funding arrangements for the installation of ABC with Councils and potentially other resilience related organisations. The program would allow for larger tree's to be planted, that can be directionally trimmed around the wires. Many Councils and communities have requested more ABC to protect urban canopy.

Ausgrid formerly had a 50/50 co-funding program for ABC but was found inequitable as it was only wealthier councils who were able to take up the offer. In the 2024-29 period, Ausgrid proposes to utilise a sliding scale for funding depending on climate risk in the area (extreme heat days, heatwave, windstorm risk, bushfire risk), socio-economic status of those in the area, and overall vulnerability.

Program	Target Audience	Success Criteria	Resilience Benefit
Co-funding arrangements	 Local Councils Local government associations Indigenous land councils Ad-hoc community groups Other resilience related organisations or critical infrastructure providers 	 Full subscription to program Demonstrated equity for those most vulnerable 	 Increased maintenance of service, avoidance of licence conditions penalties Reputational benefit Reduction in other capex costs to Ausgrid Increased public safety Insurance benefits – less likely chance for fire start caused by our network

Table 23 Co-funding arrangement solution

Opex considerations

Investment in operating costs and tools to help Ausgrid support communities and get the power on faster during events. Beyond programs such as education campaigns, examples of increased operating costs might include things such as increased scenario planning at emergency management committees, or better equipment for crews to access areas during natural hazard events.

Ausgrid is committed to providing the best outcome for its customers – especially in a future climate. We will do this by understanding the specific needs of the community that is supported by the network we manage. We recognise that solutions that work in urban areas, may not work in areas that are more remote or rural. As we work on developing resilience solutions for our network, how we respond to incidents, and the customers we serve, there will be an increase in opex related expenditure. This will be associated with the required staff to run and operate the resilience related activities, associated costs with delivering research and education.



Based off the co-design of the Framework, communities and customer advocates have requested an elevated level of community and customer engagement relating resilience expenditure. Below are examples of resilience activities with an opex consideration:

- Community and customer engagement by LGA (per Framework);
- Administration and delivery of community resilience programs and strategy planning;
- Climate impact modelling and assessments;
- Vulnerability indexing research;
- Employee training and capability uplift;
- Update to standards and operating protocols; and
- Increased PPE for workers.



Appendix B – Review of Repex

As outlined in Appendix A, some resilience solutions are similar to our BAU investments programs in technology type. However, the focus of resilience investments would be to target the delta modelled between our baseline risk to the future climate risk. These kinds of risks, such as MEDs, would typically be considered beyond scope of BAU programs.

Ensuring that there was no overlap specifically between the resilience and repex program, we performed a review on current activities that could potentially be double counting resilience/repex areas.

LV mains and steel and copper mains replacement program

For low voltage mains, the replacement investment is focused on the removal of dedicated LV circuits and service wires with only small amounts of open wire replacement with LV ABC. The locations where these programs will be targeted are urban inner-city areas, not the focus areas for resilience investment. Therefore, we do not expect any overlap on low voltage.

Steel and copper mains replacement is a planned program with a defined worklist that will extend over multiple regulatory periods. Any minor potential overlaps will be avoided through worklist review and can be substituted with alternative locations on the same worklist.

Pole replacement program

Pole replacement is a condition-based program informed by pole inspection. When a pole is condemned, it's priority is classified based on the expected remaining life. Certain pole defect types will require replacement regardless of resilience overlap as we will not be able to defer these. Non-urgent pole replacements can be deferred if they overlap with a resilience project. In the three LGAs that we are looking to focus on during this regulatory period there is a population of 445,624 poles, and we forecast replacement of 2,196 poles. The forecast overlap of urgent pole replacements with resilience projects is 153 poles (7%).

To account for any potential overlap between the resilience program and the two repex programs outlined above, we have reduced the value of our preferred investment option by \$1.95m.

