YARRA ENERGY FOUNDATION

Supported by:

AusNet

Shine a Light:

Understanding vulnerability at the intersection of disability and electricity services

Final Report

AusNet Vulnerability Research Grant 2022

April 2023

Acknowledgements

I wish to thank AusNet for initiating this worthwhile research grant opportunity, and affording YEF the opportunity to pursue such a meaningful and interesting research topic.

Thank you to the many research participants, especially those with whom I shared stimulating and compelling conversations and who generously shared their life experiences and perspectives with me.

Thank you to two anonymous friends in the disability sector who reviewed the research materials for accessibility, amongst other things, and provide valuable feedback; and to Tim Shue at YEF for valuable input throughout.

Lastly, I am particularly grateful to Jade Park and Lucy Holder at AusNet for their kind patience and critical guidance in seeing this project through to success.

Lachlan Hensey

Energy and Storage Officer
Yarra Energy Foundation

Citation: Hensey, L. (2023). *Shine a Light: Understanding vulnerability at the intersection of disability and electricity services.* Yarra Energy Foundation. Version 1.0

Contents

1. Executive Summary

1.1 Context and intent

Residents of regional and rural communities can face unique challenges in accessing services such as healthcare and disability support, as well as being more vulnerable to issues with the reliability of essential services such as the supply of electricity.

The increased incidence of extreme weather events and natural disasters as a consequence of climate change, combined with a fast-evolving energy system, exacerbates these vulnerabilities.

The inaugural AusNet Vulnerability Research Grant (2022) invited social service organisations to conduct research with "customers experiencing vulnerability or with diverse capabilities" to help AusNet "better identify these customers, understand their needs and how to best support them".[1]

The Yarra Energy Foundation, as a not-for-profit supporting better energy outcomes for communities, was excited to propose a research project investigating the lived experiences and very real risks and impacts facing vulnerable customers across the AusNet distribution area.

The project's overarching goal was to "shine a light" on the experiences of AusNet customers who live with disability or chronic health conditions[2] and to identify how AusNet can improve outcomes for these customers. Customers with specialised support needs may rely especially on their electricity supply to maintain their health and wellbeing, and may therefore experience additional challenges managing energy expenses and risks associated with incidents such as power outages.

The report found that how critical a particular use of electricity is, is not inherent to the activity or the item of technology, but is the product of an individual's unique circumstance and experience. For example, the criticality of power is particularly clear when speaking with people who face difficulties with thermal regulation, heating and cooling. These are critical medical needs, not merely comforts.

Our findings also suggest that a reliance on electricity to power mobile signal boosters – even within metropolitan Melbourne – and Wi-Fi, highlights the intersection of communications and energy technology domains. There may be opportunities for AusNet to partner with other utilities, service providers and

---

1 AusNet Vulnerability Research Grant 2022, AusNet, https://communityhub.ausnetservices.com.au/ausnet-vulnerability-research-grant-2022

2 In this report, we sometimes refer to "disabled people" or "people who live with disability or chronic health conditions". There are different opinions about the use of person-first or identity-first language as well as to what extent different health conditions ought to be considered disabilities. In this report, we aim for simplicity, employ both person-first and identity-first language (seeing both as equally legitimate), and sometimes refer only to disability. The reader should assume this includes chronic health conditions, which are disabling for the interview participants.

authorities to address problems that cut across institutional responsibilities; responsibilities that do not solely rest with AusNet. This approach may be especially important as new issues emerge through urban expansion, the transformation of the energy system, and the increasing adoption and dependencies on information and communication technologies.

Findings draw heavily on interviewees' compelling – and at times emotional – perspectives that powerfully illustrate their own lived experience and dependence on electricity supply. Overall, participants were resourceful and knowledgable about their personal risks, but did convey frustrations about the disconnect between their risk exposure and the decision-making and activities which could reduce these risks.

Although these participants are vulnerable in the sense of being highly exposed and sensitive to stressors, they also demonstrate substantial resilience, persistence, resourcefulness, patience, and good humour; they are not, in the colloquial sense, 'vulnerable' in character.

While many participants emphasised how grateful they were to be heard, these stories and experiences are still largely absent from public discourse which contributed to them feeling that their situation is invisible and unchanging. Indeed, multiple inverview participants face life-threatening risks during a power outage, but they are not recognised as 'life support customers'. This report does suggest some steps to address this gap, however a more detailed policy review of life support customers is beyond the scope of this project.

A central finding of this report is the interconnection of various risks, which means that while some impacts may appear relatively minor in isolation (such as the loss Wi-Fi), there is a propensity for these to produce a cascade of additional impacts: communicative, psychological, medical and otherwise (section 4.3). Thus, even minor stressors can have extended and substantial after-effects that may be invisible and unanticipated to those unfamiliar with this risk context.

Another key finding is that vulnerability is a conditional outcome of an individual's position with respect to institutional structures and social relationships. For example, if portable generators are made available to those who require life support equipment, decision-making around what is certified as life support equipment by medical prifessionals becomes a critical policy and governance question. Related policies or initiatives may exclude individuals who nonetheless face life-threatening risks during a power outage in a case of institutional oversight.

Likewise, the financial resources an individual can access and their capacity for employment – and, relatedly, the ability of that person to mitigate risks themselves varies considerably throughout the population. Managing ongoing health issues and support needs can also incur a significant financial cost, especially over time. The

cost of electricity is therefore a factor that shapes how participants respond to their vulnerability with respect to their disability, geography and use of electricity (section 4.4).

Nonetheless, as experts of their own experience, participants relayed various strategies that they employed to manage the challenges they encountered in their daily lives and in power outage or emergency situations (section 4.5). However, there are hard limits to the extent to which individuals can be empowered to manage risks that go far beyond their control and have impacts that are not easily remedied.

This report shines a light on the experiences of previously unheard voices of people impacted directly by the disrupted supply of electricity. It may, in some ways, also challenge the traditional role of distribution businesses as one which is evolving beyond the technical operation of electricity networks to one that involves or must consider a social and customer welfare agenda.

1.2 Key findings

Section 4.1 Sensitivity

- Some customers rely on electricity to power important therapeutic supports, refrigeration of medicine, and for heating/cooling strategies. Outages can render these ineffective, leading to additional risks to physical and mental wellbeing.
- Challenges with bodily thermal regulation appear to be relatively common. Heating/cooling is one of the most critical dependencies on electricity, and loss of heating/cooling strategies can lead to rapid and severe impacts among many people with different conditions.
- Recreation, routine, and the comfort of home take on additional importance for customers whose lives are constrained by disability or isolation, and interventions in these domains can cause significant distress.
- Disabled customers often already manage additional stress, discomfort, pain, executive dysfunction, or risks, and are more likely to experience mental health challenges. They are therefore more sensitive to stressors such as outages that disrupt self-care and management practices, which may engender disproportionate or unanticipated levels of distress from the perspective of non-disabled people.

Section 4.2 Exposure

- Customer exposure to risks is compounded by the intersection of geographic isolation, environmental hazards, and the vulnerability of network infrastructure to such hazards.
- Most customers understand the challenges posed by geography, environmental hazards and human interventions, but nonetheless express some concern regarding the degree to which network infrastructure is vulnerable to such hazards.

- Similarly, many customers recognise that although AusNet staff are likely to be doing what they can to address outages, some interview participants expressed disappointment or scepticism regarding structural or institutional factors. One participant expressed doubts about the commitment of a private entity to invest in preventative maintenance, while another identified gaps in institutional responsibility for risks that emerge out of intersecting deficiencies in telecommunications and electricity network infrastructure.
- Survey results indicated that about a quarter of respondents remain quite or extremely concerned about future power outages, and a similar number consider planned outages a moderate to significant risk to their wellbeing even when provided advanced notice.

Section 4.3 Interconnected risk and cascading impacts

- Many customers rely on 3G/4G boosters and Wi-Fi that is electrically powered in order to communicate with the outside world. This makes them particularly vulnerable should they experience a power outage alongside a health emergency or natural disaster, as well as disrupting their social lives and work or administration responsibilities.
- There may be opportunities to partner with relevant telecommunications and and government actors to address complex risks that bear shared responsibility for mitigation.
- The potential seriousness of impacts relating to power outages – especially losing communications capabilities – is a source of fear, frustration and anxiety for some participants, which can exacerbate existing physiological and mental health challenges.
- The relationships between various risks and impacts can be non-linear, unique, diverse and iterative, creating unexpected feedback loops and causal chains that may not bear a direct connection to the initial stressor, as the risk context is complex.
- Although mental health impacts may not manifest as ‘first-order impacts’ – those directly caused be a stressor – many participants highlighted the mental health aspects of power outages as the most salient and challenging to manage.

Section 4.4 Energy costs and financial vulnerability

- Survey results indicated that in the past two years, about half of respondents have felt concerned that they might struggle to pay their electricity bill, and 63% are moderately or very concerned about the cost of electricity in the future.
- Customers who experience disability and chronic health conditions may be unable to work, unable to find suitable work, underemployed, only able to work a limited amount, or retire early. Consequently, some receive low incomes and/or experience financial hardship. This is exacerbated by possible additional costs of managing their conditions.

- Participants identified solar and batteries, and generators, as worthwhile investments to help manage financial and technical risks associated with their electricity supply, but in some cases are unable to afford such an investment.
- Some dimensions of vulnerability are the result of both internal factors and external context, including an individual's experience of, and position relative to, societal structures or institutional actors such as the NDIS and CentreLink.

Section 4.5 Adaptive capacity

- Both survey respondents and interview participants have developed and/or employ a range of technological, social and behavioural strategies to manage energy expenses, power outages, and associated risks.
- Individuals prefer different modes of communication regarding planned outages, and it is recommended that AusNet continue to communicate consistently and utilising all modes to ensure the message reaches its customers.
- With advanced notice, some customers are able to employ numerous strategies to moderate the impacts of planned outages, and can reduce the stress of such experiences through planning. For others, however, advanced notice does not change the practical impacts.
- While AusNet was generally commended for diligently informing customers during unplanned outages, this is of no benefit to the many customers who rely on electricity to power their mobile signal boosters and NBN service.
- Although some participants expressed concern regarding their financial situation and/or the cost of electricity, it was not a major theme in interviews. This could be for a number of reasons, though it generally did not seem to intervene in or shape participants lives or behaviour anywhere near the extent of power outages.

1.3 Recommendations (see section 5)

Establish guiding principles for reducing vulnerability; for example:

- Reduce uncertainty
- Communicate early, often, and using different modes
- Build relationships and a presence among communities

Pursue internally-led initatives, including:

- Changes to the life support register, or introduce an additional register that accommodates vulnerable customers according to experience of risks and impacts rather than certification of equipment;
- Low-cost leasing program for backup power systems
- Data and information sharing to facilitate partnerships with external stakeholders;

- Customer outreach initiatives, such as energy efficiency and energy bill literacy workshops or guidance regarding portable batter packs for essential devices;

Support externally-led initiatives, including:

- Supporting telecommunications businesses to augment infrastructure to reduce mobil reception black spots
- Enhancing household energy efficiency and thermal comfort
- Retrofitting islandable Emergency Relief Centres

2. Conceptual review of vulnerability

In the domains of social policy and community engagement, 'vulnerability' appears as a Swiss Army knife in the lexicon, taking the place of more specific descriptors of marginalisation and disadvantage. Vulnerability is – almost by definition – relational, in that the term implies a susceptibility to an (unrealised) risk. Nonetheless, 'vulnerable populations' are frequently defined by status indicators or group identities such as income, race and age, and are often referred to homogeneously.[3]

Our conception of vulnerability recognises that status and identity are important, but only conditional, aspects of vulnerability. In fact, they appear as largely correlative rather than causative factors. For example, one's age is a driver of vulnerability only to the extent that one's social context or relevant government policies convey particular degrees and forms of support or disadvantage.

However, this does not imply that vulnerability is a purely externally derived condition. The feminist legal theorist Martha Albertson Fineman contends that "vulnerability is … universal and constant, inherent in the human condition".[4] Rather than erasing the very real differences in susceptibility to harm among individuals, Fineman's thesis is that our universal vulnerability is moderated disparately by our unique position in "a web of economic and institutional relationships".[5] This demands that the state and other 'powerbrokers' manage carefully the societal structures and institutions that distribute resources, opportunities and risks differently among individuals.

In feminist moral philosophy, Mackenzie expands and critiques Fineman's conceptualisation, calling for greater focus on the various sources of vulnerability and advocating for responses to vulnerability that promote autonomy. The latter is proposed to counter "objectionably paternalistic social policy interventions" that may "perpetuate[] relationships of domination or inequality".[6]

Seeking further granularity regarding the sources and forms of vulnerability, Mackenzie outlines a typology of vulnerability as *inherent* (part of being human) or *situational* ("context-specific and caused or exacerbated" by external factors), as well as *pathogenic* (vulnerabilities arising from prejudice, abuse or domination), *dispositional* (vulnerable to risk) or *occurrent* (risk is realised).

In relation to disability, Clough notes that the categorisation of people as vulnerable or otherwise risks reifying a binary that has serious consequences in the domains of

---

[3] Fineman, "The Vulnerable Subject: Anchoring equality in the human condition," in *Transcending the Boundaries of Law: Generations of Feminism and Legal Theory*, (London: Taylor and Francis Group), 166.

[4] Fineman, "The Vulnerable Subject," 161

[5] Fineman, "The Vulnerable Subject," 167.

[6] Mackenzie, "The Importance of Relational Autonomy and Capabilities for an Ethics of Vulnerability," in *Vulnerability: New Essays in Ethics and Feminist Philosophy*, eds. Catriona Mackenzie, Wendy Rogers and Susan Dodds (New York: Oxford University Press, 2013), 47.

law and policy. Drawing from both Fineman and Mackenzie, Clough describes the suspicion with which the vulnerability concept is perceived "due to its perceived synonymous relationship with weakness and powerlessness, and its traditional ascription to disabled people to enable controlling interventions".[7]

Vulnerability has also been explored in relation to environmental change. Adger outlines the various traditions and evolutions of vulnerability research germane to environmental change, and demonstrates how vulnerability research shares commonalities with research on resilience in the context of social-ecological systems and climate change. In Adger's domains of interest, "In all formulations, the key parameters of vulnerability are the stress to which a system is exposed, its sensitivity, and its adaptive capacity."[8]

This conception of vulnerability takes the shape of a formula that implies variables, measurement, metrics and comparison. This stands in contrast to the conception put forward by Fineman and elaborated by Mackenzie and Clough, which emphasises the corporeal and institutional basis of vulnerability. A strong link can be drawn, however, as Adger highlights that human and political ecologists "argued that the discourse of hazard management, because of a perceived dominance of engineering approaches, failed to engage with the political and structural causes of vulnerability within society."[9]

There are synergies, then, between the ideas expressed by Fineman, Mackenzie and Clough, respectively, and the broad thrust of critical political ecology – a broad church, for sure, but one that has at its core an attendance to the interconnected, indirect and long-reaching effects relationships that span political, economic, environmental, social and other landscapes.[10]

For the purposes of this research project, we wish to emphasise the risk of approaching vulnerability as a characteristic of a particular identity. Rather, like Fineman, we contend that we share an inherent vulnerability by virtue of being human – subject to biological processes and injuries – and that this shared experience highlights the need to attend to the ways in which our social, economic and political relationships moderate our situational vulnerability.

We also recognise the ways in which discourses of vulnerability can connote negative associations with powerlessness, deprivation or incapacity. As such, we hope that our approach to this project reflects our intent to empower and cultivate collective responses to the shared reality of vulnerability.

---

[7] Beverley Clough, "Disability and Vulnerability: Challenging the Capacity/Incapacity Binary," *Social Policy and Society* 16, no. 3 (Jul 2017): 469, doi:10.1017/S1474746417000069.

[8] W. Neil Adger, "Vulnerability," *Global Environmental* Change 16, no. 3 (Aug 2006): 269, doi: 10.1016/j.gloenvcha.2006.02.006.

[9] Adger, "Vulnerability," 272.

[10] Paul Robbins, *Political Ecology: A Critical Introduction* (Malden, MA: Wiley-Blackwell, 2011).

3. Methodology

3.1 Project scope

The project's scope can be considered in three dimensions: geography, identity and subject matter.

Initially, the geographic scope was limited to the Strathbogie, Murrindindi and Latrobe municipalities, as YEF had worked with each council previously and this was viewed as an advantage to making local connections. However, as is discussed later, this was not the case and in order to ensure a viable sample size, the geographic scope was broadened to include all of AusNet's electricity distribution network area.[11]

With respect to participant identities, YEF proposed to engage with people with specialised support needs – more specifically, individuals living with disability or chronic health conditions. Disability is a sometimes overlooked aspect of marginalisation and discrimination, in part as its breadth of meaning and the diversity of impairments make a shared identity and singular community less stable than other marginalised communities described by race, religion or sexuality.

A key driver of the focus on disability was the project's chief investigator having extensive domain knowledge and professional experience in this area, as well as an acute awareness of the vital importance of electricity in the day-to-day functioning of disability support services.

The focal subject matter of the research therefore emerged out of this experience, combined with insights from AusNet regarding their efforts managing the impacts of power outages, storms, and other challenges in the reliable provision of electricity. AusNet had identified particular gaps in their understanding, as well as challenges experienced in recent events, that together influenced the scope of the subject matter broached in the survey and interview guide.

3.2 Research aims

This project had three **research aims**:

1. To explore and describe participant perspectives on their experience of vulnerability (particularly in the context of electricity provision), including key concerns, possible contributing factors to risks and impacts, and any coping strategies or solutions.
2. To develop a detailed understanding of household energy consumption behaviours and patterns, and how this may contribute to specific risks/impacts, through qualitative and quantitative research methods.

[11] AusNet's gas distribution network is not discussed in this report. Wherever the term distribution network may be used, this pertains only to the electricity network.

3. To identify and describe potential methods for mitigating identified risks among regional community members, including policy and project options, network and non-network solutions, and outreach programs.

These research aims were supported by the following guiding **research questions**:

1. How do regional community members who experience disability and/or chronic health conditions use and rely on electricity to manage their lives and wellbeing?
2. In what ways are regional community members who experience disability and/or chronic health conditions disproportionately vulnerable to risks and impacts in relation to electricity provision?
3. What options are available to AusNet and other utilities or authorities to mitigate and reduce identified risks and impacts among regional community members who experience disability and/or chronic health conditions? And what measures would empower or enhance resilience among these individuals?

The project sought to respond to these research questions through using a mixed methodology involving a survey and in-depth interview methods. The design of the survey and interview guide was informed by ethics of deep engagement and collaboration, whereby participants are treated as experts in their own experience; and vulnerability is seen as both universal and particular, emerging from the interaction of internal, situational and structural factors.

The survey provided both quantitative data through multiple choice questions and qualitative data through open-ended response questions. The triangulation of quantitative and qualitative data sources yielded more robust insights than would otherwise have been possible. In particular, insights drawn from the small number of interviews (n=9) could be supported with reference to quantitative survey results with a larger sample size (n=114), as well as existing literature where appropriate.

3.3 Recruitment and sampling strategy

The original proposal aimed to recruit 50 survey respondents and 10 interview participants, and survey respondents could also participate in the interview if they so wished. The geographic scope of the project was originally limited to Strathbogie Shire, Murrindindi Shire and the City of Latrobe, as YEF had previously worked with those local councils on separate projects. However, after experiencing challenges with recruitment, the geographic scope was expanded to all of AusNet's distribution network area.

The primary sampling criteria was therefore quite simple. Eligible participants were those who (a) live in the AusNet distribution network area and (b) *either* experience disability or a chronic health condition(s); or are a parent/guardian or regular support person for someone who experiences disability or a chronic health condition(s). This was effectively a screener, and demographic representation was a secondary consideration (especially given challenges with recruitment).

Participation was incentivised as follows. Survey respondents would go in the draw to win 1 of 15 $50 e-gift vouchers, and interview participants would receive a $50 e-gift voucher. This was later increased to $150 to encourage a stronger response.

YEF first reached out to council access/inclusion and sustainability teams for support promoting the project and recruiting research participants, for example, through council newsletters or social media. Despite contacting 22 councils, this proved to be largely unsuccessful with regards to recruitment. Many councils have outsourced disability, aged care and other community services to the private sector, and as a result, seemingly have minimal direct engagement with these communities.

In many cases, councils were unable to promote the project at all due to policies that limited their communications to council-supported projects and activities. In some cases, YEF never received a response. Nonetheless, we are grateful for a small number of council officers who did engage with the project, which led to some incredibly valuable participation by community members.

YEF also contacted to all NDIS-registered support providers listed in AusNet's distribution area. Unfortunately, this was also largely unsuccessful. In the author's own experience, many NDIS providers are resource-constrained and operate in busy, stressful contexts, so while disappointing, it is not entirely surprising that the project struggled to engage NDIS providers. It was surprising, however, that there was so limited a response. This was also the case with regards to many advocacy groups and peak bodies, with the exception of a small number who offered enthusiastic support. YEF also promoted the project and sought participants through social media, electronic newsletters and through our professional networks.

After several months of difficulty in recruiting participants, with AusNet's support, two market research businesses were engaged to facilitate recruitment for the survey and interviews, respectively. Their services partially overcame the issue of connecting with members of a potentially "hard-to-reach" community. However, finding ways to hear from community members who experience disability remains an area for continued learning and improvement across society, and paid market research sampling is by no means a panacea. Both businesses were provided the abovementioned sampling criteria, with the addition of preferences (but not strict criteria) regarding demographic diversity, to ensure an appropriate sample.

Ultimately, the survey respondent sample size was n=114, of which 9 respondents came from YEF's original recruitment channels and 105 respondents were sourced by a sampling service. 5 interview participants were recruited by YEF, and 5 more were sourced by a sampling service (interview sample: n=10).

A table of documenting the participants characteristics is provided in Appendix section A.2.2.

3.4 Data collection

3.4.1 Survey design

The original survey comprised 36 questions, including several screener and administrative questions. It was developed by drawing on YEF's own expertise as a community-oriented energy service provider and experience discussing household engagement with energy, as well as existing literature on vulnerability and disability. The survey was reviewed by two professional contacts working in the disability sector to ensure accessibility and relevance.

The survey began with screener questions that confirmed eligibility before covering the following topics (skip logic was used as appropriate):

- Disability/health support needs
- Use and dependence on electricity
- Energy affordability
- Experience of power outages
- Communications (e.g., regarding utility faults, during natural disasters)
- Further demographic questions
- Feedback and contact details for incentives

The survey is included as an appendix.

3.4.2 Interview design

Following recruitment by YEF or the market research company, interviews lasting 30-60 minutes were conducted and recorded using Microsoft Teams, before transcripts were produced using a transcription service.

The interview guide pursued the same topics as the survey, but was written with the intent that it would allow a free-flowing dialogue to explore insights that emerge during the interview. In practise, most interview participants were very generous in conversation and the interview guide was mainly used to provide occasional prompts rather than to direct the conversation.

The interviews were critical to the research aims. A key normative objective of the project was to give voice to individuals whose experiences may otherwise be unheard and invisible. To properly address research aim 1 (to explore and describe participant perspectives on their experience of vulnerability), it was essential that the project facilitated opportunities for two-way dialogue that gave primacy to participants own perspectives, including how they felt and any strategies they employed to manage their perceived vulnerability. At times, this report plays the role of conduit by relaying these experiences, along with their at-times profound emotional force, with a view to demonstrating the less tangible effects of vulnerability not easily captured by the survey.

3.5 Data analysis

Following data collection, the survey results were processed in Microsoft Excel to identify significant results and relationships. Each answer from each respondent were processed into summary tables of the results of each question, before further analysis was performed to draw out further insights. However, given the relatively small sample size of 114, it has not been the intention that the survey results would yield generalisable findings per se. Rather, the survey results provide statistically meaningful support for ideas uncovered during interviews, where participant experiences can be elucidated more fully.

Interview transcripts were coded using the open-source software Taguette, through which key themes were identified. These themes form the structure of the Discussion section of this report. Special attention was paid to the similarities between participant experiences, which might indicate structural drivers, as well as unique risks and impacts, and the ways by which participants managed these. Much of the qualitative data analysis has been conducted through writing this report and the pursuit of recommendations.

4. Discussion

This chapter discusses the results through six broad themes.

Section 4.1 discusses participants' sensitivity to risks and stressors such as power outages and the cost of energy due to a critical dependence on power.

Section 4.2. outlines participants' exposure to such risks that emerge due to geographic context.

Section 4.3 explores how risk factors are interconnected and how they can compound and cascade if impacts occur.

Section 4.4 discusses the economic aspect of vulnerability and how energy costs factor into participants' behaviour.

Section 4.5 examines the strategies that participants employ in order to manage the risks and impacts to which they are subject, and employs their wisdom as a starting point for developing recommendations for AusNet and/or authorities to address vulnerability.

4.1 Sensitivity: Critical dependence on power

Most people rely on power to enable their lifestyles and to help manage their wellbeing, but for those who experience disability, power can be a particularly critical and pervasive need. This critical dependence on power constitutes a *sensitivity* to risks and stressors related to electricity availability and expenses, as the impacts have the potential to be relatively unique, diverse, and much more serious.

Vulnerability is often characterised as a function of exposure to a potential stressor, sensitivity to that stressor, and capacity to adapt (adaptive capacity).[12] This report employs this understanding of vulnerability to show how participants may be more exposed and sensitive to some risks, and may have reduced adaptive capacity to manage these when they occur. The aim of this section is to outline the ways in which disabled customers may experience greater sensitivity to risks due to their unique and diverse physiological, social, and psychological needs, and the various possible impact pathways that may result if these needs are not met. It is not simply that some disabled people may experience the same impacts as most other people but more severely; the impacts may be very different for each person due to their unique circumstance, and may lead to very different, and potentially grave, outcomes.

The figure below shows a simplified pathway from a stressor (e.g., a power outage), to the unrealised and actual events or occurrences that stem from that stressor (risks; e.g., loss of heating/cooling), to the impacts experienced by people as a consequence of the risk materialising. In reality, these categories are not so easily

[12] Adger, "Vulnerability," ; Turner et al., 'A Framework for Vulnerability Analysis in Sustainability Science'.

distinguished or linear, and some would suggest that a risk becomes an impact when it materialises. Here, for simplicity, the impacts are described as the distinct outcomes of a risk that materialises (Impact A) or otherwise (Impact B). The figure aims to show that stressors may have *multiple* associated risks and subsequent possible impacts, that may lead to further risks and impacts given the interrelation of our bodies, practices, and homes. These may even be considered stressors in other pathways.

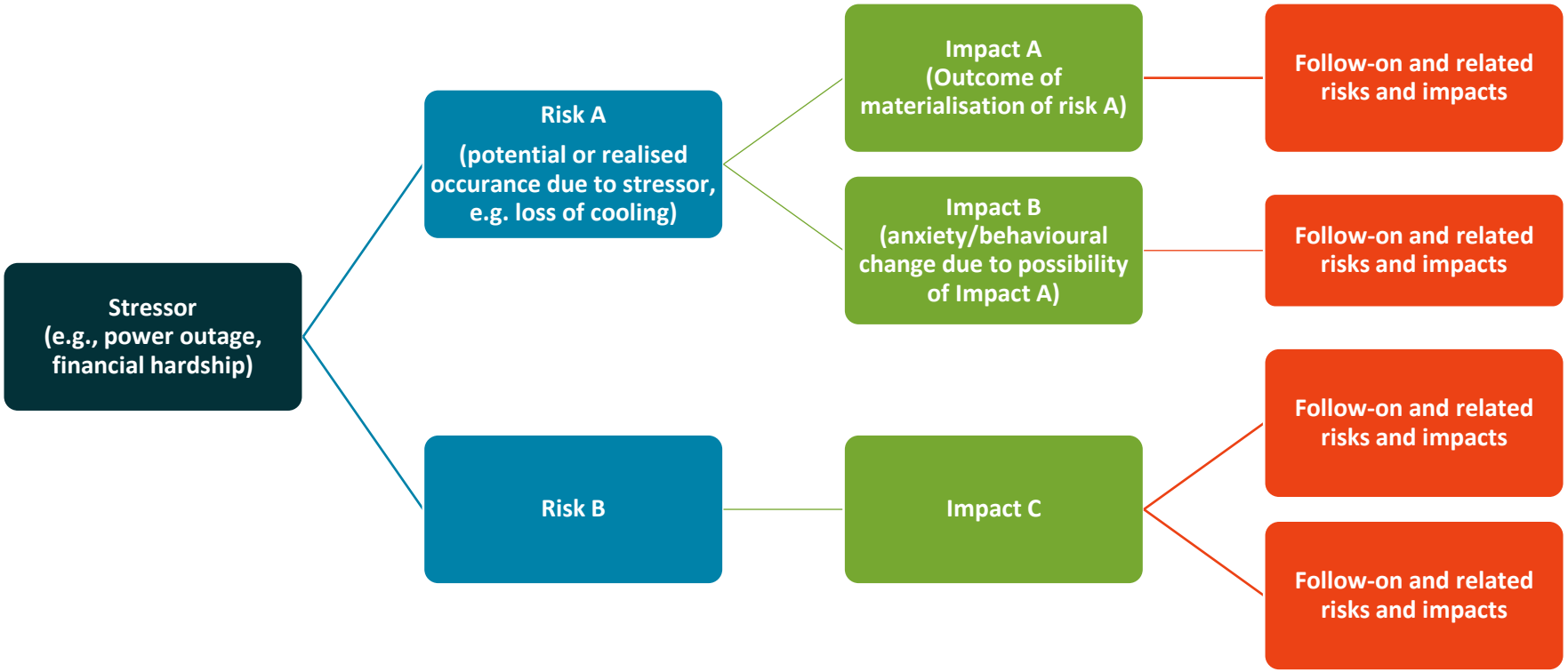

Figure 1. Pathway from stressor, to risks, to impacts

4.1.1 Therapeutic supports

Some participants use electrically powered therapeutic supports or devices and experience significant challenges or distress when these are unavailable. For example, Cathy experiences sleep apnoea and can't sleep without using a Continuous Positive Airway Pressure (CPAP) machine, which ensures she breathes properly. Here she describes her concern regarding overnight power outages cutting off power to the CPAP machine:

> Well, if I don't have the CPAP machine, I can't sleep pretty much. So it just ruins the day …. It just tires me out and- so, I do have high blood pressure and diabetes as well. So it sort of impacts that, in that it exacerbates that for me. Because part of controlling [those conditions] is to have good sleep. So, if I don't have that, it just wrecks you.
>
> [What's] most concerning to me is … if I'm in a really heavy sleep and I don't wake, well then I could die …. You know, sometimes I have slept for a while whilst it's been out and when I do wake up, my throat's red raw and everything, but that- that's the risk. The risk is if I don't have the CPAP machine, I'll stop breathing. So, I don't really wanna do that yet.

If Cathy loses power during the night – especially for a long period – it is not only her sleep that suffers. The lack of sleep exacerbates other medical conditions and affects her executive function, "ruin[ing] the day". More troubling, though, is that Cathy could stop breathing and die, or risk other serious medical complications. Two other participants also identified similar issues regarding use of a CPAP machine.

Several participants were diabetic and were concerned about the need to keep their insulin refrigerated. Even if the shelf life was not an immediate concern, participants noted additional anxiety regarding an outage and any possible reduced efficacy of the insulin. Luke uses a sensor on his arm that communicates with his phone, reading his blood sugar levels and sending an alarm when it is too low. He says he gets an alarm "three or four times per week a week", often during the night. When asked how he'd feel if his phone wasn't charged and there was an outage at dinner time, Luke responded as follows:

> Well, to put it bluntly, I'd be crapping myself because, especially around dinner time, purely because when you're having a meal, you need to have the insulin …. So if you have too much insulin, you're gonna have a reaction within the next half an hour, forty-five minutes …. If you have too much [long-acting insulin], that's where overnight it can affect you probably more than during the day…. It's more dangerous when you're asleep 'cause you don't feel it.

Asked what the worst-case scenario was if he didn't address a serious blood sugar low, Luke said:

> Death could be the worst-case scenario, if you have way too much insulin and you've had not enough sugar. Um, but the last time I had low blood sugar episode when I was asleep, my stepdaughter was home and she actually heard me, you know, having a fit in the bedroom, so she called an ambulance.

Luke started using the sensor with his phone rather than having to prick his finger throughout the day to take blood sugar readings, and it has significantly improved his quality of life. But it has introduced a new risk – if his phone runs out of battery, he loses his method for tracking his blood sugar levels and dosing his insulin appropriately. Situations like this exemplify as phenomenon whereby technological advancements improve quality of life or reduce minor everyday risks, but also

centralise risk on one component of a system – in this case, Luke's home and practices. If the power goes out, every electrically dependent technological improvement to life is rendered ineffective or at risk of failure, often having first displaced manual or unpowered techniques for overcoming life's challenges.

Q16. Of the survey asked: In relation to your disability(s) and/or health condition(s), what are the most important things you need to use electricity for? Are there any times that you most need electricity?

The open-ended responses identified a number of important therapeutic supports or essential needs, including the following:

Table 1. Power-dependent therapeutic supports and essential needs

Q16. In relation to your disability(s) and/or health condition(s), what are the most important things you need to use electricity for?	
Continuous Positive Airway Pressure (CPAP) machine	Electric blanket and heating/cooling (for thermal regulation/circulation)
Therapeutic chair	Nebuliser (for asthma)
Life support	Refrigeration of essential medication
White noise machine	Microwave for heat pack
MePACS device (fast response personal alarm service)	Lighting (esp. for those with impaired vision and for showering)
Information and communications technology for emotional regulation	Communication device (respondent does not use speech)
Electric bidet	Emergency call button
Opening electric doors/locks (cannot use key)	NBN and Wi-Fi for emergency communications (no 3G/4G reception)
Mobile network booster	Water pump
Septic and sewerage pump	

It is important to note that what may be considered a non-essential comfort for some people (e.g., heat pack, electric blanket, internet access) can be incredibly important for others who may, for example, suffer from impaired circulation or challenges with thermal regulation. Similarly, changes to routine or limited access to social supports can be seriously distressing for some, especially those with psychosocial and neurodevelopment conditions.

How critical a particular use of electricity is, therefore, is not inherent to the activity or the item, but is the product of an individual's unique circumstance and experience.

Here the responses to Q16. are represented in a word cloud:

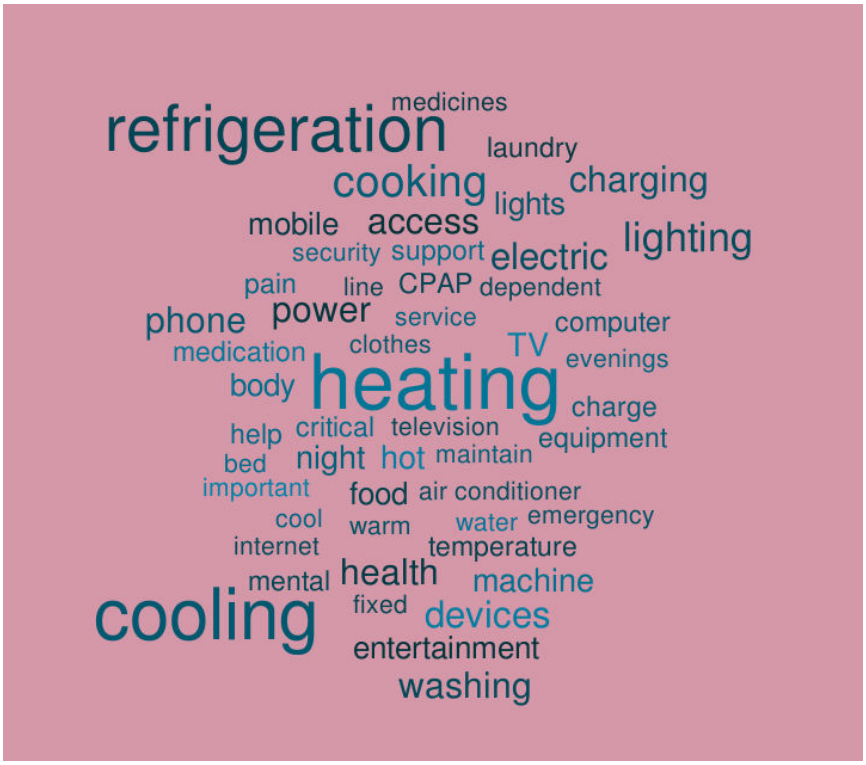

Figure 2. Word cloud of open-ended response data (cleaned) for Q16.

4.1.2 Thermal regulation

One of the most consistent themes during interviews was concern around heating and cooling, as several participants experienced issues with their body's ability to thermally regulate itself. Some were particularly sensitive to cold, which severely increased pain caused by arthritis, or fibromyalgia. Others might be unable to stop their bodies from overheating without external cooling, even in mild conditions. This put them at risk of falling unconscious due to heatstroke, as well as other potential medical complications and death.

Belinda says her body has "lost the ability to cool and regulate itself" and recounted how scary this can be:

> I get dizzy, nauseated, and I can't make out reality from illusions. It was the first summer I was there, it got to 46 degrees and I didn't know that this was a problem for me at that stage…. I was expecting the neighbour's horse to be brought down to where my new house is now. And I thought I could see her down there at a lower level when I called out, "Rosie, is that you?" Cause I could just see shades of black and white…. And luckily my neighbour had just brought her down and she called out, "are you alright?" And before I knew it, I was in a cold shower. I don't remember getting there, but my neighbour had taken me inside and put me in a cold shower. And so cold is okay cause I can manage that, but heat, mm, I might not be able to.

To manage her body's inability to cool itself, Belinda has a number of strategies:

> I need a refrigerator to have cool drinks and ice cubes to cool my cooling jackets that I wear to bring my core temperature down.
>
> I've got 16 windows and doors that allow me to cool the house, and two skylights, that require electricity to operate. So, to keep the house cool, I actually manage the opening and closing of windows. And that means I don't have to call on the power for the split system as often as I otherwise might. And we were careful to design it that way. But if the power's out, that's stuffed, and my major windows are on the east and west side, and I have internal blinds that are all by remote control. So, if they were stuck open when the power went out on a hot day, that's one of my major cooling strategies that's stuffed.

Aside from a cold shower, which may be impractical, there are few cooling strategies available to Belinda that do not rely on power; some that do can backfire if there is an outage. There are, therefore, hard limits to her ability to cope with a power outage during hot weather. During an outage, the rate at which the stressor shifts from an inconvenience to a life-threatening risk is rapid. If she is unaware that her core temperature is rising uncontrollably, she may not have the executive function or time address it before falling unconscious. She may also lose her hearing, with a risk of doing permanent damage.

Belinda's experience is not unique. Significant difficulties with thermal regulation were mentioned by five out of ten interview participants, with three more noting it as of some concern. One participant supported someone with epilepsy, and mentioned that heat could be a cause of seizures, hence it was incredibly important to be able to maintain a comfortable temperature.

The risk of being without cooling also produced mental health impacts due to anxiety regarding possible serious outcomes. The following quotes show how challenges with thermal regulation shape Karen's behaviour and state of mind:

> I suffer from arthritis and fibromyalgia. Fibromyalgia, you can't regulate your body temperature. So if it's really hot, I can't get up, I can't do anything, I'm very lethargic, so I need the cooling on. And when it's cold, I need the heating on because of the arthritis, that is affected badly.
>
> … My temperature just goes up and up and up. Even if it's 17 degrees, I can start sweating profusely and overheat very quickly. So [if I fell outside], I would imagine I would pass out and that would be, yeah, <laugh>, I'm not really sure what would happen. I've never tested it, nor do I want to.
>
> … Obviously on the extreme weather days, [if] I've got no heater, I've got no cooling, and the cooling is major. So yeah, if I start overheating-, I'm sure [there is] a mental part of it too, 'cause you're automatically going, "oh, I haven't got water, I haven't got the cooling, I haven't got-," like, I'm getting hot just thinking about it. So yeah, I think that's that mental side of it as well.

Because Karen's water is supplied by a tank on the property and relies on an electric water pump, bathing or showering to keep cool may not be possible. This risk is exacerbated by her constant challenges with physical activity due to her conditions, which can be painful, tiring and result in overheating. Together, this web of interrelated risk factors is a source of anxiety.

Just as Karen can overheat in mild temperatures, some participants experience disproportionate pain and discomfort when temperatures drop. Sally, for instance, is

“riddled with arthritis” and can feel the weather changing “in [her] bones.” Staying warm is her most important pain management technique. Many people are not merely more sensitive to the cold, in that they feel more distressed – the physiological effects they experience are genuinely atypical. For those who experience Raynaud’s syndrome,[13] such as Felicity, even mild weather can be very painful if they do not have access to external heat sources:

> In winter it's an issue because I quite easily lose feeling in my hands and my feet…. The only way I can get rid of the bone cold, where I'm in extreme physical pain … and I can't move, is to sit in the heating under a doona, or jump in a really hot shower and warm my body back up.
>
> … [T]he onset for me and the onset for a lot of people who need thermoregulation tends to be quite quick. We may not be able to get anywhere else. I get bone cold very quickly, when I'm bone cold, I can't feel my hands, I can't drive, I can't text.
>
> You also get chilblains … when it does get to those extreme cold and I can't regulate, lesions form on my peripherals, on my fingers and my toes, which is likened to frostbite in that it then makes touching things incredibly painful, like, I can't then use my phone. Winter just sucks if I get them …. My fingers and toes, can't use 'em properly.

Because Felicity’s hot water is electric, an outage during winter would engender severe pain without her usual practices to remedy it. Additionally, because she is autistic, changes to her routine and practices for managing her needs can be more disruptive and distressing than they might be for neurotypical people, and set off a series of impacts. This effect is explored later in this section and especially in section 4.3.

These examples illustrate situations where not only are the risks different to those facing most non-disabled people, but the consequences are also particularly severe relative to what might seem like an inconvenience to most non-disabled people. Although the risks differ from individual to individual, this evidences a tendency for disabled people to experience far greater sensitivity to particular external stressors.

Because sensitivity is, to a degree, inherent to a person’s unique circumstance and physiology, the propensity for disabled people to experience more significant impacts is compounded by the fact that such impacts may also be atypical and unexpected.

This challenges traditional institutional efforts to address issues for segments of a population, as possible remedies may not be universally effective. This indicates a need to address stressors ‘higher’ in the causal chain before reaching individuals.

---

[13] Raynaud’s syndrome or phenomenon is the reduced blood flow to the extremities due to sensitivity to cold, often resulting in numbness, discomfort, or pain.

4.1.3 Recreation, routine and the importance of home

Alongside physiological dependencies, participants equally expressed a significant reliance on power for recreational activities and maintaining routine. These two facets of life were important for similar but different reasons.

Disabled and chronically ill people living in regional areas may have comparatively small 'lifeworlds'.[14] That is, the scope and content of their lives – their subjective experience of the world – can be constrained by their geographical and social isolation, and the limitations of their disability or illness. For some participants, their chronic pain and mobility issues mean there are a limited number of activities they can do for leisure or to occupy themselves, and most require power. Some participants, such as Karen, also require electricity to power mobile reception boosters or for Wi-Fi in order to use their phone and communicate "outside world". If these are unavailable, just as with the physiological supports, there is a corollary psychological or emotional toll.

For instance, Karen spends much of her time baking, watching TV (which "gets [her] through the day"), and speaking on the phone with her family every day. Without power, all of those activities that structure her daily life and give her world meaning are unavailable:

> If I had no power for a full day, I would be probably curled up in bed crying. And that's the reality of it. My mental health would take a massive hit because I've got no connection, there's nothing there …. I'm alone, and sometimes that mental health hit, it's huge.
>
> I have been at the depths of despair with my mental health and … what would seem an insignificant thing to most people, because most people live in a town where, if the power goes out, you're not impacted by not having water, not having phone service, not having the internet, all those sort of things that everyone just takes for granted …. But yeah, when they seem insignificant, you go, "Ah, it'd be nice to have the phone off for a day" or "It'd be nice … to not be caught to the TV" or whatever. But that's my lifeline. That's my lifeline to the outside world.

The limited range of activities that are available to people like Karen due to chronic pain and reduced mobility can make them more sensitive to disruptions, because they have limited alternatives and are already experiencing duress.

Being without the activities or comforts that *are* available can be more distressing than others may expect, especially if an individual is already managing mental health challenges. Additionally, the sense of social isolation and the loneliness of her

[14] This term refers to the scope and content of one's subjective experience of the world.

experience (which was shared by some other participants) adds to her sensitivity to mental health impacts. This is explored further in sections 4.2 and 4.3.

In these circumstances, the home and its comforts take on a proportionally greater significance. When the routines that enable someone to get through their day are disrupted, it can be emotionally taxing to manage on top of existing challenges. This was a recurring theme for Sally, who relies on routine and the solace of home to maintain her mental health in the face of chronic pain, fatigue and reduced opportunities to engage socially:

> I don't live a day without pain, a second in my day without pain …. My day begins with fatigue, it ends with fatigue. I don't have a social life. My home is my social life. What I get on TV, Netflix or something, what I do around my home – that is my social life. So, you know, the comforts of my home [are] very important to me …. My home is my haven.
>
> It seems really weird and really irrelevant to a lot of people, but … [not] having power in the home is also a mental health problem, too …. You are already waking up in pain, you're already waking up with a challenge for the day. So if you wake up in a day and things are different, like the power's not on, you can't do your usual routine of jobs or things that are your comfort zone in a weird way. It's hard to explain to people, but that kind of reassures you that you're gonna get through another day. [It] can be a bit of a mind game issue with you.

Because Sally's world revolves around her home, impacts to her home similarly impact her own health. There is a very real connection between the health of her home and the health of her body. Because she invests such effort in managing her health through practices that support her home, power outages are disruptive not only to her self-care practices, but her home-care practices as well. The value of these practices for Sally means that she feels the impacts of outages quite seriously, as they take an immediate psychological and physical toll.

Given people who experience disability are statistically much more likely to suffer from poor mental health or psychological distress,[15] this psychological sensitivity to the impacts of power outages is likely to be prevalent in the broader disabled community. This may be especially the case for neurodivergent people like Felicity, for whom routine is crucial:

> Basically, I'm incredibly routine focused, so every day kind of has the same structure. I eat the same things, I do the same things. I'm very routine, time-based. That kind of is incredibly important to me.

Felicity spends time every evening watching Netflix and using her phone. "That's my processing time." Asked what the impact would be if this activity was unavailable, she responded:

---

[15] "Health of People with Disability," Australian Institute of Health and Welfare, published 7 July 2022, https://www.aihw.gov.au/reports/australias-health/health-of-people-with-disability#Mental%20health.

> I always say … if something's not in routine, I say it's wrong. Like, it's wrong. <laugh> But, um, it's almost panic inducing …. Without that ability to kind of regulate, I don't get to deescalate. I start the next day more heightened than I would need to.

Karen, Sally and Felicity's testimonies indicate that it is not just the acute impact of a power outage *per se* that is of consequence, but also the associated psychological cost of managing something that multiplies existing challenges and engenders follow-on impacts across time. Starting the day without power for Sally can upend her mindset and routine, such that both her physical pain and mental distress are exacerbated. Felicity might suffer "panic" at the time, but also face ongoing impacts to her wellbeing if she remains emotionally dysregulated.

4.1.4 Summary and key findings – 4.1 Sensitivity

- Some customers rely on electricity to power important therapeutic supports, refrigeration of medicine, and for heating/cooling strategies. Outages can render these ineffective, leading to additional risks to physical and mental wellbeing.
- Challenges with bodily thermal regulation appear to be relatively common. Heating/cooling is one of the most critical dependencies on electricity, and loss of heating/cooling strategies can lead to rapid and severe impacts among many people with different conditions.
- Recreation, routine, and the comfort of home take on additional importance for customers whose lives are constrained by disability or isolation, and interventions in these domains can cause significant distress.
- Disabled customers often already manage additional stress, discomfort, pain, executive dysfunction, or risks, and are more likely to experience mental health challenges. They are therefore more sensitive to stressors such as outages that disrupt self-care and management practices, which may engender disproportionate or unanticipated levels of distress from the perspective of non-disabled people.

4.2 Exposure: Geographic context and network infrastructure

Just as sensitivity can (but not always) relate to the 'internal' aspects of an individual, exposure here refers to the nature of a stressor or hazard, and/or the context external to the individual. While an individual's health condition might make them particularly *sensitive* to losing power to a cooling system, their *exposure* to the risk itself may turn on their geographic context. Because they live in a rural area subject to extremes in weather and risks to electrical infrastructure – which may not be particularly resilient to such risks – many AusNet customers are more exposed to the risk of unplanned outages than customers who live in the city.

This section discusses participants' exposure to risk with respect to their geographic context and the frequency of outages. In this case, geographic context includes the prevalence and likelihood of environmental hazards such as storms, as well as the vulnerability of network infrastructure. These dimensions of exposure also intersect with particular sensitivities explored in section 4.3, including social isolation, and unreliable or insufficient communications infrastructure, which leads to the potential for cascading risks and impacts.

4.2.1 Geographic context and environmental hazards

Due to the geography of AusNet's distribution network area, participants lived in a mix of rural areas, regional centres and Melbourne's peri-urban fringe. While those in regional centres experienced relatively few power outages, participants in rural areas and the peri-urban fringe were accustomed to outages. Participants attributed varying levels of responsibility to AusNet for reliability issues, acknowledging that they lived in areas that were subject to a challenging mix of wind and rain storms, flooding, and bushfires, which present challenges for electricity distribution.

Several participants suggested that unplanned outages were, to some extent, a natural consequence of living where they lived – rurally, in heavily treed areas, or at the end of a feeder line, and recognised that AusNet sometimes had limited ability to prevent outages due to storm damage or car accidents. Karen's perspective below illustrates this perspective as well as how her geography makes her more exposed to such risks (note: Karen relies on a powered 3G booster for mobile reception):

> The worst ones have usually been weather events or like a car accident or something like that that's hit a pole, like on the main highway or something. And then that affects the whole area. But yeah, look, they're certainly … not as often as I was expecting them to be because we are on a single wire power … It goes through all the paddocks of the neighbours and just comes down [through our property]. [W]e're at the end of a line. So yeah, we've been pretty lucky. I mean, there's not a lot of trees around the actual power lines themselves, it's usually on the main highway. If something's happened, it's usually out there. So, we don't know where it is or what's happening, the power just goes off. We don't know when it's coming back on or how long … or anything, 'cause that's the end of everything in our house.
>
> It's not [AusNet's] fault that we live in an isolated spot.

Felicity also noted that the Yarra Ranges, where she lived, is "prone" to outages due to storms, and Cathy suggested because she lives "at the end of their line … therefore we know it takes longer for us to come back on." Most participants

displayed an awareness of the reasons for power outages and the challenges involved in addressing them, and could contextualise the frequency of and impact of outages in this understanding.

4.2.2 Vulnerability and resilience of network infrastructure

How participants attributed responsibility for issues with electricity availability was linked to the emphasis they placed on possible causal factors (e.g., human behaviour, weather events, vulnerable infrastructure); and moderated by internal factors, such as their self-perceived depth of understanding of the issues, and even their personality. For example, Cathy came across as a resilient person who preferred not to dwell on any difficulties she faced, and took a balanced view regarding AusNet's responsibility for outages:

> I understand that they can't tell me how long it's going to be sometimes. And I suppose I'm a bit more realistic about that, so, they're trying very hard. It's a lot better than it's ever been before, so I'm not complaining about that. I just wish the infrastructure was a bit better. (Cathy)

Like Cathy, despite acknowledging the challenges of their geographic context, some participants still lamented the long-standing vulnerability of network infrastructure and wondered if more could be done more to bolster its resilience:

> This has been something that I've experienced living in Longwood that I didn't experience in the Kimberleys or the Northern Territory or southwest Western Australia. It's always frustrated me that Longwood's supply is so disruptive. The relatives have told me they didn't get electricity until 1969 and some of the way it was connected is very, very dodgy and the wind and rain can just put the power out, just like that, at anytime …. I would say it's probably improved a little bit since the pandemic, but it's still vulnerable to wind and rain storm. (Evelyn)

Because people who experience disability may be more sensitive to risks, managing exposure becomes all the more important in reducing the likelihood and severity of impacts. Far from ignorant of network challenges, they hold nuanced perspectives and have developed a number of strategies to mitigate certain risks (section 4.5). But the adaptive capacity of individuals has limits, and these participants recognise that their experience might be significantly improved by addressing the risk "upstream" in the network itself.

Thus, certain participants challenged AusNet's commitment to preventative maintenance and network resilience based on its perceived 'track record' and private interests:

> I understand there can be many reasons for brown outs, which is why I said at the start of this, I think that AusNet have been pretty proactive with their notifications. [But] I'm also sceptical of the amount of maintenance being done …. I've got a healthy scepticism as to what a privatised company is going to do to maintain a better, more reliable service, say, for people with disabilities. (Craig)

> And the way it hits AusNet is that after the fires, those electricity cables were supposed to go underground. And, of course, they're not going to, because shareholders don't want to spend that money. And they don't experience these blind spots.

Leaving aside the accuracy or otherwise of such perspectives, implicit in these comments is a sense of powerlessness at being exposed to a risk they have limited agency in addressing.

These participants are resourceful and knowledgeable about both their personal risk context and its wider contributors; but they feel a sense of frustration regarding the disconnect between their risk exposure and the decision-making and activities that could address it.

While living in remote areas subject to environmental hazards undoubtedly contributes to risk exposure, it is essential that this fact is not naturalised in such a way as to explain away or absolve AusNet's responsibility for these risks. The risk of power outages emerges from the *intersection* of such hazards with the electricity network – a sociotechnical system.[16] There is, therefore, an *inherent* level of responsibility for ensuring the reliable operation of the distribution network in the face of worsening environmental hazards. This is because the network and its operation is a *constituent* factor of the risk, even when the triggering event for occurs due to causes external to the network.

4.2.3 Frequency of outages

A straightforward measure of exposure to risk is the frequency at which a hazard/stressor occurs. There is significant variability among both survey respondents and interview participants regarding how frequently they experience outages, which is unsurprising given some areas are far more prone to outages than others. Regarding *unplanned* power outages, 46% of survey respondents experienced 3 or more outages per year, and 5% experience an outage about once a fortnight or more (Figure 3). 61% of respondents reported that unplanned outages typically last less than 6 hours, though a minority experience either longer outages or considered the length highly variable.

This frequency of outages among a population that is disproportionately more sensitive to outages should register concern. Almost a quarter of survey respondents feel "quite" or "extremely concerned" (Figure 4) about the risk of power outages, and 25% of respondents believe even *planned* outages pose a moderate to significant risk to their wellbeing.

[16] The term "sociotechnical systems" refers to infrastructures that are constituted by the ongoing interaction and interdependence of human agency and relations, and technical artifacts and processes. See Bijker, Hughes, and Pinch (eds.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge: The MIT Press, 1989).

Regarding *unplanned* power outages, 89% of respondents reported experiencing a power outage within the last two years, and 46% experienced more than 2 per year

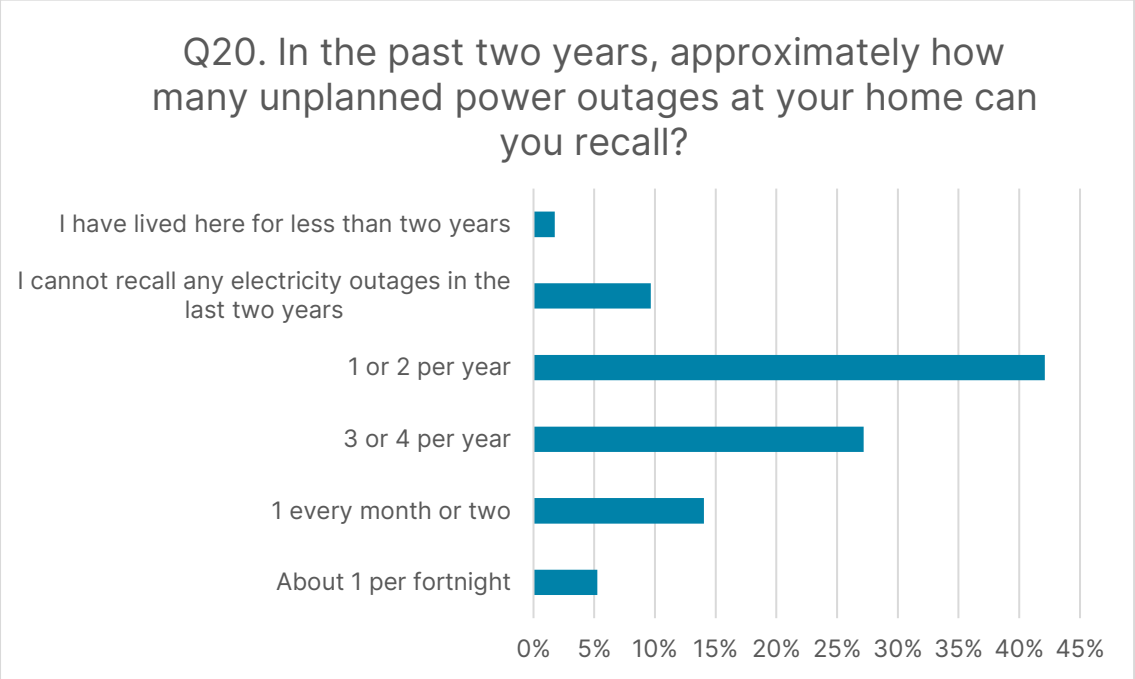

Figure 3. Frequency of unplanned outages

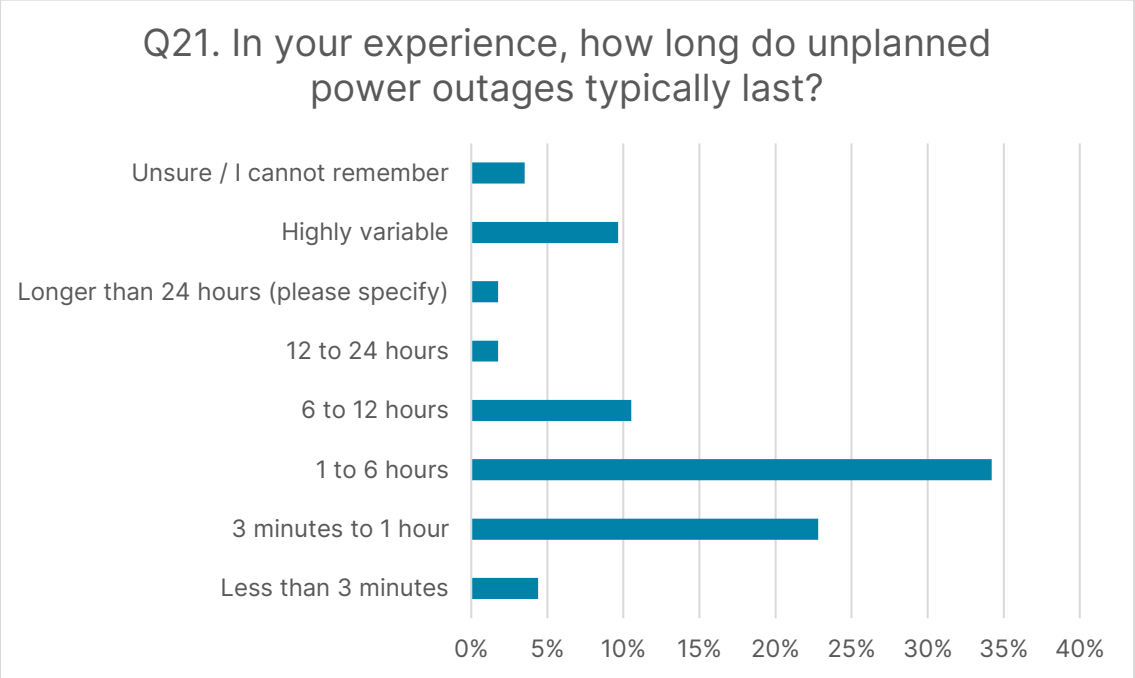

Figure 4. Typical length of unplanned outages

Interestingly, participants expressed a level of desensitisation to the frequency and length of outages:

> [Outages occur] probably every six to eight weeks maybe. … It's fairly regular. It seems to be worse in the winter for some reason. … I think I'm so used to it, I just take it as a nuisance. … I think we get a bit … insensitive to what the issues are, because we've experienced it for, well, I've experienced it for 20 odd years here. (Cathy)

> For the rest of Emerald, I reckon that they probably have a decently long power outage maybe once every six months. We're lucky in that ours tend to be a bit shorter because of the grid we're on. But still, once every six months we're losing power for longer than, you know, a day. (Aisling)

> In Longwood, … we can have a power outage as much as once a week. Sometimes more often. Sometimes they just flip out and flip back on again. Sometimes it's a bit longer and sometimes it can be out for about eight hours. (Evelyn)

> Look probably the worst one has been a day. … We've been pretty lucky in, and they probably have them … maybe once a month, maybe once every two months sort of thing. It's not common, but it's enough to be irritating. (Karen)

In the interview context, several participants seemed to stoically shrug off these challenges – often with a laugh. Some felt that because they lived outside the city, it was an unfortunate reality that their interests would be secondary to their urban counterparts; and that they had little chance of realising improvements due to institutional and economic reasons as much as geographic and environmental. That is, they did not feel there was sufficient incentive or public agency to facilitate improvements. Relatedly, almost every participant expressed real enthusiasm and even gratitude for AusNet and YEF undertaking this research project.

4.2.4 Summary and key findings – 4.2 Exposure

- Customer exposure to risks is compounded by the intersection of geographic isolation, environmental hazards, and the vulnerability of network infrastructure to such hazards.
- Most customers understand the challenges posed by geography, environmental hazards and human interventions, but nonetheless express some concern regarding the degree to which network infrastructure is vulnerable to such hazards.
- Similarly, many customers recognise that although AusNet staff are likely to be doing what they can to address outages, some interview participants expressed disappointment or scepticism regarding structural or institutional factors. One participant expressed doubts about the commitment of a private entity to invest in preventative maintenance, while another identified gaps in institutional responsibility for risks that emerge out of intersecting deficiencies in telecommunications and electricity network infrastructure.
- Survey results indicated that about a quarter of respondents remain quite or extremely concerned about future power outages, and a similar number consider planned outages a moderate to significant risk to their wellbeing even when provided advanced notice.

4.3 Interconnected risk and cascading impacts

A defining feature of the findings of this research is that there is a high degree of interconnectivity between the risks disabled customers may face, whether they relate to outages, energy expenses, or another stressor. This demonstrated how central electricity is to participants' lives, and society's increasing reliance on electronic technology. Because of the unique importance and role of electricity, customers have a marked dependence on electricity with minimal alternative or redundancy.

This vulnerability – the central importance of electricity to most facets of life – can interact hazardously with existing vulnerabilities relating to health conditions and disabilities, geography, and infrastructure. This is particularly the case where electric devices are relied on to *manage existing risks* – their failure or unavailability can be unexpected and lead to serious consequences.

Relatedly, due to the interconnectivity of the risks many vulnerable customers face, there is an inherent potential for compounding effects and cascading impacts from an initial stressor. While an outage itself may not *directly* harm an individual's wellbeing, the chief impacts are likely to arise from the chain of effects that the outage may set in motion. These can relate to, for example, physiological and mental wellbeing, additional support needs, financial burdens, and impacts on family or work life. Importantly, these impacts can play out over time and will not simply be resolved when the power comes back.

Although there are parallels between a number of participant experiences, by their very nature, the interconnections between risks and participants' unique lives and circumstances can be quite different, leading to diverse impacts. The two most critical issues that emerged through interviews were the intersection of electricity with communications technology and infrastructure, as many participants required mobile reception boosters or Wi-Fi in order to use their phones; and both acute and accumulated impacts on mental health.

4.3.1 Communications technology and emergency situations

For participants in rural areas, gullies, or other mobile reception black spots, communication beyond their property relies almost entirely on 3G/4G boosters or Wi-Fi connections that are vulnerable to power outages. Losing communication capability can be a source of anxiety, typically because of the multiple risks that emerge with the loss of communications.

As disabled and chronically ill people may have high support needs or medical risks, having working communications technology affords a level of independence, choice, and dignity that might not be otherwise possible. It also is essential in the case of a medical emergency. Here, Belinda recounts an experience that almost provides a 'test case' for

> There've been one very frightening situation where I had no power. So, I had no NBN, no mobile signal using Wi-Fi …. The power went out in a windstorm one day. And I, because of my illness, occasionally experience what's called an oesophageal spasm, which can give you 20 out of 10 pain that mimics a heart attack …. And I'm 65 years of age and I have a family history of heart disease. And at that stage, I didn't know that my heart is absolutely fine, as I do now.

“So, at 1:30 in the morning when I woke up with this pain and the normal angina spray that might ease it didn't work according to the instructions…, I had no way of calling an ambulance, or emailing anybody to ask them to call an ambulance. I couldn't move because of the pain. … And I couldn't scream, and I couldn't get any help. I thought I was gonna die.” (Belinda)

Although Belinda’s physical health emerged largely unscathed, her experience illustrates the acute and lasting psychological toll that the loss of communication can take during a health emergency. “[T]he fear of what might happen” is a continual burden on Belinda’s mental and emotional resources, and shapes aspects of her behaviour and lifestyle.

Like Belinda, Karen lives in a bushfire-prone area and relies on an expensive booster just to get 3G phone service. “… [S]till, if the power goes out, the booster goes out, that's the end of our internet, that's the end of our phone service.” Alongside the risk of her own health emergency, her main concern is losing access to the VicEmergency app:

> That's scary … to not have that VicEmergency app, which is fantastic. …. I have it set and I get alerts all the time and I'm looking at them and making sure, ‘cause … the risk of bushfires is high. So, therefore, we are very on edge over summer and also over summer, I'm also really hot, so I'm requiring cooling down. … [I]f you don't have any way of contacting the outside world or knowing what's going on, that's really nerve wracking when you are isolated like we are.

Although there is no immediate impact on Karen’s wellbeing from a power outage, the are a series of contingent risks that begin to interact. Without power, there is no “way of contacting the outside world”, which is “nerve-wracking” given the relative isolation and bushfire risk of her property. Further, because bushfire risk is prevalent over summer, and especially in hot weather, Karen would likely already be managing the risk of thermal dysregulation, which would be of growing concern were an outage to occur.

The worst-case scenario might be that an outage occurs due to a bushfire, but Karen is unaware and her husband is at work. Without power, she would be unable to contact anyone, lose the ability to keep her body cool, and be at risk of falling unconscious. Her best option to mitigate this catastrophic risk, it seems, would be to evacuate and drive to the nearest town – *whenever there is a power outage over summer* – hoping that her exit is not cut off by a possible bushfire. Not mentioned is the potential panic and distress Karen might feel throughout, and how this could impact on her decision-making and physiological state.

Although this scenario may seem far-fetched at first, it is drawn primarily from Karen's past experience and primary risk factors.

For certain stressors such as an outage due to a bushfire, severe impacts may actually become *more* likely, rather than less likely, as the connected risks yield impacts that have a cascading effect.

Given the increasing severity and frequency of bushfires, there is no reason to suggest this scenario is implausible.

So long as rural customers depend on power for communications, they are exposed to serious risks of health emergencies and natural disasters, compounded by disability and isolation. Because these risks emerge out of the related deficiencies of both the telecommunications and electricity distribution networks, we suggest that a collaborative approach among DNSPs such as AusNet and other major stakeholders could more effectively address risks that fall through the cracks of institutional responsibility. For example, sharing data to identify the most critical areas of concern would highlight which areas of AusNet's distribution network are subject to wider vulnerabilities and allow AusNet to fast-track risk mitigation (such as network augmentation or other resilience efforts). This is explored more deeply in section 5 (Recommendations).

Figure 5, on the following page, outlines some of many relationships that participants highlighted regarding the potential for one impact to produce a series of further risks or impacts. The items in rounded boxes are considered stressors or hazards. These are events or conditions that engender particular risks – most of the items connected to these boxes. There is a blurred line between risks and impacts that, for the purposes of this report, consists primarily of whether the risk has been realised (an impact) or remains a possibility (risk). The bolded items outside the box are the second-order impacts that (generally) arise indirectly from the initial stressor. For example, the increased incidence of mental health impacts is not a direct outcome of power outages, but the disruptions and anxiety that occur may lead to this outcome, particularly combined with the stressor of geographic and social isolation that many participants also face.

The figure is designed to simplify and illustrate how risks and impacts can have numerous drivers and outcomes, and that risk pathways are non-linear and contingent. This complexity adds weight to the perspective that while customer empowerment (or 'agency-building') is an important element of reducing vulnerability, it is arguably an end-of-pipe measure that may enhance adaptive capacity or reduce sensitivity without addressing exposure. As has been discussed previously, given the diverse circumstances of AusNet's customer base, addressing risks 'upstream' of the customer may benefit from efficiencies of scale, and ultimately, produce more significantly beneficial outcomes.

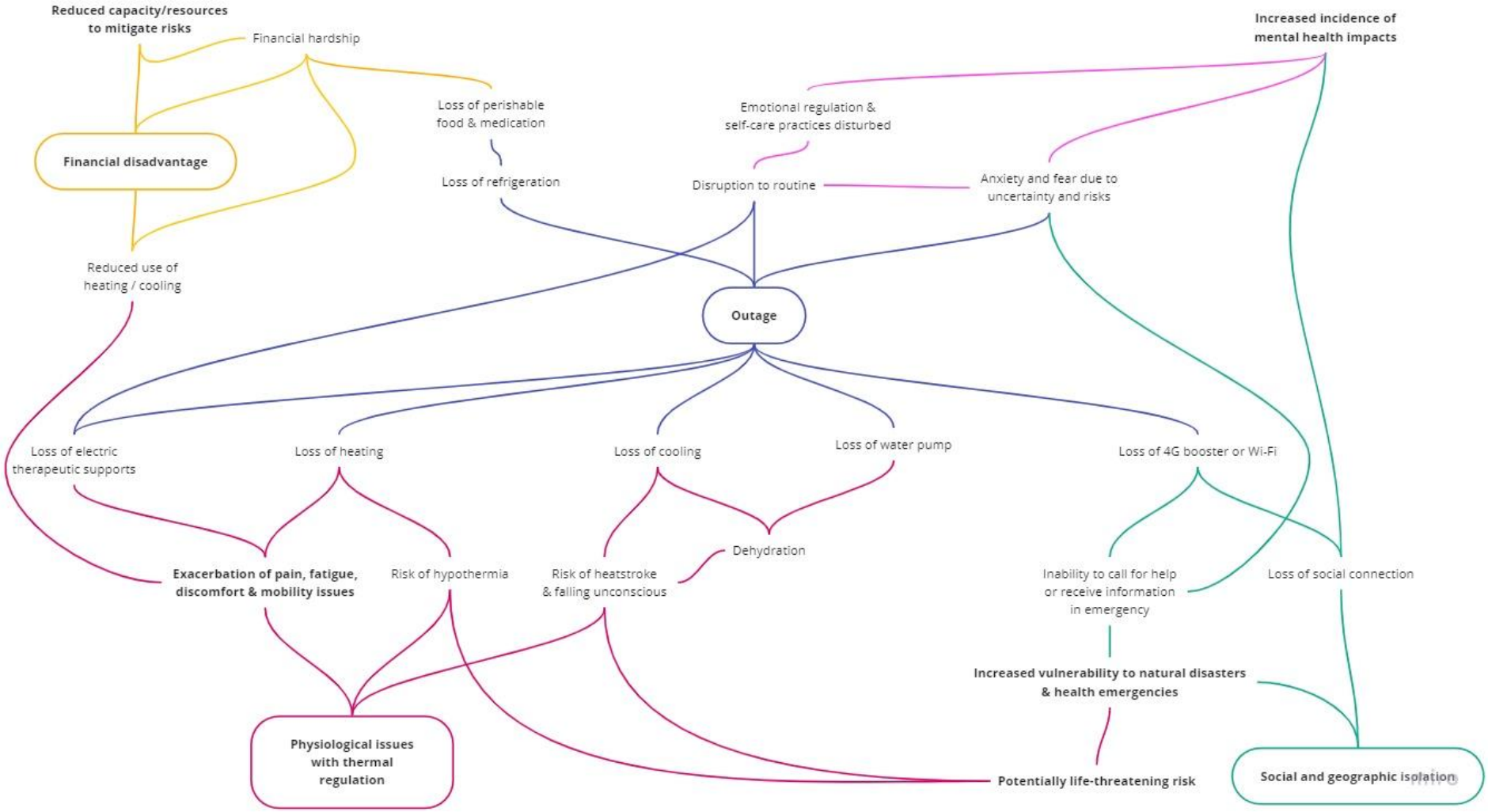

Figure 5. Overview of relationships between risks and impacts

4.3.2 Mental health impacts

Concern regarding the risks of power outages was a pervasive theme in interviews, manifesting most commonly in anxiety and fear as a result of uncertainty regarding "what might happen" (Belinda). Another motif was the emotional toll of continually managing risks and impacts in the face of existing health challenges, adding to the overall effort of getting through the day. Finally, participants also highlighted a number of ways in which their mental health was impacted by the social dimensions of their experience, and the frustration of feeling invisible to authorities when most in need.

Uncertainty was a driver of mental health impacts for Felicity, because uncertainty can be particularly troubling to neurodivergent people. She also noted the impacts for people she supported as a disability support worker, who were in some instances unable to process the uncertainty:

> [Power outages] are difficult to navigate for me because – and a lot of people that I work with, we've had them at work too – it's incredibly anxiety inducing. You don't know when it's gonna get back on. You don't know what the stuff in your fridge is gonna do. You don't know if you're gonna have to sleep anywhere else. How am I gonna have a shower? … [Y]ou can't settle. It just induces a whole lot of anxiety, not knowing.
>
> … [F]or the people we support, it's incredibly stressful and they are at physical risk, because they do have quite significant behaviours of concern. So yeah, we have had incidences of people putting their fists and their body parts through walls 'cause … that's how they have their meltdown, [they] lash out. Some lash out at us when things are going wrong. So we run, so yeah, it's … it's not good when that happens. …. [T]here's nothing you can tell 'em. "You just have to wait," "but I don't wanna wait."

Felicity's perspective as both a support worker and a neurodivergent person were incredibly valuable, as she could articulate her own experience and provide insight into the experiences of the autistic people she supports. For the most part, she is able to manage the inevitable stress of uncertainty, but for the people she supports, the uncertainty and disruption to routine can be incredibly distressing, and dangerous for all the individuals in the vicinity.[17]

The fear of what might happen also influenced and constrained participant behaviour, especially in response to experiences where risks were realised. For instance, Karen's pain and mobility challenges means she is vulnerable to falls and unable to get up on her own. She once fell while outside, but luckily, still within range of the 3G booster. Because she "[doesn't] go anywhere without [her] phone", she was able to call her husband, who was on his way home from work and could help her. She elaborated:

> … [B]ut if I'd done that at eight o'clock in the morning and we had no power all day, I'd just be still there. So that's a scary thought. And it took me a long time to start going back outside again. Just to take the dog for a walk or just for me to go get outside and just be out in the open and fresh air …. It really affects your mental health when you feel so isolated and you're too scared to go too far from the house

[17] It is these disproportionate impacts, which are frequently absent from public understanding of the experience of disabled people, that provided the initial impetus for YEF to develop this research project.

> because you don't have that service. But, also, if the power goes out, I've got no service, so, yeah.

The fear Karen holds about going outside (especially in warm or cool weather) relates to a number of different risk factors, but only some are within her control. First, she is concerned about the risk of falling and managing her body temperature and pain while being unable to get up, which relate to her chronic health conditions. Second, she is concerned about not being able to use her mobile phone, which relates to both the deficiency of telecommunications infrastructure and the risk of power outages, as she relies on a powered 3G booster.

Karen's experience demonstrates many of the themes already explored in this report: the intersection multiple risk factors, heightened sensitivity to risks, and the central role of electricity in managing existing risks – and therefore the significant impacts that can occur when the electricity supply fails. And although the experience had an acute impact on Karen in the form of psychological distress, she noted more explicitly the ongoing effect the experience had in shaping her behaviour. It further reduced the richness of her lifestyle and contributed to her battle to maintain her mental wellbeing.

Sally articulated a particularly compelling demonstration of the interconnection of stressors, risks and impacts. Sally's mental health is related to her physical health, and both are strongly linked the functionality and comfort of her home; and therefore, the electricity network. The compounding challenges of maintaining a comfortable home and managing her condition often take a significant emotional toll, especially when exacerbated by additional stressors such as a power outage:

> When you're already starting with a level of discomfort, … then you look for things that are familiar that don't need fixing, don't need repairing, … that fall into place when you need it to fall into place.
>
> I try not to let my mind wander anywhere where it shouldn't be. You know, … sometimes things become a bit hard and little things … can tip you over the edge, … especially if you're going through a period where things are pretty tough, you know, and you're sort of … questioning yourself and why you're here. And, I'll be honest, I've had those moments, … especially on the bad pain days where I can't even get up off the couch 'cause it's just too painful. And knowing that there isn't anything that can fix me and … it will continue to get worse as each year goes on to a point where … it's gonna be pretty bad.
>
> Those days [when you lose power] you've just gotta remind yourself that you are here for no one else but yourself. You know, even though you're here for everyone, your family and stuff, you've gotta focus on yourself, and you grasp at anything that you can remember that's been said to you or you've been advised to think about … how to deal with it or whatever. But yeah, you know, I feel really sort of pathetic sort of whinging about that. But, you know, it's the bigger picture that's hard to explain to people … because unless you live and breathe it, it's hard to understand.

It is sobering to be offered a window into Sally's experience and to recognise both her resilience and corollary struggle. Her recurring self-deprecation jarred with the seriousness of her statements, which highlighted both the challenges of her condition and her previous experiences of feeling dismissed and invisible when engaging medical and bureaucratic authorities – a struggle to be validated and "heard".

This is not to claim that power outages are the determining cause of mental health issues among disabled or other vulnerable customers. Rather, the intention here is to highlight the sensitivity and exposure of such customers to additional stressors, and therefore, the limited capacity some may have to cope. This can lead to distressing and potentially severe impacts that can interact in mutually reinforcing ways.

Further, the causal chain of such impacts is frequently non-linear, and there may be iterative and interactive dynamics. For example, Sally is acutely aware of the physiological impacts of her anxiety and stress:

> Sally: It alters your mindset, which can cause the acceleration of your heartbeat that can lead into cardiac arrest. Now when things aren't going your way and you get upset, that's when I seem to have my episodes. It's usually from either [being] exhausted or … stressed, is what leads into [an] abnormal heartbeat. ….
>
> Interviewer: So your mental health is very strongly related to your medical health?
>
> Sally: Totally. Yeah, it's very much part of it all…. As you get older, things become harder, little things … contribute [to tip you] over the edge a bit. …. If you're in a lot of pain, your heart's gonna be working harder to cope with it …. Anything that goes wrong adds to it.

The compounding effect of this dynamic is illustrated in the diagram below:

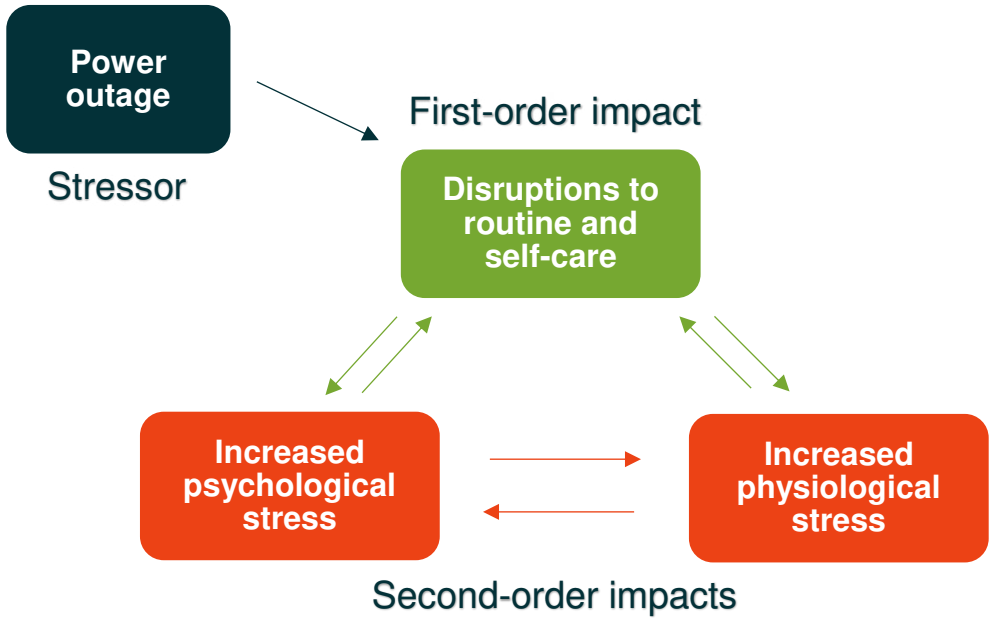

Figure 6. Iterative chain of impacts resulting from a power outage.

It is important to note that ‘second-order impacts’ such as additional psychological and physiological stress can feed back into ‘first-order impacts’, for instance, by further disrupting routine and self-care due to worsening anxiety, executive dysfunction, or pain. Thus, even minor stressors can have extended and substantial after-effects that may be invisible and unanticipated to those unfamiliar with this risk context.

4.3.3 Summary and key findings – 4.3 Interconnected risk

- Many customers rely on 3G/4G boosters and Wi-Fi that is electrically powered in order to communicate with the outside world. This makes them particularly vulnerable should they experience a power outage alongside a health emergency or natural disaster, as well as disrupting their social lives and work or administration responsibilities.
- There may be opportunities to partner with relevant telecommunications and and government actors to address complex risks that bear shared responsibility for mitigation.
- The potential seriousness of impacts relating to power outages – especially losing communications capabilities – is a source of fear, frustration and anxiety for some participants, which can exacerbate existing physiological and mental health challenges.
- The relationships between various risks and impacts can be non-linear, unique, diverse and iterative, creating unexpected feedback loops and causal chains that may not bear a direct connection to the initial stressor, as the risk context is complex.
- Although mental health impacts may not manifest as ‘first-order impacts’ – those directly caused be a stressor – many participants highlighted the mental health aspects of power outages as the most salient and challenging to manage.

4.4 Energy costs and financial vulnerability

In Australia, the cost of electricity has been a headline in public discourse for many years, often used as a political wedge in discussion concerning carbon emissions and renewable energy. For many consumers, the sheer volume of this public conversation is perhaps of greater significance than its content. It is not surprising, then, that most survey respondents and some interview participants expressed concern about the cost of electricity – especially those who already felt a sense of financial precariousness – particularly in light of an increasingly uncertain future.

4.5.1 Concern regarding electricity costs

Over half of survey respondents had felt concerned that they would struggle to pay their power bill in the last two years, and 93% were at least a little concerned that the cost of electricity will be difficult to manage now or in the near future (see figures 7 and 8 below).

Among interview participants, the perspectives varied. For Karen, who is on a disability pension, “costs make a huge difference” so she is “constantly looking out for information” about “government grants and rebates”. And while she would love to buy a generator, “that’s thousands of dollars we don’t have to buy a generator just in case the power goes out.”

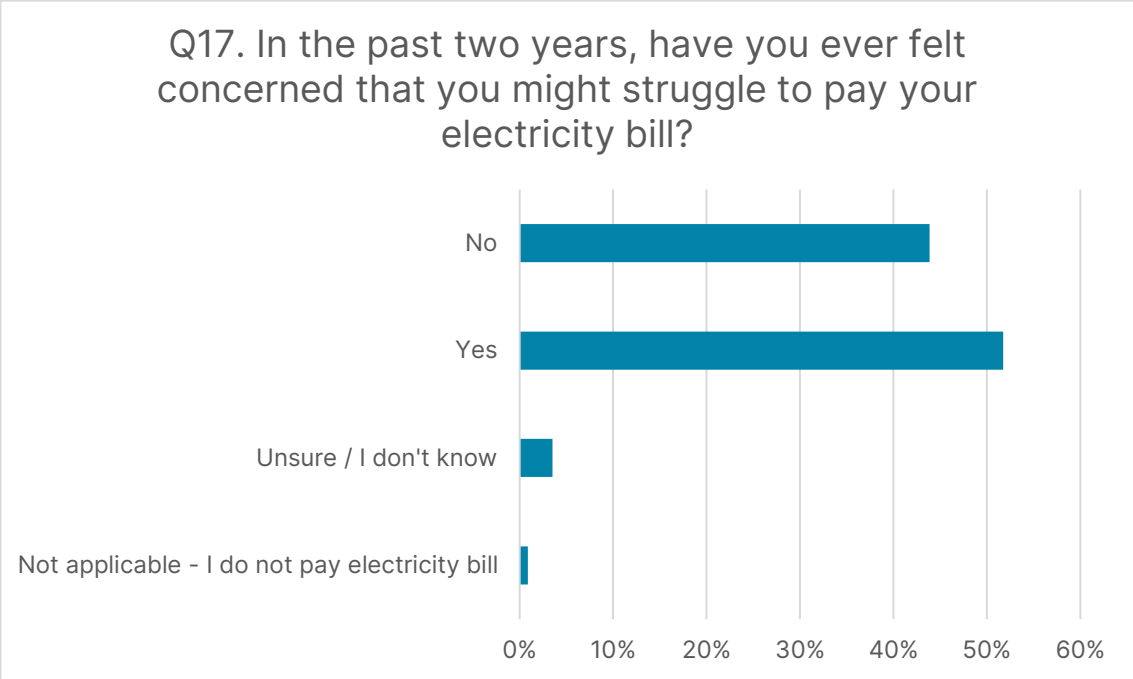

Figure 7. Concern regarding capacity to pay electricity bill in the past two years

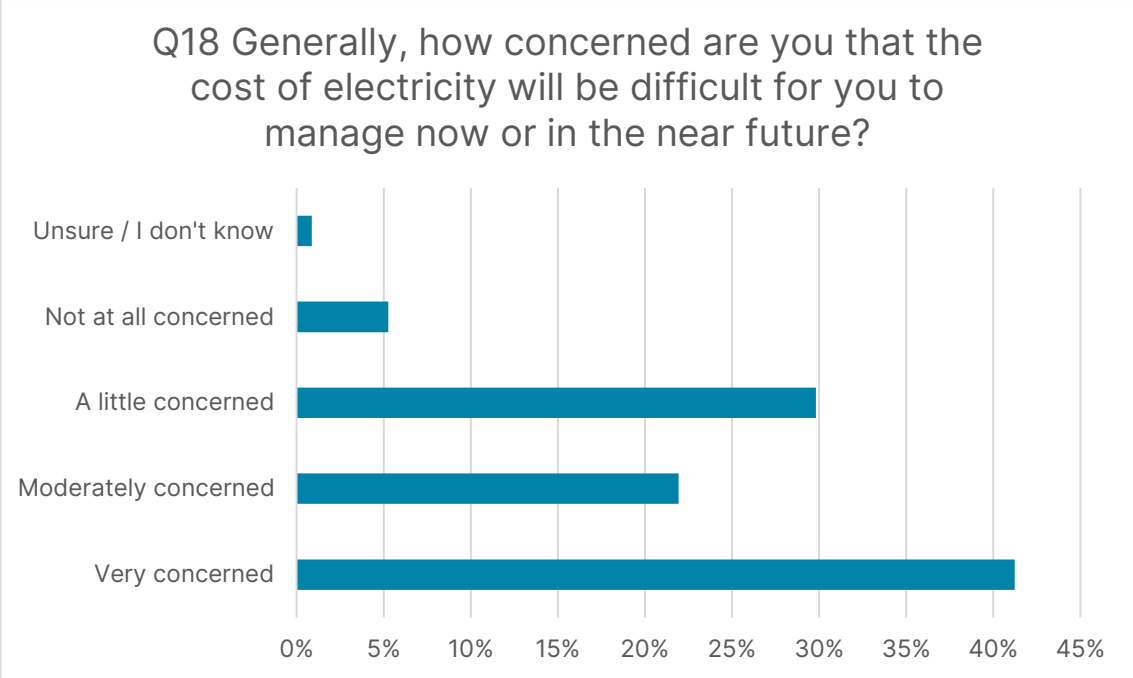

Figure 8. Concern regarding cost of electricity now or in future

4.4.2 Employment and institutional supports

Due to nerve pain, Nick "can't stand for too long [and] can't sit for too long", and hasn't been able to work for three years. Having been deemed ineligible for the National Disability Insurance Scheme, he receives the JobSeeker allowance and is forced to apply for jobs he is unable to work unless he can continually provide a medical certificate. Like many, Nick's circumstances do not seem to fit into the categories described by government support agencies. Consequently, his financial vulnerability arises not purely because of his condition, but the ways in which his circumstances fall between the institutional safety nets. Thankfully, Nick's energy expenses are minimal, having already installed solar and a battery. However, for those already facing financial hardship – or for those living in unsuitable dwellings – installing rooftop solar and accessing its financial benefits might be out of reach.

Despite a long, satisfying career, Belinda is vulnerable to the rising costs of managing her illness, of which energy expenses are a significant component. She felt compelled to retire early due to increasing challenges with executive function as a consequence of her illness. While she undertakes some work, made more manageable through the advent of video-conferencing, without significant income Belinda is in a financially precarious position.

Belinda had planned to install solar and a battery to provide limited backup power and to help manage her energy expenses. However, she has now invested so much of her financial resources (including her super) into retrofitting her home to accommodate her needs – including trying to address mobile service issues – she "would be foolish to use what [she's] got left" on solar. She has inquired with the National Disability Insurance Scheme about funding the purchase of a generator to manage power outages, but says that "it's been declined because NDIS won't cover

what other statutory bodies are required to provide, even if they don't do it. So I got nowhere and I gave up."

The example above highlights how vulnerability can emerge out of a combination of drivers, both '*internal*' – such as Belinda's health conditions and early retirement – and '*external*' – such as the gap in responsibility between AusNet and the NDIS in providing or funding the a secure supply of power. This exemplifies Fineman's contention that one's inherent vulnerability is moderated by one's position among "a web of economic and institutional relationships."[18] The context of Belinda's vulnerability, including her financial vulnerability, extends beyond her own home and encompasses various institutional structures; including, for example, the funding rules of the NDIS; the regulation of network reliability; and characteristics and thresholds that determine who is deemed a "life support customer", including who is eligible to receive a generator, and after how long.

Although Belinda may be inherently vulnerable to particular risks, this is only half the story; her vulnerability is a product of a wider economic, social, political and institutional context – as is the case for everyone. Her frustration in trying to navigate the bureaucratic world that shapes her own leads her to give up.

Although it is not made explicit by the survey data, Belinda's situation is unlikely to be uncommon. As has been demonstrated thoroughly in this report, people who live with disability and chronic health conditions; those who have specialised support needs and atypical sensitivities; depend on power in critical and diverse ways. They also can experience lower rates of employment and remuneration,[19] either through direct discrimination, structural marginalisation, or due to reduced capabilities. Although the sample size is small and may not be reflect broader trends, survey respondent households demonstrated a tendency towards low incomes.

[18] Fineman, "The Vulnerable Subject," 167.

[19] "People with Disability in Australia, Unemployment," Australian Institute of Health and Welfare, published on 5 July, 2022, https://www.aihw.gov.au/reports/disability/people-with-disability-in-australia/contents/employment/unemployment.

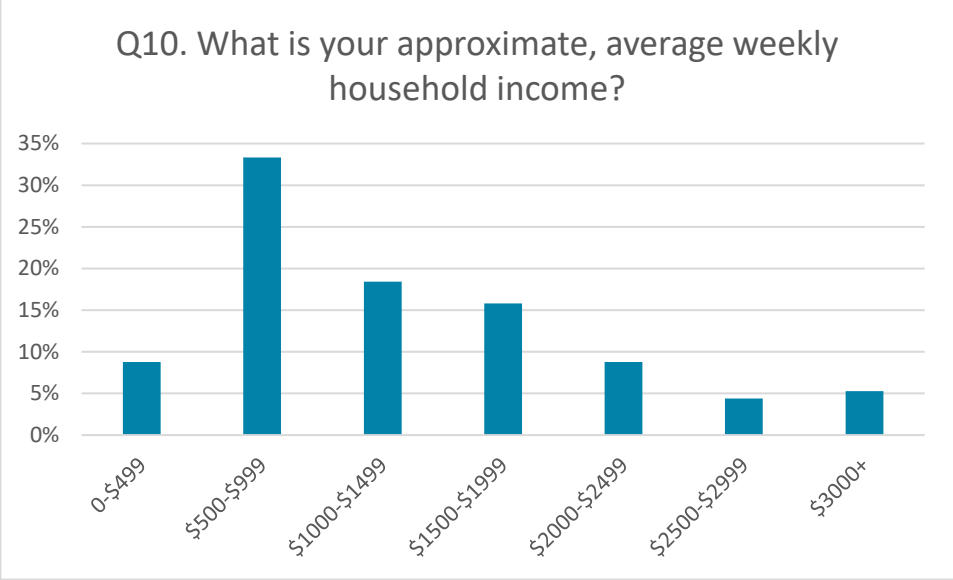

Figure 9. Average weekly household incomes of survey respondents

4.4.3 Summary and key findings – 4.4 Energy costs and financial vulnerability

- Survey results indicated that in the past two years, about half of respondents have felt concerned that they might struggle to pay their electricity bill, and 63% are moderately or very concerned about the cost of electricity in the future.
- Customers who experience disability and chronic health conditions may be unable to work, unable to find suitable work, underemployed, only able to work a limited amount, or retire early. Consequently, some receive low incomes and/or experience financial hardship. This is exacerbated by possible additional costs of managing their conditions.
- Participants identified solar and batteries, and generators, as worthwhile investments to help manage financial and technical risks associated with their electricity supply, but in some cases are unable to afford such an investment.
- Some dimensions of vulnerability are the result of both internal factors and external context, including an individual's experience of, and position relative to, societal structures or institutional actors such as the NDIS and CentreLink.

4.5 Adaptive capacity: participant strategies for managing risks and impacts

4.5.1 Managing planned outages

Participants' capacity to cope with outages varied depending on the nature of their reliance on electricity and whether they received advanced notice (i.e., a planned vs. unplanned outage). For some participants, knowing in advance that they would be without power didn't necessarily make the experience substantively easier in practical terms, and one even remarked that they would prefer short notice so they would spend less time worrying.

Notably, while most survey respondents can manage risks of power outages when given sufficient notice, for a quarter of respondents, planned outages still pose a moderate to significant risk to their wellbeing.

Table 2. Risk to wellbeing of planned outages

Q31. To what extent do planned power outages pose a risk or negatively impact your well-being?	
Despite receiving communication in advance, planned outages still pose a moderate to significant risk to me.	25%
As long as I receive sufficient communication regarding when the outage will occur, I can adequately manage any risks or impacts.	54%
Planned outages pose no or minimal risk to me.	18%
I have not experienced a planned outage.	1%
Unsure / I don't know	3%

Nonetheless, generally planned outages were considered less challenging by interview participants due to the reduced uncertainty of when they would lose power and for how long, which allowed the disruption to be managed into their plans:

> I'll have everything sorted. I'll make sure the house is warm before [the power] goes out, I'll have the fire lit, I'll have water in jugs. … I'll get up and shower at four o'clock in the morning, whatever time I need to. … and if I need to get work done for the day on the computer, …same thing. …. And then if I choose to, I'll hop in the car and disappear for the day …make it an adventurous day. … make it a better day so it doesn't affect me as much …. (Sally)

> If we've got a planned outage, I fill up more receptacles of water. …. So usually, if there's a planned one, my husband might try and take that day off and we'll go somewhere for the day, if it's gonna be an extreme weather day. … So, we'll have a plan, but that often involves my husband having to take time off work, which is a bit ridiculous, but … I can't always drive. (Karen)

> … [E]specially for autistic people, hugely important to have notice. I understand if there's storms and stuff. But that makes the world of difference because then I can organise. I can rearrange my routine in advance, because it is changeable, but I

> need to know so that I can change it. I can organise to go to my partner's house that night. … I need to know so that I can move myself to another location where I'm gonna be able to still do the same things …. (Felicity)

Providing the opportunity to plan around outages was evidently very important for most participants; especially, as Felicity noted, for autistic people, for whom maintaining routine can be critical, and unexpected events can feel overwhelming.

However, although advanced notice was always preferred, communication preferences differed, particularly in relation to participants' level of geographic isolation. For instance, Evelyn's mail isn't delivered, so she checks her mail at the post office once a week. To be sure she receives notice in time by mail, ideally AusNet would send it two weeks in advance. She suggests that is "probably not practical" and that the landline phone and email are more reliable (despite internet outages). Felicity would prefer a month, but two weeks is "enough time for [her] to sort out how I'm gonna do my life", because she "tend[s] to run on a weekly schedule". She also recommended repeated communication:

> If you know that something's gonna happen, … communicate it. Probably more than once, too – people forget. Text a couple of weeks beforehand. Text the day before.

And while email and landline were best for Evelyn, Felicity felt that "text is better":

> Text is more universal for everyone. Email's too risky – it's gonna go to junk. Never, ever, ever call me.

These comments confirm what is presumably already well-understood by AusNet – customers' communication preferences and circumstances differ, so it is necessary to utilise all communication avenues available. Although some customers may find this excessive, we suggest that the consequences of failing to communicate effectively are likely to outweigh concerns about excessive communication. Hopefully the preceding sections have illustrated this. Interestingly, interview participants generally only identified one form of communication they received from AusNet regarding planned outages, suggesting that either (a) customers tend to favour one mode of communication above others, or (b) AusNet may not consistently make use of all modes of communication. If the case is (b), addressing this issue is 'low-hanging fruit' in terms of improved service and risk mitigation.

4.5.2 Managing unplanned outages

Survey respondents highlighted that SMS was the predominant mode of communication by which they received information about utility faults. Interview participants, too, explained that they almost always received texts from AusNet informing them about unplanned outages. Ironically, for participants who relied on powered signal boosters, the text messages often only arrived when power was restored. Echoing a survey response, Felicity also noted that SMS updates ought to be taken "with an enormous grain of salt" because power is often restored much later. Conversely, several participants commended AusNet's communication during unplanned outages and the speed at which outages are addressed.

Generally, participants did not identify specific strategies for managing unplanned outages as opposed to planned outages. Although the period of notice differed, most felt that the impacts were, for the most part, the same; and the length of the outage was variable regardless of whether it was planned or not.

Perhaps owing to their frequent and sometimes challenging experiences with power outages, interview participants routinely turned to various strategies to cope without electricity. These strategies, as well as those listed by survey respondents, can loosely be divided into three groups: *technological strategies*, which employ an alternative technology to either provide electricity or replace its role; *behavioural strategies*, whereby individuals prepare for outages or change how they live and what they do to suit their circumstances; and *social strategies*, whereby individuals seek the cooperation and assistance of neighbours and their local community in order to share resources, or simply avoid the outage altogether by staying with friends or family.

Using these strategies, the research participants sought to either overcome the challenges through resourcefulness, or avoid the problem in various ways. While some strategies effectively aim to lessen the stressor itself (e.g., using a generator for backup power), for the most part, these strategies are post-facto approaches that seek to reduce the impact of a stressor. Although customers can prepare for outages in ways that lessen their sensitivity, they have limited scope to reduce their exposure to the risk or severity of an outage, as these factors are largely determined higher up the causal chain.

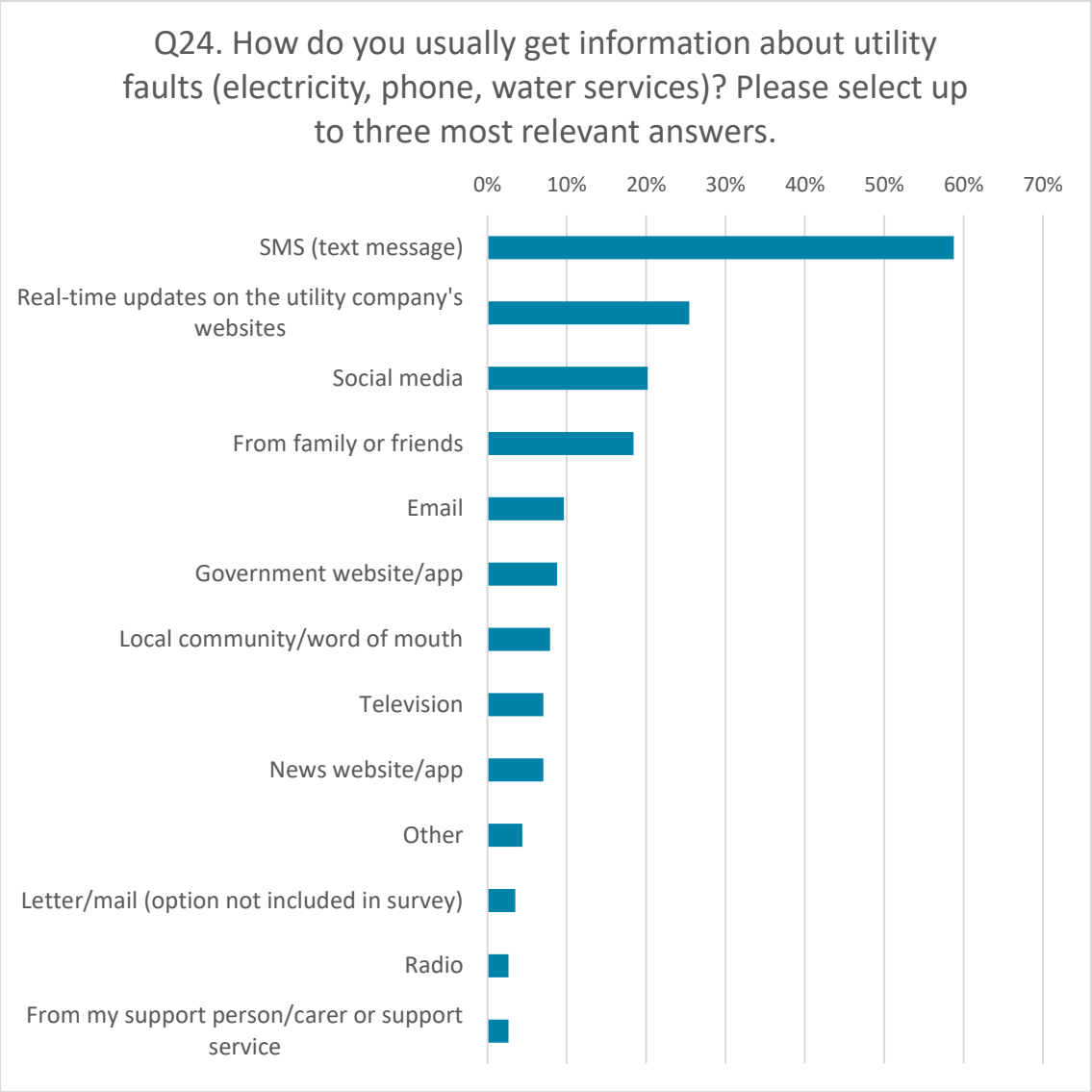

Figure 10. Communication channels regarding utility faults

Table 3. Strategies employed by survey respondents and interview participants to manage power outages

Technological
Using household (solar) batteries for backup power
Using deep-cycle batteries for back-up power (e.g., in a caravan)
Renting, purchasing, or borrowing generators during extended outages
Portable solar chargers and battery packs to charge or power essential items (e.g., CPAP machine)
Using candles, torches, and solar lighting
Using ice and eskies in place of refrigerators
Using a gas stove (esp. portable)
Charging items using a car
Lighting a wood fire for warmth and cooking
Behavioural
Using blankets to keep warm
Taking cold showers to keep cool
Getting take-away or going out for dinner
Going to bed early
Getting out of the house (e.g., doing the shopping)
Charging items in advance of a storm or scheduled outage
Filling water vessels in preparation for an outage (if relying on a water pump)
Completing essential activities early in the morning if necessary
Avoiding opening the fridge
Social
Driving to friends, family, or the nearest town (scheduled or unscheduled outage)
Remaining calm by connecting with friends and family over the phone
Co-operating with neighbours and the local community

4.5.3 Managing energy expenses

Energy expenses were not a particularly prominent aspect of any of the interview or survey responses, perhaps as this is a far less dynamic stressor – if energy expenses are too high, savvy customers try to reduce their consumption, and/or find a better retail offer. And although it might be worthwhile investing in more efficient appliances or even household efficiency measures, this expense can be difficult to accommodate for those facing financial hardship.

Additionally, customers who are typically considered “vulnerable” in either economic terms or due to disability may have little scope to reduce their consumption, as they may already be living very frugally, or rely on power for critical needs.

4.5.4 Summary of findings – 4.5 Adaptive capacity

- Both survey respondents and interview participants have developed and/or employ a range of technological, social and behavioural strategies to manage energy expenses, power outages, and associated risks.
- Individuals prefer different modes of communication regarding planned outages, and it is recommended that AusNet continue to communicate consistently and across all modes to ensure the message reaches its customers.
- With advanced notice, some customers are able to employ numerous strategies to moderate the impacts of planned outages, and can reduce the stress of such experiences through planning. For others, however, advanced notice does not change the practical impacts.
- While AusNet was generally commended for diligently informing customers during unplanned outages, this is of no benefit to the many customers who rely on electricity to power their mobile signal boosters and NBN service.
- Although some participants expressed concern regarding their financial situation and/or the cost of electricity, it was not a major theme in interviews. This could be for a number of reasons, though it generally did not seem to intervene in or shape participants lives or behaviour anywhere near the extent of power outages.

5. Concluding remarks and recommendations

5.1 Concluding remarks

In an era of increasing societal reliance on digital technology and hastening electrification of households, customers face an uphill battle to alleviate the impacts of rising energy costs and power outages. The task of reducing the risk of such events must be considered across scales: from the household, to the low-voltage network, to AusNet's distribution area, and beyond; as well as across different dimensions: the personal, the regulatory, the policy, and the technical, among others.

Both risk and vulnerability are emergent phenomena, in that they manifest through the complex interaction of sometimes minor events or drivers; yet these concepts are often treated as self-evident. It is important, therefore, to interrogate notions of risk and vulnerability in order to identify: which constituent elements are amenable to change, at either the individual or system level; which risk factors are contingent rather than fixed; and what processes and policies allow gaps that leave individuals unsupported.

This report has tried to paint a picture of vulnerability that is faithful to the words of the participants themselves – those who live with disability and chronic health conditions and viscerally experience the impacts that have been explored.

Although these participants are vulnerable in the sense of being highly exposed and sensitive to stressors, they also demonstrate substantial resilience, persistence, resourcefulness, patience, and good humour; they are not, in the colloquial sense, 'vulnerable' in character.

This project asked the following questions:

1. How do regional community members who experience disability and/or chronic health conditions use and rely on electricity to manage their lives and wellbeing?
2. In what ways are regional community members who experience disability and/or chronic health conditions disproportionately vulnerable to risks and impacts in relation to electricity provision?
3. What options are available to AusNet and other utilities or authorities to mitigate and reduce identified risks and impacts among regional community members who experience disability and/or chronic health conditions? And what measures would empower or enhance resilience among these individuals?

This report has demonstrated that although disabled customers may have certain specialised electrical needs, the impacts of disruptions to commonplace and everyday needs like heating, cooling and Wi-Fi are felt equally as acutely. Some therapeutic support devices have critical functions, but depending on personal circumstance, so do NBN connections, reverse cycle air-conditioners, and even the routine habits individuals practice as part of managing a (sometimes) challenging life experience. The heightened sensitivity of disabled customers to the risks of outages cause disproportionate effects due to a range of physiological, psychological, social and various other characteristics of an individual's experience that are unique to themselves. Importantly, though, it is often the propensity for cascading impacts that flow indirectly from the initial stressor, that highlight an individual's vulnerability to risk.

It feels inappropriate for YEF to advise AusNet about network augmentation, electricity availability, and communications. Nevertheless, as a technically-capable and well-resourced distribution business, there are opportunities for AusNet to show leadership and creativity by addressing the equity challenges of the transformation of our energy system through innovative partnerships and initiatives. In section 5.2, we propose a range of ideas that we feel capture some of the wisdom of this project's participants, and encourage AusNet to consider, rework and expand on to develop activities that align with AusNet's strategic direction and values. First, however, we discuss two complementary but counterpointing approaches to reducing vulnerability.

5.1.1 Customer-driven and 'top-down' approaches to reducing vulnerability

There are undoubtedly important and worthwhile ways in which some individuals might enhance their adaptive capacity; for example, by receiving guidance about enhancing the thermal efficiency of their home by bolstering its building envelope, or receiving assistance in negotiating the administrative requirements of registering as a vulnerable customer or applying for relevant concessions. However, the resounding message of this research has been that many putatively 'vulnerable' customers are either already experts capable in such domains, or are stretched to near-capacity in managing the requirements of daily life. If only for these reasons, it seems appropriate to suggest that the benefits of focusing on customer-driven resilience (at the expense of 'top-down' initiatives) may yield only marginal benefits.

There are three significant reasons, though, for emphasising the opportunities that lie in a top-down approach to reducing vulnerability.

First, the predominant stressor participants addressed were unplanned outages, and the frequency and length of outages they reported were, to the author, surprisingly significant and variable. Put simply, it would appear that there remains room for improvement with regard to the resilience and performance of the network. There may be benefits to AusNet, in terms of resource efficiency and regulatory compliance, to committing to an explicitly and proactively preventative approach that considers longer time horizons and previously unconsidered elements, such as the cascading impacts beyond the point of supply. It may be that this is already practiced, in which case, this point may add strength to that conviction.

Second, because vulnerability is an emergent phenomenon, it must be addressed from multiple angles. Building customer capacity and resilience is essential, especially as our society pursues electrification, the transformation of our energy system, and is subject to further destabilisation of the climate; however, this does not address the wider contextual elements of vulnerability, including those beyond the agency of the customer to address. Where customer vulnerability is not addressed, or even exacerbated, by institutions, responsibility lies with institutional actors to remedy these issues.

Multiple interview participants face life-threatening risks during a power outage, but they are not recognised as 'life support customers'. While some are registered as vulnerable customers, most experienced no tangible difference in their service. The definitions of these concepts, or the design of the associated mechanisms for receiving relevant assistance, appear ill-suited for the complexity of these customers' situations.

Third, as was outlined in section 4.3, the causal chain from stressor, to risk, to first-order impacts (and beyond) demonstrates that impacts can proliferate when moving down the chain. This is because for each stressor, risk, or impact, there are generally multiple consequences, which can interact with other dimensions of customers' experience. Although this may sound conceptually complex, in simple terms, it simply means that addressing risks before they reach the customer avoids the various subsequent impacts that can arise due to each customer's unique circumstances. This sentiment is sometimes expressed through idioms: "a stitch in time saves nine", or "prevention is better than cure".

5.2 Recommendations

In late 2022, AusNet launched its online engagement platform, the Community Hub, a project that is indicative of its active commitment to engagement to inform its operations, communications, and strategy. The Community Hub exemplifies the principles and practices by which AusNet ought to operate: a dedication to listening to and learning from community members, establishing and building mutual trust, and a dedication to improved outcomes for customers.

As such, the following recommendations can be made in a spirit of optimism, given there exists already a strong foundation for addressing vulnerability among disabled folk, those who live with chronic health conditions, and everyone who critically depends on the availability of electricity.

5.2.1 Principles for addressing vulnerability

AusNet "strive[s] to make engagement" with its customers accessible, visible and meaningful. In the context of vulnerability, these worthy values might be enhanced by several principles for addressing vulnerability. For example:

1. **Reduce uncertainty** – for neurodivergent customers, customers with mental health concerns, and for many people, uncertainty is unsettling. Wherever possible, reducing uncertainty can be a major benefit in reducing the psychological toll of power outages and limiting disruption to customer

routines. We recognise that AusNet already does practices this principle in sharing estimated outage times, but it deserves highlighting for the particular pertinence to the topic of disability. Although participants were unable to identify what additional information they might benefit from knowing, along with the time and duration of an outage, there may be additional information AusNet can share to further explain and contextualise the disruption.

2. **Communicate early, often and using multiple modes** – although most participants praised AusNet's communication, there were nonetheless opportunities for improvement. As customers have different communication preferences for various reasons, it is recommended AusNet communicate at the earliest instance and use all modes of communication available in order to meet the diverse needs of their customers. Because executive function can be affected by disability and health conditions, consistent and frequent communications can mitigate some of these challenges for customers.

3. **Build relationships and a presence among communities** – the energy sector is not subject to high levels of trust from consumers, but trust is integral to effective communication and collaboration. The transformation of the energy system, including addressing vulnerability among customers, will require establishing trust and cultivating a presence among the community. Although AusNet's website includes helpful information regarding, for example, what to do to prepare for a power outage, many AusNet customers might not realise AusNet is their local distribution business.

   While there may not be clear opportunities for AusNet to build relationships throughout the communities it services, establishing a presence in the broader community may provide AusNet a more prominent platform to share strategies for reducing vulnerability, such as registering as a life-support customer, which some eligible customers may not understand. The role of a distribution business has evolved beyond the technical operation of electricity networks to involve a social agenda for which a recognisable voice is required.

5.2.2 AusNet-led initiatives

5.2.2.1 Changes to the life support register

The AusNet Community Hub signals an important commitment to ongoing customer engagement. This commitment ought to be cultivated with the aim of ongoing deepening of engagement in order to identify customers who critically depend on electricity and are not currently registered as life-support customers, but nonetheless face life-threatening risks.

Further, several interview participants are registered as life support customers, and yet they felt it did not tangibly reduce their level of risk. In this case, engagement specifically with these customers regarding the unique risks they face might better inform AusNet's operations in this domain; and, ideally, lead AusNet beyond legal and regulatory compliance to become an industry-leading exemplar.

Because the current life support customer list is defined by approved equipment rather than customer risk factors or experiences, some customers may be unaware that they could register.

Further, it could be argued that the requirement to have equipment certified by a registered medical practitioner introduces a difficult hurdle for customers who may have had negative experiences negotiating the labyrinth of medical and government bureaucracy. While this is an essential aspect of the register given its legal and regulatory implications, it does not accommodate those customers who may not feel they qualify but face significant and even life-threatening risks all the same.

An additional register or an avenue for responsive communication with customers who face such risks would attend to the principles previously outlined, as well as deepening AusNet's own understanding of its customer base and vulnerability, while hopefully uncovering further opportunities to improve outcomes for those customers.

5.2.2.2 Low-cost leasing of backup power systems

For customers experiencing extended outages, on-site generation or backup power can address a significant proportion of impacts stemming from power outages. However, portable batteries and generators are expensive, complex, and challenging to deploy widely.

It could be possible to enable customers to lease a backup power system for an extended period of time (e.g., annually), reducing the transactional costs of installing and transporting the unit. While the unit would not be available to be deployed by AusNet in the event of a serious storm, for example, it would provide customers the opportunity to live under reduced concern regarding electricity availability in exchange for relatively low-cost lease fees compared with the cost of an equivalent private investment.

The fees could be determined such that AusNet does not profit from the program, and instead gradually covers all or part of the capital cost of the investment over an extended period of time – and ensuring that the costs are not passed on to all customers. It is possible that this program would require subsidisation by the government to be financially viable.

5.2.2.3 Data and information sharing for collaborative innovation projects with external stakeholders

It is likely that AusNet has a significant amount of data documenting the causes of power outages, but it is not evident that this data is shared and incorporated into broader research programs or innovative projects.

Optimistically, the transformation of the energy system will hopefully be characterised by collaboration and partnerships between various stakeholders. With oversight of network infrastructure, metering data, GIS capabilities, etc., AusNet is in a powerful position with regards to the information it possesses. Finding opportunities to share this information with partners who can deliver value to the community as well as AusNet should be a priority.

If AusNet share data and experience regarding the predominant causes, geographic 'hotspots', and other information about network outages and infrastructural vulnerabilities, external stakeholders may contribute innovative interventions that could enhance the resilience of the network and reduce vulnerability – for example, through the pursuit of microgrids, or other projects that provide network augmentation as a co-benefit.

Relatedly, it is likely that some parts of the network require additional monitoring, servicing, and preventative maintenance.

5.2.2.4 Customer outreach initiatives

This report illustrated that many participants were resourceful in developing strategies to cope with power outages. Nonetheless, there could be significant benefits in undertaking proactive customer outreach initiatives focused on capacity-building with respect to managing outages; for example, offering education regarding suitable battery storage devices to power CPAP machines and charge phones, or energy efficiency and energy bill literacy.

These programs are normally the domain of government agencies, not-for-profits, local councils and community groups. AusNet's expertise and resources suggest it could accomplish a great deal by leveraging economies of scale and pairing such a program with existing community/customer engagement activities or new vulnerability reduction activities. It would also support the third principle for addressing vulnerability described in section 5.2.1 by providing an ideal avenue to establish a presence among communities by building supportive relationships.

5.2.3 Externally-led initiatives

5.2.3.1 Supporting telecommunications businesses to augment infrastructure to reduce black spots

The deficiency of telecommunications infrastructure in much of AusNet's distribution area, characterised by poor mobile reception, is not AusNet's responsibility. Nonetheless, as discussed previously in this report, the severe impacts associated with power outages are sometimes the result of intersections with communications

systems. Thus, finding ways to collaboratively address problems at the intersection of electricity and other domains will likely require a collaborative approach.

Working with Tesltra, Optus, and potentially government departments and agencies, AusNet could share data and pool resources in order to target high-impact projects and initiatives that could deliver significant quality of life improvements and risk mitigation for customers who rely on power for communication.

Given AusNet's expertise in installing, operating and maintaining large infrastructure such as Victoria's electricity transmission network, it may have unique advantages, resources, and assets that could provide an efficient pathway for eliminating Victoria's telecommunications black spots.

5.2.3.2 Enhancing household energy efficiency and thermal comfort

Victorian homes are notoriously underbuilt in relation to our climate.
Recent initiatives involving not-for-profits, community organisations and government agencies have demonstrated the significant benefits of energy efficiency interventions as simple as draughtproofing, especially for low-income and vulnerable households.

By contributing towards such programs, either as a grant funder, delivery partner or program coordinator, AusNet could reduce the impact of outages for vulnerable customers while simultaneously pursuing principles of corporate social responsibility. It would also afford additional opportunities for AusNet to establish its brand as a contributor to community resilience in the face of climate change, and cultivate public trust in the energy sector. This type of initiative could target households which are most likely to experience impacts from distribution-related poweroutages, assisting to reduce the exposure of risk and decreasing householders' reliance on adaptive capacity changes.

5.2.3.2 Retrofitting islandable Emergency Relief Centres

During recent natural disasters such as the 2021 storm that particularly impacted the Dandenong Ranges and parts of Gippsland, many residents faced extended periods without power, and in some cases, without anywhere to live. As the Victorian and local governments develop strategies to adapt to a changing climate, Emergency Relief Centres (ERCs) have been proposed that utilise existing council buildings to offer safe refuge from extreme weather for the local community.

Council-nominated ERCs are often large community buildings that are sometimes suitable for large solar installations. When paired with sufficient battery storage and the capability to island from the grid, ERCs could offer local residents somewhere to charge essential devices, stay cool or warm, and undertake other activities they cannot undertake at home during a power outage.

As a distribution business, AusNet has a unique capability to identify project opportunities and provide technical support for projects such as islandable ERCs. By working with government stakeholders to achieve these strategic objectives, AusNet could build significant trust among those stakeholders and local communities. Additionally, the projects could be a testing ground for innovations to the electricity

network – for example, for progressing developments towards microgrids that may offer enhanced network resilience; or establishing transport corridors with sufficient electric vehicle charging infrastructure. These projects may be eligible for funding through the Commonwealth or Victorian Governments' funding programs for climate change innovation or neighbourhood battery implementation.

If not ERCs, AusNet could investigate *Resilient Energy Centres* (RECs). RECs are a related concept however have a narrower function and do not function as a place of emergency refuge.[20] RECs may be a community building or business that can be used by the community when needed. They can be used in preparing and planning for natural disasters, and in response to recovery to an event which cuts off power, can provide back-up or 'energy islandable' technology, energy supply for charging electronic devices and cold-store for food or medicine. They can also provide basic comforts such as hot or cold beverages, basic meals, and showers. This types of facilities, when not available at home, could help those impacted better cope with the impacts of poweroutages – in particular those who have expressed a huge importance on mental health and routines, which are often disturbed during outages.

[20] Hancock, Nigel, and Walters, Kristy. *Resilient Energy Centres - A How-to Guide.* Sydney: Community Power Agency, 2022.

6. References

Adger, W. Neil. “Vulnerability.” *Global Environmental Change* 16, no. 3 (Aug 2006): 268–81. https://doi.org/10.1016/j.gloenvcha.2006.02.006.

Bijker, Wiebe E., Thomas P. Hughes, and Trevor Pinch. *The Social Construction of Technological Systems*. Cambridge, MA.: The MIT Press, 1987.

Clough, Beverley. “Disability and Vulnerability: Challenging the Capacity/Incapacity Binary.” *Social Policy and Society* 16, no. 3 (July 2017): 469–81. https://doi.org/10.1017/S1474746417000069.

Hancock, Nigel, and Walters, Kristy. *Resilient Energy Centres - A How-to Guide.* Sydney: Community Power Agency, 2022.

Fineman, Martha Albertson. “The Vulnerable Subject: Anchoring Equality in the Human Condition.” In *Transcending the Boundaries of Law: Generations of Feminism and Legal Theory*. Edited by Martha Albertson Fineman, 161–75. London, United Kingdom: Taylor & Francis Group, 2010. http://ebookcentral.proquest.com/lib/unimelb/detail.action?docID=557287.

Mackenzie, Catriona. “The Importance of Relational Autonomy and Capabilities for an Ethics of Vulnerability.” In *Vulnerability: New Essays in Ethics and Feminist Philosophy*. Edited by Catriona Mackenzie, Wendy Rogers, and Susan Dodds, 33-59. Oxford University Press, 2013. https://doi.org/10.1093/acprof:oso/9780199316649.003.0002.

Robbins, Paul. *Political Ecology: A Critical Introduction*. 2nd edition. Chichester, West Sussex ; Malden, MA: Wiley-Blackwell, 2011.

Turner, B. L., Roger E. Kasperson, Pamela A. Matson, James J. McCarthy, Robert W. Corell, Lindsey Christensen, Noelle Eckley, et al. “A Framework for Vulnerability Analysis in Sustainability Science.” *Proceedings of the National Academy of Sciences* 100, no. 14 (Jul 2003): 8074–79. https://doi.org/10.1073/pnas.1231335100.

Appendix A: Results

A.1 Survey data

The survey comprised up to 34 questions, ranging from demographic and geographic questions to open-ended response questions regarding respondent experiences and communication with AusNet. In particular, the survey focused on the ways and extent to which power was critical in managing respondents' wellbeing and day-to-day lives, and the risks and impacts of disruptions to electricity availability. A sample of 114 individuals responded to the survey (n=114).

This section presents key results most relevant to the discussion.

A.1.1 Demographic and geographic data

There was a relatively even split among the sample with respect to gender, and a wide range of ages and incomes.

Table 4. Respondent gender

Q32. How do you describe your gender	
Female	59%
Male	39%
Non-binary	0%
Prefer not to say	2%

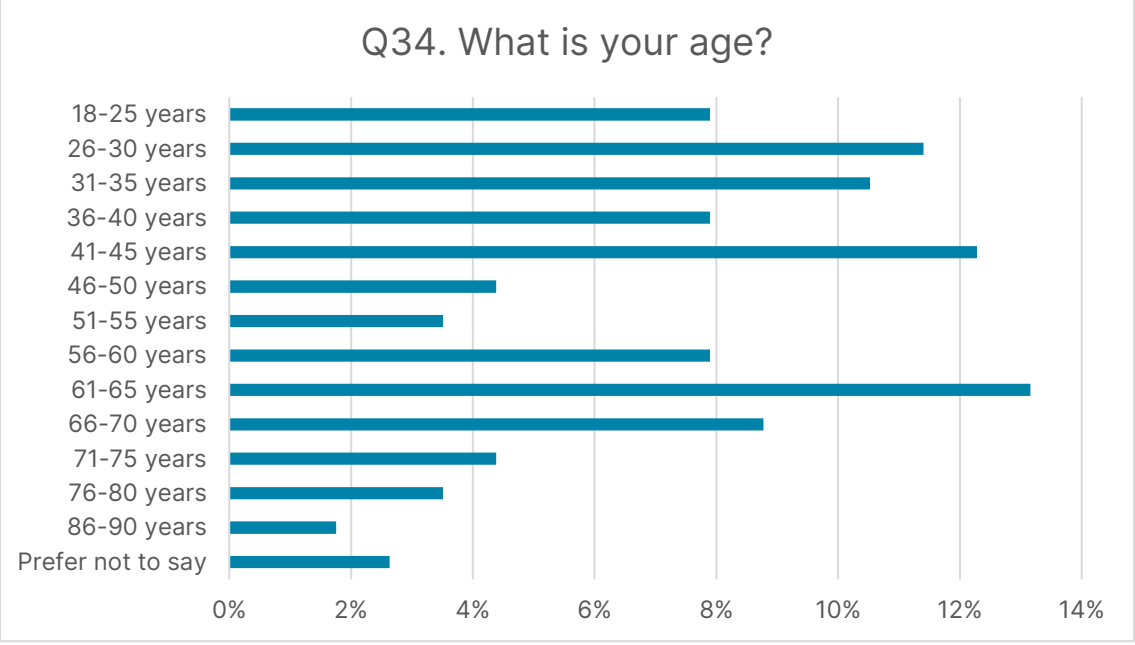

Figure 11. Respondent age

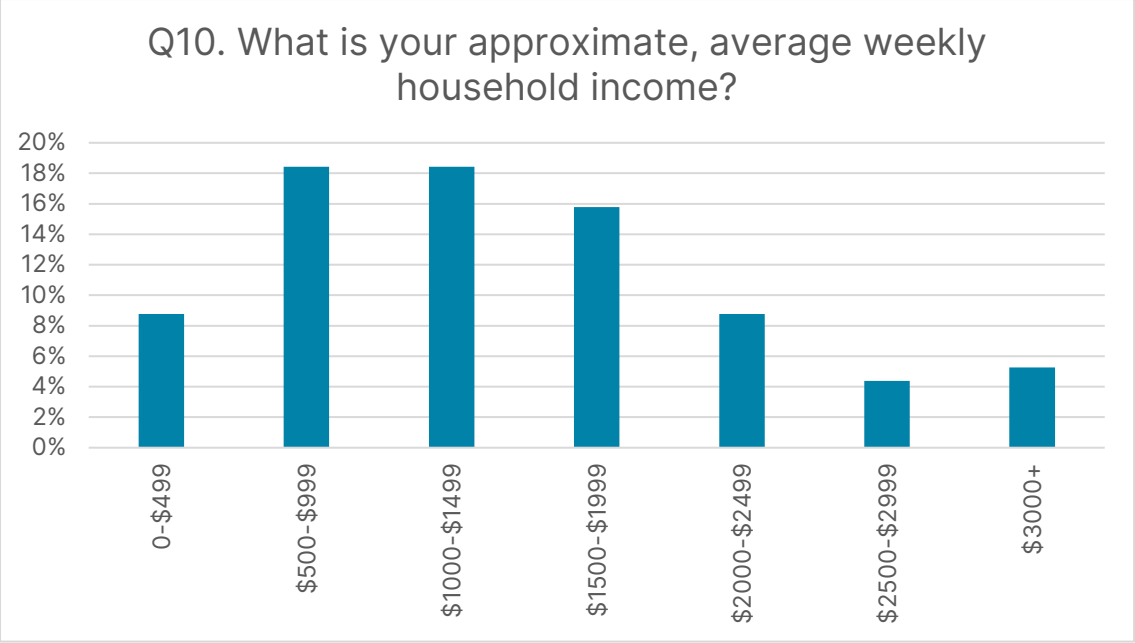

Figure 12. Range of respondents' household incomes

Survey respondents were drawn from a wide range of LGAs in AusNet's distribution area, with about half of respondents living in LGAs that form Melbourne's peri-urban fringe (Cardinia, Maroondah, Nillumbik, Whittlesea and Yarra Ranges).

Nonetheless, there was also strong and diverse representation from regional areas. 18 LGAs and 53 different postcodes were represented, with a maximum of 7 respondents from one postcode.

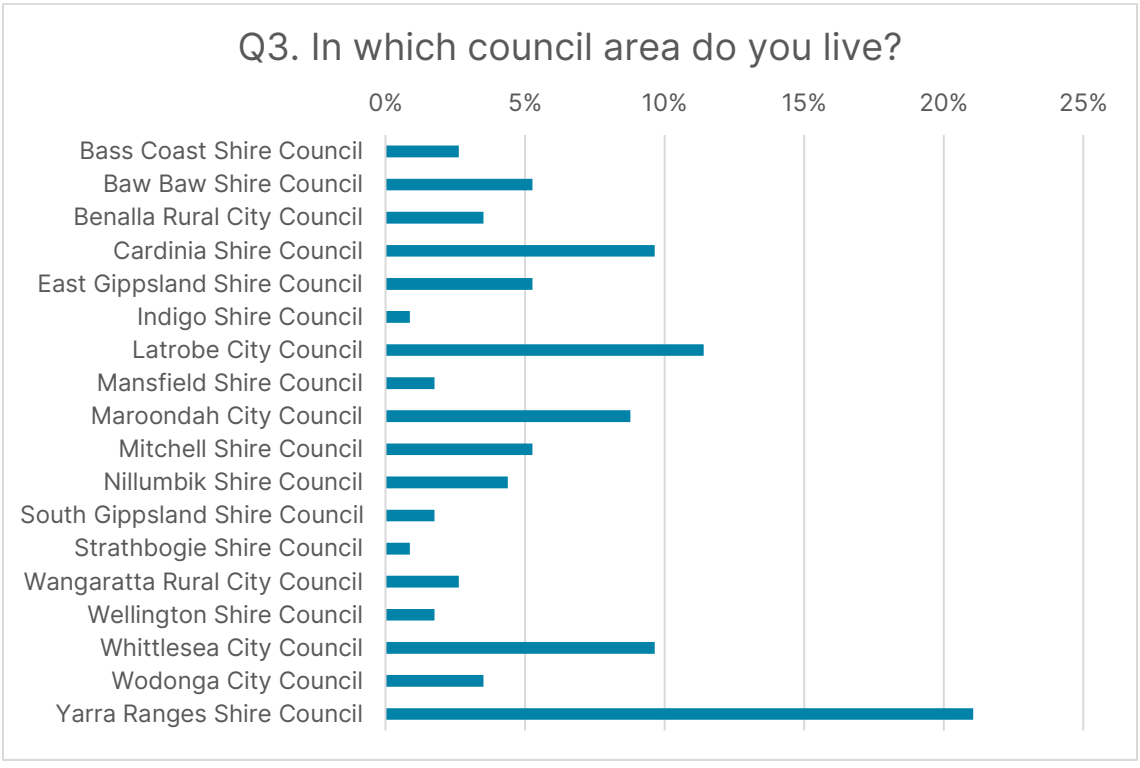

Figure 13. Percentage of survey respondents from each LGA

Most respondents were long-term residents of their LGA and were therefore well-prepared to discuss their experience with AusNet over a significant period of time. About two thirds owned their own home, a quarter were renters, and the rest lived in housing provided through government or other support services. While 21% of respondents lived either alone or as the only adult, which may exacerbate vulnerability to economic stress or risks to wellbeing, the majority live with at least one other adult.

Table 5. Length of residence in LGA

Q4. For approximately how long have you lived in this area?	
Less than 1 year	4%
1-2 years	4%
3-4 years	12%
5-10 years	22%
More than 10 years	58%

Table 6. Home ownership or household type

Q7. Which answer best describes where you live?	
Privately-owned home	66%
Rental home	26%
Public housing (government-managed)	4%
Shared supported accommodation (e.g., Specialist Disability Accommodation, Supported Residential Service)	2%
Community housing (managed by not-for-profit)	1%
Home provided by employer	1%
Other	1%

Table 7. Adult household occupants

Q11. How many adults live in your home (including yourself)?	
1	21%
2	55%
3	14%
4	9%
5	0%
6	1%

The vast majority of respondents travelled primarily by private internal combustion engine vehicle, with only three respondents relying on taxis (or equivalent). Public transport users were typically in the outer suburbs of Melbourne or in regional centres.

Table 8. Primary mode of transport

Q12. How do you normally travel to access the community (e.g., commute to work, access support, buy groceries)?	
Private car/van (electric)	4%
Private car/van (petrol/diesel)	84%
Public transport	7%
Taxi or other private transport service	3%
Other (please specify)	3%

While many respondents lived close by a community that they accessed for essentials such as groceries, about half were at least 5km away and would therefore rely on a vehicle for safe transport, especially if required to leave home in an emergency. While 5km may seem a short distance, it is far enough to constitute isolation in practical terms if this were the nearest township. Some respondents normally travelled over 20km to access the community.

Table 9. Normal travel distance to access community

Q13. How far do you normally have to travel to access essential healthcare or groceries/household supplies?	
Less than 5km	46%
5km - 20km	43%
20km - 50km	10%
50km - 100km	2%

A.1.2 Data regarding disability/chronic health condition

The most common condition respondents experienced was a chronic health condition. However, significantly, 68% of respondents selected multiple conditions, highlighting the prevalence of co-occurring conditions, which generally has a compounding effect with respect to risks/impacts and vulnerability.

Perhaps unsurprisingly given the sampling strategy, few respondents identified as experiencing an intellectual disability, although physical, psychosocial and neurodevelopmental disabilities were not uncommon.

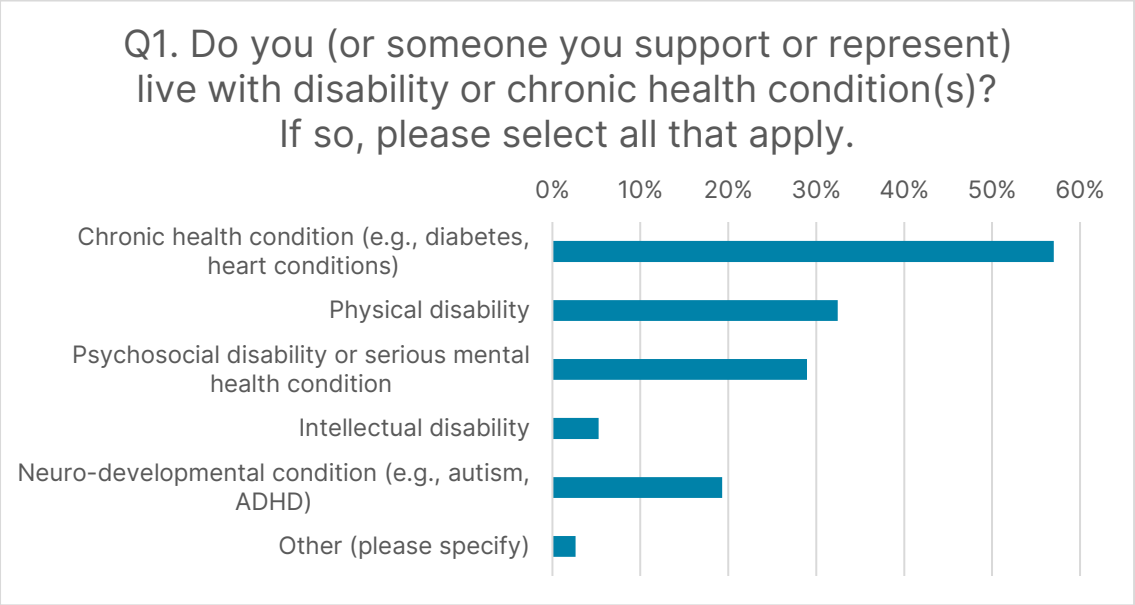

Figure 14. Percentage of respondents who experience particular forms of disability

Table 10. Percentage of respondents who experience multiple forms of disability

Percentage of respondents who selected:	1 condition:	32%
	2 conditions:	49%
	3 conditions:	14%
	4+ conditions:	4%
Total percentage of respondents who selected multiple conditions:		68%

With regards to support needs, just over half of respondents did not require meaningful support or care to manage their disability within the past year. Those that did were slightly more likely to engage unpaid support in the form of friends, family or volunteers, although about a quarter of respondents sought paid support within the past year. Among those who did require support, the average weekly hours of support received was 16.6, and the median was 6.

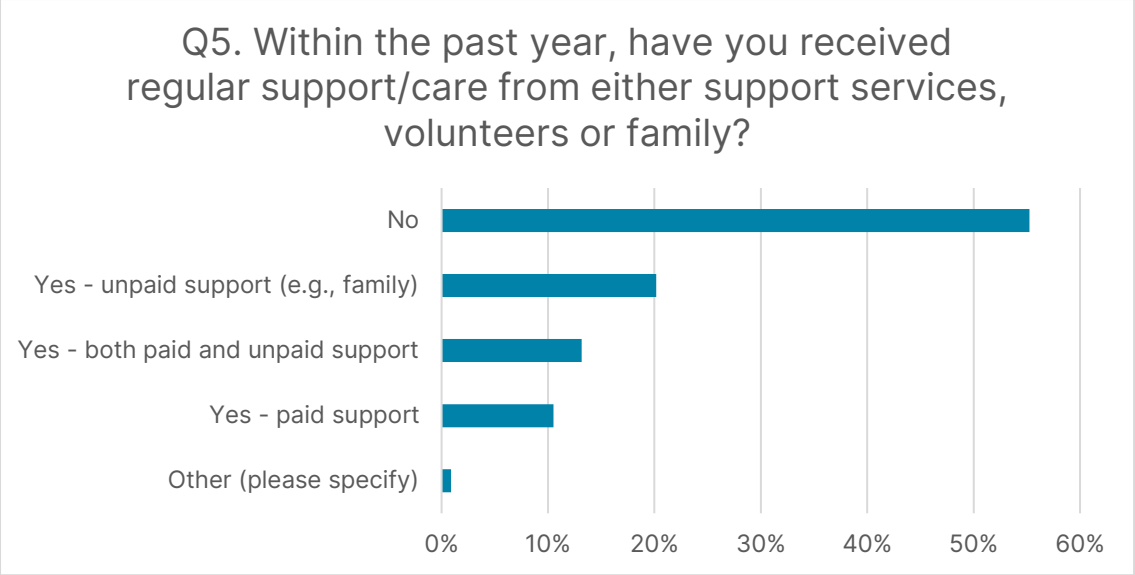

Figure 15. Respondent support needs

Table 11. Use of electric mobility aids

Q14. Do you use an electric mobility aid, and if so, what do you use?	
Electric bed or seat	3%
Electric hoist	0%
Electric scooter	3%
Electric stairlift	0%
Electric wheelchair	5%
Other (please specify)	0%
I do not use an electric mobility aid	90%

Q16. asked: In relation to your disability(s) and/or health condition(s), what are the most important things you need to use electricity for? Are there any times that you most need electricity?

The open-ended responses identified a number of important therapeutic supports or essential needs, including the following:

Table 12. Power-dependent therapeutic supports and essential needs

Q16. In relation to your disability(s) and/or health condition(s), what are the most important things you need to use electricity for?	
Continuous Positive Airway Pressure (CPAP) machine	Electric blanket and heating/cooling (for thermal regulation/circulation)
Therapeutic chair	Nebuliser (for asthma)
Life support	Refrigeration of essential medication
White noise machine	Microwave for heat pack
MePACS device (fast response personal alarm service)	Lighting (esp. for those with impaired vision and for showering)
Information and communications technology for emotional regulation	Communication device (respondent does not use speech)
Electric bidet	Emergency call button
Opening electric doors/locks (cannot use key)	NBN and Wi-Fi for emergency communications (no 3G/4G reception)
Mobile network booster	Water pump
Septic and sewerage pump	

The significance of some of these needs is explored more deeply through interviews and in the Discussion section of this report.

Here the responses are represented in a word cloud:

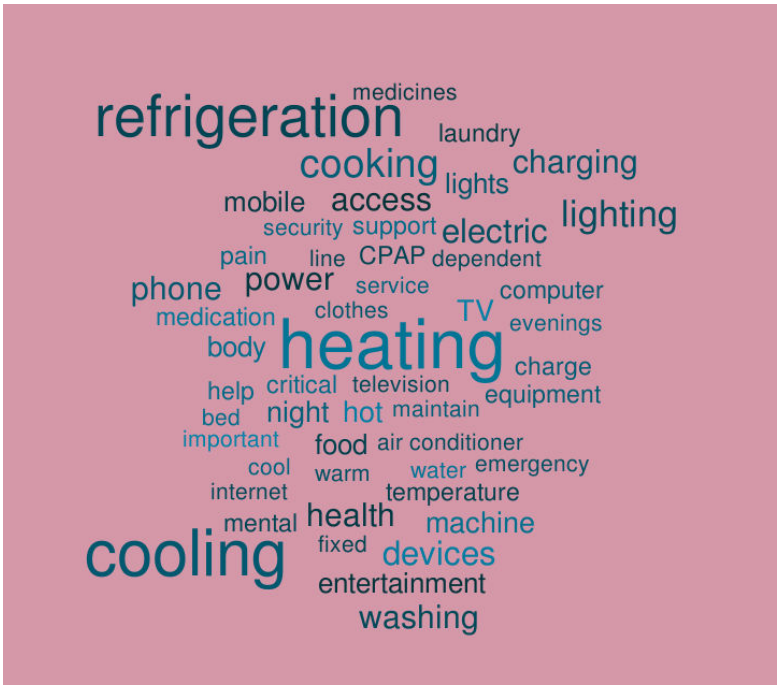

Figure 16. Word cloud of open-ended response data (cleaned) for Q16.

Q15. asked how important electricity was for maintaining wellbeing with respect to a range of activities or needs. Respondents selected on a Likert scale for each need from *Not at all important* to *Critically important*.

Table 13. Importance of electricity to maintain wellbeing by activity category

Q15. How important is electricity to your wellbeing with respect to the following daily activities:	Critically important	Very important	Somewhat important	Not so important	Not at all important	N/A
Heating and cooling to maintain comfortable body temperature	46%	37%	14%	2%	1%	0%
Lighting	45%	44%	9%	1%	0%	2%
Laundry	40%	46%	11%	3%	1%	0%
Cooking	40%	40%	13%	3%	2%	2%
Maintaining important routines and recreational activities	39%	41%	13%	4%	1%	2%
Refrigeration of medicine or other essential items	39%	37%	9%	6%	3%	7%
Bathing and hot water (if electric)	36%	25%	10%	4%	6%	19%
Working and employment-related responsibilities	25%	18%	16%	6%	4%	32%
Powering therapeutic supports (e.g., adjustable beds, hoists)	8%	15%	11%	14%	13%	39%

The minimal differentiation in importance among different activities was surprising, and may indicate a weakness in the survey design. Some respondents selected *Critically important* for each activity, meaning that electricity was critically important for maintaining their wellbeing with respect to every activity. It may be the case that electricity is critically important for each activity, but the question was intended to uncover how essential electricity was with respect to wellbeing (e.g., medical, health and safety needs). This limited any ability to identify the *most critical* needs. For

instance, it is somewhat surprising that laundry was considered a critically important need for 46 respondents.

Another issue is that because many respondents do not work or use electrical therapeutic supports, these were not scored highly. However, for those who do critically rely on electricity for therapeutic supports or work, it is largely irrelevant that many others may not consider it a critical need. The unique situational importance of a particular use must therefore not be lost in the large sample of responses.

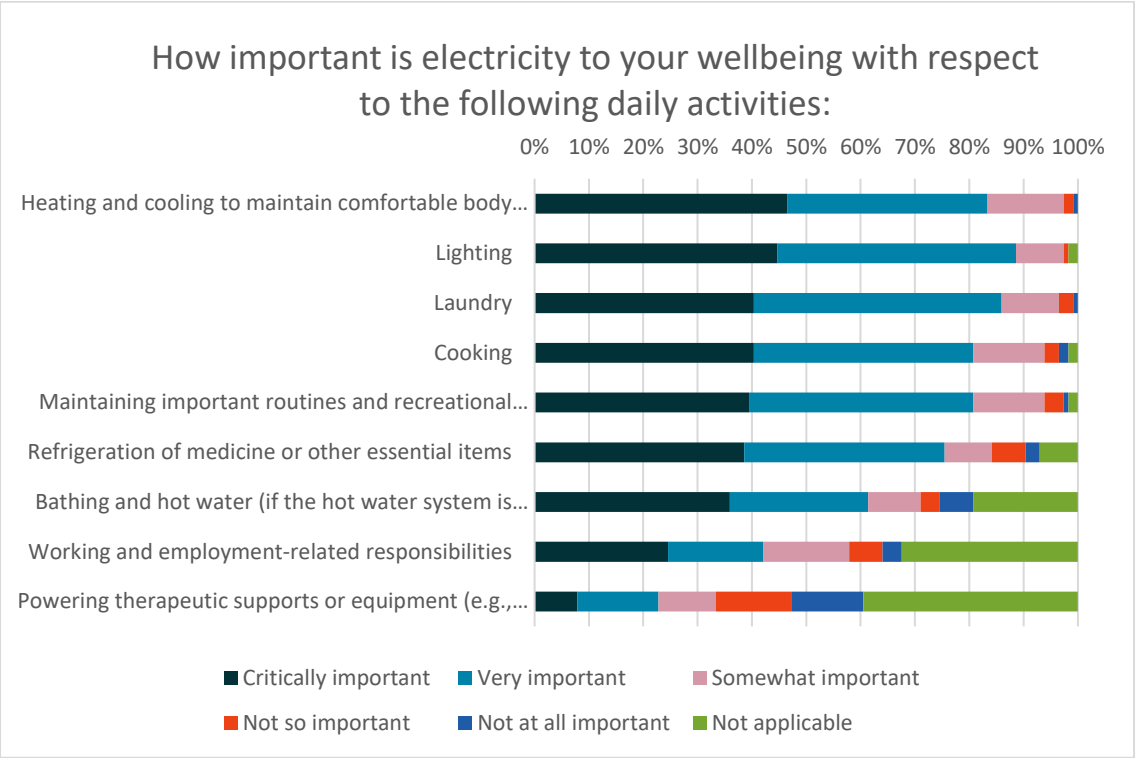

Figure 17. Importance of electricity to wellbeing for daily activities

For a breakdown of responses for each activity by disability segment, please see the appendix.

A.1.2 Data regarding experience of outages, communication, and affordability

Over half of respondents had felt concerned that they would struggle to pay their power bill in the last two years, and 93% were at least a little concerned that the cost of electricity will be difficult to manage now or in the near future.

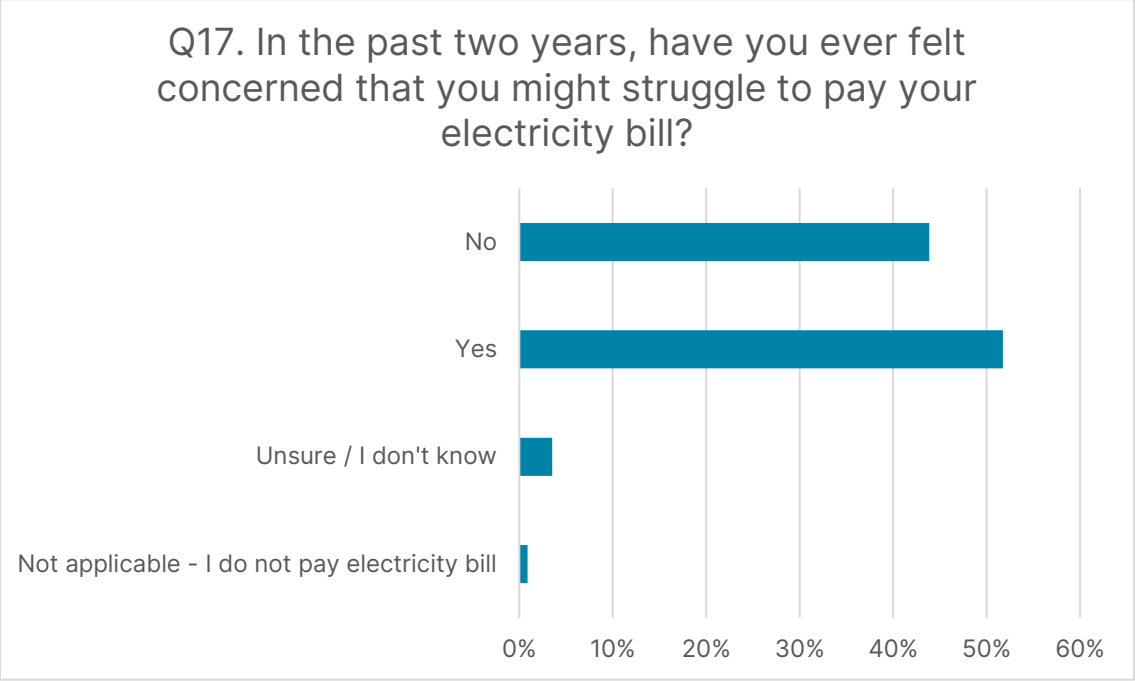

Figure 18. Concern regarding capacity to pay electricity bill in the past two years

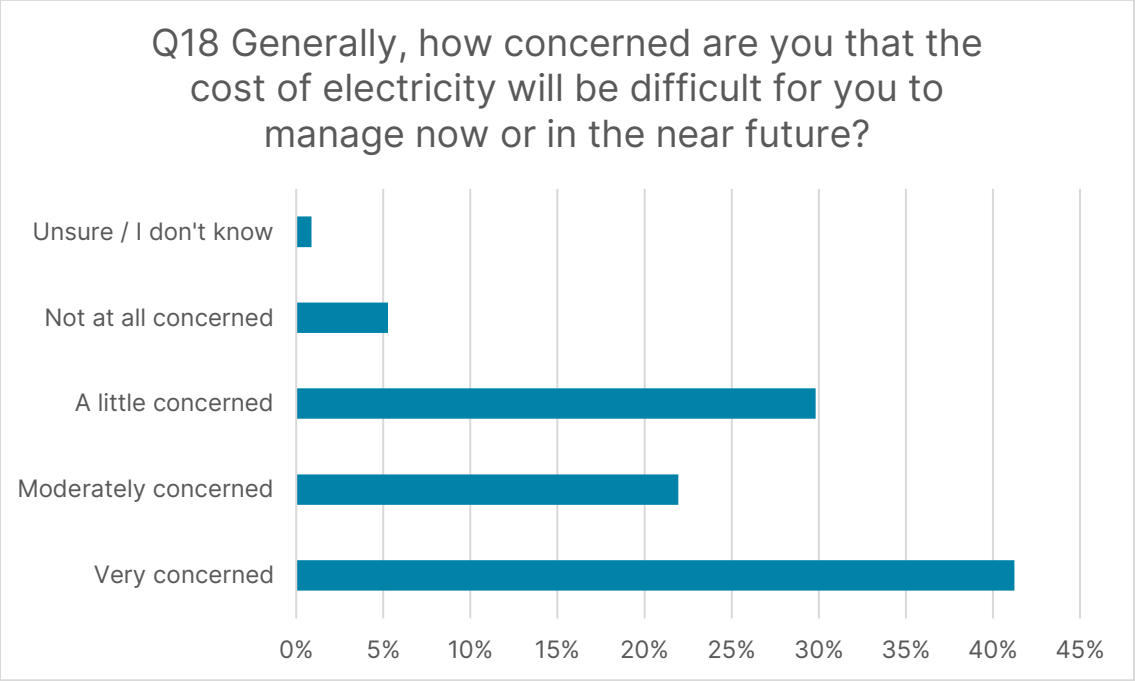

Figure 19. Concern regarding cost of electricity now or in future

Regarding *unplanned* power outages, 89% of respondents had experienced a power outage within the last two years, and 46% experienced more than 2 per year. 61% of respondents reported that unplanned outages typically last less than 6 hours, though a minority experience either longer outages or considered the length highly variable.

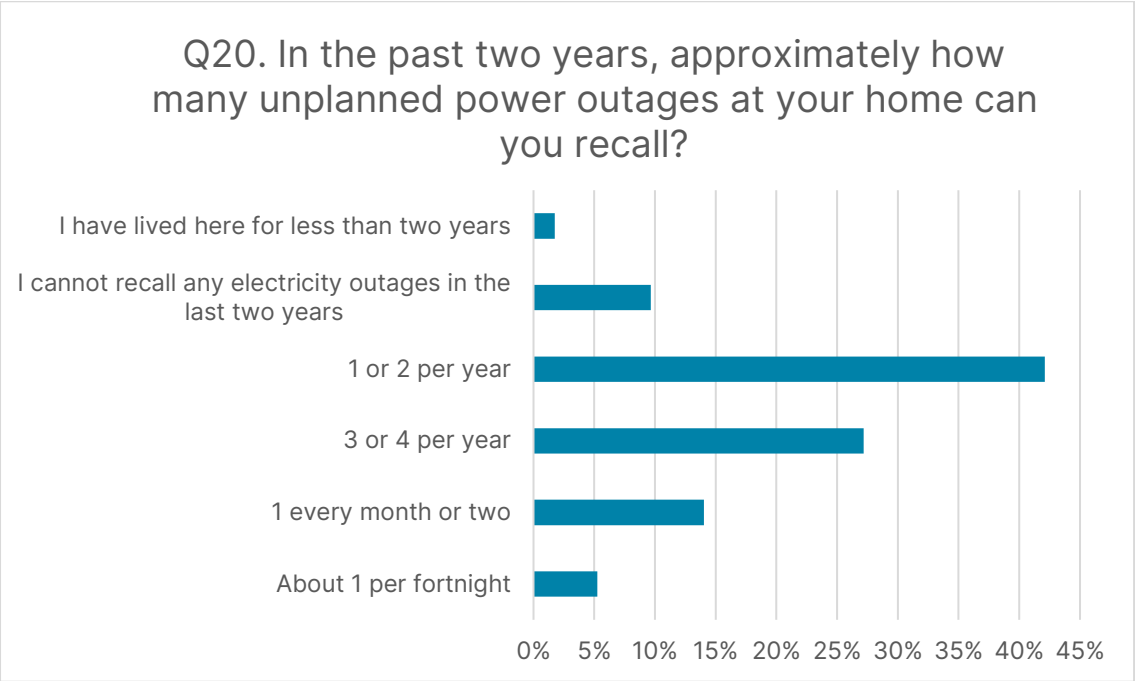

Figure 20. Frequency of unplanned outages

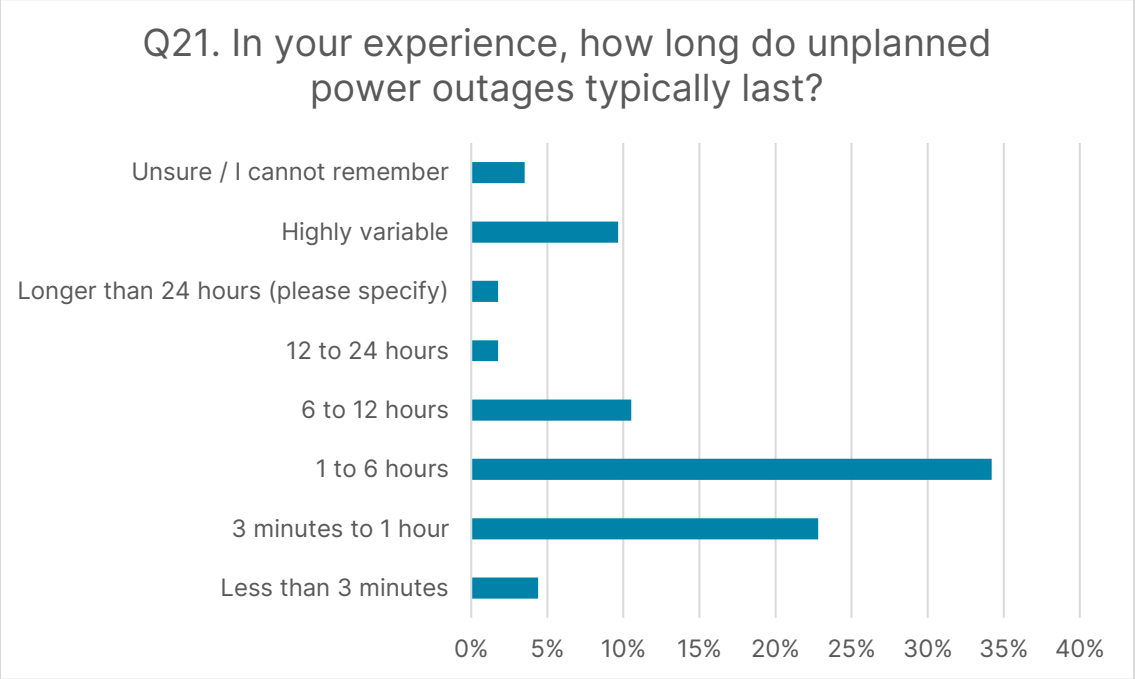

Figure 21. Typical length of unplanned outages

When asked to describe the impacts of these outages in an open-ended response, respondents provided a range of answers that commonly emphasised concern around refrigerated perishables including food and medication, as demonstrated in the word cloud from response data shown below.

Figure 22. World cloud of response data to Q22 regarding impact of unplanned outages

What is not captured by the word cloud are less common, but potentially more serious, impacts, as shown below. Responses may have been edited for readability.

Table 14. Impacts of unplanned outages

Q22. How have these power outages affected you? Please describe any impacts (if any) and any risks to your wellbeing.
Life support went off but transferred to generator
Power outages haven't affected us that much as we have solar and battery which kicks in during blackout.
No vehicle access as door is electric
Anxiety
Cooling cut out on extreme heat day (>45 C)
Unable to use MePACS unit or landline phone
Food in fridge and freezer had to be disposed of and replaced at significant cost
Impacted work and school activities
Outages have led to damage to IT equipment at significant cost
Can not call for help in an emergency or use electric door opener
CPAP machine stopped working, leading to physical discomfort, unable to sleep and effects throughout following days
Unable to use water pump, therefore no access to water
Impacts my daughter who has ASD and anxiety, she freaks out and overheats, we use iPad to regulate but with no Wi-Fi she doesn't have that option

There are variable levels of concern regarding the risk of power outages, with 47% either not or only slightly concerned, and 53% somewhat to extremely concerned. Despite the spread, it is clear that the risk of outages occupies a significant level of concern for a significant segment of respondents.

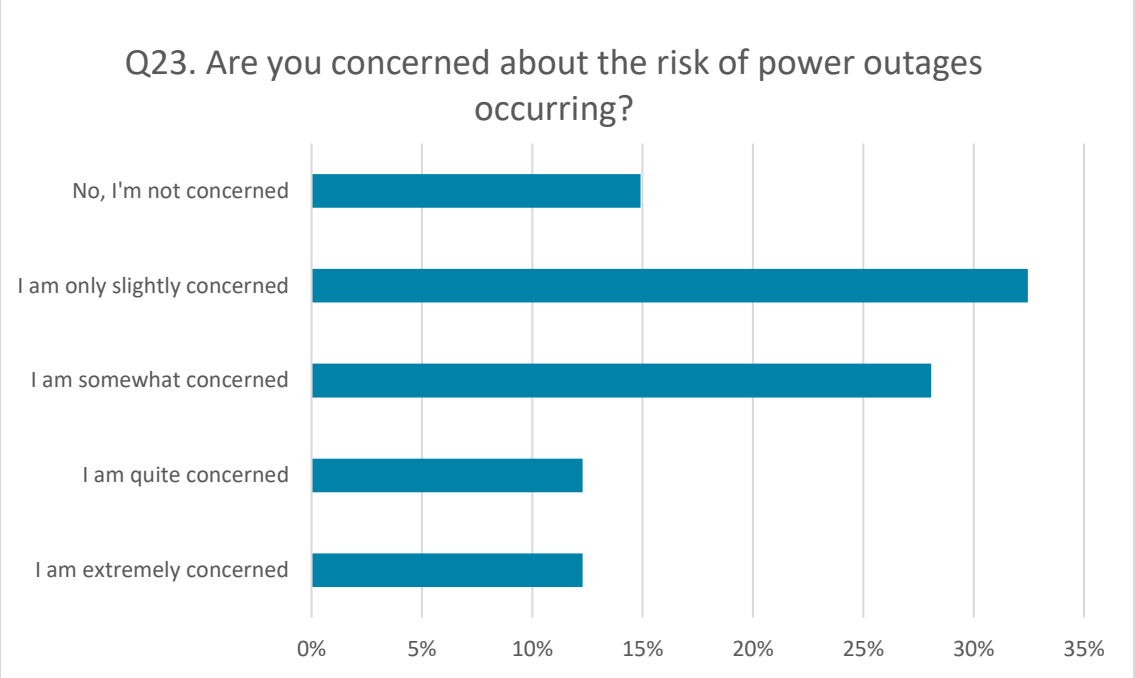

Figure 23. Concern regarding power outages

Most respondents receive information regarding utility faults through text messages, with about a quarter seeking out real-time updates from company websites. 4 respondents selected *Other* and specified that they received letters in the mail, which would apply to planned outages and was not originally included as a choice (these have been removed from *Other*). Social media and respondents' immediate social circle were other key communication channels for utility faults.

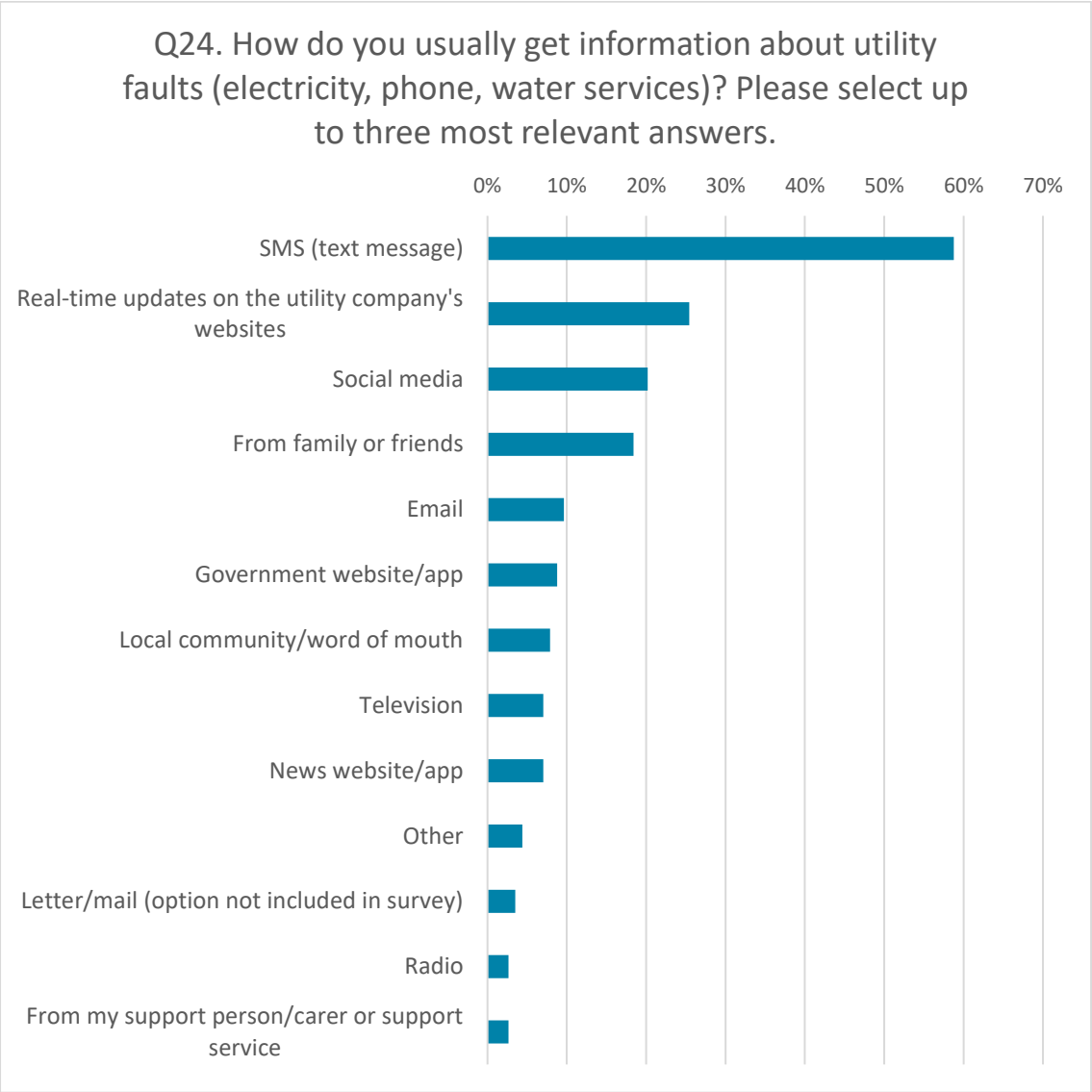

Figure 24. Communication channels regarding utility faults

While most respondents can manage risks of power outages when given sufficient notice, for a quarter of respondents, planned outages still pose a moderate to significant risk.

Table 15. Risk to wellbeing of planned outages

Q31. To what extent do planned power outages pose a risk or negatively impact your well-being?	
Despite receiving communication in advance, planned outages still pose a moderate to significant risk to me.	25%
As long as I receive sufficient communication regarding when the outage will occur, I can adequately manage any risks or impacts.	54%
Planned outages pose no or minimal risk to me.	18%
I have not experienced a planned outage.	1%
Unsure / I don't know	3%

Almost two thirds of respondents had lost power during extreme weather events and/or natural disasters. The impacts were similar to other unplanned outages, but were exacerbated by the conditions and other circumstances, such as extreme heat or loss of communication infrastructure.

Table 16. Outages during extreme weather/natural disaster

Q28. Can you recall ever being disconnected from electricity during an extreme weather event or natural disaster?	
Yes	64%
No	36%

Table 17. Impacts of losing power during an extreme weather event or natural disaster – selected responses

Responses may have been edited for readability.

Q29. How did this impact you?
Lost all food in fridge and freezer as power was out for a very long time
Loss of power meant we were unable to effectively monitor our sleeping infants
No water so no showers or toilet and mobile phones running out of charge
Affected my ability to keep my daily necessary medication refrigerated. Lost food that was affected in the fridge and freezer that was spoiled and we had to throw out which also cost us money. Our ability to recharge our phones was affected and with this we lost contact with our friends, family and community, as well as regular updates and information from emergency services. Affected us physically (temperature), created stress, anxiety and worry about the unknown and a lack of control. Effected our hygiene not being able to have hot/warm showers and bath our baby and small children. It effected our ability to cook and feed ourselves, our small children and make bottles (boil water) for the baby and sterilise the bottles.
Had to pick daughter up during storm by walking because we couldn't access garage
My home was unlivable without power due to it being too cold and not being able to cook
We lost all of our cold and frozen food back up, I lost my breast milk stash for emergencies if I've needed to leave my baby for an extended amount of time due to hospital stays etc. this was extremely stressful.
Scary and my phone was about to die so couldn't contact anyone
Was hard to breath and the outage lasted all day and late into the night during which Ausnet kept sending texts saying the power would be back on in a few hours. It was a 48c day and as a result of no cooling it ended up being over 60c inside my home so had to sit outside in 48c heat to feel cooler
It made managing my PTSD more difficult along with completing everyday household tasks.
It was 40+ degrees. No air conditioner and my wife was heavily pregnant
Couldn't use electric chair
We didn't have power for 24hrs and our food in the freezer and fridge went off and having kids this was very costly to replace.
Fear generated by lack of information – unsafe & destabilising feeling when necessary utility reconnection times cannot be estimated
In Mt Evelyn we were without power for 5 days, this was scary and uncomfortable but we were luckier that most as we didn't have any small children, our court was cut off due to trees down.
If we have no power, we can't access running water so no shower, no flushable toilet, no cooking ability but most importantly no split system so no heat so no warmth. Your little routines are actually a huge part of managing your health especially with chronic pain.

Respondents' capacity to manage these impacts with strategies of their own varied. There are some strategies that, depending on various other factors, residents may employ to replace electrical functions simply and effectively, like using torches and buying ice for refrigeration, although this may not always be possible during a natural disaster.

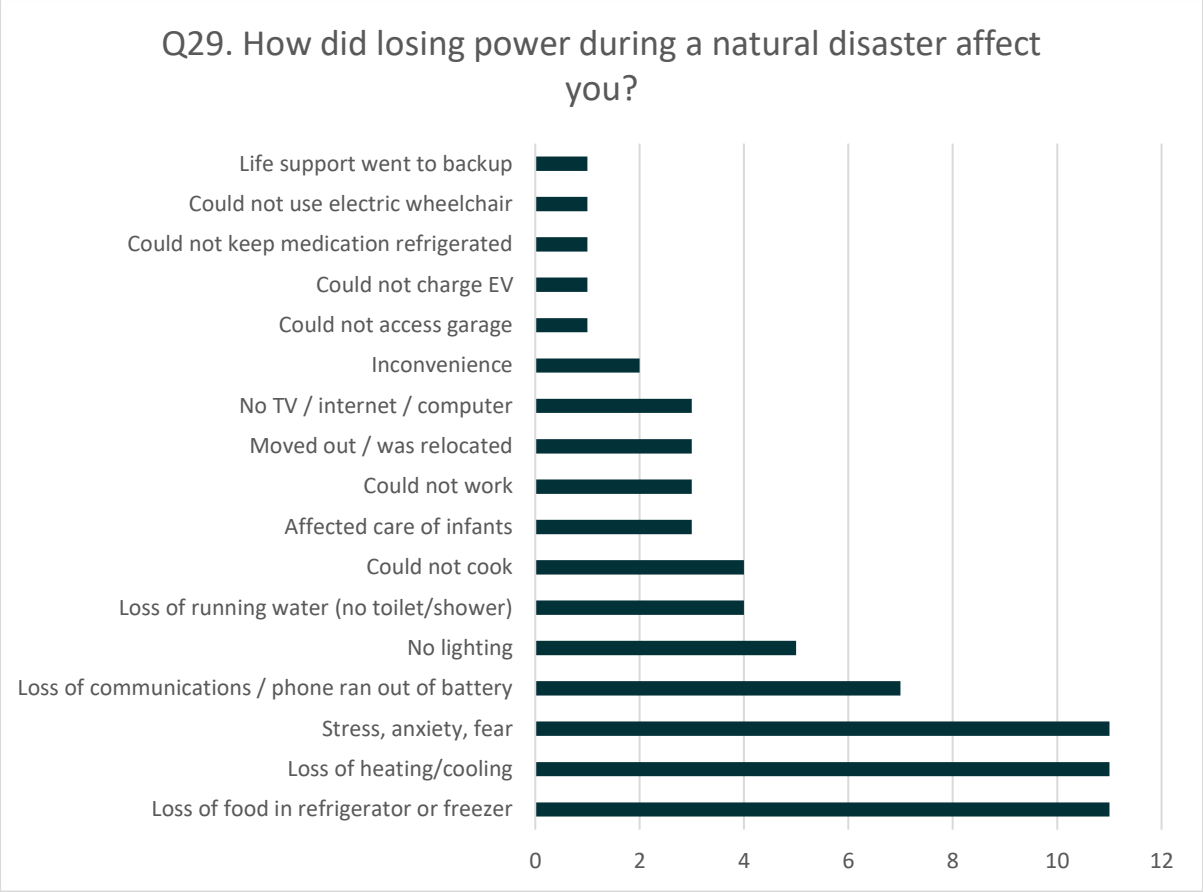

Figure 25. Tally of themes mentioned by survey respondents in Q29

Table 18. Respondent strategies for managing outage during extreme weather/natural disaster

Q30. What did you do when this happened? Please describe any strategies you used to manage the situation.
We had to purchase ice and use an esky for necessities including my medication. After a few days our neighbours 'rented' a generator and, in desperation, we ran a power cord over the fence, through the backyard and permanently left the door open enough to fit the cord through to alternate power between the fridge, hot water, kettle, and phone chargers. We didn't change the babies nappies as frequently as normal because she was bundled up so much because of the cold, trying to keep her warm, which also concerned me about SIDS and left me in a constant state of worry, stress and anxiety, and we bundled up the children and ourselves in additional layers as much as we could. We stayed longer at kindergarten and shopping centres where it was warmer to get the chill out of our bones
I have small torches in several places around the house so I found one easily and was heading towards the meter box to check if it was only my house or not. The power came back on before I got there. If I ever needed to I would drive to a family member's home and stay there until power was restored.
Told work and had to use annual leave until I could get online & use a torch to see
I got a generator to supply some of the things in my house so it was at least liveable
Called insurance and they relocated me
Cry.
We have back up with battery but sometimes the outage lasts longer than battery cycle which makes it difficult to get around home.
Little we could do initially but in subsequent years I brought the Deep Cycle batteries from our caravan and connected to a small A/C in our smallest bedroom, through an inverter. If Ausnet would provide controls so that we could use our 10kwh battery without effecting anti-islanding it would be a good pro-community measure
I remained at home because AusNet kept sending texts saying the power would be on by a certain time (within a few hours), but each of several texts changed the time to a later and later time.
After consultations I went and bought a generator to run the house

Despite respondents' coping strategies, there are social and psychological impacts, both directly due to the outage or disaster, as well as indirect 'domino' effects, that cannot easily be mitigated. The anxiety and disruption of outages can also be exacerbated by insufficient or inconsistent communication (although many respondents noted that they recognised that most unplanned outages were due to events outside AusNet's control and that AusNet were generally very effective in addressing outages).

Further, in many cases respondents had elected to purchase either generators or home batteries that could keep the power on for some time. While this is an effective strategy, it is not available to everyone as the cost and complexity can be prohibitive. Since it can be technically challenging to ensure backup power is automated rather than manual, some risks are likely to remain.

A.2 Interview data

A.2.1 Participants

10 participants were interviewed, each interview lasting roughly between 30 minutes and 1 hour.

Pseudonym	Age	Gender	LGA	Condition
Sally	65	Female	South Gippsland	Physical and psychosocial disability; chronic health conditions
Belinda	65	Female	Nillumbik	Chronic health conditions
Karen	53	Female	Indigo	Physical disability and chronic health condition
Cathy	67	Female	Strathbogie	Chronic health condition
Evelyn	82	Female	Strathbogie	Physical disability and chronic health condition
Luke	51	Male	Whittlesea	Chronic health condition
Craig	53	Male	Yarra Ranges	(carer) Chronic health condition and physical disability
Aisling	40	Female	Cardinia	(carer) Neurodevelopmental conditions
Felicity	31	Female	Yarra Ranges	Neurodevelopmental conditions; psychosocial disability; chronic health condition
Nick	50	Male	Indigo	Chronic health condition and physical disability