Value of Network Resilience 2024

Final Decision

September 2024

AUSTRALIAN ENERGY REGULATOR

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1 Executive Summary

The purpose of our Value of Network Resilience 2024 review is to establish an initial value of network resilience (VNR) that:

- is attributable to the benefit network customers receive from a resilient network, either in reduced outage probability and/or duration, where network resilience is defined as a network's ability to withstand and recover from an extreme hazard event that is likely to lead to a prolonged outage, and
- supports network investments driven by a network's ability to:
  - withstand events; for example, hardening investments (e.g. composite poles, aerial bundled cables, undergrounding), network topology (i.e. supply path redundancy), design standards, and Stand Alone Power Systems (SAPs)
  - recover from events; for example, standby mobile substations and generators, contingency standby crews, network automation, design standards (e.g. design for repairability) and communications with customers before and during outages.

Our VNR will complement our guidance on network resilience and provide the benefit value applied within the existing cost-benefit analysis framework. This will assist electricity networks, particularly Victorian distributors as part of their forthcoming revenue reset, to assess options to invest in resilience related solutions in those parts of their networks identified as the subject of increased risk of damage as a result of extreme hazard events.

We commenced our review following a request from the Energy and Climate Change Ministerial Council (ECMC) on 1 March 2024 to extend our current review of Value of Customer Reliability (VCR) to establish a value of customer resilience associated with long duration outages. On 13 May 2024 we published an issues paper seeking stakeholder views on preliminary issues (e.g., outage characteristics and VNR granularity) and the potential approaches we could use to develop an initial VNR.

On 23 July 2024 we published a draft decision which sought stakeholder views on our proposed approach for calculating an initial VNR, which will apply to outages greater than 12 hours. We received 12 submissions in response to our draft decision and while many stakeholders expressed high-level support for the draft initial VNR methodology, there was a diversity of views on some elements of the proposed approach. In particular, stakeholders had a wide range of views on the proposed VCR multiples, with some considering them to be reasonable, while others thought they were too high or too low.

Our final decision has been informed by those submissions on our draft decision, as well as the submissions on our issues paper, the customer insights obtained from our customer deliberative forums, the insights and advice from our VNR stakeholder reference group and DNSPs, and our own analysis. We have also had regard to the research and engagement materials provided to us by Victorian distribution networks including AusNet and CitiPower, Powercor and United Energy (CPU).

Our final decision adopts a combined approach of an upper bound and a multiple of VCR. This approach:

- uses multiples of the VCR for standard outages[1] to determine the initial VNRs
- applies an upper bound to the residential initial VNR, which is determined using the costs of backup generation and other non-network solutions as a reference.

This approach uses the same multiples and tiers we proposed in our draft decision. While we acknowledge there are other possible formulations to the tiered multiple approach, we did not receive new evidence from stakeholders after our draft decision which would support a specific alternative formulation. The upper bound has been rounded to $3,500 (from $3,494) to reflect it is an approximation.

We acknowledge we have had to take a pragmatic approach to develop the initial VNR methodology and deliver the initial VNR within the required timeframe. We have balanced considerations of timeliness and suitability in developing our final VNR approach, acknowledging that it is not possible to explore and implement some potentially 'first best' approaches within the required timeframe for establishing the initial VNRs.

We recognise that many stakeholders who support our proposed approach have only done so on the basis that this approach will not be the foundation for the longer term VNR approach. We also recognise the concerns held by stakeholders who do not support our proposed approach or only support elements of it.

Given the above, we will be undertaking further work on the VNR as part of our longer-term VCR/ High impact low probability (HILP)[2] work program. We intend to undertake further consultation as part of this work and explore methodologically sound approaches to determining longer-term VNRs.

1.1 Next steps

We will commence our work on the longer-term VNR in early 2025. The initial focus of this work will be on the longer term VNR scope and methodology, with a view to finalising these aspects by the end of 2025. In 2026, the focus of the work will then shift to calculating VNR using the longer-term methodology, with a view to informing future regulatory determinations.

We will begin consultation on the development of the Customer Outage Survey in November, designed to collect comprehensive data on the resilience and experiences of individuals affected by prolonged power outages (outages greater than 12 hours). This survey will be designed in close collaboration with networks and other key stakeholders to ensure it

[1] As discussed in section 4.2.1, we expect network businesses will use the most appropriate standard outage VCR for 6-12 hour outages (residential and small & medium business) or 12 hour outage (large business), or a weighted average of those VCRs, when calculating the VNR. Consistent with the approach to VCR, network businesses will need to clearly set out and justify the VCR used in the VNR calculation.

[2] HILP outages are a subset of outages which fall outside the standard outages included in the VCR. These do not occur often but may have a high impact when they do occur and may be widespread and / or prolonged.

accurately guides future investments and strategies aimed at addressing the impact of long-duration outages.

Table 1.1 AER next steps

Project step	Date
Publish final decision	September 2024
Consult with stakeholders on Customer Outage Survey design	November 2024
Phased roll-out of the Customer Outage Survey	2025
Finalise longer term VNR scope and methodology	2025
Determine longer-term VNR	2026

2 Background

This section provides context and background information relevant to our VNR project including:

- our Values of Customer Reliability (VCR) work, including the ongoing high impact low probability work program
- our guidance on the assessment of resilience investment under the National Electricity Rules (NER), including a summary of how this guidance has been applied in the most recent revenue determination processes
- the Victorian Electricity Distribution Network Resilience review in response to recent storm events, the Victorian Government's response and draft proposed Rule change and the ECMC request.

2.1 VCR and other outages

As part of our ongoing work program, we produce VCR for standard outages (unplanned localised outages of up to 12 hours in duration). VCR seek to reflect the value different types of customers place on reliable electricity supply under different conditions. VCR serves an important role in ensuring customers pay no more than necessary for reliable energy by helping energy businesses identify the right level of investment to deliver reliable energy services to customers. Our VNR issues paper provides more background information on the VCR and the work we are undertaking on outages which fall outside the scope of the VCR.[3]

2.2 AER guidance note on network resilience

In April 2022, we published guidance to help networks and consumer groups understand how resilience investments are assessed under the NER.[4] The guidance defines network resilience as a performance characteristic of a network and is the network's ability to continue to adequately provide network services and recover those services when subjected to disruptive events.[5]

The guidance notes the close relationship between resilience and reliability. While improved reliability is generally referred to as the service level outcomes from a more resilient network, other service-level outcomes like maintenance of safety and network security can also be affected.[6]

The guidance highlights that, in an environment in which the effects of climatic change on the frequency and severity of major events are uncertain, it is important that risk allocation is

[3] AER, *Issues paper – Value of Network Resilience 2024*, May 2024, pp. 6-7.

[4] AER, *Network Resilience – A note on key issues*, April 2022.

[5] Ibid., p. 6.

[6] Ibid.

optimally balanced – between ex ante (revenue proposals) and ex post funding (cost passthroughs) – to maintain service level outcomes so that it is consistent with the needs and preferences of consumers. The guidance note states our expectation that where NSPs propose resilience expenditure, they should demonstrate, within reason:

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

The guidance also highlights the related, but distinctly different, concept of community resilience. A resilient electricity network can assist in building community resilience. But many different entities, including government bodies and critical infrastructure operators (beyond electricity networks), have a role in supporting communities to withstand and recover from the effects of natural disasters.[7]

We note that there are various understandings of the term community resilience. The National Electricity Law (NEL) prescribes an electricity network service as 'a service provided by means of, or in connection with, a transmission system or distribution system.'[8] Some investments associated with building greater levels of community resilience such as the provision of portable back-up generation to energise a community hub may be captured under the definition. The purpose of this review and establishing a VNR does not at this stage require a definitive statement of whether particular types of resilience investments proposed by networks are appropriately determined to be network services. However, we do highlight that the focus for this review and a VNR is isolated to valuing network resilience.

2.3 Recent network proposals and AER decisions

Our final decisions for the Ausgrid, Essential Energy, Endeavour and TasNetworks (Dx) revenue determination processes included $322 million in expenditure forecasts related to network resilience, with the AER's resilience guidance note used as a basis for proposals and our assessment. Our VNR issues paper provides further background information on these decisions.[9]

[7] Ibid., p. 7.

[8] NEL, Part 1, section 2.

[9] AER, *Issues paper – Value of Network Resilience 2024*, May 2024, pp 9-11.

2.4 Extreme weather events, jurisdictional response and the ECMC request

There have been multiple storm events in Victoria that have triggered reviews into the resilience of its electricity distribution networks.

The Electricity Distribution Network Resilience Review was initiated in response to the 2021 storms.[10] The Victorian Government supported the vast majority of the Review's recommendations including that the relevant Victorian Government department:

- works with the AER to assess customer willingness to pay to avoid wide area, long duration outages,
- proposes a rule change to the NER capex objectives to specifically account for resilience. In supporting this recommendation, the Victorian Government noted that while current rules can, in theory, support investments in resilience, explicitly accounting for resilience in the rules would assist in future projects being favourably assessed by the AER.[11]

A further Network Outage Review has been established by the Victorian Government to investigate the response to the storms that occurred in February 2024.[12] The Review released its final report on 13 September 2024 which highlighted the impacts of the outages associated with the storms on affected customers and communities. The final report outlined the Network Outage Review panel's 19 recommendations, and 12 observations which addressed issues including the operational response, contingency and continuity planning (e.g., telecommunications continuity), customer communications, incentives and compensation, and improving the performance of worst performing feeders.[13]

[10] For more information on this review, see https://www.energy.vic.gov.au/about-energy/legislation/regulatory-reviews/electricity-distribution-network-resilience-review.

[11] State of Victoria Department of Energy, Environment and Climate Action, *Victorian Government Response to the Expert Panel's Electricity Distribution Network Resilience Review*, September 2023, p. 11.

[12] This review will cover the operational arrangements and preparedness of network service providers to respond to extreme weather events. The management of the incidents as well as the recovery process and timings will also be reviewed. In addition, there will be an investigation as to whether there were any material opportunities that could have enables a more rapid reconnection of electricity services as well as the quality of the communication with customers during the outage. For more information on this review, see https://www.energy.vic.gov.au/safety/power-outages.

[13] Network Outage Review, *February 2024 Storm and Power Outage Event Independent Review of Transmission and Distribution Businesses Operational Response*, *Final* Report, September 2024.

3 Approach to the VNR – Customer Insights and Preliminary Matters

Our draft decision discussed some important preliminary matters we needed to consider in developing an approach to VNR including outage characteristics, unserved energy and VNR granularity. In this section, we provide an overview of customer insights on the impacts of prolonged outages and discuss and outline our final decisions on these preliminary matters.

3.1 Summary of options

In our draft decision, we assessed six potential approaches for determining the initial VNR:

- Using the costs of backup generation and other non-network solutions as an upper bound.
- Using a multiple of the VCR for standard outages (that is, outages of duration of 12 hours or less).
- Extrapolating the VCR for standard outages beyond 12 hours.
- Conducting follow-up surveys to actual prolonged and/or widespread outages.
- Using modelling to estimate a value.
- Exploring other cost data.[14]

On balance, we considered option 1 (using rational alternatives as a limit) as an upper bound to the initial VNR was appropriate as it recognised electricity consumers did not have an unlimited willingness-to-pay for network resilience investment and would seek out rational alternatives during prolonged outages. We also considered this option helped strike a balance between network resilience and affordability, thereby helping to promote an efficient level of resilience investment. However, given the challenges in establishing an upper bound for business, we did not propose to apply an upper bound to the initial VNR for business.

We were of the view an upper bound was best adopted in conjunction with another option and we proposed to combine this with a multiple of VCR approach because there was strong stakeholder support for this approach and some uncertainty about whether extrapolation and follow-up survey approaches were suitable and/or timely.

3.2 Customer insights and engagement

In our draft decision, we discussed our customer engagement and provided an overview of our analysis of the customer impacts associated with prolonged outages. A summary of this

[14] More information on each of the options is available in our draft decision, which can be accessed here.

engagement and analysis is provided below, along with the stakeholder comments we received on this aspect of our VNR work.

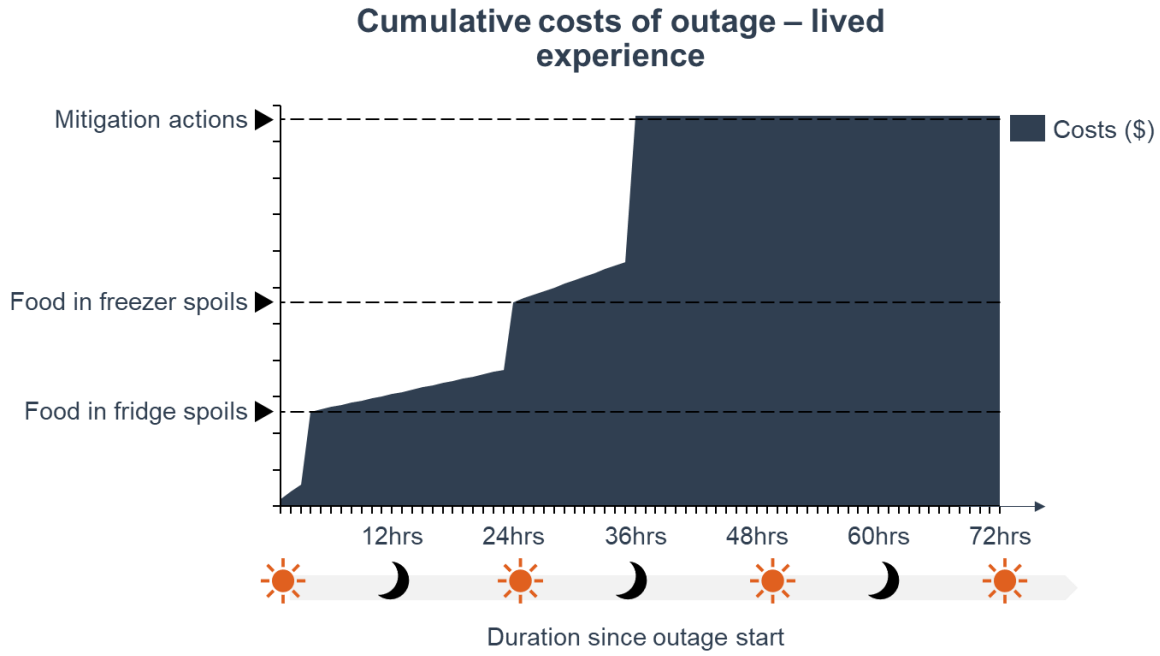
3.2.1 Customer engagement and AER analysis of customer impacts

To help inform our consideration of the potential approaches to an initial VNR, we gained an understanding of customers' lived experience of prolonged outages. To do this, we:

- held three deliberative forums with electricity customers who had recent experience of power outages
- analysed customer engagement materials provided by network businesses (e.g., deidentified survey responses from Victorian customers impacted by prolonged outages)
- reviewed the outputs of the Victorian Electricity Distribution Network and Network Outage reviews
- reviewed Business SA's analysis of the 2016 South Australian system black outage.[15]

Based on the insights from the above, it is evident that the impact of prolonged outages on customers is not constant across time. Instead, the costs incurred by customers during a prolonged outage are lumpy with stepped increases occurring at key points during an outage event. To demonstrate this, Figure 1 illustrates a hypothetical outage scenario:

Figure 1: Cumulative costs of a prolonged outage over time



[15] Business SA, *Blackout survey results – Understanding the effects of South Australia's state-wide blackout on 28 September 2016*, 2016.

For example, residential and business customers indicated that they incurred a stepped increase in costs when fridges and freezers were non-operational for a sufficient period of time for food spoilage to occur (usually between 12 – 36 hours) and when they purchased or rented generators or other mitigating actions. Another stepped increase occurred for residential customers not connected to mains water or sewer when septic tanks reached capacity and either required a pumping contractor to empty the tank or the customer to find alternative accommodation.

3.2.2 Stakeholder views on customer impacts and the AER's customer engagement

AusNet considered that, overall, many of the findings in the AER's draft decision and customer research report were consistent with its findings on this topic. This included the tipping points in the cumulative costs of prolonged power outages.[16]

John Mumford's submission also raised concerns about a number of issues including, whether the AER had captured rural and consumer views in its consultation, whether the AER understood the serious impacts of long outages, and the accessibility of the AER's consultation process for customers.[17]

3.2.3 AER comment

We acknowledge the concerns John Mumford raised in his submission. Throughout our review, we have sought to gain insights from a diverse range of customers, including those located in rural areas. Given the limited timeframe within which to conduct our review, we have leveraged the work undertaken by current and previous Victorian reviews, and by network businesses such as AusNet and CitiPower, Powercor and United Energy (CPU).

To broaden our understanding of customer impacts we will continue our engagement with stakeholders on work that will provide further insights over time (see section 5).

3.3 Preliminary matters

In our draft decision, we discussed some important preliminary matters we needed to consider in developing an approach to VNR, including customer impacts, outage characteristics, unserved energy and VNR granularity. Our final views on these preliminary matters are set out below.

3.3.1 National Electricity Objective

We must have regard to the National Electricity Objective (NEO) when we develop the initial VNR.

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[16] AusNet, *Submission on the VNR 2024 draft decision* [letter], August 2024, p. 1.

[17] John Mumford, *Submission on VNR 2024 draft decision* [letter], August 2024, pp. 1-2.

The NEO

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

a. price, quality, safety, reliability and security of supply of electricity; and

b. the reliability, safety and security of the national electricity system; and

c. the achievement of targets set by a participating jurisdiction—

i. for reducing Australia's greenhouse gas emissions; or

ii. that are likely to contribute to reducing Australia's greenhouse gas emissions.

In developing our approach to the initial VNR, we have applied the NEO. The NEO promotes efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers of electricity, taking into consideration price, quality, safety, security, reliability and emission reductions. We have particularly focussed on the price and reliability elements of the NEO in this work because the initial VNRs seek to reflect the value different types of customers place on a resilience, which is a subset of reliability, under different conditions.

We consider the initial VNR will promote the long-term interests of electricity customers by enabling businesses, regulators and other stakeholders to make informed decisions about the efficiency of proposed investments in electricity services. This is because the initial VNR will be a reasonable reflection of customer reliability preferences. These values will help decision-makers to balance resilience and network costs when making decisions about investment.

3.3.2 Outage characteristics

Consistent with our draft decision, our final decision is to focus on outage durations between 12 hours and 7 days, with a particular focus on outage durations between 12 hours and 72 hours. This is because these outage durations were generally identified by stakeholders as being the most important in the VNR context.[18] In addition, our analysis of outage data also indicates that this outage duration range is likely to capture most prolonged outages experienced by customers.[19]

[18] SA Power Networks, *Submission on VNR issues paper* [letter], June 2024, pp. 1-2; Energy Queensland, *Submission on VNR issues paper* [letter], June 2024, p. 3; ENGIE, *Submission on VNR issues paper* [letter], June 2024, p. 2; DEECA, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 1.

[19] AER, *Issues paper – Value of Network Resilience 2024*, May 2024, p. 19-20.

3.3.3 Unserved energy

Several stakeholders noted concerns about applying the methodology used to derive $/kWh VCR to any initial VNRs. In particular, the impact that the use of unserved energy estimates associated with a prolonged outages may have on any $/kWh initial VNRs.

In addition to the comments we received on our issues paper, DEECA also raised this issue in its submission on our draft decision. DEECA considered a low $/kWh VNR did not align with customer preferences and indicated the AER should develop a more suitable method for prolonged outages, which could involve a different approach and possibly be refined using direct cost surveys and deliberative forums.[20]

The approach we have developed for the initial VNR does not require an estimate of unserved energy for prolonged outages. Given this, we have not given further consideration to alternative approaches to deriving $/kWh values. However, we note this issue remains relevant to our longer-term VNR work and we intend to engage further with stakeholders on this issue as part of that work.

3.3.4 VNR granularity and use of non-AER VCR

We note some stakeholders expressed a preference for VNR that is specific to their network service area or to individual feeders.

In our draft decision, we considered it would not be possible to deliver an initial VNR at the feeder level given the time constraints for our review. Even if it were possible, we noted it may be challenging and very resource intensive due to the large number of feeders we may need to develop bespoke VNR for and the methodological difficulties in achieving this level of granularity. For example, some potential methodologies (e.g. modelling) may be less accurate at this granularity level, while for others (e.g. survey-based methods) it may be more difficult to achieve a sufficient sample and statistically significant results.

Given the VNR and VCR were likely to be used together, our draft decision was to:

- develop separate VNR for residential customers and business customers
- VNR with a similar level of granularity to the VCR in respect of geographic segmentation (climate zone and remoteness), where possible.

Stakeholder views on VNR granularity

- AusNet disagreed that the VCR approach to granularity was sufficient. It considered that if the AER's $/kWh VCR figures were highly averaged across very large areas (e.g. some climate zones span Victoria, South Australia and New South Wales) such that granular insights on willingness to pay were lost, adjustments network businesses may make for the purposes of cost-benefit analysis (including using their own load forecasts

[20] DEECA, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 2.

and outage probabilities) did not 'recover' the lost granular insights on customer willingness to pay.[21]

- Power and Water supported ensuring the initial VNR maintained a comparable level of detail to the VCR, particularly concerning geographic segmentation by climate zone and remoteness.[22]
- DEECA recommended estimating the VNR by specific feeder types, including urban, rural short and rural long feeders. It also considered further granularity, such as network service area, could improve the calculation of unserved energy.[23]

AER decision

Given that our approach to determining the initial VNR uses a multiple of the VCR, the initial VNR will have the same level of granularity and geographic coverage as the VCR which are used in the initial VNR calculation. We acknowledge AusNet's concerns regarding the VCR granularity and note these issues have been considered as part of our review of the VCR methodology.[24]

We also note the Expenditure forecast assessment guideline is silent on whether DNSPs can use different VCR to the published AER values, but that under our Regulatory investment test for distribution (RiT-D) application guidelines, DNSPs have scope to use different VCR.[25] In the context of a revenue proposal, DNSPs can propose the use of alternative VCR or an alternative VNR.

Some DNSPs have indicated their intention to use a different VNR methodology in their upcoming determination proposals to the one we have set out in this final decision. We consider any proposed deviation from, or adjustment to, our initial VNR approach must be clearly justified, including supporting material evidencing why the alternative approach is more appropriate. As part of that justification, we would expect the DNSP to provide a detailed explanation of its methodology and the assumptions used in its construction.

[21] AusNet, *Submission on the VNR 2024 draft decision* [letter], August 2024, p. 3.

[22] Power and Water, *Submission on the VNR 2024 draft decision* [letter], August 2024, p. 1, 3.

[23] DEECA, *Submission on the VNR 2024 draft decision* [letter], August 2024, p. 1.

[24] More information on our Values of Customer Reliability 2024 review is available via this link.

[25] AER, *Regulatory investment test for distribution – Application guidelines*, October 2023, pp. 28-29.

4 Approach to Determining the VNR

Our final decision is to adopt an approach that combines an upper bound with a multiple of VCR. We consider this approach is the most appropriate for determining the initial VNR. This approach involves:

- using multiples of the VCR for standard outages to determine the initial VNRs
- applying an upper bound to the residential initial VNR, which will be determined using the costs of backup generation and other non-network solutions as a reference.

Our final decision has been informed by the submissions on our draft decision, as well as the submissions on our issues paper, the customer insights obtained from our customer deliberative forums, the insights and advice from our VNR stakeholder reference group and DNSPs, and our own analysis. We have also had regard to the research and engagement materials provided to us by Victorian distribution networks including AusNet and CitiPower, Powercor and United Energy (CPU).

While the AusNet and CPU research has informed our approach, we have not used the data from this research to calculate the VNR or our residential upper bound as we are concerned doing so may result in an initial VNR which overstates customers' willingness to pay. We have formed this view because:

- We are uncertain about the extent to which results from one network business' customers can be generalised and applied to other network business' customers. For example, some experience more frequent hazard events and customers in these areas may have higher levels of preparedness as a result (e.g., own self-generation) and may be less willing to pay for network-level resilience measures.
- The direct cost approach does not account for the views of customers who were not impacted by the outage and will not benefit from the resilience investments, but who will pay for those investments. While these customers may be willing to pay to fund resilience investments elsewhere in their network area, it is not a given that their willingness to pay, or for that matter the willingness to pay of customers impacted by outages, will align directly with the costs incurred by customers who were impacted by the prolonged outages.
- In respect of the direct costs incurred by customers, there is a risk that survey respondents overstate outage-related costs because it can be difficult to distinguish between the costs incurred as a result of the electricity outage event and the costs incurred as a result of the hazard event.

However, we remain of the view this data provides important insights about the customer impacts of prolonged outages and the timing of those impacts and is particularly useful as a sense check on our decision on the appropriate level of the initial VNR.

We recognise that many stakeholders who supported our proposed approach only did so on the basis that this approach would not be the foundation for the longer term VNR approach.[26] We also recognise the concerns held by stakeholders who did not support our proposed approach or only supported elements of it.

Given the above, we commit to undertaking further work on the VNR as part of our longer-term VCR/HILP work program. We intend to undertake further consultation as part of this work and explore methodologically sound approaches to determining longer-term VNRs. We will commence this work in early 2025 with a view to refining our VNR approach to inform the next round of regulatory determinations.

We also consider it is important to delineate between network resilience, reliability and community resilience and have defined the scope of the VNR accordingly. We will also consider this issue when we update our guidance note on network resilience. We note that update will, subject to the Victorian Government's proposed rule change, likely occur after the Victorian resets.

In this section, we set out our final decision on the initial VNR approach.

4.1 Approach to determining the VNR presented in our draft decision

Our draft decision was to adopt an approach which:

- used multiples of the VCR for standard outages to determine the initial VNRs
- applied an upper bound to the residential initial VNR, which will be determined using the costs of backup generation and other non-network solutions as a reference.[27]

Stakeholder views on the overall approach

We received twelve submissions on our draft decision[28] and across those submissions, there was a diversity of views on our proposed approach.

- Energy Queensland, Jemena, Power and Water, DEECA and Engie supported the approach set out in our draft decision and agreed it was the most appropriate method

[26] For example, Ausgrid, *Submission on VNR issues paper* [letter], June 2024, pp.2-3; AusNet, *Submission on VNR issues paper* [letter], June 2024, pp.1, 5-6; Endeavour Energy, *Submission on VNR issues paper* [letter], June 2024, p. 2; SA Power Networks, *Submission on VNR issues paper* [letter], June 2024, p. 1; ENGIE, *Submission on VNR issues paper* [letter], June 2024, p. 1; Transgrid, *Submission on VNR issues paper* [letter], June 2024, p. 5; Essential Energy, *Submission on VNR issues paper* [letter], June 2024, p. 3; Jemena, *Submission on VNR issues paper* [letter], June 2024, p. 5; Energy Networks Australia, *Submission on VNR issues paper* [letter], June 2024, p. 1.

[27] See our draft decision for the further detail on the draft approach. It is available via this link.

[28] A list of submissions received is in Appendix A.

given the time constraints for our review.[29] However, Jemena had some concerns about whether the draft approach fully captured the value business customers place on resilience.[30]

- CPU and AusNet considered while the draft VNR were a positive step, the draft values may not fully capture the value customers place on resilience. Both noted our draft VNR were lower than the values they had identified through their customer research.[31]
- Erne Energy considered the VCR multiple and upper bound approaches represented a pragmatic way to expediently deliver a VNR. However, it was concerned the draft VNR approach did not accurately represent consumers' willingness to pay[32] and would promote investments that increase network costs but do not deliver network resilience benefits to customers.[33]
- Erne Energy suggested that rather than establishing the VNR, it might be more appropriate for the AER to consider incentivising DNSP performance during Major Event Days (MEDs).[34]
- The Justice and Equity Centre (JEC) maintained its view that the VNR were not the most effective or appropriate response to enable DNSPs to improve their scope to respond efficiently to prolonged outages. JEC also considered there needed to be a consistent and robust understanding of the concepts of network and community resilience, the interaction between them, what role DNSPs should play, and how the regulatory system could best address these questions before a longer term VNR could be established. Consequently, it was of the view the initial VNR should only apply to the 2026-31 Victorian DNSP revenue determinations and should not be a starting point for the longer-term VNR approach.[35]

4.1.1 VCR multiple

We proposed to apply a tiered multiple approach with different tiers for residential and business customers. While this approach would initially require the use of the 2023 VCR, we expected network businesses to use the updated 2024 VCR when they are published in December 2024.

For residential customers, the proposed tiers were:

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[29] Energy Queensland, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 2; Jemena, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 1; Power and Water, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 3; ENGIE, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 1.

[30] Ibid.

[31] CPU, *Submission on the VNR 2024 draft decision* [letter], August 2024, p. 1-2; AusNet, *Submission on the VNR 2024 draft decision* [letter], August 2024, pp. 1-2.

[32] Erne Energy cited the work of Electricity North-West Limited in the UK, which demonstrated that Electricity North-West residential customers placed a lower value on electricity as outages became more prolonged.

[33] Erne Energy, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 1.

[34] Ibid., pp. 5-6.

[35] JEC, *Submission on the VNR 2024 draft decision* [letter], August 2024, pp. 1-2.

- the standard VCR (as built up by the network business from the segmented residential VCR) for the first 12 hours of a prolonged outage
- a multiple of 2x the standard VCR (the VCR used for the first 12 hours) for the period of 12-24 hours
- a multiple of 1.5x the standard VCR (the VCR used for the first 12 hours) for the duration of the outage that extends beyond 24 hours, until the upper bound is reached.

For a residential customer, we noted this approach would result in the upper bound being reached in 7 days (based on average Victorian residential customer annual consumption and the Victorian residential VCR for outages up to 12 hours).

For business customers, the proposed tiers were:

- the standard VCR (as built up by the network business from the segmented business VCR) for the first 12 hours of a prolonged outage
- a multiple of 1.5x the standard VCR (the VCR used for the first 12 hours) for the period of 12-24 hours
- a multiple of 1.0x the standard VCR (the VCR used for the first 12 hours) for the period of 24-72 hours (1-3 days)
- a multiple of 0.5x the standard VCR (the VCR used for the first 12 hours) for the duration of the outage that extends beyond 72 hours (over 3 days).

Stakeholder views on the draft VCR multiple approach

Stakeholders expressed a range of views on the draft VCR multiples and tiers in their submissions on our draft decision, including:

- JEC did not support the VCR multiple as it considered it would result in the AER approving expenditure that would effectively set network reliability at a level higher than customers were willing to pay for. JEC also recommended using the standard VCR in tandem with the draft upper bound approach.[36]
- Energy Queensland supported the proposed VNR multiples and tier increments on the basis that the initial VNR were short-term values to be replaced with a well-considered, longer-term approach.[37]
- ENGIE supported our draft approach to adjust the rate of cost increases as the length of the outage extended but suggested it might be reasonable to extend the period that the highest multiple applied from 12-24 hours to 12-48 hours.[38]

[36] Ibid., p. 2.

[37] Energy Queensland, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 3.

[38] ENGIE, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 2.

- While AusNet acknowledged the use of a VCR multiple as acceptable given the time constraints for the review, it thought the draft VNR looked low relative to its own values and suggested the VCR multiple be adjusted to align with its adjusted direct cost data.[39]

Three stakeholders also commented specifically on the draft business customer VCR multiples and tiers:

- Energy Queensland supported the draft VNR multiples and tier increments for business customers.[40]
- Ausgrid was concerned about the 0.5x multiplier and asked the AER to either reconsider this approach or consider, more broadly, how the customer types were grouped when determining the final multipliers.[41]
- AusNet considered the draft decision to apply a 0.5 multiplier implied the value attached to prolonged outages was less than current business VCRs. It considered the multiplier should be set at minimum of 1, across all time periods.[42]

4.1.2 Costs of back up generation and other non-network solutions

We considered the least-cost of backup self-generation (plus fuel costs depending on duration of forecast outage) was likely the most objective and easily applied upper bound for residential customers. This is because we could reasonably estimate the generator and fuel costs for an average customer using average household electricity consumption, outage duration and some information about least cost generation options.

Residential self-generation upper bound

To determine the residential self-generation upper bound, we assumed the rational, hypothetical customer:

- will, given the need to refuel and the costs associated with generation, ration their usage and not consume their usual household load during the prolonged outage
- will want a generator that is capable of operating multiple household appliances but will stagger their household load and not seek to start and/or run every appliance at the same time.

We then undertook research on the starting and running wattages for common household appliances and reviewed a number of generator sizing guides published by generator retailers and manufacturers.[43] Based on that information and our above assumptions, we

[39] AusNet, *Submission on VNR 2024 draft decision* [letter], August 2024, pp. 2-3.

[40] Energy Queensland, *Submission on VNR 2024 draft decision* [letter], August 2024, pp. 2-3.

[41] Ausgrid, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 2.

[42] Ibid., p. 3.

[43] Queensland Government Electrical Safety Office, *Powering appliances with generators* [webpage] (accessed 14 June 2024); Powerlite, *What generator size do I need?* [webpage] (accessed 14 June 2024); Westinghouse,

considered that a generator size of between 5,000 to 6,500 watts would be appropriate for the residential customer upper bound.

We then undertook some market research on the price and operating specifications of the generators within this size range. We assumed the hypothetical customer would seek to balance cost and running time in selecting a generator make and model. On that basis, we selected a midrange model with the following specifications:

- Maximum load of 5,500W and running load of 5,000W
- Fuel tank size of 20L
- Price (as quoted by an Australian-based online retailer) of $1,699.

We assumed customers would likely want to operate a range of household appliances and some of these may require the generator to be hardwired, with a changeover switch installed. We therefore included costs associated with enabling the generator to be plugged directly into household circuits. Given the cost differential between manual and automatic changeover switches, we assumed the hypothetical customer would install a manual changeover switch. In calculating the upper bound, we also included operating and maintenance costs.[44] Based on these assumptions and specifications, we estimated a draft upper bound for the residential initial VNR of $3,494 per residential customer.

Business self-generation upper bound

We considered there were substantial practical challenges in developing an upper bound for business customers, because there was much greater variation in electricity consumption.[45] This heterogeneity made it very difficult to determine the appropriate specifications of the least cost self-generation solution to use in our upper bound VNR calculation.

Although we considered business customers would have limits to their willingness to pay and may employ strategies to mitigate the impacts of a prolonged outage at certain price points, we could not easily infer which strategies were likely to be used and when. Consequently, we considered it was not possible to infer a reasonable upper bound for the initial VNRs for business customers.

Portable generators [webpage] (accessed 14 June 2024); CD Power, Generator sizing guide [webpage] (accessed 14 June 2024).

[44] See Appendix D of our draft decision for detailed information on the upper bound calculation.

[45] There are also material variations in the VCR for different types of businesses. For example, the 2023 VCR for agriculture businesses is $44.40/kWh, while the VCR for industrial businesses is $74.79/kWh. For very large businesses (businesses using >10MVA peak demand), the VCR for services businesses is $12.36/kWh, while the VCR for industrial businesses is $138.34/kWh.

That said, we considered our approach to the business initial VNR should recognise that business customers:

- did not have an unlimited willingness-to-pay for network resilience and the initial VNR needed to recognise that and strike a balance between network resilience and affordability
- were likely to take steps to mitigate the impact of prolonged outages on their business (e.g., by purchasing or renting a generator). This view was based on the insights from customer engagement undertaken by the AER and network businesses and insights from the South Australian system black outage in 2016.[46]

Given the above, our draft decision was to not apply an upper bound to the initial VNR for business customers and instead propose to apply multiples of the VCR which recognise business customers also take steps, at some point in time, to mitigate the impacts of a prolonged outage.

Stakeholder views on the upper bound

Stakeholders expressed a range of views on the residential upper bound in their submissions on our draft decision, including:

- Ausgrid noted it had a high penetration of embedded networks within its network and asked the AER to clarify how the upper bound should be applied to these networks.[47]
- ENGIE agreed with the use of the least-cost of backup self-generation but noted it was unclear how the upper bound calculation was adjusted based on the assumed effective life. ENGIE noted that any capital investments made by customers following an initial prolonged outage would be able to be relied on during any subsequent prolonged outages, which might decrease the average dollar impact of subsequent outages. It considered if the assumed life of these investments did not decrease the value of the upper-bound, the calculation might overstate the value that customers' place on a resilient network.[48]
- In the absence of a defined scope and a demonstrated value of increased willingness to pay for long duration outages, JEC recommended the AER use rational alternatives as a limit for the VNR.[49]
- AusNet considered the upper bound should be tested for higher daily consumption values and should include ongoing generator fuel costs. It also considered the upper bound did not align with lived experience or customer expectations because customer frustration and government concern continued to intensify after 7 days, and it could not

[46] Business SA, *Blackout survey results – Understanding the effects of South Australia's state-wide blackout on 28 September 2016*, 2016.

[47] Ausgrid, *Submission on VNR 2024 draft decision* [letter], August 2024, pp. 1-2.

[48] ENGIE, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 1.

[49] JEC, *Submission on the VNR 2024 draft decision* [letter], August 2024, p. 2.

be assumed that customers surveyed about the 2021 storms would have bought generators that could act as a suitable substitute in future events.[50]

- AusNet considered that if the VNR adopted a cap of 7 days, it might need to be complemented with mechanisms to allow higher digital or non-network expenditures, to enable DNSPs to meet government and customer expectations.[51]

4.1.3 Other issues raised in submissions

In their submissions on our draft decision, many stakeholders also commented on issues related the practical application of the VNR and the longer term VNR approach.

Practical application of the VNR

- Erne Energy noted:
  - Where a resilience investment was made, there would be a high probability severe weather would impact a neighbouring asset that was not hardened, or hardened assets would fail, resulting in prolonged outages for customers who had been paying for resilience solutions.
  - All customers of a DNSP would pay for a specific resilience solution but not all customers would benefit. Customers in rural and regional areas also experienced poor reliability outcomes and had likely invested in their own resilience solutions. Allowing DNSPs to apply a VNR would mean that these customers might pay twice.
  - The AER and DNSPs needed to focus on resilience solutions that were mobile, agile and responsive so they could move to where the impact was being felt, supporting customers where and when an event occurred, rather than investing in fixed solutions that might fail or might not actually be located where needed. [52]
- John Mumford considered the AER needed to focus on the impact of inadequate network maintenance and resourcing.[53]
- CPU considered the network resilience review initiated by the Victorian Government had made clear the expectation that DNSPs should reduce the likelihood and impact of prolonged power outages by making investments in resilience. Given this, CPU suggested the AER exercise caution with regard to applying the VNR deterministically.[54]
- AusNet supported flexibility to use different VNRs where they are more robust and better supported through stakeholder engagement.[55]

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[50] AusNet, *Submission on the VNR 2024 draft decision* [letter], August 2024, p. 3-4.

[51] Ibid.

[52] Erne Energy, *Submission on VNR 2024 draft decision* [letter], August 2024, pp. 1-3.

[53] John Mumford, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 2.

[54] CPU, *Submission on VNR 2024 draft decision* [letter], August 2024, pp. 1.

[55] AusNet, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 3.

- JEC acknowledged the need for more consistent guidance to assist DNSPs to develop appropriate and efficient responses to the impacts associated with extreme weather events. It considered this guidance should establish a clearly defined scope around what constitutes resilience expenditure. JEC also considered the AER should consider a prohibition on classifying network hardening investments as resilience expenditure.[56]
- DEECA encouraged the AER to draw a clear connection between the VNR and its implications for community resilience investments.[57]

Longer term approach

- Many stakeholders strongly supported the AER undertaking work to develop a longer-term VNR and most stakeholders only supported the initial VNR on that basis.[58]
- Jemena noted the costs incurred by customers during a prolonged outage were a separate measure to the value all customers place on resilience. It encouraged the AER to consider how the views of customers who had not experienced a prolonged outage but may, due to postage stamp pricing, pay for resilience investments could also be reflected in the VNR. Jemena was open to the idea of developing a model to calculate the VNR and encouraged further broad-based engagement on this approach. Jemena encouraged the AER to consider potential data sources / inputs and how to ensure stakeholder confidence in the longer term VNR approach.[59]
- Ausgrid considered the longer-term VNR must be evidence based, informed by deliberative engagement, and social and economic modelling: It was also of the view it was important for the VNR to reflect consumer expectations about the resilience of their electricity service.[60]
- Ausgrid and the NSW Reconstruction Authority considered NSW DNSPs needed a longer-term methodology for VNR in place by mid-2026: Ausgrid also asked the AER to provide more detail on its proposed development timelines for the longer-term VNR review as part of its Final Decision in September.[61]
- The NSW Reconstruction Authority welcomed the opportunity to work with the AER to assist in providing economic evidence for the value of network resilience, to complement the deliberative engagement that the AER may undertake.
- DEECA supported the development of a longer-term VNR approach and considered this should be based on follow-up surveys to actual prolonged outages. It considered this approach would ensure that the VNR accurately reflected the costs and customer

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[56] JEC, *Submission on VNR 2024 draft decision* [letter], August 2024, pp. 2-3.

[57] DEECA, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 2.

[58] See for example ENGIE, *Submission on VNR 2024 draft decision* [letter], August 2024, and Ausgrid *Submission on VNR 2024 draft decision* [letter], August 2024.

[59] Jemena, *Submission on VNR 2024 draft decision* [letter], August 2024, pp. 1-3.

[60] Ausgrid, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 2.

[61] Ibid., p. 4; NSW Reconstruction Authority, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 1.

preferences in relation to prolonged outages. DEECA also proposed the VNR should be recalculated at least once every 5 years, but that the AER maintain flexibility to recalculate it earlier if circumstances changed significantly.[62]

Interaction with the AER's Resilience Guidance Note

- Jemena considered that there may be tensions between the VNR, the AER's resilience guidance note (the guidance note) and ongoing work by the Victorian Government. Jemena wanted further clarification on how this should be approached in the context of its EDPR Proposal.[63]
- Ausgrid considered the guidance note was crucial in helping networks interpret the VNR and should be reviewed and updated in parallel to the development of the longer-term VNR.[64]
- The NSW Reconstruction Authority considered the AER should review the guidance note to ensure it was complementary with NSW Disaster Adaptation Plans and welcomed the opportunity to work with the AER on how the processes and outcomes of the plans could be enabled through the guidance note, and enable a systems approach to building resilience.[65]

Victorian Network Outage Review

Jemena noted there may be an interaction between projects justified by the VNR and the recommendations included in the Victorian Outage Review. It considered the report's final recommendations may not be economically justified based on the VNR.[66]

4.2 Final decision on the approach to determining the VNR

Our final decision is that the initial VNR approach:

- uses multiples of the VCR for standard outages, with the business multiples adjusted to reflect that there is no upper bound applied to the business VNR
- applies an upper bound to the residential initial VNR which will be determined using the costs of backup generation as a reference.

On balance, we consider our approach for determining the initial VNR reflects customers' lived experience of outages and the value they place on avoiding these outages, as well as the likely timing of key stepped increases in outage impacts. We also consider it is appropriate as it:

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[62] DEECA, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 1.

[63] Jemena, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 2.

[64] Ibid., p. 3.

[65] Ibid., pp. 1-2.

[66] Ibid., p. 2.

- recognises electricity consumers do not have an unlimited willingness-to-pay for network resilience investment and will seek out rational alternatives during prolonged outages
- helps strike a balance between network resilience and affordability, thereby helping to promote an efficient level of resilience investment.

We acknowledge that many stakeholders only supported our proposed approach on the basis that it would be a short-term measure and not the basis for a longer-term VNR.[67] As we have discussed in the Executive Summary of this decision, we intend to commence work on the longer-term VNR approach in 2025, with a view to working constructively with stakeholders to develop a longer-term approach. This work will build on our initial VNR work and take into account the comments and views on the potential longer-term VNR approaches that stakeholders have expressed throughout this consultation.

Some stakeholders expressed concerns that the initial VNR may not reflect the value customers place on network resilience, either because the values were too high or too low. This issue is discussed in detail in section 4.2.1, where we set out our rationale for the multiples and tiers to be applied when calculating the residential customer and business customer initial VNRs.

We acknowledge some stakeholders are also concerned about the potential for customers who have invested in their own resilience solutions to pay twice – once for their own solution and once for the network-based solution. We note the way in which network services are priced means it is not possible to pass through the costs of resilience investments only to those customers who will benefit from the resilience investments.

In terms of the practical application of the VNR, we intend to assess resilience investments put forward by DNSPs consistent with the requirements in the NER, our Better Resets Handbook and our resilience guidance note.

We recognise that some stakeholders, including JEC, maintain the view that:

- the VNR are not the most effective or appropriate response to enable DNSPs to improve their scope to respond efficiently to prolonged outages
- there needs to be a more consistent and robust understanding of the differences between reliability and resilience, and network resilience and community resilience.

The limited scope of this review means our focus has been to develop an initial VNR by late September 2024 in time to inform the Victorian expenditure determination price review. However, we have noted the concerns and alternative approaches raised by stakeholders such as JEC, Erne Energy and John Mumford and we intend to explore these issues further

[67] See for example, Energy Queensland, *Submission on VNR 2024 draft decision* [letter], August 2024; Jemena, *Submission on VNR 2024 draft decision* [letter], August 2024; Power and Water, *Submission on VNR 2024 draft decision* [letter], August 2024; ENGIE, *Submission on VNR 2024 draft decision* [letter], August 2024.

as part of our longer-term VNR work, our update of the network resilience guidance note, and our upcoming network resets work.

4.2.1 VCR multiple

Our final decision is to apply a tiered multiple approach, with different tiers for residential and business customers. This approach will initially require the use of the 2023 VCR, but we expect network businesses to use the updated 2024 VCR when they are published in December 2024.

We also expect network businesses will use the most appropriate standard outage VCR for 6-12 hour outages (residential and small and medium business) or 12 hour (large business), or a weighted average of these VCRs, when calculating the VNR. Consistent with the approach to VCR, DNSPs will need to clearly evidence and justify the VCR used in the VNR calculation.

For residential customers, this approach will apply the following tiers and multiples:

- the standard VCR (as built up by the network business from the segmented residential VCR) for the first 12 hours of a prolonged outage
- a multiple of 2x the standard VCR (the VCR used for the first 12 hours) for the period of 12-24 hours
- a multiple of 1.5x the standard VCR (the VCR used for the first 12 hours) for the duration of the outage that extends beyond 24 hours, until the upper bound is reached.[68]

For business customers, this approach will apply:

- the standard VCR (as built up by the network business from the segmented business VCR) for the first 12 hours of a prolonged outage
- a multiple of 1.5x the standard VCR (the VCR used for the first 12 hours) for the period of 12-24 hours
- a multiple of 1.0x the standard VCR (the VCR used for the first 12 hours) for the period of 24-72 hours (1-3 days)
- a multiple of 0.5x the standard VCR (the VCR used for the first 12 hours) for the duration of the outage that extends beyond 72 hours (over 3 days).

Rationale for our approach

As noted in our draft decision, there are a broad range of potential formulations to the tiered multiple approach. We also note that there is no single correct formulation; instead, there are multiple formulations which may be appropriate. Consequently, selecting the appropriate

[68] This means for a 26 hour outage, the standard VCR would be applied for the first 12 hours, the multiple of 2x VCR would be applied between 12 hours and 24 hours, and the multiple of 1.5x VCR would be applied for hours 25 and 26.

multiples and tiers to use for the initial VNR has required us to exercise our judgment. In doing so, we have considered in depth the available international research and the findings and insights of the research and customer engagement undertaken by AusNet, CPU and other DNSPs. We have also had regard to the findings and insights arising from the Victorian Government-initiated reviews into Victoria's recent prolonged outage events.

In using a multiple of the VCR to measure the cost and inconvenience of prolonged outages we note that the VCR is defined as customers' willingness to pay to avoid prolonged outages (a measure of the cost and inconvenience caused to customers by outages) divided by the amount of unserved energy due to an interruption. It is possible for the VCR to fall as the duration of outages increases even if the cost to customers is increasing. This would happen if unserved energy increased more than in proportion to the duration of outages. These considerations are relevant to the choice of VCR multiple to measure the cost of outages of varying duration.

Given the above, we have carefully considered stakeholder views and comments on our draft VCR multiples and tiers. We note there were divergent stakeholder views on our draft formulations, with some DNSPs and stakeholders considering the formulations were appropriate, while other DNSPs considered the draft multiples were too low. In contrast, consumer representatives considered the multiples were too high and potentially did not reflect customers' willingness to pay for resilience investments.

We consider using the standard VCR, as suggested by JEC, would result in an initial VNR that may not reflect the additional inconvenience and costs associated with prolonged outages. As we noted in our draft decision, the insights from our customer engagement and the engagement undertaken by network businesses and government-initiated inquiries into recent outage events indicates customers do experience additional inconvenience and costs when these outages occur.

That customer engagement also highlighted these costs are not insignificant for many residential and business customers, ranging from food spoilage and stock losses, income or trading losses, through to the costs of renting / purchasing and operating a generator.[69] Recent customer engagement on resilience and regulatory proposals, which has been undertaken by some DNSPs (e.g., Ausgrid and Essential Energy), also indicates that customers may place a higher value on avoiding prolonged outages in comparison to standard outages.

Given these findings and insights, we consider it is reasonable to apply higher multiples to some initial VNR tiers. Our approach will also apply an upper bound to residential customers and lower multiples to some business customer initial VNR tiers in recognition of the fact that customers do not have an unlimited willingness-to-pay for network resilience investment and will also seek out rational alternatives during prolonged outages. We consider this approach,

[69] See our section 3.1.3 of our draft decision, where we discuss the lumpiness and step-ups in costs associated with prolonged outages, for further context for our approach.

and our multiple and tier formulations, will strike a reasonable balance between network resilience and network costs, thereby helping to promote an efficient level of resilience investment.

We also consider setting the VCR multiples at a level higher than those proposed in our draft decision, or alternatively using AusNet's adjusted direct cost data as a floor, may result in initial VNR which overstate customers' willingness to pay for resilience investments. In respect of the direct costs incurred by customers, we note there is a risk that survey respondents overstate outage-related costs because it can be difficult to distinguish between the costs incurred as a result of the electricity outage event and the costs incurred as a result of the hazard event.

The direct cost approach also does not account for the views of customers who were not impacted by the outage and will not benefit from the resilience investments, but who will pay for those investments. While these customers may be willing to pay to fund resilience investments elsewhere in their network area, it is not a given that their willingness to pay, or for that matter the willingness to pay of customers impacted by outages, will align directly with the costs incurred by customers who were impacted by the prolonged outages. Consequently, we consider that setting a floor based on direct cost data may overstate the willingness to pay of all customers who will pay for an investment in resilience measures.

As we noted in our draft decision, we are also uncertain about the extent to which results from one network business' customers could be generalised and applied to other network business' customers. For example, some experience more frequent hazard events and customers in these areas may have higher levels of preparedness as a result and are therefore better placed to manage the impacts of a prolonged outage. We consider it is unlikely that generalising the results of a survey from these customers to customers in a different network service area where hazard events are materially less frequent is appropriate. This is because customers who have a higher level of preparedness (e.g., those who own self-generation) may be less willing to pay for network-level resilience measures.

Consequently, an initial VNR based on DNSP's direct cost data is likely to overstate customers' willingness to pay. However, we remain of the view this data provides important insights about the customer impacts of prolonged outages and the timing of those impacts and is particularly useful as a sense check on our decision on the appropriate level of the initial VNR. As such, we have had regard to the AusNet research in considering whether the VCR multiples are both reasonable and reflective of customer experiences. We note the additional analysis AusNet provided in its submission on our draft decision supported our analysis of potential customer impacts and the timing of those impacts.[70]

In respect of the business customer tiers and multiples, we acknowledge the concerns of Ausgrid and AusNet regarding the proposed application of a lower multiple (0.5x standard VCR) to the part of the outage which extends beyond 72 hours. As we discussed in our draft

[70] AusNet, *Submission on VNR 2024 draft decision* [letter], August 2024, p. 1.

decision, the proposed business customer multiples were set at a level which we considered accounted for business customers' mitigation efforts during prolonged outages. This was different to the draft approach for residential customers, where we proposed to apply an upper bound to account for residential customers' mitigation efforts.

We took a different approach for the business customer initial VNR because although we considered business customers would have limits to their willingness to pay and might employ strategies to mitigate the impacts of a prolonged outage at certain price points, we could not easily infer which strategies were likely to be used and when. Consequently, we considered it was not possible to infer a reasonable upper bound for the initial VNRs for business customers.

We have revisited this issue between our draft and final decisions, and we remain of the view that:

- unlike the initial VNR for residential customers, it is not possible to infer a reasonable upper bound for the initial VNRs for business customers.
- our approach to the business initial VNR should recognise that business customers do not have an unlimited willingness-to-pay for network resilience and the initial VNR needs to recognise that and strike a balance between network resilience and affordability
- our approach to the business initial VNR should also recognised that businesses are likely to take steps to mitigate the impact of prolonged outages on their business (e.g., by purchasing or renting a generator). This view is based on the insights from customer engagement undertaken by the AER and network businesses and insights from the South Australian system black outage in 2016.[71]

Given the above, we consider it would not be reasonable to apply the same multiple formulations to the residential and business initial VNRs or to apply a minimum multiple of 1x the standard VCR across all time periods. In our view, these alternative formulations do not recognise that business customers will take steps, at some point in time, to mitigate the impact of a prolonged outage. These alternative formulations also imply that business customers' willingness to pay will not decline, at least on a $/kWh basis, at some point during a prolonged outage. We note this outcome is not consistent with the available research[72] or our residential initial VNR approach, where the imposition of an upper bound effectively results in a lower VNR (on a per kWh basis) over the full duration of an outage once the upper bound is reached.

As we have discussed throughout this final decision, the required timing for the initial VNR has constrained the potential methodological options for determining the initial VNR. On

[71] Business SA, *Blackout survey results – Understanding the effects of South Australia's state-wide blackout on 28 September 2016*, 2016.

[72] See for example, Electricity North West, *NIA ENWL010 Value of Lost Load to Customers – Customer Survey (Phase 3) Key Findings Report*, 2018.

balance, we consider our approaches for the residential initial VNR and the business initial VNR reflect customers' lived experience of outages and the value they place on avoiding these outages, as well as the likely timing of key stepped increases in outage impacts.

4.2.2 Upper bound

Our final decision is to:

- use the least cost self-generation option to determine the upper bound for the initial VNR for residential customers
- apply an upper bound of $3,500 per residential customer, with the upper bound for embedded networks based on the number of residential customers a DNSP estimates are served by that embedded network
- not apply an upper bound to the initial VNR for business customers and instead apply multiples of the VCR which recognise business customers also take steps, at some point in time, to mitigate the impacts of a prolonged outage.

Rationale for our approach

There was general stakeholder support for applying an upper bound to residential customers, with this aspect of our draft decision attracting fewer comments and suggested changes.

Residential upper bound

As we discussed in our draft decision, we are of the view that the least-cost of backup self-generation (plus fuel costs depending on duration of forecast outage) is the most objective and easily applied upper bound for residential customers. This is because we can reasonably estimate the generator and fuel costs for an average customer using average household electricity consumption, outage duration and some information about least cost generation options.

We determined the draft residential self-generation upper bound of $3,494 by:

- considering how a rational, hypothetical customer would consume electricity during an outage and whether they would want a generator to be hardwired
- researching the starting and running loads for common household appliances and selecting a generator size which aligned with those loads and our assumptions about electricity usage during a prolonged outage
- considering how a rational, hypothetical customer would seek to balance cost and running time when selecting a generator make and model
- researching generator options and selecting a make and model which aligned with the above assumptions about customer preferences and usage.

On that basis, we selected a midrange model with a maximum load of 5,500W and running load of 5,000W, a fuel tank size of 20L and a price (as quoted by an Australian-based online retailer) of $1,699.

We assumed customers would likely want to operate a range of household appliances and some of these may require the generator to be hardwired, with a changeover switch installed. We therefore included costs associated with enabling the generator to be plugged directly

into household circuits. Given the cost differential between manual and automatic changeover switches, we assumed the hypothetical customer would install a manual changeover switch. In calculating the upper bound, we also included operating (e.g., fuel) and maintenance costs. Based on these assumptions and specifications, we estimated a draft upper bound for the residential initial VNR of $3,494 per residential customer.

In setting the residential self-generation upper bound, we also considered an alternative self-generation option utilising battery storage and solar PV. However, this option was a considerably more expensive resilience measure compared to the generator option. Customer engagement insights also indicated this alternative option was not a 'lived experience' option considered by those that have experienced prolonged outages.

We note the calculated residential upper bound does include fuel costs and is based on our own independent analysis (as outlined above) rather than the limited data on generator costs that we obtained through customer engagement undertaken by some DNSPs. For our final decision, we have rounded the upper bound to $3,500 to reflect it is an approximation of the cost of an alternative resilience solution that a rational, hypothetical customer may invest in, rather than the cost, or average costs, of alternative resilience solutions actual customers have purchased in response to actual prolonged outages.

Consistent with the approach we have set out above, we have not assumed that the customers surveyed about the June and October 2021 storms in Victoria bought generators that can act as a suitable substitute in future events. We did however have regard to the DNSP research when determining which least-cost back-up solution was likely to be the most appropriate option for the upper bound and whether our upper bound aligned with customers' lived experience.

We have considered AusNet's suggestion that the upper bound be tested for higher levels of consumption. Our upper bound calculation was based on generator size, maximum running load and hours of usage and informed by common household appliance load requirements and assumptions regarding customer usage during an outage. We consider it is reasonable to assume that a rational, hypothetical customer will:

- given the need to refuel and the costs associated with generation, ration their usage and not consume their usual household load during the prolonged outage
- want a generator that is capable of operating multiple household appliances but will stagger their household load and not seek to start and/or run every appliance at the same time
- balance cost, running time and generator size when they select a generator.

We also note the upper bound is intended to recognise that customers do not have an unlimited willingness to pay for network resilience investment and will seek out rational alternatives during prolonged outages. It is not intended to be an ongoing substitute for electricity supply outside of an electricity outage. Given that, we are of the view the upper bound usage assumptions are appropriate and align with customers' lived experience, and as such, we have not revised the upper bound to incorporate a materially higher usage level.

Our upper bound is also a $/customer upper bound rather than a time-based upper bound as suggested by AusNet. As we noted in our draft decision, the indicative timing for reaching the residential upper bound was provided only for illustrative purposes and was based on

average Victorian residential customer annual consumption and the Victorian residential VCR (for outages up to 12 hours). In practice, the time at which the residential upper bound is reached will be dependent on the standard VCR a DNSP uses, along with the other assumptions it factors into its cost-benefit analysis (e.g., unserved energy).

We have also considered adjusting the upper bound calculation to account for the capital investments customers may have made in back-up self-generation assets following an initial prolonged outage which could then be used in subsequent outages. In that regard, we acknowledge the concerns raised by ENGIE about the potential for the initial VNR to overstate the value customers place on resilience.

Given the limited data available and the time constraints applying to our review, we were not able to obtain robust information that would allow us to make a reasonable assumption about the proportion of customers who may purchase or replace a generator within a given year or who may have purchased a generator for other reasons but also use it as a back-up solution when an electricity outage occurs. Consequently, we have not made any adjustments to upper bound to account for previous generator purchases.

We also note that the upper bound is an upper limit on the VNR for residential customers. As discussed above, whether it is reached will be dependent on the standard VCR a DNSP uses, along with the other assumptions it factors into its cost-benefit analysis (e.g., unserved energy). Additionally, our analysis of the outages which occurred within the NEM between 1 July 2021 and 30 June 2023 highlighted that the prolonged outages exceeding 72 hours are far less common than prolonged outages between 12 hours and 72 hours.[73] Given that, we anticipate the upper bound is unlikely to be reached in every resilience investment scenario considered by DNSPs.

We have also considered the practical application of the upper bound to embedded networks, as raised by Ausgrid. We consider DNSPs should be able to make an approximation of residential customer numbers and then apply the upper bound to that customer estimate to calculate the maximum residential VNR for that embedded network.

Business upper bound

As discussed in our draft decision, there are considerable practical challenges in using this upper bound for business customers, as there is much greater variation in electricity consumption. This heterogeneity makes it very difficult to determine the appropriate specifications of the least cost self-generation solution to use in an upper bound VNR calculation.

We also note that, while varying across different business contexts, businesses may have less flexibility in the short term than residential customers to source an appropriate generator or seek an alternative operating location. This means they are likely to continue to incur non-insignificant costs throughout a prolonged outage. There is also a lack of supporting customer insight evidence that businesses seek alternative generation options during a

[73] See AER, *Draft Decision – Value of Network Resilience 2024*, May 2024, p. 19 (section 3.4.3).

prolonged outage. Given these challenges we have decided not to apply an upper bound for business customers but to use multiples of the VCR to recognise business customers do not have an unlimited willingness-to-pay for network resilience and to account for their mitigation efforts during prolonged outages (see section 4.2.1).

5 Next steps and ongoing collaboration

Our VNR work will continue following the completion of the 2024 Initial VNR Review and be focused on developing a longer-term methodology for the VNR.

Our draft decision on the initial VNR canvassed stakeholder views on the development of a customer outage survey, which is one aspect of this longer-term work program. We also undertook further targeted consultation on this survey following the publication of our draft decision.

This section summarises stakeholder feedback on the post-outage survey, as well as the next steps for our broader, longer-term VNR work program.

5.1 Stakeholder feedback on the Customer Outage Survey

The feedback received from key stakeholders, including Jemena, Ausgrid, and AusNet, highlights several recurring themes regarding the AER's proposed customer survey on long-duration power outages. These themes reflect broad support for the initiative, but with caveats related to timing, methodology, flexibility, and relevance. Stakeholders also emphasised the need to balance transparency and stakeholder engagement while ensuring that the survey provides meaningful, actionable insights.

- Jemena voiced support for the AER's proposed survey, particularly the effort to capture the costs customers incur during long-duration outages, as well as the added transparency that would result from making the survey results public. Additionally, Jemena acknowledged the importance of including health and safety impacts in the survey. This data, they believe, is vital for building a complete picture of the true effects of outages on individuals and communities.
- However, Jemena highlighted that its own customer base had experienced very few long-duration outages in recent years, which could skew survey results. Despite this, Jemena was open to the idea of partnering with the AER to help distribute the survey.
- Jemena also encouraged the AER to broaden the scope of the survey beyond direct electricity-related impacts. They suggested capturing the wider socio-economic effects of outages, such as delays to health appointments or disruptions to education. To gain a full understanding of resilience, Jemena proposed that the survey could also be extended to businesses and service providers, such as schools and hospitals, as these institutions often experience different challenges compared to residential customers.
- Ausgrid supported the overall goal of the AER to build a more comprehensive evidence base on the impacts of long-duration outages, but it expressed concerns regarding the timing of the proposed survey. Ausgrid cautioned that moving forward with a survey before a robust VNR methodology is fully developed could undermine the credibility and soundness of that methodology. Ausgrid also called for meaningful consultation on the survey's design, including its format and the types of questions to be asked, to ensure that the survey's results would be both useful and aligned with the overall VNR methodology.

- AusNet echoed the support for the Customer Outage Survey but raised concerns about over-surveying customers, particularly those impacted by previous extreme weather events. A key aspect of AusNet's feedback was the importance of survey flexibility. The company highlighted the need to ask tailored questions specific to the circumstances of each outage, which would allow it to gather more relevant data and improve its performance. For example, AusNet expressed interest in learning how customers perceived the company's communication before and during outages, and how their experiences compared to previous events. Without this flexibility, AusNet warned that there could be unnecessary duplication of survey efforts, reducing the survey's overall effectiveness.
- The feedback from Jemena, Ausgrid, and AusNet demonstrates a shared commitment to improving the understanding of long-duration outages and their impacts on customers. However, it also highlights the complexities involved in designing a survey that is both useful and aligned with the broader goals of the VNR framework. Key considerations for the AER moving forward include ensuring the survey's timing does not interfere with the development of a longer term VNR methodology, maintaining flexibility to gather relevant data, and being mindful of over-surveying. These insights will be critical in shaping a survey that effectively captures customer experiences and informs the future of network resilience.

While the written submissions generally reflected broad support for the Customer Outage Survey, the AER also gathered feedback through direct conversations and meetings with stakeholders, which raised some concerns about the survey approach that were not captured in formal submissions. These concerns predominately related to further consideration of the purpose and future use of the survey to ensure it is appropriately targeted and gets sufficient buy-in from stakeholders. The VNR Final Decision recognises these additional perspectives and will take them into account as the survey design and implementation moves forward.

5.2 Next steps and ongoing collaboration

Our VNR work will continue following the completion of the 2024 VNR. We will commence our work on the longer-term VNR in early 2025. The focus of this work will be on the longer term VNR scope and methodology, with a view to finalising these aspects by the end of 2025. In 2026, the focus of the work will then shift to calculating VNR using the longer-term methodology, with a view to informing the next round of regulatory determinations. This reflects stakeholder input that work should be immediately undertaken to establish a more enduring approach to a VNR.

To help build an evidence base that will inform our development of the longer-term VNR approach, we will develop a customer outage survey to collect data on the resilience and experiences of households affected by prolonged power outages. This initiative aims to gather detailed information on the demographic attributes, specific challenges faced, and mitigation strategies employed by those affected. This data will help characterise the resilience needs of different customer cohorts, particularly those prone to prolonged outages, ensuring that future investments and strategies are effectively targeted.

We will commence consultation in 2024 to gather input on the themes, priorities, and outcomes for a proposed Customer Outage Survey that will focus on long-duration power outages (outages greater than 12 hours). We are aware there are differing stakeholder views

on the post-outage survey proposal. Stakeholder input will be instrumental in guiding its design. As we move forward, our focus is on maintaining a collaborative approach, working with stakeholders to ensure that the survey is robust, relevant, and capable of delivering actionable insights and evidence, which will be of assistance as we progress our work on the VNR over the longer term.

Appendix A: Stakeholder Submissions

Number	Submitter	Date received
1	Jemena	13-Aug-24
2	Ausgrid	15-Aug-24
3	Ergon Energy and Energex	16-Aug-24
4	Erne Energy	16-Aug-24
5	ENGIE	19-Aug-24
6	John Mumford	19-Aug-24
7	New South Wales Reconstruction Authority	19-Aug-24
8	CitiPower, Powercor and United Energy (CPU)	19-Aug-24
9	AusNet	19-Aug-24
10	Justice and Equity Centre (formerly PIAC) (JEC)	19-Aug-24
11	Power and Water	29-Aug-24
12	Victorian Department of Energy, Environment & Climate Action (DEECA)	30-Aug-24

Glossary

Term	Definition
ACCC	Australian Competition and Consumer Commission
AER	Australian Energy Regulator
Capex	Capital expenditure
CPU	CitiPower, Powercor and United Energy
DNSP or distributor	Distribution network service provider
DEECA	Department of Energy, Environment and Climate Action
ECMC	Energy and Climate Change Ministerial Council
HILP	High impact, low probability
JEC	Justice and Equity Centre
kWh	Kilowatt-hour
MED	Major event day
NEL	National Electricity Law
NER	National Electricity Rules
NSPs	Network service providers
STPIS	Service Target Performance Incentive Scheme
VCR	Value of customer resilience
VNR	Value of network resilience