Values of Customer Reliability

Final Decision

November 2019

AUSTRALIAN
ENERGY
REGULATOR

Amendment Record

Version	Date	Pages
1.1	16 September 2020	22-24.

Contents

Shortened form	Extended form
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
CATI	computer-assisted telephone interviewing
COAG	Council of Australian Governments
the Committee	the VCR Consultative Committee
CPI	Consumer Price Index
DER	distributed energy resources
ECA	Energy Consumers Australia
HILP	high impact low probability
GWh	gigawatt hour
ISP	integrated system plan
kVA	kilovolt ampere
kWh	kilowatt hour
MEI	Melbourne Energy Institute
MVA	megavolt ampere
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules
NSP	network service provider
RERT	reliability and emergency reserve trader
RIT	regulatory investment test
Solar PV	solar photovoltaic
STPIS	service target performance incentive scheme
the Subcommittee	the HILP Subcommittee
VCR	values of customer reliability
WTP	willingness to pay
$/kWh	dollars per kilowatt hour

1   Executive Summary

This *Final decision* for our Values of Customer Reliability (VCR) review sets out our methodology for deriving VCR values for the National Electricity Market (NEM) and the Northern Territory (VCR methodology).

On 5 July 2018, the Australian Energy Market Commission (AEMC) approved a rule change proposal by the Council of Australian Governments (COAG) Energy Council to give the Australian Energy Regulator (AER) responsibility for determining values different customers place on having a reliable electricity supply. This is referred to as the VCR. The rule change requires the AER to:

- develop a VCR methodology for estimating VCRs in accordance with the VCR objective and other requirements in the National Electricity Rules (the Rules)

- derive VCR values in accordance with the VCR methodology and publish them by 31 December 2019

- review the VCR methodology for estimating VCRs at least every five years.

This *Final decision* incorporates our response to an extensive consultation process that commenced in October 2018 and through which we have engaged widely with governments, energy regulators, customer and industry representatives and the public.

We established the VCR Consultative Committee (the Committee) as a key advisory body that we have regularly consulted with on key issues throughout the VCR review.[1] The Committee consists of representatives from organisations with a particular interest in VCRs, and who have relevant expertise in how VCRs should be used and/or determined. We met with the Committee six times to date and we plan to meet once more before finalising VCR values. We also formed a HILP event (high impact low probability) subcommittee (the Subcommittee), sitting under the Committee, to advise on approaches to developing a methodology to derive VCRs for widespread and long duration outages. We met twice with the Subcommittee.[2]

Our *Final decision* on the VCR methodology follows the publication of our *Draft decision* in September 2019, which outlined our proposed VCR methodology. As part of our consultation process, we also published a *Consultation paper* (October 2018) and a *Consultation update paper* (April 2019). These papers set out our progress on developing the VCR methodology.

Our *Final decision* is informed by a wide range of stakeholders from industry, government, customer representatives, energy regulators, our VCR Consultative Committee, and expert advice from our consultants: the University of Melbourne's Melbourne Energy Institute (MEI); and, KPMG working in consortium with Insync. We received 25 submissions in response to our *Consultation paper* (October 2018), six submissions in response to our *Consultation update paper* (April 2019) and seven submissions in response to our *Draft decision*.

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[1]   See section 2.5.3 for more information about the Committee.
[2]   See section 2.5.4 for more information about the Subcommittee.

Submissions from stakeholders in response to our *Draft decision* were largely supportive of our proposed VCR methodology. Accordingly, we are not proposing to make changes to the VCR methodology as set out in our *Draft decision.* While stakeholders support our methodology for this review they recommended, given the changes taking place in the energy sector, that we continue to explore different methodologies for future VCR reviews. These include revisiting revealed preference approaches, model-based methodologies and hybrid approaches. Stakeholders also recommended deliberative processes and customer forums for future reviews.

Stakeholders also indicated an interest in:

- an explanation of how we propose to segment VCR values

- the criteria for assigning the data to a network segment to ensure consistent applications of VCR

- the confidence range for VCR values

- clarification of the range and distribution of responses around caps used in the residential survey and the rationale for the exclusion of outliers.

Final segmentation of VCR values, confidence ranges of VCR values and a discussion of survey responses and analysis will, where possible, be set out in our report outlining VCR values derived from survey responses, which we plan to publish in December 2019.

In summary, the components of our VCR methodology are:

- the use of contingent valuation and choice experiment techniques to derive standard outage (typically less than 12 hours) VCRs for residential and business customers with a peak demand of less than 10 megavolt-amperes (MVA)

- the use of a direct cost survey approach to derive standard outage VCRs for business customers with a peak demand of more than 10 MVA

- the approach to converting residential, business and direct cost survey value of reliability results into dollar per kilowatt hour ($/kWh) values and how they will be combined to produce aggregate VCRs

- the use of a macroeconomic modelling approach supplemented by other techniques to derive VCRs for widespread and long duration outages (WALDO) with a total impact ranging from 1-2 gigawatt hours (GWh) to 15 GWh of unserved energy. [NOTE ON THE VCR WALDO METHODOLOGY, SEPTEMBER 2020: the WALDO methodology has been removed from the updated VCR methodology.]

- the use of a CPI-X formula for the annual adjustment mechanism. In this formula, X represents the key drivers of annual change in customer reliability preferences but, for this 5 year period X is set to zero due to a lack of available information on the extent which factors, such as the impact of new technologies (such as battery storage and electric vehicles), have on reliability preferences.

1.1 Update on implementation of methodology

As set out in our *Draft decision* the time frames under Rule 8.12 for publishing the methodology and VCR values are tight. Accordingly, around the same time as we published the *Draft decision* on the VCR methodology in September 2019 we also commenced our survey work in accordance with the then proposed VCR methodology. Further details are contained in our *Draft decision*.[3]

Our survey work closed on 23 October 2019. Overall, we collected 8,448 residential responses and 2,142 small and medium business responses and 68 large business responses. Survey responses were collected using paid online panels, open links (distributed via the AER's *Energy dispatch* journal and to a wide range of business associations) and recruitment via computer-assisted telephone interviewing (CATI).

We are currently analysing the responses to our surveys to determine VCR values.

In October 2019 we also engaged consultants ACIL Allen to undertake our model based methodology for widespread and long duration outages.

1.2 Next steps - publication of VCR values

Our VCR values calculated using the methodology set out in this *Final decision* will be published in a report in December 2019. This report will include data on the number of survey responses, key statistics and where possible, confidence ranges.

However, we expect to defer the publication of VCR values for widespread and long duration outages to the first quarter of 2020. This category of VCR values is new and untested. We consider more time is needed for development and testing in order to derive fit for purpose VCR values, and that it is unlikely we will be in a position to publish these values in December 2019.

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[3] AER, Draft decision - Values of Customer Reliability, 19 September 2019, p.6, 43-44.

2   Background

2.1 AER role in determining Values of Customer Reliability (VCR)

The Australian Energy Regulator (AER) is the independent regulator for Australia's national energy markets. We are guided in our role by the national electricity, gas, and energy retail objectives set out in the National Electricity Rules (the Rules) and the National Gas Rules, and National Energy Retail Law These objectives focus on promoting the long-term interests of consumers.

2.2 Why is the AER responsible for setting VCR?

In response to a rule change proposal from the Council of Australian Governments (COAG) Energy Council, the Australian Energy Market Commission (AEMC) amended the Rules to give the AER responsibility for determining the values different customers place on having a reliable electricity supply.[4] This is referred to as the Values of Customer Reliability (VCR). VCR links efficiency and reliability, playing a pivotal role in network planning and investment and informs the design of wholesale market standards and settings and network reliability incentives.

The AEMC considered that assigning a single body responsibility for developing a nationally consistent VCR methodology and for calculating VCR estimates would remove unnecessary duplication and decrease the overall administrative burden associated with the use of VCR by a wide range of stakeholders. The AER was considered the most appropriate body for developing the VCR methodology and VCR estimates on an on-going basis because the responsibility most aligns with its statutory functions.[5]

The AEMC's rule change came into effect on 13 July 2018.[6]

2.3 VCR Rule

Part I, Rule 8.12 of the Rules specifies the AER must, in accordance with the Rules consultation procedures:

- develop, publicly consult on, and publish a national methodology for estimating VCRs across the National Electricity Market (NEM) and the Northern Territory

- include a mechanism for directly engaging with customers and include a mechanism for adjusting VCRs on an annual basis

- publish the first VCRs calculated in accordance with the VCR methodology on or before 31 December 2019

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[4]   AEMC, Establishing VCRs, Rule Determination, 5 July 2018. Available at https://www.aemc.gov.au/rule-changes/establishing-values-of-customer-reliability.

[5]   AEMC, Establishing VCRs, Rule Determination, 5 July 2018, page 7. Available at https://www.aemc.gov.au/rule-changes/establishing-values-of-customer-reliability.

[6]   AEMC, National Electricity Amendment (Establishing values of customer reliability) Rule 2018 No. 8, page 2. Available at https://www.aemc.gov.au/rule-changes/establishing-values-of-customer-reliability.

- adjust the VCRs using the adjustment mechanism specified in the VCR methodology each year between major updates

- review the VCR methodology and update the VCRs at least once every five years, and publish updated numbers.

The Rules establish a VCR objective, which requires the AER's VCR methodology and set of VCR values are fit for purpose for any current or potential uses of values of customer reliability that the AER considers relevant.

2.4 What are VCRs?

VCRs seek to reflect the value different types of customers place on a reliable electricity supply under different conditions and are usually expressed in dollars per kilowatt hour ($/kWh) of unserved energy. VCR is a critical input for identifying efficient levels of network expenditure.

Because individual customers cannot directly specify the value they place on reliability and there is no separate market for reliability, VCR is difficult to observe directly, and is typically estimated by survey techniques. VCR is not a single number but rather a collection of numerical values which apply to different customer segments. The primary customer segments in previous surveys have been residential and business customers, and customers connected directly to transmission networks (direct connect customers).

Prior to the AEMC's rule change there was no single body formally responsible for determining VCRs and updating them on a regular basis. The first comprehensive NEM-wide study of VCRs was conducted by the Australian Energy Market Operator (AEMO) in 2014.

In its 2014 review AEMO calculated VCR values in the NEM for residential, business and direct connect customers. Residential customers were segmented by NEM jurisdiction, business customers were segmented by sector (industrial, commercial and agricultural) and size (small, medium and large) and direct connect customers were segmented by sector (metals, wood pulp and paper, and mining).[7] No previous VCR study has included the Northern Territory.

2.5 Consultation

Our VCR review has involved an extensive consultation process that commenced in October 2018, through which we engaged widely with governments, energy regulators, customer and industry representatives and the public.

2.5.1 Draft decision

This *Final decision* on the VCR methodology is preceded by our *Draft decision*, which was released on 18 September 2019. The *Draft decision* sets out each of the components of the draft methodology for developing VCR values, incorporating feedback from all of the

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[7] For detailed results see AEMO, Value of Customer Reliability Review Appendix, September 2014. B.1. Available at: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Value-of-Customer-Reliability-review.

avenues of consultation, including independent expert advice, focus group and pilot survey testing, as discussed below. A summary of the *Draft decision* is provided in Chapter 3. We received seven submissions to the *Draft decision*, which we summarise and respond to in Chapter 3 and Appendix 1.

2.5.2 Consultation papers and VCR public forums

On 19 October 2018, we commenced the VCR review with the publication of our *Consultation paper*. The *Consultation paper* sought stakeholder feedback on a number of matters including methodologies to determine VCR values and uses of VCR. We received 18 submissions to our *Consultation paper*.

Following the close of submissions, we held VCR public forums in Sydney on 5 December 2018 and in Melbourne on 6 December 2018. The public forums provided an opportunity to discuss stakeholder comments on the *Consultation paper*. Following the public forums we extended the consultation period and received a further seven submissions.

On 18 April 2019, we published a *Consultation update paper*, setting out our key assessment criteria for the VCR methodology and our proposal to build on and improve on the methodology used by AEMO in its 2014 NEM-wide VCR review. We received four submissions to the *Consultation update paper*.

Key views and feedback from stakeholder submissions to our consultation papers are summarised in Appendix 2 of our *Draft decision*.

2.5.3 VCR Consultative Committee

At the beginning of the VCR review we established the VCR Consultative Committee. The Committee is an advisory body consisting of representatives from organisations with a particular interest in VCRs or who have relevant expertise in how VCRs should be determined, who we consulted with on key matters throughout the VCR review.

Committee members include representatives from the following organisations:[8]

- Australian Energy Council (AEC)
- Australian Energy Market Commission (AEMC)
- Australian Energy Market Operator (AEMO)
- Essential Services Commission of South Australia (ESCOSA)
- Essential Services Commission of Victoria (ESCV)
- Energy Consumers Australia (ECA)
- Energy Networks Australia (ENA)
- Energy Users' Association of Australia (EUAA)
- Independent Competition and Regulatory Commission (ICRC)

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[8] We also invited Queensland Competition Authority (QCA) to attend our VCR Consultative Committee, but the invitation was declined.

- Independent Pricing and Regulatory Tribunal of New South Wales (IPART)

- Office of the Tasmanian Economic Regulator (OTTER)

- Public Interest Advocacy Centre (PIAC)

- Reliability Panel

- Utilities Commission of the Northern Territory (UC)

The Economic Regulatory Authority of Western Australia has also attended meetings of the Committee as an observer.

To date, the Committee has met six times (28 November 2018, 7 February 2019, 13 June 2019, 25 July 2019, 29 August 2019 and 30 October 2019). Minutes of Committee meetings can be found on the AER website.[9]

2.5.4 High impact low probability events (HILP) Subcommittee

A number of stakeholder submissions to our consultation papers raised matters regarding the development of VCRs for outages that are typically the result of HILP events. They highlighted a number of complex issues. To give proper consideration to these issues we established a HILP Subcommittee (the Subcommittee) sitting under the Committee. The Subcommittee consists of a subset of Committee members with a particular interest in or expertise in this subject area.

Meetings of the Subcommittee were held on 14 March 2019 and 23 May 2019 to give consideration to whether to develop VCRs for HILP events and how to achieve this. Findings of the Subcommittee were also provided to the Committee for its consideration.

We have shifted in terminology from HILP VCRs to widespread and long duration VCRs to reflect the revised scope of the study to events of a magnitude equal to or less than 15 gigawatt hours (GWh) of unserved energy.

2.6 Independent expert advice

Two consultancy groups, the University of Melbourne's Melbourne Energy Institute (MEI) and a consortium consisting of KPMG and Insync (KPMG/Insync), are assisting us in our review. The MEI is an inter-disciplinary academic research group. It assisted us in developing the VCR methodology, and has provided expert advice and quality assurance over the course of review. KPMG/Insync also assisted us in developing the VCR methodology, and in undertaking the design and delivery of surveys we conducted as part of the review.

2.6.1 Focus group and pilot survey

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[9]   https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/values-of-customer-reliability-vcr/consultation.

To improve on the residential and business surveys used by AEMO in 2014, KPMG/Insync conducted a number of focus groups and interviews across Australia in March 2019. The focus groups and interviews sought to test potential improvements to reduce bias in the contingent valuation survey technique and test the wording and design of the surveys.

Following the publication of the *Consultation update paper*, we undertook a pilot residential and business survey. Overall, the pilot survey results were promising and provided us confidence we would be able to obtain results in a main survey using the same techniques to derive VCR values for residential and business customers.

The KPMG/Insync report on the pilot survey contains recommendations to address key findings and is published on our website. MEI also provided quality assurance on the pilot survey design and results, particularly on the choice model.

3   Summary of Draft decision and responses

On 18 September 2019, we released our *Draft decision* on our methodology for developing VCR values for the National Electricity Market and the Northern Territory.

Our *Draft decision* was to build on the methodology used by the Australian Energy Market Operator (AEMO) to estimate VCRs in its 2014 NEM-wide study. In 2014, AEMO derived VCR values for outages of up to 12 hours duration. Our *Draft decision* recognises different methodologies are required for standard outages (outages of up to 12 hours duration) and widespread and long duration outages (outages of more than 12 hours duration).

Our preference is for a survey based approach to collect data on customer reliability preferences for standard outages, and a model-based approach for estimating customer reliability preferences in relation to widespread and long duration outages.

Our *Draft decision* includes an approach to convert value of reliability results from surveys into dollar per kilowatt hour ($/kWh) values, and to combine these values to produce aggregate VCRs. It also set out our proposed annual adjustment mechanism, enabling VCRs to be adjusted annually between five-yearly VCR reviews.

We received seven submissions in response to our *Draft decision*, from the following stakeholders:

- Ausgrid
- Energy Consumers Australia (ECA)
- Energy Networks Australia (ENA)
- Ergon Energy and Energex
- Evoenergy
- Major Energy Users (MEU)
- Public Interest Advocacy Centre (PIAC)

These submissions expressed broad support for our draft methodology, and are summarised below. A more detailed summary of submissions and our responses is provided in Appendix 1.

3.1 Assessment criteria

We developed an assessment criteria to assist in determining a VCR methodology. Our assessment criteria is based on requirements set out in the Rules and the National Electricity Objective (NEO). Table 3.1 sets out our assessment criteria for the VCR methodology.

Table 3.1 - Assessment criteria

Assessment criteria
1. The National Electricity Objective (NEO) to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity.

We consider the NEO will be promoted where the VCR methodology is flexible, producing values that are a reasonable reflection of customer reliability preferences today, and can be adjusted to reflect future changes in reliability preferences. These changes in preferences may be driven by a range of factors including changes in the energy market, cost, technology or customer perceptions.

2. The VCR methodology and values of customer reliability should be fit for purpose for any current or potential uses of values of customer reliability that the AER considers to be relevant (the VCR Objective).[10]

We consider:

- **the VCR methodology and values should account for the range of customers and geographic locations within the NEM and the Northern Territory, and recognise the various uses of VCR values**

- **the VCR methodology should produce reasonable estimates of customer VCRs.**

3. The VCR methodology requirements are set out in clause 8.12 of the Rules.

These state the VCR methodology must:

- **include a mechanism for directly engaging with customers which may include the use of surveys**

- **include a mechanism for adjusting the values of customer reliability on an annual basis.**

3.2 Uses of VCR

The traditional purpose of VCRs is as an input in the cost benefit analysis for network planning (such as regulatory investment tests (RITs) and the integrated system plan (ISP)) and the assessment of future network expenditure for capital projects. Using VCRs to estimate the value of unserved energy resulting from outages, a cost-benefit analysis can be performed to assess whether proposed steps to prevent outages (such as increasing network capacity) are economically justified. For example, expenditure would be justified where the value of unserved energy is greater than the cost of preventing outages through investment in a network or non-network option.[11]

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[10] Clause 8.12, National Electricity Rules.

[11] At a high-level, this is done by multiplying the applicable VCR by the energy at risk of being unserved in the event of an outage or outages and comparing this with the cost of network investment to prevent the outage. If this value is less than the cost of the proposed step to prevent the outage, then the network investment should not go ahead.

Through our consultation, we have also identified VCRs are currently used for the following purposes:

- setting transmission and distribution reliability standards and targets[12]

- to inform reviews of the wholesale market reliability standards and settings[13]

- to inform reviews of the system restart standard[14]

- to inform reliability and emergency reserve trader (RERT) procurement[15]

- to inform the assessment of requests to declare certain risks as protected events[16]

- in the distribution service target performance incentive schemes (STPIS) as the key measure for linking outcome performance with the STPIS incentives.

Similarly, our consultation to date has identified the following potential applications of VCR:

- determining load shedding priorities and compensation mechanisms in each jurisdiction

- as an input into recommendations arising from the AEMC's Black System Event Review.

3.3 Reason for Draft decision and stakeholder response

The rationale for each of the components of our draft methodology is discussed below. Stakeholder submissions to our *Draft decision* are also summarised. Further detail on our final methodology is provided in Chapter 4.

3.3.1 Survey techniques to derive VCRs for residential and business customers with peak demand less than 10 MVA per annum

Our *Draft decision* is to adopt the same combination of contingent valuation and choice experiment survey techniques as AEMO used for our methodology, to determine standard

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[12] For example, IPART has recently been requested by the Premier of NSW to review electricity distribution reliability standards taking into account the VCR values to be published by the AER as a result of this VCR review. See, https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/pricing-reviews-electricity-publications-electricitydistribution-reliability-standards/final-terms-of-reference-electricity-distribution-reliability-standards-february-2019.pdf.

[13] National Electricity Rules, clause 3.9.3A(e)(4).

[14] VCR was used as an input into the Reliability Panel's 2016 System Restart Standard Review. The Reliability Panel's determination is available at https://www.aemc.gov.au/markets-reviews-advice/review-of-the-system-restart-standard In particular, see Appendix B of the accompanying Deloitte Access Economics report on Economic assessment of System Restart Ancillary Services in the NEM.

[15] On 2 May 2019, the AEMC made a final rule determination on the enhancement to the RERT rule change proposal. The final rule introduces an additional RERT principle to provide additional guidance on RERT costs, namely that they should not exceed the average VCR. This is to recognise that the costs of emergency reserves should be less than the costs of involuntary load shedding. For more information, see https://www.aemc.gov.au/rule-changes/enhancement-reliability-and-emergency-reserve-trader.

[16] For example, AEMO's 5 November 2018 request to declare a risk to South Australia's power system from destructive winds. To assess the net economic benefits of declaring a protected event, AEMO proposed using a VCR of double the SA VCR calculated by AEMO in 2014 to account for the widespread nature of the event which it sought to address. See https://www.aemc.gov.au/market-reviews-advice/request-declaration-protected-event-november-2018.

outage VCR values for residential and business customers with a peak demand of less than 10 MVA per annum.

Our draft methodology includes some modifications to the survey techniques used by AEMO based on feedback we received from stakeholders in response to our *Consultation update paper*, focus groups and pilot testing. The principal changes we made to the AEMO methodology were:

- modifying the contingent valuation question by introducing an open-ended willingness to pay (WTP) question following the two cost prompt WTP questions for residential customers and for all business customers

- introducing a residential cap of $22 for the open-ended WTP question

- lowering the levels of the cost prompts for residential customers

- updating the definition of some outage attributes in the choice model.

The use of an open-ended WTP question removes the need to make assumptions, like AEMO did, to obtain a single WTP value from the range implied by the responses to the questions with cost prompts, and so provides a more accurate reflection of customer WTP (assessment criterion 1). The cost prompts were still included as they provide context to make the open-ended WTP question easier to respond to than a single open-ended WTP question without any cost information. This approach was supported by KPMG/Insync[17] and MEI.[18]

We introduced a WTP cap because we considered the average WTP of the majority of respondents should not be overly influenced by the very few respondents who answered with unusually high WTP values, particularly when improved reliability is likely available to these customers at a lower price than they nominate (i.e. through procuring a backup generator). We considered this approach to be in line with the intention of the NEO (assessment criterion 1). The residential cost prompts were then reduced to take account of the lower WTP cap.

For the choice model, we made changes to some of the definitions of the outage attributes. These included:

- changing the definition of peak and off-peak to account for changes in consumption behaviour 2014

- changing the definition of severity as indicated by focus groups, so that it could be better understood by respondents,

- keeping the frequency characteristic (how often a specific outage occurs in a year) constant, as there was a lack of supporting data to properly integrate results for this attribute.

Our *Draft decision* identified survey-based approaches as preferable to other methodologies for this review because:

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17   KPMG, Value of Customer Reliability Pilot Survey Report, 5 September 2019, page 28.

18   Email, from Professor Train 1 August 2019.

- the VCR values derived using survey approaches are forward looking and able to be applied to the majority of applications of VCR we identified (assessment criteria 1 and 2)

- surveys seek information directly from customers (assessment criterion 3). Further, contingent valuation and choice experiment survey techniques are able to capture both the direct cost customers experience due to an interruption in their electricity supply, as well as intangible costs such as loss of comfort (assessment criterion 1)

- surveys can better ascertain information about how customer perceptions of grid reliability change as a result of solar PV, battery storage and other emerging technologies, which better supports the achievement of the NEO (assessment criterion 1)

- survey-based approaches, particularly choice experiments, offer greater flexibility and granularity than model-based approaches with respect to the variables being measured / targeted, such as customer types, outage types and location (assessment criterion 2). This also supports the achievement of the NEO by allowing more targeted VCRs to be developed that enable better assessments of the efficiency of network expenditure (assessment criterion 1).

- MEI advised us that the combined contingent valuation and choice experiment survey techniques used by AEMO are robust and can be implemented within the Rules' timeframe (assessment criterion 2).

Our proposed survey methodology for standard outages received general support from submissions. For example, Ausgrid supports the survey approach, including the proposed modifications and improvements to AEMO's 2014 study. The MEU considers the proposed methodology is sound and should deliver appropriate values for VCR. Evoenergy agrees with the use of contingent valuation and choice modelling techniques as being the most consistent with economic theory.

PIAC considers our alteration of AEMO's 2014 contingent valuation question and the inclusion of the open-ended WTP question provides more accurate measures of customers' preferences. It supports our attempt to address concerns around biases by testing the language of surveys, and recommends more face-to-face customer engagement. PIAC suggests we investigate ways to mitigate the incentives for some large users to overstate the value they place on reliability.

3.3.1.1 Consideration of alternative methodologies

In our *Draft decision* we considered two alternative methodologies for estimating VCR values for standard outages: a model-based approach (the leisure time function) and revealed preferences techniques. We found that for this review, both these approaches had some disadvantages:

- The leisure time function does not capture other activities people may require electricity for, such as cooking. Further, it does not interact directly with customers, or easily allow us to examine changing technology preferences and target desired customer cohorts and locations.

- Our consideration of different revealed preference approaches suggests they would not be appropriate for this review, because they are untested and would take a substantial

amount of time to design, pilot and implement. An MEI study of revealed preference approaches that we commissioned identified a number of data and methodological issues that would need to be addressed before a revealed preferences approach becomes practicable.[19] We will continue to explore this methodology for future VCR reviews.

Both PIAC and ECA support exploring different methodologies and recommend future VCR reviews consider approaches other than surveys, including revealed preference approaches, model-based methodologies, hybrid approaches, deliberative processes and customer forums. ECA notes clause 8.12 of the Rules (which forms part of the AER's VCR assessment criteria) could have the consequence of enshrining surveys as the preferred approach, and questions how long the survey methodology could remain fit-for purpose in a rapidly transforming electricity system.

We note that we have considered alternative methodologies as part of this VCR review and would continue to do so in future VCR reviews. For example, during this review we have considered the leisure time approach, a model based approach proposed by ECA, as an alternative approach.

ECA also recommends we consider how to work with regulators in similar or relevant jurisdictions to undertake international benchmarking of VCRs as it is important to test whether VCR estimates are within established norms and reflect consumer preferences, rather than methodology changes. We consider that overseas VCR estimates in similar or relevant jurisdictions may provide a useful point of comparison. We note that further consideration would need to be taken to consider how useful they could be to ensuring Australian VCR estimates reflect customer preferences in the NEM and NT. For this review we were not able to undertake a detailed international VCR benchmarking exercise in the time available to complete the review. However, we took into account the leisure time approach proposed by the ECA and the advice of the Committee in setting our WTP cost prompts and in considering the appropriate approach to developing a cap on the maximum value a rational consumer would pay for reliability. We also intend to compare our VCR results to estimates derived using the leisure time approach.

Given the general stakeholder support for our *Draft decision* for a survey based methodology for standard outages we do not propose to make changes to the methodology for our *Final decision*. For future VCR reviews we will revisit the different approaches to determining VCR taking into account stakeholder recommendations for future reviews, including re-examining revealed preference and model based approaches.

Submissions also suggested we publish additional information along with VCR values. In particular, ENA, Evoenergy and PIAC called for us to report:

- the confidence range for VCR values for sensitivity analysis

- data on survey responses around and exceeding the WTP cap, to help clarify the rationale for the cap amount and the exclusion of any outliers

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[19]   Melbourne Energy Institute, Estimating values of customer reliability using revealed preference approaches, July 2019. Available at https://www.aer.gov.au/system/files/AER%20-%20Values%20of%20Customer%20Reliability%20Review%20-%20MEI%20report%20-%20July%202019.pdf.

- survey sample sizes and data on dwelling characteristics, type of energy supply and use of distributed energy resources (DER).

Where possible, this information will be included in our report on final VCR values, which will be published in in December 2019.

3.3.2 Direct cost survey for large business customers with peak demand of 10 MVA per annum or more

Our *Draft decision* is to adopt a direct cost survey approach similar to that used by AEMO in 2014. Key changes we made to the survey were expanding it to include large distribution-connected customers with a peak demand of more than 10 MVA per annum as well as transmission-connected customers, and making some minor amendments to the survey design. Large distribution-connected customers are likely to have similar characteristics and reliability needs to transmission-connected customers, making them well-suited to answering a direct cost survey. This approach enabled us to reach a greater number of large businesses and to improve the survey response rate.

The direct cost survey meets our methodology assessment criteria. For example, by engaging directly with customers and asking about the costs each incurs from outages, direct cost surveys elicit a good reflection of current customer reliability preferences fulfilling assessment criteria 1 and 3. The survey applies to all customers in the NEM who meet the eligibility requirement from all geographic locations and varied industries. We intend to segment the values into a number of different industry groups, subject to survey response rates, ensuring they are applicable to a wide range of uses, hence fulfilling assessment criterion 2.

We received no submissions in response to our proposed methodology for large business customers. Accordingly our *Final decision* on methodology for large business customers is to uphold our *Draft decision.*

3.3.3 Converting survey results into dollar per kilowatt values and aggregating VCR values

The results obtained from the VCR survey techniques used to derive standard outage VCRs need to be converted into $/kWh values and aggregated to be used in the applications we have identified. Our *Draft decision* proposes to use broadly the same approach as AEMO did in 2014, with updated data. We considers AEMO's approach remains appropriate to convert survey results into $/kWh values and produce aggregate VCR values (such as regional and NEM values).

We received no submissions commenting directly on the proposed methodology for converting survey results into dollar per kilowatt values and aggregating VCR values. Accordingly, our *Final decision* on converting survey results into dollar per kilowatt values and aggregating VCR values is to uphold our *Draft decision.*

Stakeholder submissions did raise a number of issues related to the conversion of survey results into dollar per kilowatt values and aggregating VCR values. ECA stressed the importance of ensuring the consumption data used is robust and fit-for-purpose, and

requested the AER discuss this with the VCR Consultative Committee. We had an initial discussion with the VCR Consultative Committee on potential consumption data sources at the 30 October meeting and will provide a further update on the sources of consumption data we will use on the 18 November meeting.

MEU, ENA and Evoenergy also sought clarification on the level of aggregation of published VCR values. We intend to produce regional (including ACT) and NEM-wide VCR values by load-weighting the more granular residential, business and large business VCR values which we obtain from our survey results.

3.3.4   Widespread and long duration outage VCRs

Our *Draft decision* includes a mechanism for producing VCRs for widespread and long duration outages with a total impact ranging from 1-2 gigawatt hours (GWh) to 15 GWh of unserved energy. We identified uses for these VCRs in the Reliability Panel's System Restart Standard Review and assessment of protected events, and as an input in potential recommendations arising from the AEMC's Black System Event Review. We propose using a macroeconomic modelling methodology, supplemented by other appropriate approaches to derive a widespread and long duration outage cost curve describing the impact of outages of increasing severity on VCR.

The *Draft decision* considers a macroeconomic approach preferable to survey techniques because of the need to account for costs beyond an individual affected by an outage, such as economy-wide costs, flow-on costs, or other costs borne by society. It was not clear how a survey approach would capture these costs (assessment criterion 1). Further, survey respondents would encounter great difficulty answering questions about severe outages that have either rarely occurred or have yet to occur in the NEM.

Ausgrid, ENA, Evoenergy, and PIAC all support the proposed macroeconomic modelling approach for widespread and long duration outage VCRs.

ENA considers it important that widespread and long duration outage VCRs are available for inclusion in the 2020 final ISP and for NSP RITs. It notes these values should relate to the conditions (such as ambient temperature) under which the energy-at-risk is incurred.

Given stakeholder support in response to our *Draft decision* to use a model based methodology to determine VCR values for widespread and long duration outages we will continue to develop this methodology and propose to publish VCR values in early 2020.

We have engaged ACIL Allen to conduct a study into the costs associated with widespread and long duration outages. The methodology uses a combination of techniques to estimate the costs of widespread and long duration outage scenarios for residential, commercial and industrial customers, as well as broader societal costs not captured in individual residential or commercial and industrial customer costs.

We intend to develop a "toolkit" or "calculator" allowing stakeholders to specify the widespread and long duration outage scenario to be considered by inputting the timing and physical extent of the outage, as well as the relevant climate zones, remoteness categories and load proportions of different economic sectors and residential customers affected by the outage.

Commercial and industrial costs are estimated by constructing Input-Output tables[20] and multipliers, and developing energy intensity values (the amount of gross value added to the economy per unit of electricity) for each sector of the economy. These energy intensity values are then multiplied by the stakeholder's specified load proportions by sector to calculate the costs of the outage. A further adjustment is made to take into account the extent to which different sectors are able to respond to outages and recover a proportion of the value lost due to the outage.

Residential costs are estimated by applying severity factors to the VCRs derived through the survey methodology. The relevant residential VCRs will depend on the affected climate zone and remoteness categories that have been specified by the stakeholder. These severity factors have been developed with regard to an extensive review of the literature relating to widespread and long duration outages.

The literature review has also allowed the identification and, where possible, quantification of social costs. These social costs are applied as a multiplicative factor to the commercial and industrial and residential costs.

3.3.5   Annual adjustment mechanism

Our *Draft decision* proposed to adjust VCR values on an annual basis using a CPI-X approach, where X is set to zero. We flagged a preference for a CPI-X approach in our *Consultation update paper*, where X would include the key drivers of annual change in customer reliability preferences that could increase or decrease VCR values. However, further research revealed a number of practical difficulties in calculating X and considerable risk in miscalculating it.

A number of stakeholders have raised the potential future take-up of new technologies as influencing future reliability preferences, increasing or decreasing VCR values. For example, stakeholders have mentioned solar, batteries and electric vehicles. We have considered these and a range of other potential influences on reliability preferences that could be included in an X factor. These include factors that influence the value customers place on reliability, as well as influences on their consumption of electricity - both of which can change VCR values. It is also likely that different factors could influence changes in VCR from year to year, or influence VCR by a different magnitude. This makes the task of defining the particular factors to include in X difficult.

Another difficulty is how to measure the effect of these changes on VCR values. For example, household solar and battery installations may decrease VCR values if batteries are configured to operate during an outage, however, we understand most are not. Therefore household battery ownership cannot be assumed to be a predictor of lower VCR values. Similarly, whether batteries owned by businesses lower their reliance on grid-provided electricity depends on the size of the battery compared to business operations, whether it is configured to operate during an outage and how it is used by the business. For example, if the battery is small compared to the size of business operations it may only provide limited

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[20]   Input-Output tables provide detailed information about the supply and use of products in the Australian economy, and the structure of, and the relationships between, Australian industries. See ABS, Catalogue number 5209.0.55.001 - Australian National Accounts: Input-Output Tables.

supply during an outage to wind down business operations and avoid equipment damage, or it could be used only to lower peak demand tariffs rather than provide backup supply. These uses would have little effect on a business' VCR. To determine the influence of batteries on VCR values it is necessary to isolate the influence on reliability from other benefits relating to managing electricity costs.

The influence on VCRs from electric vehicle take-up is similarly uncertain, depending on where the battery is charged and how it is used. For example, if charged at home, electric vehicles may increase household VCR values. Alternatively, if as is envisaged, car batteries are used in the future to provide back-up supply to households during an outage, or charged at high voltage charging stations at shopping centres or highways, they could lower VCRs.

The difficulties in determining factors that may influence changes in reliability preferences, as well as the direction and magnitude of changes in VCR values influenced by these factors mean that X cannot be determined with certainty. In addition, we do not consider it appropriate for the annual adjustment mechanism to be employed to make large scale changes to VCR values. We consider that broader changes in customer preferences or consumption are better measured through full scale VCR reviews.

Because of this, we have adopted an annual adjustment mechanism that provides an inflation-only adjustment to maintain the real value of VCRs. However, due to strong stakeholder support, based on a desire to signal the need to consider the impact of emerging technologies on VCR in future VCR reviews, we have retained X in the formula and set it to zero. We note that X remains undefined in our annual adjustment mechanism.

Ausgrid, Evoenergy and PIAC support our CPI-X approach, with X set to zero. PIAC notes that, given the challenges to accurately measuring X, more regular recalculations of VCR may achieve similar or better results. ECA considers our approach to annual adjustments pragmatic, but suggests we remain open to a positive value for X. It submits that setting the initial value of X to zero results in a risk that the annual adjustments could lead to 'overshooting' given the transition underway in the electricity market, and this risk needs to be monitored and mitigated.

While we recognise the potential value of retaining X in the formula to enable the annual adjustment mechanism to take account of real changes to VCR values, we consider the difficulties in determining factors to include in X and in gauging the effect of these factors on VCR values are likely to remain an impediment to calculating a non-zero X. Therefore, whether we retain X in the annual adjustment mechanism in the future is uncertain, especially if prior to the next review we can identify an alternative method to directly capture these effects. We welcome further discussions with stakeholders on how real changes in VCR could be monitored annually, prior to the next review.

We have adopted CPI as a measure to adjust VCRs as it is the most recognisable inflation measure with a broad-base enabling it to capture a wide range of uses for energy in society and the values attached to them. To measure CPI changes we will apply the annual percentage change in the Australian Bureau of Statistics' (ABS) consumer price index

(CPI)[21] all groups, weighted average of eight capital cities, for the four quarters preceding the most recently reported figure.[22] The use of this CPI measure and approach is consistent with the indexation employed elsewhere by the AER, for example to index network business' regulatory asset bases. For example, to publish annual adjustments in December, we will use the reported CPI figures for the four quarters preceding September, which are the most recently reported figures available. A detailed explanation of how this the change in CPI is calculated has been added to the VCR methodology.

3.3.6   Momentary outages

Momentary outages are outages lasting less than three minutes. For our *Draft decision* we decided not to include a methodology to calculate VCR values for momentary outages. This was because we have not identified any current or potential applications for momentary outage VCRs.

However, we plan to gather and report information on momentary outages through our surveys. Residential and business survey respondents would be asked how much they would be willing to pay, if anything, for investment in the electricity network to address momentary outages. Large business customers would be asked whether any investment in back-up generation has been undertaken to help mitigate the impact of momentary outages.

We noted in the *Draft decision* we would publish the results from the information we collect on momentary outages through our surveys. We consider the results may help inform the development of regulatory incentives or mechanisms to address momentary outages and form the basis of a methodology for momentary outages in future VCR reviews.

Submissions did not raise any issues with our *Draft decision* not to include a methodology for momentary outages for this VCR review. Accordingly, our *Final decision* is to uphold the *Draft decision* not to include a methodology to derive momentary outages.

3.3.7   Transitioning to new VCR values

Submissions also discussed the transition process from current VCR values to the new values. Evoenergy consider it may be necessary to implement a smooth transition path if the new VCR values are materially different from existing values. PIAC note smoothing should only be undertaken where there is a net customer benefit in doing so.

Several submissions from network businesses suggest we provide further information on the timing and method of transition to new VCRs in RITs and revenue proposals, including planning assessments that have recently or will shortly commence. ENA recommends the AER hold a workshop with network planners and third party practitioners to develop a common understanding on the implementation of VCR values.

ECA and PIAC recommend the AER develop a guideline for the use and application of VCR values as AEMO did in 2014, and as the AER has for other processes. PIAC further recommend the AER consider seeking a rule change to make the guideline binding.

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[21] ABS, Catalogue number 6401.0, Consumer price index, Australia.
[22] ABS, Catalogue number 6401.0, Consumer price index, Australia.

As a general principle, we consider assessment processes beginning after the publication of final VCR values should use the newly published VCR values. For those processes that are already underway, we consider the new VCR values should only be used if they are materially different from existing VCR values.

We will give further consideration to the development an application guideline. Following the publication of the VCR values, we will monitor the use of VCR values to check they are being applied correctly. We encourage those applying the VCR to contact us to work through any application issues that they may identify.

4 Methodology

This chapter sets out our *Final decision* on a methodology to calculate values of customer reliability.

Note on VCR WALDO methodology, September 2020

From March to June 2020, we consulted on the draft model for estimating widespread and long duration outages. In light of the lack of support among stakeholders for the draft model, the VCR methodology was updated to remove the Widespread and Long Durations methodology.[23]

4.1 VCR final methodology

Our review has found there are two categories of unplanned outages for which we should derive VCR values, taking into account current and potential applications of VCR standard outages with a typical duration equal to or less than 12 hours.

The VCR methodology also sets out our approach to the annual adjustment of the VCRs which we will publish at the end of this review.

The VCR methodology is set out in Tables 4.1 to 4.3 below. It is also published on the AER website separate to this *Final decision* document and serves as a standalone statement of the final methodology.

Table 4.1: Methodology for standard outages

Standard outages	
Residential and business customers with a peak demand of less than 10 MVA	Stated preference surveys using combined contingent valuation and choice experiment techniques.
	Contingent valuation
	The contingent valuation technique asks a respondent two closed questions followed by one open-ended question about their willingness to pay (WTP) to avoid two unexpected power outages a year (the baseline scenario) affecting either the home of a residential customer or the specified place of business of a business customer.
	Each unexpected outage in the baseline scenario occurs on a different random weekday in winter and lasts for one hour during off-peak times. Each outage only affects the local area.
	The closed questions present a respondent with a bill increase of $x and ask the respondent to indicate (YES or NO) as to whether they would be willing to pay the $x bill increase to fund network investment and avoid the baseline scenario.

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23 For more detail on the reasons for our decision and a summary of the issues raised by stakeholders, please refer to our VCR Final Conclusions document.

The bill increase of $x for the first closed question is randomly selected. The second closed question is double the first cost prompt if the respondent answers YES to the first question and is half the first cost prompt if the respondent answers NO to the first question.

The initial cost prompts for residential customers are the following monthly bill increase amounts: $2, $3, $4, $5, $6, $7, $8 and $9.

The initial cost prompts for business customers are the following bill increase percentage amounts: 1%, 2%, 3%, 4%, 5%, 6%, 7%, 8%, 9% and 10%.

The open-ended question following the closed questions asks respondents to indicate the maximum bill increase they would be willing to pay to avoid the baseline scenario.

Responses to the open-ended question are capped. For residential customers the cap is $22 per month, which is the approximate cost of a backup power system which can supply a household for the duration of the baseline scenario.[24] Where a respondent enters a value more than the cap, they will be asked a follow up question as to whether they would be willing to pay $22 per month to install the described backup power system. If the respondent answers NO, they will then be presented with an open-ended question asking them how much they would be willing to pay to install the described backup power system.

For business customers the cap is equal to 100 percent of their indicated electricity bill.

Choice experiment

The choice experiment technique asks respondents to identify their most preferred option out of a series of choices with different outage characteristics such as duration, severity (widespread / localised), time of day, time of week and time of year they occur in. The trade-offs customers make in choosing between options with different characteristics are used to determine the relative value respondents place on each of these attributes.

The choice experiment technique presents respondents with eight different sets of three hypothetical outage scenarios that ask respondents to select their preferred outage scenario in each set. Each outage scenario includes a specified bill discount which a customer would receive if they choose to accept the outage scenario.

Each set of outage scenarios contain the baseline scenario with no bill discount. The other two scenarios in each set are variations of the baseline scenario with changes to the severity (level) of one or more attributes (characteristics) of the outage. The attributes and levels tested in the choice experiment are:

- Outage duration: 1 hour, 3 hours, 6 hours and 12 hours

- Geographic impact: 'localised' and 'widespread'

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24   Appendix 4 of our *Draft decision* discusses how we set the cap of $22 per month.

- Time of day: Peak time and Off-peak time

- Season: Summer or Winter

- Day of the week: Weekday or Weekend

- Bill discount (residential): no change, $3 per month, $7 per month and $15 per month

- Bill discount (business), no change, 1%, 2% and 3%.

Business customers with peak demand of equal or greater than 10 MVA	*Direct cost survey* The direct cost survey asks respondents to outline and quantify the actual costs they expect to incur as a result of an unplanned outage affecting their identified business site. There are two versions of the survey - one for business sites with continuous 24/7 operations and one for business sites with non-continuous operations. For customers with continuous 24/7 operations, respondents are asked to outline and quantify the costs they would expect to incur in an unplanned outage of the following durations: 10 minutes, 1 hour, 3 hours, 6 hours, 12 hours, 24 hours and 48 hours. For customers with non-continuous operations, respondents are asked to outline and quantify the costs they would expect to incur for: - unplanned outages that start at peak times (between 7am and 10am, or 5pm and 8pm on a weekday) for the following durations: 10 minutes, 1 hour, 3 hours and 6 hours - unplanned outages that occur at off-peak times (anytime except between either 7am and 10am or 5pm and 8pm), on a weekday for the following durations: 10 minutes, 1 hour, 3 hours and 6 hours - unplanned outages that start at any time and have the following durations: 12 hours, 24 hours and 48 hours.

Table 4.3: Methodology for annual adjustment mechanism

Annual adjustment mechanism

Published values will be adjusted on an annual basis using a CPI-X approach, where X is set to zero. This ensures that in economic terms, real values of VCR are maintained between VCR reviews.

Due to the lack of available information on what the key drivers of changes in customer reliability preferences are and how they affect VCR, X is set to zero. We consider these difficulties are likely to remain an impediment to calculating a non-zero X in the near future. The AER welcomes further discussions with stakeholders on how real changes in VCR could be monitored annually, prior to the next review.

To measure CPI changes we will apply the annual percentage change in the Australian Bureau of Statistics' (ABS) consumer price index (CPI) all groups, weighted average of eight capital cities, for the four quarters preceding the most recently reported figure.[25] For example, to publish annual

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25 ABS, Catalogue number 6401.0, Consumer price index, Australia. We note this measure is consistent with our approach to indexation employed elsewhere by the AER, for example to index network business' regulatory asset bases.

adjustments in December, we will use the reported CPI figures for the four quarters preceding September, which are the most recently reported figures available.

ΔCPI_t is the annual percentage change in the ABS CPI All Groups, Weighted Average of Eight Capital Cities[26] from the September quarter in regulatory year t–2 to the September quarter in regulatory year t–1, calculated using the following method:

The ABS CPI All Groups, Weighted Average of Eight Capital Cities for the September quarter in regulatory year t–1

divided by

The ABS CPI All Groups, Weighted Average of Eight Capital Cities for the September quarter in regulatory year t–2

minus one.

For example, for the 2021 regulatory year, t–2 is September quarter 2019 and t–1 is September quarter 2020; and for the 2022 regulatory year, t–2 is September quarter 2019 and t–1 is September quarter 2020 and so on.

Table 4.4: Methodology for converting VCR survey results into dollars per kilowatt hour ($/kWh) VCR values and aggregating values

Converting survey results into dollars per kilowatt hour ($/kWh) and aggregating values	
Deriving $/kWh standard outage VCR for each residential segment	For each residential customer segment, the contingent valuation and choice experiment results are combined to produce a dollar value for a range of outage scenarios relevant for customers in that segment.
	To convert into $/kWh values, the dollar value are divided by an estimate of the consumption which a residential customer would have consumed over the period had the outage not occurred. This estimate is based on residential consumption data obtained from one or more of the following sources:
	• the residential survey
	• network business data, or
	• other available sources (actual or estimated) of residential consumption data.
	An aggregate $/kWh for each residential cohort is derived by summing the probability-weighted $/kWh VCR of each outage scenario. The probability for each outage scenario is based on estimates derived from historical network outage data.

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26   If the ABS does not or ceases to publish the index, then CPI will mean an index which the AER considers is the best available alternative index.

Deriving $/kWh standard outage VCR for each business segment with a peak demand of less than 10 MVA	The contingent valuation and choice experiment results for each business segment are in % of bill terms. These results are converted to dollar terms using estimates of business customer bills. Different bill assumptions may be used to account for consumption size and/or business sector.
	The dollar contingent valuation and choice experiment results are combined to produce a dollar value for a range of outage scenarios relevant for customers in that segment.
	To convert into $/kWh values, the dollar value is divided by an estimate of the consumption which a business customer would have consumed over the period had the outage not occurred. This estimate is based on business consumption data obtained from:
	• the business survey
	• network business data, or
	• other sources (actual or estimated) of business consumption data.
	An aggregate $/kWh for each business cohort is derived by summing the probability-weighted $/kWh VCR of each outage scenario. The probability for each outage is based on estimates derived from historical network outage data.
Deriving $/kWh standard outage VCR for business customers with peak demand greater than or equal to 10 MVA	The responses from the direct cost survey produce a dollar value for the outage scenarios asked in the survey.
	To convert into $/kWh vales, the dollar value for each outage is converted using energy consumption data obtained from the direct cost survey.
	An aggregate $/kWh for each business customer is obtained by summing the probability-weighted $/kWh VCR of each outage scenario. The probability for each outage is based on estimates derived from historical network outage data.
	The aggregate $/kWh for each response is load-weighted with other direct cost survey response, on the basis of industry or sector groupings, to produce a combined industry or sector $/kWh VCR.
Aggregating VCRs	Aggregate VCRs for a particular area or region are derived by load-weighting the relevant aggregate residential and business cohort VCRs (including combined aggregate industry or sector $/kWh VCRs for business customers with peak demand greater than or equal to 10 MVA).

5   Next steps

5.1 Publication of VCR values

We have a statutory timeframe to publish VCR values for standard outages by 31 December 2019.

Our survey work closed on 23 October 2019. With the assistance of MEI and KPMG/Insync, we are currently in the process of deriving VCR values from the survey results. These VCR values for standard outages will be ready for publication in mid-December 2019.

5.2 Implementation of methodology for widespread and long duration outages

We have engaged ACIL Allen Consulting to undertake a study of the costs associated with widespread and long duration outages. This will be one of the first studies examining widespread and long duration VCRs. Due to the novel nature and complexity of this work we will take additional time to ensure the robustness of our approach and confidence in our results. Thus, we anticipate the results of this study will be published in the first quarter of 2020.

5.3 Project timeline

Our project timeline with our next key deliverables is set out in table 5.1.

Table 5.1: VCR Review Project Timeline

Key milestones	Date	Status
Consultation paper published	19 October 2018	Completed
VCR Consultative Committee established	October 2018	Completed
Stakeholder submissions to Consultation paper	16 November 2018	Completed
VCR Consultative Committee meeting #1	28 November 2018	Completed
Sydney Public forum	5 December 2018	Completed
Melbourne Public forum	6 December 2018	Completed
Presentation to Customer Consultative Group (CCG)	11 December 2018	Completed
Further stakeholder submissions in response to Consultation paper and key issues raised at public forum and CCG	20 December 2018	Completed
All day workshop with MEI, KPMG/Insync on VCR methodology	17 January 2019	Completed

VCR Consultative Committee meeting #2 – VCR methodology and survey design	7 February 2019	Completed
VCR HILP Subcommittee meeting #1 – how to determine HILP VCR	14 March 2019	Completed
Commence pilot	End April to 24 May 2019	Completed
Publish Consultation update paper on methodology	Mid–April 2019	Completed
VCR HILP Subcommittee meeting #2	23 May 2019	Completed
Submissions to Consultation update paper	24 May 2019	Completed
KPMG/Insync report on pilot survey results	June 2019	Completed
VCR Consultative Committee meeting #3 to discuss draft pilot survey results	13 June 2019	Completed
VCR Consultative Committee meeting #4 further discussion of pilot survey results	25 July 2019	Completed
VCR Consultative Committee meeting #5 to discuss Draft decision methodology	29 August 2019	Completed
Conduct main survey (including direct cost survey)	September/October 2019	Completed
Publish Draft decision on methodology	18 September 2019	Completed
Commence development of macro-economic model to derive widespread and long duration outages	October 2019	Completed
Submissions to Draft decision close	18 October 2019	Completed
VCR Consultative Committee meeting #6 to discuss customer energy use profiles and outage probabilities to derive $/kWh VCRs, and stakeholder responses to Draft decision	30 October 2019	Completed
Develop detailed methodology for widespread and long duration outages	October/November 2019	Completed
Undertake modelling work for widespread and long duration outages	November 2019	
VCR Consultative Committee meeting #7 to discuss final VCR values and update on widespread and long duration outage modelling work	18 November 2019	
Publish Final decision on methodology	26 November 2019	
KPMG/Insync main survey report	End-November 2019	

Publish final VCR values for standard outages up to 12 hours	Mid-December 2019
VCR public forum on VCR values for standard outages	Mid-December 2019
Publish VCR values for widespread long duration outages	Q1 of 2020

Appendix 1 – Submissions to Draft decision and AER response

Issue	Party	Summary of Submissions	AER Response
Survey methodology: General comments about choosing a methodology	Energy Consumers Australia (ECA), Energy Networks Association (ENA), Evoenergy, Public Interest Advocacy Centre (PIAC)	ECA is supportive of the inclusion of assessment criteria. However it noted the requirement set out in clause 8.12 of the National Electricity Rules (the Rules), which forms part of the AER's VCR assessment criteria, that the current and all future methodologies "must include a mechanism for directly engaging with customers which may include the use of surveys". It submits that this requirement could have the consequence of enshrining surveys as the preferred approach. ECA notes that alternative approaches, including a hybrid approach and the use of deliberative processes or customer forums, should be considered in the future. ECA also notes that the increasing ability of consumers and local technology to respond quickly to manage reliability risk (as seen during 2017 heatwaves in NSW and the ACT) must be considered in reaching the VCR decision. PIAC generally supports the Draft decision, commending the AER for its process to develop a robust, relevant and fair VCR. It also suggested future reviews should incorporate revealed preferences methods, and model based approaches to align with approaches adopted internationally. It also supports direct customer engagement with deliberative face-to-face engagement. ENA suggests the AER revise the following matters before finalising the methodology: • determine what is being published and specify criteria for assigning the data to a network segment to ensure consistent applications of VCR • indicate the confidence range for VCR values. This information would be applied by NSPs, for example in the conduct of sensitivity analysis when undertaking Regulatory Investment Test processes. • clarify the range and distribution of responses around the $22 cap and the rationale for exclusion of outliers. Similarly, Evoenergy submits that it would be beneficial for the AER to publish: • a confidence range for the updated VCR values which can be used to undertake sensitivity analysis • data on the number of survey responses exceeding the WTP cap, and any survey results regarding customer WTP for backup power systems.	Regarding the ECA's concerns around the requirements in clause 8.12, we considered that it requires us to ensure the methodology includes a mechanism for direct engagement. The use of surveys is highlighted in the clause as one example of a form of direct engagement. Thus, we do not consider clause 8.12 requires the AER to favour survey approaches over other forms of customer engagement. As set out in our Draft decision and this Final decision, in developing our methodology we have considered different techniques other than survey approaches. For future reviews we will re-examine the methodologies to determine VCR to ensure the methodology remains fit-for-purpose. This will include consideration of the use of revealed preference techniques, model-based approaches, testing of alternative approaches against international studies and more deliberative face-to-face customer engagement. We note that we have considered alternative methodologies as part of this VCR review and would continue to do so in future VCR reviews. For example, during this review we have considered the leisure time approach, a model-based approach proposed by the ECA, as an alternative approach. We also intend to compare our VCR results to estimates derived using the leisure time approach. In December 2019 we will publish our survey results and the $/kWh VCR values derived from these results. This will include NEM and regional VCR values derived from weighting the VCRs of the appropriate customer segments. The exact granular survey results and VCR values which we publish will not be definitely known prior to the methodology being finalised as they will be driven by the survey responses. We will endeavour to provide initial views on criteria to assign data to network segments but this is a question of application that may require further discussion with stakeholders following the publication of the VCR values. We will publish confidence ranges of VCR values where possible and include information of the distribution of responses around the $22 residential cap which will be published in our Final report on VCR values in December 2019.

Survey methodology:	Ausgrid, ECA, Major Energy Users (MEU), Evoenergy, PIAC	Ausgrid supports the survey approach, including the proposed modifications and improvements to the AEMO 2014 study.	In relation to PIAC's comments, we recognise the difficulty in mitigating respondent incentives to over- or understate costs in direct cost surveys. Our approach in this VCR review to build on and improve AEMO's 2014 VCR study also extends to the direct cost survey. We made a number of improvements to the survey to make it easier to follow, and to make the questions more precise and clear with the purpose of eliciting factual responses and avoiding over or understating costs. In future VCR reviews we will seek to continue improving the VCR methodology to ensure more accurate estimates of customer reliability are obtained.
About the adopted methodology		The MEU considers that the proposed methodology is sound and should deliver appropriate values for VCR.	
		Evoenergy broadly agrees with the major components of the AER's methodology.	
		PIAC considers large energy users, particularly those on transmission networks may have an incentive to overstate their preference for reliability given they do not pay the full cost. It suggests the AER seek to mitigate the incentive for large users to overstate their reliability preferences.	
		Similarly, ECA is broadly supportive of the overall approach set out in the Draft decision, but notes that it is an open question as to how long the methodology can remain fit-for purpose in a rapidly transforming electricity system.	We note the ECA's concerns that the methodology may not remain fit-for purpose for long in a rapidly transforming electricity system. We are required to undertake reviews of the VCR methodology at least every five years. Through this process we will be able to make changes to the methodology to ensure it remains fit-for purpose. If we see evidence of a substantial shift in customer reliability preferences as a result of changes in the electricity system, we would consider bringing forward the next review.
		ECA proposes that the AER consider how it might work with regulators in similar or relevant jurisdictions to undertake international benchmarking to test whether VCR estimates are within established norms. It considers this is important in the context of:	
		• survey methodology issues (including the difficulty of stated preference surveys to properly communicate with respondents, frequent changes in methodology and sample variations) that create uncertainty as to whether estimates reasonably reflect customer preferences	We consider that overseas VCR estimates in similar or relevant jurisdictions may provide a useful point of comparison. However further consideration would need to be taken to consider how useful they could be to ensuring Australian VCR estimates reflect consumer preferences in the NEM and NT. For this VCR review we were not be able to undertake a detailed international VCR benchmarking exercise in the time available to complete the review.
		• significant shifts in Australian VCR estimates over time that cannot be explained as changes in consumer preferences	
		• Australian VCR estimates being high by international standards.	
		Given these factors, ECA submits that it is critical to ensure that trends in estimates over time can be explained by shifts in consumer preferences, rather than being an outworking of methodology changes. It notes that KPMG/Insync's VCR Pilot Survey report shows that when the methodology is held constant, consumer preferences have declined in real terms between the 2014 and 2019 VCR surveys.	We recognise it is desirable that changes in VCR be attributable to changes in consumer preferences rather than methodological changes. However, it would not be desirable to maintain elements of a methodology which we consider flawed. As set out in the Draft decision, we decided to change the contingent valuation survey question to allow for customers to provide a more accurate indication of their willingness to pay to avoid the baseline outage. While this may result in changes in the VCR values which result from methodological changes it should ensure the VCR is more reflective of customer preferences.
		ECA also submits that it is important that the data on consumption is robust, and fit for purpose, and would appreciate advice from the AER on the sources for consumption data at the next Consultative Committee meeting.	At the 30 October VCR Consultative Committee meeting the AER discussed sources of consumption data and how they may be used to help derive final VCR values. Further information will be provided to members at the VCR Consultative Committee on 18 November. The sources of consumption data and how we use them to derive VCR values will be published in our Report

			accompanying the VCR values for standard outages in December 2019.
Sample size and diversity	Evoenergy	Evoenergy would welcome the AER publishing key statistics from the VCR surveys, including sample sizes and the number of responses across jurisdictions and customer types	The AER's decision on final VCR numbers will be published in December 2019. This publication will include key statistics from the VCR surveys, including sample sizes and the number of responses across customer types
Potential bias	PIAC	PIAC supports the AERs work to remove biases from the survey.	
Direct cost survey	Ausgrid, ENA	Ausgrid considers the AER should have a VCR segment for major transport and infrastructure customers, as these customers: • typically have continuous 24/7 operations • have VCR expectations that are likely to vary from other conventional manufacturing and process industries • have made long-term project investments with electricity requirements in various NEM regions. ENA also proposes a segment for transport infrastructure, which would be helpful given the significant levels of infrastructure spending currently being undertaken by governments and the significant community impacts should this infrastructure not be undertaken.	We explored the option of a VCR segment for major transport and infrastructure customers. However, it is unlikely we will be able to obtain sufficient customer responses in this segment to produce a separate major transport and infrastructure VCR.
Customer VCR segments	MEU, PIAC, ENA, Evoenergy	PIAC supports VCR segmentation by climate zone and remoteness for residential customers. The MEU considers the AER should determine what level of aggregation it will adopt for VCR values. It considers that the VCR should be calculated on a NEM regional basis (with and without direct connect customers, as AEMO did). The MEU has concerns about using VCRs at a sub-regional level, noting that VCRs are averages with large margins for error. ENA considers it critical the VCR methodology provide values for different customer segments, outage types, ambient temperature and locations, and that it also provide guidance on how these values should be combined and used. ENA considers VCRs appear to be segmented by climate zone and remoteness and not by a NSPs' local area. It queries how the probability weighted data will be used. Evoenergy would welcome clarification from the AER on whether a distinct VCR will be derived based on survey results from the ACT. It considers that a robust analysis requires developing VCR values for the ACT as distinct from the NSW NEM region, reflecting the composition and preferences of the ACT's customers.	We are still finalising segmentation of VCR values. Final VCR values will be published in our Final report on VCR values in December. Final segmentation of VCR values will reflect the number of survey responses we receive for each customer cohort as well as whether there are statistical differences between cohorts. We will segment residential customers by climate zones and by suburban and regional cohorts within climate zones. We will also separately derive VCR values for the Northern Territory. This differs from AEMO's 2014 segmentation of residential customers by state. Our proposed segmentation reflects our analysis of survey data which shows that climate zone is a key driver in determining customer responses to outages. Our analysis of business responses suggests we will be able to segment by more business sectors than AEMO did in its 2014 study. In 2014 AEMO segmented business VCR values into agricultural, industrial (at least covering manufacturing and mining) and commercial sectors. We anticipate also segmenting by agriculture, industrial (manufacturing and mining) and a few different commercial sectors, such as construction, retail, health and safety. We have not yet finalised these segments. We are still calculating VCR values for large business customers (those that received the direct cost survey). However, we anticipate

			developing VCR values for the following large business sectors: Mines: including coal and gold mines, and goods transport Metals: including steel and other metals refining and processing plants Manufacturing: including a range of industries such as pulp and paper, explosives, medical grade gasses and agriculture inputs See AER comments under 'Application of new VCRs (including transition)' for guidance to be provided on the use of and application of the new VCRs.
Widespread and Long Duration Outages methodology	Ausgrid, ENA, PIAC	PIAC supports the use of macroeconomic modelling to calculate VCRS for widespread and long duration outages. Ausgrid considers the proposed macro-economic modelling approach is appropriate for estimating widespread and long duration outage VCRs. ENA supports the development of VCRs for widespread and long duration outages and the macroeconomic approach to develop them. ENA comments these values will take into account economy wide flow-on costs, and other costs borne by society, that extend beyond those experienced by individuals. Ensuring these values are available for inclusion in the 2020 final ISP and for NSP RITs is important. In particular, VCRs should relate to the conditions under which the energy at risk is incurred. For example, if the energy at risk is only being incurred on days of extreme heat, VCRs applied to the energy at risk should relate to the ambient temperature.	We will use a model-based approach to calculate a $ per MWh value for widespread and long duration outages. The $ value will be made up of residential, commercial and social costs. Each of the residential, commercial and social costs will be calculated separately using a separate methodology and then combined into a single widespread and long duration VCR value. Users will be able to enter high level inputs including the: • timing of the outage (season, day of week, start time) • location of the outage (climate zone, remoteness and wideness of the outage). • load impacted by the outage • composition of industrial load by industry sector (according to ABS ANZIC codes, e.g. agriculture, mining, manufacturing etc.) • duration of load, or the unserved energy in a range of 1-15 GWh.
Application of new VCRs (including transition)	Ausgrid, ENA, PIAC, Evoenergy, Energex & Ergon Energy	PIAC advocates for an application guideline to accompany the Final decision which sets out principles covering the interpretation and application of VCR values, the limited circumstances in which alternative VCRs may be appropriate, and acceptable approaches to develop alternative VCRs. This guideline would support the NEO by: • ensuring consistent application of VCRs • providing certainty for businesses, consumers and others • minimising regulatory compliance burden and limiting the grounds on which businesses may seek judicial review of AER decisions regarding VCR. PIAC also suggests the AER seek a rule change to make such a guideline binding. Similarly, ECA submits that an important next step in the process should be the development by the AER of a	We will give further consideration to the development an application guideline. Following the publication of the VCR values, we will monitor the use of VCR values to check they are being applied correctly. We encourage those applying the VCR to contact us to work through any application issues that they may identify. As a general principle, we consider assessment processes that begin after the publication of final VCR values should use the newly published VCR values. For those processes that are already underway, that new VCR values should be used if they would result in a materially different outcome (such as changing the preferred option identified in a RIT assessment). We note currently that the 2020-25 revenue determinations for Energex, Ergon and SA Power Networks are currently underway. In the

guideline for the use and application of the VCR estimates.

Ausgrid requests the AER clarify the timing and method of transition for use of the new VCRs following publication.

ENA suggests the AER hold a workshop with network planners to clarify how the new VCRs will be included into planning for current network revenue proposals and current RITs

PIAC considers in transitioning to the new VCR values, smoothing should only be undertaken where there is a net customer benefit to doing so.

Evoenergy submits that it may be necessary to implement a smooth transition path if the new VCR values are materially different from the existing values.

Ergon and Energex consider that as the VCR values are not due to published until 31 December 2019 they will not have an opportunity to incorporate the values into their revised revenue proposal (due 10 December 2019). As such, it would be prudent to allow the existing AEMO VCR values to be use for their final revenue determinations and assessment of capital expenditure programs over the next regulatory control period.

Ergon and Energex consider that RITs which have commenced public consultation should continue to use the existing AEMO values. However DNSPs should have the discretion to reapply a RIT where the application of a new VCR would constitute a material change under clause 5.17.4(t)-(v).

Similarly, Evoenergy considers that the new VCR values should only apply to revenue proposals and regulatory investigations commencing after the publication of the updated values.

draft decisions[27] for those determinations we outlined our intention to use the latest VCRs published to set the service target performance incentive scheme (STPIS) incentive rates in the final decision.

| VCR review frequency and annual adjustment | Ausgrid, ECA, PIAC | Ausgrid supports a CPI – X model for the annual adjustment mechanism, where X is set to zero, but would like to participate in any future discussion on alternative values for X.

ECA suggests that the AER remain open to a positive 'X'. It considers that the decision to set the initial value of X to zero results in a risk that these adjustments could lead to "overshooting" given the transition underway in the electricity market. ECA would appreciate the opportunity to discuss the management of this risk in the Consultative Committee.

PIAC recommends the VCR be reviewed every 4 years rather than 5. It supports adjusting VCR by inflation between reviews, and also supports an annual adjustment mechanism with the form: CPI – X, but recognises X is difficult to calculate and that it may be better captured in full VCR reviews. | We propose that X be set at zero in the Draft decision due to the lack of information or data available to track changes in customer reliability preferences, and the lack of information to determine how changes in reliability preferences (for example, from take up of new technologies) influence VCR values. We are not aware of any new information since the publication of the Draft decision that would improve our ability to accurately measure these changes. We believe this is unlikely to change in the near future and consider that X should remain at zero.

The NER requires us to undertake a VCR review at least once every five years. We consider this an appropriate timeframe given the need to balance maintaining stability of VCR values for planning purposes, and ensuring their accuracy. |

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[27] AER, *Draft decision - Energex Energy Distribution Determination 2020-2025 - Attachment 10 Service target performance incentive scheme*, p.10-11; AER, *Draft decision - Ergon Energy Distribution Determination 2020-2025 - Attachment 10 Service target performance incentive scheme*, p.10-11; AER, *Draft decision - SA Power Networks Distribution Determination 2020-2025 - Attachment 10 Service target performance incentive scheme*, p.10-11.

However, the rules also allow us to review VCR values more frequently if necessary. If we did consider changes in the energy market had caused a shift in customer reliability preferences, we would be bring forward the next VCR review to address this, for example, if there was a substantial change in the cost of alternatives to grid connection (such as storage) or take-up of technology dependent on electricity (such as electric vehicles). We acknowledge that in practice this may be difficult to monitor, and it would also be difficult to isolate the influence this would have on reliability preferences. We would welcome further discussion with stakeholders following the review on how changes in customer preferences could be monitored prior to the next review.

We do not consider the purpose of the annual adjustment mechanism is to make substantial changes in published VCR values. Such changes should be addressed via reviews of the VCR.

Uses of VCR	PIAC	PIAC supports the use of VCRs to determine load shedding priorities, suggesting load shedding should take account of differing customer VCRs.