grid australia
BACKBONE OF THE NEM

19 April 2013

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Dear Reena

Re: Value of Customer Reliability Issues Paper

Introduction

Grid Australia is pleased to make this submission in response to AEMO's Value of Customer Reliability (VCR) Issues Paper (the Issues Paper).

The submission first provides a brief summary of Grid Australia's position on key issues before discussing some background on the use of VCR. Further comments are then provided on key issues under separate headings.

Summary of Grid Australia's position

Our position is summarised as follows:

- The potential societal costs of widespread outages are likely to materially exceed the customer interruption costs used to date in Australia to derive VCR estimates. This suggests that there is a need to distinguish between the estimated value of reliability of electricity supply to an individual customer's premises, and the estimated value of supply reliability to the community as a whole.

- All methods for estimating VCR are prone to error and uncertainty. This is because the VCR cannot be measured directly, but must instead be estimated indirectly through customer surveys. It is appropriate, therefore, to employ more than one method to estimate the VCR to better understand the magnitude of the estimation errors.

- VCR estimates are subject to significant uncertainty and measurement error. This is illustrated by the wide range of VCR estimates across NSW distributors and between those derived for NSW and Victoria. It is important that reported values of VCR highlight the inherent uncertainty in the estimates and that this is taken into account in investment analysis.

- The application of VCR in the context of transmission investment analysis typically ignores customers' exposure to high impact, low probability events. It would be helpful if AEMO's assessment on VCR also attempted to better understand customers' willingness to incur additional transmission costs in order to reduce exposure to the costs of high impact events.

Background

Grid Australia understands that VCR estimates, as currently used, are taken to represent the value that customers collectively place on the reliability of electricity supply. The VCR is expressed as a dollar amount per unit of energy not supplied (e.g. $/MWh). The VCR is used to calculate a dollar value for expected unserved energy during supply interruptions. This dollar value estimate can be used to assess the net benefit of investments that may reduce expected unserved energy (by maintaining or improving supply reliability).

Where VCRs have been applied in transmission network investment evaluation to date, typically one composite value has been used[1]. Under such an approach a single VCR value is taken to represent the same value of reliability to consumers, regardless of whether the supply interruption is caused by generation, distribution or transmission, and therefore regardless of whether the supply interruption is localised or of a widespread nature.

Distinguishing between the costs caused by localised and widespread outages

Consumers are likely to place different values on the reliability provided by a distribution network and a transmission network. This is because the scope and impacts of supply interruptions are likely to vary significantly depending on the source of the interruption. For instance, distribution network outages that cause loss of electricity supply generally affect customers in a localised area.

Transmission outages that cause loss of supply are much less frequent than distribution outages, and they generally have sub-regional impacts (affecting many suburbs, towns, or districts). Extensive transmission outages can affect very large populations across widespread areas such as cities, or across several regions.

In a report on VCR prepared for AEMO in 2011[2], Oakley Greenwood commented on the implications of this as follows:

> "In 2007 VENCorp commissioned CRA to update the sectoral and state level VCRs. The updated value determined in the study was $47,850 per MWh. However, the 2007 study was expanded to include a review of the broader social costs that could occur in the event of a widespread power outage. These costs included disruption to community services such as fire, police and/or ambulance services, but were limited to the disruption to normal services and did not include the level of demand for service that might be experienced during the

[1] It is noted that in Victoria the composite VCR is derived from a weighted average of separate VCR estimates for the domestic, agricultural, industrial and commercial sectors. Transmission connection investment in Victoria is evaluated using location-specific composite VCR estimates obtained using weighted averages of sector VCRs that reflect the composition of load by sector.

[2] Oakley Greenwood, Valuing Reliability in the National Electricity Market: Report prepared for the Australian Energy Market Operator, March 2011.

> conditions of a widespread or extended outage. Non-tangible and flow-on social disruption costs were also beyond the scope of the 2007 study. Non-tangible costs include impacts on leisure and study time, and interruptions to schools, public administration and public transportation. Flow-on costs include impacts such as trauma related to injuries/ mortalities, fear, panic, and increased incidents of crime.
>
> The value determined for social disruption cost in the 2007 study – at $1,000 per MWh – was therefore considered by the study's authors to be very conservative."

It is clear from the above statement that the VCR estimates in Victoria do not recognise the full societal costs of a widespread or prolonged outage. In the event of a widespread interruption, other infrastructure is likely to be affected, in addition to and due to the absence of electricity supply. For instance, the supply of water and sewerage services could be affected, as well as rail transport, traffic management (traffic lights, street lighting), and communications systems.

In these circumstances the value that consumers place on a reliable electricity supply should acknowledge that substitutes are unlikely to be available, and that consumers may suffer considerable detriment in addition to the direct costs of supply interruption that have been inferred from individual customer surveys.

The following comments from Oakley Greenwood's 2011 report to AEMO are consistent with this view:

> "Events which can lead to breach of the technical envelope for system security are treated as HILP [high impact low probability] events where individual end-user VCR values are only a part of the implied value at risk. In HILP events, social disruption costs are high. (For example, if a widespread outage occurs, the mitigation actions identified through the Economic Principle of Substitution may not be available. You can go out to dinner if the electricity is out in your neighbourhood, but this may not be possible if the outage has affected all of the restaurants in the city. Also, no value is ascribed to lost time - inconvenience - or the inability to contact family and friends when telecommunications networks are affected by power failure)."

Clearly, further careful consideration needs to be given to the estimation of the costs of widespread electricity supply interruptions, and to the methods that might be applied to estimate such costs. It seems clear, however, that the costs of widespread interruptions (such as those likely to be caused by transmission outages) are likely to materially exceed the customer interruption costs used to date in Australia to derive VCR estimates. It follows, therefore, that the value of the reliability provided by a distribution network is likely to be less than the value provided by a transmission network.

Methodologies for deriving VCRs

Regional/ Sectoral VCRs

The Issues Paper explains that VCRs have been calculated to date on a regional basis. Grid Australia notes that applying a regional VCR at a connection point that predominately supplies industrial load, for example, would potentially provide the wrong investment signal. This is because VCR differs materially across customer groups and, therefore, it is not necessarily appropriate to apply an average or regional VCR estimate for a particular investment project.

Grid Australia is therefore supportive of AEMO's suggestion that more granular VCRs should be developed on a national basis. More granular VCRs would facilitate improved analysis of the costs and benefits of augmentation at particular connection points. For example, suburban areas of a major city are likely to place a different value on transmission reliability from a major area of heavy industry.

Approaches to deriving VCRs

Grid Australia does not consider that any one of the possible survey-based or model-based approaches is objectively better suited than any other. Grid Australia notes that the Economic Principle of Substitution (EPS) estimation approach has been employed for VCR studies in Victoria. As noted by AEMO, this approach estimates the VCR by examining the costs of goods or services that a customer may purchase to limit their fall in utility.

Grid Australia notes that VCR estimates using the EPS approach may be systematically understated where customers do not select a substitute good or service in response to the hypothetical loss of supply. The treatment of a nil response may reflect the absence of a reasonable substitute for a continuous electricity supply, rather than a zero value for the unserved energy. As already noted, survey techniques may also ignore or under-estimate the societal impacts of a widespread or prolonged transmission outage.

More generally, estimation problems arise because VCR cannot be sampled directly. Instead, the different techniques described in the Issues Paper seek to establish VCR principally through surveys. It is important to note that the estimation techniques are inherently prone to error and uncertainty and therefore the VCR results should be treated with caution.

Grid Australia considers that AEMO should employ a number of different measuring/ estimating approaches to develop a better understanding of the uncertainty associated with the VCR estimates. For AEMO's information, Grid Australia is aware that Eskom in South Africa has worked with model-based approaches to derive VCRs.

Direct Customer Consultation

Directly connected industrial customers already have an existing relationship with their connecting TNSP. This relationship should be used to advantage to understand the value of reliability for each particular customer. Direct discussions between TNSPs and such customers could elicit a far greater degree of understanding of a customer's particular reliability needs than can be derived through generic surveys. For example, the duration of an outage is known to be of critical concern for some customers, or reliability may be valued more highly when particular items of plant are running. Whilst surveys may, if appropriately framed, obtain this information, it is lost in the process of averaging to determine a sectorial VCR expressed in terms of $/MWh.

Uncertainty in VCR estimates

Grid Australia is concerned that currently published VCRs convey a false sense of accuracy and precision. As already noted, VCR estimates are prone to error because the VCR cannot be measured directly. It can only be estimated through indirect means, such as customer surveys. Grid Australia notes that AEMO has previously recognised that an error band of +/-50% is applied

to VCR estimates in New Zealand[3]. Grid Australia considers that a range of this magnitude more accurately reflects the uncertainty inherent in the estimation techniques.

The range of VCR outcomes in Australia also points to the significant uncertainty and imprecision in the estimates. For example, Oakley Greenwood's estimate of VCR provides the following VCR estimates for NSW by customer type, with relatively narrow standard errors[4].

Table 37: State-wide VCRs and standard errors by DNSP Territory ($/kWh)

Customer sector	State-wide [E]		Ausgrid [F]		Endeavour Energy [G]		Essential Energy [H]	
	VCR ($/kWh)	Std error ($/kWh)	VCR ($/kWh)	Std error ($/kWh)	VCR ($/kWh)	Std error ($/kWh)	VCR ($/kWh)	Std error ($/kWh)
Residential	$20.71	$1.08	$22.77	$1.88	$19.75	$1.68	$17.82	$1.56
Business <160 MWhpa	$413.12	$26.93	$408.48	$45.97	$563.46	$47.46	$202.82	$25.59
Business ≥ 160 MWhpa	$53.30	$9.60	$34.83	$11.02	$33.99	$9.80	$130.57	$37.46
Total	**$94.99**	**$5.91**	**$86.79**	**$8.57**	**$110.71**	**$8.65**	**$90.71**	**$15.44**

It is also instructive to reproduce the VCR estimates for Victoria from the same report.

Victoria 2007 (indexed by AEMO to $2010-11)

Sector	VCR ($/kWh)
Residential	$23.80
Agricultural	$130.26
Commercial	$103.77
Industrial	$41.24
Total	$57.88

3 AEMO, National Value of Customer Reliability, 19 January 2012, page 5.

4 Oakley Greenwood, NSW Value of Customer Reliability, May 2012, page 47

Grid Australia notes that the average VCR in NSW is almost double the estimate for Victoria. Furthermore, Oakley Greenwood calculates a small standard error in NSW, which implies a 95% confidence that the true VCR for NSW lies between $83,420 per MWh and $106,570 per MWh[5].

However, the Victorian VCR estimate falls substantially below the bottom of this range. The range of VCR estimates for the same customer categories in NSW also point to significant estimation uncertainty. For example, small business customers in Endeavour Energy's distribution network are estimated to have a VCR that is more than double the estimate for the same customer group in Essential Energy's network.

It is conceivable that the range of VCR estimates may genuinely reflect differences in the value that customers place on reliability. It is much more likely, however, to reflect significantly higher estimation error and uncertainty than is often assumed. Grid Australia notes that Oakley Greenwood adopted a 'Willingness to Pay' and 'Willingness to Accept' survey approach in its NSW study, which is markedly different from the Victorian estimation approach, which used Economic Principle of Substitution techniques. This may explain the wide range of VCR estimates between Victoria and NSW, but it does not explain the wide variation in VCR estimates for the small business customer group across NSW distributors.

Other estimation problems arise because the survey techniques often fail to address the societal impacts that may arise from widespread and prolonged disruption. As already noted, it is important to understand that transmission failures may have significant impacts on the provision of community services, such as the provision of health services and water and sewerage services. These are costs that may be difficult to capture in a customer survey.

In publishing a single number for a VCR, the uncertainty and estimation errors are likely to be disregarded in subsequent investment analysis. Grid Australia considers that AEMO should highlight and explain the uncertainties and likely estimation errors in its future work on estimating the VCR.

Role and Scope of VCRs

The Issues Paper acknowledges that the AEMC will determine the full role and scope of how the VCR should be used in setting the Market Price Cap and the national transmission and distribution reliability standards[6]. Nonetheless, the Issues Paper invites respondents to comment on:

- the planning contexts in which the VCR should be applied; and
- the network regulation contexts in which the VCR should be applied.

Grid Australia considers that these matters are beyond the scope of AEMO's terms of reference, and are being considered by the AEMC in its current review of the national framework for transmission reliability. Grid Australia's position on these issues will be detailed in its submission to the AEMC's review.

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5 Oakley Greenwood, NSW Value of Customer Reliability, 30 May 2012, page 48.
6 AEMO, Value of Customer Reliability Issues Paper, March 2013, page 7.

However, in advance of lodging that submission, Grid Australia notes that the AEMC's review will adopt as a starting point the recommendations of the 2010 Transmission Reliability Standards Review, which is that transmission reliability standards should be economically derived, but expressed deterministically. The valuation of customer reliability has a central role to play in establishing transmission reliability standards that are economically derived.

In relation to AEMO's second question regarding the use of VCR in economic regulation (including incentive mechanisms), Grid Australia notes that the AEMC will also address this issue. In particular, chapter 2 of the AEMC's Issues Paper examines the characteristics of transmission and distribution, and notes the significant differences in terms of:

- the customers served;
- investment planning and the types of investment undertaken; and
- the type and level of performance reporting that can be undertaken.

In light of its examination, the AEMC concludes that[7]:

> "These differences mean that it is difficult to effectively design outputs based performance reporting for transmission networks. As a result, the type of performance reporting that is appropriate for transmission networks is different in nature from the type of performance reporting that is appropriate for distribution networks.
>
> These differences [also] mean that while consistency at a high level in how the national frameworks for transmission and distribution reliability are applied is possible, the detail of how each framework operates and the types of standards and incentives that should apply will need to differ."

Grid Australia notes that the DNSP Service Target Incentive Performance Scheme (STIPS) relies on output based measures, which the AEMC has recognised (correctly) are difficult to design for transmission networks. Given this practical constraint, and the issues relating to the uncertainty of VCR estimates (discussed above), the VCR cannot be used in a meaningful way to penalise or reward service performance on the transmission network.

High-Impact Low Probability Interruptions (HILPs)

Probabilistic planning weights outcomes by the probability of occurrence. This approach is reflected in the estimation of the VCR because the cost of a prolonged outage, for example, is weighted by the low probability of occurrence. This issue has been examined in Oakley Greenwood's 2011 report to AEMO as follows[8]:

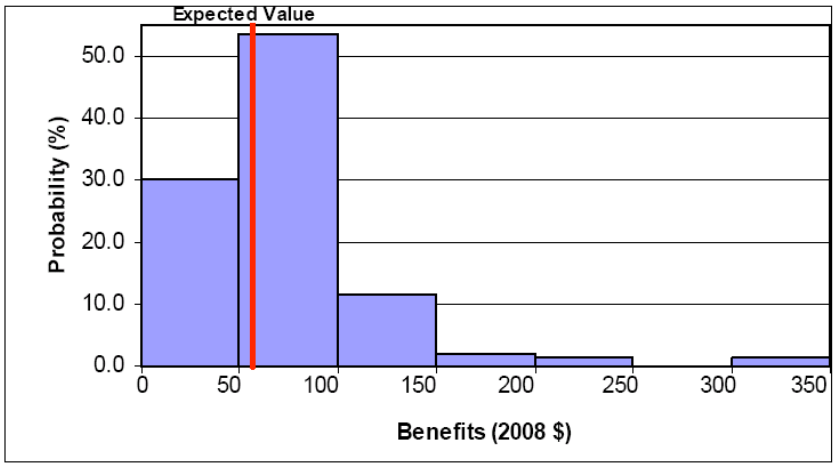
> "By contrast, the value of avoiding cascading outages in a broad area of the power system following a single thermal failure requires consideration of costs that potentially go far beyond the sum of the direct and indirect costs experienced by individual electricity users. These include the social disruption costs that were addressed in part in the 2007

7 AEMC, Issues Paper: Review of the national framework for transmission reliability, Mar 2013, page 13.

8 Oakley Greenwood, Valuing Reliability in the National Electricity Market, Final Report, March 2011, page 39.

Victorian VCR, but can also include the costs of so-called high impact, low probability (HILP) events, such as the transmission failure that occurred in Auckland in 2006. Incorporation of HILP events within the VCR will therefore require additional analysis. In the first instance, additional effort will be required to assess the actual level of cost experienced in HILP events. In addition, some alteration would need to be made to the VCR calculation method in order to incorporate HILP costs – or these costs would need to be considered separately. This is because the VCR calculation method weights the costs of outage events by their probability of occurrence only. As a result, the contribution of HILP events to the VCR would be reduced to almost zero."

The treatment of high impact, low probability events is an important issue in assessing the benefits of a proposed network augmentation. The following diagram, which is reproduced from a report prepared for the California Energy Commission in 2005, shows the range of benefits and probabilities associated with a proposed transmission investment.[9]



The above figure shows that the expected benefit from a proposed project is approximately $56 million. If, for example, the expected cost of the augmentation is $60 million, the project will have a negative net benefit and, under a strict probabilistic approach, would not proceed. However, careful regard must be given to the outlier benefit of $350 million, which may reflect the possibility of a high-impact outage. While a probabilistic approach weights this outcome by a low probability of occurrence, alternative decision-making criteria – such as least regrets or no regrets – could legitimately attribute much greater weight to this outcome.

The application of VCR in the context of transmission investment analysis typically places a very low weight on customers' exposure to high impact, low probability events. While this issue is outside the scope of AEMO's VCR review, it is worth noting that high impact low probability events will have implications for the VCR. In particular, as already noted, the VCR should include the costs of social disruption and the broader impacts that would arise from a major or prolonged outage.

[9] Pinnacle Consulting, Assessing High Impact Low Probability Events, Final Report, October 2005, page 7.

We look forward to further engagement with AEMO and other stakeholders on the estimation and application of VCR to network investment analysis.

Please don't hesitate to contact Greg Hesse on 07 3860 2632 or me on 08 8404 7983 if you would like to discuss any aspect of this submission.

Yours sincerely

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