TransGrid

ABN 19 622 755 774

201 Elizabeth Street (cnr Park St)
PO Box A1000 Sydney South
New South Wales 1235 Australia
Facsimile (02) 9284 3456
Telephone (02) 9284 3000
Web http://www.transgrid.com.au
DX1122 Sydney

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Mr John Pierce
Chairman
Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

Dear John

Review of Distribution Reliability Outcomes and Standards, Draft Report - NSW workstream

TransGrid welcomes the opportunity to lodge this submission in relation to the Commission's draft report on its review of NSW distribution reliability standards. As the review is concerned with distribution reliability standards, TransGrid's principal interest relates to the Commission's approach and methodology, rather than the specific implications for NSW distribution reliability standards.

The Commission has raised four questions in its draft report, which are addressed in this submission as follows:

- Question 1 is concerned with the Commission's cost benefit assessment, including the VCR estimate and discount rate.

  As explained in section 1 of this response, TransGrid considers that the Commission's approach to the cost benefit assessment and the VCR estimate does not have sufficient regard to the issue of uncertainty. Section 2 comments on the issues of risk aversion and insurance, which are not fully considered in the Commission's approach. TransGrid also comments briefly on the discount rate in section 3 of this response.

- Question 2 asks whether there are any implications from the NSW VCR survey methodology that should have been taken into account by the Commission in considering the survey results.

  TransGrid considers that the NSW VCR survey results suggest that there is a substantial degree of uncertainty in estimating the VCR. Section 1 of this response highlights a number of observations on the survey results that cast doubt on the veracity of the confidence interval ascribed to the survey results. Consequently, the results of the subsequent cost benefit assessment should be treated with caution.

- Question 3 is concerned with the Commission's modelling scenarios and whether any changes should be considered.

  TransGrid does not have any particular comments on the scenarios adopted by the Commission. However, TransGrid is concerned that the Commission's approach is focused solely on maximising net benefits. It is important to consider other approaches, which specifically recognise the concepts of utility maximisation and uncertainty. Section 2 of this response discusses these alternative approaches in more detail.

TransGrid notes that question 4 is specifically concerned with implementation issues for NSW distributors. As such, TransGrid does not have any specific comments on these issues.

1. Uncertainty in input parameters

The Commission's analysis essentially embraces a probabilistic planning approach because it seeks to trade off different exposures to unserved energy against the costs of providing network services.

TransGrid regards "probabilistic planning" as a misnomer because it implies that probabilities can be applied to calculate the expected costs and benefits of alternative investment plans. In reality, however, the reliability impact of adopting different investment plans is inherently uncertain because it will depend on the consequences of asset failure(s). In the case of the transmission network, multiple coincident plant failures at a time of peak demand, for example, may cause widespread disruption to supply.

Therefore, while the Commission's analysis is conceptually sound at one level, it implies a level of precision that is unlikely to be appropriate. In particular, Oakley Greenwood's estimate of VCR provides the following VCR estimates for NSW by customer type, with relatively narrow standard errors.

Table 4.4 NSW VCR by customer type

Customer type	VCR ($/MWh)	Standard error ($/MWh)
Residential	$20,710	±$1,080
Small business < 160 MWh pa	$413,120	±$26,930
Medium/ large business ≥ 160 MWh pa	$53,300	±$9,600
NSW weighted average	$94,990	±$5,910

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

Table 4.5 Current Victorian VCR - Indexed from the Victorian VCR 2007 survey results[52]

Customer type	VCR ($/MWh)
Residential	$23,800
Agricultural	$130,260
Commercial	$103,770
Industrial	$41,240
Victorian weighted average	$57,880

It is important to note that the weighted average VCR for Victoria is estimated to be $57,880 per MWh compared to a VCR estimate for NSW of $94,990 per MWh. The standard error in NSW is +/-$5,910 per MWh. Oakley Greenwood assumes that the VCR is normally distributed and therefore a 95% confidence interval can be established that the true VCR lies

between $83,420 per MWh and $106,570 per MWh[1]. TransGrid notes, however, that the Victorian VCR estimate falls well outside this range. In light of this significant difference, it would be reasonable to conclude that survey outcomes may be unreliable and that the confidence interval derived by Oakley Greenwood is much too narrow. For the avoidance of doubt TransGrid is not saying that the VCR estimates for Victoria are more reliable or in some way better than the VCR estimates for NSW.

Other aspects of the survey results also cast doubt on its veracity. For example, Table 4.4 shows the estimated VCR for small businesses is nearly 8 times greater than the VCR for medium and large businesses. The Commission makes the following comment to explain this material difference[2]:

> "Small businesses may have a higher VCR than medium and large businesses as they are more likely to be reliant on electricity at peak periods for a substantial proportion of their income. As a result, if the electricity supply of a small business was interrupted during the worst possible time, for example during the Friday lunch period of a Sydney CBD cafe, the business could lose a substantial proportion of the value of its normal day's trade.
>
> In contrast, larger businesses are more energy intensive and are more likely to have an even level of consumption throughout a day. This may mean that the relative impact of a supply interruption, even during the worst possible time, is lower than for small businesses. Larger businesses may also have more extensive alternative power sources that they can use to minimise the impact of an interruption."

TransGrid queries whether this explanation is sufficient to explain the apparently anomalous variation in VCR between the customer sectors. In addition, it does not explain the wide variation in VCR outcomes across the three NSW distributors[3]:

> "However, while the VCRs for small businesses are higher than medium/large businesses for all DNSPs, the VCRs for each business type are significantly different between the three DNSPs. The VCR for small businesses ranges from $563,460 / MWh in Endeavour Energy's network to $202,820 / MWh in Essential Energy's network, while the VCR for medium/large businesses ranges from $130,570 in Essential Energy's network to $34,830 in Ausgrid's network.
>
> From the results of the VCR surveys we cannot determine why the results differ between customer types or why the same customer types in different distribution networks place such different values on the reliability of their electricity supply."

TransGrid notes that the estimated VCR for medium/large businesses in Endeavour Energy's network is more than twice the estimate for those customers in Essential Energy's network. The range is even greater for medium/large businesses, with the highest estimate being nearly 4 times greater than the lowest estimate.

The wide range of outcomes across distributors appears to be at odds with the relatively low standard errors reported by Oakley Greenwood. For example, the VCR for NSW small customers is estimated to be $413,120/MWh with a standard error of +/-$26,930 per MWh. This compares with the VCR estimate of $130,570 per MWh for small customers in Essential Energy's network.

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1 Oakley Greenwood, NSW Value of Customer Reliability, 30 May 2012, page 48.

2 AEMC, Review of Distribution Reliability Outcomes and Standards, Draft Report, 8 June 2012, page 45.

3 Ibid, page 45.

These anomalies in the VCR estimates point to problems with the survey design, which may indicate systematic error. Granger, Henrion and Small[4] explain systematic error as follows:

> "Systematic error is the difference between the quantity being measured and the quantity of interest, which are virtually never the quite same... Unfortunately, it is not unusual to ignore the fact that the measured quantity and the quantity of interest are different, and so ignore the systematic error when assessing the overall uncertainty."

In relation to the VCR survey, it is important to recognise that the VCR cannot be sampled directly. Instead, the survey seeks to establish VCR samples through a series of questions regarding customers' responses to an outage. It should also be noted that modelling the economic impact of supply interruption as a fixed $/MWh parameter differs from other models that have a fixed and variable component. Therefore selecting this particular model of VCR potentially introduces another source of error.

In light of the above observations, TransGrid considers that the VCR survey results illustrate the inherent difficulties in accurately estimating VCR. Given the wide range of outcomes from the survey, it would be reasonable for the Commission to question the validity of the stated confidence interval, and to exercise considerable caution in the analysis that follows. However, instead of emphasising these issues, the analysis appears to proceed on the presumption that the point estimate produced by the VCR study can be relied on. TransGrid is concerned that the overall approach assumes a level of precision that is not justified.

It is noteworthy that during a recent consultation conducted by AEMO on a national value of customer reliability, stakeholders commented that there is a high degree of uncertainty in the derived VCR estimates. In response AEMO noted that an error band of +/-50% is applied to VCR estimates in New Zealand[5]. TransGrid considers that an error band of this magnitude is more realistic than the narrow confidence intervals quoted by Oakley Greenwood.

It is also important to emphasise that the VCR is only one element of uncertainty in the Commission's analysis. The other elements of uncertainty relate to the reliability consequences of changing the NSW reliability standards. This observation raises important questions around the concepts of risk aversion, insurance and decision analysis, which we discuss next.

2. Insurance and decision analysis

In addition to the VCR survey results, the Commission has conducted a willingness to pay study. As noted by the Commission, the survey shows that customers require a significant reduction in their electricity charges in order to compensate for a reduction in reliability. This finding may be indicative of risk aversion, where customers are reluctant to accept a reduction in the reliability (or certainty) of their electricity supply. In addition, the analysis may also indicate that customers tend to prefer the current reliability standards.

Risk aversion is a well-understood phenomenon that explains why individuals and businesses insure against risk. From a strict probabilistic cost-benefit perspective, a decision to insure may appear to be irrational because the insurance premium will exceed the expected cost of the insured event. However, risk adverse individuals prefer certain outcomes to uncertain ones, and this explains why they insure against risk.

The cost-benefit evaluation approach applied by the Commission is similar to the probabilistic transmission planning approach applied in Victoria. Under this approach, investment options (including 'do nothing') are evaluated by estimating their expected benefits and costs. The option with the greatest expected net benefit (in terms of net present value) is identified as the

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[4] M. Granger, M. Henrion and M.Small, Uncertainty: A Guide to Dealing with Uncertainty in Quantitative Risk and Policy Analysis, page 59.

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

most efficient option. In interpreting the decision signals provided by such analytical approaches, it is important to recognise that a central estimate (that is, the expected value) of costs and benefits are being weighed up. As noted correctly by the Commission, a consequence of this approach is that high impact, low probability events receive a low weighting, which reflects their low probability of occurrence.

It is important to understand, however, that maximising customer utility may be different from maximising expected net benefits. This is because customers will be concerned about the very significant costs associated with a sustained outage, rather than only focusing on the expected outcome. That is to say, the utility to a risk adverse customer of avoiding a high consequence event is higher than the expected cost (which is the consequence multiplied by the probability). The probabilistic approach could be augmented by considering customers' utility functions – although measuring such a function would be problematic. As a minimum, however, the Commission's cost benefit analysis should explicitly examine the question of whether sufficient consideration has been given to outlier events.

In a transmission context at least, there are reasonable grounds to posit that risk averse electricity customers are likely to value transmission investments that 'insure' against catastrophic losses, even if such losses are regarded as extremely unlikely. The Commission's own analysis concludes that the savings for customers from a reduced level of reliability may only be $18 per customer per annum. It is legitimate to ask whether customers are willing to pay this 'insurance premium' if it minimises the widespread disruption associated with a prolonged outage. The Commission's analysis does not appear to address this question.

In terms of the decision analysis, it is also important to consider the appropriate approach when the probability of different reliability outcomes and customers' utility functions cannot be estimated. In these circumstances, a decision rule such as 'minimax' could be applied. This decision rule differs from one based on maximising expected net benefits or maximising utility. The objective of a minimax decision rule is to minimise the consequences of a worst case (maximum loss) scenario. In some respects, this concept is closely aligned with the widespread engineering practice under which redundancy is factored into design standards to minimise worst case outcomes.

TransGrid notes that the issues outlined above raise important questions regarding the appropriateness of the probabilistic planning approach, which underpins the Commission's analysis. In particular these issues suggest that a probabilistic approach should be applied cautiously rather than mechanistically. Moreover, the evaluation of reliability standards – particularly for transmission – should encompass a consideration of decision rules that reflect risk aversion, and which accommodate explicit consideration of the implied insurance value of investment. These observations are particularly pertinent in setting transmission reliability standards.

3. Approach to cost-benefit assessment

It is important to ensure that the definition of cash flows used in the cost-benefit analysis is consistent with the definition of the discount rate. It appears that a nominal discount rate has been applied. If this is correct, all cash flows used in the analysis should also be expressed in nominal (that is, price escalated) terms. It is unclear from the Commission's draft report whether this is in fact the case. For instance, the report does not detail any assumptions regarding cost escalation or inflation. However, the draft report states (on page 34):

> "The VCR was held constant over the modelling period, we did not provide for any indexation of the VCR over the period in undertaking our cost-benefit assessment."

On the assumption that a nominal discount rate has been applied, the Commission's approach adopts a VCR estimate that is declining in real terms. Assuming that the VCR

would increase at the rate of inflation or higher[6], the approach adopted by the Commission leads to the costs (increased unserved energy) associated with reducing investment being under-estimated in the base case analysis.[7]

In addition, it is not possible to verify from the draft report whether the cost and benefit cash flow streams are expressed appropriately, given the truncation of the study period at 15 years. For example, on page 56 of the draft report it appears that that the whole of the $200 million worth of Sydney CBD capital expenditure deferred in 2028/29 is counted as a benefit, with no offset for the (presumably) later timing of that expenditure. If the entire avoided cost of the $200 million CBD project is counted as a benefit, then the subsequent cost (in terms of increased annual load shedding) should be included for the life of the avoided investment, which may be 45 years. Alternatively, a view should be taken on the likely period of deferral and a consistent approach in measuring the costs and benefits over this period should be adopted.

One way of ensuring that the costs and benefits are expressed in a manner that enables comparisons to be made over a relatively short study horizon is to express capital cost changes as annuities, calculated at the discount rate and over the economic life of the assets. This approach would enable costs (annual load shedding) to be compared directly with savings (annualised capital expenditure deferred / not spent) over any period shorter than the lives of the assets.

It would be helpful if the Commission's final report could address this potential issue in further detail.

4. Concluding comments

In lodging this submission on the draft report, TransGrid's principal interest relates to the approach and methodology applied by the Commission. TransGrid is keen to ensure that the differences between distribution and transmission reliability standards are fully understood, and are recognised in any future analysis of transmission reliability standards.

TransGrid also considers that there are a number of important issues arising from the draft report's approach and methodology that should be carefully considered by the Commission in finalising its assessment of NSW distribution reliability standards. As noted in this submission:

- estimating the VCR, and applying a probabilistic approach are inherently uncertain. The analysis presented in the draft report appears to assume a level of precision that is not justified.
- electricity customers are risk averse, which means that they are willing to insure against high impact, low probability events. The probabilistic approach adopted by the Commission necessarily applies a low weight to such events. This is a weakness of the methodology. An alternative decision analysis, which may be especially important for transmission networks, is to ensure that 'worst case' outcomes are avoided. The challenge is to develop an analytical approach that combines concepts of insurance with the probabilistic planning concept of maximising net benefit.
- there are potential issues relating to the definition of the discount rate and cash flows, escalation of the VCR, and the truncation of the analysis at year 15 that are worthy of further careful consideration and explanation in the Commission's final report.

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[6] There is reason to believe that VCR may increase in real terms over time, as customers become more reliant on a highly reliable electricity supply. See the comments on page 38 of the draft report, for instance, on the reasons why the escalated 2007 Victorian VCR is well below the 2012 survey results for NSW.

[7] It is noted that "Sensitivity 3" estimates the impact of not converting the value of expected energy not served into a net present value on the cost benefit assessment for each scenario, on the basis that "it is likely that customers' value of reliability will increase into the future".

TransGrid looks forward to the publication of the Commission's final report in late August of this year. In the meantime, should you or your staff have any queries regarding this submission, please contact me on (02) 9284 3555.

Yours sincerely

Stephen Clark
Executive General Manager | Network Planning and Performance