Responding to the future needs of customers: the value of lost load.
Peer review.

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GLOSSARY OF TERMS

Abbreviation	Term
CE	Choice experiment
CV	Contingent Valuation
DECC	Department of Energy and Climate Change
DG	Distributed Generation
DNO	Distribution Network Operator
ECP	Engaged customer panel
EV	Electric vehicle
GB	Great Britain
LCN	Low Carbon Network
LCT	Low carbon technology
MRS	Market Research Society
NEA	National Energy Action
NGET	National Grid Electricity Transmission
NHH	Non half hourly
Ofgem	Office of Gas and Electricity Markets
PSR	Priority Service Register
RIIO-ED2	Electricity distribution price control 2023 and beyond
SME	Small and medium enterprises
SMS	Short Message Service
VoLL	Value of Lost Load
WTA	Willingness to accept
WTP	Willingness to pay

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1. EXECUTIVE SUMMARY

The Impact Research project "*Responding to the future needs of customers – the value of lost load*" aims to investigate if a single uniform value of lost load (VoLL), applied to all customer segments, remains appropriate, as Great Britain moves towards an economy increasingly reliant on electricity, whilst being driven by a decarbonisation agenda.

The research study outlined by Impact Research is an admirable and rigorous examination of how the VoLL can be measured through customer engagement and surveys.

The combination of online and telephone survey of customers will ensure sampling coverage of all customer segments in the most efficient and economical way. The main survey of 5,000 customers (split between 4,300 domestic customers and 700 interviews with SMEs) in Electricity North West's operating region and across other networks maintained by other licenced DNOs across GB will provide statistically significant results.

The stated preference choice experiment (CE) proposed by Impact Research will allow estimates of WTP to be made for variations in duration, notification, and customer assistance. There are some issues that require consideration in the application of the CE, and in the analysis of the data, and in the interpretation of the results. These relate to part-whole bias, scope effects, WTA, and market demand.

The analysis proposes to use a mixed logit (MXL) model to account for heterogeneity in customer preferences. This is appropriate. However, if comparisons are to be made with London Economics (2013) study then the analysis should also include the standard conditional logit (CL) model.

The research methodology and analysis proposed by Impact Research, to estimate the VoLL based on the future needs of customers, is a practical and effective way of investigating if a single uniform value of lost load (VoLL), applied to all customer segments, remains appropriate, as Great Britain moves towards an economy increasingly reliant on electricity. The methodology is admirable, and comprehensive in its approach.

2. THE OBJECTIVES OF THIS PEER REVIEW

The Impact Research project "*Responding to the future needs of customers – the value of lost load*" aims to investigate if a single uniform value of lost load (VoLL), applied to all customer segments, remains appropriate, as Great Britain moves towards an economy increasingly reliant on electricity, whilst being driven by a decarbonisation agenda.

The purpose of this peer review is to assess the suitability of the customer survey methodology proposed by Impact Research; and whether it provides a comprehensive assessment of how VoLL should be defined and measured across a range of customer segments to inform a potential revised framework to assist DNOs better plan their network investment and customer strategies. The review will consider the

- Breadth of the literature review and its implications for the project.

- Approach taken to customer engagement, and the extent to which the methodology proposed by Impact Research to customer engagement is appropriate, relevant, robust, and representative of customers.
- Credibility of the WTP stated preference methodology proposed to measure VoLL.
- Assessment of the manner in which the research effectively measures how customers' preferences may change with future decarbonisation of heat and transport

This review has been undertaken by Professor Ken Willis, who is Emeritus Professor of Environmental Economics at Newcastle University. His research concentrates on environmental valuation (using stated preference, and revealed preference travel-cost and hedonic price models) and cost-benefit analysis; covering biodiversity, cultural heritage, energy, forests, landscape, quarries, recreation, transport, waste disposal, and water quality and supply.

He is currently the Editor of the *Journal of Environmental Economics & Policy*. He has undertaken research projects on Renewable Energy and Its Impact on Rural Development and Sustainability in the UK, for the Department of Trade and Industry; on The Growth Potential for Micro-generation in England, Wales and Scotland, for the Department of Business, Enterprise & Regulatory Reform; and a Cost-Benefit Analysis of Sustainable Public Procurement, for the Department for Environment, Food & Rural Affairs.

Ken Willis has a wealth of experience in evaluating the suitability of market research methodologies and the application of advanced statistical analysis and econometric techniques in analysing consumer preferences and choices.

The rest of this report focuses on an assessment of the methodology proposed by Impact Research to assess whether a revised VoLL model might be more appropriate as Britain moves towards an economy increasingly reliant on electricity, driven by a decarbonisation agenda.

3. LITERATURE REVIEW

The literature review by Impact Research in the methodology statement is quite comprehensive, and it informs the proposed research strategy on assessing the preferences and choices of customers in relation to electricity power supply and outages. No literature review will be totally comprehensive, since this would lead to an overload of information. The literature review by Impact Research is targeted on relevant literature, and is suitable for the purpose of the study, providing an appropriate review of the literature on estimating the value of avoiding outages and the value of lost load to customers. This shows how the VoLL varies between seasons; during the day and week: at peak, off-peak and weekends; by type of customer; and by length and frequency of outage.

What is perhaps lacking is literature on the economic analysis of consumer demand and consumer choice, where this is relevant to stated preference techniques. The literature quoted is used to assess whether it is appropriate to use stated preference (SP) or revealed preference (RP) techniques to measure the value to customers of service reliability: changes in the frequency of supply interruptions and durations of outages.

Whilst Impact Research clearly justify that SP rather than RP techniques should be used in the study; the inclusion of literature on the economic analysis of consumer demand and consumer choice could be used to support, at the more detailed level, the preferred survey method and the SP approach proposed for assessing customer preferences and demand for electricity supply.

4. APPROACH TO CUSTOMER ENGAGEMENT

The research study outlined by Impact Research is an admirable and rigorous examination of how the VoLL can be measured through customer engagement and surveys.

The study appropriately proposes using focus group meetings in the qualitative stage of the research through the formation of an Engaged Customer Panel (ECP). This ensures the research effectively engages with key customer segments: both domestic (urban and rural, and worst served customers) and industrial and commercial (I&C) customers: particularly SMEs and industries heavily reliant on electricity within this sector. This will ensure that the questionnaire or survey instrument developed by Impact Research for the study will be readily understood by customers, and produce accurate and reliable responses from customers.

In assessing whether VoLL varies by customer segment, and how VoLL might vary with low carbon technology (LCT) adoption, the study and survey design needs to consider how LCT might affect electricity supply dependence and reliability (and hence the VoLL). The study could clarify at the beginning whether the purpose is only to investigate how customers with different degrees of LCT in their homes and businesses will value lost load; or whether it will also assess customers' preferences for outages, and duration, in response to the adoption of LCT in electricity supply?

As Britain decarbonises heat and transport, and customers become more reliant on electricity for their energy needs, the VoLL may well change. To provide informative answer and assessments, customers need to understand how the reliance on electricity might change (e.g. in transport, domestic heating and cooking), and the extent to which LCT is able to meet the future demand for electricity.

Customers need to fully understand the implications of LCT adoption for electricity supply if accurate, robust and reliable estimates of the VoLL are to be made. The VoLL might increase in the future as a result of (1) the adoption of LCT and decarbonisation of heat and transport with its implied service changes to electricity demand, (2) customer preference for more reliable electricity supply with increasing income and wealth, (3) increasing risk aversion to outage frequencies and durations, (4) increasing use of and reliance on electricity in society. Separating and measuring these four influences over time is not an easy task. But the proposal by Impact Research will readily permit the VoLL to be estimated in relation of variation in customer adoption of LCT in their homes of businesses.

The questions that the ECP will be asked to consider, (Section 5.1) and address, should provide some understanding of customers' views, which can be used in developing the quantitative phase of the research.

The combination of online and telephone survey of customers will ensure sampling coverage of all customer segments in the most efficient and economical way.

The pilot sample sizes proposed by Impact Research (40 ECP customers, plus 100 domestic customers, and 30 SME customers) should be adequate to test of the SP questionnaire, although the pilot sample of 30 SME customers is not likely to produce statistically significant results.

The main survey of 5,000 customers (split between 4,300 domestic customers and 700 interviews with SMEs) in Electricity North West's operating region and across other networks maintained by other licenced DNOs across GB will provide statistically significant results. A sample of 250 within each DNO region should ensure a representative sample and statistically significant results for each DNO region, if required. If the analysis is to be undertaken by household and business adoption of particular LCT products, then some stratified random sampling may be required to ensure sufficient observations in each LCT category.

Splitting the sample between summer and winter to reflect seasonal demand is appropriate. The only concern is with December 2016: as Christmas approaches customers may be less willing, because of seasonal commitments, to participate in a questionnaire survey. Could the survey be brought forward to cover the latter part of November and the early part of December? or alternatively the beginning of December and the first two weeks in January?

The collection of data on customers' experience of supply interruptions will allow the effect of duration of interruption, notification of interruption, and customer assistance, on the VoLL to be estimated.

5. WTP STATED PREFERENCE APPROACH TO MEASURING VOLL

The choice experiment (CE) proposed by Impact Research will allow customers' trade-offs between attributes to be estimated. The four attributes proposed (duration, notification, customer assistance, payment amount) are a mixture of quantitative (duration, payment amount) and qualitative (notification, customer assistance) variables. The CE will allow estimates of WTP to be made for variations in duration, notification, and customer assistance.

There are some issues that require consideration in the application of the CE, and in the analysis of the data. These relate to part-whole bias, scope effects, WTA, and market demand.

It is proposed that the CE omits some variables included in the London Economics (2013) study, so that other variables not previously included can be tested. Care must be taken to avoid part-whole bias with this procedure. The values for notification and customer assistance may not be additive to London Economics estimates for other attributes. It would be preferable if all variables were included in the analysis.

But if it is not practical to include all variables in the CE, it may be possible to examine part-whole bias issue by checking that the WTP estimate for duration of outage (common to both London Economics and Impact Research studies) is equivalent. If it is significantly greater,

then calibrating values for notification and customer assistance on the London Economics duration of outage WTP value, may partly avoid over-estimating the total value of VoLL.

Both the London Economics study and the Impact Research proposal do not include a variable in the CE for number of occurrences per year (frequency of outages). In the interpretation of the results it should be recognised that, because of scope effects, WTP for successive outages per year will decline monotonically from the WTP value for one outage. This has implication for the application of the results.

WTA is quite difficult to measure accurately compared to WTP values. WTA values typically considerably exceed WTP values for the same marginal quantity change. This can be reduced, or even eliminated entirely, by trading experience. Whilst trading experience can be included in CV studies, it is not easy to replicate in stated preference CE studies. In the proposal the WTA scenario is not fully explained. Will symmetry between WTP and WTA be assumed in the analysis of the data?

The CE does not include the "current situation" in the CE card. Consumer choice is usually make with reference to the customers' current situation, i.e. level of service and bill amount. I appreciate that it might be difficult to describe the current situation that each customer faces; but some justification could be provided for omitting the current situation (e.g. it is too difficult to describe to customers in terms of probabilities of outages of varying durations), and that omitting the current situation will still allow the number of customer who do not wish to pay for an improved level of services to be estimated.

6. STATISTICAL ANALYSIS

The statistical analysis proposed by Impact Research will investigate WTP and WTA by subgroups of customers.

The analysis proposes to use a mixed logit (MXL) model to account for heterogeneity in customer preferences. This is appropriate. However, if comparisons are to be made with London Economics (2013) study then the analysis should also include a standard conditional logit (CL) model, since London Economics' WTP values are estimated using the more econometrically restrictive CL model.

7. CONCLUSION

The research methodology and analysis suggested by Impact Research to estimate the VoLL based on the future needs of customers is a practical and effective way of investigating if a single uniform value of lost load (VoLL), applied to all customer segments, remains appropriate, as Great Britain moves towards an economy increasingly reliant on electricity. The methodology is admirable, and comprehensive in its approach.

The sample size will ensure that estimates of customers' utility for the attributes of electricity supply are statistically significant; and that, subject to safeguards, accurate and reliable estimates of WTP for the VoLL for different customer segments can be determined.