

Customer Survey Methodology Peer Review

Customer Load Active System Services
(CLASS) Project



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VERSION HISTORY

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APPROVAL

Name	Role	Signature & date
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GLOSSARY OF TERMS

Abbreviation	Term
CLASS	Customer Load Active System Services
LCNF	Low Carbon Network Fund
ENW	Electricity North West
CEP	Customer Engagement Plan
ECP	Engaged Customer Panel
I&C	Industrial & Commercial
LC	Latent Class
MNL	Multinomial Logit

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1. EXECUTIVE SUMMARY

This report is submitted as part of the Electricity North West Customer Load Active System Services (CLASS) Tier 2 Low Carbon Network Fund (LCNF) project.

CLASS will demonstrate a low cost, rapidly deployable solution that applies innovative and active voltage management to provide a range of demand response capabilities and network voltage regulation services. By aligning demand to existing network capacity through voltage control, CLASS has the potential to minimise the need for costly asset-based interventions and make a positive contribution to a low carbon future.

One of the key CLASS hypotheses is that:

Customers within the CLASS trial areas will not see/observe/notice any impact on their power quality when these innovative techniques are applied.

To test this hypothesis a range of customer engagement activities will be undertaken during the life of the project. Key amongst these will be a series of customer surveys. Where appropriate these surveys will elicit customer perceptions and observations of any effects on their electricity supply.

This document and the observations therein form part of the project dissemination and specifically details the peer review of the customer survey methodology, undertaken by Professor Ken Willis.

The customer survey methodology has been proposed by Impact Research, a CLASS project partner, who will provide dedicated support in developing and implementing customer surveys and analysing the results. Impact Research is a market research organisation with extensive experience in customer engagement activities in the utilities industry.

The research approach referenced within this document was submitted as part of the Electricity North West CLASS Customer Engagement Plan (CEP) approved by Ofgem on XXX.

2. THE OBJECTIVE OF THIS PEER REVIEW

The purpose of this peer review is to determine the suitability of the customer survey methodology proposed by Impact Research to provide robust quantitative research that will assist in answering the CLASS hypotheses. The peer review is also intended to maintain standards of quality, improve performance, and provide credibility.

This review has been undertaken by Professor Ken Willis. Ken Willis 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 techniques onto market research data. Given his expertise within the energy sector he is well placed to provide a peer review of the CLASS survey methodology.

The rest of this report focuses on an assessment of the customer research proposal submitted by Impact Research and is based entirely on the informed opinion of Ken Willis. His independence means the narrative is void of amendment from neither Impact Research nor Electricity North West.

3. CUSTOMER ENGAGEMENT OBJECTIVES

The research proposal by Impact Research for Electricity North West (ENW) is to test whether a Customer Load Active System Services (CLASS) supply demand management system will be indiscernible to customers.

CLASS applies voltage control tools to manage supply demand balances, to maximise the use of existing electricity assets, with the aim of deferring or avoiding investment in new distribution capacity, thus reducing distribution development costs. CLASS will also enable more low carbon generation to be used.

The customer engagement will test the hypothesis (H_1) that there is a discernable effect of CLASS management on customers' perception of electricity supply, against the alternative null hypothesis (H_0) that CLASS does not result in any discernable effect on customers' perception about supply. The expectation is H_1 will not be proven, and that CLASS will not have any discernable effect on customers' perceptions.

4. PLANNING ACTIVITIES (ENGAGED CUSTOMER PANEL)

The research study outlined by Impact Research is an excellent and rigorous examination of the effect of CLASS on customer perceptions.

The study appropriately uses 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 both domestic and industrial and commercial (I&C) customers; and 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.

5. SURVEY DESIGN

5.1 The survey approach

The trial appropriately covers different seasons of the year, and different degrees of voltage reductions (e.g. 3%, 4.5%, and 6%). The majority of voltage reduction trial tests will also be suitably conducted between 17.00 and 19.00 hours, Monday to Thursday, in the winter, when CLASS is likely to be required.

The survey of customer perceptions at weekends (Friday to Sunday) following the voltage reduction tests (Monday to Thursday) should increase the probability that customers can be contacted and at convenient times for the customer. But as the time period between the test and survey increases, memory failure may increase bias in responses.

Tests across 60 primary substations split between the demand (voltage) and frequency response tests will ensure a representative coverage of customers, from different types of area (rural and urban) and different socio-economic group profiles.

5.2 Test vs. control methodology

The quantitative research by Impact Research rightly proposes having a 'test group' (where electricity supply is varied) and a 'control group' (where electricity supply is not varied) to assess whether customers can discern any difference between the two situations. The selection of customers for the control and test groups will be taken from the same group of recruited survey participants.

Thus in one wave of the research a customer may be in the control group and in another wave in the test group, without knowing to which group they were assigned. This is a "blind trial" or "blind experiment": the subject does not know whether s/he is in the test or control group. This avoids any potential customer response bias, in reporting whether the customer has or has not perceived any CLASS effect. And although it is not a "double blind trial" [where neither the customer nor the

experimenter (Impact Research) knows to which group a customer has been assigned], since researchers acting on behalf of Impact Research do not personally know ENW customers, observer bias will be minimised.

Blind experiments are the most rigorous of all the analytical methods, and the method that is most likely to produce true, accurate, and robust results. So the methodology proposed by Impact Research is an excellent research procedure, and in fact the best that can be adopted.

5.3 Testing for a placebo effect

The research is ground breaking by including, in the experimental design, a test for a 'placebo effect' [an observed and measurable effect on health or behaviour not attributable to a medication or treatment that has been administered].

The research experiment proposed by Impact Research can essentially be visualised as a two by two matrix with 'test' and 'control' groups, with half of customers in each group being given information (yes) that they are part of a group prior to the experiment, with the other half of customers not being informed (no).

	CLASS Test Group	Control Group
Information: yes	A	B
Information: no	C	D

The analysis by Impact Research will assess whether there is any statistical difference in perception between the two groups: test and control. They appropriately propose using a binomial test, based on the binomial distribution (customers either noticed a difference or not), to assess whether there is any difference between the numbers (or percentage of customers) in each group (test and control) who reported an effect. If the confidence limits of the means for the test and control groups overlap then it can be stated that there is no statistically significant difference between the two groups.

Clearly there are many ways of making a comparison between these sub-sections in the overall sample of customers; e.g. A+C compared to B+D; A compared to B; C compared to D; A compared to C; etc. ; to reveal the perceptions of customers with respect to CLASS.

5.4 Sample size

The sample sizes proposed by Impact Research should be adequate to test the *null hypothesis* that there is no difference between the test and the control groups. But Impact Research is correct in pointing out that drilling down the analysis across factors where there are less than 75 customers in any sub-group is not likely to produce a statistically significant result.

6. RECRUITMENT OF SURVEY PARTICIPANTS

6.1 The importance of contacting the most appropriate I&C customers

In contacting customers it is important as far as industrial and commercial customers are concerned that the person in charge of maintaining the firm's production output is the point of contact. This is the person who will notice the effect of any CLASS change, and be more likely to be affected by the application of CLASS.

This may not be a problem for small commercial premises with three or four workers, such as hairdressers and small shops. In these firms the person paying the electricity bill is also likely to be the person managing the enterprise. But for larger industrial and commercial establishments employing large numbers of workers, it is important to survey the most appropriate person in the production process affected by electricity supply considerations.

The finance director or accountant who pays the electricity bill may not be so sensitive to CLASS changes and be less concerned about the application of CLASS. Identifying an appropriate person in a large firm will be a challenging task for Impact Research.

Identifying a sample of industrial and commercial customers is also a challenging task. The sample needs to reflect both the industrial structure of firms supplied by ENW and also the size of electricity usage. The representativeness of the industrial and commercial sample can best be assured if soft quotas on the type of industry and electricity consumption are applied when recruiting the baseline of 200 industrial and commercial customers.

6.2 Interviewing the same customers over the course of the survey period

Interviewing the same person across different interviews standardises for attitude and other characteristics. But where the person interviewed has changed, e.g. through the household moving to a different property, or through a job change in the firm, then it would be useful to note this and account for this variable in the analysis.

6.3 Incentivising participation in the customer survey

Impact Research propose structuring incentives to participants to induce them to take part in the study, and then to compensate them at each subsequent shorter interview where the effect of a CLASS trial is assessed, with a possible bonus upon completion.

This is a logical tailoring of incentives. However, it is important to prevent participants dropping out of the sample before the experiment is completed, and as far as possible to retain the same individuals in the sample throughout the time period of the experiment.

So, the bonus at the end needs to be more explicit and definite (it is currently rather vague) and be sufficiently large to ensure that the vast majority of participants complete all the experiments. This will ensure that the characteristics of the households, as well as those of the industrial and commercial customers, are standardised throughout the research.

7. THE SURVEY PROCESS

7.1 Overall survey approach

The study by Impact Research envisages collecting demographic, energy consumption, attitudinal and behavioural data at the beginning of the study from each customer in the baseline survey.

Subsequent telephone survey contact is to ascertain whether the test or control group customer has perceived or experienced any change in their electricity supply.

It might also be useful to ascertain whether there has been any significant change in the household or in the appliances it uses at each interview stage. For example if the household has subsequently had a stair chair lift installed between interviews, the customer might have more concerns, and also be more sensitive to possible changes in electricity supply compared to those expressed in a previous interview.

7.2 Pre-notification of a test taking place

The research is innovative in assessing whether there is any impact on perception from an information effect where customers are notified 48 hours in advance that a test might occur.

48 hours seems an appropriate time frame for this. If the time period is longer, customers may forget about the experiment, whilst a shorter time period may not be enough notice to disseminate information to everyone affected e.g. in the household (if the respondent is temporarily absent, and CLASS affects only other household members).

If the notice does not inform customers of the specific 30 minute period during the day when CLASS will be implemented, or a broader time period e.g. between 4pm and 6pm, then the questionnaire should ask respondents if they observed a CLASS effect during each 30 minute time period between 4pm and 6pm. Either way, with a specific 30 minute time slot named or a time period, the study can evaluate whether customers' observations correspond with actual occurrence.

7.3 Survey coverage

My understanding is that the survey will ask if any effects are noticed (spontaneous) and then provide respondents with more specific trial dates and times (prompted). The survey needs to ensure that this does not encourage positive response bias. If

survey participants have noticed an impact they should themselves be able to recall the date and time of this impact, provided the survey is conducted soon after the trial.

8. STATISTICAL ANALYSIS

8.1 Suitable statistical tests

The statistical analysis proposed by Impact Research assumes that each test trial is independent, and that the maximum of 4 interviews subsequent to the baseline survey are independent. This is a reasonable assumption. But it may also be the case that some customers are interviewed more than once, so that the data could also be assumed to have a panel structure.

A panel structure may give rise to correlation between observations or responses from the same customer (household or I&C). Thus a customer may be sampled on different voltage reduction occasions, or as part of a control group. The statistical significance of the customer's perception across these events could be assessed in terms of a non-parametric matched pair sign change.

Thus there are additional non-parametric statistical tests which might be more applicable to the data, depending on how the data is analysed; or if there is a case for assuming the error terms are not normally distributed. If this is the case, and if the data has a panel structure, then non-parametric statistical tests could be used, such as a McNamar test, Cochran Q test, or a Wilcoxon match pairs signed ranks test. These tests would account for responses where samples were related (two sample cases, or k sample case).

Which test to adopt would depend on how the response perception question is asked in the customer survey. Impact Research suggest a nominal response question e.g. did you notice any difference? yes/no. But it may be that an ordinal response question could be adopted e.g. no difference, slight difference, large difference.

8.2 Drawing on the key learnings from other relevant studies

Previous studies¹ investigating disutility and willingness-to-pay (WTP) to avoid outages have identified the time of day, day of week, season of year, and usage of electricity, as important factors. Impact Research rightly suggests that the analysis should drill down into the data by sub-groups which have sufficiently large sample

¹ K.G. Willis and G.D. Garrod (1997). Electricity Supply Reliability: estimating the value of lost load. *Energy Policy* 25 (1): 97-103.

sizes to produce statistically significant results, namely season, customer type, type of test, pre-notified or not notified, test vs control, and rural vs urban.

8.3 Enriching the results with additional analysis

It may also be possible to apply some additional statistical analysis to investigate differences between groups of customers, e.g. those who notice a difference when a CLASS test occurs and those who do not.

Discriminant analysis can be used to assess what variables assign each customer to a particular 'group' i.e. those noticing a difference, and those who do not. Alternatively multinomial logit (MNL), and latent class (LC) techniques could be used to explore 'group' membership, and what 'groups' actually characterise the data. Of course this is not key to the validity of the results of the study, but it aids understanding of the results and can identify which factors are likely to be instrumental in individual customers' perception of whether a voltage change has occurred.

The application of analytical statistical techniques such as discriminant analysis, MNL, and LC analysis, depends on what information is initially gathered from individual customers about their use of energy, and their household characteristics, or the characteristics of their firm.

9. CONCLUSION

The research methodology and analysis suggested by Impact Research on Customer Load Active System Services is an excellent, admirable, study proposal.

The research methodology is commendable in its experimental design with test and control groups; in assessing whether the effect of CLASS on customer utility is statistically significant or not; and also in measuring any information and placebo effects that might be attributable to CLASS.

The analysis proposed is meticulous and detailed, and will provide accurate and reliable information about customers' preferences.

The research analysis might be enhanced with richer information in recording customer preferences and perceptions in the test and control questionnaires, and with more attention to detail on the characteristics of customers. This would allow additional statistical analysis, as well as the application of non-parametric statistics to exploit the full structure of the data set.