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| Network Innovation Competition 2020 Supplementary Answer form | | |

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| Project Name | QUEST | | |
| Question number | #30 | Pro forma section | 3 |
| Question date | 29/09/20 | Answer date | 01/10/20 |
| Question summary | In your response to SQ26, you stated you “will now include for an additional deliverable in the QUEST project, undertaking research on how and by what degree this relationship might change in this period.” Please could you provide more information on the scope and method of this additional deliverable. | | |

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## Answer (please retain document formatting and do not exceed 2 pages unless otherwise agreed with Ofgem)

We will conduct a targeted tender exercise during project delivery to ensure value for money, during which the precise methodology for this research will be confirmed. We would seek suggestions from tenderers on how they might best approach the research question.

However, we consider that the scope and method for the additional deliverable can be split into three key areas:

1. Research and stakeholder engagement

A literature review of projects and academic research into the voltage demand relationship will be conducted. Working alongside our partners, we will consult equipment vendors of low carbon technologies (e.g. ASHPs, EV chargers, LED lighting, battery inverters, PV inverters) to understand the electrical characteristics of these technologies and how they respond to changing voltages both today and in future.

We will consult a relevant company with expertise in econometric forecasting, such as Delta-EE, to get data on household load profiles which include EVs and heat pumps. Delta-EE maintain an ongoing database detailing the type of chargers expected to make up the approximately 2.9 million home charging devices predicted for the UK by 2030, as well as other types and locations of EV chargers, and also monitor the roll out of heat pumps across the UK, recording details of the various manufacturers’ market shares and their respective heat pump types. As part of the Demand Scenarios project, Delta-EE conducted load forecasting work for ENWL which considered the impacts of the evolving loads and profiles resulting from the electrification of mobility and heat and understand the breakdown of typical residential loads and the extent to which each type of load (inductive, resistive, etc.) might be modified using voltage control.

1. Review network data to determine today’s voltage demand relationship

The intelligent relays deployed as part of CLASS and QUEST measure the voltage demand ratio (kp), and this data will be assessed to understand if it is changing over time. This value is captured from the relays at 15 minute intervals and stored in the NMS data historian which gives access to up to 3 years of data currently.

This will be supported by data from the LCTs (see 1, above) connected to each of the substations; for example, EV charge points, heat pumps, storage, and distributed generation connection over time.

1. Assess the future voltage demand relationship

The future uptake of LCTs is uncertain, but there are several established forecasts that provide insight and uptake scenarios we would expect to use:

* National Grid’s Future Energy Scenarios (FES) to provide a national view of LCT uptake and the future characteristics of the power system in GB.
* ENWL’s Distribution Future Energy Scenarios (DFES) to provide a more focused view of the future load and uptake of LCTs in a distribution network.

This data will be used in conjunction with the findings of the network data analysis (see 2, above), literature review, and stakeholder engagement (see 1, above) to estimate the future energy mix. Using methods consistent with the CLASS research, we will conduct power system modelling to determine the voltage demand relationship.

The various scenarios within the DFES will be used to perform a sensitivity analysis within the modelling and demonstrate how the voltage demand relationship is affected by factors such as seasonality, customer type, load type, and low carbon technology type.

The output of this modelling will deliver the expected voltage demand relationship and associated kp values along a future trajectory out to 2050, to be used in the update of the project cost benefit analysis.