Low Carbon London
'a learning journey'

Change Request CR1
11 December 2012

vFinal

Confidential and Restricted

Contents

1. Introduction – Objective

Low Carbon London is fully committed to delivering a rich portfolio of learning outcomes that will benefit our electricity customers, other DNOs, and our joint stakeholders. It will inform the future development of effective and efficient low carbon electricity distribution and explore the necessary steps of transition and identify the optimum way of implementing that transition. It is an extremely important strategic project to UK Power Networks, our project partners and customers alike. To our knowledge, Low Carbon London is the most ambitious and expansive of the LCNF projects approved to date, encompassing a holistic approach across our complete network and business activities. UK Power Networks remains committed to delivering DNO-led focussed trials, analysis, reporting and associated learning objectives.

The project is based on a portfolio of trials and experiments delivered through a number of project workstreams, to demonstrate new technologies, demand types and innovative technical and commercial solutions. The project seeks to better understand and to validate the impact of the deployment of new low carbon technologies and devices, their interaction and associated impact across the depth and breadth of the entire DNO electricity system network and business operation. This will provide a valuable insight into customer behaviour and reaction that models the likely action necessary for the transition to a low carbon economy and the building blocks of the 'smart grid' of the future.

The revised proposals detailed here will still deliver the original outcomes and benefits, moreover in most cases they are a development of the originally stated research methods, e.g. augmenting trial data by obtaining additional suitable empirical data from other real UK low carbon trials. The proposals also represent significantly better value for customers, for example by reducing costs to recruit 'active' trial participants, with a change of methodology from active recruitment to using empirical trial data from other UK low carbon trials. (For clarity, this is not modelled data and therefore will still provide relevant and valuable new learning.)

The LCNF is itself aimed at encouraging challenging, ambitious innovative research and development whilst operating in a climate of an extended economic downturn. The nature of such projects means that the approach to delivering the learning must continually evolve and adapt, in response to the emerging environment, experiences and insights gained. Low Carbon London is explicitly branded as a "Learning Journey", and this adaptive approach delivers the same outcomes more cost-effectively, so maintaining and protecting value for consumers and investors in the project.

The total project budget funded by customer contributions is proposed to be reduced by c. £3.58m. This reduction will be offset with a further contribution of funded costs of £2m by UK Power Networks and project partners resulting in a net reduction. This budget reduction will be delivered by a mix of savings, renegotiated cost reductions, increased benefit in kind and additional cash contribution. If costs turn out to be lower than anticipated, it is planned that any unspent part will be returned to contingency (subject to approval) and if un-utilised then back to the customer.

In accordance with Ofgem's LCNF Governance Document V5, (paragraph 3.98), this change request sets out the proposed project changes.

The changes are set out in two distinct categories, changes to the Project Direction driven by material changes in circumstances (Section 2) and other changes to the project that do not require changes to the Project Direction (Section 3).

Following discussions with Ofgem over previous draft submissions, and taking guidance emanating from those discussions, some proposed changes have been re-categorised (e.g. from a material change to a developmental change) and two previously proposed changes (ANM and Electric Vehicles), are now no longer required due to the project successfully mitigating the drivers, namely recruitment challenges, for the original proposed changes, but have been included in Section 3 for completeness and information.

Each material component of the change is set out in turn, providing a concise explanatory reason why the change is required.

For each component, the detail describes:

a) what the change is;

b) the reason for the change (and for those changes to be set out in the revised project direction, an explanation of the exact material change in circumstances requiring the change); and

c) why the change is in the best interests of customers – this section will also address any points raised from the TNEI report or from other DNO's.

It is important to recognise that the Ofgem appointed adviser, TNEI's Graeme Bathurst, is *"comfortable with the direction that the project is heading and that it is on-track to achieve the stated learnings and deliverables. There have been some changes that have been necessary due to external factors and learnings as part of the process, but these appear to being managed effectively and are not unexpected on a project of this nature."*

2. Material Change Request Detail

This section describes each component of the material change request. It sets out each change to the Full Submission, the material change in circumstance requiring the change, why the change is the most appropriate way forward (including commentary and narrative to back up the current position in light of comments from the DNOs/TNEI).

Section 6 sets out any other responses to any other DNO/TNEI comments not already covered elsewhere.

2.1 Changes to the project direction driven by material changes in circumstance

2.1.1 Heat pump trial recruitment

The Requested Change

The project formally notifies Ofgem that it wishes to cease **active** recruitment of further participants for both residential and I&C heat pump (HP) trials. This applies to both Industrial & Commercial (I&C) as well as residential trials.

The project proposes to augment the project's own heat pump trial data with real empirical data from other appropriate UK-based heat pump trials and sources, focussing principally on I&C applications, harmonic effects and implementation.

The material change in circumstance requiring the change

The project formally notifies Ofgem of a lack of heat pump installations in LPN, and delays to the implementation of the Renewable Heat Incentive (RHI) having an added effect to the lack of installations

The availability and recruitment rates of participants for the project's heat pumps trials has been found to not match that implicitly assumed in the original submitted bid.

Further active recruitment of participants is likely to be slow and expensive and would not represent best use of customers' money.

To date, heat pumps are not an evident or prevalent low carbon technology in a dense city such as London. This is due to a number of factors including the delay in the establishment of the Renewable Heat Incentive, the underlying geology of London and the lack of available ground space for residential installations.

Why the change is in the best interests of customers

The reason for this proposed change is to recognise that diminishing returns from further active recruitment within London means that this is not a cost-effective use of customers' money and that the trial numbers recruited to date constitute a suitable sample (both in the I&C and residential categories) of trial participants.

The proposed change recognises that further **active** recruitment within London is not a cost-effective use of project resource or customer funds.

The expected final pool of trial participants, will constitute a workable sample (both in the I&C and residential categories) of trial participants from those actively recruited to date and those expected to continue to enrol, either through yet to complete recruitment in progress, or through other participants recruited through passive organic recruitment by general awareness of what is now a very high profile low carbon project in London.

The use of empirical data from other suitable UK-based heat pump trials, including other LCNF projects, is a very cost-effective way to supplement the project's own garnered trial data.

The project has worked closely with Imperial College London to develop data normalisation techniques that will enable empirical data from other UK heat pump trials to be absorbed into the project's London network topology. This data will supplement the project's own trial data as if the data had been originally and empirically collected from trials conducted within the London Power Network itself.

It is important to recognise that project trial participant numbers may continue to increase, but this will be solely due to direct approaches to the project from potential participants themselves and not through any active recruitment. The project will also intend to maintain current recruited participants to ensure an engaged and positive customer experiences. The project may also acquire empirical data from all sources, properly and robustly assessed where it is appropriate and cost effective to do so.

Points raised in TNEI report or from other DNO's

The TNEI report recommends that the heat pump trials are de-scoped from the project. This recommendation is not supported by the project. As has been outlined previously, the project has made considerable progress in the cost-effective recruitment of both Industrial and Commercial (I&C) and residential heat pump, and given the holistic integrated nature of the projects trials and objective and expected outputs however, it is recognised that further active recruitment would not be a good use of project funds.

The costs to the programme of recruiting these participants to date has been cost-effective, with the data obtained being invaluable to the project and to the wider DNO learning. It should also be noted that the costs to reverse engineer heat pumps out of the projects designed trial and network topologies will be expected to be in excess of any perceived financial savings through cancelling the HP trial elements.

No explicit comments relating to heat pumps were received from other DNOs except for Scottish Power around the concept of 'relevant data injects', although it was recognised by a number the respondents, of the importance and necessity to be adaptive to trial design, data sources, recruitment processes (NPG, SSEPD, WPD as examples) and the maturity of technology and users of low carbon technology, and the importance of developing an understanding of their effect and application to power networks (see WPD and SP Energy Networks DNO responses as an example).

The project has also developed a categorisation and selection process; as per document reference LCL CR1 vFinal 201112 Active Injects Trial Location Categorisation and LCL CR1 vFinal 201112 External Data Injects Process Flow Diagram. These are focussed exactly on the issues raised such as relevance, accuracy, and UK focus.

These will come from a range of sources and locations. They will be evaluated & tested for relevance, robustness etc, such as:

- Low carbon technology data connected to and in use in other parts of the UK Power network distribution system.
- Other LCNF trials and stakeholders, an example being the CLNR HP trials.
- Imperial College – all relevant departments.
- Institute for Sustainability (IfS).

- Other projects UK Power Networks is associated with aligned to LCL:
  - FP7 Project Celsius – Bunhill Heat scheme involving Islington Borough Council.
  - Other TSB projects - Sept 2012 to 2013 – 'CHP VPP', and Home Energy Demand Response
  - London Future City Demonstrator – collaboration partner lead by GLA and involving c. 30 organisations and entities.
- Partner data, supplier data - i.e., EV vehicle charging profiles; EV use profiles and charging data.
- Smart meter data, and potentially EV and smart meter ToU data from other/current trials undertaken separately by other project partners – matters around confidentiality and sensitivity will need to be robustly assessed and understood.
- European funded FP7 EV Project – Green eMotion.
- Delta-EE – Heat Pump data.
- Energy Savings Trust – Heat Pump trial data.
- Eurolab.

2.1.2 Moving from trial areas centred on the Mayor's ten low carbon zones to trial zones throughout all of the London Power Network (LPN) area

The Requested Change

The project formally notifies Ofgem that it:

a) seeks to move from a network topology and trial participant pool based exclusively on the now-defunct Mayor of London's ten low carbon zones (LCZs), to a network topology and potential trial participant pool based on the wider London Power Network (LPN); and, where appropriate, to select some trial participants (e.g. for SSEG or EV trials) drawn from UK Power Networks' Eastern and Southern Power Network areas;

b) seeks to create three engineering instrumentation zones (EIZs), based on three of the previous low carbon zones (Brixton, Queens Park and Wandle Valley) to provide areas of intense and in-depth technical analysis of the impacts of low carbon technologies and techniques on the distribution network;

c) has increased trial participant demographic profile sample types and spread for the smart meter and ToU trials. The project has Increased the demographic samples groups from 2 to 17 based on Experian ACORN and MOASIC classifications and the trial ToU recruitment numbers from a notational less than 100 for wind dynamic ToU to c. 1,500 ToU trial participants This is based on a 30% uptake rate of conversion to a ToU tariff, a 20% attrition rate and a 90% confidence level to provide a statistically valid and robust trial outcome. (As detailed in the use case document – section U0 1.1 page 7; there where no quantities given for dynamic ToU participants in the original use case document. In the Use Case reference U0 5.1.b 15,000 participants was noted. This is a legacy error from post bid stage as the project direction stated 5,000 smart meter participants - as further evidenced in the bid stage submitted Project Description document Box No. 24, page 45. The justification and academic analysis for these numbers is underpinned and evidenced in the following documents ToU Scope Impact Assessment - FINAL - Confidential v1, ToU tariff design v0 6, ToU High Level Plan V1, and finally within document reference: Low Carbon London - Smart meter options - v1 0.pdf.

The material change in circumstance requiring the change

The project formally notifies Ofgem that the material changes in circumstance is that the Mayor's LCZs were dismantled in Q2 2012 and no longer exist. This decision was notified to the project in December 2011 with final LCZs' closedown reporting taking place in March 2012.

The impact of the closedown of the LCZ initiative was exacerbated by the delayed pilot deployment of the initial 500 smart meters, which was deferred by six months in 2011 whilst the situation regarding the expected availability of a SMETS-compliant smart meter was clarified and the decision subsequently taken to deploy an existing Generation 2 (Gen 2) meter, the L&G 5236.

Why the change is in the best interests of customers

As reported to Ofgem in previously issued 6 month progress reports, and as a result of pilot trial in 2011, if the project had based all of its recruitment and trials on the ten LCZs then the usefulness of the data gathered would have been considerably constrained and of negligible and limited use, as a London-wide model or as one capable of extrapolation to other DNO areas, large GB cities or to a GB-wide level of modelling and forecasting. Furthermore, considerable additional expense would have to have been incurred on targeted recruited to achieve some level of acceptable demographic balance from within the ten LCZs.

In addition, the LCZ's did not represent a balanced demographic of London, nor one that would provide a sound basis for further extrapolation to a UK level or context, due to the focus, whilst a robust endeavour, on areas of social deprivation and urban regeneration when all 10 LCZs are taken into account as a whole.

Recruiting from the wider LPN area provides a more robust, much broader demographic base pool of potential trial participants across all proposed trials. Further the need to revalidate the ToU demographic sample types and number and the ToU trial participant numbers is necessary to provide statistically valid robust trials outputs that can also be extrapolated to a UK level.

Specifically for the smart metering profiles and consumption trials, such an approach allows a balanced sample set of trial participants to be recruited much more cost-effectively than would otherwise be the case if such a pool were to be drawn from the original ten LCZs, due to the inherent demographic skew the ten LCZs present, due to their deliberate focus on areas of social deprivation and needed regeneration.

The specific three ex-LCZs selected as EIZs do in themselves provide a better demographic mix that can be extrapolated to a Great Britain wide level of analysis, as well as providing an appropriate mix of low carbon technologies to suitable levels of density, critical mass and low voltage network context within the LPN area.

The EIZs are representative variants of LPN's overall LV network topology and will be intensely instrumented to provide the required density and critical mass of empirical data measuring the impact of low carbon technologies on the LPN network.

By adopting an LPN-wide approach to general recruitment and being prepared to allow selected suitable trial participants from UK Power Networks' other distribution networks where appropriate (e.g. for selected SSEG and EV trial participants) and with data suitable normalised to appear as if it had been generated from within the LPN area, represents a significantly more efficient and cost-effective approach to recruitment.

Similarly, the use of three ex-LCZs as EIZs provides a sound but concentrated balance of suitable network variants and clustered low carbon technologies at required levels of density and critical mass represents a better value approach to providing the required in-depth DNO analysis of the impact of low carbon technologies and techniques on the distribution network than would have been the case using a much broader but of necessity more diluted ten LCZ-wide approach.

The three EIZ approach represents the most cost effective and value for money option to meet the aims and objectives of the project when compared to an un-clustered instrumentation approach without relevant density, as originally suggested with the 10 original LCZ's.

It should be noted that Imperial College recognised the value of this approach in their letter commenting on LCL CR1:

"*The rationalisation of the original proposed 10 Low Carbon Zones to 3 engineering zones also represents a significant, more demographically and representative sample (and at a UK level) step forward in the engineering and network visualisation trials. In focussing on fewer zones it has been possible for HV and LV datasets to be clustered, cleansed and integrated; this again represents a large step forward in terms of understanding data management issues and the data quality for control and planning analysis purposes. These are essential steps for integrating new methodologies and approaches into the main-stream process of managing and designing future distribution networks.*"[1]

Points raised in TNEI report or from other DNO's

The TNEI report requested further justification of the costs associated with the two Engineering Instrumentation Zones (EIZs) proposed when compared to the costs associated with the 10 original Low Carbon Zones (LCZs).

The number of EIZs has been increased from an originally proposed two EIZs discussed with TNEI, up to three EIZs without incurring further cost, through coordination with the UKPN Tier 1 project "Distribution Network Visibility", by facilitating an overlap in the locations of the required upgraded RTUs for both projects, thus actively demonstrating effective cross-project collaboration.

It is also important to note that the instrumentation approach and costs within the original LCZ's had not been fully detailed in either the original bid or at any stage in the project prior to the adoption of the EIZ approach. The instrumentation approach was only designed once the three trial hypothesis themes of a) network visibility, b) demand flexibility and c) high-resolution profiling, had been established in late 2011 (as reported in the PPR of December 2011), as part of the detailed design process.

In the absence of an available Generation 3 (Gen 3) smart meter, the costs of providing full alternative instrumentation

[1] Professor Goran Strbac, Letter to Liam O'Sullivan , 3 September 2012

across the 10 LCZs would undoubtedly be very significant and well outside of the budget provision and funding of the project. This cost over-run would have been subsequently worsened given the potential stranded asset risk and considerable decommissioning costs and associated increased customer disruption. The alternative approach of using a sub-set of three of the original LCZ's represents a more cost-effective and better value approach for customer investment.

The project also expects to further enhance the instrumentation approach through co-ordination with the UKPN Tier 1 project "Smart Urban LV Network". This project is fully instrumenting the LV network associated with two City Road Substation HV feeders and at no further incremental cost to customers.

In summary, it was never intended to provide full instrumentation across the 10 LCZs and no cost analysis was provided for such within the original bid; clearly if a "Gen 3" smart meter capable of measuring voltage characteristics had been available then the incremental instrumentation using RTU's may have been different, however, since a "Gen 3" meter has not been made available, the project, by carefully selecting three LCZs to form the EIZs, has achieved a highly cost-effective instrumentation solution that in many ways represents an improvement on a low-density, un-clustered instrumentation spread across 10 LCZs. Additionally, the LV network topology within the three EIZs best represents the topology within the whole of the LPN area.

Therefore, it is not possible to provide a cost comparison of instrumentation costs in ten LCZs against the instrumentation costs of the three EIZs. However, the above explanation demonstrates that the instrumentation of the three EIZs represents best value for money and will enable a richer portfolio of analyses and DNO learning than would otherwise have been the case using the 10 LCZs.

Positive and supporting comments relating to the move to trials areas throughout all of the LPN area and the development of the three EIZs were received from other DNO stakeholder partners, an example of this can be evidenced from SSEPD, WPD responses:

- significantly increased statistical confidence and validity of trials and participant samples;
- increased/better modelling robustness;
- behavioural sample sets increased in validity and application, capable of being extrapolated across all of UK and other DNO areas as relevant;
- increased number of demographic groups, increased validity and robustness in participant survey data gathered as a result;
- reduced costs due to stranded asset risk and decommissioning burden;
- increased scientific rigour for modelling and time of use trial participant modelling and outcomes; and
- reduced cost, increased benefits and value for customers and DNO's.

2.1.3 Change from ENXsuite to a custom-built carbon impact reporting tool

The Requested Change

The project formally notifies Ofgem that it wishes to move from ENXsuite, a common non modifiable, customisable off the shelf carbon impact reporting software application tool to a custom-built, bespoke but adaptable reporting tool.

The material change in circumstance requiring the change

The project formally notifies Ofgem that the ENXsuite software package for carbon impact reporting was acquired by new owners Infor, in October 2011. Infor decided not to honour the original quotation to acquire the software, nor the commitment to subsequently customise the product for use within the LCL project.

Instead, Infor proposed a significantly increased price, which was well outside the available budget provision within the project and a refusal to provide the promised tailored changes to meet specific LCL carbon impact analysis and reporting requirements.

Why the change is on the best interests of customers

As discovered, notwithstanding the inflexible nature of the product, following both detailed discussions with Logica, the project partner who had proposed to use the ENXSuite tool, development of the 'brief' and application of such a tool for the project post solution design development and in dialogue with the National Physical Laboratory, Teddington (NPL), the project contracted with Logica to deliver a new carbon impact tool suite. NPL conducted a successful technical assessment and certification of the proposed algorithms designed to meet the full requirements of the project. The final outcome represents a more cost effective and better value proposition for the project and in-turn customer funding, whilst maintaining the original, albeit developed, brief and application for the tool.

Although this resulted in an overall increase in costs of £110,000 from the original pre-takeover ENXsuite estimate (i.e. not the increased estimate from the new owners Infor), £46,800 was absorbed by Logica and the project sustained a cost increase of the remaining £63,200. The revised solution has also enabled the project's precise detailed requirements to be fed into the specification, enabling a more exact, adaptable and precise set of carbon reports specific to he broad an integrated nature of the various trials to be delivered throughout the project than would otherwise have been the case with the "off the shelf" ENXsuite solution.

Points raised in TNEI report or from other DNO's

TNEI requested an explanation of the reasons for the move from using ENXsuite to a generic 'carbon tool'. They also requested reasons for and benefits of this change as well as details of how this impacts on project costs.

These requests are fully addressed in the detail above.

No specific comments relating to move to the move from ENXsuite to a custom-built carbon impact analysis and reporting tool were received from other DNOs.

3 Changes that were included in previous versions of the LCL change request drafts.

This section sets out other changes to the project that do not require changes to the Project Direction as now recognised. These are now described as project developments. These are driven by learning and insights gained from pilot trials, customer feedback and recruitment activities, as well as required adaptation to deliver and maintain the outputs and objectives of the project. This requirement was also recognised by the DNO stakeholders, as detailed in their feedback and is supported by the project academic partner, Imperial College London.

This section also sets out changes that were included in previous versions of the LCL change request drafts; and why the project no longer considers that these developments require changes to the LCL Project Direction.

These are principally:

- the combination of dynamic time of use and wind twinning tariff trials;
- the development and adaption of the active network monitoring (ANM) trials;
- the profile, coherent treatment and coordination of Small Scale Embedded Generation (SSEG) detailed in many of the trial descriptions in the original use cases and now condensed into a coherent trial hypothesis and set of tests and use cases;
- use of L&G 5236 Gen 2 meters;
- I&C Wind Twinning and Multipartite DR contracts
- treatment of SME's; and
- the deployment of time of use EV charging and load shift associated with EV charging

Section 3.1 explains the background to the status of the trial areas that are deemed as non material changes. These were detailed in previous versions of change request drafts and notifications that do not require a change to the project direction. These drafts had included projected changes that do not require changes to the project direction that have resulted from further discussions on previous change request drafts that outlined and detailed other project developments. Section 3.2 sets out reasons for the changes as now described as developments, and why these developments and adaptations are in the best interests of customers, including addressing points raised by TNEI/DNOs.

3.1 From the outset of the original discussions in April 2012, the project has since briefed Ofgem on challenges and projections on trial types, locations and recruit quantities with confirmation on potential effects this could have had on elements of the project delivery and expected outcomes.

This developed into a proposed change request to the LCL project issued to Ofgem, with subsequent adaptation. Ongoing focus and drive in delivery, resulted in the project lead by UKPN outlining other developments to the project that whilst not forming a material change and therefore are not part of the formal change request, are of note to provide an oversight of the overall shape and development of the project at this stage.

In some areas, these developments have also been refined since that stated from the start of the change notification process due to for example areas related to trial participant recruitment – where previously, quantity, type and location of recruits had lower than expected projections and forecasts – these were less than have now been acquired or projected to be acquired as trial recruits having now recovered or increased – an inherent nature of conducting such pioneering innovative projects.

3.2 The development areas in more detail

3.2.1 Use of a combined dynamic multi-tariff time of use trial

Change element

The use of a combined dynamic multi-tariff trial covering wind twinning and residential and SME demand side management.

Reason for the change and why the change is not considered a material change

The project intends to adopt a dynamic multi-tariff trial that combines wind twinning and residential and SME demand side management (this approach was originally envisaged in the use cases and has now been developed and underpinned with robust statistical analysis conducted by ICL), with increased demographic profile class types and sample sets.

This change is not a material change as the project will execute the full scope of the trials as described in the original use cases, it is simply a more efficient method to delivering that scope. There is no material change in circumstance driving this development and the Project Direction does not require amendment as a result.

Why the change is on the best interests of customers

The dynamic ToU trial combines a number of use case scenarios within a single trial exercise. There is no loss of scope from the original dynamic or wind twinning use case scenario. Dynamic ToU trial participants will be subject to signals simulating the availability of wind generated electricity AND also network constraints – maintaining a DNO focused set of trials and outcomes whist recognising and enabling outcomes to be evidenced: on the developing potential for low cost low carbon generation; and the visibility of constraints and synergies of concurrent effects of network constraints and availability of such low carbon generation being optimally used by customers.

This approach is evidently supported as the right course of action and truly supports recent industry, government and Ofgem endeavors for a reduction in tariff numbers offered to and simplicity of use by customers, with a reduction in complexity of implementation to customers and the burden of use by customers.

It has also been assessed and concluded by UK Power Networks and Imperial College that by combining the dynamic network constraint and dynamic wind trials as an integrated set of interventions gives a truer outcome of the DNO lead ability to robustly consider and use such tariff structures for network management purposes.

Combining the dynamic tariff trials into a single integrated trial keeps the required trial sample population to a realistic and manageable size. Conducting separate trials to achieve statistically valid results would have required an initial pool of potential trial customers well in excess of the total electricity customer population of London.

Static tariff trials will still be maintained and conducted with data sets, suitably managed in terms of anonymity and security from other LCNF projects and suitable data sources.

Points raised in TNEI report or from other DNO's

The project does not support the suggestion to reserve the decision on the wind twinning tariff. This is for three very important reasons:

a. Firstly, and as stated previously the wind twinning tariff trial is being progressed as part of the wider dynamic Time of Use (ToU) tariff trials. The dynamic ToU trial combines a number of use case scenarios within a single trial exercise and therefore, there is no loss of scope from the original wind twinning use case scenario. Dynamic ToU trial participants will be subject to signals simulating the availability of wind generated electricity. It has also been assessed and concluded by UK Power Networks and Imperial College that combining the dynamic network constraint and dynamic wind trials as an integrated set of interventions gives a truer outcome of the DNO-led ability to robustly consider and use such tariff structures for network management purposes.

b. A further reason to combine the dynamic tariff trials into a single integrated trial is to keep the required trial sample

population to a realistic and manageable size. Conducting separate trials to achieve statistically valid results would have required an initial pool of potential trial customers well in excess of the total electricity customer population of London.

c. Thirdly, the relevant paragraph in the TNEI report (3.2.2) does not clearly set out the reasons for the recommendation to reserve the decision. The reviewer recommends that the decision is reserved "until it is proven that it is not required/necessary/relevant", but the report does not explain how it will be proven one way or another, nor how such would or could be implemented – note that implementing a ToU tariff is a very complex and time laboured process (and costly). This approach, at a statistically valid and robust scale, is simply not practical or valid within the timescales and integrated nature of the LCL project. Therefore it is the projects' considered judgement that it is simply not possible to agree to and implement something that is not properly defined, practical or cost effective for limited unproven outcome.

The ToU tariff approach and the potential use of other existing trial data and collaboration on the use of such data when already funded by customers is supported by the DNO stakeholder partners, as example in WPD, SSEPD and NPG responses.

3.2.2 Increased co-ordination and profile of Small Scale Embedded generation (SSEG) within the overall project

Change Element

The project will increase the prominence of SSEG within its monitoring trials into a coherent set of coordinated combined trials.

Reason for the change and why the change is not considered a material change

The trials will centre largely on I&C based SSEG installations, by far the most common and relevant implementation of this type of low carbon technology in a city metropolis such as London, although some residential SSEG installations have also been recruited.

This is not a material change as the project is collating and condensing the treatment of SSEG technologies as detailed in many of the trial descriptions in the original use cases into a coherent trial hypothesis and full set of tests and use cases.

There is no material change in circumstances driving this change and the Project Direction does not require amendment to reflect this change.

Why the change is in the best interests of customers

Installations within the wider UK Power Networks distribution networks of South Eastern Power Networks Plc (SPN) and Eastern Power Networks Plc (EPN) will also be considered for inclusion where appropriate. The network topology infrastructure within the project has been specifically designed and built to accommodate and normalise real data (i.e. not modeled or computer-generated) from other sources. This approach is both valid and is normal practice within the DNO's operational business, to provide enhanced network analysis. Using real data from UK Power Networks' other distribution networks, with proper assessment, categorisation, cleansing and normalisation, in order to present the data as if it had been generated from within the London Power Network, will enable legitimate analysis and learning within the Low Carbon London network topology.

Points raised in TNEI report or from other DNO's

The agreement and confirmation by TNEI to include small scale embedded generation (SSEG) trials is welcomed, which the project and UK Power Networks fully support. It should be noted that these will largely be I&C-based SSEG installations – by far the most common and relevant implementation of this type of low carbon technology in a city metropolis such as London.

However, the further suggestion by TNEI that the extension of the use case 3.2 to include SSEG data from UK Power Networks‟ other two licensed network areas (Eastern Power Network and South Eastern Power Network) is of "questionable value" is not supported by the project.

The network topology infrastructure within the project has been specifically designed and built to accommodate and normalise real data (i.e. not modelled or computer-generated) from other sources. This approach is perfectly valid and is normal practice within the operational business, to provide enhanced network analysis. Using real data from UK Power Networks‟ other distribution networks, with proper assessment, categorisation, cleansing and normalisation, in order to present the data as if it had been generated from within the London Power Network, will enable legitimate analysis and learning within the Low Carbon London network topology. (This was discussed at length in person with Graeme Bathurst and was understood to be an approach with which he was comfortable.)

3.2.3 Active Network Management (ANM) trials – recruitment challenges

Change Element – customer trial participant numbers

Potential trial customers are unable and/or unwilling to allow modulated output from their generation sets for the active ANM trials, leading to reduced numbers for active trials and a proposal for ''Modelled actions to be taken by ANM trials only".

(This change element is for information-only purposes and is included here for completeness, as the project has subsequently overcome the issues driving the original proposed element of change associated with recruitment numbers).

Reason for the Change and why the change is not considered a material change

This was proposed in July 2012, prompted then by the lack of active trial participants for the ANM trials; subsequently, the project has reached the required minimum of 5 active recruits, with either an acquired recruit signed up under contract or agreed in principle reached with an active ANM trial recruit. In addition, the project will also be using ANM to trigger demand response (DR) in the active and autonomous DR calls, i.e. the application of a technical trial solution (ANM) to a DR trial commercial solution contract.

This is considered to be an advanced pioneering application which emulates more closely the future activation of DR from a DNO control and operation automated process (and was commented as being innovative and pioneering by TNEI during their change request evaluation work).

This is not a material change given the continued and increased successes in recruiting participant numbers for the active trials, and as per the development of the monitoring and facilitation trials this is no longer a material concern or change. The project has also developed ANM active trials to trigger demand response customers.

Why the change is in the best interests of customers (expanded application)

Optimised use of resource and funding, where one solution can be applied to multiple trials. Reduces overall costs of equipment, the technical solution will be used in other UKPN lead and LCNF trials UK wide; the solution is developed for the DNO and industry with less stranding risk and potential development, testing and decommissioning cost and risk.

Points raised in TNEI report or from other DNO's

Please clarify what is meant by "Modelled actions to be taken by ANM".

This statement was in reference to one of the mitigations in place supporting the active control of Distributed Generation (DG) learning objectives, and as such was always intended to be part of the "enabling and visualisation of DG". The project is recruiting a sample population of active control DG participants, and a larger sample of DG customers recruited will have ANM systems installed to only monitor the generator output as originally planned. The "modelled actions to be taken by ANM" is the set of control signals that the ANM systems will generate for these installations, in real time, even though the control signals will not physically be issued to the DG control unit. Thus, the activity of the ANM and DG system will be modelled in the project analyses, based on real network data, real DG output curves and these simulated control signals. Given that the project is now proposing to also control DR using the ANM systems developed (which TNEI explicitly commended and praised), this is now a less relevant point when applied to the 'active' DG trials.

3.2.4 Adoption of Landis & Gyr (L&G) 5236 smart meter

Change Element

Availability of SMETS Compliant Smart Meter within the project's required timescales.

Reason for the change and why the change is not considered a material change

The project has adopted the L&G 5236 "Generation 2" smart meter as its core smart meter for the residential and SME demand response and wind twinning trials.

This decision was taken due to delays in the availability of a SMETS-compliant Generation 3 smart meter (still commercially unavailable at time of writing). The L&G 5236 meter is a production version fully tested meter that will provide half-hourly meter reads to enable new demand profiles to be constructed – a crucial component of the project's smart meter trials.

By selecting a mainstream Gen 2 meter, already prevalently in use with EDF Energy and British Gas, as opposed to selecting a less commonly used device, the project minimised any potential stranded assets costs.

This change is not a material change, as the project will supplement the population of Gen 2 smart meters with additional measurement instrumentation deployed in the distribution network, to capture the required data to fully analyse the impact of smart meters on the distribution network.

Why the change is in the best interests of customers

To deliver the project and test required hypothesis. Reduces stranding risk and potentially significant disruption to customers.

Points raised in TNEI report or from other DNO's

None raised by TNEI.

DNOs

Scottish Power suggested the use of a non-approved, non-SMETS compliant "Gen 3" smart meter in a non-fiscal context – this is not considered to be an appropriate alternative.

The project has developed alternative solutions to voltage measurement and monitoring including enhanced version and wider Remote Terminal Unit (RTU) installations and substation monitoring within the EIZs; including the use of EDMI SMETS compliant single phase tariff meter, reference 7B and three phase SMETS tariff meter, reference 10A as secondary or substation metering.

3.2.5 Wind Twinning of I&C customers to provide reserve capacity and frequency regulation

Change Element

Wind twinning of I&C Customers and multipartite DR contracts involving National Grid

Reason for the change and why the change is not considered a material change

The project is working closely with aggregators, other DNOs and National Grid to explore and develop a framework for the provision of reserve capacity and frequency regulation to address the emerging implications based on the variability and unpredictability of wind generation. However, resolving the complexities of this topic are considered to be outside of the timescales of this project and it is unlikely that the project will be able to place a multi-partite contract between DNOs, an aggregator and National Grid within the project's timeframes (although that still remains a key deliverable). The project and its partners recognise that a hurried and aggressive approach to concluding such a fundamental aspect of sustainable low carbon electricity delivery may not appropriate. In the meantime the project is continuing to work enthusiastically and actively with other DNOs, aggregators and National grid to develop a workable framework. It is important to note that the anticipated Use Case learning points will still be delivered as legitimate outputs from the project's active engagement with National Grid, other DNOs and demand aggregators.

This change is not a material change as the project will continue to deliver all the learning points identified in the original use case document.

Why the change is on the best interests of customers

- Optimised use of trial funding and reduced costs to implement.
- To deliver the proposed trial learning, outcomes and objectives – but NOT at any cost or where the practicalities of doing are of little future application or benefit.

Points raised in TNEI report or from other DNO's

No issues raised by TNEI or the other DNOs.

The project continues to develop learning, contracts, trial opportunities and collaborate with National Grid, Aggregators and other DNO's. The project is working on a potential trial with SSE in their LPN area inset network and an existing project aggregator and trial with a recruitment DR customer. Other aggregators have also expressed an opportunity and an interest to develop specific multipartite DR contracts and I &C wind winding trials with existing/future LCL trial recruits.

3.2.6 Treatment of SMEs within the project

Change Element
Treatment of SMEs within the project, Small to Medium size Enterprises (SMEs) involvement in Demand Side Management (DSM) trials

Reason for the change and why the change is not considered a material change
No change - SME have been part of recruitment in all trials, residential and I&C.

This is not a material change as SMEs will continue to be included in all appropriate residential and I&C trials, as per the original use case document.

Why the change is on the best interests of customers

No change.

Points raised in TNEI report or from other DNO's

Please provide further explanation as to why Small to Medium size Enterprises (SMEs) have been removed from Demand Side Management (DSM). TNEI has suggested that they have been removed at our (Ofgem's) request, please clarify where we asked for this change to be made.

For the avoidance of doubt, there has been no change to the treatment of SMEs to that contained within the original use case, project terms of reference scoping or project direction documents. In the change request, the project has stated that it will not be conducting any SME-specific trials and this is in line with the original use case document, where SMEs are always referred to and contained within the phrase "residential and SME customers". SMEs will inevitably be included where captured and recruited across all trials, but will not be explicitly managed as a separate trial group.

3.2.7 Electric Vehicles

Change Element
This change element comprises four components:

a) using CNO charging systems to implement active control of EV charging, triggered by network constraints (e.g. ANM systems);
b) deploying contained EV ToU trials; and
c) monitor EV charging activity, as planned, but expecting fewer enrolled vehicle owners. Final analysis models will use monitoring data together with suitable external, empirical data sources.

Reason for the change and why the change is not considered a material change
This change is not a material change – the project will deliver the outputs envisaged in the original use case document.

With the continued and increased success in recruiting participant numbers for the monitoring of EV charging infrastructure (approximately 1300 EV charging posts) together with the development of demand response trials, has enabled EDF Energy using c.28 vehicles and CNO's, such as Pod-Point across the Source London (PiP) area to support the project in EV time of use and load shift trials respectively.

The project will deliver all the envisaged use case outputs through the improved recruitment rates, the support of the project's relevant partners and the use of external data from other UK EV trials.

Why the change is on the best interests of customers

No change. This is a development of the EV trial delivery strategy.

Points raised in TNEI report or from other DNO's

No issues raised by TNEI or the other DNOs.

4. Benefits Update

4.1 Benefits Appraisal and Review:

The project remains committed, to delivering the learning outcomes, trials and experiments as described in this document.

- The project has committed to deliver two specific sets of benefits:
    - **Direct Benefits:** avoided network reinforcement to a value of £1.8m in the project's lifetime – this is the only direct benefit identified in the original project proposal.
    - This has been realised and delivered and as accepted by Ofgem. Direct benefits of £1.8m have been delivered using demand response contracts delivered by Low Carbon London applied to the derogation mitigation for Ebury Bridge primary substation as demand relief support.
    - **Indirect Benefits:**
        - ***Net benefits:*** arising as an extrapolation of the LCL project costs and deferred reinforcement costs and reduced losses. The learning objectives seek to validate and test the assumptions that underpin the benefits assessment originally described. Delivery of this element remains on track and will be delivered as an outcome of the delivery of the project, and the completion of the various trials and experiments, learning reports and outcomes.
        - ***Carbon Benefits****:* the carbon savings are listed as a subset of 'indirect benefits' as they are related to the assumptions in determining the 'physical' direct benefits associated to avoided / deferred investment. Again these will be delivered and enhanced in terms of robustness and validity test. The original benefits build-up included demand response and EV penetration uptake, not the direct effects of heat pumps or SSEG/DER – the project will be adding these into the overall assessment for delivery by the end of the project. This action will significantly increase the validity of the carbon benefits analysis as a result of low carbon technology uptake.
- These comprise all the identified benefits from the project.

Benefits Analysis Table:

Original Benefits	Revised Benefits	Change Proposed
– Direct benefits arising as part of the project through avoided/ deferred capital investment in network reinforcement – Net benefits arising as an extrapolation of the LCL project costs and deferred reinforcement costs and reduced losses – Carbon benefits	– Direct benefits arising as part of the project through avoided/ deferred capital investment in network reinforcement – Net benefits arising as an extrapolation of the LCL project costs and deferred reinforcement costs and reduced losses – Carbon benefits	NONE
Direct and indirect benefits £1.85m IQI benefit from avoided reinforcement; £12 billion NPV to 2050	**Direct and indirect benefits** £1.85m IQI benefit from avoided reinforcement realised early (LCL Demand response applied to Ebury Bridge primary substation for derogation mitigation for deferred reinforcement scheme)	Delivered and achieved.
Projected carbon reduction 0.6 billion tonnes – NPV of £29 billion compared to BAU to 2050**	**Projected carbon reduction** 0.6 billion tonnes – NPV of £29 billion compared to BAU to 2050**	Still to be realised and as a result of the execution of the project – as originally planned
Learning Reports and outcomes ICL – Learning Reports 1 to 18 To underpin, validate and test assumptions used in the benefits analysis tables and projections	**Learning Reports and outcomes** ICL – Learning Reports 1 to 18 and additional DNO reports 1 to 16 To underpin, validate and test assumptions used in the benefits analysis tables and projections	Refined and enhanced **** note HP and PV (DER/SSEG) empirical trial or 'relevant data injects' did NOT explicit feature in the bid CBA commitments - driven mainly by demand response, residential and I&C and EV uptake impact**

5. Cost Value Analysis

Cost Value Analysis Table (for areas of material change, efficiency savings and development)

Workstream	Original proposed costs	Revised costs	Comments
WS04 EIZ	£191,509	£49,509	Reduction in Instrumentation for 10 zones and to 3 Engineering Instrumentation Zones (EIZ's)
WS04 ToU	£524,738	Unchanged	Costs allocated from contingency
WS02 ANM/DG	£3,413,074	£3,305,074	Refining ANM Active control proposals. Reduction in equipment (part £108k) Also savings in total equipment required.
WS03 – HP	£250,000	£0	Includes (part) decommissioning £100K, Incentives £150K, Recruitment support £150K. No original budget. (saving incl contingency allocation (net))
WS03 – SSEG	£250,000	Unchanged	Costs allocated from contingency
Other central	£8,614,236	£7,285,236	Reduction in PMO (£319k), Accommodation (£402k) and Inflation savings (£398k), Training £250K), remaining net from contingency allocation
Other workstreams	£16,645,572	£ 15,243,572	Includes Smart Metering Profiles, ODS/HE/Tools, PMO, Imperial Learning, Wind Twinning DR, EV/CP
Additional contribution		£2,000,000	Split between UK Power Networks and Partners

The total project budget funded by customer contributions is proposed to be reduced by c. £3.6m. This reduction will be offset with a further contribution of funded costs of £2m by UK Power Networks and project partners resulting in a net reduction. This budget reduction will be delivered by a mix of savings, renegotiated cost reductions, increased benefit in kind and additional cash contribution. If costs turn out to be lower than anticipated, it is planned that any unspent part will be returned to contingency (subject to approval) and if un-utilised then back to the customer.

The Change Request (CR1) reflects the Project's circumstances as at November 2012. The proposed level of change is appropriate given:

- The development of the project delivery to date, the learning's, insights, readiness and maturity of customers.
- The experienced uptake of certain low carbon technologies, SMETS compliant smart meter, HP's, EV's and PV whilst still delivering in the main the expected project benefits – direct, indirect and carbon benefits by developments and refinements to recruitment methods.
- Low Carbon London is an important and ambitious holistic smart grid trial that will generate valuable lessons for the DNO community.
- We should all accept that change is inevitable in an R&D project of this nature.
- The project has responded pro-actively to external changes to preserve the benefits substantially as originally planned.

The changes are principally derived from:

• £1.2m stranded cost absorption for smart meters;
• Resource re-allocation and reduction – saving in contingency;
• Cessation of active recruitment for HP trials - c. £0.3m;
• 3 EIZ's instead of 10 LCZ's originally – optimised use of spend plus reducing ongoing burden for maintenance risk, and decommissioning, c.£0.1m, also provides a more dense clustering effect;
• Managing project location and inflation charges (£0.8m); plus
• Efficiency savings by re-negotiating elements of equipment supply and services from partners, c.£0.8m
• Other, c. £0.3m including reduction in training budget.

6. DNO and Imperial College responses

The contents of the letters and any matters arising were covered in a series of teleconferences, which were attended by Rebecca Langford, on 21 September 2012. The only material matters arising were as follows:

From Scottish Power:

i) Page 3, Section 2 (Changes and Developments Proposed)

SPEN are not as familiar with the project budget as UKPN (and Ofgem), so some clarification of the original project budget and associated Ofgem contribution would help to indicate the significance of any budget reduction and related reduction in LCNF contribution.

UK Power Networks Response -

Request for more information on the original project budget and associated Ofgem contribution – refer to section 5 of this document and change request commercial updates – Project Direction resubmitted cost table Full Submission spreadsheet LCL CR1 vFinal Appendix A 201112 Confidential and Restricted.

ii) Page 4, second major bullet point (external empirical trial data)

No information is provided on whether or not external empirical trial data been identified, and whether this is UK-only data? Further information is required on the sources of data and how applicable they are to the UK-wide context.

UK Power Networks Response –

Refer to Ofgem Q&A document reference ''Ofgem Detailed Questions Response 160812 DRAFT FINAL.docx'' – sources of potential data are identified on a register should UK Power Networks propose to use this approach; such data is also proposed from other LCNF projects to optimise cost of capture from customer funds and some remains to be identified.

The project has also developed a categorisation and selection process; as per document reference LCL CR1 vFinal 201112 Active Injects Trial Location Categorisation and LCL CR1 vFinal 201112 External Data Injects Process Flow Diagram. This is focussed exactly on the issues raised such as relevance, accuracy, and UK focus.

These will come from a range of sources and locations. They will be evaluated & tested for relevance, robustness etc, such as:

- Low carbon technology data connected to and in use in other parts of the UK Power network distribution system.
- Other LCNF trials and stakeholders, an example CLNR HP trials.
- Imperial College – all relevant departments.
- Institute for Sustainability (IfS).
- Other projects UK Power Networks is associated with aligned to LCL:
    - FP7 Project Celsius – Bunhill Heat scheme involving Islington Borough Council (also involved in ANM trials and funding deployment of ANM for equipment for that trial to preserve budget and optimise use for ANM recruitment activities).
    - Other TSB projects - Sept 2012 to 2013 – 'CHP VPP', and Home Energy Demand Response.
    - London Future City Demonstrator – collaboration partner lead by GLA and involving c. 30 organisations and entities.
- Partner data, supplier data - i.e., EV vehicle charging profiles; EV use profiles and charging data.

- Smart meter data, and potentially EV and smart meter ToU data from other/current trials undertaken separately by other project partners – matters around confidentiality and sensitivity will need to be robustly assessed and understood.
- European funded FP7 EV Project – Green eMotion.
- Delta-EE – Heat Pump data.
- Energy Savings Trust – Heat Pump trial data
- Eurolab.

iii) Page 5, Table 1 (Smart meters and Network Visibility)

The use of an advanced Smart Meter was one of the unique selling points of the original LCL project, so the proposed use of the less advanced L&G5236 is disappointing. In particular, replacing smart meter voltage measurements with fewer monitored locations augmented with network modelling will significantly impact on the learning – LV network modelling is known to be fraught with practical difficulties, hence the need for increased network monitoring in all LCNF Tier 2 projects to date. Therefore, is there the option of using a more advanced Smart Meter, even if it is not (yet) SMETs compliant? If there are concerns about using a development meter for customer billing, is it not possible to leave the old meter in place as a back-up and operate the Smart Meter as a secondary meter?

100% coverage of the 500 sites may not be possible, but having the advanced Smart meter as the default option, with contingency measures if there is not enough space for a second meter would be preferable to 100% coverage using a less sophisticated meter. For example, 95% coverage with an advanced Smart Meter would be preferable to 100% coverage with the L&G 5236 meter.
Additionally, one of the expected outcomes of this and many other LCNF projects will be how to assess network performance using incomplete data sets (to reflect the real-world situation). However, the starting point has to be as complete a data set as you can manage in the first instance, then see how much less data you can live with in order to come up with the same conclusion.

UK Power Networks Response –

Scottish Power suggested the use of a non-approved, non-SMETS compliant “Gen 3” smart meter in a non-fiscal context – this is not considered to be an appropriate alternative. The project has developed alternative solutions to voltage measurement and monitoring including enhanced version and wider Remote Terminal Unit (RTU) installations and substation monitoring within the EIZs; including the use of EDMI SMETS compliant single phase tariff meter, reference 7B and three phase SMETS tariff meter, reference 10A as secondary or substation metering.

UK Power Networks are also somewhat disappointed with this issue, but alas that is/was beyond our control. The project will be augmenting consumption profiles with secondary measured data including voltage by using either an EDMI meter or another method of voltage capture based on observed behaviour and capture – NOT modelled behaviour or capture; modelled outcomes using this data was always the case so no change here.

The project has also devised the engineering instrumentation zones which gives greater penetration, critical mass and cluster effect. Also note that the 5,000+ meters are across the whole of London with an enhanced demographic profile and sample size truly reflective of UK and extrapolated to the UK/GB context – a much better outcome and stronger hypothesis. Stranded asset risk and customer journey and experience are key factors so we have empirically assessed what’s actually needed where and to what numbers in terms of penetration to give the same outcome.

Putting in secondary meters leaving the existing does not work as the treatment cases don’t work as per intervention required – the sample sets are skewed and not consistent. Scottish Power comment on coverage

depth and spread versus 100% L&G5236 is fully understood and UK Power Networks totally agree, the project went through a series of intermediate decision points so as to not close the door to some advanced meter coverage until the absolute last moment, unfortunately we have still not reached the point of having a fiscal SMETS meter available to the programme, as the Elster meter promised from May 2011 still has not materialised and will not in time – now proposed in March 2013.

The incomplete aspect we will still test as thoroughly as possible, observe and demonstrate in terms of what penetration may actually be required as opposed to 100% reading coverage.

iv) Page 10, Table 1, Distributed Generation (Summary Benefits Analysis)

The DG output is proposed to be monitored along with the network data in order to simulate control signals issued by an actual control algorithm. We consider that this is a missed opportunity for a trial, in that the control signals should not just be simulated, but enacted in practice with real generators, otherwise this will be no more than a research project which does not align with the objectives of LCNF. Can you comment on the possibility of the control system being operated in "closed loop" control?

UK Power Networks Response –

This has moved on since the CR draft and the project now have routes to DG customers for active control of modulated output as well as modelled outcomes which was always a primary want and requirement – the additional, very real and interesting learning here is of course customer willingness, ability, awareness and the journey of education and confidence to allow output of their 'process' to be controlled by a third party – of course dynamically. Static control is performed today as BaU - we do that today by tripping customers off when an event occurs.

Use of simulated ANM control signals – this concern is now obsolete as the project is in the process of recruiting trial participants (at least 5) prepared to allow active control of their generation installations.

v) Page 14, Table 1, Heat Pumps (Benefits)

Whilst we agree that there has to be a minimum number of devices in order to be statistically relevant, we also consider it important to note that heat pumps (and EV charging) is relatively immature technology and is therefore likely to change significantly in the future. Therefore, we recognise the need to begin the process of characterising these devices, but would point out that this will need to be an on-going process as EV charging and heat pump technology evolves, which given the inherent finite timescales of the LCNF, is outside the scope of this project.

UK Power Networks Response –

Observing that many of the low carbon technologies will be subject to further development and as such will require ongoing investigation and trialling as they develop.

UK Power Networks wholeheartedly agree – statistical validity in terms of sample size is of less importance – duty profiles, consumption, customer behaviour and interaction etc are of course of great relevance and as customers and these technologies are at the left hand side of the experience, innovation and maturity curve – what's observed today needs to be understood and reflected as changing the most in terms of relying on such for locked in investment and planning decisions.

From Electricity North West:

Confirmation that UK Power Networks' contribution, commitment and risk exposure will remain the same and that customers are not expected to provide further funding.

UK Power Networks Response – confirmed.

No other material queries were raised by other DNOs.

7. Change Request Appendices

This change request is composed of (Bold signifies updated versions included):

- **This Change Request CR1 Executive Summary document.**
- **A proposed SDRC table as per the Project Direction document (vFinal 111212)), with tracked-changes from the current version.**
- **A SDRC change log (vFinal) that records each proposed change that this would create to the list of project Successful Delivery Reward Criteria Build, Trial and Evidence Phases.**
- **A proposed update of the Use Case document, (v1.1 111212) with tracked-changes from the current version.**
- A suite of Trial Strategy Review documents that define the proposed trials approaches, outputs, risks, and key factors that require further confirmation.
- A timeline figure that displays the proposed timeline for all of the trial and analysis phases.
- A financial impact assessment and proposed project budget; and
- A Costs versus Benefits document.
- ToU Scope Impact Assessment - FINAL - Confidential v1
- ToU tariff design v0 6
- ToU High Level Plan V1
- Low Carbon London - Smart meter options - v1 0.pdf. Confidential & Restricted
- SDA T 02 Trial Hypotheses v2.0
- SDA P 05 Product Dependency Matrix v1.0
- Evidence Artefacts as listed in this document
- **DNO and ICL response evidence letters**
- **LCL CR1 vFinal 0111212 Active Injects Trial Location Categorisation**
- **LCL CR1 vFinal 111212 External Data Injects Process Flow Diagram**
- **LCL CR1 Ofgem Cost Table vFinal Confidential & Restricted 1111212.pdf**
- **LCL CR1 vFinal Appendix A 111212 Confidential & Restricted.xlsb**
- **LCL - CR1 vFinal Project Description Confidential & Restricted 111212.doc**
- **TNEI Report Reference: 8038 - 02 - Review of LCL CR01 for Ofgem - R0.pdf**

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Prof Goran Strbac
Chair in Electrical Energy Systems
Low Carbon London Learning Lab

3 September 2012

Liam G O'Sullivan
Low Carbon London
Project Director

Via email

Dear Liam,

Low Carbon London (LCL) - Change Request CR1

I write to formally record that Imperial College has been intrinsically involved in the design and development of the LCL Change Request CR1 and as now finalised and detailed in document reference ''LCL - 280812 CR1 - Executive Summary - vFinal Confidential''. We recommend and advocate that the proposed changes – development of methodology and approach are appropriate, deliverable, are in the sprit of the original bid, and will deliver the learning and benefits as originally detailed.

Energy systems, technologies and policies are in a state of flux, and it is clear that programmes such as LCL require significant flexibility in terms of approach; methodology of delivery drives a need to iterate and adapt in order to overcome challenges as our full understanding of the complexity and customer needs is developing.

Barring the changes due to practical constraints, for example third generation (3G) residential meters not being available to measure voltage, the proposed changes represent an improvement to project definition in terms of both scope and clarity.

As an example,

- The residential heat pump and solar PV trials, without a '3G' meter, would not have significantly improved upon existing and forthcoming datasets, for example the BERR PV trial and the Energy Savings Trust heat pump trial (results due this year). This data will be used as empirical trial data as per the derived concept of 'relevant data injects'.

- Conversely the dynamic residential ToU tariff, combining DNO constraint management and supply following, is a ground-breaking trial and will be of global interest.

In the process of experimental design and trial recruitment, Low Carbon London has yielded a number of important insights that contribute to a significantly enhanced understanding of the broader system and options for intervention (for example with the CHP trials). Thus whilst

practical barriers have necessitated changes in trial approach, the identification of such barriers is itself an important aspect of the learning, demonstration and research process.

The rationalisation of the original proposed 10 Low carbon Zones to 3 engineering zones also represents a significant, more demographically and representative sample (and at a UK level) step forward in the engineering and network visualisation trials. In focussing on fewer zones it has been possible for HV and LV datasets to be clustered, cleansed and integrated; this again represents a large step forward in terms of understanding data management issues and the data quality for control and planning analysis purposes. These are essential steps for integrating new methodologies and approaches into the main-stream process of managing and designing future distribution networks.

In terms of additional sources of data, Imperial welcomes the potential contribution of data from other LCNF programmes. We also have access to a range of other potential contributors from both within Imperial, for example the Centre for Transport Studies as intended to be used to augment empirical trial data, as well as externally given our participation in some major EU demonstration projects.

We fully endorse the change proposed and strongly believe that this will not compromise in any way the projects original objectives and expected learning.

Yours sincerely

Goran Strbac

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Liam O'Sullivan

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London
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28 September 2012

Dear Liam

Validation Statement

RE: Low Carbon London (LCL) - Change Request CR1 Validation Response

Please accept this letter as the formal record that ENWL have been requested to review and respond to the change request following Ofgem's request and your follow up as detailed in document reference ''LCL - 280812 CR1 - Executive Summary - vFinal Confidential'' and Imperial College's assurance note.

In the main we recognise the matters being experienced, the need to adopt a flexible approach to delivery, to be iterative and adaptive to evolving circumstances and new learning.

We believe, in so far as we are able to, with an arms length assessment that the project can continue to deliver the expected benefits and learning. Therefore, given the current status and proposed changes we are able to recommend and advocate that the proposed changes be approved; being driven mainly by externalities – as developments in methodology and approach are appropriate, deliverable, are in the spirit of the original bid. We also believe that these can deliver the learning and benefits as originally detailed.

Our one comment would be that you confirm that UKPN's contribution, commitment and risk exposure will remain the same and that customers, as these LCNF projects are funded by aggregated customer funds from other DNO's, are not expected to further fund any changes.

Regards Steve Cox

Future Networks Manager

Electricity North West Limited

Liam O'Sullivan
UK Power Networks
Newington House
237 Southwark Bridge Road
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5 October 2012

Dear Liam

LOW CARBON LONDON – CHANGE REQUEST

As requested, here is my feedback on the change request for Low Carbon London that you circulated for comment.

I think you have presented a clear case for the changes you are proposing and the reasons why those changes are necessary. As I think we have all recognised, multi-year innovation projects never proceed in the manner originally forecast for all sorts of legitimate reasons. We need to be alert to the need for change and modify our plans in order to deliver the maximum value from projects. This appears to be what you have done. I expect change to be the norm for projects such as Low Carbon London. Indeed, I would not be surprised if you needed to change direction again since you have more than two years further left to run.

I am being offered a partial view here of the changes you propose. I recognise that the consultants will be exploring this in more detail with more of the facts to hand. I must therefore defer to their judgement on the assessment of whether the new methodology will deliver the outputs in a robust manner. However in the meantime I am reassured that your academic partner validates the changes made as witnessed by the letter from Imperial. I recognise that it is their methodology that is having to change to accommodate more empirical data as opposed to physical trials in the absence of certain types of trial participants.

You (and Ofgem) have asked us to comment on the outputs coming from your project. As I understand it, I think you will provide all the outputs originally promised plus some more. The timing of their release will have to change to match the new methodology you propose. That appears reasonable and I am therefore content.

I trust that these views provide you with what you need from me but please get in touch if you would like any further input to the process.

Yours sincerely

Jim Cardwell
Head of Regulation & Strategy

Scottish and Southern
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Mr Liam O'Sullivan
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Newington House
237 Southwark Bridge Road
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1 October 2012

Dear Mr O'Sullivan

Low Carbon London - proposed change request

Firstly we believe that it is important that demonstration projects can absorb and adapt to learning quickly and efficiently in order to accelerate the learning process. We would support anything that creates a rapid project evolution while broadly remaining within the original objectives and budget. Your proposals clearly achieve this.

Having reviewed your proposed changes it is clear that you have adapted to early learning in particular in relation to the challenges of customer engagement. This learning will be key as we start to consider the adoption of DSM and similar solutions for which the customer is an active element. As a result I would consider your current situation to be valuable learning for the industry in its own right and look forward to hearing more detail at the LCNF conference.

Similarly external factors such as the development of smart metering specifications should not hold back our learning as an industry and in fact your proposed solution starts to break into the classic "chicken and egg" loop that revolves around the benefits of smart meters to distribution operators. It is worth pointing out that the NTVV project is using a similar approach and we would be very willing to share our monitoring solutions if of value to allow you to create your data sets.

We believe that the increase of sample area and numbers can only be a good thing if achieved within budget. We have already established that local economics are a large factor in the engagement levels that can be achieved in an area. Understanding where engagement is viable and when not is key to the application of advanced solutions in future so a larger sample is clearly of value.

The development of tariffs is a key element of the project and we believe that your proposals are

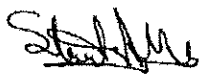
sound. The impact of tariffs will be global and as a result it is essential that a robust statistical trial is carried out. Your changes appear to concentrate on achieving this aim.

With regard to ANM we would consider your experiences in recruitment to be learning, your changes are a logical adaptation to that learning, and as a result we are comfortable with the approach.

With regard to EVs, subject to the success of our EATL I2V project there may be scope for synergy here, however I would not consider the projects to overlap in terms of learning outcome.

Overall we recognise that a logical approach is being taken in the proposed changes but also believe that this would be a good time (while not delaying the changes) to promote further close cooperation between other previously successful projects to "synchronise" learning. Having recently been involved in a European FP7 project I believe that this is possible but would require some form of coordinating authority, something which I believe we should discuss at the ENA in the coming months.

Yours sincerely



Stewart A Reid
Future Networks and Policy Manager

SP ENERGY NETWORKS

Network Development

Liam O'Sullivan
Project Manager
Low Carbon London
UK Power Networks

Your ref

Our Ref

Date
27 September 2012

Contact / Extension
Martin Hill
0141 614 1768

Dear Liam,

SP Energy Network Response to UKPN Change Request CR1 (Low Carbon London)

We welcome the opportunity to comment on your proposed change request in relation to the above LCNF Tier 2 project. Generally, we are supportive of your change request. We recognise the challenges involved in any trial project, especially a project as multi-faceted as your Low Carbon London Project. However, we would like to highlight a few instances where, in our opinion, the project could be further improved. Our detailed comments are outlined below, making reference to the change request document as appropriate.

i) Page 3, Section 2 (Changes and Developments Proposed)

SPEN are not as familiar with the project budget as UKPN (and Ofgem), so some clarification of the original project budget and associated Ofgem contribution would help to indicate the significance of any budget reduction and related reduction in LCNF contribution.

ii) Page 4, second major bullet point (external empirical trial data)

No information is provided on whether or not external empirical trial data been identified, and whether this is UK-only data? Further information is required on the sources of data and how applicable they are to the UK-wide context.

iii) Page 5, Table 1 (Smart meters and Network Visibility)

The use of an advanced Smart Meter was one of the unique selling points of the original LCL project, so the proposed use of the less advanced L&G5236 is disappointing. In particular, replacing smart meter voltage measurements with fewer monitored locations augmented with network modelling will significantly impact on the learning – LV network modelling is known to be fraught with practical difficulties, hence the need for increased network monitoring in all LCNF Tier 2 projects to date. Therefore, is there the option of using a more advanced Smart Meter, even if it is not (yet) SMETs compliant? If there are concerns about using a development meter for customer billing, is it not possible to leave the old meter in place as a back-up and operate the Smart Meter as a secondary meter?

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100% coverage of the 500 sites may not be possible, but having the advanced Smart eter as the default option, with contingency measures if there is not enough space for a second meter would be preferable to 100% coverage using a less sophisticated meter. For example, 95% coverage with an advanced Smart Meter would be preferable to 100% coverage with the L&G 5236 meter.

Additionally, one of the expected outcomes of this and many other LCNF projects will be how to assess network performance using incomplete data sets (to reflect the real-world situation). However, the starting point has to be as complete a data set as you can manage in the first instance, then see how much less data you can live with in order to come up with the same conclusion.

iv) Page 10, Table 1, Distributed Generation (Summary Benefits Analysis)

The DG output is proposed to be monitored along with the network data in order to simulate control signals issued by an actual control algorithm. We consider that this is a missed opportunity for a trial, in that the control signals should not just be simulated, but enacted in practice with real generators, otherwise this will be no more than a research project which does not align with the objectives of LCNF. Can you comment on the possibility of the control system being operated in "closed loop" control?

v) Page 14, Table 1, Heat Pumps (Benefits)

Whilst we agree that there has to be a minimum number of devices in order to be statistically relevant, we also consider it important to note that heat pumps (and EV charging) is relatively immature technology and is therefore likely to change significantly in the future. Therefore, we recognise the need to begin the process of characterising these devices, but would point out that this will need to be an on-going process as EV charging and heat pump technology evolves, which given the inherent finite timescales of the LCNF, is outside the scope of this project.

We hope that these points are useful and constructive in the re-evaluation of the project for this change request.

Yours sincerely,

Martin Hill
Future Networks Manager
SP Energy Networks

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Liam G O'Sullivan
Programme Director - Low Carbon London
UK Power Networks,
Newington House,
237 Southwark Bridge Road,
London,
SE1 6NP

Our ref	*Your ref*	*Date*
-	-	25 September 2012

Dear Liam

Low Carbon London – Proposed Change of Scope

Thanks for offering me the chance to comment on your proposed change request for the Low Carbon London project. It is positive to see you adopting a flexible approach to delivery, adapting to changing circumstances and new learning. As in all R&D&D type initiatives it is impossible to predict all the obstacles that may be encountered during delivery, and changes should be seen as a sign of a well-managed project.

I can sympathise with the technological and customer related issues you have found. The WPD portfolio of LCNF projects has also found a reticence by customers to engage in these type of initiatives, and we have also experienced some technical challenges. I fully expect that delivery aspects within all the Tier 2 projects will continue to evolve, whilst preserving the original learning objectives.

I am not able to undertake a quantitative assessment of the business case for you continuing with the project (since this was originally carried out by the expert panel and Ofgem), however my engineering judgement tells me there would be more value in continuing than abandoning at this stage. Having reviewed the document I can offer the following observations:

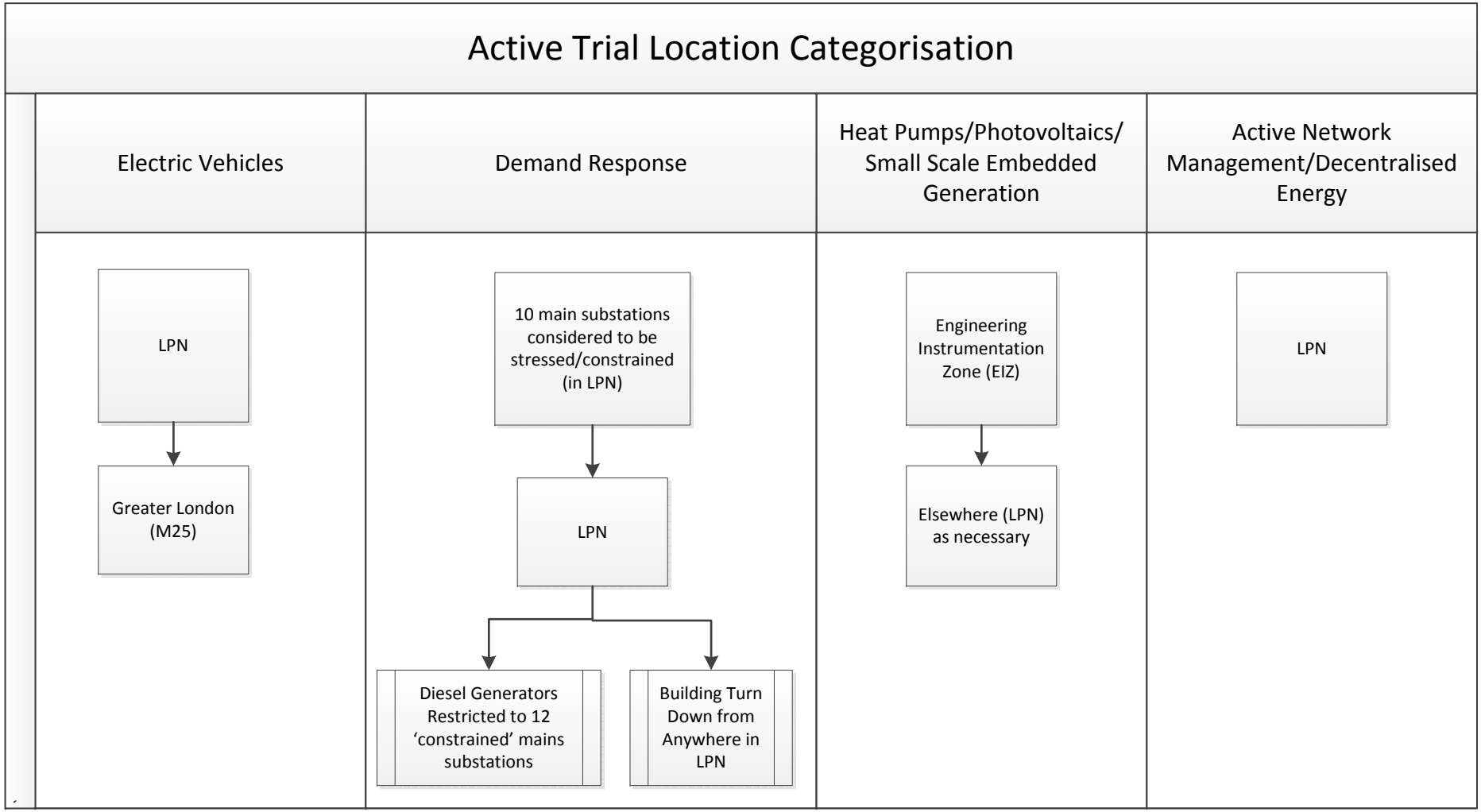
- The customer and technical issues are not unique to Low Carbon London
- The main issues identified were beyond UKPN scope of control
- The use of data external to the trials (measured or empirical) is second best to new measured data within the trials area for network measurements. I note that you are confident that it will still result in valid analysis and learning.
- I agree however that the use of data external to the trials (measured or empirical) can sometimes prove to be as good (or better) than new measured trial data. It can be result in a more statistically robust sample set. Generally you only discover this when some of the measured data is analysed following customer recruitment.

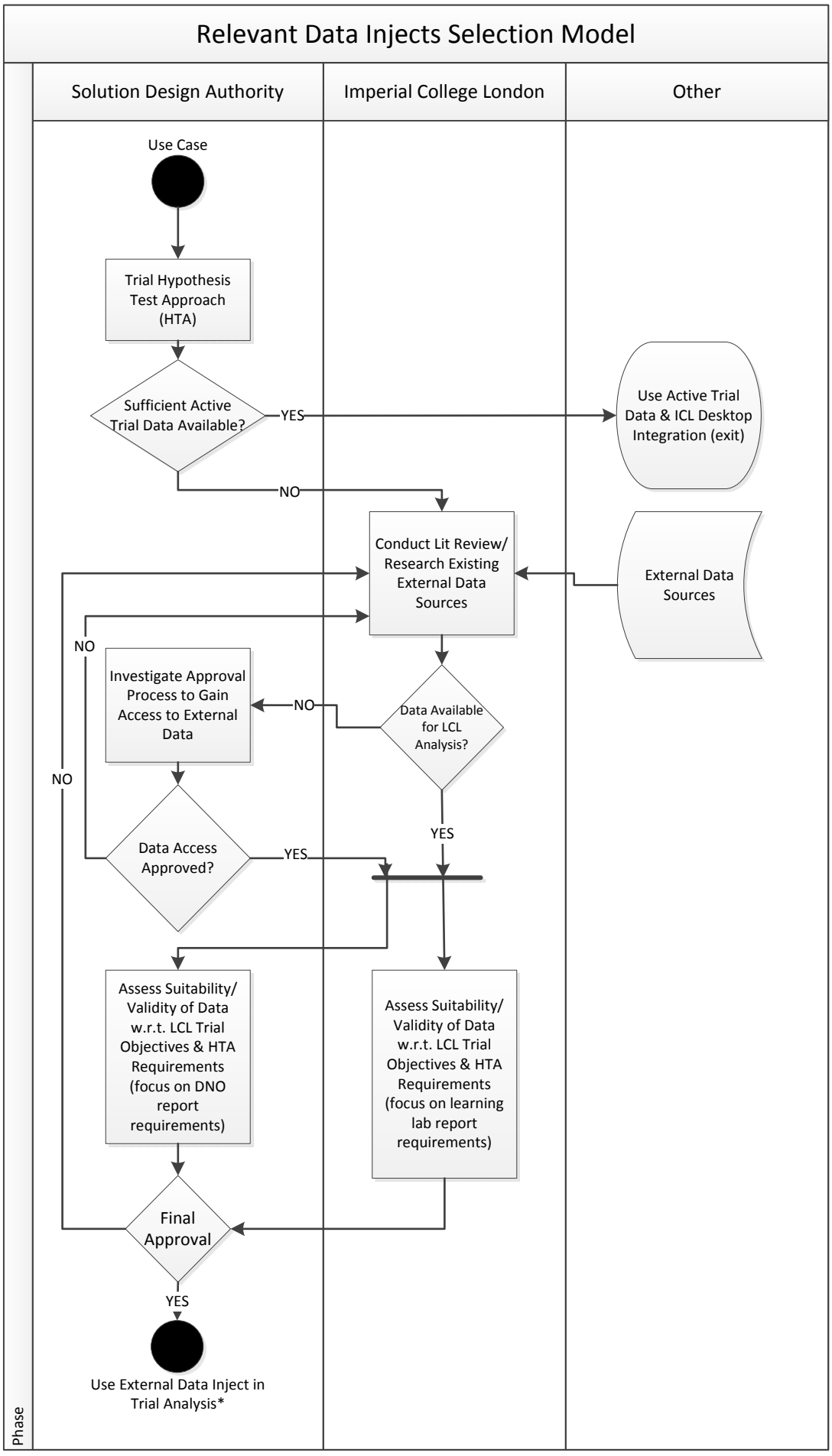
- As expected from a significant reduction in delivery volumes, I note that the costs of delivering the project will reduce substantially.

I hope you find these comments useful. If you wish to discuss this matter further please contact me.

Yours sincerely

Roger Hey
Future Networks Manager
Western Power Distribution


Active Trial Location Categorisation
Electric Vehicles
Demand Response
Heat Pumps/Photovoltaics/ Small Scale Embedded Generation
Active Network Management/Decentralised Energy
LPN
Greater London (M25)
10 main substations considered to be stressed/constrained (in LPN)
LPN
Diesel Generators Restricted to 12 'constrained' mains substations
Building Turn Down from Anywhere in LPN
Engineering Instrumentation Zone (EIZ)
Elsewhere (LPN) as necessary
LPN



*Approved data injects will be incorporated into programme delivery through standard program design and governance procedures

tnei
enterprise with energy

Title: **Review of Low Carbon London Change Request CR01 for Ofgem**

Client: **Ofgem**

Report Nº: **8038-02-R0**

Date: **15th October 2012**

Part of the Petrofac group

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CONTENTS

1 Executive Summary

Attn: Dora Guzeleva – Ofgem

Dear Dora,

The following is the requested review undertaken by TNEI on behalf of Ofgem and based on the information originally provided to Ofgem by Low Carbon London (LCL), the additional evidence requested by TNEI, notes from the interview with the key LCL project team, and some further evidence provided by LCL subsequent to the interview.

The structure of this note is first a review of the key areas where changes have been identified, then a review of the modified Use Case document submitted by UKPN and then a review of the cost implications and finally a short summary.

Where appropriate, signposts are provided to the relevant evidence documents supporting the view, although some of the following are also notes from my interview with the LCL project management team.

In all I am broadly comfortable with the direction that the project is heading and that it is on-track to achieve the stated learnings and deliverables. There have been some changes that have been necessary due to external factors and learnings as part of the process, but these appear to be being managed effectively and are not unexpected on a project of this nature.

Regards,

Graeme Bathurst

Petrofac-TNEI

(Technical Consultant to Ofgem)

cc.

Sam Cope – Ofgem

Rebecca Langford – Ofgem

2 Introduction

2.1 Review Scope

The key aim of the review of the change request was an assessment of the revised costs that are being proposed for the project. The key activities that were required from the consultant for the review are set out below.

- ISSUE FAMILARISATION/BACKGROUND
  - Meet with Ofgem for an explanation of the information that has been provided to date and Ofgem concerns
  - Consultant then to review this information and identify the key areas for testing
- DETAILED COST REVIEW
  - Undertake a review of the revised summaries of work scope, amended use cases and cost information that has been provided by UKPN
  - Where the project scope has been changed the consultant will examine the cost changes that are being proposed
  - Seek to clarify issues that are identified with UKPN
  - For each area of change in the project, the consultant will either confirm that UKPN's cost approach appears reasonable or else highlight and explain concerns identified. Where UKPN have provided further justification for the costs these will be highlighted

The above work was to be undertaken quickly to help Ofgem come to a decision regarding the change request.

2.2 Low Carbon London Project Interview

The Low Carbon London project interview was conducted on the 26th of September 2012 (11am – 5pm) at UKPN Newington House with the following attendees:

- Liam O'Sullivan – LCL Project Director
- Brian Kelly – LCL Programme Manager
- David Boyer – LCL Solution Design Manager
- Dave Openshaw – UKPN Head of Future Networks (by telephone)
- Keith Hutton – UKPN Head of Regulation (initial part only)
- Graeme Bathurst – Ofgem Technical Consultant (TNEI)

3 Key LCL Project Area Changes

3.1 Smart Meters & Change of Trial Zones

3.1.1 Summary of Issue

The lack of an available SMETS compliant meter has created an issue for the project that was not allowed for in the project design or risk mitigation. The project design required both half-hourly metering as well as local point of supply voltage monitoring. The Version 1 of the SMETS has basic voltage monitoring and Version 2 of SMETS has more advanced voltage monitoring. Generation 2A and 2B Smart Meters are not SMETS-V1 compliant.

The 5,000 meters rolled out for this trial with EdF Energy are the L&G 5326 meter, which is a Generation 2B meter. 500 meters were initially rolled out to test the installation.

The project team has reacted to the lack of SMET meter availability by proceeding with the existing available Generation 2B meters, and sourcing additional voltage measurement units for critical network locations. The existing Gen2B meters have limited voltage data capture.

3.1.2 TNEI Impact Assessment

The objective of the metering data was two-fold. The data is required to develop statistically sound load profiles of the selected different customer load types, and to provide a sufficient number of customers for Time of Use (ToU) trials such that any small tariff driven load change is statistically detectable. This drove the requirement for 5000 SM customers to provide 1500 ToU SM customers as well as sufficient numbers for the load profiles.

The load profiles are required to provide the basis for LV network modelling using the ADMD (After Diversity Maximum Demand) method, and subsequent testing of the existing network via the "network planning tool" as part of Use Case 4. It is not necessary for these meters to be in any specific geographical location as the customer type is more critical.

The Operational Data Store is the collation of all data from network topology, electrical parameters and MPAN profiles, and will be the source of the modelling data for the network planning tool. The ODS will be part of an enduring solution for UKPN. Additional data points are required within the PI (data historian) system, this is achieved in a temporary means via another system for the purposes of this project.

The Engineering Instrumentation Zones (EIZ) will be used to verify the methodology of using the updated customer demand profiles for network planning purposes. The location of the network monitoring is critical for this verification, but the customer meters are not critical for testing.

The ICL report on state-estimation in UC4 and UC8 on the requirements for network monitoring is on the HV rather than LV network. The EIZ and Tier 1 network datasets are stated to be sufficient for observability of the system, from the description of the proposed EIZ instrumentation then this appears valid.

These changes appear to be a reasonable reaction to the investigatory work undertaken and issues faced with currently available Smart Meters.

3.1.3 Cost Implications

The cost base is largely unchanged as the same number of meters will be required and the head-end system supplied by Logica is still required. As the non-SMETS compliant meters now have to be replaced by 2018 by SMETS compliant meters, the time-expired value of the meters installed in advance for this trial need to be under-written by this project.

The Logica head-end is provided as a licensed service, some equipment may become redundant, or run by a supplier, however the hope is that this will ultimately be novated to the DCC once set-up. There are some costs associated with customisation and hook-up of specific meters.

The change request is primarily about under-written the Gen2B meters now that their costs cannot be socialised. Suppliers would not be rolling out the meters as rapidly, i.e. they would wait until SMETS compliant meters were available.

3.1.4 Relevant Evidence

Evidence 01 – SDA C 03 Location Model V1_0.pdf

Evidence 02 – To inform smart meter trial design V1 0.pdf

3.2 Time of Use Trials & Wind Twinning

3.2.1 Summary of Issue

There was the original ambition for trialling "multiple tariffs" in UC5, these were to be Static, Dynamic and Wind Twinning. The objective was to observe customer response rather than network modelling as such, so as to inform how load profiles (for ADMD) may change, and subsequently to inform how this could be modelled to resolve network issues.

Analysis by ICL of the numbers of customers required for statistically representative results flagged an issue with the volume of participants required. As such, a decision was taken by LCL to focus on a combined dynamic ToU trial with a combined price tariff, and aim to get input on the static tariff from other Tier 2 projects (i.e. CLR). The objective was ultimately more about testing the benefit or impact on networks of flexible tariffs.

Data injects in this context were that the customer interventions were to be simulated high/low price or wind days to ensure a sufficiently valid number of events, rather than wait for natural existing events that may not presently be sufficiently frequent. This is essentially a combined Energy and Network tariff response.

The tariff structure was based on a survey by EdF on the number of levels and types. At present this has summarised expected customer behaviour, day ahead and billing formats and presentation to the customer. Reference was made to Tempo in France as the effectiveness of a simple strategy.

3.2.2 TNEI Impact Assessment

As the purpose was to observe customer behaviour and response on an individual level, rather than test network response, then the dynamic ToU trials appear to be satisfactory as outlined.

The analysis by ICL of the numbers of trial participants required for a statistically observable response given the relatively small potential demand changes appears to support the need to restrict the types of tariffs that are deployable.

It is suggested that LCL is allowed to proceed initially with a single dynamic tariff to observe responses, however suggested that the decision is reserved on the Wind Twinning tariff until it is proven that it is not required/necessary/relevant. i.e. there is presently not enough evidence yet to justify that it is not an appropriate approach to take.

3.2.3 Cost Implications

The change in scope to consider only a single combined ToU tariff does not appear to have any significant cost reduction advantages as the same overall number of customers is being used. The impact on IT costs have been closely considered in deciding the strategy for application of the dynamic ToU tariff.

3.2.4 Relevant Evidence

Evidence 02 – To inform smart meter trial design V1 0.pdf

Evidence 03 – ToU Scope Impact Assessment – FINAL 0 Confidential v2.0.pdf

3.3 Automatic Network Management and Demand Response

3.3.1 Summary of Issue

The automatic network management is targeted at the distributed generation trials to monitor and develop towards active control. The initial project design was to directly control the participant generators, however there has been reluctance from the participants to be automatically controlled as part of a new system trial. As such, a small change to the design of the trial has been introduced to provide a manual control while the systems are tested and developed.

Sign-up of trial participants is well underway and volumes for Distributed generation (DG) have been achieved. Demand Response (DR) was proving difficult but shortly before the interview a new significant central London department store had agreed to provide 1.5MW of flexible demand capacity into the trial.

A further key difference is the introduction of commercial aggregators rather than direct DNO control of generators and building turn-down. This provides the customers with a single technical and commercial interface for both provision of generation and demand flexibility which covers both system balancing and network response.

3.3.2 TNEI Impact Assessment

The development of Aggregator provision of combined demand response and generation control is a very positive development for networks particularly as UKPN are using a third party for provision of technical system services.

Significant technical issues have been discovered on the ability for customers to provide building turn-down which needs further consideration for the long-term.

The Accent Report commissioned by LCL to review their customer engagement strategy identified a number of issues with the presentation of the business case for the customers and subsequent follow-up. This was done to provide an independent view of the UKPN approach. The issues have been recognised by the project as new learning and a small task-force has been set-up to address the identified issues. It was also used as an opportunity to contact other parties outside of UKPN normal business contacts.

3.3.3 Cost Implications

There is some overlap between the ANM trials and DR trials in terms of participants however the costs are predominantly due to the ANM equipment and Participant Incentives. The number of schemes and trial participants appear to be similar and as such no material scope change has occurred. There is a cost reduction due to consolidation or reduction of direct-control equipment; however this has been recycled into aggregator payments or customer incentives. As such the change is relatively cost-neutral. The use of Aggregators does not radically change the overall system requirements.

3.3.4 Relevant Evidence

Evidence 04 – ANM Triggering DR Trial Proposals rev 3.pptx

“LCL Trial by numbers”

3.4 Change of Zones from LCZ to EIZ

3.4.1 Summary of Issue

The use of the Low Carbon Zones (LCZ) within London has lessened from the original project brief partly because the LCZs are winding down due to reductions in funding, but primarily because the customer demand types within the zones were not sufficiently broad to cover the needs for UC4 and others. LCL is still working with the Project Managers of the LCZs were they exist but they stressed that the use of these zones originally was only as areas in which the trials could be done and observed.

The Engineering Instrumentation Zones (EIZ) have been focused onto two areas where the network has sufficient suitable customer types and can be instrumented to observe and characterise that network in detail. These have been reduced from three down to two and there is an associated saving in less network monitoring equipment and installation time.

3.4.2 TNEI Impact Assessment

This appears to be reasonable approach and the documents reviewing the LCZs suggests that they were not all appropriate for robust trial outputs.

3.4.3 Cost Implications

The change of the monitoring to focus only on two EIZs rather than three has provided a cost reduction against the original budget based 10 zones. It is noted that the original budget allocation for the 10 low carbon zones was insufficient against the envisaged requirements. There is insufficient detail to provide a definitive view on this however it is not unreasonable.

3.4.4 Relevant Evidence

Evidence 01 – SDA C 03 Location Model V1_0.pdf

3.5 Electric Vehicles, Heat Pumps & SSEG

3.5.1 Summary of Issue

Trial participant sign-up has been challenging for all three categories. Since the CR submission there has been some positive movement on EV participants.

Electric Vehicles (EV) have currently secured 25 residential and 40 commercial vehicles at the time of the CR1 submission but not able to be used for ToU trials. Subsequently a further 30 residential vehicles have been sourced via EdF Energy that can be used for ToU trials. Increasingly more residential and commercial vehicles are participating. EV uptake modelling will be based on modelling performed at ICL Transport School (John Pollock) with the trial participant data used to inform and verify the usage modelling.

Heat Pump (HP) customer trial recruitment not proving to be good value to get participants due to high recruitment effort and cost for very limited return. This is partially believed by LCL to be because London is unlikely to be an early adopter of this technology due to building type and density.

Small Scale Embedded Generator (SSEG) participation is limited, partially because of the lack of uptake originally anticipated. The inclusion of SSEG was originally within the planning and learning use case and has just been given prominence in one location. The primary learning is to understand network voltage impact and develop technology specific load profiles for demand growth estimation in network models.

The objective for all three technologies was to recruit sufficient numbers of participants to monitor consumption/generation to develop customer type profiles similar to normal demand profiles. These could then be used for the desktop modelling where the network impact assessments could be performed.

3.5.2 TNEI Impact Assessment

EV participants are lower at present than ideal. The central objective was to develop a set of demand profiles for different customer types that could then be used in network modelling to assess impact of different levels of EV uptake. There was always going to be a level of usage modelling required, however now there will have to be a heaver bias towards usage modelling to derive the load profiles for the network assessment.

HPs are believed to be reasonably straight-forward to model as they are based on known heat requirements. ICL to use established models and verify using trial data where available.

SSEGs are unlikely to provide significant learning in this case due to the relatively low numbers and expected density within the London area. It is only a minor part of the overall project and as such not a critical feature. It appears to be included in the network modelling and impact analysis for completeness rather than necessity. For other licence areas the implications of SSEG is more critical due to higher expected uptake and so the specific learning may be more valuable from those areas.

TNEI suggest that the project progresses with EVs, drop HPs trials and leave to other LCNF projects (potentially continue with those already signed-up to maintain relationship and reputation). Allow SSEG to be incorporated where already signed up, and include in network modelling impact assessment based on other datasets.

3.5.3 Cost Implications

Recruitment is the largest cost and has already ceased based on an internal project decision of appropriate value of return against cost. No active intervention trials were planned and investigations were to be via desktop study within the existing ICL budget. These can still be performed although the EV trials may require additional traffic/usage pattern modelling from the transport group of ICL for the data inputs.

3.5.4 Relevant Evidence

Evidence 05 – LCL – 072012 CR – Trial Strategy Review – EV – v1.1.pdf

Evidence 06 – LCL – 072012 CR – Trial Strategy Review – HP & SSEG – v1.1.pdf

4 Review of the Use Case Changes

Overall the revised Use Case document needs to reflect the contract position rather than just as an internal project control document. There are a number of minor editing changes (name-changes or typo corrections) and others that appear to be clarifying or changing intent.

Due to the volume of changes within this document, it is not clear what the material changes are as they are lost within the minor changes; some of which appear to be preferred wording changes rather than material changes. The use of comments in the track-change version to clarify intent is not ideal as if these are significant points then they need to be introduced as explicit change or removed.

My recommendation is that if this document is contractually significant between Ofgem and UKPN, then the project scope changes are clearly split-out from the internal clarification changes. The change document should then only contain the material changes that UKPN need Ofgem to review and accept rather than the "nice to have textual improvements". The following is a case-by-case review of the changes to the use cases:

4.1 UC1 – Wind Twinning

The primary change appears to be that this will no longer be run as a separate "wind twinning" tariff but bundled within the dynamic ToU tariff in UC5. This was an outcome of the ICL analysis of participant volumes required.

The change from use of live forecast data from NGET to simulated wind events reflecting a future higher level of wind generation is a semantic point as this would have been required in any case to obtain a meaningful trial result. The main implication may be that as NGET do not formally require this service at present, then it is not possible to "contract" with them as suggested in the use-case.

There are a number of minor editing changes, comments, and other changes that appear to be clarifying or changing intent. Other changes relate to name changes and general tweaking which are not material can be neglected for the purposes of this change request.

4.2 UC2 – Enabling and Integrating Distributed Generation

Of the changes noted in the revised use case, there do not appear to be any material changes. The main "change" is that direct automatic control of DG by the DNO has been found to unacceptable by many participants. Further clarity on the point "Modelled actions to be taken by ANM..." should be included in this text as from the interview discussions this text does not correctly describe the intended approach.

Some of the proposed wording changes could be interpreted as a subtle shift from physical testing different solutions to only modelling, i.e. "...test by modelling,...", "Envisaged performance..." and as such LCL is recommended to review these to ensure that this is deliberate rather than unintended.

The point is made by LCL that participant uptake has been challenging due to the external environment changes and slower than expected ramp-up of DG; and that this has implications on the trials.

There are a number of minor editing changes, comments, and other changes that appear to be clarifying or changing intent. Those that are not material changes should be neglected for the purposes of this change request.

4.3 UC3 – Enabling Electrification of Heat and Transport

This represents a material change based on the lack of market update on Electric Vehicles and Heat Pumps. The change reflects the drop-out of participant organisations and other EV programmes that were reasonably envisaged at the bid stage. The changes reflect the reduced amount of live operational data that will be received as part of the trial.

UC3.2 now explicitly includes SSEG and wraps Heat Pumps into a common Distributed Energy Resource (DER) category. It also proposes to extend coverage across all three UKPN licence areas for the collection of demand profile data.

The extension of UC3.2 is of questionable additional value as some of this learning can be achieved via other projects.

There are a number of minor editing changes, comments, and other changes that appear to be clarifying or changing intent. Those that are not material changes should be neglected for the purposes of this change request.

4.4 UC4 – Using Smart Meters to facilitate Smart Grids

The main change here is that the smart meter roll-out will now be across the full London licence area rather than restricted to the LCZs and Green Enterprise District. This change was to ensure sufficient participants of different customer types could be gathered to make the collected data statistically relevant. The Engineering Instrumentation Zones are now focused on two of the LCZs rather than spread across all zones.

The other change relates to the unavailability of SMETS compliant meters and that Gen2B meters will be used instead. This should be made more explicit in the use case as well as the proposed use of additional voltage monitoring to capture the otherwise missing voltage profile information.

There are a number of minor editing changes, comments, and other changes that appear to be clarifying or changing intent. Those that are not material changes should be neglected for the purposes of this change request.

4.5 UC5 – Demand Side Management

The removal of SMEs from DSM involvement was stated to be at direction from Ofgem. This should be confirmed by Ofgem that this is also their understanding as this appears to be one of the material changes.

UC5.1a has scaled back the energy efficiency measures to only include electrical efficiency measures and there is some change due to the reduced smart meter specification.

UC5.1b has a minor change to reflect that the key observation will be customer reaction to price change events rather than different ToU tariffs. This is possibly a clarification of intent rather than a change as such. There is additional detailing of the learning points sought from this trial which seem reasonable clarification rather than "changes".

UC5.2 has removed kVar metering from the data to be collected from I&C customers subject to DSM arrangements. Further detail is required as to why this change has been made although it is minor given kVar will still be monitored at the primary substation.

UC5.3 mostly reflects clarification and extension rather than a "change".

There are a number of minor editing changes, comments, and other changes that appear to be clarifying or changing intent. Those that are not material changes should be neglected for the purposes of this change request.

4.6 UC6 – New distribution network planning and operational tools

The main change is in UC6.4 where the scope has been changed significantly to remove the explicit specification of ENXSuite and moves to a more generic "carbon tool" approach. The intent of this needs to be clarified as from the cost analysis it appears that the licence fee for the use of this tool is still included.

No commentary has been provided on why this change has occurred and the need or benefits of the change.

4.7 UC7 – The Low Carbon London Learning Lab

The changes only appear to be the titles of the deliverables, and much of this is re-wording and tightening of intent rather than major focus change. As such these do not appear to be material and questionable as to why they need to be changed at this stage.

4.8 UC8 – Development of new network design and operation practices

There do not appear to be any material changes in this use-case. The additional table in UC8.3 simply cross-references the responsibilities from UC8 into other UC deliverables.

5 General Review of Project

5.1 Review of Project Structure

The LCL PMO is run in a flexible manner resourced up and down as project demands to keep costs down and respond to project requirements. There is the potential risk of under-resourcing due to too-lean an operation, however this does not appear to be evidenced.

Dave Openshaw – UKPN Head of Future Networks is the LCL content owner

Liam O'Sullivan – Project Director and day to day management

Brian Kelly – Programme Manager

Director of Strategy & Regulation – Project Sponsor

Asset Management – Project Output Customer

The internal decision to review customer engagement through the appointment of Accent to review the approach and selected customer experience was beneficial and it appears that the criticisms were taken on-board and they sought to remedy these.

The PMO does a weekly deep-dive on each work-stream and there are monthly meetings of the Engineering Governance on the project. Partners are involved in the decisions but it is not a consensus process, UKPN is clear that it is their project and their decision. The project Partners have had some challenges in learning out to be partners rather than contractors, but by in large they have adapted and responded well. It was a positive surprise to the project team that the Aggregators have started actively working together to help develop the demand-side market.

There is associated evidence provided by LCL of all the internal project change control documentation, work package linkages and dependencies and an up to date organisation chart which lends credence to the above view.

5.2 Review of Learning and Benefits

It is too early in the project to measure the outputs directly, but I cannot see anything other than the minor Heat-Pump elements that are likely to not deliver the learning and benefits that were originally envisaged. There are some areas where it has not been able to meet up to the original ambition, however from the evidence presented by LCL in terms of project documents then it appears that the learning is on-track and will be realised.

Some of the initial learning is feeding through into this change request itself and is evident in the need to adapt some of the project methodology to achieve the end-outcomes. The effective dissemination of this learning both within UKPN and to the other DNOs and stakeholders in the LCNF process is important to ensure that the learning has enduring value.

There is the potential that additional learning from an explicit Wind Twinning tariff will not be obtained through the use of the combined ToU tariff. However this could be considered as part of the learning and it will have to be seen how effective a single combined tariff is.

5.3 Review of Cost Implications

Most cost savings appear to be procurement efficiencies and symptoms of the bid development versus project set-up. The project scope itself has not changed significantly in terms of activities, although some volumes and physical techniques have changed. From interview discussion it appears that the volumes are generally not the primary cost drivers however.

The project Partners appear to have engaged strongly with provision of additional savings or free resource/equipment.

UKPN senior management provided LCL with a direction to return costs early rather than hold until the end. Some of the "additional value" appears to be contingency or underwriting rather than real money and as such may be released or not realised as savings at the final project completion.

The cost changes are defended by LCL on a narrative basis against the key line item level rather than detailed bottom-up build-up. Seeing as the original budget that the project award was given was also formulated on this basis then it is not unreasonable. The narrative appears consistent with the other project documentation and review of the use-cases however it could be more clearly presented as some of the savings from line items are recycled into increased expenditure in others.

However, I am essentially comfortable with the intent of the savings and additional contributions at this high level and that they are in-line with the overall project position.

5.4 Other DNO Feedback on Change Request

UKPN has provided TNEI with the formal feedback from the other DNO's they have consulted with as part of the Change Request process. This was reviewed by TNEI only after completing the formal review process to minimise the risk of opinion contamination.

In general the other DNO's were supportive of the change request, and the sympathetic to the reasons for this change being necessary. Some offered support and potential data or knowledge sharing from their own projects if appropriate. The general comment was that this sort of change is to be expected from projects of this nature.

6 Summary

In all, I believe that the project is largely on-track in terms of achieving its objectives and has responded well to the learning and external changes.

The scope of the project has not changed significantly and therefore the expected learnings from the project can still be achieved provided the project continues on the current course.

The cost savings appear to be primarily due to procurement efficiency rather than significant scope reduction due to the change request.

This does appear to be part of a necessary evolution of an R&D project and as such flexibility is important to ensure that the project progresses effectively and efficiently.