Project Code/Version No SSET205

Low Carbon Networks Fund
Full Submission Pro-forma

Section 1: Project Summary

1.1 Project title

I²EV - Innovation-squared: managing unconstrained EV connections **NON-CONFIDENTIAL VERSION**

1.2 Funding DNO

Southern Electric Power Distribution

1.3 Project Summary

The I²EV project has been conceived by, and will be managed by, a non-DNO to deliver a low carbon solution to benefit customers and the network, creating a blueprint for the interaction of DNOs and third parties. The full bid content is endorsed by SSEPD, the project's participant DNO, but is written, developed and fronted by EA Technology. The project will deliver essential learning on managing the strain on the distribution network from anticipated increased uptake of electric vehicles (EVs). I²EV will deliver essential learning and a cost effective solution to DNOs, that reduces network reinforcement need, demonstrates a new project delivery framework by a third party project lead and will support EV market growth.

Innovation 1 (commercial): Novel commercial arrangement I²EV will be delivered by a third party innovation technology provider on a risk and reward basis, with the arrangement ensuring that the DNO meets the requirements of the LCN Fund and other obligations.

Innovation 2 (technical): New Technology trials EA Technology has independently developed a novel monitoring and control solution, 'Esprit' ('the Technology') to manage the supply of electricity to EVs connected to distribution networks. The Technology will be trialled on a range of real networks, with real customers and EVs.

1.4 Funding

Second Tier Funding request (£k)	4,175		
DNO extra contribution (k)	0	**External Funding (£k)**	4,908

1.5 List of Project Partners, External Funders and Project Supporters

Project partners: EA Technology: Third party technology innovation provider and I²EV project manager. Nissan: EV and EV charger manufacturer; supplier of EVs for project trials. Fleetdrive Electric: EV lease hire company. De Montfort University: Socio-economic modelling. Northern Powergrid: link with CLNR project. Charge Your Car: EV infrastructure support. Automotive Comms: EV specialist communications.
External funders: In-kind: Nissan, Northern Powergrid, Fleetdrive Electric, EA Technology, Charge Your Car. **Project supporters:** Bracknell Forest Council, Hyde District Climate Change Forum. Academic partners to be appointed September 2012 for independent project/solution verification and project evaluation.

1.6 Timescale

Project Start Date	7 January 2013	**Project End Date**	31 December 2015

1.7 Project Manager contact details

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Section 2: Project Description

The I²EV project will be developed, project managed and delivered by EA Technology as a turnkey innovation technology provider. Focusing on one technical problem and one technical solution, the project will demonstrate how a non-network company can, through a novel commercial arrangement with a supporting DNO, access the LCNF Fund to deliver a low carbon solution.

2.1 Aims and objectives

1 Commercial

Problem: Ofgem has been looking at ways to open up innovation mechanisms to third parties under the RIIO (Revenue = Incentives + Innovation + Outputs) framework, as a potential vehicle to accelerate technology development and adoption. A key challenge in doing so is ensuring that that trials and risks are managed on real networks with real customers, and that knowledge is transferred to the DNO to secure buy-in and engagement to the project and its outputs. This project will demonstrate how non-DNOs can lead projects in a structured contractual framework to ensure development of adoptable solutions from third party providers, by developing a commercial structure for rapid solution deployment by a third party delivery body.
Solution to Problem: In order to provide access to the network, a blueprint commercial and operational framework will be developed between a DNO (SSEPD) and a non-network company (EA Technology). The blueprint will address issues and risks to both the DNO and third party delivery body while ensuring compliance with the relevant regulatory and LCNF governance requirements and obligations.
Method: Lead project management by non-DNO innovation technology provider: EA Technology will assume absolute responsibility for project management of I²EV, from project inception to delivery. The field trials will be designed by the third party, who will then work in partnership with SSEPD to conduct the field trials. Where possible the installation and commissioning of the Technology on electricity networks will be subcontracted to third parties.
Summary: LCN funding under Tier 2 is required to develop a blueprint commercial and operational framework for use between DNO and third party innovation technology provider development and roll-out to all GB DNOs. The development of this lies outside SSEPD's usual course of business and is timely given the projected launch of Network Innovation Competition funding in 2015.

2 Technical

Problem: Increased stresses on the network - overload due to market growth of EVs: by 2023, 1-3 million EVs are forecast to be on UK roads, 23 million by 2050 (Smart Grids Forum Work Stream 3). Peak energy demand from charging EVs could increase by 36%, resulting in 'a profound impact on the utilisation of generation and network capacity in the electricity system' (Advanced Smart Metering report, Imperial College/ENA, March 2010). Even at lower end forecasts, without the optimisation of demand side technology, this analysis indicates that this GB market growth is set to lead to local overloading of distribution networks. The I²EV project will provide DNOs with a cost effective intervention that avoids network reinforcement while at the same time supports the growth of EVs. Potential cost savings in terms of reducing stresses on the network due to EVs range are around £2 billion by 2030 (see section 4's calculation of net benefits for details). SSEPD has worked with EA Technology to select a project that addresses a single pertinent technical problem with a single technical solution - allowing focus on the structure as well as the technical aspects of the project. The I²EV project will be led by EA Technology who will be contracted by SSEPD to deliver the I²EV project from project start-up, through management and delivery.
Solution to Problem: The I²EV project facilitates the expedient connection of EV chargers to the DNO LV network as it avoids the possibility of the DNO becoming a barrier to multiple EV connections along a particular LV feeder. If successful, the solution will give GB DNOs a low cost, easy to implement, alternative to traditional network reinforcement when faced with networks overloading due to unconstrained connection of EV chargers. The Technology could also be used to control other major demand types, e.g. heat pumps.
Method: Modelling and trials of the Technology: Modelling and trials will aim to prove that the Technology works, with customer support, on a range of LV network types: cable, overhead line, mixed, heavily and lightly populated circuits. The technical aspects of the trials will consist of installing monitor-controllers (MC) at distribution substations, with active sockets (AS) installed in customer installations. The MC ensures that the load of all EV chargers does not take the load above the rating of the LV circuit. The initial proving trials will be conducted on cable LV networks that are located in the SSEPD area (Zero Carbon Homes, Chalvey) in September 2012. A key aspect to widespread deployment will be in understanding customers' attitude and behaviours to managed EV control; I²EV has enlisted the support of a social science academic partner. The trials will require the engagement of trial participants, both in 'clusters' (i.e. 10-25 people on one feeder).

2: Project Description cont.

The cluster trials, or 'technical trials' will aim to prove the Technology and mimic a 2030 network; these clusters will be in both residential situations (charging at home) and in business situations (fleet cars charging at work). The non-cluster 'social trial' EV users will be monitored for behavioural and socio-economic data, and will be largely fleet hire users (with the current exception of the North East Nissan employees under the LEAF hire scheme). Electricity customers lie at the heart of the I²EV project. The project will determine how best to manage a rapid uptake of EVs in given clusters, whilst developing a smart solution to make this a win-win solution for the community.

Summary: The Technology that forms the basis of the solution to the problem of increased stresses on the network (overload due to market growth of EVs) has not yet been released to the market. The solution is at the laboratory testing stage (TRL5), with plans to be ready for wide-scale in-situ testing on live networks (TRL7) by Q3-Q4 2012. Therefore the Technology will be beyond R&D stage at I²EV project commencement. I²EV will provide a large enough field trial to rigorously test the Technology on real LV networks, with real EVs and with real customers. LCN funding is required to undertake the trials and resultant GB-wide dissemination of results and learning to DNOs, which would not otherwise form part of SSEPD's usual course of business. The magnitude of the field trials required makes the project relevant to LCN Fund Second Tier funding. The Technology has not been trialled previously by SSEPD due to the nascent nature of EVs. The balance of risks makes it timely for the I²EV project to commence now given the projected acceleration of EV uptake and associated stresses on the existing network.

2.2 Technical description of the project

1 Commercial innovation

The commercial aims of the project are:

- To demonstrate delivery of a low carbon network project by a non-DNO on behalf of a DNO (see 'commercial innovation delivery framework' on page 10)
- To develop a novel commercial arrangement (see traditional and I²EV models on page 17)
- To enable all procurement related to the project activity to be managed by a non-DNO
- Evaluate the extent to which third party delivery accelerates deployment of low carbon network projects

The work is innovative as:

- It is delivered by a third party on behalf of a DNO
- It is project managed by a third party
- Will create a blueprint for future low carbon network projects to be delivered by a non-DNO

The commercial innovation is novel as it is the first project of its type under the Low Carbon Networks Fund.

2 Technical innovation

The technical aims of the project are:

- Learn customer driving and charging habits and the implications for control via the Technology.
- Develop and trial the equipment to ascertain its ease of installation.

Develop the integration of the Technology into the EV charging points including how existing intelligence and attributes in charging points can be harnessed to reduce the cost and improve the performance.

- Evaluate the range of networks where it can operate successfully and identify any type of networks that are inappropriate.
- Evaluate how often switch off routines are likely to be initiated from real life trials and extrapolation via modelling using the results.
- Evaluate the most appropriate length of time to switch off charging and how to cycle switches with references for battery management and customer preference and habits.
- From the results and extrapolation via modelling, estimate the typical and maximum thermal capacity gained.

The work is innovative as it:

- Is the first trial of equipment to directly control circuits within customers' premises using power line carrier (PLC) and without reference to a third party such as a supplier or aggregator.
- Takes into account customer behaviour, the needs of the network and the needs of battery management in developing a network control system.
- Integrates network control technology into a customer appliance (namely an EV charging point).
- Engages EV manufacturers to work with DNOs and those developing network control technology.
- It is a network trial led by a third party working with the DNO.
- Demonstrates the benefit of allow a DNO to directly limit or control elements of a customer's supply.
- Develop the principles of access to allow the management of multiple installations on one constrained network.

The trial design is from the perspective of both a technology developer and independent consultant. It aims to draw out the needs of a manufacturer, whilst ensuring technical rigour and trial validation satisfy the DNOs' requirements. See diagram on page 10 for an illustration of how the Technology works.

2: Project Description cont.

2.3 Description of design of trials

The tasks for the project are:

Task 0. Novel commercial agreement

Draft and agree a contract for a non-DNO entity to manage an LCNF Tier 2 project, including the obligations on each party and responsibility for different risks. This will detail the permissions and duties passed on or withheld by the DNO. At the end of the project the contract will be reviewed and improved if possible. This will be published for use by other DNOs.

Deliverables

i. Commercial agreement for the I2EV project
ii. Template for other LCNF projects led by a third party

Task 1. Initial background

Evaluation of the initial trial (November 2012) by the University of Manchester to improve the Technology and approach in the extensive trials planned. This will identify any improvements or additions in the logic developed to date for the Technology equipment to enhance the design. Other possibilities are additional monitoring capability, means to change control parameters or user interface in terms of lights or other means to indicate availability for charging. It will also investigate the most flexible and practical monitoring and means to inject communications signals to reduce interruptions to customers and installation time. The University of Manchester will also carry out a literature survey of the estimates of the additional load that EVs will cause and the potential for load shifting. De Montfort University will carry out a literature survey of existing knowledge of customer behaviour with regard to the use of EV and acceptance of direct control of appliances. This will highlight gaps in the knowledge and likely response and the best way to approach customers.

Deliverables

i. Assessment of the initial trial and recommendations on improvements to the design.
ii. Technical literature survey of load shifting potential of EVs and heat pumps.
iii. Social-economic literature survey of customer behaviour with EVS and acceptance of direct control of appliances.

Task 2. Customer engagement

Key to the success of the project is the engagement of trial participants and the sourcing of EVs for trial participants to use. Informal contacts have demonstrated enthusiasm to participate and communities in Hyde, New Forest and Leeds have written letters of support (see Appendix K). From the outset, and from learning derived from other LCNF projects, it has been recognised that the engagement of trial participants, not least those in clusters (i.e. on one feeder), presents a key challenge to the project. A list of potential clusters is given in Appendix B. The expertise of Paul Clarke (Automotive Comms) will be used to establish further clusters through a range of contacts (see Appendix E).

The project has also engaged Nissan Europe's EV Steering Committee. As a result, Nissan has brokered a deal with Fleetdrive Electric, an EV fleet hire company, to provide the project with 250 EVs at a subsidised monthly rental for each trial participant either for residential or business use. The Nissan offer is unique to the I^2EV project, and demonstrates Nissan's commitment to the UK being a priority for the EV market. This early work with Nissan and trial participants serve to de-risk the project, by addressing a major challenge - supply of EVs.

The project is further de-risked by working with SSEPD's New Thames Valley Vision's (NTVV) Consumer Consortium to identify EV fleet hire opportunities. There is a clear plan to engage Nissan with the Consortium and sign up major blue chip companies to the 'non-cluster' trial programme. This trial arm will provide valuable socio-economic data, together with data on charging habits, customer behaviour, charging times etc. To further de-risk the project, I^2EV has partnered with Northern Powergrid and Charge Your Car North Ltd. This will give access to an additional 200 Nissan employees on the Nissan LEAF hire scheme in the North East and the trial data from those EV users, ensuring linkage with Northern Powergrid's Customer-Led Network Revolution (CLNR) (LCN Funded project).

Through the links with the NTVV Consumer Consortium and the CLNR projects, the I^2EV demonstrates a pioneering approach to LCN Fund project planning and delivery; by working with two of the largest existing LCN Fund projects, crossing two DNO areas (Scottish and Southern Energy and Northern Powergrid), I^2EV will reduce the risk of duplicating research, resources and crucially, will further lessen any disruption to the customer - whilst at the same time delivering added long term benefit to the customer by future proofing

2: Project Description cont.

network to manage increased stresses due to uptake of EVs and other low carbon technologies. The initial sub-task to Task 2 is the development of the customer engagement plan, which will be consulted upon and agreed with Ofgem. The outline knowledge dissemination plan, that will form the core of the customer engagement plan, is in Appendix M. This will be supported by a robust data protection strategy (outlined in Appendix L).

Two groups of trials will take place:

1. Social trials: Monitoring of existing EV owners and EV fleet hire users

During this process, EA Technology will engage with Nissan, Charge Your Car North Ltd and Fleetdrive to approach EV owners (wherever they are located) with the intention of monitoring and recording, with reference to location, their driving and charging habits, in a statistically significant numbers. The monitoring will be a basic power monitor to record the charging point load downloaded remotely (or from the charger itself if this is available) and a request to householders to record their mileage and time of journeys (possibly via a sat-nav) with any additional charging away from home. De Montfort University will provide information as to the social economic data required. This will enable:

- A statistical comparison of the behaviour in the trials to be compared with a larger population to check that the customers within the trials are a true representation of the population as a whole.
- Data set available will be more statistically significant than currently available information.
- An understanding of the socio-economic situation of customers (whether they represent a cross section of society or only higher social-economic sections) and the implications for EV customer behaviour in future.
- Detailed data on the opinion of the trial participants into the technology in general, allowing understanding of the likely acceptance of the DNO control of loads.
- The results of the trials to be extrapolated to a larger population in the modelling work.

Pre-project progress in identifying existing EV owners

Charge Your Car North Ltd and Nissan have offered access to the Nissan Sunderland employees' LEAF hire scheme participants; 200 EV users' data will be shared with I^2EV. See Appendix K for letters of support.

Through the New Thames Valley Vision Consumer Consortium, major blue chip companies such as Dell, GE, 3M, Honeywell and Waitrose will be approached with fleet hire options to lease an EV at a subsidised cost. Charging points will be installed, potentially free of charge, the Technology trialled and trial participants' behaviours, cycle and charging times etc. monitored.

Pre-project progress in identifying EV fleet hire customers

EA Technology with the support of Bracknell Forest Council (see letter of support in Appendix K) and SSE will facilitate a meeting with the New Thames Valley Consumer Consortium, Nissan and Fleetdrive Electric in October 2012.

2. Technical trials: Trialling the Technology and monitoring using clusters (10-20 on one feeder) of EV charging points, with residential customers

To identify suitable communities and sign up customers for the trial, De Montfort University will provide input into the customer engagement to ensure that customers understand the social-economic information required. They will also review the engagement process to understand what was successful and what could be improved. Different means of engagement will be used. Automotive Comms and project partners will provide in-kind contribution via support to identifying clusters and engaging trial customers/participants:

- Nissan's (LEAF EV manufacturer) EV ambassadors will be made available to facilitate evening briefing sessions to demonstrate / educate potential EV users of the benefits of using EVs.
- Fleetdrive Electric, an EV lease company, will help to identify suitable trial clusters from its EV database
- Charge Your Car North Ltd (CYC) will support with identifying clusters.

Pre-project progress in identifying clusters is in Appendix B and strategy is outlined on page 48. Mainstream, industry and social media, contacts in local authorities and green community networks will be used to attract clusters. Ideally at least one cluster will be achieved on an island or remote location to demonstrate the potential on weak networks where upgrades are prohibitively expensive but the potential for renewable generation is high and transport fuel is expensive. An additional incentive will be a further subsidy from the project to cluster participants. This should encourage those interested to sign up their neighbours.

The aim is to achieve clusters of around 10-20 EV connected to one feeder. 10-20 is a suitable number as it gives the scope to understand the likely variation in use of EVs and charging in any given location by different customers:

2: Project Description cont.

- Cycle charging points also require between two and eight switched off at any point and therefore 10 is a minimum number.

The challenge of managing multiple EVs in a given LV feeder is not currently a problem, but could pose a significant challenge as EV uptake figures increase. If there are insufficient clusters, with any combination of EVs or heat pumps, the results from the clusters available will be extrapolated using network modelling. Whilst the principle aim is for EV charging control, heat-pump users are another client base area and so further information will still provide information on the viability of the product.

Project Stage-Gates

Independent evaluation of the project by a subcontracted third party will review the approach and progress of establishing trials at 6, 9 and 12 months. After 6 months, if there insufficient clusters within SSE and NPG's license areas, clusters outside these areas will be approached with permission from the DNO responsible for the relevant area. After 9 months, if there are insufficient clusters, potential heat pump clusters will be approached. To manage value for money, funds for installing clusters will only be released as they are established. Any unused funds will be withdrawn after 18 months; the overview of the stage-gate approach and associated review process are depicted on page 28.

As indicated, if after nine months there are insufficient clustered customers to trial an EV, a mitigation option is to utilise heat pumps; social landlords will be targeted as they often have clusters of housing stock where each home will have a heat pump installed. A mixture of EV clusters and heat pumps clusters may be used to achieve suitable 'cluster' sizes. Contact will be made via existing contacts from engagement in other LCNF projects, through information about social landlords who have participated in CESP or the Renewable Heat Premium Programme and therefore likely to have heat pumps installed in clusters. Examples of possible candidates are Southern Housing Group on the Isle of Wight, A2 Dominion, Hampshire Voluntary Housing Society, Hyde, Martlet, Swaythling Housing and Bracknell Forest Homes. In the case of heating, back-up heat or heat stores may need to be supplied to give comfort to households that they will not be cold, although based on the operation of the Technology, these are not expected to be used. Reference will be made to DECC's research on heat pumps with heat stores. If there are insufficient clusters, with any combination of EVs or heat pumps, the results from the available clusters will be extrapolated using network modelling.

Discussions that took place with Nissan, as referenced earlier, resulted in the agreement to provide sufficient EVs to undertake the trials via Fleetdrive Electric car leasing company. The negotiated rates are appropriately low in order to make participation in the trial appealing to consumers.

Contingency

The risk of gaining sufficient numbers of users is significantly reduced following the agreement and accompanying letter of support from Nissan to provide EVs at a reduced rate for the trials. However, arranging suitable clusters of EV users is a significant threat for the project and for this reason, breakpoints to assess progress and the alternative of controlling heat pumps is written into the plan. Additionally, a range of funding options and potential participants will be contacted to increase the potential for signing up clusters. If few clusters of any type are found, monitoring individual EVs users will be used to extrapolate the results. The alternative plans should cost less than the priority option.

Deliverables

i. Customer engagement plan
ii. Social trials: 150 EV users engaged to participate in trials
iii. Technical trials: 100 customers signed up for the EV trial, in cluster groups of 10-25 EV users (heat pumps if necessary)
iv. Monitoring equipment installed to monitor an existing EV owner's behaviour.

Task 3. Integration of the Technology with charging points

Alongside Task 2, EA Technology will engage with manufacturers of charging points to integrate the ability to accept Power Line Carrier (PLC) signals and the Technology logic into the charging point. Ideally, this will allow just a charging point (of any make) to be installed with the control capability included rather than two pieces of equipment. If this is not possible, the Technology logic will be installed in series with the charging points. Control of charging points may be one of many applications of the Technology and therefore the logic will be developed separately so that it can be used to control other appliances such as heat pumps.

Deliverables

i. Integration of the Technology into charging points or other loads.

2: Project Description cont.

Task 4. Establishment of customer / cluster trials

The first cluster will be fully engaged by March 2013; the network will be assessed and the Technology installed together with charging points. It is planned to have a temporary circuit installed on a spare way from the customer's consumer unit. Alternatively, a separate consumer unit may be installed for the additional circuit. Learning from this trial will improve further installations. As more clusters are found the Technology will be installed. It may be necessary to provide parking space for customers' conventional cars during the trial as they may not have space to park an additional vehicle. With DNO support, EA Technology will aim to find parking space for the existing vehicles. The NCP network will be approached to provide secure parking for the 'traditional' vehicles. It has been established that there is proven technology to bypass appliances that could block a PLC signal if necessary. There is a risk that the feeder itself is too noisy however the PLC technology has been successfully tested elsewhere on the UK (e.g. Hook Norton LCNF project and at Houghton, Slough under IFI). Therefore experience to date indicates that PLC could be applied to the majority of the LV network. If any of the trials show that PLC cannot be used, the character of these feeders will be useful learning as will using alternative communications. A temporary change in the connection agreement with the customers to cover the direct control of the EV charger will be agreed. Installation of chargers may be incremental to ensure the Technology can prevent overload without switching off chargers excessively.

Deliverables

i. Charging points, the Technology and monitoring installed.
ii. Likely number and length of switch-offs under different scenarios, incl. impact of higher capacity charging.

Task 5. Monitoring first trial

The measurements to be taken each 10 minutes are:

- Feeder current
- Demand from each EV charging socket (or heat pump)
- Voltage at the customer premises
- PLC signals sent
- PLC signal received
- Number of switch offs each socket actuates
- Length of each switch off
- Time and length of each charge and total energy demand

The monitoring will be via the Technology and power monitors on the charging point circuits. Data will be downloaded remotely using power line carrier (PLC) or mobile communications, should PLC not be available, as appropriate. EA Technology has used a number of data logging systems and will select the most cost effective means to communicate. The data monitor/controller will be able to log all the data that it and the Technology can measure, saving to a laptop or logger. This information will be downloaded from the substation by mobile phone, power line carrier or land line depending on the location. It is anticipated that the time and length of each charge and the energy used will be recorded by the charging point. If this is not possible a low cost power meter will be installed in series. The results from the other tasks and the first trials will feed back into the 'main' trials so that the control may be improved on an on-going basis.

The first and each subsequent trial will last between 12 and 18 months. Due to the diversity of the network, and to ensure applicability to a GB-wide scenario, the limits on current may be set artificially low, and to different levels, to monitor successful operation, cycling of chargers etc. even when the feeders are not actually overloaded. There will be no adverse effect on the customer; only a small, and agreed (with the customer) interruption to supply to install the charging point. In the case of heat pumps, the internal temperature and coefficient of performance (COP) will be assessed to measure whether the performance has improved or degraded compared with operation without direct control.

Deliverables

i. Data collected monthly for duration of each trial; reported every six months to the steering group.

Task 6. Trial participant interviews

The De Montfort University will hold pre, during and post-trial interviews with customers (trial participants) regarding:

- Driving and charging habits;
- Concerns over charging being switched off; and
- Any problem encountered as a result of the Technology.

De Montfort University will develop a suitable interview 'pack'. The interviews will be conducted with a mixture of face to face where possible or, where this is not feasible, written or online surveys.

2: Project Description cont.

The participation in feedback surveys will be written into participants' contracts for the trial to ensure that as much information as possible is gathered.

Contingency

A range of data gathering options, (paper, online and face to face interviews) will be used to provide participants with as much choice as possible in how they respond to maximise data returned. Statistical analysis will be used to estimate data where there are gaps.

Deliverables

i. Interviews with customers held, social economic analysis carried out and recommendations made.

Task 7. Modelling

Using the results from the trials, the University of Manchester, with support from EA Technology, will model the actual test networks and other representative networks, using work carried out by Work Stream 3 of the Smart Grids Forum to establish the:

- % increase in thermal and voltage headroom and resulting cost savings in avoiding reinforcement compared with unmanaged installation of EV charging sockets (or heat pumps) including the impact of higher capacity charging.
- Increased capacity and options for back-feeding and resulting cost savings.
- Likely resulting increase in uptake of EVs (or heat pumps) and resulting savings in carbon emission using DECC published carbon intensity figures.
- Any type of network that is unsuitable for the Technology.

The results of monitoring the driving and charging habits of individual drivers in different locations and demographics will be used to verify that the habits seen in the trial clusters are representative and can be extrapolated to different types of network and locations. The results will be used to estimate the savings possible by using the Technology rather than reinforcing the network and the logic requirements of the Technology. If heat pumps are used, recommendations to achieve the best COP whilst using the Technology will be made.

Deliverables

i. Network models of the impact of EV charging and the Technology. ii. Cost-benefit analysis (on a GB scale and DNO licence scale) for the network using the Technology. This will be based on the approach developed under Work Stream 3 of the Smart Grids Forum to help validate this work.

ii. Likely carbon savings of using the Technology.

Task 8. Consultation with EV manufacturers: cycle times

With the results of the trials, discussions with Nissan regarding the optimum switch off time and cycle time without adversely affecting battery management or lifetimes will take place. This will also take into account customer and network requirements and which charger to switch off first.

Deliverables

i. Cycle times and logic for the Technology agreed.

Task 9. Project and regulatory recommendations and implementation

Make recommendations as to whether:

- Installation of the Technology (or similar) should become standard for large loads.
- There should be changes in the regulation to allow the DNO to directly control customers' supply.

Deliverables

i. Independent evaluation of project and the Technology.

ii. Regulatory recommendations, including integration into DNO business as usual.

iii. Technical and commercial framework recommendations.

Task 10. Dissemination

As much information as possible will be disseminated to other DNOs, manufacturers and the general public, without compromising the intellectual property or customer privacy of those involved, as described in the dissemination plan.

Deliverables

i. Dissemination plan developed and executed.

An independent 3rd party will review the project progress and approach every 6 months and make recommendations for improvements. It will also compare the Technology to alternatives.

2: Project Description cont.

2.4 Changes since Initial Screening Submission

A number of significant activities have been undertaken since the submission of the 2012 ISP. Whilst the core of the project has not radically changed, the project now has a clearer focus, rationale and structure to maximise learning.

Increase in requested LCNF funding: This has increased from £2.5 million in the ISP to £4.1 million at full bid submission. This is accounted for by a number of key factors. At ISP stage costs for establishment of customer / cluster trials were under costed at £550,000. This has increased to around £1.8 million - with an in kind leverage of £5.8 million; no in kind leverage had been achieved at ISP stage. Management of the subsidised EV rental programme and other trial associated costs (collection/delivery of EVs, installation of charging points, finding trial participants) were either not accounted for or under costed. Management of the rental programme alone accounts for £225,875 and was not costed at ISP stage. Fleet management is not core to either EA Technology's or SSEPD's business; we have since engaged with an EV fleet hire partner who has worked with us to address and further refine costs for this element, in return for a high quality output that will de-risk the trial stages of the project - by providing the project with EVs and management of those EVs.

EV manufacturer engaged: The most significant development between submission of ISP and full bid is the committed engagement of Nissan to the project. Nissan is supplying, through a uniquely subsidised deal, 300 EVs to the trial programme, through an EV lease hire company, Fleetdrive Electric. Through Nissan's project partnership, I²EV will also have access to Nissan's Low Emissions Centre of Excellence in Sunderland which will support learning and technical need throughout the lifetime of the project. Two key learning areas from the trials will be social and technical, the former requiring EV drivers in different locales, the latter requiring clusters of 10-25 trial participants on one feeder (e.g. on one street, cohousing development or gated community). See Appendix K for letters of support from Nissan and Fleetdrive Electric.

Social trials - participants identified and secured in principle: Access to 200 EV drivers secured through partnering with Charge Your Car who manage the Nissan employees LEAF hire scheme in Sunderland. Progress made in engaging support of Bracknell Forest Council to provide direct links to SSEPD's NTVV's Consumer Consortium (blue chip companies) for fleet hire trials.

Technical trials - Clusters for trial identified and engaged: Successful trialling of the Technology depends upon identifying and engaging trial participants in clusters. Two potential clusters have already been engaged in Hyde, New Forest, and Leeds.

Review of all Tier 2 projects - collaboration with Northern Powergrid (CLNR) and link with NTVV: A comprehensive review of all Tier 2 projects has been undertaken to ensure the I²EV project effectively builds on the UK's LCNF portfolio. As a result, clear strategic links have been established with other LCN Fund projects - New Thames Valley Vision (NTTV) and the Customer-Led Network Revolution (CLNR) (both Tier 2). In recognition of the natural link between I²EV and CLNR, given both projects' involvement with EVs, Northern Powergrid has committed as a partner to the I²EV project.

Detailed costing and in-kind support: Detailed costing has been carried out following the re-focused project; partners' in kind support has been quantified and contractors costed.

GB DNO business as usual: Introduction of focused activity to bridge the gap into GB DNO business-as-usual including detailed technical evaluation of charging/derogation consideration, identification of the need for use-cases, policies, procedures and design tools to be developed in the project and the identification of the need to develop training material to educate the range of DNO stakeholders through the project.

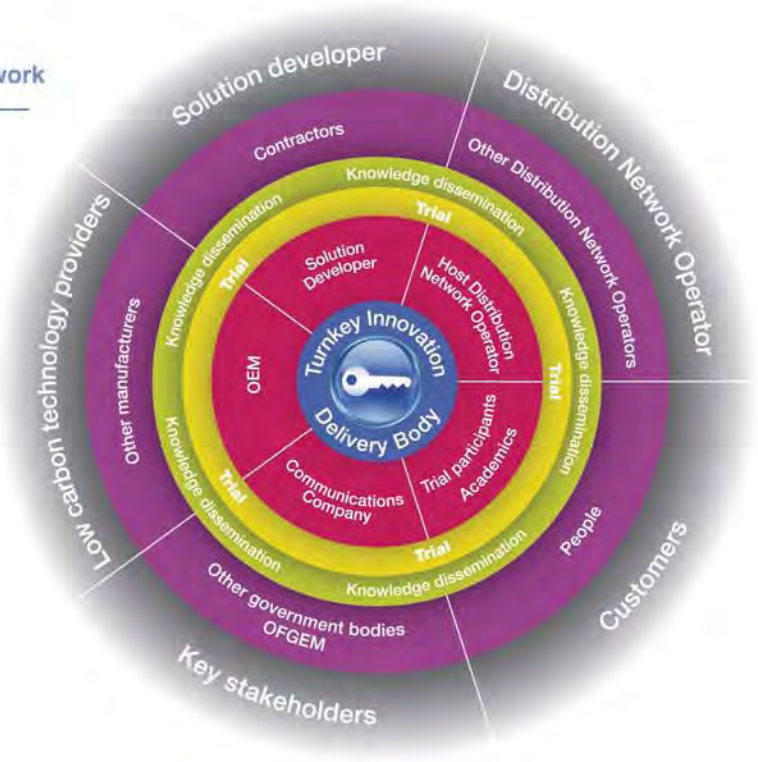
Improvements made to the project readiness:
- Governance: Project steering group and board established (see Appendix F for organogram)
- Commercial innovation: I²EV commercial model has been drawn up (see page 17)
- On-site trial of the Technology to de-risk the project - trial results will be available in September 2012
- Management of EVs for duration of the trials programme has been established with a trusted partner
- Letters of support have been provided by project partners and technical trial cluster groups (Appendix K)
- Social trials: Through Charge Your Car North, access to 200 EV drivers in the North East
- Technical trials: Two clusters have been identified and both have provided a letter of support
- Detailed project plan has been developed (Appendix G)
- Outline knowledge dissemination plan to inform the communications plan developed (Appendix M)
- Outline data protection strategy to support customer engagement plan has been developed (Appendix L)

2: Project Description Images, Charts and tables.

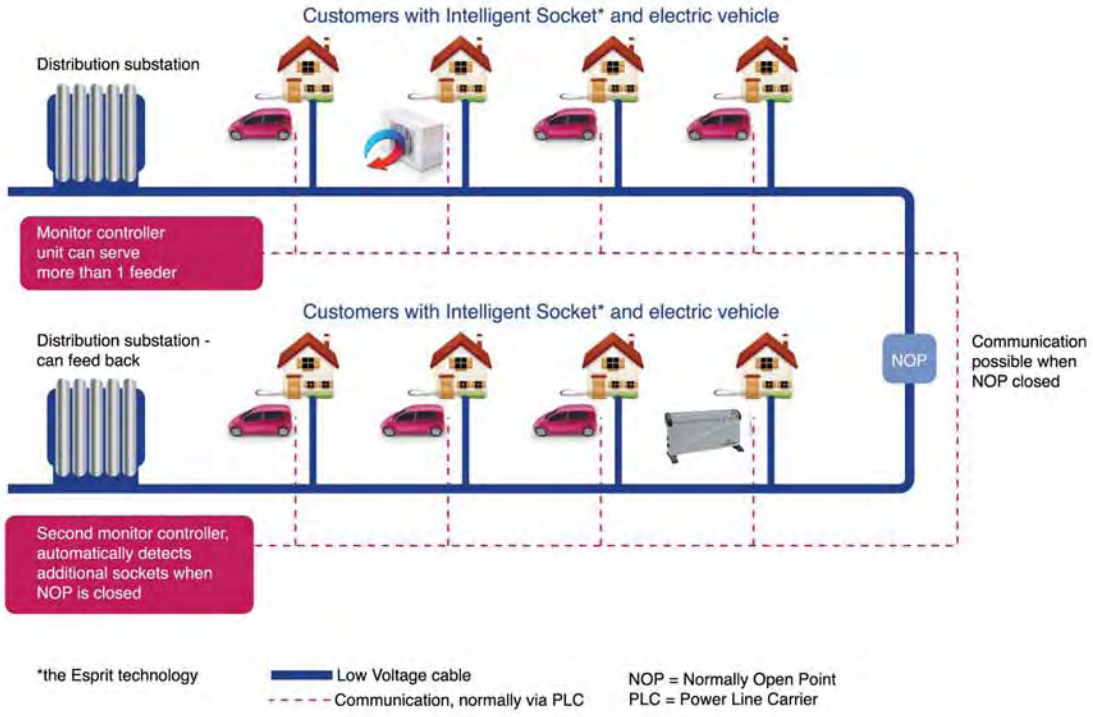
I²EV
Commercial innovation - delivery framework

This diagram illustrates the framework for a non-Distribution Network Operator (DNO) to deliver a low carbon network innovation project, from inception to delivery, on behalf of a DNO.

- i. The Turnkey Innovation Delivery Body (TIDB) develops, manages and delivers the low carbon network project on behalf of the DNO
- ii. These are the core parties with whom the TIDB partners in order to develop the project, leading to stage iii
- iii. Trials of the technology to support the low carbon network of the future
- iv. The knowledge and learning from the trials is disseminated to the partners in stages ii and v
- v. The key beneficiaries of learning from the project
- vi. The outer layer captures the main partner groups



I²EV
Technical innovation – how the Technology works



Project Description images

Section 3: Project Business Case

3.1 I²EV in an SSEPD Context

I²EV is proposed by SSEPD, which is part of the Scottish and Southern Energy (SSE) group. SSE is involved in the generation, transmission, distribution and supply of electricity, the production, storage, distribution and supply of gas and in the provision of other energy-related services.

One of SSE's main priorities is to:
'Deliver upgraded electricity transmission networks and operational efficiency and innovation in electricity and gas distribution networks as they respond to the decarbonisation and decentralisation of energy.'

The learning from the LCNF projects such as the I²EV project continues to inform SSE's strategy to deliver on these priorities. Its role in informing efficient investment, the innovative application of technology and the support the project provides for decarbonised energy will be key to its success and the reason why SSEPD is submitting this bid to the Low Carbon Networks Fund.

SSEPD extends this to draw on the innovation of project partners and stakeholders, an approach which has reaped rewards both in SSEPD's Smart Grid projects Northern Isles New Energy Solutions (NINES) in Shetland and New Thames Valley Vision (NTVV) project in South England..

It is this disciplined yet supportive approach to innovation that gives colleagues and stakeholders the confidence to propose inspiring, challenging and novel projects like I²EV.

In developing I²EV we, along with our lead partner, EATL, have taken the learning from an array of successfully delivered IFI and LCNF projects which have allowed us to gain a useful understanding of the challenges of the future and the tools both commercial and technical that we can utilise to resolve issues. Projects of note include:

- *Orkney Registered Power Zone: the first network based operational Active Network Management system in the UK.*
- *Chalvey Zero Carbon homes: an SSE funded project in conjunction with Slough Borough council which has constructed 10 fully occupied zero carbon homes to demonstrate the most advanced home energy systems available for the new home market.*
- *Shetland battery: a six megawatt hour sodium sulphur (NaS) battery - Europe's biggest - installed adjacent to our power station on Shetland.*
- *Customer-Led Network Revolution - Northern Powergrid's LCNF project.*

Integration with SSEPD's Business Plan

SSEPD's delivery priority is to deliver upgraded electricity transmission networks, operational efficiency and innovation in electricity distribution networks as they respond to the decarbonisation and decentralisation of energy.

The learning from the LCNF projects will assist our preparation for RIIO, and is absolutely in line with the values core to the operation of our business.

Converting innovation to business as usual

SSEPD's pragmatic approach to developing and implementing research projects and technology trials ensures the generation of outputs which are practical and effective. Conversion of these useful outputs to business as usual, for SSEPD and for the wider industry includes:

- *the creation of new policies and procedures*
- *commercial precedents*
- *component specifications*
- *vocational and technical training courses*
- *management tutorials*
- *providing key data relating to this intervention (cost per intervention, risk, operational implications)*

3: Project Business Case contd.

3.2 The I²EV Business Case

The business case for the I²EV project falls into two parts. Firstly there is a business case for the mode of operation and delivery of the project and secondly there is the benefit of the social, economic and technical deployment of the Technology and associated monitoring and engagement.

There is significant benefit to the DNOs of developing a framework in which third parties can trial new technology on one or more DNOs' networks whilst still working closely with the DNO as the sponsor of the project.

The benefits are:

- Accelerating the development and deployment of new technology by allowing a third party to drive the trials forward. It harnesses alternative approaches from outside the DNOs and the drive of technology developers to achieve trial results allowing DNOs to concentrate on network development.
- With a fixed price contract is transfers the project management risk to a third party.
- Ensuring that the technology aligns with a DNOs needs and has DNO support to integrate it into normal working practice through DNO sponsorship of the project.
- Using a third party as the lead on the project enables one DNO to be the sponsor whilst allowing the Technology to be tested on other DNOs' networks ensures efficient management of the trials whilst ensuring testing on as wide a cross-section of networks as possible. Separate projects per DNO may increase costs by 50% as the project management and analytical costs would remain at a similar level and would not scale for two smaller projects.
- Developers working with DNOs engenders trust and understanding of risk that is beneficial for operating together in a `business as usual' context.
- Not only will the project help EA Technology grow as a developer of the Technology, the project brings ANDTR, Fleetdrive Electric and Automotive Comms (all SMEs) into contact with the distribution system, supporting their growth and securing jobs.
- The project will also support the safeguarding of Nissan's jobs at Nissan's plant in Sunderland through raising the profile of the Nissan LEAF and potential new technological developments in integrating the Technology with the charging point.
- By ensuring that electric vehicle charging points can easily be connected to the network, the uptake of vehicles is likely to increase security of jobs in the electric vehicle industry. The automotive sector already accounts for 12% of the UK's manufacturing employment; low and ultra-low emission vehicles offer the potential to secure these jobs and build upon them ('Making the Connection - the Plug-In Vehicle Infrastructure Strategy', Office for Low Emission Vehicles, June 2011).

To achieve these aims, there are various contractual and working arrangements that will be trialled within the project. These frameworks will be made available to all DNOs and third parties so that this work does not have to be repeated. Thus, although over £200,000 has been allocated between SSEPD and EA Technology to develop the contracts and define scopes of work, much of the output can be used on other LCNF projects. Savings on future project will depend on their nature. However, if a modest £50,000 is saved on each future project, only four additional projects are required for there to be a cost saving.

From a technical perspective, the Technology will help mitigate the impact of low carbon technologies. Projections for the uptake levels of low carbon technologies (LCTs) across Great Britain have been determined as part of wide-ranging work within Government to provide forecast scenarios to meet the Carbon Plan. These scenarios, developed primarily by DECC, but with input from DfT regarding EVs, highlight the need for large-scale uptake of EVs, heat pumps and photovoltaic generation if the UK is to meet its carbon reduction targets without the need to purchase carbon credits. Detail on these scenarios has been published by Work Stream 1 of the Smart Grids Forum. With respect to EVs in particular, the 'mid` scenario forecasts in excess of 6m EVs in Britain by 2030, with over 23m EVs by 2050. Further drivers of the expected high numbers of EVs by 2020 are:

1. The UK has stated an ambitious target of an 80% reduction in CO2 by 2050 compared to 1990 baseline levels. Road transport is an important element of this, and the King Review in 2007/8 provided recommendations to government about how to achieve such reductions So far, government policy has acted upon the recommendations to incentivise the take-up of ultra-low carbon cars and there is no sign that this will stop.
2. Recently the EU has confirmed that all car manufacturers in Europe must aim for a fleet average target of 95g/km CO_2 by 2020. The only way that most manufacturers will achieve that is by their vehicles having plug-in capability, either full EV or plug-in hybrid/E-REV etc.

3: Project Business Case contd.

3. Most London boroughs, including Camden, are heading for large fines from Europe for air quality issues (for regulated rather than CO2 emissions) - it will be cheaper for them to encourage electric vehicles rather than pay the fines.
4. London Congestion Charge is likely to change soon with the result of encouraging more EVs in the capital.
5. The Automotive Council Technology Road Map is the official consensus between manufacturers and industry organisations about vehicle technologies over the next 40 years. It shows that electric cars will be a mainstream car technology before 2020.
6. Motorists want low car running costs - electric vehicles provide this.
7. The problem at the moment is that EVs are expensive in relation to their driving range capability. However, the Renault Zoe will be launched in early 2013 and will cost around half of most current mainstream EVs (£13,650 plus £70/month battery rental). It will also have a range of 130 miles. Factor in the ever increasing price of oil and EVs will become more and more attractive to the average motorist.
8. When the 'Mark I' Toyota Prius hybrid appeared it was seen as an oddball car for eco-warriors. It is now the world's best-selling car, with EVs likely to follow this pattern.

Each of the LCTs described here poses a certain challenge for electricity distribution networks, which will need to be met in order to ensure that customers continue to enjoy a robust electricity supply. In the case of EVs, the challenges that will be faced include a potential exacerbation of peak demand if drivers plug in their vehicle upon returning home from work (therefore coinciding with the traditional network peak between 5 and 7pm). However, this is not the only issue, as simultaneous charging of multiple EVs along one LV feeder will also cause the voltage along that feeder to be depressed, potentially taking it outside statutory limits. The challenges associated with heat pumps are similar, as they are expected to form a significant drain on the thermal headroom of circuits, while similarly depressing voltage, particularly when starting on cold days (when load on the network is already likely to be at a high level).

Even if the projections given here do not turn out to be fully reflective of the way in which LCTs appear, there will be a need for all network operators to consider the effects that these LCTs will have on their local distribution networks.

Work carried out under Work Stream 1 of the Smart Grids Forum predicts that if fast charging is possible by 2023 (only 10 years after the start of the project) there could be between 1 and 3 million EVs on the road. Charging speed is a key factor in take up and allowing charging to draw up to 7-8kW at home will encourage low carbon vehicles. Given that the present, after diversity, maximum demand of a property is of the order of 1 - 2kW, the impact on the local electricity distribution infrastructure will be significant; particularly given the possibility outlined above regarding customers charging at certain times of day that will lead to considerable increases in the peak demand level observed on the network. See page 28 for GB uptake scenarios for different forms of low carbon technology (Source: DECC, SGF WS1).

For the calculations in this bid, we have used 3kW per charger to represent an average, slower charge possible today. It should be noted that this estimate may turn out to be on the conservative side, given that second generation EVs will have larger batteries and higher charging rates (with the same charger). This means that they will either need to draw more power to charge over the same period, or will need to charge at the 3kW for a longer period. This makes some demand side response solutions (e.g. Time of Use tariffs) less attractive, as the amount of demand that would need to be shifted to another time of day would be considerably larger (in terms of kWh). A means by which a DNO can have a direct control over EV charging loads to avoid reinforcement would remove potential barriers to chargers being installed. It should be noted that it is only under heavy loading, that charging may need to be curtailed, possibly only a few times a year, and that the customer may not notice at all. As well as reduced costs of driving and electricity to cover costs of reinforcement, the customer avoids the disruption of re-laying cables in return for a very small restriction on charging. DNOs will have a low cost solution as a `safety belt' allowing them to connect LCTs with less caution as they have the comfort of being able to control them even as a short term measure whilst further measures are introduced.

Alongside the technology itself, DNOs will gain greater understanding of:
- The habits of customers and their use of low carbon technologies and the impact on the network.
- Customers' acceptance of direct demand control by the DNO.

The additional data will help validate Smart Grids Forum network models.

3: Project Business Case contd.

The benefits of deploying the Technology are significant in terms of avoiding reinforcement. It is estimated that the savings of using the Technology rather than reinforcement will be £740 million across Great Britain or £53 million per licence area by 2040. The details of the assumption and estimation of the number of feeders where the Technology may be used are given in section 4. Whilst some of the projections given above are extrapolations to 2040, the preparation to accommodate new LCTs will occur in the next 5 to 10 years. Clusters of EVs are likely to occur, particularly in urban environments or areas where they are being manufactured or promoted.

Thus DNOs will be taking action and using techniques such as the Technology in the near future. These solutions will then be rolled out as clusters appear elsewhere. Whilst SSEPD has expressed particular interest in the Technology and has sponsored the project, the Technology will be applicable to all DNOs. This is demonstrated by the fact that trials are expected to be on other networks as well as SSEPD's such as Northern Powergrid who have expressed their support for the Technology by agreeing to take part in the project.

Carbon savings from using the Technology will be due to the facilitation of the uptake of EVs by allowing easy access to fast charging that is noted as a key to adoption of EVs in the UK's Carbon Plan. If facilitating fast charging helps move adoption from the medium to high scenario, 4 million additional cars would be on the road by 2030, about 2 million more in 2025 and 500,000 in 2020. The SGF WS 3 predicted a 10% saving in infrastructure costs to implement fast charging using the technology. If it is therefore assumed that 10% of the additional carbon saving from the increased adoption of EVs in the high scenario is due to this saving it equates to 33.5 million tonnes of carbon by 2030. Further savings may be possible due to facilitation of the connection of other LCTs such as heat pumps. Whilst the uptake of EVs and associated environmental benefits is not the prime driver for the project, the awareness raising and opportunity to experience driving an EV should encourage the adoption of EVs. There is therefore an additional indirect benefit from the project.

3.4 Time savings and avoiding disruption

A key advantage of the Technology is that it can be deployed quickly; even as a stop gap and with minimal disruption. The Technology is expected to be very fast to install; a matter of a few hours to a day of time compared with months of planning and installation time for re-laying feeders. This will speed up the connection of LCTs and avoid disruption and inconvenience of installation to customers.

Leverage
The indirect benefits to the EV industry have resulted in the project attracting a number of in kind contributions. There is significant leverage from the LCNF demonstrating value for money to the customers. The outside funding as a proportion of the total cost is significantly greater than previous LCNF projects.

3.5 Alternatives

The currently available alternative option is to continue in a 'business-as-usual' manner, laying additional cable to split existing feeders and hence reduce the load on each feeder. This has been demonstrated above as being very costly both in terms of the amount of investment required from network operators, and also in terms of the societal cost in the level of disruption caused through excavating and laying thousands of km of LV cable. As such, this is not regarded as a viable alternative.

DNO-supplier-customer demand management
Some form of "smart" solution is therefore required to facilitate the connection of EVs (and heat pumps) in the future. The most apparent alternative would be to make use of variable tariffs, instigated by suppliers that would incentivise customers to charge their vehicles at particular times of day. There are several potential drawbacks to this. Firstly, such a solution would depend upon a great deal of unknown quantities; not least of which would be the appetite of suppliers to offer such tariffs, and that of the customer to accept them. There is also the issue of cost: how much would a supplier be willing to offer a customer to move demand from one time of day to another, and what is the minimum level of payment that a customer would be willing to accept? Analysis carried out using the Smart Grid Forum Work Stream 3 modelling work has shown that suppliers may look to shift demand fairly significantly at a cost of around 2p/kWh. However, it is unlikely a customer would accept such a low amount. A figure that seemed "reasonable" for customers to accept would be of the order of 20p/kWh, given that this is reflective of the sort of cost differential that exists between peak and off-peak tariffs at present. However, at this level of payment, the analysis showed that it was not cost-effective for suppliers to shift demand.

3: Project Business Case contd.

Another consideration is that suppliers' focus is broad, generally on a national level; while the needs of a DNO are inherently more local. The likelihood of being able to align these two drivers may well be low. Furthermore, the number of connections where Demand Side Management could be used to reduce load and relieve an LV cable is typically under 100 per feeder. The probability of sufficient voluntary load reduction via engaged customers through the use of tariffs on one feeder without automation is low.
There is also the issue that DNOs would look for a solution in which they could place a good deal of confidence and which could be applied uniformly across their network. Customers along any given feeder may have different energy suppliers and different tariff structures; and hence may respond to pricing signals differently. The Technology would ensure that the same solution could be applied across a range of networks (both in terms of feeder types and locations) and would not be contingent upon any third party being involved in the solution (unlike supplier-led Demand Side Response measures).

In addition, the Esprit Technology has the capability to measure voltage at the point of the Technology's installation at the customer's connection, regardless of where on the feeder it is located. As such if the Technology is installed in a premises at the extreme end of a feeder the voltage at the end of the feeder can be accurately measured. If however, the Technology is installed at a connection part way down a feeder, then the data provided can be used to make a reasonable estimate of the voltage at the remote end. Any measurements taken can be transmitted to a data-logger for future retrieval and analysis if required, essentially providing DNOs with a low-cost means to gather data on voltage and current profiles at customer premises and feeders.

3.6 Conclusion

The business case is therefore in four parts.

1. It has the potential to reduce capital investment requirements for network operators consistent with the objectives of RIIO ED1 that will also be beneficial to customers.
2. It facilitates the adoption of LCTs to reduce carbon emissions by reducing the cost, inconvenience and time for connection.
3. It provides the data and technology to maximise the use of network capacity
4. It provides a framework for a DNO to work with third parties who are leading network projects.

SSEPD commented that:

It is clear that the solutions that we are implementing in the I²EV project do carry some uncertainty, in particular in relation to their ability to perform as planned, level of customer uptake and response and the sustainability of the technology. However, we consider waiting until the network is on the brink of overload would be an even higher risk and is not a realistic option.

Therefore, we have to look for solutions now and believe that the installation of the I²EV technology will help avoid EVs causing excessive stress on electrical networks that would necessitate the replacement of a significant proportion of our low voltage network. We estimate that the replacement value of SSEPD's assets across the two licences would be circa £3 billion.

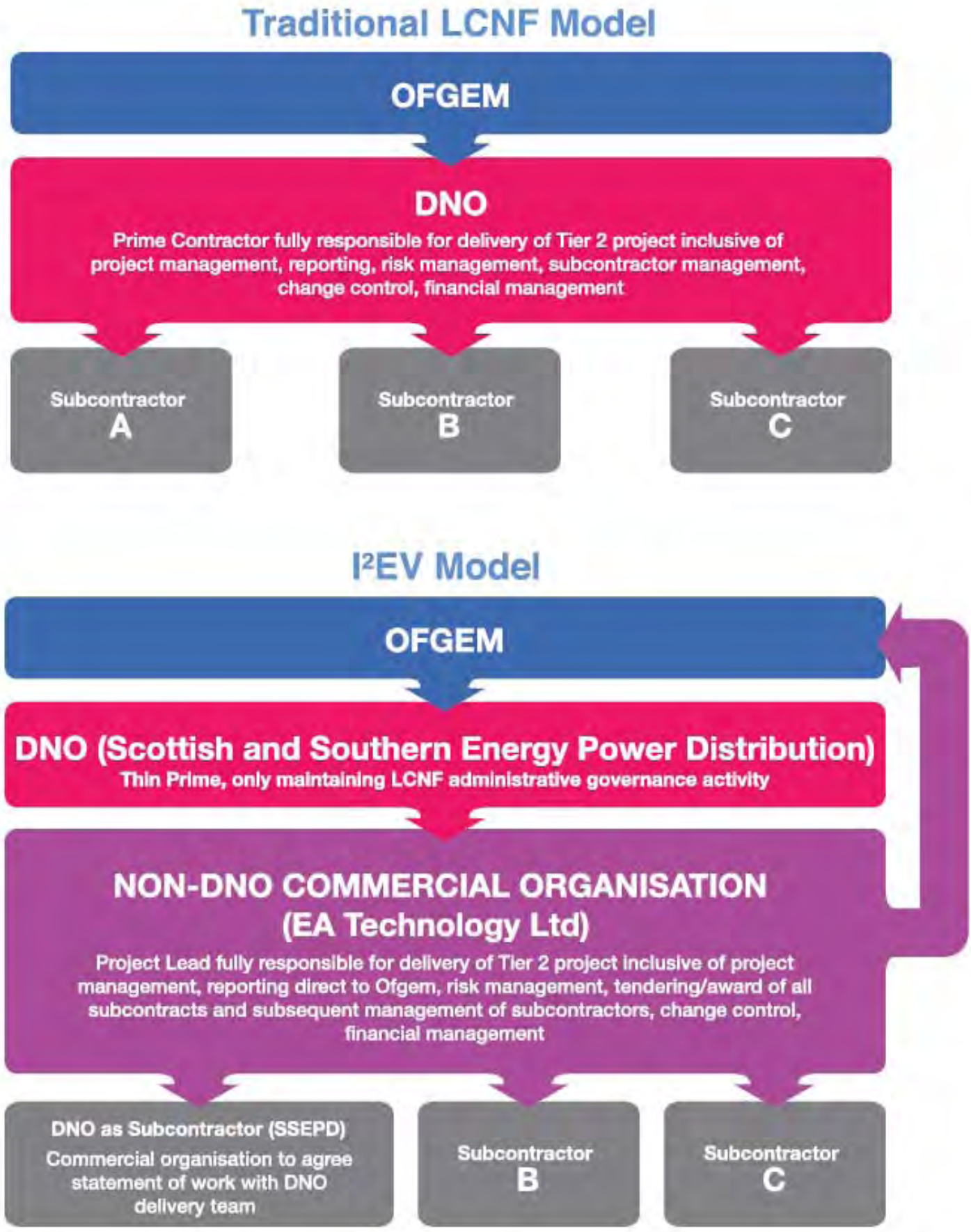
In addition, the disruption to public highways would be a significant consideration and would require the programme to be phased over tens of years, resulting in unacceptable delays to the connection of low carbon solutions. This is not compatible with our aim of providing the energy customers need in a sustainable way and therefore is not an option.

In our opinion we need to do something new, now, and believe that the I²EV technology will be a valuable tool for the DNOs to use in the future to manage their networks.

Project Code/Version No SSET205

3: Project Business Case contd.

3: Project Business Case images, charts and tables.



Project Business Case images

Section 4: Evaluation Criteria

4.1 Accelerates the development of a low carbon energy sector and has the potential to deliver net benefits to future and/or existing customers

The I²EV project facilitates the expedient connection of EV chargers to the DNO LV network as it avoids the possibility of the DNO becoming a barrier to multiple EV connections along a particular LV feeder. This could occur when multiple EVs wish to connect to a portion of network, but the local feeder may not be sufficiently rated to accommodate this load. In order to avoid overstressing the feeder and interrupting supplies to all customers fed via this circuit, the DNO would need to engage in reinforcement work, i.e. installing cables or overhead lines with higher rating. This would be time-consuming and result in the DNO forming a barrier to connection of multiple EVs. However, spare capacity does exist in these feeders, but it is time dependent, i. e. there may not be any spare capacity (or "headroom") at times of peak demand; if some demand could be moved to other times of the day then this latent capacity could be utilised. Such profile changing may become possible through smart metering, but this is unlikely to be in effect until 2019, and will not be in widespread use before RIIO-ED2 in 2023. In the meantime, clustering of EVs is likely to occur in certain network areas, and not always as a result of an obvious reason (e.g. geography), but could be 'irrational' (e. g. neighbours wishing to "keep up with the Jones'" by purchasing an EV). It is this sporadic clustering that may result in the biggest problems for DNOs. Even with smart metering it is unlikely that DNOs will have the confidence to rely on load shifting without direct control and will prefer a system over which they have control such as the Technology. The benefit will accrue to all customers directly in the form of reduced reinforcement costs, and indirectly from cleaner air and reduced carbon emissions. It is `smart meter' ready in that the algorithms could be incorporated in a meter.

Solution 1 - commercial

Carbon Plan: Low carbon transport is a priority under s.1.12 of the Carbon Plan. Section 2.79 and 2.86 illustrate the expected uptake of EV and plug in hybrids expected to fulfil the goal of decarbonising the transport system. The solution contributes to the Carbon Plan by allowing the expedient connection of EVs through an in depth understanding of how and where intelligent charging units could be used, thereby allowing the rapid deployment of techniques to manage the anticipated increase in penetration of low carbon technologies such as EVs. Deploying a third party who wishes to develop a technology helps accelerate the deployment and facilitates the Carbon Plan.

Financial Benefits: The project will demonstrate the extent to which third party delivery of innovation projects could be more efficient than the projects being merely led by the host DNO. The savings will be via:

- Using the expertise in third party project management to tightly manage time and budget
- Experience to date shows that DNOs are expert in project managing the maintenance and installation of assets but do not have a large pool of expertise in development of new technologies.
- Rather than seek to recruit new staff for this role, the project seeks to demonstrate that third party management is more effective, as knowledge and expertise can be drawn in as required. With a fixed price contract, it transfers the management risk to a third party.
- Enabling faster deployment using a third party rather than a DNO whose timescales for asset consideration is 40 years.

Solution 2 - Technical

Carbon Plan: The Technology that forms the basis of the solution to the problem of increased stresses on the network - overload due to market growth of EVs, wholly aligns with the UK Government's Carbon Plan. Under s.1.12 in the Carbon Plan's 'Vision for 2050', low carbon transport, and in particular, EVs, are cited as being at the heart of the step change needed to reduce emissions. The UK is tasked to reduce emissions from transport around 17 $MtCO_2$ by 2020 (325$MtCO_2$) from 2010 (342$MtCO_2$) figures. The Carbon Plan also recognises that the grid will be faced with increased demands. The Technology solution under the I²EV project addresses the inevitable additional stress on the network from EVs, (and other LCTs) by facilitating the connection of EVs without the need for excessive network reinforcement, thereby minimising costs. The project will also provide information on driving habits and customer response to LCTs that will help to promote them and achieve the Carbon Plan targets.

4: Evaluation Criteria contd.

Alignment with other strategies: In addition to demonstrating alignment with the Carbon Plan, I²EV directly supports the Office for Low Emission Vehicles' (OLEV) 'Making the Connection - the Plug-In Vehicle Infrastructure Strategy' (June 2011). Ofgem's Low Carbon Networks Fund is cited in the executive summary (page 7) as being a conduit to support recharging at home through support of smart grid projects linked to Plugged-In Places (PIP) projects in London and the North East; Charge Your Car is the PIP programme for the North East and is a confirmed partner to I²EV (see letter of support in Appendix K).
The clustering effect of low carbon technologies is recognised in OLEV's Strategy in relation to electric vehicles and that 'recharging in particular locations could lead to the need for local reinforcement' (page 33 of OLEV's strategy). This fully aligns with the I²EV trial programme and the need to engage with clusters to effectively demonstrate the Technology as a solution to the future problem of network overload on local distribution networks. The I²EV project has been presented to OLEV and will benefit from their support in terms of strategic direction, identifying clusters and access to other synergistic data and projects, (see Appendix K for letter).

4.1 Calculation of Net Benefits

Commercial solution

Cost Savings: The base case is that the project is led and coordinated by the DNO. This is estimated to require 2 full time staff (or equivalent) over 5 years at a total cost of £1 million. In contrast the commercial solution will cost £808,656 in developing a contractual framework and for the project management services of a third party. This delivers a net benefit of £191,344. For future projects it is assumed that having established the contractual framework, there will only be a cost equivalent of 25% of that allowed for developing the framework in this project. It is envisaged that in RIIO-ED1 period under Network Innovation Competition (NIC) that the number of projects adopting this framework will increase rapidly. For RIIO-ED2 and beyond, a modest number of projects are expected given the uncertainty around funding mechanisms. In total by 2040 it is expected there will be 40 projects using this commercial innovation delivering a net benefit of £13.99 million.

This expectation is extrapolated on the basis of the below assumptions:

- Of the LCN Fund Tier 2 projects awarded in 2010 and 2011 (eleven projects in total) six are technically-led projects that could have benefited from the approach outlined in the I²EV project. This gives an average of 3 projects per year;

- 27 years until 2040, giving a total based on the average of 3 projects per year of 81;

- The overall figure has then been scaled back assuming that 50% of those tasks would be suitable for being undertaken with the third party delivery model gives 40 projects.

It is stressed that this assumption has been extrapolated using a small pool of existing projects. The extent to which this assumption is true will depend on the attractiveness to both parties (developers and DNOs) of the final commercial contract in terms of its share of risk and reward.

Time Savings: The key benefit to the commercial innovation is anticipated to be the accelerated deployment of a particular solution. It harnesses alternative approaches from outside the DNOs and the drive of technology developers to achieve trial results allowing DNOs to concentrate on network rather than technology development.

Headroom: No additional headroom is achieved, although the headroom gains associated with the technical solution could be achieved more quickly.

Rollout: It is envisaged that this commercial innovation could be applied to any large scale (LCNF or Network Innovation Competition) project anywhere in the country.

4: Evaluation Criteria contd.

Technical Solution

Cost Savings: The only conventional alternative to the Technology is reinforcement of the LV network. For each of the trial sites, it is assumed that 300m of cable would have to be laid. The average costs to lay LV cable as agreed under DPCR 5 is £98.4/m. The cost for 10 feeders is therefore £295,200 (the base case). In contrast, the target costs for the substation installation for the Technology is £2,000 for the equipment and one day's work for two people to install it. This assumes that the cost will fall with bulk manufacturing. If staff cost £500 a day, this is £3,000 per substation. Note that this is a lower figure than that quoted by the Smart Grids Forum (SGF) Work Stream 3 (WS3) analysis as this included the cost of any installation at the customers' premises. It is known that for the proposed technology, the cost of the intelligent socket (the Technology) would be borne by the customer and should not noticeably increase the cost of the charging point. Therefore the cost to the DNO is lower than that quoted in the SGF WS3 documentation. The logic within the Technology should be maintenance free. The comparison gives a saving of £265,200 in I^2EV project terms (i.e. across 10 substations with one feeder controlled at each). Scaling this up to a GB-wide scenario by the forecast number of substations where this will be deployed (source SGF WS3) in 2040 gives 27,920 installations. This would see cost savings across Britain of over £740 million by 2040 assuming an average benefit of £26,520 per site from the above net benefits calculations. One Technology installation in a substation could serve all the feeders and therefore comparing the cost with relaying one feeder length of cable is a pessimistic comparison of the savings that the Technology could offer.

(WS3: http://www.ofgem.gov.uk/Networks/SGF/Publications/Documents1/WS3%20Ph2%20Report%20Issue%203-1%20-%2031-Jul-12.pdf).

Installation time savings: It is estimated that once planning has been carried out and permissions obtained, four months is the shortest time elapsed to relay a cable. In contrast, if the Technology is in stock, it could be installed in three weeks' time allowing for time to book the necessary staff time and record the installation. If EV installations are already present, a monitor controller may already be available. Therefore the Technology could be implemented in 25% of the time required to relay cables across Great Britain. Installation time will be useful learning from the project.

Headroom: The average load in a home during the night is less than 20% of peak loading and around 50-60% during the day. It is therefore estimated that by shifting EV charging, twice as many charging points could connect. That is, if 10 charging points can connect and charge during the peak, there should be headroom for 20 during the other 18 hours of the day. If on one feeder, on average 20 EV chargers can be installed rather than 10 without reinforcement using the Technology, this will provide about 30kW of additional headroom (assuming 3kW per charger). Extrapolated across the country, if used on 130,000 feeders envisaged under Smart Grids Forum Work Stream 3 work and freeing the same headroom, this would, in total, provide 390 MW of headroom.

Uptake: The rapid uptake of EVs is expected over the next 15-20 years. This timescale is longer than the likely roll out period for the technology. If the study in Work Stream 3 is correct, the Technology is applicable to more than a third of all LV radial feeders supplying suburban streets, 32% of LV radial feeders in villages and 18% of LV radial feeders on terraced streets and in town centres. Note that many of the other feeders would not experience problems due to EV charging and therefore the applicability is very widespread.

4.2 Provides value for money to distribution customers

Solution Benefits: As per the calculation of net benefits above, were the DNO required to manage costly reinforcement measures to address the overload on local distribution networks due to the uptake of EVs and other low carbon technologies; this would have a severe impact on customers' electricity bills. The Technology will provide a solution to manage and alleviate this overload, thus having a positive effect on customers' bills as the costs of reinforcement are mitigated and the alternative saves 10% when rolled out across the UK.

Further benefits to the distribution system are via the development of new commercial frameworks for rapid cost effective deployment of new technology.

4: Evaluation Criteria contd.

Trial Design: The trial has been designed to gain maximum learning whilst ensuring the project scope and costing is not excessive. As per the modelling carried out for the SGF-WS3, there are a total of 19 different LV feeder types used in GB today, and each with a very different mix of customers (residential, light commercial, etc). Ideally, the project would focus on installations of a statistically significant sample of each of the 19 types of network. We recognise that the costs (and time) to achieve this would not be in the interest of customers, and have therefore focussed on a much smaller sample of c10 cluster groups. Data from these field trials will then be combined with the social analysis from the c150 social trial participants, allowing simulation on the likely usage and benefits of the Solution to be carried out through desktop modelling. These steps significantly reduce the cost of the project to customers.

In addition to this, there are the socio-economic benefits of facilitating EVs and avoiding the disruption of relaying cables. Throughout the document, the indirect benefits have been highlighted. Benefits associated with factors other than the distribution system are:

- Encouraging uptake of EVs.
- Supporting SMEs and other industry thus safeguarding jobs.
- Reducing carbon emissions from transport.
- A product suitable for export.
- Raising awareness of energy.

Partner selection

The companies participating in the project have been invited to participate for a number of reasons and/or by several methods, in each case offering value for money.

- SSE: Project Sponsor.
- EA Technology: Invited by SSE to take a lead role in the project due to strong working relationship. EA Technology has significant experience in managing multi-party projects (e.g.. CLNR, SGF WS3, STP), supported by a robust project management culture and procedures. This, combined with its ability to deliver projects on time, and to the necessary quality, even at its own cost when required, is why EA Technology was asked to trial this commercial proposal.
- Nissan: At time of initial project development, Nissan was the only EV manufacturer with EVs available for general sale in the UK. In addition, Nissan is a strong voice behind the drive for installation of `Fast Charge Points' to be installed across Europe. They also bring the expertise of the Zero Emission Centre of Excellence to the Project.
- De Montfort University: Awarded their role following a successful, competitive tender process.
- University of Manchester: Awarded their role following a successful, competitive tender process.
- Independent Project evaluator: to be awarded via competitive tender.
- Automotive Communications: Unmatched equivalent expertise or experience in EV utilisation and proliferation.
- Fleetdrive Electric: Introduced to EA Technology by SSE as an organisation that could help in structuring and managing the lease contracts associated with deploying the vehicles.
- Charge Your Car: Previous experience through the Plugged In Places projects, would avoid unnecessarily reinventing any activity that has already been done elsewhere in the UK.
- Northern Powergrid: Approached by EA Technology and SSE owing to their geographic location associated with Nissan's Sunderland plant and its staff.

4.3 Generates knowledge that can be shared amongst DNOs

Two distinct elements of the project generate knowledge which can usefully be shared amongst all the DNOs to the benefit of the industry as a whole:

1. Commercial innovation

Successful partnership between SSEPD and a non-DNO third party creates an opportunity to generate a framework for contractual relationships of this nature. Deployment of this framework will facilitate future partnership-working between DNOs and non-DNO third parties by streamlining the process. That is, by providing a format and check list to organise the work, such as identifying in advance the key success criteria; potential risks and mitigating actions; essential processes and protocols; cultural issues, knowledge and skills gaps to be addressed. This framework will ensure that the advantages of third party commercial flexibility, delivery in tight timescales and innovation can be effectively married with the DNO experience and stability of supply. Sponsorship from a DNO ensures that the technology is practical and will be used as 'business as usual'.

4: Evaluation Criteria contd.

Utilising the additional capacity and capitalising on potential increased flexibility offered by partnerships with third parties will increase the scope for accessing the LCN Funding and enable more or larger scale energy-related projects to be delivered within the remaining timeframe of the LCN Fund. This can be continued for gas and electricity-related projects within the remit of the future Network Innovation Competition from 2015 onwards. This will allow commercial flexibility and innovation to be applied without risk to energy supply, while meeting LCN Fund requirements.

2. Technical innovation

Trialling the technology over a statistically significant number of participants and period will provide learning that will benefit all DNOs and related industry practitioners. This knowledge will include but is not limited to:

- Customer behaviours and attitudes i.e. current driving habits and how EV usage may change these, the extent to which customers are/are not willing to make lifestyle adjustments
- Charging habits and the impact on the network with greater EV usage
- The impact that usage of the Technology will have in reducing the load on the network
- How much available network headroom will be released through use of the Technology
- Cost savings to DNOs as a result of the Technology negating the requirement for network upgrades and the collateral impact on energy service companies and retail companies
- Time and materials required for installation

Learning from this project will also be relevant to and disseminated amongst other stakeholders including current and future EV manufacturers, EV charger manufacturers, local authorities and government policy makers, as well as the general car buying and car using public.

4.4 Involvement of other partners and external funding

EA Technology has worked with SSE to pool experience and contacts to attract the right partners for the project. The potential project has been discussed with delegates at EV conferences and seminars:

- Contacts in the EV industry have been established through SSEPD's other LCNF projects A communications director with a track record in promoting LCT and particularly low carbon vehicles has been recruited.
- Identifying possible locations for the first clusters via various routes and contacting the relevant DNOs (letter of support from Northern Powergrid in Appendix K).
- Circulating invitations to tender to universities and other candidate organisations.
- Discussing the projects with relevant government agencies e.g. DECC, BIS and DfT through the Office for Low Emission Vehicles (OLEV) (letter in Appendix K).

Through this process, ideas for finding clusters, deploying EVs at a low cost, analysing the technical results and engaging with customers have been received. These have been distilled into the project by considering:

- How they may help attract customer participation and make the project practical
- How they may reduce the risks to the project
- How they may enhance the rigour of the analysis and results
- How they enhance the learning and value of the project

It is important to note, that given a non-DNO organisation that is developing technology is delivering the project, the independent analysis from third parties is vital to ensure the results are independent and rigorous.

4: Evaluation Criteria contd.

Partners Involvement to date and contributions

Further to the partner selections identified on page 21, SSEPD is the project sponsor with EA Technology delivering the project. The following partners and support have been recruited:

Nissan: EV manufacturer and charging point manufacturer - will provide in kind support via a subsidised rental programme to trial participants, use of Nissan's EV ambassadors to engage trial participants, and will facilitate provision of free chargers to customers for the trials through the Plugged in Places programme and Chargemaster, in eligible areas (London East of England and Milton Keynes). Subsidised chargers and installation will be provided in the North East through Charge Your Car. Access to and use of Nissan's Zero Emissions Centre of Excellence will be made available to the project.
In kind value: £1,970,000

Charge Your Car North Ltd: EV infrastructure - will support in identifying clusters, use their EV infrastructure and media contacts in the North East as a means of engaging clusters, will deploy their EV sector and EV infrastructure knowledge and expertise on the project.
In kind value: £30,000

Northern Powergrid: DNO - agreed to support EV trials through the CLNR project - Northern Powergrid will supply access to substations and demographic information to support identification of trials participants / clusters.

Fleetdrive Electric: EV lease hire company - will supply EVs at subsidised lease hire rates to the project and will give use of their extensive database of EV drivers to the project to support in identifying clusters.
In kind value: £97,000

Automotive Comms: Low carbon vehicle sector communications expert - customer engagement and communications director. Already made contact with interested parties to ascertain interest in clusters.

De Monfort University: Socio-economic modelling, tender award subject to LCNF project approval.

University of Manchester: Independent network modelling and technical evaluation -tender to be awarded.

Academic partner: Independent project evaluation - tender to be awarded.

Blah d Blah Ltd: (EA Technology's creative communications agency) Project Dissemination, quotation received.

EA Technology: Programme manager and technology developer - EA Technology will contribute circa £636,000 in development, administration and communication costs.

4: Evaluation Criteria contd.

4.5 Relevance and Timing

The Department of Energy and Climate Change provides predictions of the growth of EV ownership across the UK to 2030 (page 22 in the Smart Grid Forum's Work Stream 3 report to the Electricity Networks Association). It shows that if fast charging is possible, that by 2023 (only 10 years after the start of the project) there could be between 1 and 3 million EVs on the road. Charging is a key factor in take up; allowing charging drawing up to 7-8kW at home will encourage low carbon vehicles. The Technology facilitates the installation of such chargers in a cost effective manner. Other forecasts and drivers align with this prediction - see section 3.

Nissan, Vauxhall, Peugeot, Renault, Mitsubishi and Citroen are launching EVs or plug in hybrids from 2013. The Society of Motor Manufacturers and Traders report that manufacturers expect plug-in vehicle uptake within the range 3-10% in 2020-2025, depending on the infrastructure and supportive measures.

The UK Government's Carbon Plan shows the forecast reductions in transport emissions to 2027, and expects 40% of vehicles sold by 2030 to be battery, battery with a range extender, or plug-in hybrid. Such an increase in EVs will require cost effective measures such as the Technology to manage the increased demand on the local distribution networks.

The development of EV charging infrastructure is nascent in GB, however the national roll-out of a UK-wide EV infrastructure programme has recently been announced through Elektromotive Limited, Europe's leading provider of electric vehicle (EV) charge points, and Charge Your Car. The aim is to create the UK's largest pay-as-you-go, `open source' network of public access charging stations for EVs, based upon the development of its proven pay-by-phone technology. The goal is to create a recharging network with 10,000 public access pay-as-you-go charge points located across the UK. This will encourage the purchase of EVs and the demand for home charging.

The project has confirmed engagement with Nissan, who aim to put the UK on the low vehicle emissions map. This is a critical partnership that will enable the project to supply EVs to trial participants. Nissan's support for the I^2EV in itself demonstrates that this is a timely and relevant project to benefit customers and to future proof the distribution network against prohibitively costly reinforcement measures.

[Partner confidential information removed.]

Nissan's forecasts provide supporting evidence on the rate of EV sector growth over the coming decade, and illustrate why delivering the I^2EV project over the period 2013 - 2015 is key in future proofing the GB distribution network by potentially offering a lower cost (to traditional reinforcement methods) of managing the network to deal with increased load due to increased numbers of EVs.

The graphs on page 28 illustrate the GB uptake scenarios for EVs, as forecast by the Department of Energy and Climate Change (DECC); around 1.7 million EVs are expected to be on UK roads by 2020, with over 10 million by 2030. The Nissan forecast figures corroborate this uptake scenario, as illustrated in the 'Nissan predictions for GB EVs - total and market share' graph on page 28.

See also Appendix J for Nissan EV sector growth forecast figures, compared with GB EV sector growth uptake projections.

The interest from cluster groups from initial contacts show that there is an appetite for EVs from the public that the Technology will help to nurture. The description below shows the potential sites already identified, even before customer engagement within the project has begun. Even if not all of these are possible, it demonstrates that with the number of candidate communities that can be contacted, it is likely that 10 will come to fruition.

4: Evaluation Criteria contd.

Furthermore, we have been approached, independently, by people volunteering to participate in the project, without any publicity or active recruiting being undertaken at this time.

Locations of potential clusters:

- In SSE licence areas:
  - Hyde, New Forest
  - Thames Valley Vision area
  - North of Scotland
  - Medstead, Basingstoke
  - Bramley, Hampshire
  - Reading, Berkshire
- In NPG licence areas:
  - Leeds
  - Sunderland
- Other, out of area, options:
  - Bristol
  - Whitchurch, Shropshire
  - Mold, North East Wales
  - Capenhurst, Nr Chester

All project partners are engaged and are in a position to commence work on the project in January 2013, pending project approval.

It is thought that if the Technology performs successfully, that it should be incorporated into business as usual working practices without significant training. Within SSE or other DNOs planning guidance would need to include use of the Technology either as standard when EV charging points are installed or as a solution to potential overloads. However, to ensure widespread roll out is possible, either receivers must be installed in homes or incorporated in to chargers. This may require changes to Engineering Recommendations (ERs) or similar. This project will provide the information and data for changes in ERs as well as internal working practices.

The regulation of the distribution network operators is in the process of being revised (RIIO-ED1) and this project demonstrates new ways of working and the involvement of third parties that could be incorporated.

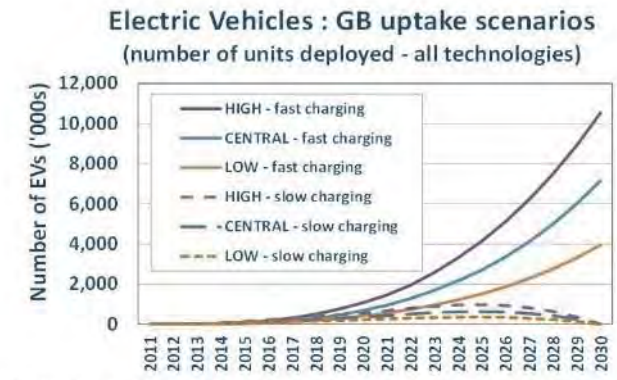
Project Code/Version No SSET205

4: Evaluation Criteria contd.

Project Code/Version No SSET205

4: Evaluation Criteria contd.

4: Evaluation Criteria images, charts and tables.



GB uptake scenarios for different forms of carbon technology (Source DECC, WS 1)

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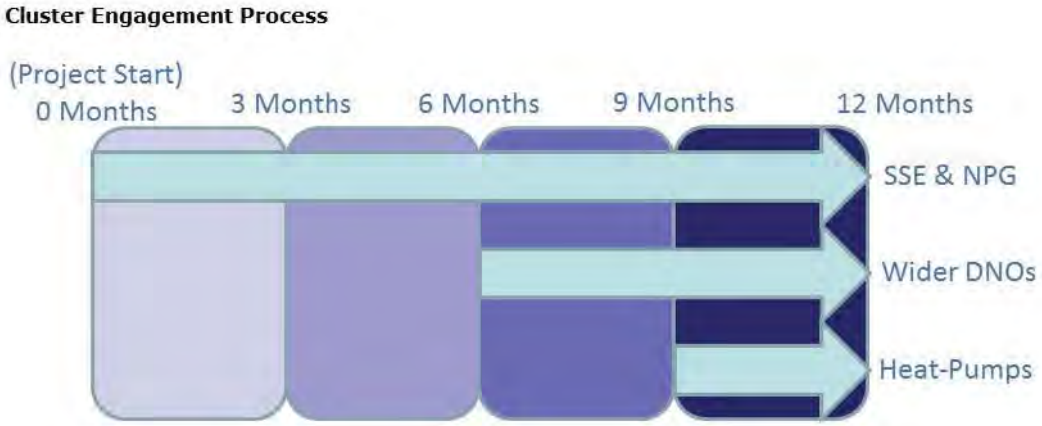
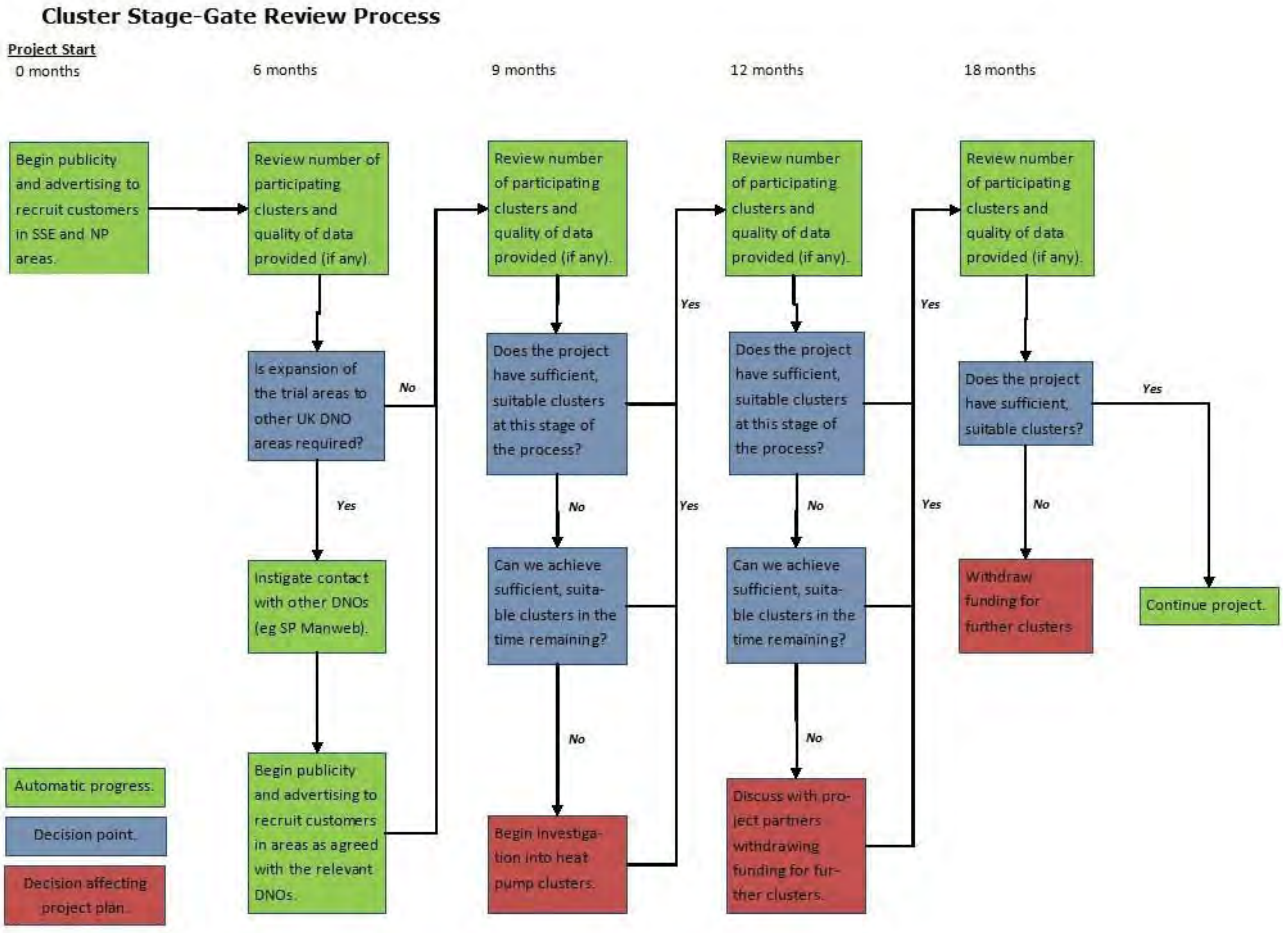




Evaluation Criteria Images

Section 5: Knowledge dissemination

☐ Put a cross in the box if the DNO does not intend to conform to the default IPR requirements

5.1 Learning dissemination

The I²EV project is unique in that although it has a transport focus, and deals with one particular customer behaviour; the learning has a wide impact and is of interest to a wide general audience including all vehicle owners and users, as well as DNOs. The learning dissemination will differentiate the project from other LCN Fund projects, as the learning will be actively disseminated not only to the DNOs and related interested parties, but to the general public as well.

This dissemination will take place through a variety of media, as detailed in the communications plan to be developed under the project. The depth of communication will be phased across the lifetime of the project. There will be significant communication across a wide range of media at the outset of the project to raise general awareness across a wide spectrum of stakeholders and to facilitate the recruitment of trial participants. As the project progresses, steady but lower weight communication will continue to maintain interest and communicate progress. Communication will be accelerated to Government at the end of the project, notionally through a Parliamentary exhibition and reception, to disseminate the learning outcomes across all relevant stakeholders.

A customer engagement plan will be drawn up at the start of Task 2 and will be agreed with Ofgem. An illustrative guide of dissemination methods under consideration is located in Appendix M, the contents of which will be refined into the Communications Plan for the project. Its purpose will be to inform and enthuse people about the trials and ultimately engage them as trial participants. These participants will fall into separate user groups to allow us to study two distinct facets of the trials:

Social trials: Socio-economic impact of EV usage and deployment of the Technology. This category of individual users can be more geographically widespread, and therefore customer engagement activities will focus on communicating with fleet EV users within large commercial organisations and individuals via Nissan and Charge Your Car.

Technical trials (the Technology): This will require clusters of residents whose households can be served by a single feeder. Customer engagement activities will therefore focus on approaching domestic users within specific geographic catchment areas.

Each user group will be communicated with using a variety of media deemed to be the most appropriate to reach and engage them. This is likely to include the use of social media, industrial media and forums, community networks, local authorities, national and local press and radio, targeted mailshots and door-drops. This communication campaign will be overseen and directed by a dedicated specialist communications team member to ensure maximum effectiveness. The customer engagement plan will be supported by a robust data protection strategy (see outline in Appendix L), that will ensure that customers' privacy is protected at all times.

General information

It is important that, in addition to disseminating the specific learning outcomes, general information about the project is shared with as wide a range as possible of stakeholders throughout the course of the project. This will use a variety of communications techniques to make the information accessible for each respective audience throughout the course of the project. These techniques will aim to be appropriate for multiple audiences so that communication is as effective and cost-efficient as possible and will include but not limited to:

- A dedicated I2EV website which will act as a shop window for the trials with separate public and private sections intended for general and specialist audience
    - Social media channels sharing the latest news and allowing direct two-way communication with trial participants
    - Industrial media and forums
    - National and local media coverage including press and radio
    - Printed and electronic documents including papers, newsletters and leaflets conveying information appropriate for either general or specialist audiences

5: Knowledge dissemination contd.

Particular Knowledge dissemination

The project will also generate three particular areas of knowledge which can be shared to benefit a range of stakeholders. It is intended to communicate these particular areas of knowledge as follows:

(1) Commercial innovation

Information: This successful partnership between SSE and non-DNO third party creates the opportunity to generate a standard framework for contractual working arrangements between a DNO and non-DNO third party deliverer including elements such as key success criteria, examples of best practice, requirements (legal, operational, knowledge) for each party, appropriate timeframes, etc. Utilising partnership-working rather than a DNO-led approach can be applied across other energy-related projects under the remit of the LCN Fund and the future Network Innovation Fund format.

It has the benefit of tapping into the additional capacity, commercial flexibility and external innovation of a third party organisation while still meeting the LCN Fund requirements of DNO involvement.

Audience: The findings and potential blueprint framework for a successful contractual working arrangement will be shared with Ofgem, other DNOs, as well as any other third party organisations likely to be able to lead-manage a similar energy-related project.

Formats: As well as publicising the outcomes through a variety of relevant communications channels including the national and trade press, we propose to make available skeleton contractual documents on the dedicated I^2EV project website and publish a full written report on the learning outcomes to be shared with the relevant stakeholders. We also propose to hold a specific session sharing the learning within LCNF workshops and to offer both on- and off-line training sessions on successful partnership working.

(2) Technical innovation

Information: Trialling the Technology over a statistically significant number of participants and period will provide learning that will benefit all DNOs and related industry practitioners. This knowledge will include, but not be limited to:

- The impact of the Technology on the network, how much the load can be shifted, what cost savings may be made, how much additional capacity is created when and where;
- The success of the use of the power line carrier;
- What issues for the control of EV charging may arise from the customer, manufacturer and network perspective;
- The outcome of the project validation

Audience: This learning will be of interest to Ofgem and will benefit all DNOs and related industry practitioners such as manufacturers of EVs and EV chargers, as well as other stakeholders including local authorities and government policy makers, interest groups and housing developers. The outcomes will therefore be shared using a range of communication techniques that are appropriate for the specific audience.

Formats: We will publish the high-level outcomes on the dedicated I^2EV project website, and share specific highlights on social media channels, as well as utilising the national trade press to communicate with the relevant stakeholders as widely as possible. We propose to publish a formal written report of the learning outcomes and will share the results with other industry practitioners by holding a specific session within the LCNF workshops and across other industry events and seminars to reach a wider audience.

5: Knowledge dissemination contd.

(3) Socio-economic learning

Information: It is anticipated that the project will result in learning significant details about customer EV driving habits and how these change over the duration of the trials, the trial participants' degree of openness to change, and how they respond to the Technology itself. Additionally, there may be other, hitherto unforeseen areas of learning about customer behaviour that may arise.

Audience: We anticipate this area of new knowledge being relevant to a particularly wide range of stakeholders including, amongst others Ofgem, the DNOs, other energy industry practitioners, manufacturers of both EVs and standard cars, manufacturers of EV chargers, national government policy makers and local government authorities, special interest and trade groups, academia and the public.

Formats: Given the wide range of stakeholders for communication, a variety of media will be used to ensure the relevant information is disseminated effectively. As well as wide-ranging media coverage on a national and trade basis, we will, amongst other communications activities, include the high-level outcomes on the dedicated I²EV website, feature the highlights on social media channels, publish a full written report on the learning outcomes and hold a session within LCNF workshops for industry stakeholders and other workshops where appropriate to reach a wider audience.

This multi-layered, multi-media approach will be the most efficient and cost-effective method of disseminating information to the various interested parties in the most accessible way. These multiple contact points will reinforce the learning outcomes rather than relying on one single source to reach each stakeholder and will allow us to engage with each at an expert or general level as appropriate to them. It also provides the opportunity to inform policy and decision-makers in relevant areas of national and local government, manufacturing, energy transmission, distribution and retail, to the benefit of all in developing new low carbon technologies.

5.2 IPR

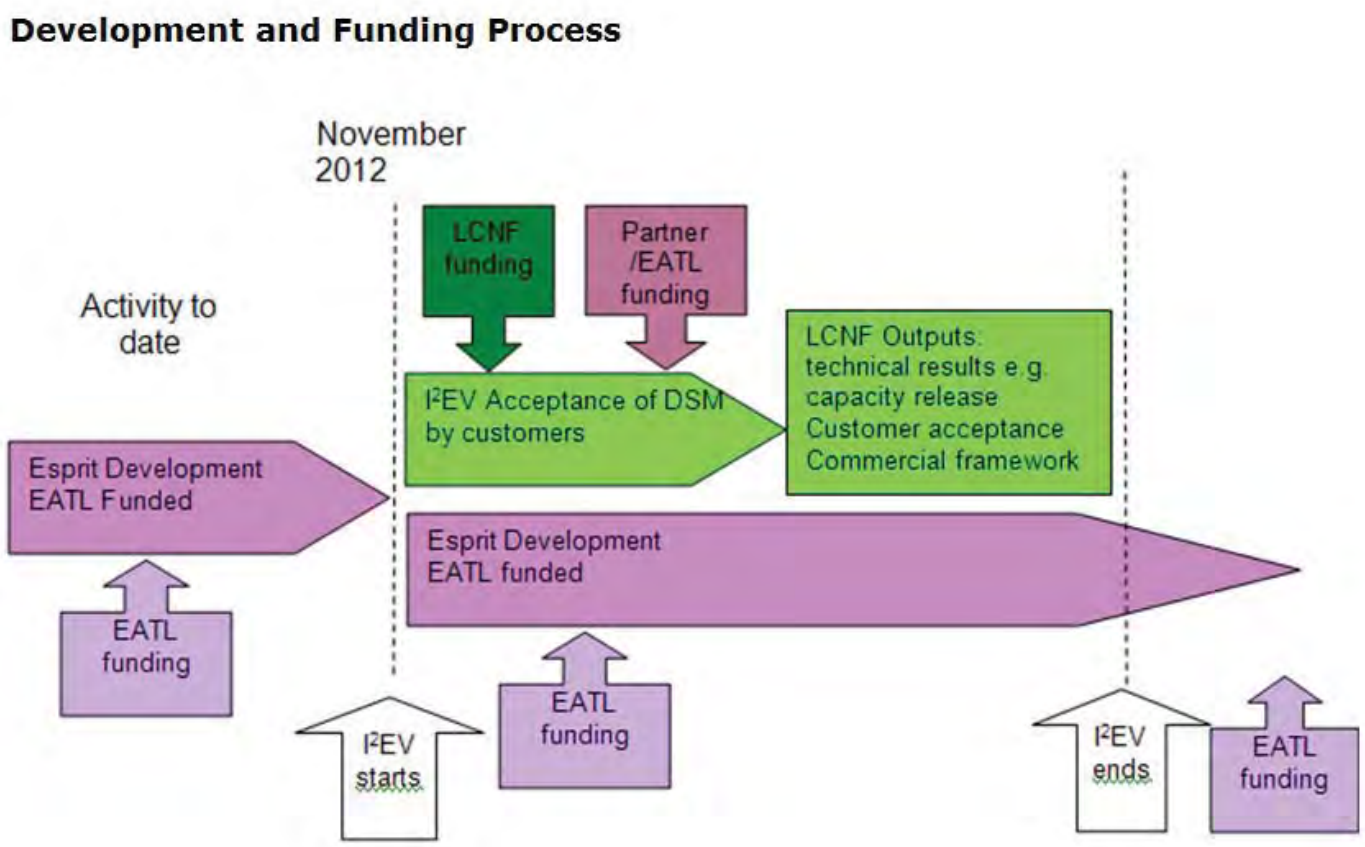
Throughout the duration of the I²EV project, two streams of IP will be developed in relation to the Esprit Technology. It should be noted at this stage that the invention, research and development of the Esprit Technology to date has been undertaken solely by EA Technology, at our own expense without technical input or funding from the LCN Fund or other parties. As such, all IP relating to the Esprit Technology, generated before the I²EV project starts is wholly owned, and will continue to be owned, by EA Technology. The two streams of learning, and hence IP, related to the Esprit Technology are as follows:

1. Technical Applicability: The relevant foreground IP relating to the use of the Esprit (or equivalent) Technology on the UK network, including perceived and actual impacts to end consumers, operation of connected devices such as EVs and Heat-Pumps, and data transmission problems on specific local networks will be provided to all project partners, the LCNF and GB Licence Holders in line with the default LCNF IP Terms. This is due to the LCNF funding all elements mentioned above as part of the I²EV Project and hence owning the relevant Foreground IP.
2. Technical Development: The IP relating to further research, development and technical improvements to the Technology will be undertaken, (as is underway at present), by EA Technology, at its own cost. As such, IP generated in relation to the technical improvements (e.g. development of algorithms to improve efficiencies) will not be made available beyond the limited `non-exclusive licence' to the relevant background IPR to other participants (reference SSES004).

   In summary, the learning results following the addition of Esprit (or equivalent) technology to the network will be disseminated to all parties, but the internal workings of the Esprit Technology, how it operates both now, and following any future improvements, will remain the IP of EA Technology. This was clarified at the Expert Panel Session on 26-09-2012 with the separation of the streams and associated funding is depicted on page 32.

   With respect to IP surrounding the Commercial Arrangements, this will be owned by SSE and shared with GB Licence Holders in line with the default LCNF IP terms.

5: Knowledge dissemination images, charts and tables.



Knowledge dissemination images

Section 6: Project readiness

Requested level of protection require against cost over-runs (%).	0%
Requested level of protection against Direct Benefits that they wish to apply for (%).	0%

6.1 Why the project can start in a timely manner

Governance: SSEPD and EA Technology through their engagement on the New Thames Valley Vision (NTVV) project already have a set of LCNF governance compliant terms and conditions agreed. These can be used as a foundation for I²EV enabling a swift lead into addressing the unique commercial set up of this work.

SSEPD will retain their prime contractor position as DNO, solely to maintain administrative compliance with current governance. As such, SSEPD will maintain the bank account containing I²EV funding but as part of the commercial innovation, the acceptance of subcontractor deliverables and subsequent payment to such organisations shall be managed by EA Technology. The responsibility for delivery of the I²EV project shall reside with EA Technology which will be reflected in a pass through statement of work that SSEPD shall flow to EA Technology. For the purposes of the Project, SSEPD will then be another subcontractor who will feed input up through to EA Technology. Please see flow charts on page 17 contrasting the commercial structure proposed for I²EV with the current commercial structure.

As LCN Fund governance requires, SSEPD will cover 10% of the overall project costs to the LCN Fund, (to be reclaimed upon achievement of the Successful Delivery Reward Criteria). As a measure of confidence in the project and to share the balance of risk, EA Technology and SSEPD will establish a contract whereby the cost and therefore the risk is shared under independent agreement. In the case of the I²EV project, this balance is agreed at a ratio of 25% EA Technology (as an SME the financial risk is inherently greater on balance), and 75% SSEPD. These ratios would be expected to flex on future projects under this novel delivery framework, to recognise the commensurate size and nature of the parties involved.

Key appointments: The project team at EA Technology is ready to start project delivery in January 2013. The communications and dissemination team is in place through Automotive Comms, a low carbon vehicle sector specialist and communications expert with specific experience in recruiting trial participants for EV trials, and Blah d Blah design and communications company. De Montfort University has been engaged through a formal tendering process to conduct the socio-economic modelling work and the University of Manchester has been engaged through a formal tendering process to carry out the network modelling. The independent project evaluation will be awarded to a third party via a formal tendering process.

Project plan: A robust project plan has been developed to guide project task delivery (Appendix G) with stage gate reviews, monthly risk and project meetings, quarterly board meetings and monthly communications meetings. This is a living document that will be continually updated as the project progresses.

Customer engagement plan: This will form part of an over-arching communications plan. An outline of what will be included is in section 5.

Data protection strategy: The full data protection strategy will be developed in the first quarter of 2013; an outline of what will be included is in Appendix L.

Partner engagement: Key partners have been engaged pre-project, to enable effective delivery to start promptly in January 2013. Nissan has committed to the project and will supply EVs and support with trial participant engagement and charging point infrastructure supply and installation. Fleetdrive Electric, an EV lease hire company, has committed themselves to the project to manage the subsidised lease deal brokered with Nissan and support with delivery and maintenance of the EVs. Charge Your Car North is engaged and will provide access to EV drivers in the North East, providing a valuable link to Northern Powergrid and the Customer-Led Network Revolution project. Northern Powergrid is a partner to the I²EV project, demonstrating cross-DNO working and an innovative joint delivery approach to LCN Funded projects. All partners cited have provided letters of support for the project.

6: Project readiness contd.

Trial progress: The project has already informally embarked upon identifying and engaging with EV users and clusters of trial participants. Through Charge Your Car North and Nissan's involvement in the project, we have direct access to 200 EV drivers in the North East for socio-economic modelling purposes. Through early engagement with Bracknell Forest Council, we have access to the New Thames Valley Vision's Consumer Consortium and major blue chip companies who are a target audience for EV fleet hire purposes. Clusters of trial participants have been actively engaged in Hyde, New Forest and Leeds (letters of support from clusters are in Appendix K). Local authorities and government agencies have given `in principle' support to finding clusters. Informal contacts indicate a willingness to participate and two unsolicited requests to participate have also been received. A map of the UK, detailing the DNO areas and an indicative spread of the potential clusters is located on page 40.

6.2 How the costs and estimates have been estimated

A breakdown of the costs are given below. Phasing over the years is estimated from the likelihood of when clusters will be established and therefore when data will be available.

The cost of each task has been budgeted by estimating the days for EA Technology and partners time and the materials, travel and accommodation required. Where possible fixed price contracts have been arranged. The contingencies were calculated by multiplying the costs for mitigating the risk by the probability of the risk occurring. The breakdown of costs per task is as follows. Please note that all costs are in gross real terms (i.e. the partner / customer contribution(s) have not been shown, and the figures are un-inflated):

Novel commercial agreement	**£211k**
Initial background - evaluation of initial trial	**£24k**
Customer engagement	**£194k**
Integration of the Technology with charging points	**£357k**
Establishment of Customer / Cluster trials	**£5,545k**
Monitoring the trials	**£122k**
Trial participant interviews	**£177k**
Network Modelling	**£199k**
Independent Project Evaluation	**£150k**
Consultation with EV manufacturers - cycle times	**£30k**
Project recommendations and implementation	**£264k**
Dissemination	**£322k**
Programme Management	**£848k**
Project Contingency	**£395k**

The calculation methods for the benefits are given in sections 3 and 4.

The costs overview is in Appendix A2; all prices are expressed in 2012 real terms. Please see full cost spreadsheet delivered as part of the full bid submission for further information and detailed costing. For the avoidance of doubt, all costs in the cost spreadsheet are provided in nominal terms.

EA Technology has requested a contingency of £400k (nominal terms) against the funding request of £4.137m. This equates to 9.7% of the LCNF request. The scale of this contingency request is a function of the size of EA Technology. In FY12 EA Technology's revenue was £22m (a record for the organisation since being employee-owned in 2004), so this scale of project and level of risk involved is significant against the size of the organisation. The contingency has been developed bottom-up against each of the identified risks, as shown in Appendix H, and will be managed as part of the project governance as the project is deployed.

Clearly, there is an intention that contingency funds will not be needed - any unspent monies would be provided back to customers at the end of the project. The exact nature of this financial transaction will need to be agreed as part of the commercial discussions under Stage 0.

To ensure value for money, funds to install and monitor clusters will only be released once a cluster is signed up. There is an 18 month window for agreeing the establishment of a cluster after which the unallocated funds will be withdrawn. The amount that could be returned will be a proportion of a work-stream 4.5, 4.6,4.7,4.8,5.1 5.3 and 11.1. The proportion will depend on the number of clusters established, their type and locations. The maximum amount of LCN funding if no clusters were established would be approximately £1.75 million, (up to 40% of total requested funding).

6: Project readiness contd.

6.3 Measures to minimise possibility of cost overruns or shortfalls in direct benefits

The following are used to minimise cost over runs:

Project management

Project management will utilise a monthly report to maintain progress against time and budget, identifying problems for each party as early as possible, detailing tasks where appropriate in relation to:

- Schedule
- Budget
- Milestones achieved
- Activities in the next month
- Risks / issues / mitigation / contingency
- Lessons learned
- Actions required of others

The reports will allow a comparison of spend against budget, identification of any problems or risks anticipated in next few months and mitigating actions. This will aim to identify any areas that are likely to go over budget and allow time to take mitigating action. The Gantt chart will be updated each month to track progress and a monthly project team meeting will be held face to face or by phone. This will aid identifying any short fall in resources as soon as possible. Formal meetings with SSEPD management will be held on a six monthly basis.

The breakpoints in the project plan will minimise unnecessary expenditure as the project can be reduced in scope or halted.

EA Technology will allocate a project manager and project director. If problems cannot be solved on a day to day basis they will be escalated accordingly.

There will be one I^2EV programme manager at EA Technology to coordinate different parties involved. This will:

- Prevent duplication of work
- Help coordinate tasks
- Identify factors in different tasks that together may cause budget overspend and take mitigating action

An EA Technology resource will be located part-time at SSEPD's Reading office. This will provide a direct link between the two contracting parties and facilitate project delivery, as well as acting as a link for the trial programme and SSEPD commitment around practical delivery e.g. installation of monitoring equipment at substations.

An initial project risk register (Appendix H) has been prepared, and this will be maintained following bid submission. Risk mitigation has been agreed with SSEPD. The responsibility of the safe running of the distribution network resides with SSE but project risks are the responsibility of EA Technology. There is therefore an overlap between the two roles and a clear interface is needed.

To ensure that all risks due to the project are acceptable and well managed, for each action on the network EA Technology will:

- Provide the method statements from the contractor.
- List potential risks.
- List how the risks will be mitigated.
- Allocate contingency to risks and mitigation where appropriate.

SSE will:

- Confirm that the method statement is in accordance with their policies and procedures.
- Confirm that the contractor is authorised and/or supervised as appropriate
- That the risk and mitigation is acceptable.
- They give permission for the work to be carried out.
- They take on the residual risk.

This will be signed off by Stewart Reid, Future Networks and Policy.

The project does not envisage any direct benefits to the DNO, in that the clusters will be artificially created; the project is not targeting any areas of the network previously requiring reinforcement.

6: Project readiness contd.

6.4 Verification of all information in the proposal

The information in this proposal has been developed in conjunction with all project partners and has been subject to checks and analysis to ensure its validity. Contact details for all project partners and suppliers to the project are in Appendix E - project partner register and project supplier register tables.

Project partner profiles are in Appendix I.

On-site proving trial of the Technology in advance of I²EV project commencement

Carrying out an initial, small-scale trial before the start of the Tier 2 project will help streamline installation, allowing any problems with the technology to be solved. Using a PLC system that has already been trialled on SSEPD's network and has demonstrated its performance and practicality for use on the UK LV system reduces the risk of delays from problems with the PLC. The company providing the PLC has also already demonstrated their good service and proactive attitude to solving any issues.

Verification

Costs

SEPD and Northern Powergrid's costs

The costs to SEPD and Northern Powergrid were estimated by SSE and EA Technology by breaking down their role in the project, days and personnel required. DNO involvement is lower than previous projects given EA Technology's lead role.

SSEC's costs

Installation of the equipment in substations must be carried out by authorised staff. SSEC were asked to quote for a `unit price' per substation as an estimate (as the locations are unknown and costs could vary). This was multiplied by 20 (the maximum number of clusters).

Modelling and evaluation contracts

The modelling and evaluation tasks were out to competitive tender. The invitation to tender for the socio-economic tasks was sent to:

[List of parties removed for confidential version.]

The invitation to tender for the network modelling tasks was sent to:

[List of parties removed for confidential version.]

The tenders were or will be marked by three members of staff against ability to meet the brief, experience and cost. De Montfort University won the tender for social-economic tasks and the University of Manchester won the network modelling. The independent evaluation invitation to tender will be offered again in October.

In kind Contributions

The costs to Fleet-drive, Charge your Car and Nissan were estimated by the respective companies.
- Fleetdrive Electric provided a breakdown of costs and their in-kind contribution.
- Nissan provided confirmation of subsidised vehicle hire and staff to promote the project.
- Charge your Car provided confirmation of the costs they would incur and those available in kind.

Subcontractors' costs

The activities for other partners were discussed and either day rates or quotes received from:
- Automotive Comms.
- ANDTR.
- Blah d Blah.
- SSEC (for network installations).

6: Project readiness contd.

EA Technology Costs

These were divided into three categories:

1. Consulting: Technical analysis and management. Consulting costs are based on day rates from experience of the time required for tasks and include travel and accommodation. Internal governance administration will be provided in kind.
2. Project management: Overall coordination. Project management costs are based on experience of other large projects and LCNF.
3. Technology development: Development of the solution. EA Technology will provide the technology development costs in kind, this includes also some of the publicity costs.

Capital costs

Charge Your Car, Nissan, ANDTr and Fleetdrive provided information on the costs of charging points, leasing and installation.
Costs for monitoring and downloading data were estimated by EA Technology from experience on other projects.

Other Data

Data on the growth of the use of electric vehicles is based on the latest data from work within the Smart Grids Forum, Technology Strategy Board, Government's Carbon Plan and OLEV's Plug-In Vehicle Infrastructure Strategy. Technical information on charging points and electric vehicles were provided by the manufacturers.

6.5 How project would still deliver learning if take-up in trial area of low carbon technologies lower than anticipated

The Project plan demonstrates EA Technology's understanding of the magnitude of challenge in engaging with participants to use EVs as part of the I²EV trial; learning has been taken from the Customer-Led Network Revolution LCN Fund Tier 2 project, which has found customer engagement in trials to be a major challenge. In recognition of this learning, the I²EV project trials are broken down into two groups:

1. Social trials: Monitoring existing EV users and new EV users

2. Technical trials: Trialling the Technology with clusters of EV charging points

This approach will de-risk the project by limiting the cost to the customer and ensuring that the appetite for technical trial participation exists in the number and density of clusters needed to deliver a successful technical trial. Running concurrently with the technical trial will be the social trial programme, with the activity and learning, which is irrespective of take-up in technical trial areas (i.e. clusters):

- Evaluation of the initial on-site trial of the Technology by a University to improve the Technology and approach. This will identify any improvements or additions in the logic developed to date for the Technology equipment to enhance the design. This may be additional monitoring capability, means to change control parameters or user interface in terms of lights or other means to indicate availability for charging. It will also investigate the most flexible and practical CTs for monitoring and means to inject PLC signals to reduce interruptions to customers and installation time. The University will also carry out a literature survey of the estimates of the additional load that EVs will cause and the potential for load shifting. They will also survey work with respect to the additional load from heat pumps and potential for shifting heating load.
- A literature survey of existing knowledge of customer behaviour with regard to use of EV and acceptance of direct control of appliances will be carried out. This will highlight gaps in the knowledge and likely response and the best way to approach customers.
- Analysis of the data collected from the social trials including driving habits compared to location and demographics. This will be compared with data from the literature survey.

6: Project readiness contd.

6.6 Processes in place to identify circumstances where the most appropriate course of action will be to suspend the project, pending permission from Ofgem that it can be halted

As well as the stage gate release of funds for clusters, breakpoints will be key times when the viability of the project will be reviewed and if necessary, the scope can be reduced or the project closed. The project plan is in Appendix G.

Risk identification will be the responsibility of all partners to the project. Changes and additional risks will be managed by the project manager and reviewed on a monthly basis. Should any risk materialise and be insurmountable or become too great, then the project will be reviewed and possibly closed.

Project Code/Version No SSET205

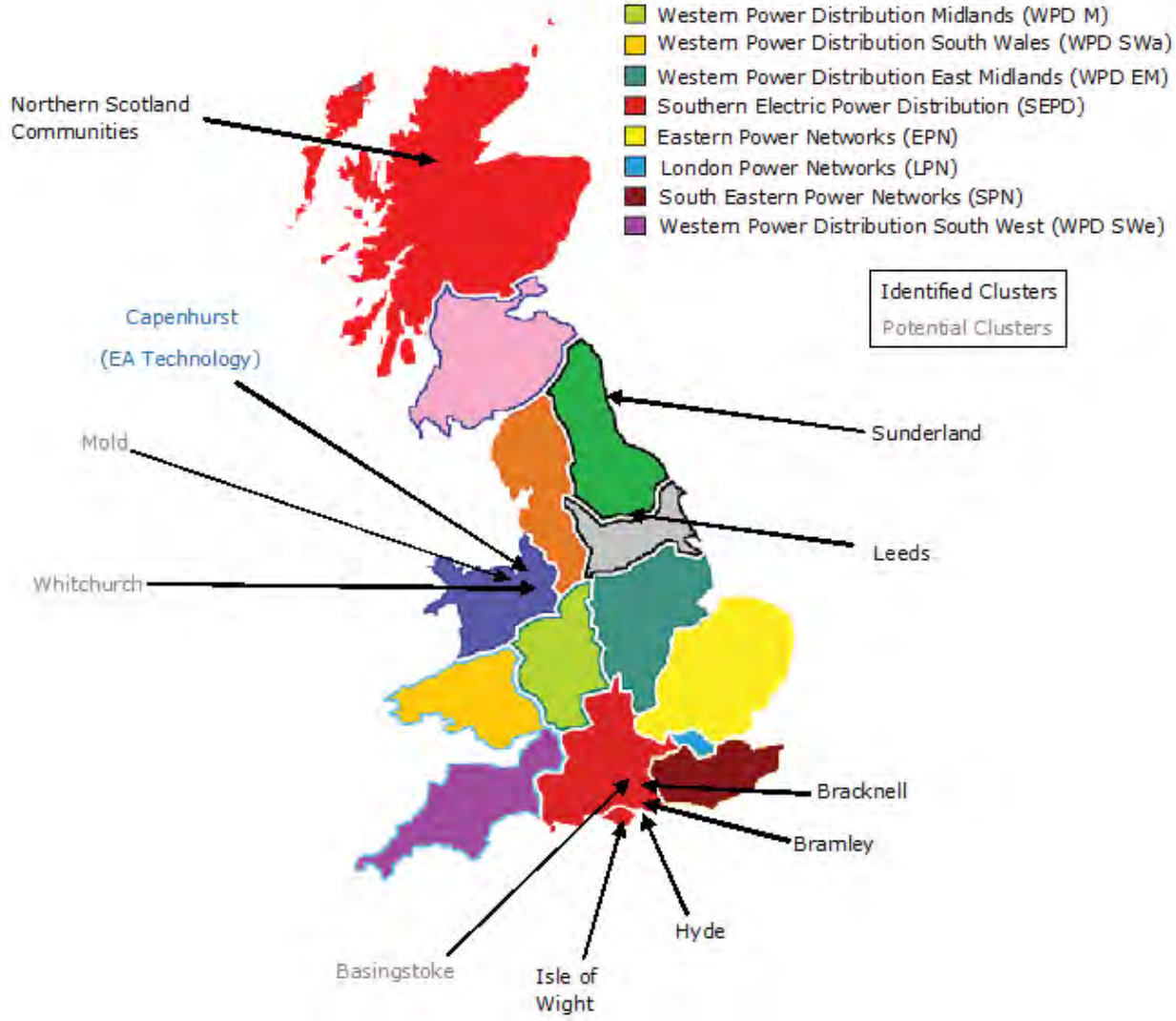
6: Project readiness contd.

6: Project readiness images

I²EV Partners

I²EV Suppliers

DNO Map Detailing Identified and Potential Cluster Trial Locations



Project readiness Images

Section 7: Regulatory issues

☐ Put a cross in the box if the Project may require any derogations, consents or changes to the regulatory arrangements.

The project will provide the DNO direct control over an element of the customer's supply, limiting a circuit under certain circumstances. This is different to most previous load control methods as the control does not go through a third party of a supplier or aggregator who has a contract with the customer. It should be noted that the ability to limit the supply only applies to the significant load on a separate circuit, specific to the trials of EVs, and does not apply to the rest of the household supply. The supply is not de-energised.

Currently, the only direct control of appliances is switching storage heaters by Teleswitching Agreement. This is controlled by the suppliers and operated by DNOs on their behalf. However, SSE does control teleswitching to maintain the power system and has initiated load management areas in locations where changing switching times could overload the network. (Southern Electric Power Distribution PLC, Miscellaneous Charging Services Statement, Effective from April 2012 http://www.ssepd.co.uk/uploadedFiles/Controls/Lists/Resources/SEPD_2012_-_2013_Charging_statements/SEPD_MiscellaneousServicesStatementApril2012.pdf). This is a precedent for SSE developing direct control of Electric Vehicles charging points to maintain the power system.

The two contractual agreements that may be affected by the DNO having direct control is the Distribution Connection and Use of System Agreement (DCUSA) and the Distribution Code.

The DCUSA states that a supply must be informed of any change or variation from the standard Connection Terms that will affect use of system charges, but direct control will not affect these charges (page 121).

On p121 in the DCUSA, there is an obligation on the DNO to convey electricity to each Exit point subject to agreements made by the connectees and the DNO. Therefore non-standard arrangements are allowable.

Within DCUSA the National Connection terms on p264 states that:

"Network constraints. Our obligations [the DNO] under this agreement are subject to the maximum capacity and any other design feature of the connection. You must contact us in advance if you propose to make any significant change to the connection or to the electric lines or electrical equipment at the premises, or if you propose to do anything else that could affect our network or if you require alterations to the connection."

Installation of an Electric Vehicle charger that is capable of delivering 7-9kW of power could be regarded as a significant change. This is also stipulated in DPC 5.2.1 on page 49 of the distribution code:

"Where required by the DNO in order to ensure control of the DNO's Distribution System, communications between Users and the DNO shall be established in accordance with the following. Users shall provide and maintain those parts of the communications equipment within their location. Provision of any necessary communications requirements shall be in accordance with the Connection Agreement for a specific connection."

DCUSA also makes provision (on p266) to agree other connection terms:

"Agreeing other connection terms. You and we may each, at any time, ask the other to enter into an alternative connection agreement in respect of the connection if you or we believe an alternative agreement is needed because of the nature of the connection."

On page 371, DCUSA provides the right of DNOs to designate Load Management Areas to control the switching of loads to prevent coincident switching over loading the network. However, it is unclear whether the switching must be carried out by the suppliers.

DPC 5.3.2 provides for the DNO to agree methods to minimise the impact of disturbing loads. An EV charger could be regarded as a disturbing load.

DPC 6.7.1 provides for communications to be established between the customer and the DNO where it is required for the control of the network and included in a connection agreement.

DPC 6.7.4 stipulates that the communications required within the customer's premises should be maintained by the customer. In the Technology's case, the maintenance is minimal.

7: Regulatory issues contd.

Conclusion

It would be appropriate to agree a temporary change to the connection agreement with the customer to cover the direct control of the EV charger. This does not require a derogation from the regulations.

7: Regulatory issues images, charts and tables

Regulatory issues images

Regulatory issues images

Section 8: Customer impacts

Customer awareness and understanding

Paul Clarke (Automotive Comms) will direct the communication and customer engagement aspects of this project. Paul has managed a communication consultancy for over 20 years specialising in the area of LCTs and is working with Camden Council on trialling EVs. In 2006 he founded the UK's original green car news website, Green-Car-Guide.com, and remains the editor. He also has a wide range of contacts and networks in the industry including all the major motor manufacturers; public sector bodies such as the Automotive Council, Cenex, EST (Energy Savings Trust), LowCVP (Low Carbon Vehicle Partnership), OLEV (Office for Low-Emission Vehicles), SMMT (Society for Motor Manufacturers and Traders); and other media. He thus has the expertise and contacts to communicate information, raise awareness and explain why the information gathered is required.

To ensure the widest demographic mix possible, the following channels/organizations will be used/ approached to help develop clusters:

- Mainstream media and Social media.
- Specialist EV media and forums.
- Charge Your Car initiatives.
- EV charging point companies.
- LAs (Local Authorities) that are highly motivated to encourage EVs.
- Green residential developments & cohousing, gated communities.
- Green newsletters, Low Carbon Communities Network.
- Informal contacts.
- Ambassadors via fleet EVs who may enlist neighbours.

8.1 Customers impacts in a learning outcome context

The learning outcomes to be delivered by the project are shown in Appendix C:

Commercial

Learning outcome C1: To what extent does a DNO enabling a third party delivery of innovation accelerate deployment?

The project will demonstrate the extent to which third party delivery of innovation projects could be more efficient than the projects being merely led by the host DNO. The savings will be via:

- Using the expertise in third party project management to tightly manage time and budget preventing project delays.
- Experience to date shows that DNOs are expert in project managing the maintenance and installation of assets but do not have a large pool of expertise in trialling and evaluating new technologies.
- Rather than seek to recruit new staff for this role, which is a time consuming process, the project seeks to demonstrate that third party management is more effective, as relevant knowledge and expertise is already utilised as part of business as usual activities.

By using a third party innovation provider rather than outsourcing task elements, it ensures that a company with a proven track-record for delivering effective, innovative projects is in overall control, improving efficiencies throughout the project.

Technical

Learning outcome T1: To what extent can DNO direct demand control facilitate the connection of low carbon technology?

Long term sustainability of the electricity network to the benefit of all customers, again regardless of EV or other low carbon technology (LCT) ownership, will be the result of successful trialling of the Technology, which will demonstrate how a DNO can use direct demand control to connect any LCT thus removing potential blockers to their uptake.

The learning outcomes are linked to the Successful Delivery Reward Criteria (SDRC) in section 9. The SDRC register and illustration of how they are mapped to the learning outcomes is in Appendix D.

8: Customer impacts contd.

Expedient delivery of the innovative technology to be trialled under I²EV, if successful, will future proof local distribution networks. Lights will stay on, household electrical appliances will continue to operate even at peak times of EV charging. This is a potentially beneficial customer impact of the Technology that is applicable to all electricity users, not just those that drive EVs.

8.2 Monitoring Existing EV owners (the social trials)

Monitoring the behaviour of existing EV owners: via Nissan and Charge Your Car and other bodies promoting EVs (e.g. local authorities), existing EV owners will be approached to see if they are willing to have their EV use and charging habits recorded. A brief explanation of the project and how the data will be used and its benefits will be provided.

Much of the information may be available via the charging units and permission to use the data is all that is required. In other cases a power monitor and GSM communications will be required. Customers will have to allow entry and installation to take place. However, this work will be inside the customers' premises and not on the DNO's network. This may require a brief disconnection of the circuit feeding the EV charger. Customers will also be asked to record their journey times and lengths and some socio-economic data on an anonymous basis.

The tariffs and contractual arrangements for supply of electricity with the customer will remain the same. Apart from some minor intrusion, the only other impact for the customer will be visibility of their charging habits. They may be able to identify a better tariff for their electricity use as a result. Much of this data will be made available through the Nissan employee LEAF hire scheme, managed by Charge Your Car.

Monitoring the behaviour of new EV users. Via Nissan and Fleetdrive Electric, fleet hire users will be approached through the New Thames Valley Consumer Consortium.

Customers who do not use an EV will benefit from additional knowledge about LV networks and avoidance of reinforcement costs. It will also prevent EV charging potential absorbing all the available headroom providing DNOs more flexibility in serving all their customers. Indirect benefits will be improved air quality and reduced carbon emission and traffic noise.

The regulation of the distribution industry uses a 'socialised cost' model in that customers are already required to cover the cost of supplying additional load (unless it is a `disturbing load'), The commercial and technical solution proposed should provide the lowest cost approach to managing the supply of additional load.

8.3 Clusters of EV Charging Points (the technical trials)

The project will recruit about 150 customers to lease an EV for 12-18 months. These will be approached via EV manufacturers (Nissan), Fleetdrive Electric and Charge your Car in collaboration with EA Technology. A full explanation of the project and how the data will be used and its benefits will be provided. Nissan will provide the use of their EV ambassadors to support recruitment and to run evening community engagement sessions, where a Nissan LEAF (EV) will be available to test-drive.

Routes to customer engagement are illustrated on page 48, as proposed under Fleetdrive Electric's plans to engage customers for the project trial programme. The lease will be at subsidised cost and the charger installed will be removed at the end of the trial if required by the customer. There will be car parking space provided for other vehicles owned by the customers during the trial if necessary. Customers will be asked to fill in surveys during the trial.

An explanation of the contract for the car, costs and what is expected in terms of monitoring and feedback will be provided.

The tariffs and contractual arrangements for supply of electricity with the customer will remain the same. There should be no impact on the availability of the EVs for the customers however if the trial is not successful, customers will still have previous transport options available to them.

8: Customer impacts contd.

To install the EV charger, there is likely to be a short interruption to the supply to the customer's premises as would be expected during a standard installation. It is expected that the PLC monitor control can be installed live, using approved live working procedures. However, the local population will be given notice of a brief interruption of supply, one interruption per substation, in accordance with the regulations.

The Technology will only switch off the circuit supplying the EV charger (that will not be supplying other loads). The supply to the existing loads will be unaffected by the Technology. The only load that is controlled is the EV that is provided on a conditional basis.

A key aspect to the trial will ensure that the chargers can be cycled on and off without causing large voltage step changes or flicker.

Should heat pumps be used it is expected that the level of interruptions would be very similar during installation. It is assumed that the heat pump is connected to a dedicated circuit within the premises.

It is anticipated that protection is required from the Interruption Incentive Scheme for a maximum of 10 brief interruptions.

8.4 Impacts to Customers resulting from the Trial

Non-Participating Customers on the Feeder

It is the ultimate intention of the trial that there will be no disruption to non-trial participating customers as part of the installation of the solution; in order to achieve this different techniques will be assessed for installation, though recognising that tailoring will be required to suit different applications (e.g.. pole-mounted substations/ground mounted open LV boards/ground mounted closed LV boards).

With respect to the PLC controller to be installed in the affected substations, whilst we have demonstrated in previous PLC projects that it is possible to install the necessary equipment without requiring an outage to customers e.g. b breeching onto a live cable using live-working techniques), it cannot be guaranteed that every potential site will be suitable for such an installation method without a survey of the substation in question.

As such, whilst currently there are no planned interruptions for any customers not having equipment installed, confirmation of necessary outages, (if all available live-working methods are unsuitable for use) at each location will have to be determined on a case-by-case basis, as cluster locations are identified.

Customers Participating in the Trials

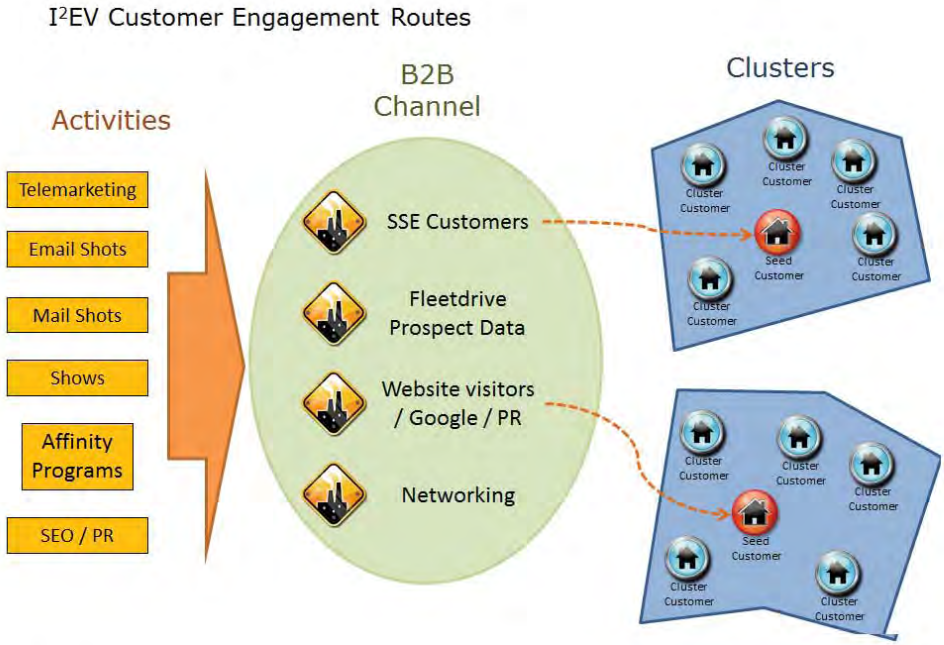
There will be a minor interruption of service required for customers having a charge-point installed in order to allow connection into their property's consumer unit. Due to the fact that EVs are not yet in widespread use, an average installation time that holds a high degree of certainty cannot be ascertained as EV charge-points are yet to be installed at a wide range of property types and ages.

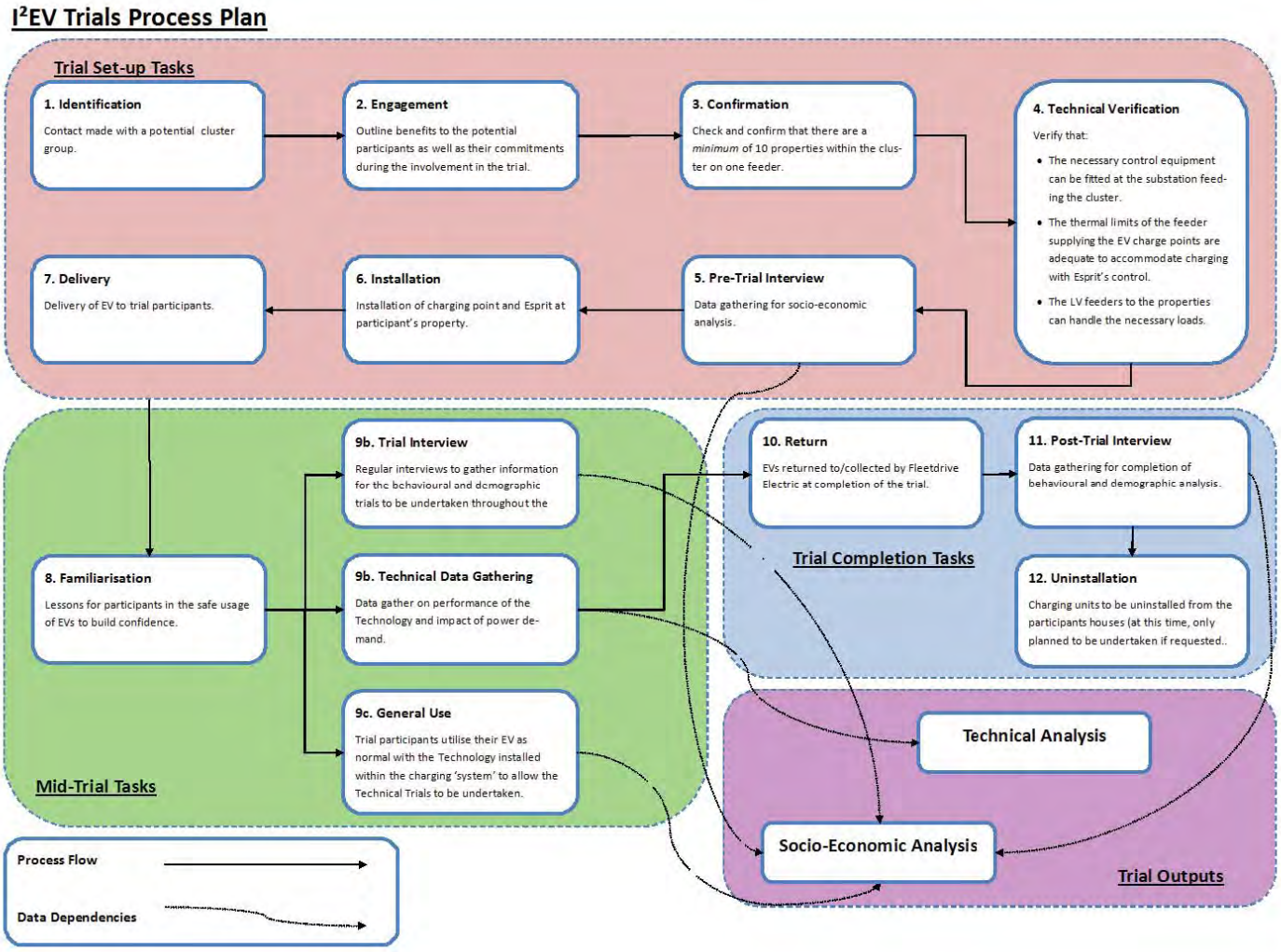
Based on previous experiences held by EATL and project partners, it is not expected that during the course of installing a customer's charge-point, that the power should be interrupted for more than 2 hours. In the majority of cases, the interruption is likely to be less than an hour.

For the avoidance of doubt, during the installation of a customer's charge-point, the interruption only applies to the customer and not all other properties connected to the same feeder.

8: Customer impacts contd.

8: Customer impacts images, charts and tables





Customer Impacts images

Section 9: Succesful Delivery Reward Criteria

Criterion (9.1)

Focus: Commercial
Document the learning from the experience of a third party leading a Tier 2 bid including suggestions for where the process could be more open or streamlined.
This will include: structure of the project, interaction with the DNO, establishment of project partners, project costing, bid development commitment (costs and time), IPR positions, risk sharing principles and Ofgem Expert Panel / Consultant process.

Related learning:
Learning outcome C1.2.1 - what learning has come out of the bid process?
Related Task: 0 - Novel commercial agreement
Related commercial aims: Under 2.2 the commercial aims are to:
- Demonstrate delivery of a low carbon network project by a non-DNO on behalf of a DNO (see 'commercial innovation delivery framework' on page 10)

Evidence (9.1)

9.1.1 The provision of a report outlining key areas of learning in the identified areas, with recommendations. The reports will be written such that they can be published in the public domain for an audience of: DNOs, Ofgem or other interested third parties who may wish to lead a LCN Fund project in collaboration with a DNO.

Achieved by month 2.

Criterion (9.2)

Focus: Commercial
The blueprint of the contractual arrangements put in place with the DNO for a third party lead on a LCN Fund Tier 2 project.

Related learning:
Learning outcome C1.2.2 - what form are the contracts?
Learning outcome C1.2.3 - how are the risks managed with the DNO?
Learning outcome C1.2.4 - what form does the programme management take?
Related Task: 0 - Novel commercial agreement
Related commercial aims: Under 2.2 the commercial aims are to:
- Develop a novel commercial arrangement (see traditional and I^2EV models on page 17)
- Enable all procurement related to the project activity to be managed by a non-DNO

Evidence (9.2)

9.2.1 Make available the initial contract template used between SEPD and EA Technology together with supporting guidance of the thinking behind key clauses. This will be made available to Ofgem and other DNOs as a starting point for use in future projects **(available by end of month 4).**

9.2.2 Review of the contract put in place between SEPD and EA Technology. A review of the initial contract developed in 9.2.1 focussing on what worked well, what didn't work well, and what should be done differently in the future **(month 34).**

9.2.3 An updated contract template taking into account learning from 9.2.2 **(month 36).**

9: Succesful delivery reward criteria contd.

Criterion (9.3)

Focus: Commercial
An assessment, based on direct experience, of how a third party can effectively manage delivery on innovative projects with a DNO, and whether this allows DNOs to take on more innovation projects.

Related learning:
Learning outcome C1.1.1 - what is the management and interface process with the DNO?
Learning outcome C1.1.2 - how is 'buy-in' and engagement achieved within a DNO?
Learning outcome C1.1.4 - how does learning become business as usual when project is non-DNO led?
Learning outcome C1.3.1 - how is expedient deployment achieved - benefits/other over DNO-led approach?
Related Task: 0 - Novel commercial agreement
Related commercial aims: Under 2.2 the commercial aims are to:
- Demonstrate delivery of a low carbon network project by a non-DNO on behalf of a DNO (see 'commercial innovation delivery framework' on page 10).

Evidence (9.3)

9.3.1 Report detailing processes established and utilised throughout the project including templates of any forms (e.g. work orders for SSEC staff) and records of meetings/regular communications created as part of the process. This will include an evaluation of the collaboration between SSEPD and Northern Powergrid with a 3rd party interface.

9.3.2 A framework to enable update suggestions to SSE policies and/or procedures, identified during the course of the project will be provided, (e.g. A procedure detailing the necessary steps when considering a customer's request for an EV charging point).

9.3.3 An assessment from the participating DNO of the level of effort expended on Project Management of the I²EV task by the staff involved in comparison to previous innovation projects.

Achieved by month 34.

Criterion (9.4)

Focus: Commercial
An assessment of how the DNO and other interested parties can ensure independent validation of a third party's Solution throughout a project, and upon completion.

Related learning:
Learning outcome C1.3.2 - how are the project and results validated?
Related Task: 9 - Project recommendations and implementation
Related commercial aims: Under 2.2 the commercial aims are to:
- Demonstrate delivery of a low carbon network project by a non-DNO on behalf of a DNO (see 'commercial innovation delivery framework' on page 10)

Evidence (9.4)

9.4.1 The provision of 6 monthly independent reviews of the project and technology with specific inclusion of improvements and adaptations to working practices incorporated by the project team following the previous independent review.

(a) Produce 6 monthly report (highlighting strengths and improvement areas) to be tabled at steering group meetings.
(b) Produce response to 6 monthly report, detailing improvements planned by Project Steering Group, as a result of the review.

Achieved by months 7, 13, 19, 25, 31, and 36.

9: Succesful delivery reward criteria contd.

Criterion (9.5)

Focus: Technical
Sign up and involvement of sufficient customers in the trial to adequately test the Technology.
This trial is attempting to simulate a future network where large numbers of high loads, such as EVs, are connected (clustered) in close proximity to one another. Getting enough customers on board in the trial to emulate this is therefore key to test the technical Solution.
Related learning:
Learning outcome T1 - To what extent can DNO direct demand control facilitate the connection of low carbon technology?
Related Tasks: Task 4 - Establishment of customer / cluster trials; Task 5 - Monitoring the trials
Related Technical aims: Under 2.2 the technical aims are to:
- Learn customer driving and charging habits and the implications for control via the Technology; - Evaluate the range of networks where it can operate successfully and identify any type of networks that are inappropriate.

Evidence (9.5)

9.5.1 **Technology trials:** Establishment of the cluster groups to trial the Solution
- Sign up of 3 cluster groups (**month 9**)
- Sign up of 5 cluster groups (**month 12**)
- Sign up of 10 cluster groups (**month 18**)

9.5.2 All cluster funding allocated due to successful establishment of clusters **(month 18)**

9.5.3 **Social trials:** Minimum of 100 EV drivers signed up to have their driving habits recorded **(month 18)**.
(a) Reports presented to the monthly project meetings to capture and log progress in signing up customers to the EV trials
(b) Six monthly reports to steering group on trial engagement progress

Criterion (9.6)

Focus: Technical
An assessment of the public acceptance (or otherwise) to Demand Side Response of EVs (or HPs as defined in 9.5) using this sort of technology.

Related learning:
T.1.1.1 - how does a trial encourage the uptake of low carbon technology?
T.1.1.2 - what social factors have an impact on the use of the Technology?
T.1.1.3 - how can a trial be used to educate customers about the electricity network and low carbon technologies?
Related Task: 6 - Trial participant interviews
Related Technical aims: Under 2.2 the technical aims are to:
- Learn customer driving and charging habits and the implications for control via the Technology.

Evidence (9.6)

9.6.1 A report documenting the finding from the socio-economic analysis on public reaction to the technology.

Achieved by month 34.

9: Succesful delivery reward criteria contd.

Criterion (9.7)

Focus: Technical
An assessment of the most appropriate integration of the Technology for different applications and suitable cycling times or reasons why this is not possible if the trials are not successful.

Related learning:
Learning outcome C1.1.3 - what is the interface and management process for other manufacturers?
T.1.1.2 - will customers accept direct control and under what circumstances?
T.1.2.4 - how do the needs of EV charging (or other loads) affect the settings?
Related Task: 3 - Integration of the Technology with charging points
Related Technical aims: Under 2.2 the technical aims are to:
- Develop and trial the equipment to ascertain its ease of installation. - Develop the integration of the Technology into the EV charging points including how existing intelligence and attributes in charging points can be harnessed to reduce the cost and improve the performance.

Evidence (9.7)

9.7.1 Documentation describing:
(a) Views of the OEM community of the impact (if any) that cycling of EVs (or HPs) may have on their product(s) and end of life
(b) Recommendations of suitable cycle times for EVs (and possibly Heat Pumps) for demand-side response
(c) Evidence of whether this solution would be feasible or not combining learning from 9.5, 9.6.

Achieved by month 30.

Criterion (9.8)

Focus: Technical
An assessment of how much headroom this sort of technical solution would yield, considering different network topologies and load types.
Related learning:
T1.2.1 - how much headroom is released?
T1.2.2 - how close to thermal rating should load be before deployment?
T1.2.3 - on what type of networks can the technology be used?
T1.2.4 - how do the needs of the EV charging (or other loads) affect the settings?
Related tasks: 5 - Monitoring the trials
Related Technical aims: Under 2.2 the technical aims are to: - Evaluate how often switch off routines are likely to be initiated from real life trials and extrapolation via modelling using the results; - From the results and extrapolation via modelling, estimate the typical and maximum thermal capacity gained.

Evidence (9.8)

9.8.1 Modelling to understand additional headroom available / other network benefits from using the Technology. (a) The models will assess the % of thermal and voltage headroom estimates produced.).
(b) The project will deliver an updated Solution template(s) specific to the Technology, and any updated EV charging profiles for use in the GB Smart Grid Forum modelling (e.g. WS3 model http://www.ofgem.gov.uk/Networks/SGF/Publications/Documents1/WS3%20Ph2%20Solution%20Annex%20V1.0.pdf).

9.6.2 Potential cost savings and carbon emission savings using DECC published carbon intensity figures. If technology is unsuccessful, reasons why will be stated.

Achieved by month 35.

Section 10: List of Appendices

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Separate Attachment
Detailed Costs Breakdown

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Costs Overview

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Trial Activity Summary

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I²EV Project Learning Outcomes

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Project Code/Version No SSET205

Low Carbon Networks Fund
Full Submission Pro-forma

Section 1: Project Summary

1.1 Project title

I²EV - Innovation-squared: managing unconstrained EV connections **NON-CONFIDENTIAL VERSION**

1.2 Funding DNO

Southern Electric Power Distribution

1.3 Project Summary

The I²EV project has been conceived by, and will be managed by, a non-DNO to deliver a low carbon solution to benefit customers and the network, creating a blueprint for the interaction of DNOs and third parties. The full bid content is endorsed by SSEPD, the project's participant DNO, but is written, developed and fronted by EA Technology. The project will deliver essential learning on managing the strain on the distribution network from anticipated increased uptake of electric vehicles (EVs). I²EV will deliver essential learning and a cost effective solution to DNOs, that reduces network reinforcement need, demonstrates a new project delivery framework by a third party project lead and will support EV market growth.

Innovation 1 (commercial): Novel commercial arrangement I²EV will be delivered by a third party innovation technology provider on a risk and reward basis, with the arrangement ensuring that the DNO meets the requirements of the LCN Fund and other obligations.

Innovation 2 (technical): New Technology trials EA Technology has independently developed a novel monitoring and control solution, 'Esprit' ('the Technology') to manage the supply of electricity to EVs connected to distribution networks. The Technology will be trialled on a range of real networks, with real customers and EVs.

1.4 Funding

Second Tier Funding request (£k)	4,175		
DNO extra contribution (k)	0	**External Funding (£k)**	4,908

1.5 List of Project Partners, External Funders and Project Supporters

Project partners: EA Technology: Third party technology innovation provider and I²EV project manager. Nissan: EV and EV charger manufacturer; supplier of EVs for project trials. Fleetdrive Electric: EV lease hire company. De Montfort University: Socio-economic modelling. Northern Powergrid: link with CLNR project. Charge Your Car: EV infrastructure support. Automotive Comms: EV specialist communications.
External funders: In-kind: Nissan, Northern Powergrid, Fleetdrive Electric, EA Technology, Charge Your Car. **Project supporters:** Bracknell Forest Council, Hyde District Climate Change Forum. Academic partners to be appointed September 2012 for independent project/solution verification and project evaluation.

1.6 Timescale

Project Start Date	7 January 2013	**Project End Date**	31 December 2015

1.7 Project Manager contact details

Contact name & Job title

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Section 2: Project Description

The I²EV project will be developed, project managed and delivered by EA Technology as a turnkey innovation technology provider. Focusing on one technical problem and one technical solution, the project will demonstrate how a non-network company can, through a novel commercial arrangement with a supporting DNO, access the LCNF Fund to deliver a low carbon solution.

2.1 Aims and objectives

1 Commercial

Problem: Ofgem has been looking at ways to open up innovation mechanisms to third parties under the RIIO (Revenue = Incentives + Innovation + Outputs) framework, as a potential vehicle to accelerate technology development and adoption. A key challenge in doing so is ensuring that that trials and risks are managed on real networks with real customers, and that knowledge is transferred to the DNO to secure buy-in and engagement to the project and its outputs. This project will demonstrate how non-DNOs can lead projects in a structured contractual framework to ensure development of adoptable solutions from third party providers, by developing a commercial structure for rapid solution deployment by a third party delivery body.
Solution to Problem: In order to provide access to the network, a blueprint commercial and operational framework will be developed between a DNO (SSEPD) and a non-network company (EA Technology). The blueprint will address issues and risks to both the DNO and third party delivery body while ensuring compliance with the relevant regulatory and LCNF governance requirements and obligations.
Method: Lead project management by non-DNO innovation technology provider: EA Technology will assume absolute responsibility for project management of I²EV, from project inception to delivery. The field trials will be designed by the third party, who will then work in partnership with SSEPD to conduct the field trials. Where possible the installation and commissioning of the Technology on electricity networks will be subcontracted to third parties.
Summary: LCN funding under Tier 2 is required to develop a blueprint commercial and operational framework for use between DNO and third party innovation technology provider development and roll-out to all GB DNOs. The development of this lies outside SSEPD's usual course of business and is timely given the projected launch of Network Innovation Competition funding in 2015.

2 Technical

Problem: Increased stresses on the network - overload due to market growth of EVs: by 2023, 1-3 million EVs are forecast to be on UK roads, 23 million by 2050 (Smart Grids Forum Work Stream 3). Peak energy demand from charging EVs could increase by 36%, resulting in 'a profound impact on the utilisation of generation and network capacity in the electricity system' (Advanced Smart Metering report, Imperial College/ENA, March 2010). Even at lower end forecasts, without the optimisation of demand side technology, this analysis indicates that this GB market growth is set to lead to local overloading of distribution networks. The I²EV project will provide DNOs with a cost effective intervention that avoids network reinforcement while at the same time supports the growth of EVs. Potential cost savings in terms of reducing stresses on the network due to EVs range are around £2 billion by 2030 (see section 4's calculation of net benefits for details). SSEPD has worked with EA Technology to select a project that addresses a single pertinent technical problem with a single technical solution - allowing focus on the structure as well as the technical aspects of the project. The I²EV project will be led by EA Technology who will be contracted by SSEPD to deliver the I²EV project from project start-up, through management and delivery.
Solution to Problem: The I²EV project facilitates the expedient connection of EV chargers to the DNO LV network as it avoids the possibility of the DNO becoming a barrier to multiple EV connections along a particular LV feeder. If successful, the solution will give GB DNOs a low cost, easy to implement, alternative to traditional network reinforcement when faced with networks overloading due to unconstrained connection of EV chargers. The Technology could also be used to control other major demand types, e.g. heat pumps.
Method: Modelling and trials of the Technology: Modelling and trials will aim to prove that the Technology works, with customer support, on a range of LV network types: cable, overhead line, mixed, heavily and lightly populated circuits. The technical aspects of the trials will consist of installing monitor-controllers (MC) at distribution substations, with active sockets (AS) installed in customer installations. The MC ensures that the load of all EV chargers does not take the load above the rating of the LV circuit. The initial proving trials will be conducted on cable LV networks that are located in the SSEPD area (Zero Carbon Homes, Chalvey) in September 2012. A key aspect to widespread deployment will be in understanding customers' attitude and behaviours to managed EV control; I²EV has enlisted the support of a social science academic partner. The trials will require the engagement of trial participants, both in 'clusters' (i.e. 10-25 people on one feeder).

2: Project Description cont.

The cluster trials, or 'technical trials' will aim to prove the Technology and mimic a 2030 network; these clusters will be in both residential situations (charging at home) and in business situations (fleet cars charging at work). The non-cluster 'social trial' EV users will be monitored for behavioural and socio-economic data, and will be largely fleet hire users (with the current exception of the North East Nissan employees under the LEAF hire scheme). Electricity customers lie at the heart of the I²EV project. The project will determine how best to manage a rapid uptake of EVs in given clusters, whilst developing a smart solution to make this a win-win solution for the community.

Summary: The Technology that forms the basis of the solution to the problem of increased stresses on the network (overload due to market growth of EVs) has not yet been released to the market. The solution is at the laboratory testing stage (TRL5), with plans to be ready for wide-scale in-situ testing on live networks (TRL7) by Q3-Q4 2012. Therefore the Technology will be beyond R&D stage at I²EV project commencement. I²EV will provide a large enough field trial to rigorously test the Technology on real LV networks, with real EVs and with real customers. LCN funding is required to undertake the trials and resultant GB-wide dissemination of results and learning to DNOs, which would not otherwise form part of SSEPD's usual course of business. The magnitude of the field trials required makes the project relevant to LCN Fund Second Tier funding. The Technology has not been trialled previously by SSEPD due to the nascent nature of EVs. The balance of risks makes it timely for the I²EV project to commence now given the projected acceleration of EV uptake and associated stresses on the existing network.

2.2 Technical description of the project

1 Commercial innovation

The commercial aims of the project are:

- To demonstrate delivery of a low carbon network project by a non-DNO on behalf of a DNO (see 'commercial innovation delivery framework' on page 10)
- To develop a novel commercial arrangement (see traditional and I²EV models on page 17)
- To enable all procurement related to the project activity to be managed by a non-DNO
- Evaluate the extent to which third party delivery accelerates deployment of low carbon network projects

The work is innovative as:

- It is delivered by a third party on behalf of a DNO
- It is project managed by a third party
- Will create a blueprint for future low carbon network projects to be delivered by a non-DNO

The commercial innovation is novel as it is the first project of its type under the Low Carbon Networks Fund.

2 Technical innovation

The technical aims of the project are:

- Learn customer driving and charging habits and the implications for control via the Technology.
- Develop and trial the equipment to ascertain its ease of installation.

Develop the integration of the Technology into the EV charging points including how existing intelligence and attributes in charging points can be harnessed to reduce the cost and improve the performance.

- Evaluate the range of networks where it can operate successfully and identify any type of networks that are inappropriate.
- Evaluate how often switch off routines are likely to be initiated from real life trials and extrapolation via modelling using the results.
- Evaluate the most appropriate length of time to switch off charging and how to cycle switches with references for battery management and customer preference and habits.
- From the results and extrapolation via modelling, estimate the typical and maximum thermal capacity gained.

The work is innovative as it:

- Is the first trial of equipment to directly control circuits within customers' premises using power line carrier (PLC) and without reference to a third party such as a supplier or aggregator.
- Takes into account customer behaviour, the needs of the network and the needs of battery management in developing a network control system.
- Integrates network control technology into a customer appliance (namely an EV charging point).
- Engages EV manufacturers to work with DNOs and those developing network control technology.
- It is a network trial led by a third party working with the DNO.
- Demonstrates the benefit of allow a DNO to directly limit or control elements of a customer's supply.
- Develop the principles of access to allow the management of multiple installations on one constrained network.

The trial design is from the perspective of both a technology developer and independent consultant. It aims to draw out the needs of a manufacturer, whilst ensuring technical rigour and trial validation satisfy the DNOs' requirements. See diagram on page 10 for an illustration of how the Technology works.

2: Project Description cont.

2.3 Description of design of trials

The tasks for the project are:

Task 0. Novel commercial agreement

Draft and agree a contract for a non-DNO entity to manage an LCNF Tier 2 project, including the obligations on each party and responsibility for different risks. This will detail the permissions and duties passed on or withheld by the DNO. At the end of the project the contract will be reviewed and improved if possible. This will be published for use by other DNOs.

Deliverables

i. Commercial agreement for the I2EV project
ii. Template for other LCNF projects led by a third party

Task 1. Initial background

Evaluation of the initial trial (November 2012) by the University of Manchester to improve the Technology and approach in the extensive trials planned. This will identify any improvements or additions in the logic developed to date for the Technology equipment to enhance the design. Other possibilities are additional monitoring capability, means to change control parameters or user interface in terms of lights or other means to indicate availability for charging. It will also investigate the most flexible and practical monitoring and means to inject communications signals to reduce interruptions to customers and installation time. The University of Manchester will also carry out a literature survey of the estimates of the additional load that EVs will cause and the potential for load shifting. De Montfort University will carry out a literature survey of existing knowledge of customer behaviour with regard to the use of EV and acceptance of direct control of appliances. This will highlight gaps in the knowledge and likely response and the best way to approach customers.

Deliverables

i. Assessment of the initial trial and recommendations on improvements to the design.
ii. Technical literature survey of load shifting potential of EVs and heat pumps.
iii. Social-economic literature survey of customer behaviour with EVS and acceptance of direct control of appliances.

Task 2. Customer engagement

Key to the success of the project is the engagement of trial participants and the sourcing of EVs for trial participants to use. Informal contacts have demonstrated enthusiasm to participate and communities in Hyde, New Forest and Leeds have written letters of support (see Appendix K). From the outset, and from learning derived from other LCNF projects, it has been recognised that the engagement of trial participants, not least those in clusters (i.e. on one feeder), presents a key challenge to the project. A list of potential clusters is given in Appendix B. The expertise of Paul Clarke (Automotive Comms) will be used to establish further clusters through a range of contacts (see Appendix E).

The project has also engaged Nissan Europe's EV Steering Committee. As a result, Nissan has brokered a deal with Fleetdrive Electric, an EV fleet hire company, to provide the project with 250 EVs at a subsidised monthly rental for each trial participant either for residential or business use. The Nissan offer is unique to the I^2EV project, and demonstrates Nissan's commitment to the UK being a priority for the EV market. This early work with Nissan and trial participants serve to de-risk the project, by addressing a major challenge - supply of EVs.

The project is further de-risked by working with SSEPD's New Thames Valley Vision's (NTVV) Consumer Consortium to identify EV fleet hire opportunities. There is a clear plan to engage Nissan with the Consortium and sign up major blue chip companies to the 'non-cluster' trial programme. This trial arm will provide valuable socio-economic data, together with data on charging habits, customer behaviour, charging times etc. To further de-risk the project, I^2EV has partnered with Northern Powergrid and Charge Your Car North Ltd. This will give access to an additional 200 Nissan employees on the Nissan LEAF hire scheme in the North East and the trial data from those EV users, ensuring linkage with Northern Powergrid's Customer-Led Network Revolution (CLNR) (LCN Funded project).

Through the links with the NTVV Consumer Consortium and the CLNR projects, the I^2EV demonstrates a pioneering approach to LCN Fund project planning and delivery; by working with two of the largest existing LCN Fund projects, crossing two DNO areas (Scottish and Southern Energy and Northern Powergrid), I^2EV will reduce the risk of duplicating research, resources and crucially, will further lessen any disruption to the customer - whilst at the same time delivering added long term benefit to the customer by future proofing

2: Project Description cont.

network to manage increased stresses due to uptake of EVs and other low carbon technologies. The initial sub-task to Task 2 is the development of the customer engagement plan, which will be consulted upon and agreed with Ofgem. The outline knowledge dissemination plan, that will form the core of the customer engagement plan, is in Appendix M. This will be supported by a robust data protection strategy (outlined in Appendix L).

Two groups of trials will take place:

1. Social trials: Monitoring of existing EV owners and EV fleet hire users

During this process, EA Technology will engage with Nissan, Charge Your Car North Ltd and Fleetdrive to approach EV owners (wherever they are located) with the intention of monitoring and recording, with reference to location, their driving and charging habits, in a statistically significant numbers. The monitoring will be a basic power monitor to record the charging point load downloaded remotely (or from the charger itself if this is available) and a request to householders to record their mileage and time of journeys (possibly via a sat-nav) with any additional charging away from home. De Montfort University will provide information as to the social economic data required. This will enable:

- A statistical comparison of the behaviour in the trials to be compared with a larger population to check that the customers within the trials are a true representation of the population as a whole.
- Data set available will be more statistically significant than currently available information.
- An understanding of the socio-economic situation of customers (whether they represent a cross section of society or only higher social-economic sections) and the implications for EV customer behaviour in future.
- Detailed data on the opinion of the trial participants into the technology in general, allowing understanding of the likely acceptance of the DNO control of loads.
- The results of the trials to be extrapolated to a larger population in the modelling work.

Pre-project progress in identifying existing EV owners

Charge Your Car North Ltd and Nissan have offered access to the Nissan Sunderland employees' LEAF hire scheme participants; 200 EV users' data will be shared with I^2EV. See Appendix K for letters of support.

Through the New Thames Valley Vision Consumer Consortium, major blue chip companies such as Dell, GE, 3M, Honeywell and Waitrose will be approached with fleet hire options to lease an EV at a subsidised cost. Charging points will be installed, potentially free of charge, the Technology trialled and trial participants' behaviours, cycle and charging times etc. monitored.

Pre-project progress in identifying EV fleet hire customers

EA Technology with the support of Bracknell Forest Council (see letter of support in Appendix K) and SSE will facilitate a meeting with the New Thames Valley Consumer Consortium, Nissan and Fleetdrive Electric in October 2012.

2. Technical trials: Trialling the Technology and monitoring using clusters (10-20 on one feeder) of EV charging points, with residential customers

To identify suitable communities and sign up customers for the trial, De Montfort University will provide input into the customer engagement to ensure that customers understand the social-economic information required. They will also review the engagement process to understand what was successful and what could be improved. Different means of engagement will be used. Automotive Comms and project partners will provide in-kind contribution via support to identifying clusters and engaging trial customers/participants:

- Nissan's (LEAF EV manufacturer) EV ambassadors will be made available to facilitate evening briefing sessions to demonstrate / educate potential EV users of the benefits of using EVs.
- Fleetdrive Electric, an EV lease company, will help to identify suitable trial clusters from its EV database
- Charge Your Car North Ltd (CYC) will support with identifying clusters.

Pre-project progress in identifying clusters is in Appendix B and strategy is outlined on page 48. Mainstream, industry and social media, contacts in local authorities and green community networks will be used to attract clusters. Ideally at least one cluster will be achieved on an island or remote location to demonstrate the potential on weak networks where upgrades are prohibitively expensive but the potential for renewable generation is high and transport fuel is expensive. An additional incentive will be a further subsidy from the project to cluster participants. This should encourage those interested to sign up their neighbours.

The aim is to achieve clusters of around 10-20 EV connected to one feeder. 10-20 is a suitable number as it gives the scope to understand the likely variation in use of EVs and charging in any given location by different customers:

2: Project Description cont.

- Cycle charging points also require between two and eight switched off at any point and therefore 10 is a minimum number.

The challenge of managing multiple EVs in a given LV feeder is not currently a problem, but could pose a significant challenge as EV uptake figures increase. If there are insufficient clusters, with any combination of EVs or heat pumps, the results from the clusters available will be extrapolated using network modelling. Whilst the principle aim is for EV charging control, heat-pump users are another client base area and so further information will still provide information on the viability of the product.

Project Stage-Gates

Independent evaluation of the project by a subcontracted third party will review the approach and progress of establishing trials at 6, 9 and 12 months. After 6 months, if there insufficient clusters within SSE and NPG's license areas, clusters outside these areas will be approached with permission from the DNO responsible for the relevant area. After 9 months, if there are insufficient clusters, potential heat pump clusters will be approached. To manage value for money, funds for installing clusters will only be released as they are established. Any unused funds will be withdrawn after 18 months; the overview of the stage-gate approach and associated review process are depicted on page 28.

As indicated, if after nine months there are insufficient clustered customers to trial an EV, a mitigation option is to utilise heat pumps; social landlords will be targeted as they often have clusters of housing stock where each home will have a heat pump installed. A mixture of EV clusters and heat pumps clusters may be used to achieve suitable 'cluster' sizes. Contact will be made via existing contacts from engagement in other LCNF projects, through information about social landlords who have participated in CESP or the Renewable Heat Premium Programme and therefore likely to have heat pumps installed in clusters. Examples of possible candidates are Southern Housing Group on the Isle of Wight, A2 Dominion, Hampshire Voluntary Housing Society, Hyde, Martlet, Swaythling Housing and Bracknell Forest Homes. In the case of heating, back-up heat or heat stores may need to be supplied to give comfort to households that they will not be cold, although based on the operation of the Technology, these are not expected to be used. Reference will be made to DECC's research on heat pumps with heat stores. If there are insufficient clusters, with any combination of EVs or heat pumps, the results from the available clusters will be extrapolated using network modelling.

Discussions that took place with Nissan, as referenced earlier, resulted in the agreement to provide sufficient EVs to undertake the trials via Fleetdrive Electric car leasing company. The negotiated rates are appropriately low in order to make participation in the trial appealing to consumers.

Contingency

The risk of gaining sufficient numbers of users is significantly reduced following the agreement and accompanying letter of support from Nissan to provide EVs at a reduced rate for the trials. However, arranging suitable clusters of EV users is a significant threat for the project and for this reason, breakpoints to assess progress and the alternative of controlling heat pumps is written into the plan. Additionally, a range of funding options and potential participants will be contacted to increase the potential for signing up clusters. If few clusters of any type are found, monitoring individual EVs users will be used to extrapolate the results. The alternative plans should cost less than the priority option.

Deliverables

i. Customer engagement plan
ii. Social trials: 150 EV users engaged to participate in trials
iii. Technical trials: 100 customers signed up for the EV trial, in cluster groups of 10-25 EV users (heat pumps if necessary)
iv. Monitoring equipment installed to monitor an existing EV owner's behaviour.

Task 3. Integration of the Technology with charging points

Alongside Task 2, EA Technology will engage with manufacturers of charging points to integrate the ability to accept Power Line Carrier (PLC) signals and the Technology logic into the charging point. Ideally, this will allow just a charging point (of any make) to be installed with the control capability included rather than two pieces of equipment. If this is not possible, the Technology logic will be installed in series with the charging points. Control of charging points may be one of many applications of the Technology and therefore the logic will be developed separately so that it can be used to control other appliances such as heat pumps.

Deliverables

i. Integration of the Technology into charging points or other loads.

2: Project Description cont.

Task 4. Establishment of customer / cluster trials

The first cluster will be fully engaged by March 2013; the network will be assessed and the Technology installed together with charging points. It is planned to have a temporary circuit installed on a spare way from the customer's consumer unit. Alternatively, a separate consumer unit may be installed for the additional circuit. Learning from this trial will improve further installations. As more clusters are found the Technology will be installed. It may be necessary to provide parking space for customers' conventional cars during the trial as they may not have space to park an additional vehicle. With DNO support, EA Technology will aim to find parking space for the existing vehicles. The NCP network will be approached to provide secure parking for the 'traditional' vehicles. It has been established that there is proven technology to bypass appliances that could block a PLC signal if necessary. There is a risk that the feeder itself is too noisy however the PLC technology has been successfully tested elsewhere on the UK (e.g. Hook Norton LCNF project and at Houghton, Slough under IFI). Therefore experience to date indicates that PLC could be applied to the majority of the LV network. If any of the trials show that PLC cannot be used, the character of these feeders will be useful learning as will using alternative communications. A temporary change in the connection agreement with the customers to cover the direct control of the EV charger will be agreed. Installation of chargers may be incremental to ensure the Technology can prevent overload without switching off chargers excessively.

Deliverables

i. Charging points, the Technology and monitoring installed.
ii. Likely number and length of switch-offs under different scenarios, incl. impact of higher capacity charging.

Task 5. Monitoring first trial

The measurements to be taken each 10 minutes are:

- Feeder current
- Demand from each EV charging socket (or heat pump)
- Voltage at the customer premises
- PLC signals sent
- PLC signal received
- Number of switch offs each socket actuates
- Length of each switch off
- Time and length of each charge and total energy demand

The monitoring will be via the Technology and power monitors on the charging point circuits. Data will be downloaded remotely using power line carrier (PLC) or mobile communications, should PLC not be available, as appropriate. EA Technology has used a number of data logging systems and will select the most cost effective means to communicate. The data monitor/controller will be able to log all the data that it and the Technology can measure, saving to a laptop or logger. This information will be downloaded from the substation by mobile phone, power line carrier or land line depending on the location. It is anticipated that the time and length of each charge and the energy used will be recorded by the charging point. If this is not possible a low cost power meter will be installed in series. The results from the other tasks and the first trials will feed back into the 'main' trials so that the control may be improved on an on-going basis.

The first and each subsequent trial will last between 12 and 18 months. Due to the diversity of the network, and to ensure applicability to a GB-wide scenario, the limits on current may be set artificially low, and to different levels, to monitor successful operation, cycling of chargers etc. even when the feeders are not actually overloaded. There will be no adverse effect on the customer; only a small, and agreed (with the customer) interruption to supply to install the charging point. In the case of heat pumps, the internal temperature and coefficient of performance (COP) will be assessed to measure whether the performance has improved or degraded compared with operation without direct control.

Deliverables

i. Data collected monthly for duration of each trial; reported every six months to the steering group.

Task 6. Trial participant interviews

The De Montfort University will hold pre, during and post-trial interviews with customers (trial participants) regarding:

- Driving and charging habits;
- Concerns over charging being switched off; and
- Any problem encountered as a result of the Technology.

De Montfort University will develop a suitable interview 'pack'. The interviews will be conducted with a mixture of face to face where possible or, where this is not feasible, written or online surveys.

2: Project Description cont.

The participation in feedback surveys will be written into participants' contracts for the trial to ensure that as much information as possible is gathered.

Contingency

A range of data gathering options, (paper, online and face to face interviews) will be used to provide participants with as much choice as possible in how they respond to maximise data returned. Statistical analysis will be used to estimate data where there are gaps.

Deliverables

i. Interviews with customers held, social economic analysis carried out and recommendations made.

Task 7. Modelling

Using the results from the trials, the University of Manchester, with support from EA Technology, will model the actual test networks and other representative networks, using work carried out by Work Stream 3 of the Smart Grids Forum to establish the:

- % increase in thermal and voltage headroom and resulting cost savings in avoiding reinforcement compared with unmanaged installation of EV charging sockets (or heat pumps) including the impact of higher capacity charging.
- Increased capacity and options for back-feeding and resulting cost savings.
- Likely resulting increase in uptake of EVs (or heat pumps) and resulting savings in carbon emission using DECC published carbon intensity figures.
- Any type of network that is unsuitable for the Technology.

The results of monitoring the driving and charging habits of individual drivers in different locations and demographics will be used to verify that the habits seen in the trial clusters are representative and can be extrapolated to different types of network and locations. The results will be used to estimate the savings possible by using the Technology rather than reinforcing the network and the logic requirements of the Technology. If heat pumps are used, recommendations to achieve the best COP whilst using the Technology will be made.

Deliverables

i. Network models of the impact of EV charging and the Technology. ii. Cost-benefit analysis (on a GB scale and DNO licence scale) for the network using the Technology. This will be based on the approach developed under Work Stream 3 of the Smart Grids Forum to help validate this work.

ii. Likely carbon savings of using the Technology.

Task 8. Consultation with EV manufacturers: cycle times

With the results of the trials, discussions with Nissan regarding the optimum switch off time and cycle time without adversely affecting battery management or lifetimes will take place. This will also take into account customer and network requirements and which charger to switch off first.

Deliverables

i. Cycle times and logic for the Technology agreed.

Task 9. Project and regulatory recommendations and implementation

Make recommendations as to whether:

- Installation of the Technology (or similar) should become standard for large loads.
- There should be changes in the regulation to allow the DNO to directly control customers' supply.

Deliverables

i. Independent evaluation of project and the Technology.

ii. Regulatory recommendations, including integration into DNO business as usual.

iii. Technical and commercial framework recommendations.

Task 10. Dissemination

As much information as possible will be disseminated to other DNOs, manufacturers and the general public, without compromising the intellectual property or customer privacy of those involved, as described in the dissemination plan.

Deliverables

i. Dissemination plan developed and executed.

An independent 3rd party will review the project progress and approach every 6 months and make recommendations for improvements. It will also compare the Technology to alternatives.

2: Project Description cont.

2.4 Changes since Initial Screening Submission

A number of significant activities have been undertaken since the submission of the 2012 ISP. Whilst the core of the project has not radically changed, the project now has a clearer focus, rationale and structure to maximise learning.

Increase in requested LCNF funding: This has increased from £2.5 million in the ISP to £4.1 million at full bid submission. This is accounted for by a number of key factors. At ISP stage costs for establishment of customer / cluster trials were under costed at £550,000. This has increased to around £1.8 million - with an in kind leverage of £5.8 million; no in kind leverage had been achieved at ISP stage. Management of the subsidised EV rental programme and other trial associated costs (collection/delivery of EVs, installation of charging points, finding trial participants) were either not accounted for or under costed. Management of the rental programme alone accounts for £225,875 and was not costed at ISP stage. Fleet management is not core to either EA Technology's or SSEPD's business; we have since engaged with an EV fleet hire partner who has worked with us to address and further refine costs for this element, in return for a high quality output that will de-risk the trial stages of the project - by providing the project with EVs and management of those EVs.

EV manufacturer engaged: The most significant development between submission of ISP and full bid is the committed engagement of Nissan to the project. Nissan is supplying, through a uniquely subsidised deal, 300 EVs to the trial programme, through an EV lease hire company, Fleetdrive Electric. Through Nissan's project partnership, I²EV will also have access to Nissan's Low Emissions Centre of Excellence in Sunderland which will support learning and technical need throughout the lifetime of the project. Two key learning areas from the trials will be social and technical, the former requiring EV drivers in different locales, the latter requiring clusters of 10-25 trial participants on one feeder (e.g. on one street, cohousing development or gated community). See Appendix K for letters of support from Nissan and Fleetdrive Electric.

Social trials - participants identified and secured in principle: Access to 200 EV drivers secured through partnering with Charge Your Car who manage the Nissan employees LEAF hire scheme in Sunderland. Progress made in engaging support of Bracknell Forest Council to provide direct links to SSEPD's NTVV's Consumer Consortium (blue chip companies) for fleet hire trials.

Technical trials - Clusters for trial identified and engaged: Successful trialling of the Technology depends upon identifying and engaging trial participants in clusters. Two potential clusters have already been engaged in Hyde, New Forest, and Leeds.

Review of all Tier 2 projects - collaboration with Northern Powergrid (CLNR) and link with NTVV: A comprehensive review of all Tier 2 projects has been undertaken to ensure the I²EV project effectively builds on the UK's LCNF portfolio. As a result, clear strategic links have been established with other LCN Fund projects - New Thames Valley Vision (NTTV) and the Customer-Led Network Revolution (CLNR) (both Tier 2). In recognition of the natural link between I²EV and CLNR, given both projects' involvement with EVs, Northern Powergrid has committed as a partner to the I²EV project.

Detailed costing and in-kind support: Detailed costing has been carried out following the re-focused project; partners' in kind support has been quantified and contractors costed.

GB DNO business as usual: Introduction of focused activity to bridge the gap into GB DNO business-as-usual including detailed technical evaluation of charging/derogation consideration, identification of the need for use-cases, policies, procedures and design tools to be developed in the project and the identification of the need to develop training material to educate the range of DNO stakeholders through the project.

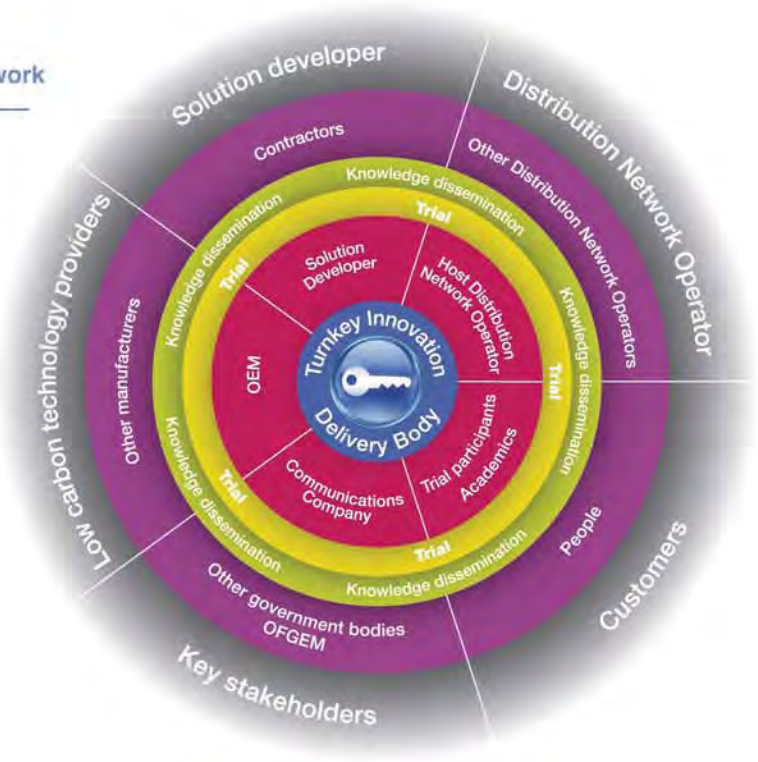
Improvements made to the project readiness:
- Governance: Project steering group and board established (see Appendix F for organogram)
- Commercial innovation: I²EV commercial model has been drawn up (see page 17)
- On-site trial of the Technology to de-risk the project - trial results will be available in September 2012
- Management of EVs for duration of the trials programme has been established with a trusted partner
- Letters of support have been provided by project partners and technical trial cluster groups (Appendix K)
- Social trials: Through Charge Your Car North, access to 200 EV drivers in the North East
- Technical trials: Two clusters have been identified and both have provided a letter of support
- Detailed project plan has been developed (Appendix G)
- Outline knowledge dissemination plan to inform the communications plan developed (Appendix M)
- Outline data protection strategy to support customer engagement plan has been developed (Appendix L)

2: Project Description Images, Charts and tables.

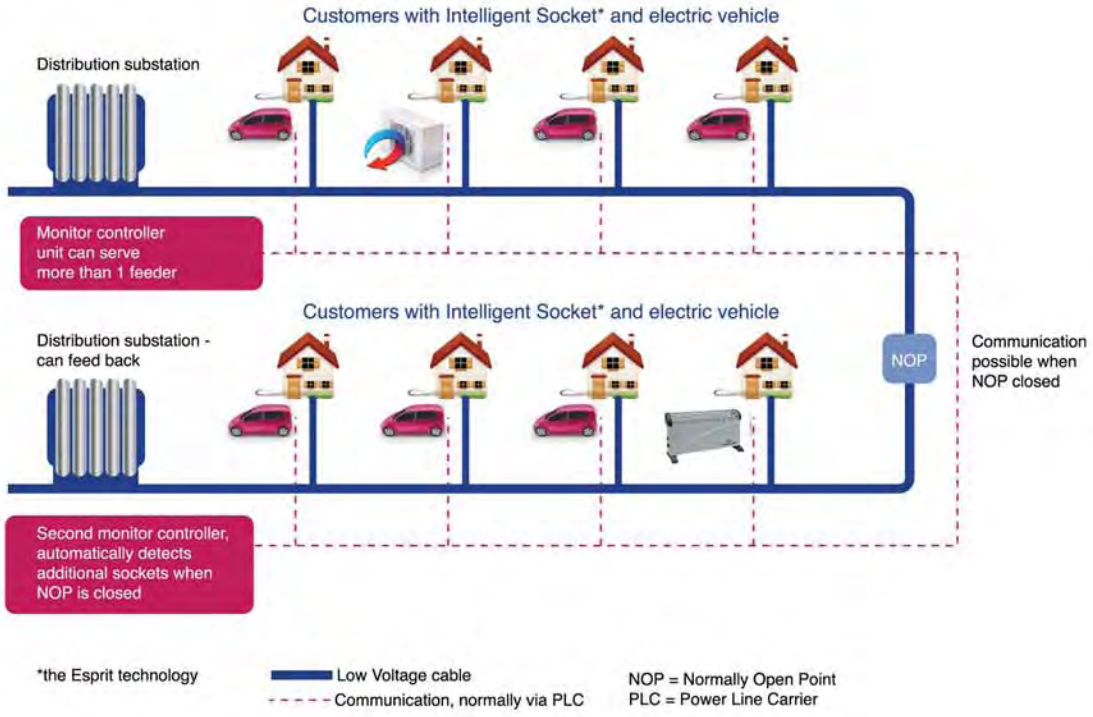
I²EV
Commercial innovation - delivery framework

This diagram illustrates the framework for a non-Distribution Network Operator (DNO) to deliver a low carbon network innovation project, from inception to delivery, on behalf of a DNO.

- i. The Turnkey Innovation Delivery Body (TIDB) develops, manages and delivers the low carbon network project on behalf of the DNO
- ii. These are the core parties with whom the TIDB partners in order to develop the project, leading to stage iii
- iii. Trials of the technology to support the low carbon network of the future
- iv. The knowledge and learning from the trials is disseminated to the partners in stages ii and v
- v. The key beneficiaries of learning from the project
- vi. The outer layer captures the main partner groups



I²EV
Technical innovation – how the Technology works



Project Description images

Section 3: Project Business Case

3.1 I²EV in an SSEPD Context

I²EV is proposed by SSEPD, which is part of the Scottish and Southern Energy (SSE) group. SSE is involved in the generation, transmission, distribution and supply of electricity, the production, storage, distribution and supply of gas and in the provision of other energy-related services.

One of SSE's main priorities is to:
'Deliver upgraded electricity transmission networks and operational efficiency and innovation in electricity and gas distribution networks as they respond to the decarbonisation and decentralisation of energy.'

The learning from the LCNF projects such as the I²EV project continues to inform SSE's strategy to deliver on these priorities. Its role in informing efficient investment, the innovative application of technology and the support the project provides for decarbonised energy will be key to its success and the reason why SSEPD is submitting this bid to the Low Carbon Networks Fund.

SSEPD extends this to draw on the innovation of project partners and stakeholders, an approach which has reaped rewards both in SSEPD's Smart Grid projects Northern Isles New Energy Solutions (NINES) in Shetland and New Thames Valley Vision (NTVV) project in South England..

It is this disciplined yet supportive approach to innovation that gives colleagues and stakeholders the confidence to propose inspiring, challenging and novel projects like I²EV.

In developing I²EV we, along with our lead partner, EATL, have taken the learning from an array of successfully delivered IFI and LCNF projects which have allowed us to gain a useful understanding of the challenges of the future and the tools both commercial and technical that we can utilise to resolve issues. Projects of note include:

- *Orkney Registered Power Zone: the first network based operational Active Network Management system in the UK.*
- *Chalvey Zero Carbon homes: an SSE funded project in conjunction with Slough Borough council which has constructed 10 fully occupied zero carbon homes to demonstrate the most advanced home energy systems available for the new home market.*
- *Shetland battery: a six megawatt hour sodium sulphur (NaS) battery - Europe's biggest - installed adjacent to our power station on Shetland.*
- *Customer-Led Network Revolution - Northern Powergrid's LCNF project.*

Integration with SSEPD's Business Plan

SSEPD's delivery priority is to deliver upgraded electricity transmission networks, operational efficiency and innovation in electricity distribution networks as they respond to the decarbonisation and decentralisation of energy.

The learning from the LCNF projects will assist our preparation for RIIO, and is absolutely in line with the values core to the operation of our business.

Converting innovation to business as usual

SSEPD's pragmatic approach to developing and implementing research projects and technology trials ensures the generation of outputs which are practical and effective. Conversion of these useful outputs to business as usual, for SSEPD and for the wider industry includes:

- *the creation of new policies and procedures*
- *commercial precedents*
- *component specifications*
- *vocational and technical training courses*
- *management tutorials*
- *providing key data relating to this intervention (cost per intervention, risk, operational implications)*

3: Project Business Case contd.

3.2 The I²EV Business Case

The business case for the I²EV project falls into two parts. Firstly there is a business case for the mode of operation and delivery of the project and secondly there is the benefit of the social, economic and technical deployment of the Technology and associated monitoring and engagement.

There is significant benefit to the DNOs of developing a framework in which third parties can trial new technology on one or more DNOs' networks whilst still working closely with the DNO as the sponsor of the project.

The benefits are:

- Accelerating the development and deployment of new technology by allowing a third party to drive the trials forward. It harnesses alternative approaches from outside the DNOs and the drive of technology developers to achieve trial results allowing DNOs to concentrate on network development.
- With a fixed price contract is transfers the project management risk to a third party.
- Ensuring that the technology aligns with a DNOs needs and has DNO support to integrate it into normal working practice through DNO sponsorship of the project.
- Using a third party as the lead on the project enables one DNO to be the sponsor whilst allowing the Technology to be tested on other DNOs' networks ensures efficient management of the trials whilst ensuring testing on as wide a cross-section of networks as possible. Separate projects per DNO may increase costs by 50% as the project management and analytical costs would remain at a similar level and would not scale for two smaller projects.
- Developers working with DNOs engenders trust and understanding of risk that is beneficial for operating together in a `business as usual' context.
- Not only will the project help EA Technology grow as a developer of the Technology, the project brings ANDTR, Fleetdrive Electric and Automotive Comms (all SMEs) into contact with the distribution system, supporting their growth and securing jobs.
- The project will also support the safeguarding of Nissan's jobs at Nissan's plant in Sunderland through raising the profile of the Nissan LEAF and potential new technological developments in integrating the Technology with the charging point.
- By ensuring that electric vehicle charging points can easily be connected to the network, the uptake of vehicles is likely to increase security of jobs in the electric vehicle industry. The automotive sector already accounts for 12% of the UK's manufacturing employment; low and ultra-low emission vehicles offer the potential to secure these jobs and build upon them ('Making the Connection - the Plug-In Vehicle Infrastructure Strategy', Office for Low Emission Vehicles, June 2011).

To achieve these aims, there are various contractual and working arrangements that will be trialled within the project. These frameworks will be made available to all DNOs and third parties so that this work does not have to be repeated. Thus, although over £200,000 has been allocated between SSEPD and EA Technology to develop the contracts and define scopes of work, much of the output can be used on other LCNF projects. Savings on future project will depend on their nature. However, if a modest £50,000 is saved on each future project, only four additional projects are required for there to be a cost saving.

From a technical perspective, the Technology will help mitigate the impact of low carbon technologies. Projections for the uptake levels of low carbon technologies (LCTs) across Great Britain have been determined as part of wide-ranging work within Government to provide forecast scenarios to meet the Carbon Plan. These scenarios, developed primarily by DECC, but with input from DfT regarding EVs, highlight the need for large-scale uptake of EVs, heat pumps and photovoltaic generation if the UK is to meet its carbon reduction targets without the need to purchase carbon credits. Detail on these scenarios has been published by Work Stream 1 of the Smart Grids Forum. With respect to EVs in particular, the 'mid` scenario forecasts in excess of 6m EVs in Britain by 2030, with over 23m EVs by 2050. Further drivers of the expected high numbers of EVs by 2020 are:

1. The UK has stated an ambitious target of an 80% reduction in CO2 by 2050 compared to 1990 baseline levels. Road transport is an important element of this, and the King Review in 2007/8 provided recommendations to government about how to achieve such reductions So far, government policy has acted upon the recommendations to incentivise the take-up of ultra-low carbon cars and there is no sign that this will stop.
2. Recently the EU has confirmed that all car manufacturers in Europe must aim for a fleet average target of 95g/km CO_2 by 2020. The only way that most manufacturers will achieve that is by their vehicles having plug-in capability, either full EV or plug-in hybrid/E-REV etc.

3: Project Business Case contd.

3. Most London boroughs, including Camden, are heading for large fines from Europe for air quality issues (for regulated rather than CO2 emissions) - it will be cheaper for them to encourage electric vehicles rather than pay the fines.
4. London Congestion Charge is likely to change soon with the result of encouraging more EVs in the capital.
5. The Automotive Council Technology Road Map is the official consensus between manufacturers and industry organisations about vehicle technologies over the next 40 years. It shows that electric cars will be a mainstream car technology before 2020.
6. Motorists want low car running costs - electric vehicles provide this.
7. The problem at the moment is that EVs are expensive in relation to their driving range capability. However, the Renault Zoe will be launched in early 2013 and will cost around half of most current mainstream EVs (£13,650 plus £70/month battery rental). It will also have a range of 130 miles. Factor in the ever increasing price of oil and EVs will become more and more attractive to the average motorist.
8. When the 'Mark I' Toyota Prius hybrid appeared it was seen as an oddball car for eco-warriors. It is now the world's best-selling car, with EVs likely to follow this pattern.

Each of the LCTs described here poses a certain challenge for electricity distribution networks, which will need to be met in order to ensure that customers continue to enjoy a robust electricity supply. In the case of EVs, the challenges that will be faced include a potential exacerbation of peak demand if drivers plug in their vehicle upon returning home from work (therefore coinciding with the traditional network peak between 5 and 7pm). However, this is not the only issue, as simultaneous charging of multiple EVs along one LV feeder will also cause the voltage along that feeder to be depressed, potentially taking it outside statutory limits. The challenges associated with heat pumps are similar, as they are expected to form a significant drain on the thermal headroom of circuits, while similarly depressing voltage, particularly when starting on cold days (when load on the network is already likely to be at a high level).

Even if the projections given here do not turn out to be fully reflective of the way in which LCTs appear, there will be a need for all network operators to consider the effects that these LCTs will have on their local distribution networks.

Work carried out under Work Stream 1 of the Smart Grids Forum predicts that if fast charging is possible by 2023 (only 10 years after the start of the project) there could be between 1 and 3 million EVs on the road. Charging speed is a key factor in take up and allowing charging to draw up to 7-8kW at home will encourage low carbon vehicles. Given that the present, after diversity, maximum demand of a property is of the order of 1 - 2kW, the impact on the local electricity distribution infrastructure will be significant; particularly given the possibility outlined above regarding customers charging at certain times of day that will lead to considerable increases in the peak demand level observed on the network. See page 28 for GB uptake scenarios for different forms of low carbon technology (Source: DECC, SGF WS1).

For the calculations in this bid, we have used 3kW per charger to represent an average, slower charge possible today. It should be noted that this estimate may turn out to be on the conservative side, given that second generation EVs will have larger batteries and higher charging rates (with the same charger). This means that they will either need to draw more power to charge over the same period, or will need to charge at the 3kW for a longer period. This makes some demand side response solutions (e.g. Time of Use tariffs) less attractive, as the amount of demand that would need to be shifted to another time of day would be considerably larger (in terms of kWh). A means by which a DNO can have a direct control over EV charging loads to avoid reinforcement would remove potential barriers to chargers being installed. It should be noted that it is only under heavy loading, that charging may need to be curtailed, possibly only a few times a year, and that the customer may not notice at all. As well as reduced costs of driving and electricity to cover costs of reinforcement, the customer avoids the disruption of re-laying cables in return for a very small restriction on charging. DNOs will have a low cost solution as a `safety belt' allowing them to connect LCTs with less caution as they have the comfort of being able to control them even as a short term measure whilst further measures are introduced.

Alongside the technology itself, DNOs will gain greater understanding of:
- The habits of customers and their use of low carbon technologies and the impact on the network.
- Customers' acceptance of direct demand control by the DNO.

The additional data will help validate Smart Grids Forum network models.

3: Project Business Case contd.

The benefits of deploying the Technology are significant in terms of avoiding reinforcement. It is estimated that the savings of using the Technology rather than reinforcement will be £740 million across Great Britain or £53 million per licence area by 2040. The details of the assumption and estimation of the number of feeders where the Technology may be used are given in section 4. Whilst some of the projections given above are extrapolations to 2040, the preparation to accommodate new LCTs will occur in the next 5 to 10 years. Clusters of EVs are likely to occur, particularly in urban environments or areas where they are being manufactured or promoted.

Thus DNOs will be taking action and using techniques such as the Technology in the near future. These solutions will then be rolled out as clusters appear elsewhere. Whilst SSEPD has expressed particular interest in the Technology and has sponsored the project, the Technology will be applicable to all DNOs. This is demonstrated by the fact that trials are expected to be on other networks as well as SSEPD's such as Northern Powergrid who have expressed their support for the Technology by agreeing to take part in the project.

Carbon savings from using the Technology will be due to the facilitation of the uptake of EVs by allowing easy access to fast charging that is noted as a key to adoption of EVs in the UK's Carbon Plan. If facilitating fast charging helps move adoption from the medium to high scenario, 4 million additional cars would be on the road by 2030, about 2 million more in 2025 and 500,000 in 2020. The SGF WS 3 predicted a 10% saving in infrastructure costs to implement fast charging using the technology. If it is therefore assumed that 10% of the additional carbon saving from the increased adoption of EVs in the high scenario is due to this saving it equates to 33.5 million tonnes of carbon by 2030. Further savings may be possible due to facilitation of the connection of other LCTs such as heat pumps. Whilst the uptake of EVs and associated environmental benefits is not the prime driver for the project, the awareness raising and opportunity to experience driving an EV should encourage the adoption of EVs. There is therefore an additional indirect benefit from the project.

3.4 Time savings and avoiding disruption

A key advantage of the Technology is that it can be deployed quickly; even as a stop gap and with minimal disruption. The Technology is expected to be very fast to install; a matter of a few hours to a day of time compared with months of planning and installation time for re-laying feeders. This will speed up the connection of LCTs and avoid disruption and inconvenience of installation to customers.

Leverage
The indirect benefits to the EV industry have resulted in the project attracting a number of in kind contributions. There is significant leverage from the LCNF demonstrating value for money to the customers. The outside funding as a proportion of the total cost is significantly greater than previous LCNF projects.

3.5 Alternatives

The currently available alternative option is to continue in a 'business-as-usual' manner, laying additional cable to split existing feeders and hence reduce the load on each feeder. This has been demonstrated above as being very costly both in terms of the amount of investment required from network operators, and also in terms of the societal cost in the level of disruption caused through excavating and laying thousands of km of LV cable. As such, this is not regarded as a viable alternative.

DNO-supplier-customer demand management
Some form of "smart" solution is therefore required to facilitate the connection of EVs (and heat pumps) in the future. The most apparent alternative would be to make use of variable tariffs, instigated by suppliers that would incentivise customers to charge their vehicles at particular times of day. There are several potential drawbacks to this. Firstly, such a solution would depend upon a great deal of unknown quantities; not least of which would be the appetite of suppliers to offer such tariffs, and that of the customer to accept them. There is also the issue of cost: how much would a supplier be willing to offer a customer to move demand from one time of day to another, and what is the minimum level of payment that a customer would be willing to accept? Analysis carried out using the Smart Grid Forum Work Stream 3 modelling work has shown that suppliers may look to shift demand fairly significantly at a cost of around 2p/kWh. However, it is unlikely a customer would accept such a low amount. A figure that seemed "reasonable" for customers to accept would be of the order of 20p/kWh, given that this is reflective of the sort of cost differential that exists between peak and off-peak tariffs at present. However, at this level of payment, the analysis showed that it was not cost-effective for suppliers to shift demand.

3: Project Business Case contd.

Another consideration is that suppliers' focus is broad, generally on a national level; while the needs of a DNO are inherently more local. The likelihood of being able to align these two drivers may well be low. Furthermore, the number of connections where Demand Side Management could be used to reduce load and relieve an LV cable is typically under 100 per feeder. The probability of sufficient voluntary load reduction via engaged customers through the use of tariffs on one feeder without automation is low.
There is also the issue that DNOs would look for a solution in which they could place a good deal of confidence and which could be applied uniformly across their network. Customers along any given feeder may have different energy suppliers and different tariff structures; and hence may respond to pricing signals differently. The Technology would ensure that the same solution could be applied across a range of networks (both in terms of feeder types and locations) and would not be contingent upon any third party being involved in the solution (unlike supplier-led Demand Side Response measures).

In addition, the Esprit Technology has the capability to measure voltage at the point of the Technology's installation at the customer's connection, regardless of where on the feeder it is located. As such if the Technology is installed in a premises at the extreme end of a feeder the voltage at the end of the feeder can be accurately measured. If however, the Technology is installed at a connection part way down a feeder, then the data provided can be used to make a reasonable estimate of the voltage at the remote end. Any measurements taken can be transmitted to a data-logger for future retrieval and analysis if required, essentially providing DNOs with a low-cost means to gather data on voltage and current profiles at customer premises and feeders.

3.6 Conclusion

The business case is therefore in four parts.

1. It has the potential to reduce capital investment requirements for network operators consistent with the objectives of RIIO ED1 that will also be beneficial to customers.
2. It facilitates the adoption of LCTs to reduce carbon emissions by reducing the cost, inconvenience and time for connection.
3. It provides the data and technology to maximise the use of network capacity
4. It provides a framework for a DNO to work with third parties who are leading network projects.

SSEPD commented that:

It is clear that the solutions that we are implementing in the I²EV project do carry some uncertainty, in particular in relation to their ability to perform as planned, level of customer uptake and response and the sustainability of the technology. However, we consider waiting until the network is on the brink of overload would be an even higher risk and is not a realistic option.

Therefore, we have to look for solutions now and believe that the installation of the I²EV technology will help avoid EVs causing excessive stress on electrical networks that would necessitate the replacement of a significant proportion of our low voltage network. We estimate that the replacement value of SSEPD's assets across the two licences would be circa £3 billion.

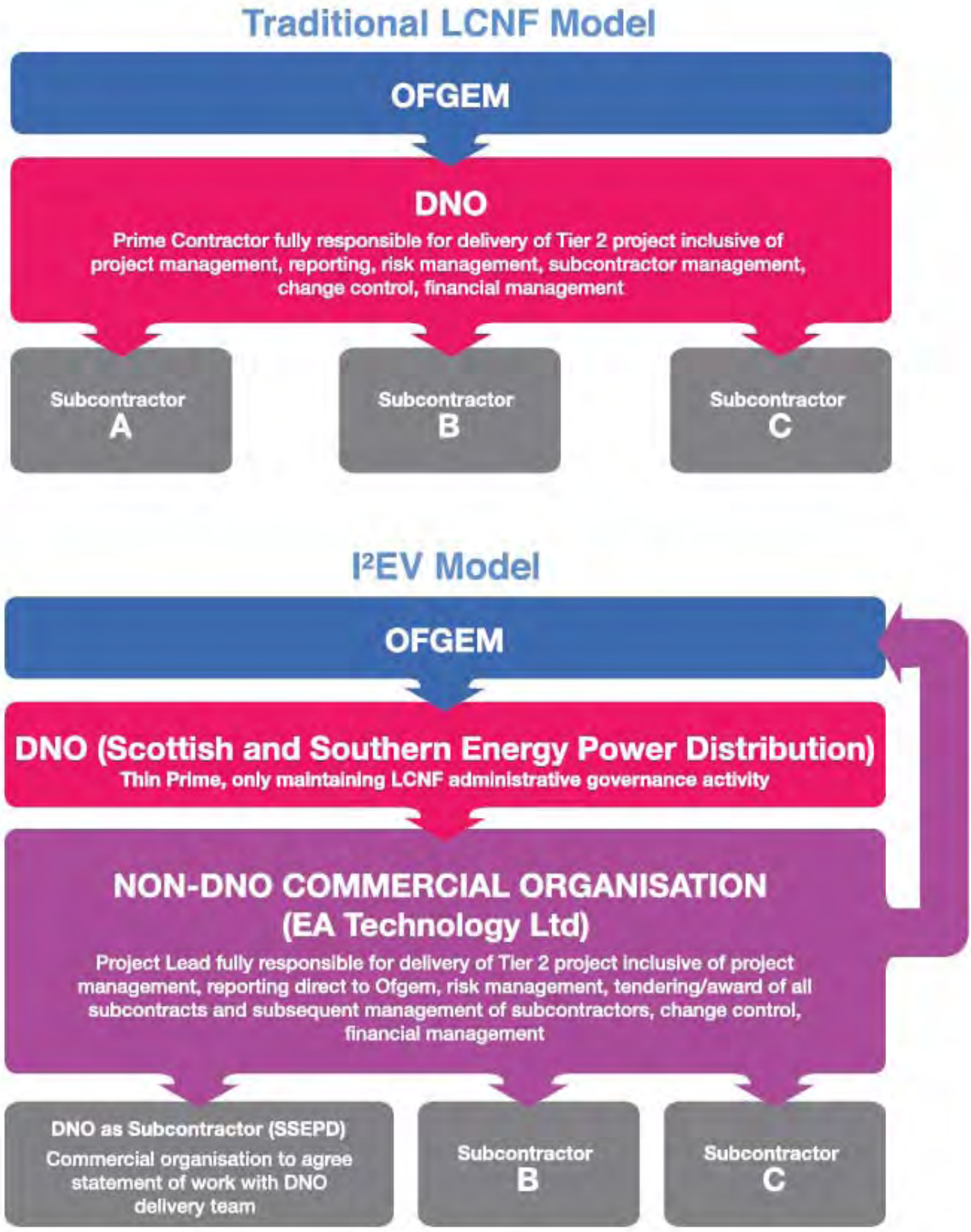
In addition, the disruption to public highways would be a significant consideration and would require the programme to be phased over tens of years, resulting in unacceptable delays to the connection of low carbon solutions. This is not compatible with our aim of providing the energy customers need in a sustainable way and therefore is not an option.

In our opinion we need to do something new, now, and believe that the I²EV technology will be a valuable tool for the DNOs to use in the future to manage their networks.

Project Code/Version No SSET205

3: Project Business Case contd.

3: Project Business Case images, charts and tables.



Project Business Case images

Section 4: Evaluation Criteria

4.1 Accelerates the development of a low carbon energy sector and has the potential to deliver net benefits to future and/or existing customers

The I²EV project facilitates the expedient connection of EV chargers to the DNO LV network as it avoids the possibility of the DNO becoming a barrier to multiple EV connections along a particular LV feeder. This could occur when multiple EVs wish to connect to a portion of network, but the local feeder may not be sufficiently rated to accommodate this load. In order to avoid overstressing the feeder and interrupting supplies to all customers fed via this circuit, the DNO would need to engage in reinforcement work, i.e. installing cables or overhead lines with higher rating. This would be time-consuming and result in the DNO forming a barrier to connection of multiple EVs. However, spare capacity does exist in these feeders, but it is time dependent, i. e. there may not be any spare capacity (or "headroom") at times of peak demand; if some demand could be moved to other times of the day then this latent capacity could be utilised. Such profile changing may become possible through smart metering, but this is unlikely to be in effect until 2019, and will not be in widespread use before RIIO-ED2 in 2023. In the meantime, clustering of EVs is likely to occur in certain network areas, and not always as a result of an obvious reason (e.g. geography), but could be 'irrational' (e. g. neighbours wishing to "keep up with the Jones'" by purchasing an EV). It is this sporadic clustering that may result in the biggest problems for DNOs. Even with smart metering it is unlikely that DNOs will have the confidence to rely on load shifting without direct control and will prefer a system over which they have control such as the Technology. The benefit will accrue to all customers directly in the form of reduced reinforcement costs, and indirectly from cleaner air and reduced carbon emissions. It is `smart meter' ready in that the algorithms could be incorporated in a meter.

Solution 1 - commercial

Carbon Plan: Low carbon transport is a priority under s.1.12 of the Carbon Plan. Section 2.79 and 2.86 illustrate the expected uptake of EV and plug in hybrids expected to fulfil the goal of decarbonising the transport system. The solution contributes to the Carbon Plan by allowing the expedient connection of EVs through an in depth understanding of how and where intelligent charging units could be used, thereby allowing the rapid deployment of techniques to manage the anticipated increase in penetration of low carbon technologies such as EVs. Deploying a third party who wishes to develop a technology helps accelerate the deployment and facilitates the Carbon Plan.

Financial Benefits: The project will demonstrate the extent to which third party delivery of innovation projects could be more efficient than the projects being merely led by the host DNO. The savings will be via:

- Using the expertise in third party project management to tightly manage time and budget
- Experience to date shows that DNOs are expert in project managing the maintenance and installation of assets but do not have a large pool of expertise in development of new technologies.
- Rather than seek to recruit new staff for this role, the project seeks to demonstrate that third party management is more effective, as knowledge and expertise can be drawn in as required. With a fixed price contract, it transfers the management risk to a third party.
- Enabling faster deployment using a third party rather than a DNO whose timescales for asset consideration is 40 years.

Solution 2 - Technical

Carbon Plan: The Technology that forms the basis of the solution to the problem of increased stresses on the network - overload due to market growth of EVs, wholly aligns with the UK Government's Carbon Plan. Under s.1.12 in the Carbon Plan's 'Vision for 2050', low carbon transport, and in particular, EVs, are cited as being at the heart of the step change needed to reduce emissions. The UK is tasked to reduce emissions from transport around 17 $MtCO_2$ by 2020 (325$MtCO_2$) from 2010 (342$MtCO_2$) figures. The Carbon Plan also recognises that the grid will be faced with increased demands. The Technology solution under the I²EV project addresses the inevitable additional stress on the network from EVs, (and other LCTs) by facilitating the connection of EVs without the need for excessive network reinforcement, thereby minimising costs. The project will also provide information on driving habits and customer response to LCTs that will help to promote them and achieve the Carbon Plan targets.

4: Evaluation Criteria contd.

Alignment with other strategies: In addition to demonstrating alignment with the Carbon Plan, I²EV directly supports the Office for Low Emission Vehicles' (OLEV) 'Making the Connection - the Plug-In Vehicle Infrastructure Strategy' (June 2011). Ofgem's Low Carbon Networks Fund is cited in the executive summary (page 7) as being a conduit to support recharging at home through support of smart grid projects linked to Plugged-In Places (PIP) projects in London and the North East; Charge Your Car is the PIP programme for the North East and is a confirmed partner to I²EV (see letter of support in Appendix K).
The clustering effect of low carbon technologies is recognised in OLEV's Strategy in relation to electric vehicles and that 'recharging in particular locations could lead to the need for local reinforcement' (page 33 of OLEV's strategy). This fully aligns with the I²EV trial programme and the need to engage with clusters to effectively demonstrate the Technology as a solution to the future problem of network overload on local distribution networks. The I²EV project has been presented to OLEV and will benefit from their support in terms of strategic direction, identifying clusters and access to other synergistic data and projects, (see Appendix K for letter).

4.1 Calculation of Net Benefits

Commercial solution

Cost Savings: The base case is that the project is led and coordinated by the DNO. This is estimated to require 2 full time staff (or equivalent) over 5 years at a total cost of £1 million. In contrast the commercial solution will cost £808,656 in developing a contractual framework and for the project management services of a third party. This delivers a net benefit of £191,344. For future projects it is assumed that having established the contractual framework, there will only be a cost equivalent of 25% of that allowed for developing the framework in this project. It is envisaged that in RIIO-ED1 period under Network Innovation Competition (NIC) that the number of projects adopting this framework will increase rapidly. For RIIO-ED2 and beyond, a modest number of projects are expected given the uncertainty around funding mechanisms. In total by 2040 it is expected there will be 40 projects using this commercial innovation delivering a net benefit of £13.99 million.

This expectation is extrapolated on the basis of the below assumptions:

- Of the LCN Fund Tier 2 projects awarded in 2010 and 2011 (eleven projects in total) six are technically-led projects that could have benefited from the approach outlined in the I²EV project. This gives an average of 3 projects per year;

- 27 years until 2040, giving a total based on the average of 3 projects per year of 81;

- The overall figure has then been scaled back assuming that 50% of those tasks would be suitable for being undertaken with the third party delivery model gives 40 projects.

It is stressed that this assumption has been extrapolated using a small pool of existing projects. The extent to which this assumption is true will depend on the attractiveness to both parties (developers and DNOs) of the final commercial contract in terms of its share of risk and reward.

Time Savings: The key benefit to the commercial innovation is anticipated to be the accelerated deployment of a particular solution. It harnesses alternative approaches from outside the DNOs and the drive of technology developers to achieve trial results allowing DNOs to concentrate on network rather than technology development.

Headroom: No additional headroom is achieved, although the headroom gains associated with the technical solution could be achieved more quickly.

Rollout: It is envisaged that this commercial innovation could be applied to any large scale (LCNF or Network Innovation Competition) project anywhere in the country.

4: Evaluation Criteria contd.

Technical Solution

Cost Savings: The only conventional alternative to the Technology is reinforcement of the LV network. For each of the trial sites, it is assumed that 300m of cable would have to be laid. The average costs to lay LV cable as agreed under DPCR 5 is £98.4/m. The cost for 10 feeders is therefore £295,200 (the base case). In contrast, the target costs for the substation installation for the Technology is £2,000 for the equipment and one day's work for two people to install it. This assumes that the cost will fall with bulk manufacturing. If staff cost £500 a day, this is £3,000 per substation. Note that this is a lower figure than that quoted by the Smart Grids Forum (SGF) Work Stream 3 (WS3) analysis as this included the cost of any installation at the customers' premises. It is known that for the proposed technology, the cost of the intelligent socket (the Technology) would be borne by the customer and should not noticeably increase the cost of the charging point. Therefore the cost to the DNO is lower than that quoted in the SGF WS3 documentation. The logic within the Technology should be maintenance free. The comparison gives a saving of £265,200 in I^2EV project terms (i.e. across 10 substations with one feeder controlled at each). Scaling this up to a GB-wide scenario by the forecast number of substations where this will be deployed (source SGF WS3) in 2040 gives 27,920 installations. This would see cost savings across Britain of over £740 million by 2040 assuming an average benefit of £26,520 per site from the above net benefits calculations. One Technology installation in a substation could serve all the feeders and therefore comparing the cost with relaying one feeder length of cable is a pessimistic comparison of the savings that the Technology could offer.

(WS3: http://www.ofgem.gov.uk/Networks/SGF/Publications/Documents1/WS3%20Ph2%20Report%20Issue%203-1%20-%2031-Jul-12.pdf).

Installation time savings: It is estimated that once planning has been carried out and permissions obtained, four months is the shortest time elapsed to relay a cable. In contrast, if the Technology is in stock, it could be installed in three weeks' time allowing for time to book the necessary staff time and record the installation. If EV installations are already present, a monitor controller may already be available. Therefore the Technology could be implemented in 25% of the time required to relay cables across Great Britain. Installation time will be useful learning from the project.

Headroom: The average load in a home during the night is less than 20% of peak loading and around 50-60% during the day. It is therefore estimated that by shifting EV charging, twice as many charging points could connect. That is, if 10 charging points can connect and charge during the peak, there should be headroom for 20 during the other 18 hours of the day. If on one feeder, on average 20 EV chargers can be installed rather than 10 without reinforcement using the Technology, this will provide about 30kW of additional headroom (assuming 3kW per charger). Extrapolated across the country, if used on 130,000 feeders envisaged under Smart Grids Forum Work Stream 3 work and freeing the same headroom, this would, in total, provide 390 MW of headroom.

Uptake: The rapid uptake of EVs is expected over the next 15-20 years. This timescale is longer than the likely roll out period for the technology. If the study in Work Stream 3 is correct, the Technology is applicable to more than a third of all LV radial feeders supplying suburban streets, 32% of LV radial feeders in villages and 18% of LV radial feeders on terraced streets and in town centres. Note that many of the other feeders would not experience problems due to EV charging and therefore the applicability is very widespread.

4.2 Provides value for money to distribution customers

Solution Benefits: As per the calculation of net benefits above, were the DNO required to manage costly reinforcement measures to address the overload on local distribution networks due to the uptake of EVs and other low carbon technologies; this would have a severe impact on customers' electricity bills. The Technology will provide a solution to manage and alleviate this overload, thus having a positive effect on customers' bills as the costs of reinforcement are mitigated and the alternative saves 10% when rolled out across the UK.

Further benefits to the distribution system are via the development of new commercial frameworks for rapid cost effective deployment of new technology.

4: Evaluation Criteria contd.

Trial Design: The trial has been designed to gain maximum learning whilst ensuring the project scope and costing is not excessive. As per the modelling carried out for the SGF-WS3, there are a total of 19 different LV feeder types used in GB today, and each with a very different mix of customers (residential, light commercial, etc). Ideally, the project would focus on installations of a statistically significant sample of each of the 19 types of network. We recognise that the costs (and time) to achieve this would not be in the interest of customers, and have therefore focussed on a much smaller sample of c10 cluster groups. Data from these field trials will then be combined with the social analysis from the c150 social trial participants, allowing simulation on the likely usage and benefits of the Solution to be carried out through desktop modelling. These steps significantly reduce the cost of the project to customers.

In addition to this, there are the socio-economic benefits of facilitating EVs and avoiding the disruption of relaying cables. Throughout the document, the indirect benefits have been highlighted. Benefits associated with factors other than the distribution system are:

- Encouraging uptake of EVs.
- Supporting SMEs and other industry thus safeguarding jobs.
- Reducing carbon emissions from transport.
- A product suitable for export.
- Raising awareness of energy.

Partner selection

The companies participating in the project have been invited to participate for a number of reasons and/or by several methods, in each case offering value for money.

- SSE: Project Sponsor.
- EA Technology: Invited by SSE to take a lead role in the project due to strong working relationship. EA Technology has significant experience in managing multi-party projects (e.g.. CLNR, SGF WS3, STP), supported by a robust project management culture and procedures. This, combined with its ability to deliver projects on time, and to the necessary quality, even at its own cost when required, is why EA Technology was asked to trial this commercial proposal.
- Nissan: At time of initial project development, Nissan was the only EV manufacturer with EVs available for general sale in the UK. In addition, Nissan is a strong voice behind the drive for installation of `Fast Charge Points' to be installed across Europe. They also bring the expertise of the Zero Emission Centre of Excellence to the Project.
- De Montfort University: Awarded their role following a successful, competitive tender process.
- University of Manchester: Awarded their role following a successful, competitive tender process.
- Independent Project evaluator: to be awarded via competitive tender.
- Automotive Communications: Unmatched equivalent expertise or experience in EV utilisation and proliferation.
- Fleetdrive Electric: Introduced to EA Technology by SSE as an organisation that could help in structuring and managing the lease contracts associated with deploying the vehicles.
- Charge Your Car: Previous experience through the Plugged In Places projects, would avoid unnecessarily reinventing any activity that has already been done elsewhere in the UK.
- Northern Powergrid: Approached by EA Technology and SSE owing to their geographic location associated with Nissan's Sunderland plant and its staff.

4.3 Generates knowledge that can be shared amongst DNOs

Two distinct elements of the project generate knowledge which can usefully be shared amongst all the DNOs to the benefit of the industry as a whole:

1. Commercial innovation

Successful partnership between SSEPD and a non-DNO third party creates an opportunity to generate a framework for contractual relationships of this nature. Deployment of this framework will facilitate future partnership-working between DNOs and non-DNO third parties by streamlining the process. That is, by providing a format and check list to organise the work, such as identifying in advance the key success criteria; potential risks and mitigating actions; essential processes and protocols; cultural issues, knowledge and skills gaps to be addressed. This framework will ensure that the advantages of third party commercial flexibility, delivery in tight timescales and innovation can be effectively married with the DNO experience and stability of supply. Sponsorship from a DNO ensures that the technology is practical and will be used as 'business as usual'.

4: Evaluation Criteria contd.

Utilising the additional capacity and capitalising on potential increased flexibility offered by partnerships with third parties will increase the scope for accessing the LCN Funding and enable more or larger scale energy-related projects to be delivered within the remaining timeframe of the LCN Fund. This can be continued for gas and electricity-related projects within the remit of the future Network Innovation Competition from 2015 onwards. This will allow commercial flexibility and innovation to be applied without risk to energy supply, while meeting LCN Fund requirements.

2. Technical innovation

Trialling the technology over a statistically significant number of participants and period will provide learning that will benefit all DNOs and related industry practitioners. This knowledge will include but is not limited to:

- Customer behaviours and attitudes i.e. current driving habits and how EV usage may change these, the extent to which customers are/are not willing to make lifestyle adjustments
- Charging habits and the impact on the network with greater EV usage
- The impact that usage of the Technology will have in reducing the load on the network
- How much available network headroom will be released through use of the Technology
- Cost savings to DNOs as a result of the Technology negating the requirement for network upgrades and the collateral impact on energy service companies and retail companies
- Time and materials required for installation

Learning from this project will also be relevant to and disseminated amongst other stakeholders including current and future EV manufacturers, EV charger manufacturers, local authorities and government policy makers, as well as the general car buying and car using public.

4.4 Involvement of other partners and external funding

EA Technology has worked with SSE to pool experience and contacts to attract the right partners for the project. The potential project has been discussed with delegates at EV conferences and seminars:

- Contacts in the EV industry have been established through SSEPD's other LCNF projects A communications director with a track record in promoting LCT and particularly low carbon vehicles has been recruited.
- Identifying possible locations for the first clusters via various routes and contacting the relevant DNOs (letter of support from Northern Powergrid in Appendix K).
- Circulating invitations to tender to universities and other candidate organisations.
- Discussing the projects with relevant government agencies e.g. DECC, BIS and DfT through the Office for Low Emission Vehicles (OLEV) (letter in Appendix K).

Through this process, ideas for finding clusters, deploying EVs at a low cost, analysing the technical results and engaging with customers have been received. These have been distilled into the project by considering:

- How they may help attract customer participation and make the project practical
- How they may reduce the risks to the project
- How they may enhance the rigour of the analysis and results
- How they enhance the learning and value of the project

It is important to note, that given a non-DNO organisation that is developing technology is delivering the project, the independent analysis from third parties is vital to ensure the results are independent and rigorous.

4: Evaluation Criteria contd.

Partners Involvement to date and contributions

Further to the partner selections identified on page 21, SSEPD is the project sponsor with EA Technology delivering the project. The following partners and support have been recruited:

Nissan: EV manufacturer and charging point manufacturer - will provide in kind support via a subsidised rental programme to trial participants, use of Nissan's EV ambassadors to engage trial participants, and will facilitate provision of free chargers to customers for the trials through the Plugged in Places programme and Chargemaster, in eligible areas (London East of England and Milton Keynes). Subsidised chargers and installation will be provided in the North East through Charge Your Car. Access to and use of Nissan's Zero Emissions Centre of Excellence will be made available to the project.
In kind value: £1,970,000

Charge Your Car North Ltd: EV infrastructure - will support in identifying clusters, use their EV infrastructure and media contacts in the North East as a means of engaging clusters, will deploy their EV sector and EV infrastructure knowledge and expertise on the project.
In kind value: £30,000

Northern Powergrid: DNO - agreed to support EV trials through the CLNR project - Northern Powergrid will supply access to substations and demographic information to support identification of trials participants / clusters.

Fleetdrive Electric: EV lease hire company - will supply EVs at subsidised lease hire rates to the project and will give use of their extensive database of EV drivers to the project to support in identifying clusters.
In kind value: £97,000

Automotive Comms: Low carbon vehicle sector communications expert - customer engagement and communications director. Already made contact with interested parties to ascertain interest in clusters.

De Monfort University: Socio-economic modelling, tender award subject to LCNF project approval.

University of Manchester: Independent network modelling and technical evaluation -tender to be awarded.

Academic partner: Independent project evaluation - tender to be awarded.

Blah d Blah Ltd: (EA Technology's creative communications agency) Project Dissemination, quotation received.

EA Technology: Programme manager and technology developer - EA Technology will contribute circa £636,000 in development, administration and communication costs.

4: Evaluation Criteria contd.

4.5 Relevance and Timing

The Department of Energy and Climate Change provides predictions of the growth of EV ownership across the UK to 2030 (page 22 in the Smart Grid Forum's Work Stream 3 report to the Electricity Networks Association). It shows that if fast charging is possible, that by 2023 (only 10 years after the start of the project) there could be between 1 and 3 million EVs on the road. Charging is a key factor in take up; allowing charging drawing up to 7-8kW at home will encourage low carbon vehicles. The Technology facilitates the installation of such chargers in a cost effective manner. Other forecasts and drivers align with this prediction - see section 3.

Nissan, Vauxhall, Peugeot, Renault, Mitsubishi and Citroen are launching EVs or plug in hybrids from 2013. The Society of Motor Manufacturers and Traders report that manufacturers expect plug-in vehicle uptake within the range 3-10% in 2020-2025, depending on the infrastructure and supportive measures.

The UK Government's Carbon Plan shows the forecast reductions in transport emissions to 2027, and expects 40% of vehicles sold by 2030 to be battery, battery with a range extender, or plug-in hybrid. Such an increase in EVs will require cost effective measures such as the Technology to manage the increased demand on the local distribution networks.

The development of EV charging infrastructure is nascent in GB, however the national roll-out of a UK-wide EV infrastructure programme has recently been announced through Elektromotive Limited, Europe's leading provider of electric vehicle (EV) charge points, and Charge Your Car. The aim is to create the UK's largest pay-as-you-go, `open source' network of public access charging stations for EVs, based upon the development of its proven pay-by-phone technology. The goal is to create a recharging network with 10,000 public access pay-as-you-go charge points located across the UK. This will encourage the purchase of EVs and the demand for home charging.

The project has confirmed engagement with Nissan, who aim to put the UK on the low vehicle emissions map. This is a critical partnership that will enable the project to supply EVs to trial participants. Nissan's support for the I^2EV in itself demonstrates that this is a timely and relevant project to benefit customers and to future proof the distribution network against prohibitively costly reinforcement measures.

[Partner confidential information removed.]

Nissan's forecasts provide supporting evidence on the rate of EV sector growth over the coming decade, and illustrate why delivering the I^2EV project over the period 2013 - 2015 is key in future proofing the GB distribution network by potentially offering a lower cost (to traditional reinforcement methods) of managing the network to deal with increased load due to increased numbers of EVs.

The graphs on page 28 illustrate the GB uptake scenarios for EVs, as forecast by the Department of Energy and Climate Change (DECC); around 1.7 million EVs are expected to be on UK roads by 2020, with over 10 million by 2030. The Nissan forecast figures corroborate this uptake scenario, as illustrated in the 'Nissan predictions for GB EVs - total and market share' graph on page 28.

See also Appendix J for Nissan EV sector growth forecast figures, compared with GB EV sector growth uptake projections.

The interest from cluster groups from initial contacts show that there is an appetite for EVs from the public that the Technology will help to nurture. The description below shows the potential sites already identified, even before customer engagement within the project has begun. Even if not all of these are possible, it demonstrates that with the number of candidate communities that can be contacted, it is likely that 10 will come to fruition.

4: Evaluation Criteria contd.

Furthermore, we have been approached, independently, by people volunteering to participate in the project, without any publicity or active recruiting being undertaken at this time.

Locations of potential clusters:

- In SSE licence areas:
  - Hyde, New Forest
  - Thames Valley Vision area
  - North of Scotland
  - Medstead, Basingstoke
  - Bramley, Hampshire
  - Reading, Berkshire
- In NPG licence areas:
  - Leeds
  - Sunderland
- Other, out of area, options:
  - Bristol
  - Whitchurch, Shropshire
  - Mold, North East Wales
  - Capenhurst, Nr Chester

All project partners are engaged and are in a position to commence work on the project in January 2013, pending project approval.

It is thought that if the Technology performs successfully, that it should be incorporated into business as usual working practices without significant training. Within SSE or other DNOs planning guidance would need to include use of the Technology either as standard when EV charging points are installed or as a solution to potential overloads. However, to ensure widespread roll out is possible, either receivers must be installed in homes or incorporated in to chargers. This may require changes to Engineering Recommendations (ERs) or similar. This project will provide the information and data for changes in ERs as well as internal working practices.

The regulation of the distribution network operators is in the process of being revised (RIIO-ED1) and this project demonstrates new ways of working and the involvement of third parties that could be incorporated.

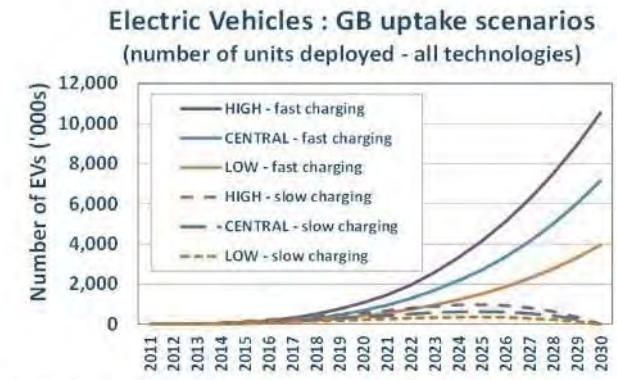
Project Code/Version No SSET205

4: Evaluation Criteria contd.

Project Code/Version No SSET205

4: Evaluation Criteria contd.

4: Evaluation Criteria images, charts and tables.



GB uptake scenarios for different forms of carbon technology (Source DECC, WS 1)

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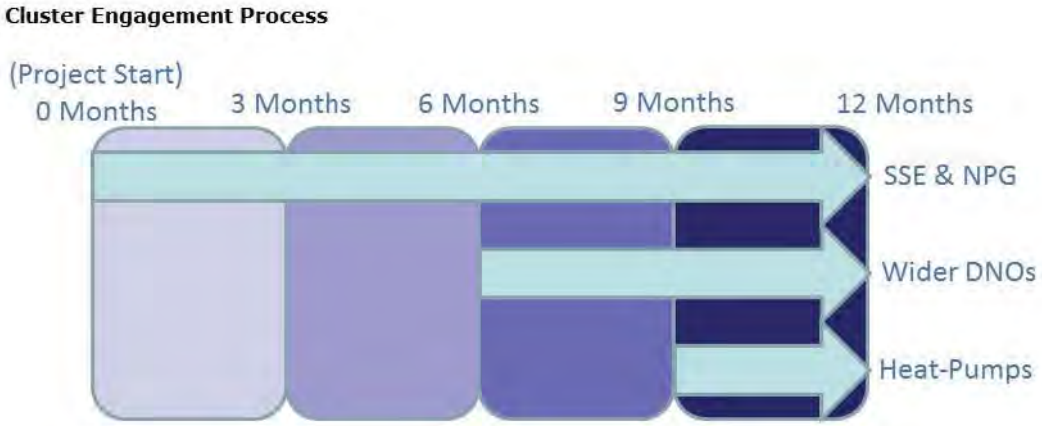
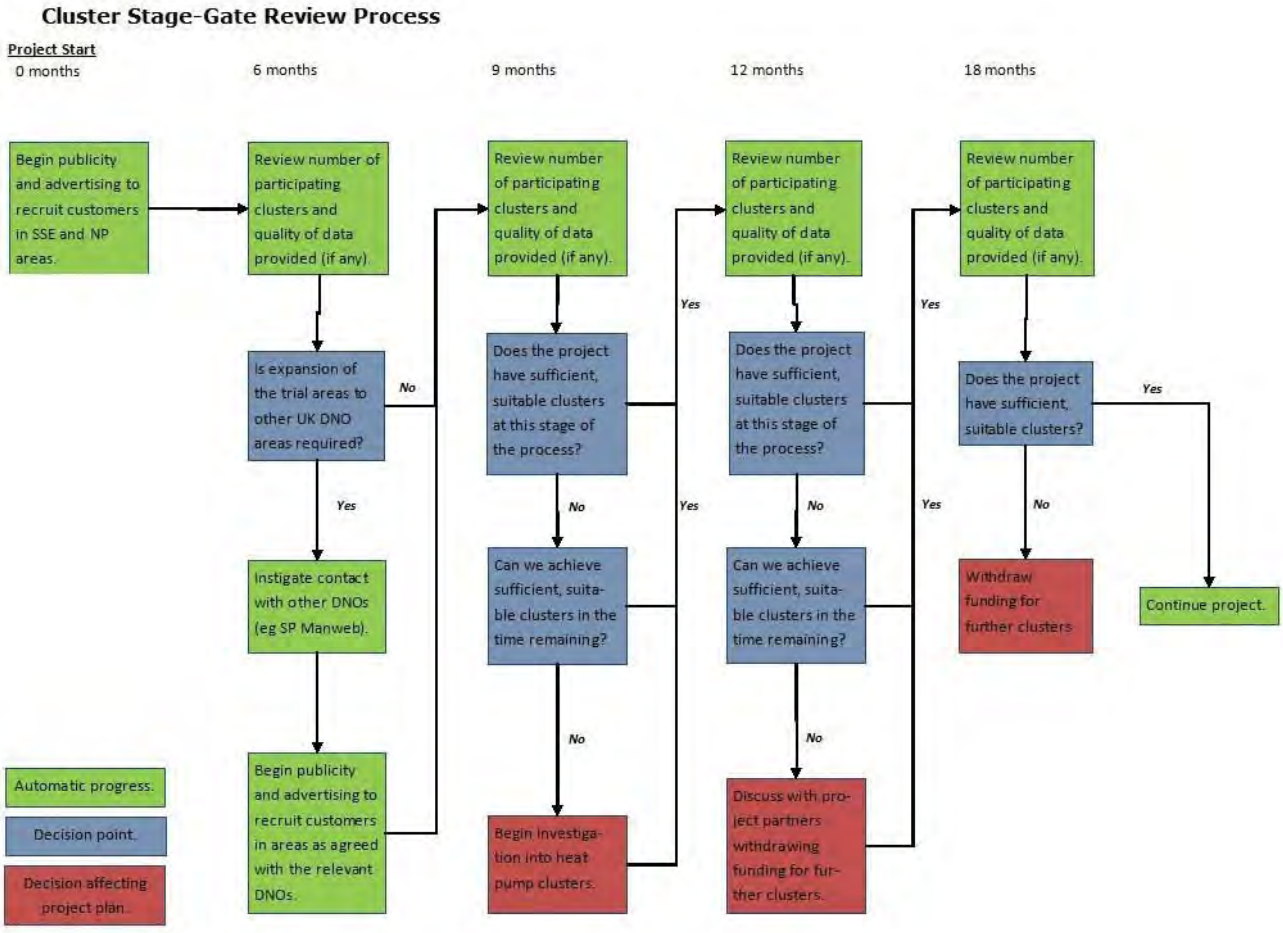




Evaluation Criteria Images

Section 5: Knowledge dissemination

☐ Put a cross in the box if the DNO does not intend to conform to the default IPR requirements

5.1 Learning dissemination

The I²EV project is unique in that although it has a transport focus, and deals with one particular customer behaviour; the learning has a wide impact and is of interest to a wide general audience including all vehicle owners and users, as well as DNOs. The learning dissemination will differentiate the project from other LCN Fund projects, as the learning will be actively disseminated not only to the DNOs and related interested parties, but to the general public as well.

This dissemination will take place through a variety of media, as detailed in the communications plan to be developed under the project. The depth of communication will be phased across the lifetime of the project. There will be significant communication across a wide range of media at the outset of the project to raise general awareness across a wide spectrum of stakeholders and to facilitate the recruitment of trial participants. As the project progresses, steady but lower weight communication will continue to maintain interest and communicate progress. Communication will be accelerated to Government at the end of the project, notionally through a Parliamentary exhibition and reception, to disseminate the learning outcomes across all relevant stakeholders.

A customer engagement plan will be drawn up at the start of Task 2 and will be agreed with Ofgem. An illustrative guide of dissemination methods under consideration is located in Appendix M, the contents of which will be refined into the Communications Plan for the project. Its purpose will be to inform and enthuse people about the trials and ultimately engage them as trial participants. These participants will fall into separate user groups to allow us to study two distinct facets of the trials:

Social trials: Socio-economic impact of EV usage and deployment of the Technology. This category of individual users can be more geographically widespread, and therefore customer engagement activities will focus on communicating with fleet EV users within large commercial organisations and individuals via Nissan and Charge Your Car.

Technical trials (the Technology): This will require clusters of residents whose households can be served by a single feeder. Customer engagement activities will therefore focus on approaching domestic users within specific geographic catchment areas.

Each user group will be communicated with using a variety of media deemed to be the most appropriate to reach and engage them. This is likely to include the use of social media, industrial media and forums, community networks, local authorities, national and local press and radio, targeted mailshots and door-drops. This communication campaign will be overseen and directed by a dedicated specialist communications team member to ensure maximum effectiveness. The customer engagement plan will be supported by a robust data protection strategy (see outline in Appendix L), that will ensure that customers' privacy is protected at all times.

General information

It is important that, in addition to disseminating the specific learning outcomes, general information about the project is shared with as wide a range as possible of stakeholders throughout the course of the project. This will use a variety of communications techniques to make the information accessible for each respective audience throughout the course of the project. These techniques will aim to be appropriate for multiple audiences so that communication is as effective and cost-efficient as possible and will include but not limited to:

- A dedicated I2EV website which will act as a shop window for the trials with separate public and private sections intended for general and specialist audience
    - Social media channels sharing the latest news and allowing direct two-way communication with trial participants
    - Industrial media and forums
    - National and local media coverage including press and radio
    - Printed and electronic documents including papers, newsletters and leaflets conveying information appropriate for either general or specialist audiences

5: Knowledge dissemination contd.

Particular Knowledge dissemination

The project will also generate three particular areas of knowledge which can be shared to benefit a range of stakeholders. It is intended to communicate these particular areas of knowledge as follows:

(1) Commercial innovation

Information: This successful partnership between SSE and non-DNO third party creates the opportunity to generate a standard framework for contractual working arrangements between a DNO and non-DNO third party deliverer including elements such as key success criteria, examples of best practice, requirements (legal, operational, knowledge) for each party, appropriate timeframes, etc. Utilising partnership-working rather than a DNO-led approach can be applied across other energy-related projects under the remit of the LCN Fund and the future Network Innovation Fund format.

It has the benefit of tapping into the additional capacity, commercial flexibility and external innovation of a third party organisation while still meeting the LCN Fund requirements of DNO involvement.

Audience: The findings and potential blueprint framework for a successful contractual working arrangement will be shared with Ofgem, other DNOs, as well as any other third party organisations likely to be able to lead-manage a similar energy-related project.

Formats: As well as publicising the outcomes through a variety of relevant communications channels including the national and trade press, we propose to make available skeleton contractual documents on the dedicated I^2EV project website and publish a full written report on the learning outcomes to be shared with the relevant stakeholders. We also propose to hold a specific session sharing the learning within LCNF workshops and to offer both on- and off-line training sessions on successful partnership working.

(2) Technical innovation

Information: Trialling the Technology over a statistically significant number of participants and period will provide learning that will benefit all DNOs and related industry practitioners. This knowledge will include, but not be limited to:

- The impact of the Technology on the network, how much the load can be shifted, what cost savings may be made, how much additional capacity is created when and where;
- The success of the use of the power line carrier;
- What issues for the control of EV charging may arise from the customer, manufacturer and network perspective;
- The outcome of the project validation

Audience: This learning will be of interest to Ofgem and will benefit all DNOs and related industry practitioners such as manufacturers of EVs and EV chargers, as well as other stakeholders including local authorities and government policy makers, interest groups and housing developers. The outcomes will therefore be shared using a range of communication techniques that are appropriate for the specific audience.

Formats: We will publish the high-level outcomes on the dedicated I^2EV project website, and share specific highlights on social media channels, as well as utilising the national trade press to communicate with the relevant stakeholders as widely as possible. We propose to publish a formal written report of the learning outcomes and will share the results with other industry practitioners by holding a specific session within the LCNF workshops and across other industry events and seminars to reach a wider audience.

5: Knowledge dissemination contd.

(3) Socio-economic learning

Information: It is anticipated that the project will result in learning significant details about customer EV driving habits and how these change over the duration of the trials, the trial participants' degree of openness to change, and how they respond to the Technology itself. Additionally, there may be other, hitherto unforeseen areas of learning about customer behaviour that may arise.

Audience: We anticipate this area of new knowledge being relevant to a particularly wide range of stakeholders including, amongst others Ofgem, the DNOs, other energy industry practitioners, manufacturers of both EVs and standard cars, manufacturers of EV chargers, national government policy makers and local government authorities, special interest and trade groups, academia and the public.

Formats: Given the wide range of stakeholders for communication, a variety of media will be used to ensure the relevant information is disseminated effectively. As well as wide-ranging media coverage on a national and trade basis, we will, amongst other communications activities, include the high-level outcomes on the dedicated I²EV website, feature the highlights on social media channels, publish a full written report on the learning outcomes and hold a session within LCNF workshops for industry stakeholders and other workshops where appropriate to reach a wider audience.

This multi-layered, multi-media approach will be the most efficient and cost-effective method of disseminating information to the various interested parties in the most accessible way. These multiple contact points will reinforce the learning outcomes rather than relying on one single source to reach each stakeholder and will allow us to engage with each at an expert or general level as appropriate to them. It also provides the opportunity to inform policy and decision-makers in relevant areas of national and local government, manufacturing, energy transmission, distribution and retail, to the benefit of all in developing new low carbon technologies.

5.2 IPR

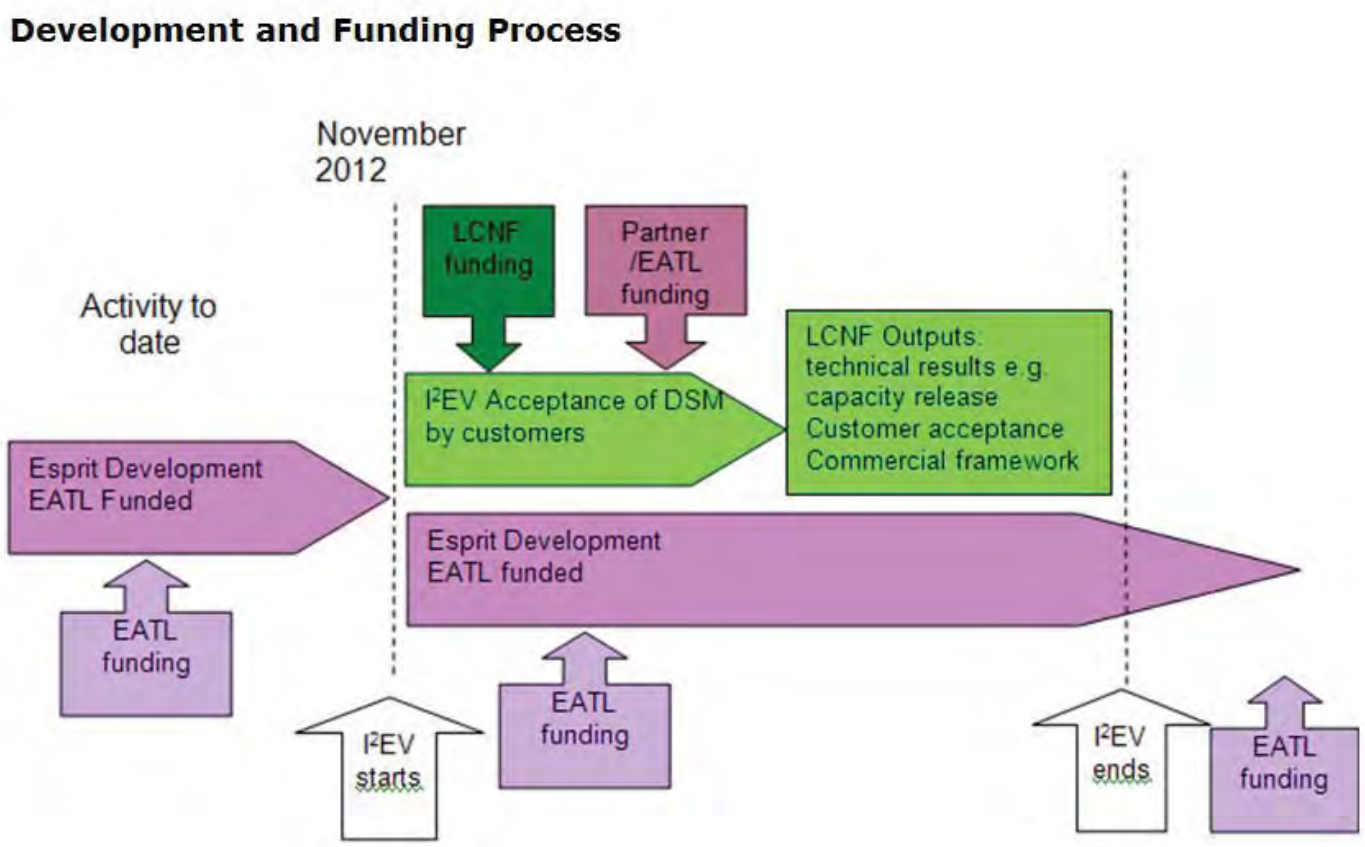
Throughout the duration of the I²EV project, two streams of IP will be developed in relation to the Esprit Technology. It should be noted at this stage that the invention, research and development of the Esprit Technology to date has been undertaken solely by EA Technology, at our own expense without technical input or funding from the LCN Fund or other parties. As such, all IP relating to the Esprit Technology, generated before the I²EV project starts is wholly owned, and will continue to be owned, by EA Technology. The two streams of learning, and hence IP, related to the Esprit Technology are as follows:

1. Technical Applicability: The relevant foreground IP relating to the use of the Esprit (or equivalent) Technology on the UK network, including perceived and actual impacts to end consumers, operation of connected devices such as EVs and Heat-Pumps, and data transmission problems on specific local networks will be provided to all project partners, the LCNF and GB Licence Holders in line with the default LCNF IP Terms. This is due to the LCNF funding all elements mentioned above as part of the I²EV Project and hence owning the relevant Foreground IP.
2. Technical Development: The IP relating to further research, development and technical improvements to the Technology will be undertaken, (as is underway at present), by EA Technology, at its own cost. As such, IP generated in relation to the technical improvements (e.g. development of algorithms to improve efficiencies) will not be made available beyond the limited `non-exclusive licence' to the relevant background IPR to other participants (reference SSES004).

   In summary, the learning results following the addition of Esprit (or equivalent) technology to the network will be disseminated to all parties, but the internal workings of the Esprit Technology, how it operates both now, and following any future improvements, will remain the IP of EA Technology. This was clarified at the Expert Panel Session on 26-09-2012 with the separation of the streams and associated funding is depicted on page 32.

   With respect to IP surrounding the Commercial Arrangements, this will be owned by SSE and shared with GB Licence Holders in line with the default LCNF IP terms.

5: Knowledge dissemination images, charts and tables.



Knowledge dissemination images

Section 6: Project readiness

Requested level of protection require against cost over-runs (%).	0%
Requested level of protection against Direct Benefits that they wish to apply for (%).	0%

6.1 Why the project can start in a timely manner

Governance: SSEPD and EA Technology through their engagement on the New Thames Valley Vision (NTVV) project already have a set of LCNF governance compliant terms and conditions agreed. These can be used as a foundation for I²EV enabling a swift lead into addressing the unique commercial set up of this work.

SSEPD will retain their prime contractor position as DNO, solely to maintain administrative compliance with current governance. As such, SSEPD will maintain the bank account containing I²EV funding but as part of the commercial innovation, the acceptance of subcontractor deliverables and subsequent payment to such organisations shall be managed by EA Technology. The responsibility for delivery of the I²EV project shall reside with EA Technology which will be reflected in a pass through statement of work that SSEPD shall flow to EA Technology. For the purposes of the Project, SSEPD will then be another subcontractor who will feed input up through to EA Technology. Please see flow charts on page 17 contrasting the commercial structure proposed for I²EV with the current commercial structure.

As LCN Fund governance requires, SSEPD will cover 10% of the overall project costs to the LCN Fund, (to be reclaimed upon achievement of the Successful Delivery Reward Criteria). As a measure of confidence in the project and to share the balance of risk, EA Technology and SSEPD will establish a contract whereby the cost and therefore the risk is shared under independent agreement. In the case of the I²EV project, this balance is agreed at a ratio of 25% EA Technology (as an SME the financial risk is inherently greater on balance), and 75% SSEPD. These ratios would be expected to flex on future projects under this novel delivery framework, to recognise the commensurate size and nature of the parties involved.

Key appointments: The project team at EA Technology is ready to start project delivery in January 2013. The communications and dissemination team is in place through Automotive Comms, a low carbon vehicle sector specialist and communications expert with specific experience in recruiting trial participants for EV trials, and Blah d Blah design and communications company. De Montfort University has been engaged through a formal tendering process to conduct the socio-economic modelling work and the University of Manchester has been engaged through a formal tendering process to carry out the network modelling. The independent project evaluation will be awarded to a third party via a formal tendering process.

Project plan: A robust project plan has been developed to guide project task delivery (Appendix G) with stage gate reviews, monthly risk and project meetings, quarterly board meetings and monthly communications meetings. This is a living document that will be continually updated as the project progresses.

Customer engagement plan: This will form part of an over-arching communications plan. An outline of what will be included is in section 5.

Data protection strategy: The full data protection strategy will be developed in the first quarter of 2013; an outline of what will be included is in Appendix L.

Partner engagement: Key partners have been engaged pre-project, to enable effective delivery to start promptly in January 2013. Nissan has committed to the project and will supply EVs and support with trial participant engagement and charging point infrastructure supply and installation. Fleetdrive Electric, an EV lease hire company, has committed themselves to the project to manage the subsidised lease deal brokered with Nissan and support with delivery and maintenance of the EVs. Charge Your Car North is engaged and will provide access to EV drivers in the North East, providing a valuable link to Northern Powergrid and the Customer-Led Network Revolution project. Northern Powergrid is a partner to the I²EV project, demonstrating cross-DNO working and an innovative joint delivery approach to LCN Funded projects. All partners cited have provided letters of support for the project.

6: Project readiness contd.

Trial progress: The project has already informally embarked upon identifying and engaging with EV users and clusters of trial participants. Through Charge Your Car North and Nissan's involvement in the project, we have direct access to 200 EV drivers in the North East for socio-economic modelling purposes. Through early engagement with Bracknell Forest Council, we have access to the New Thames Valley Vision's Consumer Consortium and major blue chip companies who are a target audience for EV fleet hire purposes. Clusters of trial participants have been actively engaged in Hyde, New Forest and Leeds (letters of support from clusters are in Appendix K). Local authorities and government agencies have given `in principle' support to finding clusters. Informal contacts indicate a willingness to participate and two unsolicited requests to participate have also been received. A map of the UK, detailing the DNO areas and an indicative spread of the potential clusters is located on page 40.

6.2 How the costs and estimates have been estimated

A breakdown of the costs are given below. Phasing over the years is estimated from the likelihood of when clusters will be established and therefore when data will be available.

The cost of each task has been budgeted by estimating the days for EA Technology and partners time and the materials, travel and accommodation required. Where possible fixed price contracts have been arranged. The contingencies were calculated by multiplying the costs for mitigating the risk by the probability of the risk occurring. The breakdown of costs per task is as follows. Please note that all costs are in gross real terms (i.e. the partner / customer contribution(s) have not been shown, and the figures are un-inflated):

Novel commercial agreement	**£211k**
Initial background - evaluation of initial trial	**£24k**
Customer engagement	**£194k**
Integration of the Technology with charging points	**£357k**
Establishment of Customer / Cluster trials	**£5,545k**
Monitoring the trials	**£122k**
Trial participant interviews	**£177k**
Network Modelling	**£199k**
Independent Project Evaluation	**£150k**
Consultation with EV manufacturers - cycle times	**£30k**
Project recommendations and implementation	**£264k**
Dissemination	**£322k**
Programme Management	**£848k**
Project Contingency	**£395k**

The calculation methods for the benefits are given in sections 3 and 4.

The costs overview is in Appendix A2; all prices are expressed in 2012 real terms. Please see full cost spreadsheet delivered as part of the full bid submission for further information and detailed costing. For the avoidance of doubt, all costs in the cost spreadsheet are provided in nominal terms.

EA Technology has requested a contingency of £400k (nominal terms) against the funding request of £4.137m. This equates to 9.7% of the LCNF request. The scale of this contingency request is a function of the size of EA Technology. In FY12 EA Technology's revenue was £22m (a record for the organisation since being employee-owned in 2004), so this scale of project and level of risk involved is significant against the size of the organisation. The contingency has been developed bottom-up against each of the identified risks, as shown in Appendix H, and will be managed as part of the project governance as the project is deployed.

Clearly, there is an intention that contingency funds will not be needed - any unspent monies would be provided back to customers at the end of the project. The exact nature of this financial transaction will need to be agreed as part of the commercial discussions under Stage 0.

To ensure value for money, funds to install and monitor clusters will only be released once a cluster is signed up. There is an 18 month window for agreeing the establishment of a cluster after which the unallocated funds will be withdrawn. The amount that could be returned will be a proportion of a work-stream 4.5, 4.6,4.7,4.8,5.1 5.3 and 11.1. The proportion will depend on the number of clusters established, their type and locations. The maximum amount of LCN funding if no clusters were established would be approximately £1.75 million, (up to 40% of total requested funding).

6: Project readiness contd.

6.3 Measures to minimise possibility of cost overruns or shortfalls in direct benefits

The following are used to minimise cost over runs:

Project management

Project management will utilise a monthly report to maintain progress against time and budget, identifying problems for each party as early as possible, detailing tasks where appropriate in relation to:

- Schedule
- Budget
- Milestones achieved
- Activities in the next month
- Risks / issues / mitigation / contingency
- Lessons learned
- Actions required of others

The reports will allow a comparison of spend against budget, identification of any problems or risks anticipated in next few months and mitigating actions. This will aim to identify any areas that are likely to go over budget and allow time to take mitigating action. The Gantt chart will be updated each month to track progress and a monthly project team meeting will be held face to face or by phone. This will aid identifying any short fall in resources as soon as possible. Formal meetings with SSEPD management will be held on a six monthly basis.

The breakpoints in the project plan will minimise unnecessary expenditure as the project can be reduced in scope or halted.

EA Technology will allocate a project manager and project director. If problems cannot be solved on a day to day basis they will be escalated accordingly.

There will be one I^2EV programme manager at EA Technology to coordinate different parties involved. This will:

- Prevent duplication of work
- Help coordinate tasks
- Identify factors in different tasks that together may cause budget overspend and take mitigating action

An EA Technology resource will be located part-time at SSEPD's Reading office. This will provide a direct link between the two contracting parties and facilitate project delivery, as well as acting as a link for the trial programme and SSEPD commitment around practical delivery e.g. installation of monitoring equipment at substations.

An initial project risk register (Appendix H) has been prepared, and this will be maintained following bid submission. Risk mitigation has been agreed with SSEPD. The responsibility of the safe running of the distribution network resides with SSE but project risks are the responsibility of EA Technology. There is therefore an overlap between the two roles and a clear interface is needed.

To ensure that all risks due to the project are acceptable and well managed, for each action on the network EA Technology will:

- Provide the method statements from the contractor.
- List potential risks.
- List how the risks will be mitigated.
- Allocate contingency to risks and mitigation where appropriate.

SSE will:

- Confirm that the method statement is in accordance with their policies and procedures.
- Confirm that the contractor is authorised and/or supervised as appropriate
- That the risk and mitigation is acceptable.
- They give permission for the work to be carried out.
- They take on the residual risk.

This will be signed off by Stewart Reid, Future Networks and Policy.

The project does not envisage any direct benefits to the DNO, in that the clusters will be artificially created; the project is not targeting any areas of the network previously requiring reinforcement.

6: Project readiness contd.

6.4 Verification of all information in the proposal

The information in this proposal has been developed in conjunction with all project partners and has been subject to checks and analysis to ensure its validity. Contact details for all project partners and suppliers to the project are in Appendix E - project partner register and project supplier register tables.

Project partner profiles are in Appendix I.

On-site proving trial of the Technology in advance of I²EV project commencement

Carrying out an initial, small-scale trial before the start of the Tier 2 project will help streamline installation, allowing any problems with the technology to be solved. Using a PLC system that has already been trialled on SSEPD's network and has demonstrated its performance and practicality for use on the UK LV system reduces the risk of delays from problems with the PLC. The company providing the PLC has also already demonstrated their good service and proactive attitude to solving any issues.

Verification

Costs

SEPD and Northern Powergrid's costs

The costs to SEPD and Northern Powergrid were estimated by SSE and EA Technology by breaking down their role in the project, days and personnel required. DNO involvement is lower than previous projects given EA Technology's lead role.

SSEC's costs

Installation of the equipment in substations must be carried out by authorised staff. SSEC were asked to quote for a `unit price' per substation as an estimate (as the locations are unknown and costs could vary). This was multiplied by 20 (the maximum number of clusters).

Modelling and evaluation contracts

The modelling and evaluation tasks were out to competitive tender. The invitation to tender for the socio-economic tasks was sent to:

[List of parties removed for confidential version.]

The invitation to tender for the network modelling tasks was sent to:

[List of parties removed for confidential version.]

The tenders were or will be marked by three members of staff against ability to meet the brief, experience and cost. De Montfort University won the tender for social-economic tasks and the University of Manchester won the network modelling. The independent evaluation invitation to tender will be offered again in October.

In kind Contributions

The costs to Fleet-drive, Charge your Car and Nissan were estimated by the respective companies.
- Fleetdrive Electric provided a breakdown of costs and their in-kind contribution.
- Nissan provided confirmation of subsidised vehicle hire and staff to promote the project.
- Charge your Car provided confirmation of the costs they would incur and those available in kind.

Subcontractors' costs

The activities for other partners were discussed and either day rates or quotes received from:
- Automotive Comms.
- ANDTR.
- Blah d Blah.
- SSEC (for network installations).

6: Project readiness contd.

EA Technology Costs

These were divided into three categories:

1. Consulting: Technical analysis and management. Consulting costs are based on day rates from experience of the time required for tasks and include travel and accommodation. Internal governance administration will be provided in kind.
2. Project management: Overall coordination. Project management costs are based on experience of other large projects and LCNF.
3. Technology development: Development of the solution. EA Technology will provide the technology development costs in kind, this includes also some of the publicity costs.

Capital costs

Charge Your Car, Nissan, ANDTr and Fleetdrive provided information on the costs of charging points, leasing and installation.
Costs for monitoring and downloading data were estimated by EA Technology from experience on other projects.

Other Data

Data on the growth of the use of electric vehicles is based on the latest data from work within the Smart Grids Forum, Technology Strategy Board, Government's Carbon Plan and OLEV's Plug-In Vehicle Infrastructure Strategy. Technical information on charging points and electric vehicles were provided by the manufacturers.

6.5 How project would still deliver learning if take-up in trial area of low carbon technologies lower than anticipated

The Project plan demonstrates EA Technology's understanding of the magnitude of challenge in engaging with participants to use EVs as part of the I²EV trial; learning has been taken from the Customer-Led Network Revolution LCN Fund Tier 2 project, which has found customer engagement in trials to be a major challenge. In recognition of this learning, the I²EV project trials are broken down into two groups:

1. Social trials: Monitoring existing EV users and new EV users

2. Technical trials: Trialling the Technology with clusters of EV charging points

This approach will de-risk the project by limiting the cost to the customer and ensuring that the appetite for technical trial participation exists in the number and density of clusters needed to deliver a successful technical trial. Running concurrently with the technical trial will be the social trial programme, with the activity and learning, which is irrespective of take-up in technical trial areas (i.e. clusters):

- Evaluation of the initial on-site trial of the Technology by a University to improve the Technology and approach. This will identify any improvements or additions in the logic developed to date for the Technology equipment to enhance the design. This may be additional monitoring capability, means to change control parameters or user interface in terms of lights or other means to indicate availability for charging. It will also investigate the most flexible and practical CTs for monitoring and means to inject PLC signals to reduce interruptions to customers and installation time. The University will also carry out a literature survey of the estimates of the additional load that EVs will cause and the potential for load shifting. They will also survey work with respect to the additional load from heat pumps and potential for shifting heating load.
- A literature survey of existing knowledge of customer behaviour with regard to use of EV and acceptance of direct control of appliances will be carried out. This will highlight gaps in the knowledge and likely response and the best way to approach customers.
- Analysis of the data collected from the social trials including driving habits compared to location and demographics. This will be compared with data from the literature survey.

6: Project readiness contd.

6.6 Processes in place to identify circumstances where the most appropriate course of action will be to suspend the project, pending permission from Ofgem that it can be halted

As well as the stage gate release of funds for clusters, breakpoints will be key times when the viability of the project will be reviewed and if necessary, the scope can be reduced or the project closed. The project plan is in Appendix G.

Risk identification will be the responsibility of all partners to the project. Changes and additional risks will be managed by the project manager and reviewed on a monthly basis. Should any risk materialise and be insurmountable or become too great, then the project will be reviewed and possibly closed.

Project Code/Version No SSET205

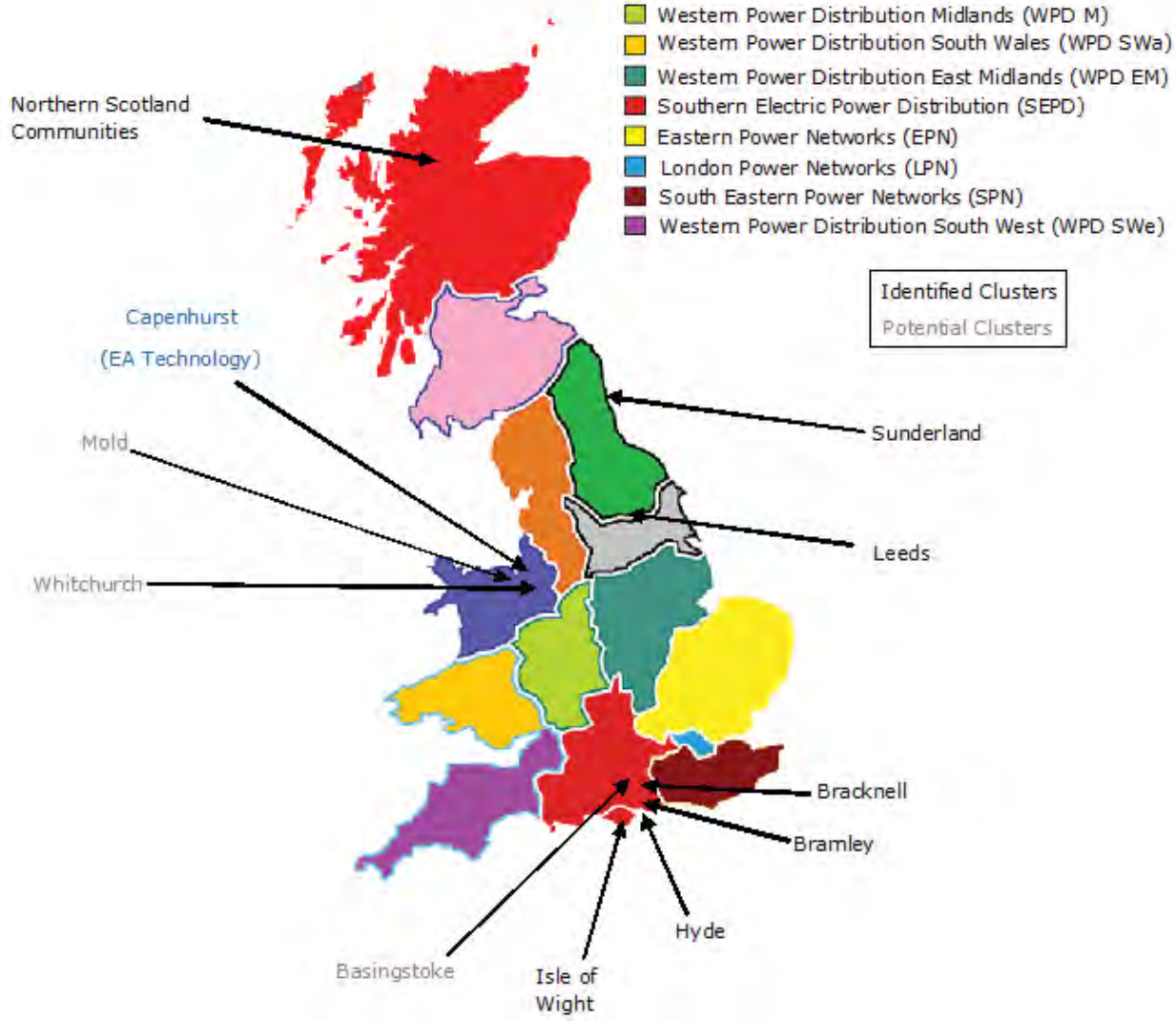
6: Project readiness contd.

6: Project readiness images

I²EV Partners

I²EV Suppliers

DNO Map Detailing Identified and Potential Cluster Trial Locations



Project readiness Images

Section 7: Regulatory issues

☐ Put a cross in the box if the Project may require any derogations, consents or changes to the regulatory arrangements.

The project will provide the DNO direct control over an element of the customer's supply, limiting a circuit under certain circumstances. This is different to most previous load control methods as the control does not go through a third party of a supplier or aggregator who has a contract with the customer. It should be noted that the ability to limit the supply only applies to the significant load on a separate circuit, specific to the trials of EVs, and does not apply to the rest of the household supply. The supply is not de-energised.

Currently, the only direct control of appliances is switching storage heaters by Teleswitching Agreement. This is controlled by the suppliers and operated by DNOs on their behalf. However, SSE does control teleswitching to maintain the power system and has initiated load management areas in locations where changing switching times could overload the network. (Southern Electric Power Distribution PLC, Miscellaneous Charging Services Statement, Effective from April 2012 http://www.ssepd.co.uk/uploadedFiles/Controls/Lists/Resources/SEPD_2012_-_2013_Charging_statements/SEPD_MiscellaneousServicesStatementApril2012.pdf). This is a precedent for SSE developing direct control of Electric Vehicles charging points to maintain the power system.

The two contractual agreements that may be affected by the DNO having direct control is the Distribution Connection and Use of System Agreement (DCUSA) and the Distribution Code.

The DCUSA states that a supply must be informed of any change or variation from the standard Connection Terms that will affect use of system charges, but direct control will not affect these charges (page 121).

On p121 in the DCUSA, there is an obligation on the DNO to convey electricity to each Exit point subject to agreements made by the connectees and the DNO. Therefore non-standard arrangements are allowable.

Within DCUSA the National Connection terms on p264 states that:

"Network constraints. Our obligations [the DNO] under this agreement are subject to the maximum capacity and any other design feature of the connection. You must contact us in advance if you propose to make any significant change to the connection or to the electric lines or electrical equipment at the premises, or if you propose to do anything else that could affect our network or if you require alterations to the connection."

Installation of an Electric Vehicle charger that is capable of delivering 7-9kW of power could be regarded as a significant change. This is also stipulated in DPC 5.2.1 on page 49 of the distribution code:

"Where required by the DNO in order to ensure control of the DNO's Distribution System, communications between Users and the DNO shall be established in accordance with the following. Users shall provide and maintain those parts of the communications equipment within their location. Provision of any necessary communications requirements shall be in accordance with the Connection Agreement for a specific connection."

DCUSA also makes provision (on p266) to agree other connection terms:

"Agreeing other connection terms. You and we may each, at any time, ask the other to enter into an alternative connection agreement in respect of the connection if you or we believe an alternative agreement is needed because of the nature of the connection."

On page 371, DCUSA provides the right of DNOs to designate Load Management Areas to control the switching of loads to prevent coincident switching over loading the network. However, it is unclear whether the switching must be carried out by the suppliers.

DPC 5.3.2 provides for the DNO to agree methods to minimise the impact of disturbing loads. An EV charger could be regarded as a disturbing load.

DPC 6.7.1 provides for communications to be established between the customer and the DNO where it is required for the control of the network and included in a connection agreement.

DPC 6.7.4 stipulates that the communications required within the customer's premises should be maintained by the customer. In the Technology's case, the maintenance is minimal.

7: Regulatory issues contd.

Conclusion

It would be appropriate to agree a temporary change to the connection agreement with the customer to cover the direct control of the EV charger. This does not require a derogation from the regulations.

7: Regulatory issues images, charts and tables

Regulatory issues images

Regulatory issues images

Section 8: Customer impacts

Customer awareness and understanding

Paul Clarke (Automotive Comms) will direct the communication and customer engagement aspects of this project. Paul has managed a communication consultancy for over 20 years specialising in the area of LCTs and is working with Camden Council on trialling EVs. In 2006 he founded the UK's original green car news website, Green-Car-Guide.com, and remains the editor. He also has a wide range of contacts and networks in the industry including all the major motor manufacturers; public sector bodies such as the Automotive Council, Cenex, EST (Energy Savings Trust), LowCVP (Low Carbon Vehicle Partnership), OLEV (Office for Low-Emission Vehicles), SMMT (Society for Motor Manufacturers and Traders); and other media. He thus has the expertise and contacts to communicate information, raise awareness and explain why the information gathered is required.

To ensure the widest demographic mix possible, the following channels/organizations will be used/ approached to help develop clusters:

- Mainstream media and Social media.
- Specialist EV media and forums.
- Charge Your Car initiatives.
- EV charging point companies.
- LAs (Local Authorities) that are highly motivated to encourage EVs.
- Green residential developments & cohousing, gated communities.
- Green newsletters, Low Carbon Communities Network.
- Informal contacts.
- Ambassadors via fleet EVs who may enlist neighbours.

8.1 Customers impacts in a learning outcome context

The learning outcomes to be delivered by the project are shown in Appendix C:

Commercial

Learning outcome C1: To what extent does a DNO enabling a third party delivery of innovation accelerate deployment?

The project will demonstrate the extent to which third party delivery of innovation projects could be more efficient than the projects being merely led by the host DNO. The savings will be via:

- Using the expertise in third party project management to tightly manage time and budget preventing project delays.
- Experience to date shows that DNOs are expert in project managing the maintenance and installation of assets but do not have a large pool of expertise in trialling and evaluating new technologies.
- Rather than seek to recruit new staff for this role, which is a time consuming process, the project seeks to demonstrate that third party management is more effective, as relevant knowledge and expertise is already utilised as part of business as usual activities.

By using a third party innovation provider rather than outsourcing task elements, it ensures that a company with a proven track-record for delivering effective, innovative projects is in overall control, improving efficiencies throughout the project.

Technical

Learning outcome T1: To what extent can DNO direct demand control facilitate the connection of low carbon technology?

Long term sustainability of the electricity network to the benefit of all customers, again regardless of EV or other low carbon technology (LCT) ownership, will be the result of successful trialling of the Technology, which will demonstrate how a DNO can use direct demand control to connect any LCT thus removing potential blockers to their uptake.

The learning outcomes are linked to the Successful Delivery Reward Criteria (SDRC) in section 9. The SDRC register and illustration of how they are mapped to the learning outcomes is in Appendix D.

8: Customer impacts contd.

Expedient delivery of the innovative technology to be trialled under I²EV, if successful, will future proof local distribution networks. Lights will stay on, household electrical appliances will continue to operate even at peak times of EV charging. This is a potentially beneficial customer impact of the Technology that is applicable to all electricity users, not just those that drive EVs.

8.2 Monitoring Existing EV owners (the social trials)

Monitoring the behaviour of existing EV owners: via Nissan and Charge Your Car and other bodies promoting EVs (e.g. local authorities), existing EV owners will be approached to see if they are willing to have their EV use and charging habits recorded. A brief explanation of the project and how the data will be used and its benefits will be provided.

Much of the information may be available via the charging units and permission to use the data is all that is required. In other cases a power monitor and GSM communications will be required. Customers will have to allow entry and installation to take place. However, this work will be inside the customers' premises and not on the DNO's network. This may require a brief disconnection of the circuit feeding the EV charger. Customers will also be asked to record their journey times and lengths and some socio-economic data on an anonymous basis.

The tariffs and contractual arrangements for supply of electricity with the customer will remain the same. Apart from some minor intrusion, the only other impact for the customer will be visibility of their charging habits. They may be able to identify a better tariff for their electricity use as a result. Much of this data will be made available through the Nissan employee LEAF hire scheme, managed by Charge Your Car.

Monitoring the behaviour of new EV users. Via Nissan and Fleetdrive Electric, fleet hire users will be approached through the New Thames Valley Consumer Consortium.

Customers who do not use an EV will benefit from additional knowledge about LV networks and avoidance of reinforcement costs. It will also prevent EV charging potential absorbing all the available headroom providing DNOs more flexibility in serving all their customers. Indirect benefits will be improved air quality and reduced carbon emission and traffic noise.

The regulation of the distribution industry uses a 'socialised cost' model in that customers are already required to cover the cost of supplying additional load (unless it is a `disturbing load'), The commercial and technical solution proposed should provide the lowest cost approach to managing the supply of additional load.

8.3 Clusters of EV Charging Points (the technical trials)

The project will recruit about 150 customers to lease an EV for 12-18 months. These will be approached via EV manufacturers (Nissan), Fleetdrive Electric and Charge your Car in collaboration with EA Technology. A full explanation of the project and how the data will be used and its benefits will be provided. Nissan will provide the use of their EV ambassadors to support recruitment and to run evening community engagement sessions, where a Nissan LEAF (EV) will be available to test-drive.

Routes to customer engagement are illustrated on page 48, as proposed under Fleetdrive Electric's plans to engage customers for the project trial programme. The lease will be at subsidised cost and the charger installed will be removed at the end of the trial if required by the customer. There will be car parking space provided for other vehicles owned by the customers during the trial if necessary. Customers will be asked to fill in surveys during the trial.

An explanation of the contract for the car, costs and what is expected in terms of monitoring and feedback will be provided.

The tariffs and contractual arrangements for supply of electricity with the customer will remain the same. There should be no impact on the availability of the EVs for the customers however if the trial is not successful, customers will still have previous transport options available to them.

8: Customer impacts contd.

To install the EV charger, there is likely to be a short interruption to the supply to the customer's premises as would be expected during a standard installation. It is expected that the PLC monitor control can be installed live, using approved live working procedures. However, the local population will be given notice of a brief interruption of supply, one interruption per substation, in accordance with the regulations.

The Technology will only switch off the circuit supplying the EV charger (that will not be supplying other loads). The supply to the existing loads will be unaffected by the Technology. The only load that is controlled is the EV that is provided on a conditional basis.

A key aspect to the trial will ensure that the chargers can be cycled on and off without causing large voltage step changes or flicker.

Should heat pumps be used it is expected that the level of interruptions would be very similar during installation. It is assumed that the heat pump is connected to a dedicated circuit within the premises.

It is anticipated that protection is required from the Interruption Incentive Scheme for a maximum of 10 brief interruptions.

8.4 Impacts to Customers resulting from the Trial

Non-Participating Customers on the Feeder

It is the ultimate intention of the trial that there will be no disruption to non-trial participating customers as part of the installation of the solution; in order to achieve this different techniques will be assessed for installation, though recognising that tailoring will be required to suit different applications (e.g.. pole-mounted substations/ground mounted open LV boards/ground mounted closed LV boards).

With respect to the PLC controller to be installed in the affected substations, whilst we have demonstrated in previous PLC projects that it is possible to install the necessary equipment without requiring an outage to customers e.g. b breeching onto a live cable using live-working techniques), it cannot be guaranteed that every potential site will be suitable for such an installation method without a survey of the substation in question.

As such, whilst currently there are no planned interruptions for any customers not having equipment installed, confirmation of necessary outages, (if all available live-working methods are unsuitable for use) at each location will have to be determined on a case-by-case basis, as cluster locations are identified.

Customers Participating in the Trials

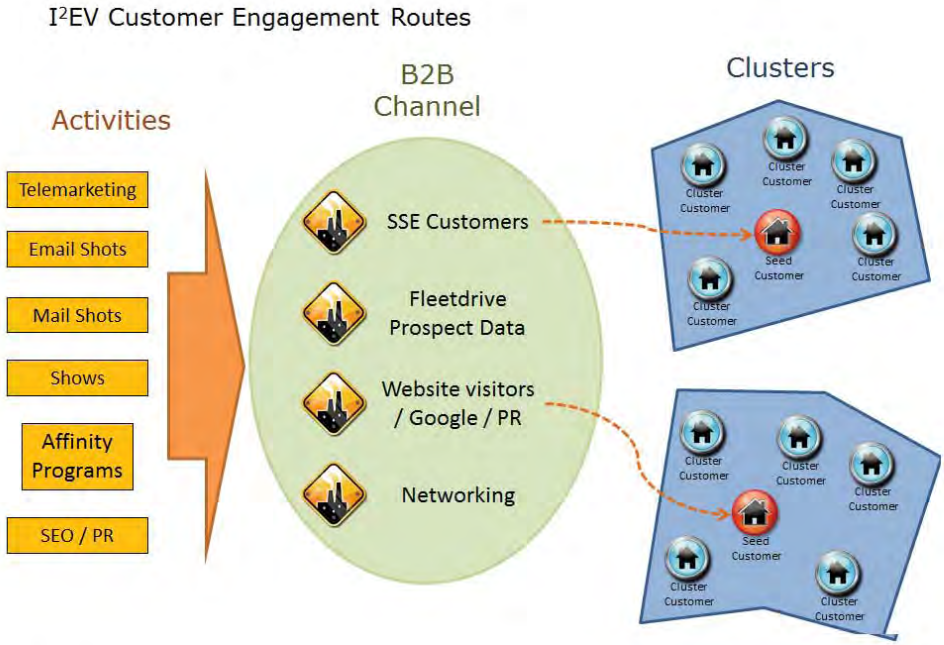
There will be a minor interruption of service required for customers having a charge-point installed in order to allow connection into their property's consumer unit. Due to the fact that EVs are not yet in widespread use, an average installation time that holds a high degree of certainty cannot be ascertained as EV charge-points are yet to be installed at a wide range of property types and ages.

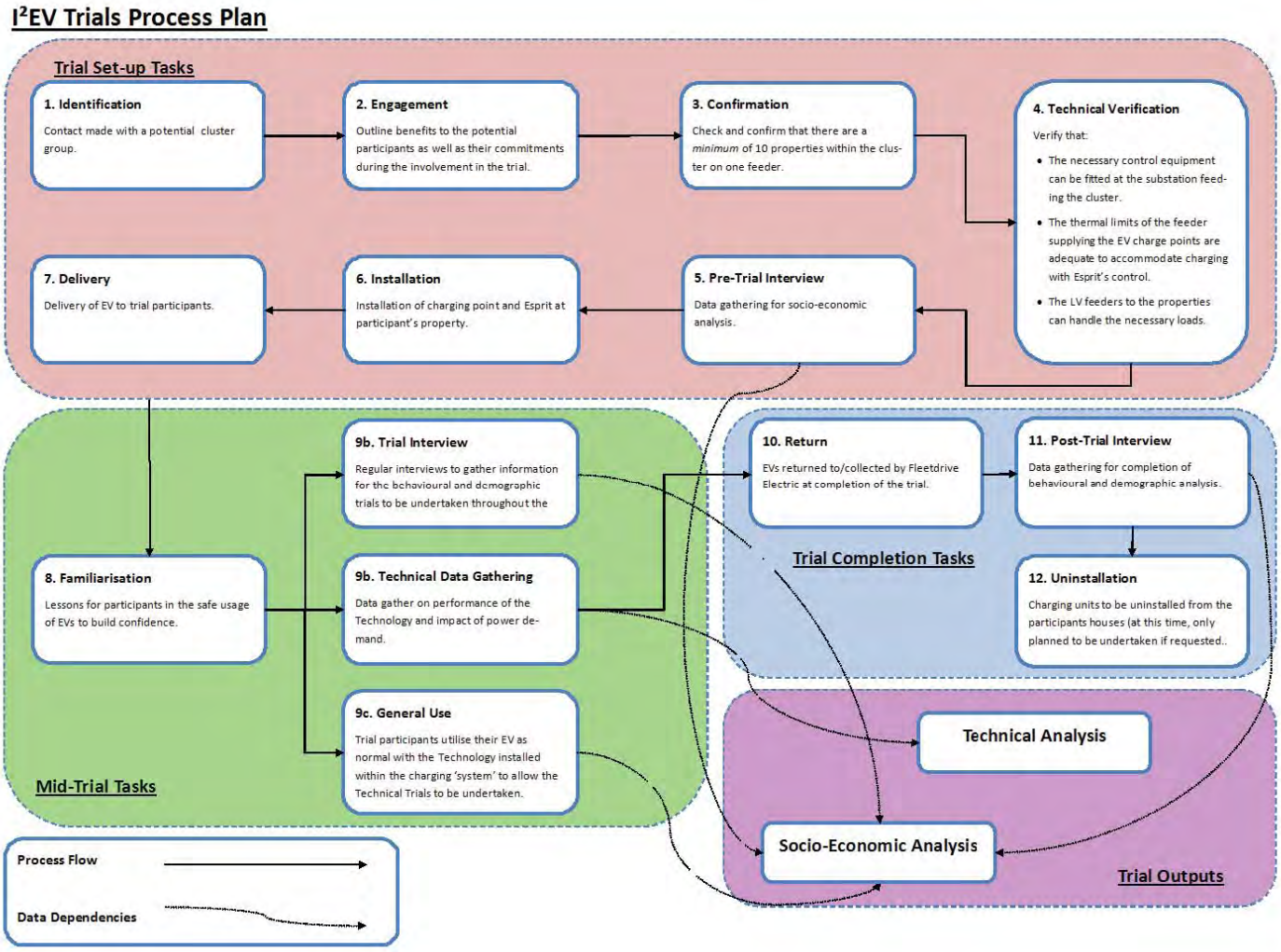
Based on previous experiences held by EATL and project partners, it is not expected that during the course of installing a customer's charge-point, that the power should be interrupted for more than 2 hours. In the majority of cases, the interruption is likely to be less than an hour.

For the avoidance of doubt, during the installation of a customer's charge-point, the interruption only applies to the customer and not all other properties connected to the same feeder.

8: Customer impacts contd.

8: Customer impacts images, charts and tables





Customer Impacts images

Section 9: Succesful Delivery Reward Criteria

Criterion (9.1)

Focus: Commercial
Document the learning from the experience of a third party leading a Tier 2 bid including suggestions for where the process could be more open or streamlined.
This will include: structure of the project, interaction with the DNO, establishment of project partners, project costing, bid development commitment (costs and time), IPR positions, risk sharing principles and Ofgem Expert Panel / Consultant process.

Related learning:
Learning outcome C1.2.1 - what learning has come out of the bid process?
Related Task: 0 - Novel commercial agreement
Related commercial aims: Under 2.2 the commercial aims are to:
- Demonstrate delivery of a low carbon network project by a non-DNO on behalf of a DNO (see 'commercial innovation delivery framework' on page 10)

Evidence (9.1)

9.1.1 The provision of a report outlining key areas of learning in the identified areas, with recommendations. The reports will be written such that they can be published in the public domain for an audience of: DNOs, Ofgem or other interested third parties who may wish to lead a LCN Fund project in collaboration with a DNO.

Achieved by month 2.

Criterion (9.2)

Focus: Commercial
The blueprint of the contractual arrangements put in place with the DNO for a third party lead on a LCN Fund Tier 2 project.

Related learning:
Learning outcome C1.2.2 - what form are the contracts?
Learning outcome C1.2.3 - how are the risks managed with the DNO?
Learning outcome C1.2.4 - what form does the programme management take?
Related Task: 0 - Novel commercial agreement
Related commercial aims: Under 2.2 the commercial aims are to:
- Develop a novel commercial arrangement (see traditional and I^2EV models on page 17)
- Enable all procurement related to the project activity to be managed by a non-DNO

Evidence (9.2)

9.2.1 Make available the initial contract template used between SEPD and EA Technology together with supporting guidance of the thinking behind key clauses. This will be made available to Ofgem and other DNOs as a starting point for use in future projects **(available by end of month 4).**

9.2.2 Review of the contract put in place between SEPD and EA Technology. A review of the initial contract developed in 9.2.1 focussing on what worked well, what didn't work well, and what should be done differently in the future **(month 34).**

9.2.3 An updated contract template taking into account learning from 9.2.2 **(month 36).**

9: Succesful delivery reward criteria contd.

Criterion (9.3)

Focus: Commercial
An assessment, based on direct experience, of how a third party can effectively manage delivery on innovative projects with a DNO, and whether this allows DNOs to take on more innovation projects.

Related learning:
Learning outcome C1.1.1 - what is the management and interface process with the DNO?
Learning outcome C1.1.2 - how is 'buy-in' and engagement achieved within a DNO?
Learning outcome C1.1.4 - how does learning become business as usual when project is non-DNO led?
Learning outcome C1.3.1 - how is expedient deployment achieved - benefits/other over DNO-led approach?
Related Task: 0 - Novel commercial agreement
Related commercial aims: Under 2.2 the commercial aims are to:
- Demonstrate delivery of a low carbon network project by a non-DNO on behalf of a DNO (see 'commercial innovation delivery framework' on page 10).

Evidence (9.3)

9.3.1 Report detailing processes established and utilised throughout the project including templates of any forms (e.g. work orders for SSEC staff) and records of meetings/regular communications created as part of the process. This will include an evaluation of the collaboration between SSEPD and Northern Powergrid with a 3rd party interface.

9.3.2 A framework to enable update suggestions to SSE policies and/or procedures, identified during the course of the project will be provided, (e.g. A procedure detailing the necessary steps when considering a customer's request for an EV charging point).

9.3.3 An assessment from the participating DNO of the level of effort expended on Project Management of the I²EV task by the staff involved in comparison to previous innovation projects.

Achieved by month 34.

Criterion (9.4)

Focus: Commercial
An assessment of how the DNO and other interested parties can ensure independent validation of a third party's Solution throughout a project, and upon completion.

Related learning:
Learning outcome C1.3.2 - how are the project and results validated?
Related Task: 9 - Project recommendations and implementation
Related commercial aims: Under 2.2 the commercial aims are to:
- Demonstrate delivery of a low carbon network project by a non-DNO on behalf of a DNO (see 'commercial innovation delivery framework' on page 10)

Evidence (9.4)

9.4.1 The provision of 6 monthly independent reviews of the project and technology with specific inclusion of improvements and adaptations to working practices incorporated by the project team following the previous independent review.

(a) Produce 6 monthly report (highlighting strengths and improvement areas) to be tabled at steering group meetings.
(b) Produce response to 6 monthly report, detailing improvements planned by Project Steering Group, as a result of the review.

Achieved by months 7, 13, 19, 25, 31, and 36.

9: Succesful delivery reward criteria contd.

Criterion (9.5)

Focus: Technical
Sign up and involvement of sufficient customers in the trial to adequately test the Technology.
This trial is attempting to simulate a future network where large numbers of high loads, such as EVs, are connected (clustered) in close proximity to one another. Getting enough customers on board in the trial to emulate this is therefore key to test the technical Solution.
Related learning:
Learning outcome T1 - To what extent can DNO direct demand control facilitate the connection of low carbon technology?
Related Tasks: Task 4 - Establishment of customer / cluster trials; Task 5 - Monitoring the trials
Related Technical aims: Under 2.2 the technical aims are to:
- Learn customer driving and charging habits and the implications for control via the Technology; - Evaluate the range of networks where it can operate successfully and identify any type of networks that are inappropriate.

Evidence (9.5)

9.5.1 **Technology trials:** Establishment of the cluster groups to trial the Solution
- Sign up of 3 cluster groups (**month 9**)
- Sign up of 5 cluster groups (**month 12**)
- Sign up of 10 cluster groups (**month 18**)

9.5.2 All cluster funding allocated due to successful establishment of clusters **(month 18)**

9.5.3 **Social trials:** Minimum of 100 EV drivers signed up to have their driving habits recorded **(month 18)**.
(a) Reports presented to the monthly project meetings to capture and log progress in signing up customers to the EV trials
(b) Six monthly reports to steering group on trial engagement progress

Criterion (9.6)

Focus: Technical
An assessment of the public acceptance (or otherwise) to Demand Side Response of EVs (or HPs as defined in 9.5) using this sort of technology.

Related learning:
T.1.1.1 - how does a trial encourage the uptake of low carbon technology?
T.1.1.2 - what social factors have an impact on the use of the Technology?
T.1.1.3 - how can a trial be used to educate customers about the electricity network and low carbon technologies?
Related Task: 6 - Trial participant interviews
Related Technical aims: Under 2.2 the technical aims are to:
- Learn customer driving and charging habits and the implications for control via the Technology.

Evidence (9.6)

9.6.1 A report documenting the finding from the socio-economic analysis on public reaction to the technology.

Achieved by month 34.

9: Succesful delivery reward criteria contd.

Criterion (9.7)

Focus: Technical
An assessment of the most appropriate integration of the Technology for different applications and suitable cycling times or reasons why this is not possible if the trials are not successful.

Related learning:
Learning outcome C1.1.3 - what is the interface and management process for other manufacturers?
T.1.1.2 - will customers accept direct control and under what circumstances?
T.1.2.4 - how do the needs of EV charging (or other loads) affect the settings?
Related Task: 3 - Integration of the Technology with charging points
Related Technical aims: Under 2.2 the technical aims are to:
- Develop and trial the equipment to ascertain its ease of installation. - Develop the integration of the Technology into the EV charging points including how existing intelligence and attributes in charging points can be harnessed to reduce the cost and improve the performance.

Evidence (9.7)

9.7.1 Documentation describing:
(a) Views of the OEM community of the impact (if any) that cycling of EVs (or HPs) may have on their product(s) and end of life
(b) Recommendations of suitable cycle times for EVs (and possibly Heat Pumps) for demand-side response
(c) Evidence of whether this solution would be feasible or not combining learning from 9.5, 9.6.

Achieved by month 30.

Criterion (9.8)

Focus: Technical
An assessment of how much headroom this sort of technical solution would yield, considering different network topologies and load types.
Related learning:
T1.2.1 - how much headroom is released?
T1.2.2 - how close to thermal rating should load be before deployment?
T1.2.3 - on what type of networks can the technology be used?
T1.2.4 - how do the needs of the EV charging (or other loads) affect the settings?
Related tasks: 5 - Monitoring the trials
Related Technical aims: Under 2.2 the technical aims are to: - Evaluate how often switch off routines are likely to be initiated from real life trials and extrapolation via modelling using the results; - From the results and extrapolation via modelling, estimate the typical and maximum thermal capacity gained.

Evidence (9.8)

9.8.1 Modelling to understand additional headroom available / other network benefits from using the Technology. (a) The models will assess the % of thermal and voltage headroom estimates produced.).
(b) The project will deliver an updated Solution template(s) specific to the Technology, and any updated EV charging profiles for use in the GB Smart Grid Forum modelling (e.g. WS3 model http://www.ofgem.gov.uk/Networks/SGF/Publications/Documents1/WS3%20Ph2%20Solution%20Annex%20V1.0.pdf).

9.6.2 Potential cost savings and carbon emission savings using DECC published carbon intensity figures. If technology is unsuccessful, reasons why will be stated.

Achieved by month 35.

Section 10: List of Appendices

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