Review of Low Carbon Network Fund Proposals

Final Report to Ofgem and Expert Panel

ELECTRICITY NORTH WEST LIMITED

Capacity to Customers (C_2C)

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II Report Context

This report has been prepared for the Expert Panel with the aim of supporting them in their funding allocation recommendations for the Low Carbon Network Fund.

This report has been prepared from Electricity North West Limited (ENWL) Low Carbon Network Fund Tier 2 Submission of 18th August 2011 and the supporting information received by the Consultants from ENWL prior to their final presentations and clarifications to the Expert Panel and Ofgem on the 5th October 2011.

Having reviewed the submission pro-forma and all of the supporting material, as well as answers to clarification questions put to the DNO, this report is intended to serve two purposes:

- It sets out any factual clarifications that may be helpful to the Expert Panel when considering the submissions, based on information or data that is not immediately apparent or available in the pro-forma submissions; and

- It highlights any concerns in any particular areas from, for example, either a technical, commercial or deliverability perspective that the Expert Panel may wish to explore further with the DNO.

Consequently, the Expert Panel may assume that the factual content of the submission pro-forma to be sound unless noted otherwise in this report. For clarity in producing this report and the associated documents, the Consultants have avoided reproducing large parts of the submission verbatim, which stands on its own merits for the Expert Panel’s consideration.

This report does not seek to assess the quality of this submission or rank it against any others. In particular, it does not provide any opinion as to whether the proposal should be funded.

This report and any associated documents are not intended to be read in isolation and should be reviewed alongside the pro-forma and compulsory appendices.

III Notice

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IV Circulation

Name	Role	Reason for Issue
Ofgem	Client	Final
Expert Panel	Stakeholder	Final

V References

Ref.	Details	Published by	Issue date
01	LCNF Governance Document Version 4	Ofgem	April 2011

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1. Summary

1.1 Project Description

Project summary	
Objectives	• Current topology on high voltage (HV) networks provides a high level of redundancy to achieve security of supply. These networks are often connected via Network Open Points (NOPs) which are used in the event of a fault on the network or planned outage. This network topology means that circuits operate at 50% to 60% of their capacity. • The Project will trial and demonstrate techniques to make use of the inherent spare capacity.
Problem	• An increase in demand, driven primarily by decarbonisation, will lead to high costs to customers and significant societal and environmental impacts.
Solution	• To release inherent capacity using an alternative Method, in order to connect new Low Carbon Technologies (LCTs) at lower cost and with less societal and environmental impact.
Method	• Where possible and relevant, close the NOP, and run two circuits together as a "ring". In the event of a fault, use network automation to restore supply. • In the event that inherent capacity is being used and to avoid overload in the post-fault situation, use Demand Response Contracts to reduce the consumption of contracted customers on the relevant circuits.
Cost	• Total project cost is £10,691k with external funding of £489k. • LCNF Second Tier Funding request is £9,042k.

1.2 Evaluation Summary

The ENWL proposal is technically feasible and is to be trialled on HV circuits that are representative of the wider GB network. The learning and knowledge is expected to be of value to the wider GB network and the proposal demonstrates the estimated financial and carbon impacts on the GB network. These financial and carbon calculations are robust. The economics and level of incentives will be tested during this Trial. The Project requires derogation from P2/6 and this is critical for the Project to go ahead.

The Project's success rests on the ability to incentivise a sufficient number of customers to adopt new contracts and participate in the Trial. The size and length of the Trial and location on "fault free" HV and EHV circuits may limit the experience that can be gained from operation under actual fault conditions coincident with high loads on the network.

The risk register identifies a number of risks internal to the Project and ENWL. These risks include internal teams not being able to support the installation of the automated devices; key personnel being unavailable; financial management and ring fenced accounts; carbon emissions the reduction target not being achieved; and poor project management.

Our concerns on this Project relate to the limited opportunities in the Trials to test the Method. There are risks of insufficient information being gathered on customers' appetite to sign Managed Contracts and their reaction to actually being cut off.

It is our view that external funding of this Project is low, at only 5% of Total Project Costs.

We conclude that this Project will deliver valuable learning and knowledge which will be shared with other DNOs and interested parties. The Method being Trialled has the potential to deliver significant carbon reduction and customer savings.

2. LCNF Criteria Evaluation

Acceleration of the development of a low carbon energy sector

- ENWL have demonstrated that their proposal, if implemented, will accelerate the development of a low carbon energy sector. Their analysis is robust and well documented.
- The Project contributes to the UK government's strategy for reducing greenhouse emissions. In particular, it creates additional capacity for the connection of LCTs by utilising redundant capacity on HV networks. The additional contribution is dependent upon the installation of new LCTs but the Project facilitates this.
- Carbon benefits are also realised through the avoidance of asset upgrades. These carbon benefits offset an increase in network losses that result from increased network loading and therefore greater losses due to C_2C. Overall, the Project is compliant with LCTP directives.
- The proposed plan can be reasonably expected to deliver the carbon benefits. Whilst the plan is extensive and considers multiple variables, the carbon benefits are not overstated. This solution is replicable across HV across GB.
- The Project demonstrates how the Method can be replicated and rolled out across GB. Throughout, a structured and extensive case outlines how and when carbon benefits will be realised. The Method is more efficient than what is currently available.
- The potential roll out is proposed across the ENWL network and GB. This will involve 1,000 HV rings at ENWL and over 13,700 HV rings at GB scale.
- It is feasible that connection of LCTs will be less costly and can be completed more quickly with the proposed Method, supporting Chapters 3 to 7 of the Low Carbon Transition Plan (LCTP).

Has the potential to deliver net financial benefits to existing and/or future customers

- The C_2C Project has the potential to generate significant net benefits to customers.
- The costs of full implementation of C_2C in the Trial area have been estimated. The cost build up, including the marginal cost of the Network Management System (NMS) upgrade, is reasonable.
- Calculation of network reinforcement to achieve 454 MVA capacity increase is based on recent case studies, with weighting towards more typical connection projects.
- The proposal estimates the financial benefit of C_2C through comparison of Base Case and Method Costs at this scale.
- C_2C's potential for replication across the ENWL area and GB is demonstrated in terms of the number of ENWL circuits and DNOs that the Method could be applied to.

Level of impact on the operation of the distribution system

- ENWL C_2C Method has implications for future planning standards and operational procedures as it challenges current best practice in the design, operation and use of distribution network assets. The complementary new contract offerings will deliver significant cost benefits for customers over traditional demand side response formats. This will inform changes in the involvement of network users in the operation of GB's distribution networks.
- The principal benefit to customers of the C_2C Solution is that it enables significant additional load and generation to be connected, without incurring the high levels of expenditure associated with traditional HV network reinforcement.
- The proposal clearly identifies the external contribution of the 10 Project Partners, their respective roles and indicates that the key learning from their involvement contributes to the Project's outcome.

Generates knowledge that can be shared amongst all DNOs

- In our opinion, this generates knowledge that will be of value to other DNOs.
- The C_2C Project proposes using a transferable Method and will deliver three key outputs:
  - Adaptive network automation to unlock significant capacity;
  - New commercial contracts offering choice to customers; and
  - A new design and operating standard to ensure security of supply in the low carbon future.
- The learning outcomes are focused and aligned with key aspects of the transition to the low carbon economy and will help DNOs to reduce carbon emissions.
- The level of incremental learning has been carefully defined and there is a clear chain from data gathering to knowledge dissemination that includes the other GB DNOs. The knowledge dissemination starts at the initial project stage. It continues with six-month progress reports, which include a feedback mechanism; however, the majority of the learning for a number of key areas of particular interest to other DNOs will be disseminated towards the latter stages of the Project, such as the learning from the Trial.
- The proposal demonstrates that the learning is relevant, timely and will be subject to robust governance and management. The learning and dissemination workstream is tasked with ensuring that the right deliverables are made available to the right audience, through various methodologies and that cost estimates outlined in the bid are not exceeded.
- The Project meets the LCNF default IPR principles and it is not anticipated that the Project will develop foreground IPR that will fall outside of the default IPR requirements.
- The DNO intends to conform to the default IPR requirements of the LCN Fund Governance v.4.

Involvement of other partners and external funding

- ENWL have prepared a consortium of major organisations to provide the range of skills and competencies required to complement their own capabilities on this Project. The collaboration is appropriate and the partner organisations are independent from ENWL. External funding, subject to contractual agreement, is 4.6% of the total Project cost.
- The Project will receive 3.8% of its total funding requirement from IGE UK Ltd ("GE") and equal, small contributions from six other corporate or university partners.

Relevance and timing

- The Project focuses on the associated carbon benefit that will be realised through increasing the capacity of HV networks. This enables a key development in the transition to a low carbon economy by creating added network capacity for the connection of LCTs, particularly electric vehicles (EV), heat pumps and wind turbines.
- The C_2C Project, if successful, will form a significant part of the future commercial, technological, and operational planning for the HV networks, reducing the need for network reinforcement in the short term through the deployment of the automation onto the existing asset base. ENWL proposes that the design and planning standard being delivered as part of the Project will inform the amendment or replacement of the existing Engineering Recommendation.
- The C_2C Method seeks to inform the RIIO–ED1 review process specifically regarding the extent to which Distribution Networks can use demand response to assist in the management of the network, both in an operational and planning timeframe. The Method will also generate knowledge that will inform other critical areas such as connections, charging methodologies, and commercial incentives to promote competition in the demand–side market.
- The HV networks represent a significant proportion of the DNO total network asset and the benefits available from this Method can flow immediately on heavily loaded circuits where more connections are requested. There is an uncertainty regarding the degree of success of the Method until the Trial is complete.
- In our view the two-year period of the Trial may not be sufficient to fully assess the value of the Method (because of the low number of faults to which Demand-Managed customers will be exposed), but there will be sufficient learning to at least inform and assist the debate regarding deployment of such techniques in the RIIO-ED1 price control period.

Demonstration of a robust methodology and that the project is ready for implementation

- The Project is relatively simple in concept and the approach to delivery is clear and focused. ENWL and their partners have the capability to deliver the Project. Further commentary on costs, benefits, deliverability, and success criteria are presented in Sections 3 and 4. The Trial will itself deliver some carbon benefits and cost savings to customers and, more importantly, will deliver knowledge of the feasibility and scale of benefits of the Method on roll out.

3. Detailed Assessment

3.1 Feasibility Assessment

Summary

- This Method is significant in view of the scale of change it can bring to 11kV network operations, by changing from a longstanding custom of operating the network in a "radial" fashion to forming connected rings. It brings innovation to network operations to operate in this manner, managing faults by automated switching regimes including managed response from customers. In our view, if successful, the Method will clearly reduce the reinforcement level of the network otherwise required to meet new demands.
- The Method to be tested is potentially feasible and of high value in delivering benefits of lower carbon and lower costs to customers. If successful, the Project will deliver an effective solution to defer or avoid network reinforcement. The benefits are very much dependent upon the opportunities to deploy the solution in place of network reinforcement that would otherwise be necessary.
- This Project is technically feasible, and ENWL and their partners are ready to undertake the Project. The Project plan includes appropriate planning, overall management, co-ordination, resourcing, risk management, governance, and communication.
- The Trial is appropriately designed and sized to test the feasibility of the Method, subject to there being sufficient faults experienced by consumers during the period of the Trial. This is a key factor to test the confidence in the fault restoration techniques and the customers' engagement through contracts for potentially delayed restoration. This Project is designed to deliver such knowledge.

3.1.1 Technical Assessment

Is the Project technically feasible?

- Yes. The proposal seeks to Trial a Method to enable more use of the existing network's capacity without reducing security of supply. The solution of operating radial circuits as closed rings and applying network automation for restoration of supplies (to most of the affected customers), is feasible to deliver additional capacity at lower cost than traditional methods.
- A key element of (and therefore risk to) the Project is sufficient numbers of customers of sufficient demand contracting for delayed supply restoration in the event of a fault at times when full demand cannot be met until the network can be restored or re-configured to deliver.
- The Trial will determine whether customers are prepared to agree to Demand Response Contracts and what level of incentive would be required to gain their agreement.
- Providing there are sufficient faults in the Trials, which require Demand Response to be actioned (i.e. the customers' power is cut off), the Project will discover the acceptability of such contracts to customers.

Is it safe?
• No significant Health and Safety risks have been identified beyond those in Business As Usual (BAU) in high voltage network design and operations, nor any additional risks arising in consumers' premises associated with loss of supply been identified.

Is it innovative? If so, how?
• The operation of high voltage networks as closed rings is not new, neither is the use of post-fault automatic restoration nor the concept of demand-side management in the event of insufficient network capacity to supply. However, the total package of the Method, and its application as a matter of policy to improve network use, is new. • There is considerable scope for innovation within the software developments in the automation system, NMS configuration, systems integration, customer database, and network data analysis. • This Project neither depends upon nor contributes to the national Smart Metering Implementation Programme.

How mature is the equipment?
• The mechanisms to provide remote operation of switches are well-proven and robust.

What is the technical impact on customers?
• Customers may experience a greater number of short-term interruptions as the two ends of the HV ring from which they are supplied will be tripped for any fault. However, with the automation scheme the restoration time for most customers will be better than with BAU, where manual operations would be required on the circuits. • Those non-domestic customers who contract to contribute to this Method are exposed to longer restoration periods at times of high network demand, in accordance with the contracts that will be Trialled on this Project. • Planned interruptions to customers' supply will be required to install some of the equipment

What is the technical impact on normal operations?
• The Method requires many changes to network operations. Systems and procedures will support ENWL's staff in managing the new proposals. • Design policies will change to incorporate this Method in addition to traditional network reinforcement as a means of meeting additional demand. • The Trial will fully assess the scale of theses impacts.

3.1.2 Assumptions

Assumption	Comment
Sufficient circuits will be selected for the Trials to meet two criteria: (a) be representative of networks within ENWL and elsewhere in GB (b) experience sufficient faults on the system to provide meaningful conclusions.	ENWL have a clear process for circuit selection. The Trial is well sized, with 180 rings to be selected. Too many would cause extra costs. A smaller number would create high risk of not experiencing sufficient faults for a meaningful Trial, and not be representative of GB networks as a whole. It is estimated that 50 faults will be experienced within the Trial period, although it is unknown at this stage how many of these will affect those customers who have agreed to Demand Managed contracts.
Sufficient numbers of customers will contract to provide sufficient demand reduction.	It is our view that this is the key uncertainty regarding the Method. The Trial will deliver an assessment of customers' desire for such contracts, but assessment of their reaction to delayed restoration will be limited to a small sample size. It is important for the learning that at least some of the customers with managed contracts experience faults during the Trial period.

3.1.3 Project Delivery Assessment

Is the Project plan robust?
• From studying the Project Submission, the Project Plan and Milestones, and our subsequent discussions with ENWL, we believe the plan to be robust. • Effective governance arrangements are proposed and appropriate resources have been identified. • ENWL senior management is committed to the Project and we believe that the Project will be effectively resourced.

Is the Project schedule credible?
• The timescales for development and installation are ambitious but achievable. • It is important that installation and commissioning be completed as soon as possible in order to maximise the period of Trialling. • There is scope for early learning on software development and installation of the equipment. There will also be opportunity for early feedback on the reactions of customers to Demand Management Contract offers. • The two-year period for Trialling is short, in terms of gaining sufficient experience of faults and for signing Managed Contracts, although a necessary compromise to minimise cost and to provide early input into RIIO-ED1.

Are resources adequate?
• Availability of key personnel is identified by ENWL as their highest project risk. The proposed mitigation does not include any identified alternatives, but we note that ENWL and their partners have extensive resources and we would expect them to re-allocate suitable staff and management to a project of this importance as required.

How do partners add value, how are they tied in to the Project, and is their contribution appropriate?
• The Project Partners are signatories to a Consortium Agreement and they are familiar with this Project and the LCNF process. In addition, their understanding of the need to mobilise quickly will assist in avoiding the delays that have been experienced in other second tier projects from last year. • We understand that GE agreed to a Memorandum of Understanding and incorporation of the default IPR conditions in the contract to be finalised. Given their commercial interest through the development of a new product and the opportunity for follow-on work at ENWL, we believe there is very limited risk that GE will delay this project. They are contributing 4% towards Total Project Costs. • The contribution from the Consortium Agreement partners is, in our view, a relatively small amount at £11,155 each. • We note that the Second Tier funding requirement of this Project is high, at 84% of Total Project Cost.

Is the customer/stakeholder communication plan appropriate?
• The ENWL proposal includes an engagement plan and there are extensive tasks identified in the project plan for further development of this plan. • We have identified that the engagement plan does not include an explicit study of customers' response to their power supplies being interrupted and how the experience of interruption will alter their perceptions. This is different to their initial acceptance of a managed contract. We understand that ENWL will include this within their Customer Engagement Plan. • A key feature of the plan will be the development of the right approach to customers to maximise the chances of uptake of Demand Management Contracts at a reasonable price. There is little point in overpaying for contracts in order to run the Trial if the incentive levels are unsustainable on full roll out post-Project. • The plan will also need to describe the relationship between energy suppliers and ENWL in order that customers (especially those at the lower end of the demand spectrum) have a clear understanding of the separate roles of the supplier and the distributor.

Are Successful Delivery Criteria compliant with the LCN Fund Governance Document v.4?
• In our view, the Criteria are specific, measurable, achievable, relevant and time-bound, thus satisfying SMART criteria. • In terms of achieving the objectives of the Project, of the seven Criteria submitted, five are outputs and two are inputs. We consider this a reasonable mix. • The ENWL criterion requiring only 10 customers to have signed-up to the managed contracts is, in our opinion, not very challenging and is low compared to the scale of this Project.

Have key risks been identified and mitigated? Is contingency appropriate?
• The Risk Register for this Project is based upon ENWL's standard Risk Model as described in the proposal. • The Risk Register focuses on Project risk and the feasibility of the Trial in demonstrating the delivery of carbon and customer financial benefits. • We note that ENWL have shown examples of risk mitigation rather than specific mitigating actions. Unmitigated risk raises uncertainty regarding the costs and deliverability of the Project. We understand that ENWL's project team will review and develop detailed mitigating actions prior to proceeding with this Project if the bid is successful. • Contingency is included within the mitigation part of the Risk Register, and generally depends upon the potential to use sidelined contingency, referring to the 10% cost contingency built into the Project. • We consider that the risk assessments for this Project are incomplete.

3.1.4 Assumptions

Assumption	Comment
Resources are available within ENWL and partners to complete this Project.	The risk of a shortage of resources are identified and mitigated within the Project Plan.
Derogation will be granted by Ofgem on P2/6.	Ofgem are consulting on principles. We consider it likely that derogation will be granted.
The Contracts with Partners will be readily completed in Phase 1 of the Project.	Much has been learnt from last year's LCNF projects to assist in moving from the Consortium Agreement to bilateral contracts. In addition, the partnership arrangements on the Project are relatively simple, with very specific roles and deliverables for each party. The arrangements with GE are different to those with other partners. This relationship will need special attention, as ENWL are alone amongst the GB DNOs in not using GE's NMS, and therefore do not have a significant background in working with GE and their systems.

3.2 Commercial Assessment

Summary

- ENWL will develop new contracts for new and existing customers that will allow them to manage the demand of those customers who are on the new contracts at the time of the fault and to get all customers back online as quickly as possible.
- Customers on the new contracts will have reduced connection charges commensurate with the savings in the reinforcement costs.
- ENWL expect there to be in the region of 40 new I&C load connections and 10 new renewable generation connections on the Trial circuits.
- The Trial will affect 12% of ENWL's customers and potentially 1,200 I&C customers.

3.2.1 Nature and Scale of Commercial Impact

Does the Project involve innovative commercial arrangements, if so, how?
• In our opinion the Project is innovative. It involves the offering of new contracts for I&C customers associated with reduced connection charges on those rings where the changes have been made. • Customers who sign up to this contract will benefit from lower connection charges. • The proposed contracts are a new offering where the customer has a lower connection charge in return for greater network management by ENWL and the possibility of a higher incidence of interruption. • The commercial arrangement are a significant change such that ENWL are seeking a derogation from its Standard Licence Condition 24.1 (a), i.e. to plan and develop its distribution system in accordance with a standard not less than that set out in the relevant Engineering Recommendation (ER) P2/6. As such, this can be seen as a challenge to the status quo of network design and is testing a new approach.

How does the Project impact upon the customer (demand and generation)? What is the nature of this impact and does it endure beyond the Project?
• The customer who has signed the new contract will have their network more closely managed by ENWL. They will benefit from a lower connection charge. • Generation customers are unlikely to be affected by slightly increased intermittency but will benefit from lower connection charges. • We believe that, assuming that there is a permanent licence change, these arrangements will endure beyond the Project.

How does the Project impact upon the broader electricity and technology supply chains? What is the nature of this impact and does it endure beyond the Project?
• ENWL report that the Project changes the nature of the contract relationship between DNO and customer by allowing new post-fault demand contracts, and that these can endure beyond the contract. We believe that this is valid.

Within current regulatory frameworks, where will financial benefits accrue within the supply chain (suppliers, DNOs, customers etc.)?
• The financial savings of the Project are in the reduced network infrastructure cost of the DNO. The saving is to the benefit of all connected customers.

Are these commercial arrangements replicable across the GB distribution network on roll out?
• Subject to regulatory changes, ENWL report that the technical changes, and therefore the associated new commercial arrangements, could be replicated across GB networks apart from Central London in UKPN's London DNO and Merseyside/North Wales in Scottish Power's MANweb DNO. • This equates to about 90% of the GB HV network.

3.2.2 Assumptions

Assumption	Comment
ENWL are granted their derogation request.	This is critical to the Project. The process was started immediately and is out to consultation. It is anticipated that this will be granted for this request but ENWL cannot proceed without it.
New customers take up new contract.	The Project can only be tested if the new customers take up the new contract. There are very real savings in connection charges for customers who take up the Project so the chances of success are high. The success of this is a key area of monitoring and learning of the Project.
Existing customers take up the new contract.	This is harder to predict and quantify and is an area of key focus.

3.3 Wider Context Assessment

Summary

- The Trial will inform the RIIO-ED1 negotiations.
- The Project will assess the use of controls, automation, monitoring and demand-side short-term interruption contracts to provide greater control and the capability to utilise existing headroom (required under ER P2/6).
- The Project will require a definite derogation from standard licence condition 24.1 as the Project seeks to utilise latent network capacity that will potentially make the relevant area of network non-compliant with the planning requirements of ER P2/6. It is anticipated that all classes of supply (except Class F) may become ER P2/6 non-compliant as a result of the Project. The C_2C Project will be applied to an existing area of network that is currently (i.e. at the date of the application) fully compliant with the requirements of ER P2/6.
- The networks that are part of any roll out may also require this derogation. The Trial will test whether the application of new software and network controls offers an opportunity to review P2/6 conditions and to examine whether and under what circumstances such derogations maybe applicable. Any change to ER P2/6 has a wide impact upon the network, licences, and the portfolio of DNOs.
- The proposal demonstrates that the Method will address issues affecting all DNO areas and, subject to regulation and access to the software, is extendable throughout 90% of the GB network (with the exception of Central London and Merseyside/North Wales) with an estimated £1.06bn of cumulative savings by 2035 – the numbers have been prepared by an expert Project Partner (Parsons Brinckerhoff Ltd).

To what extent will the Project overcome current obstacles to the future low carbon network?
• To meet the LCTP more low carbon electricity generation will need to connect to the UK electricity system to facilitate increased demand. These changes in generation and demand will significantly increase customers' requirements for HV network capacity. In our opinion, the Trial will address these requirements cost-effectively, quickly, with less disruption, and with lower carbon impact than current reinforcement methods. • The Trial will inform the following areas: o The level to which this solution de-carbonises the grid and facilitates the reduction in carbon emissions; o The level to which connection times and reinforcement costs can be reduced to encourage and support more connections to the HV network; o The level to which existing and new business are incentivised to accept short-term interruptions and exploit the opportunities of wider demand-side management; and o The extent to which the commercial drivers can enhance energy efficiency and reduce emissions on customer sites. • The proposal presents a high-level validated financial and carbon impact analysis along with other benefits using credible assumptions that will be tested during the Trial.

To what extent will the Project trial new technologies that could have a major low carbon impact?
• The Trial will use existing technologies and introduce automation that supports adaptive network management and demand-side management. The Trial also includes some upgrades and installation of additional monitoring and communications software. • The Trial will test the how effective and secure the network is whilst operating under active management without ER P2/6 compared to operating under traditional passive methods.

To what extent will the project demonstrate new system approaches that could have widespread application?
• The proposal describes the new methodologies that will be Trialled: o Effective customer segmentation and engagement including message and communications channel; o Demand-side commercial contracts and incentives will be Trialled; and o Network design and management and creation of transferable control and automation systems for adaptive network management.

3.4 Carbon Emissions Reduction Assessment

Summary

- ENWL have provided full details on well-structured carbon emissions reduction projections. They are extensive and take account of numerous variables, particularly on roll out of the Project. They are robust.
- The C_2C Solution will enable greater use of the redundant capacity on HV networks thereby creating capacity for additional LCTs, whilst also reducing the need for carbon-intensive network upgrades. The Method is expected to be replicable across GB with carbon emissions reductions achieved by both the DNOs and their customers.
- ENWL provided a detailed, comprehensive, conservative account of how, when and where carbon savings will be made. Multiple variables are given for the Trial and roll out to the ENWL network as well as across GB. Specifically these variables are divided into three sections:1) Facilitated emissions reductions by customers due to a faster release of network capacity; 2) Changes to embodied carbon in the network through reduction of network upgrades; and3) Losses carbon which takes into account the differences in distribution losses per year.
- Increases in network losses will give rise to increased carbon emissions. This is more than offset by the carbon abatement from avoided asset upgrades and the quicker connection of new LCTs to the networks.
- The Tyndall Centre at the University of Manchester has independently reviewed the carbon emission methodology and calculation. It was also noted that the Tyndall Centre and University of Strathclyde would review carbon emissions throughout the Project Trial to provide ongoing accurate emissions reduction projections.

3.4.1 Nature and Scale of Carbon Emissions Reduction

Does the Project align with the Low Carbon Transition Plan? If so, how?
• Claimed carbon benefits align strongly with the LCTP with reference being made to the LCTP and government Carbon Budgets throughout the proposal. Specifically the C_2C Method will accelerate a low carbon future by releasing a significant amount of the distribution network pre-existing capacity that will be used to meet the UK's objectives to use renewables and reduce carbon emissions. Crucially the C_2C Solution will release this capacity more cost-effectively, much more quickly, and with lower disruption and carbon impact than current reinforcement methods.

What is the nature of claimed carbon emissions reductions and what is the balance between the technological and behavioural change?
• The C_2C Project identifies three carbon impacts. These are: ○ Facilitated emissions reductions by customers due to quicker release of network capacity: The primary carbon emissions abatement associated with this Project result from the accelerated deployment of low carbon heat and motive technologies, and distributed generation solutions (around 96% of the total emissions abatement). It is forecast on average, that the C_2C Solution will allow deployment of low carbon solutions four months sooner than would otherwise be the case with conventional grid reinforcement. We believe this to be an acceptable, if conservative, timescale from which to forecast potential carbon emissions reductions; ○ Asset carbon: Further benefits derive from the avoidance of the need to manufacture and install conventional grid reinforcement technologies (around 4% of the total emissions abatement). Losses carbon: System losses will be impacted by the C_2C Solution, and will increase as the capacity loading of the network rises. The submission estimates that the carbon impact of these losses will negate much of the benefit from avoidance o_f the manufacture and installation of conventional grid reinforcement assets. • All of these emissions reductions result from technological change. Emissions abatement resulting from technological change is generally more persistent than those reliant on behavioural change.

Nature of emissions reductions

	Type of reduction
Facilitate LCT uptake more quickly & lower cost	xxx
Avoidance of asset upgrades	x
Network efficiency	(x)
Efficiency of use	

xxx - Main focus
x - Secondary focus

Note: Network efficiencies are negative. (x)

What is the size of claimed carbon emissions reductions?
• ENWL calculations endorsed by the Tyndall Centre suggest that the C_2C Solution will deliver net carbon benefits of 71.8 thousand tonnes CO_2e for the Trial sites, 364.5 thousand tonnes CO_2e for the broader ENWL network, and 4,987 thousand tonnes CO_2e for GB as a whole, over the period to 2035. • This has been calculated through estimated potential for 450 MVA of capacity to be released earlier during the Project, 2.4 GVA of capacity to be released on roll out to ENWL's network and 32 GVA of capacity from GB roll out. • The split between the three types of carbon impact are given in the table below.

Roll-Out at Scale

	tonnes CO_2	Base case emissions	Method emissions	Net carbon emissions reduction
Trial / Method	Facilitated carbon emissions (LCT uptake)	0	-4,810,000	4,810,000
	Asset carbon	0	-637,000	637,000
	Losses carbon	0	460,000	-460,000
	Total	**0**	**-4,987,000**	**4,987,000**

When will the carbon emissions reduction occur?
• The savings will occur in the period from 2012 to 2035. This is the approximate period over which C_2C would replace traditional HV and EHV reinforcement on a significant proportion of the GB network. After that time, increasing demand for network capacity would exceed the latent capacity which C_2C can deliver, and further increases in capacity would need to be delivered by a combination of traditional reinforcement in combination with C_2C. The period to 2035 was chosen by comparing the expected capacity released by C_2C with scenarios for customers' requirements for increased network capacity over time. • These assumptions are fair and the time period is realistic.

3.4.2 Carbon Emissions Reduction Assessment

How comprehensive are the carbon emissions reduction estimates?
• The carbon emissions reductions estimates are comprehensive, detailed and have taken into account a wide range of variables across the three streams of activity. • Carbon emission calculations for the Project were reviewed by the independent experts at the Tyndall Centre for Climate Change. • Overall, the proposal forward a strong and logical case for carbon emissions reductions.

Are carbon emissions reduction estimates additional to business as usual?
• All the carbon emissions reductions claimed for the Project is additional to those that would have occurred in the normal course of business. • On roll out to ENWL's network (1,000 rings); the Method will enable 1.3m electric vehicles (EV), plus 1.8m domestic heat pumps and 470 wind turbines to be connected as additional connections. On roll out across GB (over 13,700 HV rings) the Method would be equivalent to creating sufficient capacity for 18m electric vehicles, plus 25m domestic heat pumps, plus 6,500 wind turbines up to 2035.

Are carbon emissions reduction estimates realistic?
• We believe that the carbon emissions reduction estimates are achievable. The Project uses a comprehensive methodology, reviewed independently by the Tyndall Centre for Climate Change to estimate projected carbon emissions. It takes into account multiple variables that relate to both facilitated carbon reductions by customers being able to connect to the grid more quickly as well as carbon emissions embedded in avoided network upgrades. We believe this methodology to be robust. • Emissions reduction estimates are dependent on underlying assumptions, which have been documented in detail in the proposal. The proposal also documents how the assumptions will be tested over time, to allow the carbon reduction assessment to be updated and further insights shared. Key assumptions for each of the three main emissions reduction techniques are identified below, along with comment on the evidence provided in support of these assumptions.

3.4.3 Assumptions

Assumption	Comment:
On average, C_2C will permit deployment of low carbon transport, heat, and distributed generation four months sooner than conventional grid reinforcement.	This estimate is based on evidence in Appendix 11 and further information provided through the DNO question-answer process
Unit emissions savings associated with EV, heat pumps and wind turbines are estimated to be 0.2, 0.4, and 0.7 $tCO_2e/yr/kVA$ respectively.	These are based on government and other forecasts, so are reasonable but may change over time.
Of the capacity released by C_2C to 2035 it is estimated that 30% will be absorbed by EV, 20% by heat pumps and 40% by wind turbines.	The bid states that "there remains considerable uncertainty as to the precise scale of increase, depending on the mix of technologies and behaviours in the decarbonisation pathway". Different ratios will give rise to different realised carbon savings, however the proposal makes credible, cautious assumptions and highlights how the savings will be monitored and updated over time.
Asset carbon	
Unit emissions associated with conventional grid reinforcement as are estimated to equate to 44.7tCO_2e/km of high voltage cable.	This may change over time.
Length of high voltage cable needed for grid reinforcement.	This estimate is based on evidence provided through the DNO question-answer process and appears to be plausible. Credible government and industry sources have been used.
Losses carbon	

Assumption	Comment:
Increase in capacity and resulting losses for C_2C relative to traditional grid reinforcement.	These losses are anticipated to change over time as network and grid reinforcements and efficiency improvements are made.
Rate of decarbonisation of the grid and resulting carbon impact associated with losses.	These losses are anticipated to change over time as network and grid reinforcements and efficiency improvements are made.

3.5 Project Costs and Cost Benefits Assessments

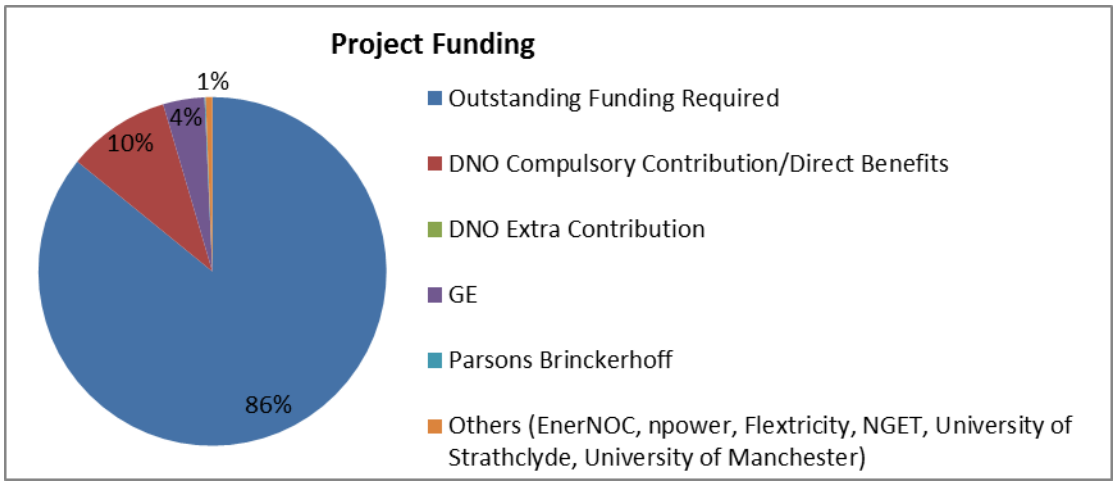
Summary

- Project activities are comprehensive and consistent with scope and objectives of the C_2C Project. Activities are specifically focused on the technical and commercial aspects of the Trial and dissemination of the Project outcomes.
- Project costs are realistic, largely driven by the cost of automation, monitoring and communications infrastructure across a large number of HV circuits (180).
- In our opinion, the C_2C approach has the potential to generate significant net benefits to customers. If successful, the approach appears to be replicable across a large part of the GB's HV network.
- The technical and commercial feasibility of the C_2C Method is to be explored in this proposed LCNF Project.

3.5.1 Project Costs

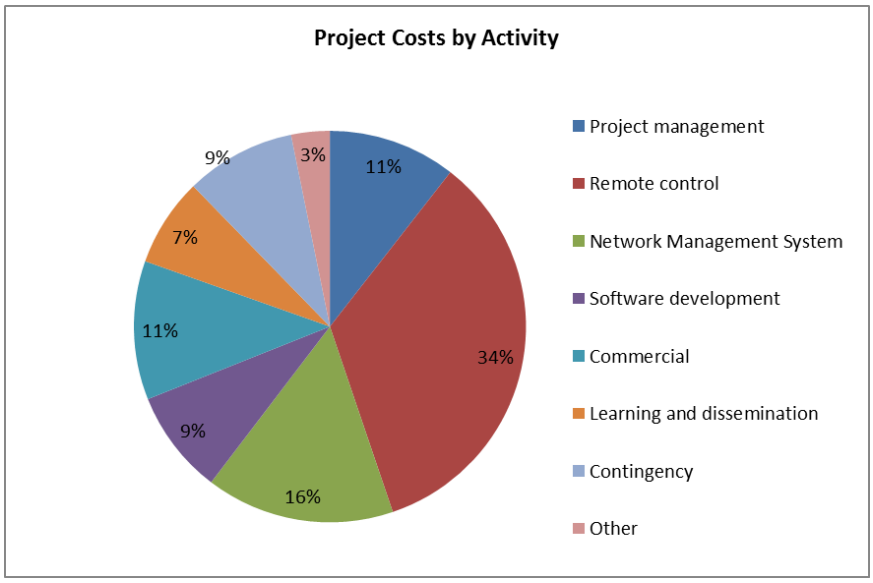
Project Funding

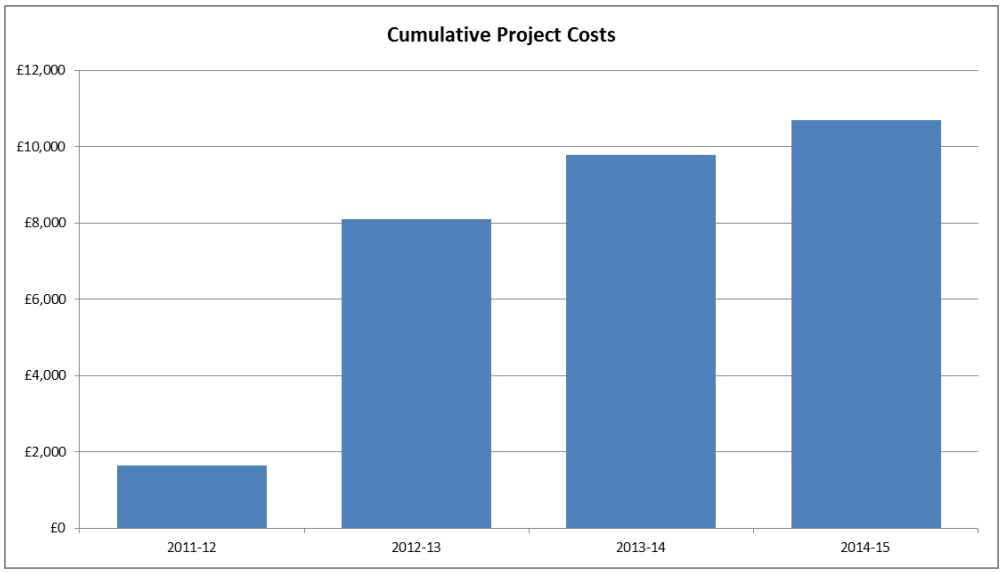
		Total
Project Participants Contribution (£'000s)	GE	£410.77
	Parsons Brinckerhoff	£11.16
	Others (EnerNOC, npower, Flextricity, NGET, University of Strathclyde, University of Manchester)	£66.93
	DNO Extra Contribution	£0.00
	DNO Compulsory Contribution/Direct Benefits	£1,023.05
	Outstanding Funding Required	**£9,179.11**
	Total Project Costs	**£10,691.02**



Project Costs by Activity and Year

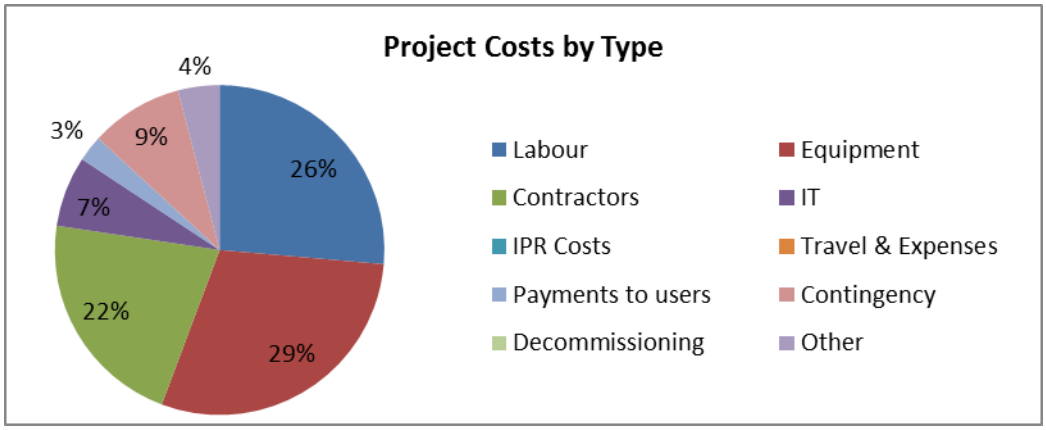
		Year				
		2011-12	2012-13	2013-14	2014-15	Total
Costs of activities (£'000s)	Project management	£135	£396	£297	£298	£1,126
	Remote control	£431	£3,101	£86	£45	£3,663
	Network Management System	£594	£934	£75	£61	£1,664
	Software development	£310	£524	£86	£0	£919
	Commercial	£0	£486	£475	£265	£1,225
	Learning and dissemination	£30	£382	£339	£30	£781
	Contingency	£123	£497	£228	£124	£972
	Other	£13	£134	£119	£75	£341
	Total	**£1,635**	**£6,453**	**£1,705**	**£897**	**£10,691**
	Cumulative total	**£1,635**	**£8,089**	**£9,794**	**£10,691**	





Project Costs by Type and Year

		Year				
		2011-12	2012-13	2013-14	2014-15	Total
Costs by type (£'000s)	Labour	£612	£1,185	£590	£433	£2,819
	Equipment	£595	£2,532	£9	£2	£3,137
	Contractors	£24	£1,656	£477	£157	£2,314
	IT	£239	£450	£51	£0	£740
	IPR Costs	£0	£0	£0	£0	£0
	Travel & Expenses	£0	£0	£0	£0	£0
	Payments to users	£0	£0	£166	£107	£273
	Contingency	£123	£497	£228	£124	£972
	Decommissioning	£0	£0	£0	£0	£0
	Other	£43	£134	£184	£75	£436
	Total	**£1,635**	**£6,453**	**£1,705**	**£897**	**£10,691**



Direct Benefits

	Base Cost	Method Cost	Net benefit
Direct Benefits of Project (£m)	n/a	n/a	£0.48

Are the Direct Benefits of the Project realistic?
• Calculation of net benefits is based on the cost savings made during the course of the Project from connecting new customers by the C_2C Method rather than by traditional reinforcement. • ENWL expects there to be approximately 40 new I&C load connections and 10 new renewable generation connections on the Trial circuits during the period of the C_2C Project. • Cost saving per C_2C connectee estimated at about £46,000. ENWL's contribution of this sum is 62% , of which 60% is attributable to Direct benefits. • Total is based on assumption of 28 new C_2C connectees. • Methodology appears to be appropriate and outcome is realistic given the typical size of I&C connectees and typical reinforcement costs.

3.5.2 Project Costs Assessment

How comprehensive are the Project costs?
• Project activities appear to be comprehensive and consistent with scope and objectives of the C_2C Project. • These activities focus specifically on the technical and commercial aspects of the Trial and dissemination of the Project outcomes.

Are the Project costs realistic?
• The Trial will involve the closure of the Normal Open Points (NOPs) between the 360 HV circuits creating 180 HV closed rings. Circuit selection has been carefully considered to produce a representative selection across various combinations of types of circuit (voltage, circuit type, reliability and customer type), but excluding circuits with high numbers of faults. • The number of circuits in the Trial drives the cost of the procurement and installation of remote control equipment and accounts for about 34% of total costs. The application of remote control is a common business activity within ENWL and will therefore be subject to competitive tendering. GE will provide NMS software based on its PowerOn Fusion product. GE's NMSs are widely adopted by DNOs in the UK and globally, but not currently used by ENWL. The cost of this element of the Project appears to be realistic in the light of typical costs for these systems and needs to integrate with existing ENWL systems. • A total of £273k is included as payments to customers for demand side response (DSR), with a further £60k as contingency. It is understood that these amounts are based on previous experience of procuring other types of DSR. ENWL accepts that C_2C may require a different pricing level to attract DSR customers.

Does the Project provide value for money?
• Potential cost savings are large if C_2C is successful and widely adopted by ENWL and other DNOs.

Is the Project feasible within the budget?
• The Project appears to be feasible within the budget proposed.

3.5.3 Assumptions

Assumption	Comment
Budget allocated for DSR payment will be sufficient to attract a large number of I&C customers.	High potential cost savings forecast to DNOs and customers in general if C_2C successful. However increased risks to I&C customers difficult to quantify in advance and therefore take up.
Project costs are agreed with Project partners.	ENWL expects to have bilateral agreements in place with partners before project commencement.

3.5.4 Cost Benefits Assessment

Financial Benefits

- The principal benefit to customers of the C_2C Solution is that it enables significant additional load and generation to be connected, without incurring the high levels of expenditure associated with traditional HV network reinforcement. This increase is stated as around 35% of the existing firm HV network capacity or around 50% of simultaneous HV demand.
- Successful demonstration of key technologies, such as network control and monitoring systems, could increase future sales for equipment suppliers.

Non-Financial Benefits

- Outcomes from the C_2C Project will inform discussions on RIIO-ED1 and future network planning.

Method Costs

	Description		Comment
Method Costs £m	Automation and minor reinforcements	£6.6	180 rings, direct cost £22k per ring + OH
	Integration and support of C_2C within NMS	£2.3	Marginal impact within NMS upgrade
	Losses due to increased loading	£20.6	DNO incentive rate, DECC guidelines
	Automation costs to contracted C_2C customers	£9.0	£5k per remote control point, 1800 points
	Total	**£38.5**	

Are the unit Method costs calculated on an appropriate basis and are the unit Method costs realistic?
• Calculation of Method costs has been based on 10 desktop case studies conducted by Parsons Brinckerhoff comparing the C_2C Method to traditional reinforcement, this suggested that applying the C_2C Method to release 50% of available capacity would deliver on average 3 MVA/ring at 11kV and 2 MVA/ring at 6.6kV. In the Trial there will be 90 circuits at 11kV and 90 circuits at 6.6kV. This suggests that there is the total potential to release 454 MVA in the Trial area, which it is assumed will be achieved over the period to 2035. • The cost of fully implementing C_2C in the Trial area in order to increase capacity by 454 MVA has been estimated at £38.5m.

Base Costs

	Description		Comment
Base Case Costs £m	Network reinforcements costs to 2035 to deliver 454 MVA	£41.0	Network reinforcement cost of £43/kVA at 11kV and £72/kVA at 6.6kV
	Losses due to increased loading on radial network	£8.8	
	Total	**£49.8**	

Are the unit Base Case costs calculated on an appropriate basis and realistic?
• Calculation of network reinforcement costs are based on recent case studies, with weighting towards more typical connection projects, and scaled to a capacity increase of 454 MVA. • Increased loading will increase power losses and hence costs to customers by an estimated £8.8m.

Summary of Net Benefits of Roll

		Base Case cost (£m)	Method cost (£m)	Net benefit (£m)
Trial / Method	Trial area to deliver 454 MVA	£49.8	£38.5	£11.3
	ENW area	£322	£205	£117
	GB rollout	£3,888	£2,812	£1,076

Out

Are the forecast benefits of roll out realistic?

• The net difference between the Method and Base Case costs is £11.3m, based on a £32.1m reduction in network costs, combined with a £20.8m increase in non-network costs (associated with losses for all customers and costs of C_2C customers' automation equipment).
• Customers would receive £32.1m reduction in network costs to 2035 via:
  ○ Reduced requirements for HV network reinforcement.
  ○ Reduced connectee charges for C_2C customers.
  ○ Demand response and generation payments for C_2C customers.
• The net benefit of replication of C_2C across ENWL as a whole is based on the assumption that 1,000 rings are created out of the total number of ENWL HV circuits (2,935). This implies a capacity increase of ~2,400 MVA, or an increase by a factor of 5.28 on the Trial area (454 MVA).
• On this basis, replication or roll out of C_2C across ENWL network would cost £205m, compared to the cost of traditional reinforcement of 322m. (Figures include increased network losses). ENWL represents 6.5% of GB's distribution network. A review by Parsons Brinckerhoff suggested that C_2C could be applied to all GB's distribution network with the exception of Central London and Mersyside /North Wales. The proposal makes the assumption that C_2C could be applied to 90% of GB's HV networks, and could therefore deliver a 32GW increase in network capacity or 13.74 times the scale of its application to the ENWL HV network.
• The costs of GB roll out of C_2C have been calculated to £2,812m over the period to 2035, compared to the cost of traditional replacement of £3,888m, implying net financial benefits to customers of £1,076m. .
• The Methodology does not take into account financial benefits of accelerating uptake of LCTs.
• In summary, it is our conclusion that C2C has the potential to deliver significant financial benefits across ENWL and GB.

3.5.5 Assumptions

Assumption	Comment
Scale of available headroom through deployment of C_2C.	Actual headroom available to be investigated in the Trial.
Maximum level of release of this headroom through deployment of C_2C.	There may be technical and commercial limits to the economic utilisation of increased capacity (headroom).
Assumes that the Method can be replicated across approximately 90% of GB's HV networks.	Technical and commercial barriers may limit the potential for roll out to less than 90% of GB's HV networks.

3.6 New Learning Potential

Summary

- ENWL have provided a well-defined learning, analysis, and knowledge dissemination plan that defines individual partner roles and responsibilities for data gathering, analysis and knowledge dissemination during and after roll out of the Project.
- The expected key learning areas and outcomes are clearly defined.
- In the consultant's view the knowledge dissemination process is well considered, embedded within a dedicated workstream and plans to target a wide range of stakeholders.
- The consultants expect that the knowledge will come towards the end of the Project and will inform RIIO-ED1.
- The learning and dissemination will incorporate all data analysis and knowledge dissemination activities, including website development and build, conference attendance and the drafting of white papers. These activities will often occur in parallel and there is a risk of a confused message.

3.6.1 New Learning Assessment

What is the potential for new learning?

- The Project will generate incremental learning in six key areas that in many cases will feed into the discussions for RIIO-ED1 in the following areas:
  - **Customer engagement and segmentation** – Will provide new information on the most appropriate channels to market for new commercial arrangements;
  - **Demand side response** – Develop new commercial offerings and understanding of willingness of customers to engage in demand side response contracts;
  - **Network planning and design standards** – Generate new network design and operating procedures that may be utilised as the change proposal for updating the existing ER P2/6 and/or developing a DNO operating standard;
  - **System performance** – Generation of data and knowledge of the impact on power losses, power quality, network utilisation and standards of performance;
  - **Network management systems** – Creation and understanding of an enhanced and transferable control and automation system for adaptive network management; critical importance in the future of network management and as the regulatory system changes; and
  - **Economic and carbon modelling** – Inform Ofgem and other DNOs of the impact that the Method can have on operators or networks in terms of carbon savings and customer benefits.

What are the plans for disseminating such learning?
• ENWL state that they will distribute at least one piece of key learning every six months and have proposed a number of dissemination approaches designed to not only distribute the learning but also provide a feedback mechanism. Our view is that a dedicated workstream is likely to increase the effectiveness of the knowledge transfer. • The proposal includes knowledge dissemination within the Successful Delivery Reward Criteria 9.6 and specific milestones for knowledge dissemination are included in the Successful Delivery Reward Criteria 3, 4, 5, and 7 (early technical, early economic, early impact and final report respectively). Explicit funding is available for learning and dissemination.

What is the IP management strategy and does it deviate from the default IPR conditions? If so, how?
• The default arrangements of the LCN Fund Governance v4 are being applied. • Parties and stakeholders have progressed with the IPR arrangements through a `consortium agreement. • The consultants understand that GE has agreed to the default IPR arrangements in the Memorandum of Understanding, which, will be transferred into the Direct Agreement with GE for the delivery of the C_2C Project.

Are the IP benefits to partners adequately reflected in the proposal?
• It is understood that the Project Partners have agreed with the default IPR commitments, which will be reflected within the respective agreements. • All Project Partners are contributing to the Project costs.

3.6.2 Assumptions

Assumption	Comment
That the media channels, incentives and customers are sufficient to attract customers to the new contracts.	The customer communication plan is well documented and managed by a dedicated workstream.
That the technology deployed as a part of the Trial Method can be integrated with the network management software.	Project Partners and roles are closely defined, existing infrastructure well understood.

3.7 Risk Assessment

- The technical interventions are well understood and considered by the consultants to be low risk and feasible. The terms of the post-fault demand and generation-side response contracts will be developed during the Trial and there is a risk that protracted negotiations will delay the learning and benefits realised by the Trial.
- ENWL have a high-level Project Risk Register with mitigation statements in place. The highest scoring risks are summarised in the Project Risk table below.
- Additional risks have been identified by the consultants and appear in the Further Risk table below.

ENWL C_2C				
PROJECT RISK				
Index	**Type**	**Risk**	**Mitigation Plan**	**Contingency**
1	Project	Risk that internal Operations team will not be able to support installation of automation devices.	Yes	Yes
2	Project	There is a risk that the key personnel will not be available to deliver the Project.	Yes	No
3	Project	There is a risk of problems with the financial control of the Project because of the new requirement for and management of separate bank accounts.	Yes	No
4	Project	Project fails to achieve its predicted Low Carbon Saving because of inaccurate estimates or significant change.	Yes	No

ENWL C_2C				
FURTHER RISK				
Index	**Type**	**Risk**	**Mitigation Plan**	**Contingency**
1	Project	Insufficient participating customers connected to networks that experience interruption.	Yes	No
2	Project	The proposed network circuits will not generate faults to inform the Trial.	No	No
4	Project	Derogation not granted.	No	No
6	Roll out	Derogation not granted.	No	No
7	Roll out	No customer engagement on GB networks.	No	No