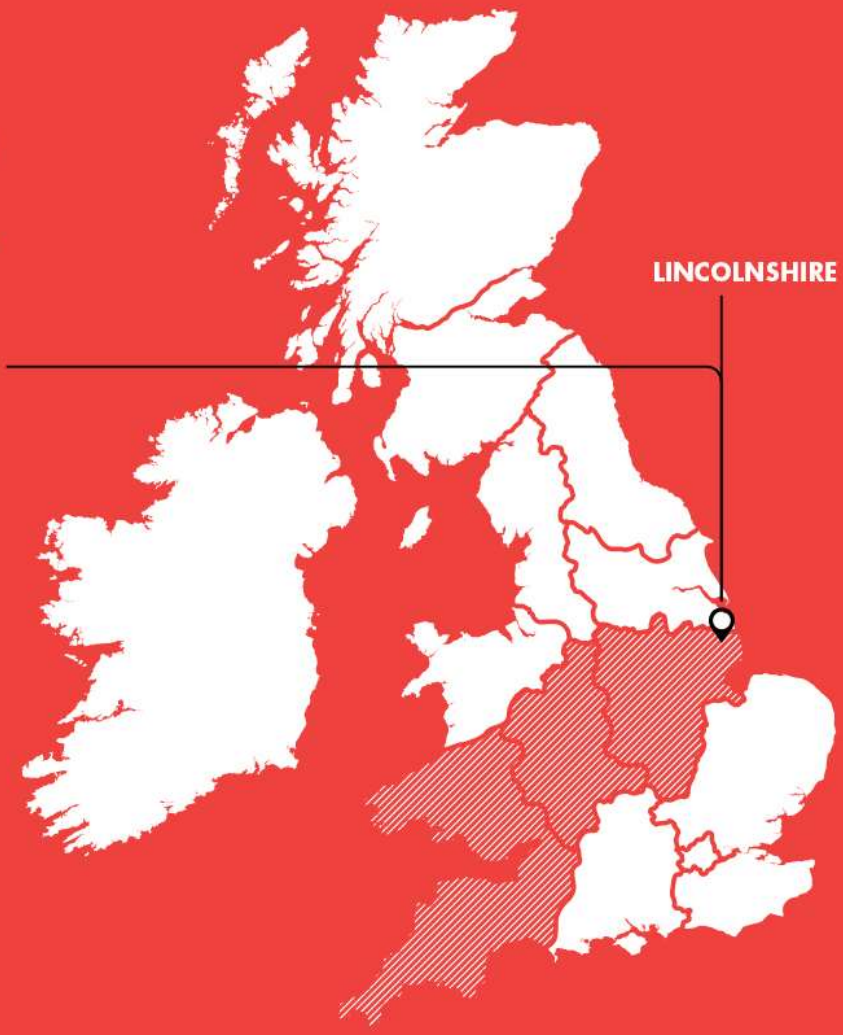
WESTERN POWER DISTRIBUTION

LOW CARBON HUB

CONNECTING RENEWABLE ENERGY IN LINCOLNSHIRE



Low Carbon Hub
SDRC Application

April 2016

LCN Fund
Low Carbon Networks

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Contents

1 Executive Summary

Traditionally the electricity distribution networks have been designed to operate passively. This means that the network is designed with a tapering capacity on the assumption that electricity generation is large scale and centralised, and power flow will be unidirectional from the higher voltage transmission system to the lower voltages of the distribution network.

The capacity of network circuits and components is dictated by the maximum demand, the fault level rating and the need to maintain voltages within defined ranges. When a generator is connected to the distribution network power flow often becomes bidirectional, fault level is increased and voltage control becomes more complex. Conventional design solutions to the resulting changes in fault level, voltage control and capacity are often substantial cost. This can mean that in areas which have abundant renewable energy resources the connection of distributed generation is uneconomical. Lincolnshire is one such area. It has a rich wind resource which may be underutilised for distributed generation due in part to electricity distribution network connection costs.

THE SOLUTION
Creating an active smarter design and operation of the network will allow generation to be connected to the distribution network more economically. This will allow the most suitable generation sites to connect to the network. The Low Carbon Hub (LCH) solution sought to develop a distribution network optimised for demand and generation whilst demonstrating potential solutions to some of the network limitations.

OUTCOMES
The LCH has been a real success. It did experience some challenges as all projects do and with LCH all of them were genuinely unforeseen at the time of the bid. However, the fact that the learning and results of the project have been explored with a follow on project, Network Equilibrium , and real change to business as usual through the development of an Active Network Management tool we feel is a demonstration of its undoubted success.

In addition the creation of new Alternative Connection Agreements, that is new commercial arrangements with generators, is particularly positive for the industry as a whole and we expect to deliver more on this further. Indeed we have been offering these new arrangements since February 2014 and have seen savings as well as definite interest from developers.

In this report we qualify the successes & challenges of the project and provide information to support our application for the discretionary award.

2 Successful Delivery Reward Criteria

As detailed previously within the Low Carbon Hub Closedown Report and its accompanying appendices, the project met all of its objectives, aims and Successful Delivery Reward Criteria. All SDRCs were achieved on time and through extensive engagement with Stakeholders we believe have a breadth and depth of quality because of that. The learning that has come from the Low Carbon Hub has already spawned two further initiatives. We will provide further information on this in this application.

Below we expand on the evidence detailed within the close down report to include the relevant links to the evidence and provide additional commentary to further support our belief in the successful achievement of the relevant criteria.

Successful delivery reward criterion (SDRC)	Proposed evidence	Actual evidence	Further commentary & links to further information
SDRC 1 Host a successful workshop with Distributed Generation developers and feed learnings into the project plan.	Holding an interactive workshop by the end of 02/2011, collating feedback from attendees during the workshop sessions. A satisfaction survey will be carried out within 30 days of the event to gauge the value of the workshop to participants and identify any further follow up actions.	As detailed in the June 2011 six monthly report, an interactive workshop was held, the feedback from the workshop survey was detailed in Appendix A of the Closedown Report. The project continued to engage with stakeholders and held a subsequent workshop with DG customers where we presented the proposed alternative connections. The alternative proposals were presented to the wider industry.	Engagement with customers was a key aspect of this project. Moreover, for this project it was more challenging in that it was attempting to address an increasingly contentious issue where capacity constraints were hampering the ability of customers to connect to the network. Of course there are no easy fixes in these instances and so going out to the customers and actively trying to engage with them presented challenges in itself. The fact that our efforts have been well received is a testament to the hard work put in by the whole project team to get a successful outcome in challenging circumstances. We held an initial workshop and feedback from it was positive. Throughout the project we continued this engagement and undertook an independent survey to measure our performance. Overall this was extremely satisfying. Of course there is still work to be done but we believe that that LCH has provided us with some insights as to how to manage customers of this type going forward. More information on this can be found here: http://www.westernpowerinnovation.co.uk/Document-library/2015/CNT2002-LLCH-Close-Down-Report_v1-0-Final.aspx

SDRC 2 Development of UK technical recommendations for: 1. Installing optical fibre on existing wood pole OHLs; 2. Installing optical fibre on new wood pole OHLs 3. Installing microwave or radio antennas and associated equipment within the proximity of distribution assets including the configuration of equipment for effective system protection.	A set of three comprehensive documents sent to all UK DNOs and IDNOs before 31/05/2011. These documents could form the basis of future ENA Engineering Recommendations. The technical recommendations will provide costs and designs for generic OHL construction. Western Power Distribution will also present lessons learnt from project management and engineering experiences associated with delivery of the three aspects. This will be carried out on a minimum of an annual basis. A final report will be included in the project closure documentation in 02/2015.	All three documents (existing wood pole OHLs; Installing optical fibre on new wood pole OHLs and Installing microwave or radio antennas in existing substations) have been shared with the industry. Designs and costs have been created through the construction of the telecoms network. WPD policies and standard techniques have been made available on request.	We have extensively shared the detailed designs with DNOs and invited comments throughout. More can be found on this deliverable here: http://www.westernpowerinnovation.co.uk/Document-library/2011/LLCH-Communications-Review-v1.aspx Further information is also provided within the Closedown Report and the appendices http://www.westernpowerinnovation.co.uk/Document-library/2015/CNT2002-LLCH-Close-Down-Report_v1-0-Final.aspx http://www.westernpowerinnovation.co.uk/Document-library/2015/CNT2002-LLCH-Close-Down-Report-Appendices-V1-0-Fin.aspx Evidence of such is on the project website – http://www.westernpowerinnovation.co.uk/Document-library/2011/LLCH-Communications-Review-v1.aspx
SDRC 3 Completion of the first application of dynamic system control and operation using GE PowerOn Fusion (PoF).	Evidenced through the handover of the capability to the Network Control centre. In accordance with our normal IT business processes the handover will have a documented Operational Acceptance certificate approved by the project board	As detailed in the December 2012 six monthly report, the GE PoF dynamic system rating plugin was incorporated within WPD's NMS. The handover and acceptance followed WPD's standard IT process.	A key aspect of the LCH was the implementation of the IT solution within BaU systems. In order to be able to prove the validity of the Method, this SDRC was specifically aimed at ensuring that the business could utilise dynamic system control through PoF. Link to December 2012 six monthly report is here: http://www.westernpowerinnovation.co.uk/Document-library/2013/WPD-PPR-The-Low-Carbon-Hub-December-2012.aspx Further details on the dynamic systems control within Power On Fusion is included within the Closedown Report.

	during the 08/2012 meeting.		http://www.westernpowerinnovation.co.uk/Document-library/2015/CNT2002-LLCH-Close-Down-Report_v1-0-Final.aspx http://www.westernpowerinnovation.co.uk/Document-library/2015/CNT2002-LLCH-Close-Down-Report-Appendices-V1-0-Fin.aspx
SDRC 4 Determining the degree to which voltage can be controlled by installing and operating a FACTs device. In particular, ascertain whether the device improves quality of supply to demand customers and/or improves generator network availability.	Install a FACTs device, and connect to our network by 01/2014. We will operate the FACTs device under a variety of network conditions and demonstrate how generation could be used to support the system under abnormal operating conditions. The knowledge learnt from this element of the project will be disseminated through a technical paper. The dissemination will be supported by a site visit for interested parties to the FACTs device location. The paper and the visit will be completed by 07/2014. A final report will be included in the project closure documentation in 02/2015.	As detailed in the May 2014 six monthly report, the FACTs device was connected to the network in January 2014. The DStatcom has been operated both in fixed VAR mode and in Volt mode with a range of target voltages and slopes. All DNOs were invited to a dissemination event held in Louth, which included a site visit to Trusthorpe Primary substation. 5 of the 6 UK DNOs attended the event. All DNOs received a copy of the slides, the policies, standard techniques and technical paper.	A FACTS technical report was disseminated on 1st July 2014 and all designs were incorporated into a document that was disseminated via our website on 1st October 2014. Technical Report: http://www.westernpowerinnovation.co.uk/Document-library/2014/LLCH-FACTS-Technical-Report-v1-0.aspx Combined Design Document: http://www.westernpowerinnovation.co.uk/Document-library/2014/Combined-LCH-Design-Appendix.aspx There was a FACTS device dissemination event in Aug 2014 and the slides from that event are here: http://www.westernpowerinnovation.co.uk/Document-library/2014/FACTS-Dissemination-Event-Slide-Pack.aspx Link to May 2014 six monthly report is here: http://www.westernpowerinnovation.co.uk/Document-library/2014/LCH-Project-Progress-Report-May-2014.aspx
SDRC 5 Development of a stronger relationship with distributed generation developers	A telephone survey will be conducted by an external agency before and after the project (12/2010 and 02/2015	As detailed in all six monthly reports, all DG customers directly impacted by the LCH were contacted by Accent (an independent market research	The first survey was undertaken in Feb 2011, as reported within the June 2011 PPR. Feedback was provided within the PPR for reference. The results of the 2015 telephone survey were published and are included within the appendices of the closedown report.

directly impacted by the LCH.	respectively). During the project we will continuously collect and review feedback, which will be formally reviewed at the four lessons learned sessions detailed in the project plan.	company). The results showed that we had developed a very strong relationship with our DG customers but highlighted a few opportunities where we could improve, such as displaying constraint information.	Appendix N details all of the relevant feedback. Overall the findings were extremely positive and we are using the findings to develop our interactions and communications with customers more broadly. The Appendices can be found here: http://www.westernpowerinnovation.co.uk/Document-library/2015/CNT2002-LLCH-Close-Down-Report-Appendices-V1-0-Fin.aspx
SDRC 6 The capture of sufficient information to determine the business case for operating active 33kV ring networks using innovative solutions.	Project closure documentation (02/2015) will include a cost benefit analysis for each of the techniques deployed and the combination of all aspects.	Section 8 of the closedown report details the cost benefit analysis for each method and the project based on the learning from the LCH.	The Closedown Report can be found here: http://www.westernpowerinnovation.co.uk/Document-library/2015/CNT2002-LLCH-Close-Down-Report_v1-0-Final.aspx It can be seen from the analysis that in four areas there are some potential gains from the methods on trial within LCH. The New Commercial Arrangements, the 33kV active Network Ring, the Network Enhancements and the FACTs device all offer some capacity increases. Whilst it is of course difficult to say that there will be a universal benefit across the UK(because of regional and local variations and constraints) it is clear to us that more work needs to be done in these areas.
SDRC 7 Disseminate knowledge and evaluate the potential for similar projects throughout the UK.	The project closure documentation will detail the knowledge generated from the design, construction operation and commercial aspects from the LCH before 02/02/2015. The final project report will be shared with DNOs and IDNOs and interested parties along with: An internet presence; ENA workshops; Publications; and Appropriate industry conferences; etc.	The project has generated a significant amount of knowledge which has been regularly shared with the wider industry.	A number of documents and events have taken place throughout the lifecycle of LCH. Presentations and documents are all available on the WPD Innovation Website. In addition within the closedown Report we included a large number of appendices which detail all of the relevant learning documents that the project produced including feedback from customers, template agreements and other useful media. We also shared with DNO's Standard Techniques and other documents allowing them to utilise the outputs of LCH. We have had a number of the documents peer reviewed throughout and are therefore confident that the quality of outputs from the project enables other DNOs to use them should they wish to. The Final Event to share all of our findings was undertaken on 3rd June 2015. Slides from the day can be found here:

			http://www.westernpowerinnovation.co.uk/Document-library/2015/LCH-Closedown-dissemination-slides-V1-0-complete-(.aspx The overall library of LCH documents can be found here: http://www.westernpowerinnovation.co.uk/Documents.aspx

3 Cost Effectiveness

The Low Carbon Hub went over budget in some areas and we have reported on this in previous six monthly reports. These are detailed below with the appropriate commentary. In summary though, the project faced a number of unforeseen challenges locally within the community that could not have been predicted. No additional funding has been requested for the project, WPD covering the additional expenditure and some funds have been handed back to customers as part of the change request in 2013. We do believe that to have achieved what we did and with some very useful learning is a massive achievement.

A key facet of research projects is of course how the learning can be further applied outside of the research and key elements of the LCH project have now been taken forward. The Low Carbon Hub has two follow on related projects, Network Equilibrium and Active Network Management (ANM). These projects take specific areas of learning from Low Carbon Hub and are either seeking to implement them in Business as Usual for the benefit of customers or further explore the findings because we believe that there is the potential to benefit customers. These facts of themselves we believe demonstrate the value for money and effectiveness of the Low Carbon Hub.

The budget below is the one that was presented in the Close Down Report (published on 29th May 2015) but we have added more detail to those variances where they have caused the project to over spend.

In addition the following procurement activity was required:

Requirement	Outcome
Active Network Management Scheme- production and installation of the ANM scheme	Three vendors applied, evaluation criteria were technical fit, service levels, delivery and financial/commercials. The tender specification was provided as part of the Closedown Report. Awarded in October 2013, FAT passed in March 2014. This had to be integrated within WPD's NMS to facilitate the cost effective connection of generation.
FACTs device	Three vendors applied, evaluation criteria were technical fit, Contract Management and financial/commercials. The tender specification was provided as part of the Closedown Report. Awarded in December 2012, FAT passed in August 2013. This had to be integrated within WPD's NMS to limit voltage fluctuations and further facilitate the cost effective connection of generation.

Contractors were used only when normal business services could not provide the relevant skills as was required. Moreover, the contractors used were from our standard internal

approved contractors and could be sourced at competitive prices and short notice. This was an important consideration as undertaking a procurement exercise as part of the change request would have added further delays and increased costs and we wanted to avoid that eventuality.

Category	Total Budget £k	Total Spend £k	Variance	Variance %
Box 6 – Labour	549	604	56	9%
WPD Project Management	235	239	4	2%
Create a 33kV active network ring – Skegness	17	18	2	9%
Create a 33kV active network ring – Alford	36	42	6	15%[1]
Create a 33kV active network ring – Ingoldmells	83	87	4	5%
Create a 33kV active network ring - Chapel St Leonards	91	130	39	30%[1]
Create a 33kV active network ring – Trusthorpe	82	81	0	-1%
Create a 33kV active network ring – Bambers	5	6	1	18%[1]
Box 7 – Equipment	1510	1675	165	10%
Dynamic Voltage Control - Development + Maintenance of ENMAC and SCADA systems, Voltage control algorithm including Training and site AVC modifications	42	51	9	17%[2]
Flexible Alternating Current Transmission system (FACTs) - procurement of Devices	575	571	-4	-1%
Create a 33kV active network ring - Skegness includes: new CTs, Protection, 33kV cable and small wiring	48	52	5	9%
Create a 33kV active network ring - Alford includes: new CTs, protection, 1250A busbar, VT, 36kV Breaker, 33kV cable & small wiring	102	121	18	15%[1]
Create a 33kV active network ring - Ingoldmells includes: new CTs, protection, VT, earth electrode, 36kV Breaker, 1250a busbar, 3ph insulators, 33kV cable & small wiring	236	278	42	15%[1]
Create a 33kV active network ring - Chapel St Leonards includes: new CTs, protection, VT, RMU, 1250a busbar, 33kV cable & small wiring	260	325	66	20%[1]
Create a 33kV active network ring - Trusthorpe includes: new CTs, protection, Incoming Transformer, 3/7 new switchboard, earth electrode, 33kV cable & small wiring	233	255	23	9%
Create a 33kV active network ring - Bambers includes: new CTs, protection & small wiring	14	22	7	33%[3]
Box 8 – Contractors	357	283	-74	-26%
Engineering Design & Surveys	106	107	0	0%
Enhancing planned network alterations - 33kV OHL asset rebuilds as 300HDA instead of 150 ASCR	80	78	-2	-2%
Innovative Commercial Arrangements - Workshop, Lawyers, data flows, network configuring with generators	70	27	-43	158%[4]

Category	Total Budget £k	Total Spend £k	Variance	Variance %
Development + Maintain of ENMAC and SCADA systems, Voltage control algorithm including Training and site AVC modifications	21	21	0	-2%
Dynamic Systems Ratings - Future Design standard 1) fibre over existing lines	10	0	-10	-100%[5]
Dynamic Systems Ratings - Future Design standard 2) fibre over new lines	10	0	-10	-100%[5]
Dynamic Systems Ratings - Future Design standard 3) radio or microwave links	10	0	-10	-100%[5]
Flexible Alternating Current Transmission system (FACTs) - provision of foundations	50	50	0	1%
Box 10 - IT Costs (inc Telecommunications)	872	973	101	10%
Telecommunications Design	25	81	56	69%[6]
Graphical Interface of data received, Development + Maintenance of ENMAC and SCADA systems, Voltage control algorithm including Training	60	43	-17	-38%[7]
Site AVC modifications	21	21	0	-2%
Dynamic System Ratings	50	0	-50	-100%[5]
Fibre to OHLs	458	480	21	4%
Skegness to Alford Line (UG Fibre)	20	41	21	51%[6]
Skegness	20	40	20	51%[6]
Alford	17	25	8	34%[6]
Ingoldmells	48	69	21	31%[6]
Chapel St Leonards	48	70	22	32%[6]
Trusthorpe	48	48	1	1%
Bambers	19	23	5	21%[6]
Skegness Comms	32	32	0	1%
Asgarby Comms	9	0	-9	-100%[8]
Box 10 - Contingency	129	132	2	2%
Combined Project	14	27	12	46%[9]
Enhancing Planned network alterations	3	0	-3	-100%[10]
New commercial agreements with DG customers with increased capabilities	5	16	11	68%[9]
Dynamic voltage control	3	0	-3	-100%[10]
Dynamic system ratings	22	0	-22	-100%[10]
Flexible Alternating Current Transmission system (FACTs)	25	69	44	64%[11]
Create a 33kV active network ring	57	20	-37	-186%[12]
Totals	3417	3667	250	7%

Detailed Commentary

The project did not experience an overspend on the revised budget(agreed as part of the change request in November 2013). No one "Box" came over 10%, as per the governance arrangements for these projects. However as mentioned previously some individual line items did and below we explain in more detail why these variances were necessary to deliver the project:

[1] As detailed in six monthly reports, Section 6, the requirement to change to the planning approach added additional costs due to a change in scope and a truncated delivery programme. The CBA as described in Section 8 has also been updated accordingly. Because of having a truncated delivery programme this led to some additional costs in overall management of the project.
[2] As this method developed, there was a requirement for a D400 RTU capable of sending analogue outputs to the AVC relays due to a limitation with the existing D20 RTU. This was not catered for within the original budget.
[3] Variance in the scope of works (reconfiguring of transducers) and the need to use external resource (i.e. Contractors) resulted in increased costs for this line item.
[4] As the project developed, it was possible to deliver this section for less than the project budget. Some costs had to then be reapportioned where they had been incorrectly reported in previous 6 monthly reports.
[5] This activity was conducted by Western Power Distribution internally and accounted for in Project Management.
[6] Variance in the scope of works (installing 96 fibres instead of the originally planned for 24) and poor ground conditions resulted in increased design and delivery costs. This was unforeseen at the original proposal for the bid.
[7] As this project developed, it was possible to deliver this section for less than the project budget.
[8] This communications link was no longer required due to wider changes to the WPD SCADA network as the project developed.
[9] There were additional costs associated with delivering this particular method but they were out of scope of the original design. In amending the design it was important to ensure that the method still had a level of integrity.
[10] Contingency was not required in these sections, but was required in other areas. However the total increased contingency spend was within LCNF guidelines.
[11] Increased civil costs associated with the poor ground conditions. This could not be foreseen at the commencement of the project and therefore some contingency had to be used to address this.
[12] Costs and descriptions have been included in boxes 7 & 8. Contingency has been used here for the 33kV active network ring.

As can be seen by the budget line items, there were some areas where the project required us to use contingency to retain the integrity of the various methods being tested. However, we feel that by being true to the intent of the project we have exceeded expectations. The project has delivered significant learning that we have been keen to explore further with the use of a) more LCNF Funding (Network Equilibrium) and b) investment via business as usual in ANM. Moreover the rollout of Alternative Connection Agreements adds further to the significant legacy of the Low Carbon Hub.

4 Project Management

4.1 Approach

The Low Carbon Hub necessitated a broad delivery vehicle across the business. As with all projects it was important to have a robust governance structure. A Project Board was formed of 4 senior stakeholders and a set of terms of reference agreed.

In summary the key responsibilities of the Project Board were as follows:

- Ensuring that the project was delivered according to scope as set out within the bid and plan
- Approve transition from phase to phase
- Monitor project progress against key milestones
- Steer, assist and guide with key project decisions, providing endorsement.
- Interface with business to support implementation of project key learning
- Review risks / issues, and approve mitigating actions
- Providing independent guidance and direction to the projects,
- Approve Ofgem reports and submissions
- Ensuring that benefits are realised during and after the project
- Approval of any major changes
- Champion LCH internal and external communications

The project team reported into the Project Board via the LCH Project Manager. The Project Board took an active role in guiding and helping to shape the project – this became incredibly important when it became clear that some of the project elements could not be delivered as was originally intended. Nevertheless our view is that the learning that came from the process has been invaluable.

The Project Board contained four Senior Stakeholders who it was deemed were best placed to influence the business as may be required during the project. This was especially important as we required the input of Major Projects, Engineering Design and Delivery throughout and engagement at an operational and Senior level was crucial during the period when we had to change the project.

The reporting structure of the project was as follows:

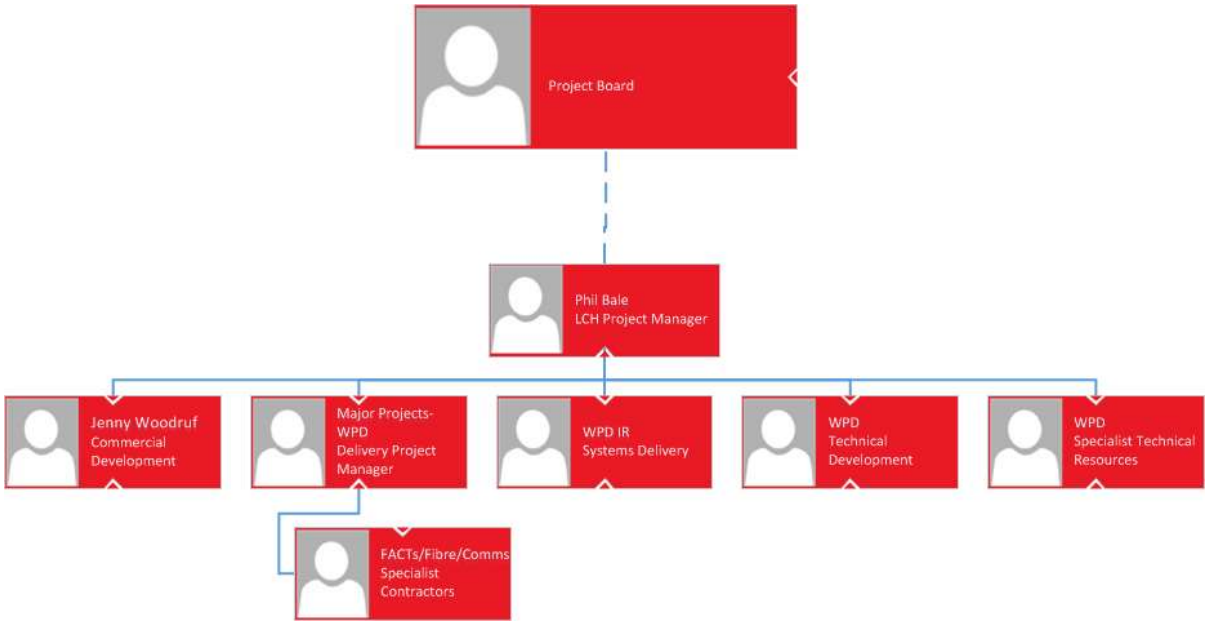

Diagram 1: Low Carbon Hub Project Reporting Structure

4.2 Key Role Descriptions and responsibilities

4.2.1 The Project Manager's role

The Project Manager's role was to:

- Escalating key issues/risks to the Future Networks Project Manager as required
- Reporting on progress to the Project Board
- Developing and managing the project plan
- Risk and Issue Management
- Track project progress
- Ensure milestones and objectives are delivered to time, cost and quality
- Manage financial delivery of the project
- Produce bi-annual Tier 2 LCNF reports for Ofgem
- Co-ordination of business resources to ensure successful project delivery
- Manage stakeholder engagement programme and internal and external communication

4.2.2 The Commercial Development Engineers role

The Commercial Development Engineers role was a part time position and had responsibility for creating the frameworks which ensured the LCH could operate in a flexible manner in conjunction with connected generators.

Key responsibilities included:

- Development of the methodology for commercial agreements looking at both Connection and Ancillary services agreements

- Understanding the interactions with National Grid and outlining the commercial aspects of LCH.
- Outlined a number of potential options for how these could be delivered.
- Organised workshops with generators
- Produced final agreements and work with connected generators

4.2.3 The Delivery Manager's Role

The Delivery Manager's role was needed because we were aware that there was a significant construction element associated with LCH which would have a direct bearing on the delivery of the key project objectives. With the associated reliance of the project on generation connections, and customer engagement the Delivery Manager came from our Major Projects department.

Key responsibilities included:

- Manage overall construction activities ensuring co-ordination between internal delivery resource and external specialist contractors.
- Ensure construction activities were delivered to time cost and quality.
- Report progress, risks and issues back to the LCH Project Manager

4.2.4 The Technical Development Engineer

The Technical Development Engineer was a requirement because LCH had many complex technical aspects to it which impacted on the design and delivery of the whole project. New standards were required and technical solutions needed to be developed to ensure integration of the new technologies. It was therefore vital that LCH had electrical engineering support.

The Technical Development Engineer's responsibilities included the following:

- Advice on new and innovative technical components of LCH
- Support technical reviews and any potential re-design processes
- Liaise with internal and external technical resources
- Support LCH modelling for New Connection activities

4.3 Corporate Project Management Governance

WPD operates all projects under its corporate project management governance arrangements. The Low Carbon Hub utilised this framework and this ensured that the Senior Stakeholders were appointed to form the project board. They agreed their Terms of Reference for their specific roles and they formally approved transition from phase to phase throughout the project.

The project board for LCH met regularly throughout the project to be updated on progress, approve documents and review the Risk and Issues that the project faced. It was also responsible for signing off transition from phase to phase and supporting the project manager in escalating matters as the need arose. Having Senior support for the project was a vital part of the success of LCH. More information is provided on this further within this section.

4.4 Risk Management process

At the outset of the project a RAID log was created and this formed the basis of all project team meetings and communications. The RAID log was then reviewed with the Project Board on a regular basis and, if needed, specific risks or issues were escalated to a member of the board for resolution.

With a project of this scale there were of course a number of risks and issues that cropped up during the project. The Governance arrangements are there to support the resolution of those issues and ensure that the project delivers its commitments.

WPD has its own bespoke arrangements based on PRINCE 2 that support each of our Innovation projects through to completion. The Low Carbon Hub was no different in this regard and the project board were instrumental in ensuring that the project delivered.

During the project 15 significant risks were recorded and mitigated and 3 were escalated as issues. It was the Project Manager's responsibility to ensure that risks were recorded, the risk assessed and assigned appropriately to the relevant person within the business or project and ensure that actions were taken to mitigate the risk as agreed with the owner. The Project Manager would keep the Project Board informed of progress throughout.

It is only through the rigorous application of governance that we feel that innovation projects can deliver learning for the various stakeholders with an interest in the outcomes and LCH, despite some significant challenges, has delivered a real legacy for us and for the wider stakeholder groups.

4.5 Changes to the Project

There was one change to the project during its lifecycle. The full change request is provided as a link in Section 6.3. Here we discuss the rationale for the change.

The LCH originally intended to build an active ring by building a new 5km interconnector. As the project commenced it became clear that permission to build such an interconnector was unlikely to be granted. This was a disappointment but we believed that it was important to try to press ahead with the project.

In order to circumvent this issue and still deliver the underlying principles of LCH we undertook to build a new primary substation at Ingoldmells, additional network equipment,

protection assets and telecommunications equipment. In addition the intention was to reduce the amount of OHL alterations within the project.

In making this change we were absolutely confident that the LCH would still deliver against its stated objectives contained within the bid and this we still believe to be true.

The change request to support these amendments was peer reviewed and submitted to Ofgem for approval, that approval being granted in November 2013. This change request amended the budget as well as some of the accompanying deliverables.

5 Basis of application for SDRC Award

In this section we provide a short summary of why WPD believes that the Low Carbon Hub merits a discretionary award.

We believe that there are 4 factors as follows:

1. The Hub has taken specific outcomes and developed them into Business as Usual change through the Alternative Connection Agreements. This is a fundamental principle of the Low Carbon Network Fund and moreover these agreements reduce costs to customers.
2. We have taken learning and developed it further within Network Equilibrium, through the inclusion of System Voltage Optimisation (SVO). In addition we have taken the learning from the LCH trial and scaled it to something akin to a normal BaU level trial to prove it for future adoption within the business. Again, this has to be an objective of the fund.
3. We have successfully rolled out Active Network Management across all four licence areas with 11 new zones opened by 2023. This requires a considerable programme of work internally but we see real business benefit from it.
4. We proved that Dynamic Line Rating was not appropriate for BaU due to the higher risks of wind sheltering.

In summary, it is our belief that being able to prove or disprove the underlying hypotheses of the project and take the learning forward is exactly the premise of these projects and therefore believe that Low Carbon Hub merits its discretionary award. We welcome the opportunity to discuss this application further.

In accordance with LCNF project governance (CRC5A) we can confirm that this application has been peer and manager reviewed and approved for publication by a Manager/Director.

6 Appendices

We have included within this appendix all Project Progress Reports (PPRs), all disseminated SDRC documentation, and the change request to support our application.

6.1 PPR's

1/6/2011 LCH Progress Report

http://www.westernpowerinnovation.co.uk/Document-library/2011/3-LCH-Project-Progress-Report-June-2011-WPD.aspx

1/12/2011 LCH Progress Report

http://www.westernpowerinnovation.co.uk/Document-library/2011/4-LCH-Project-Progress-Report-Dec-2011-WPD.aspx

1/6/2012 LCH Progress Report

http://www.westernpowerinnovation.co.uk/Document-library/2012/5-LCH-Project-Progress-Report-June-2012-v1-0.aspx

1/12/2012 LCH Progress Report

http://www.westernpowerinnovation.co.uk/Document-library/2013/WPD-PPR-The-Low-Carbon-Hub-December-2012.aspx

10/6/2013 LCH Progress Report

http://www.westernpowerinnovation.co.uk/Document-library/2013/PPR_WPD_LINCS_LC_HUB_MAY2013_PUBLIC.aspx

16/12/2013 LCH Progress Report

http://www.westernpowerinnovation.co.uk/Document-library/2013/11-LCH-Project-Progress-Report-Nov-2013.aspx

13/6/2014 LCH Progress Report

http://www.westernpowerinnovation.co.uk/Document-library/2014/LCH-Project-Progress-Report-May-2014.aspx

10/12/2014 LCH Progress Report
http://www.westernpowerinnovation.co.uk/Document-library/2014/Lincs-LCH-Nov-14-PPR-V1-0.aspx

6.2 SDRC's

28/5/13 Design Justification
This document is intended to outline the designs that have been considered as part of the project and assessment criteria taken in reaching the final design for construction based on the through life assessment.
http://www.westernpowerinnovation.co.uk/Document-library/2014/Low-Carbon-Hub-Design-Justification-v2-2.aspx

30/1/2015 LCH Knowledge Dissemination Report
This project report details the knowledge generated from the design, construction, operation and commercial aspects from the
Low Carbon Hub.
http://www.westernpowerinnovation.co.uk/Document-library/2015/LLCH-Knowledge-SDRC-V1.aspx

6.3 Change Requests

1/7/2013 LCH Resubmission
The change request submitted to Ofgem due to a change in project circumstances that necessitated a design modification in the active network ring. More information is provided within Section 4.4.

http://www.westernpowerinnovation.co.uk/Document-library/2014/LCH-re-submission-v1-2-(Clean-Copy).aspx