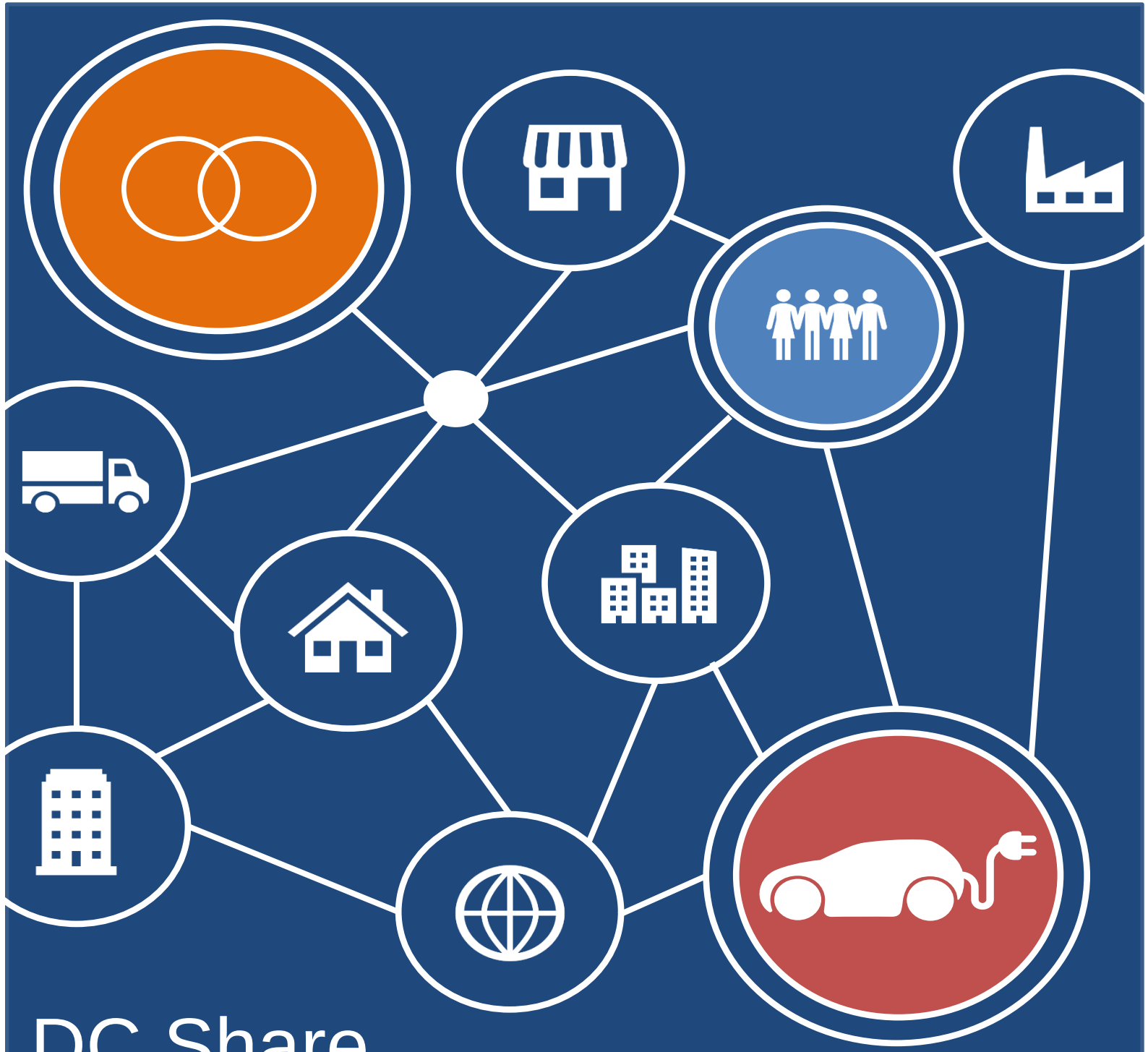

DC Share

Project Progress Report No.1

January – June 2020

ED 11196 | Issue Number 1 | Date 25/06/2020

Customer:

Western Power Distribution

Customer reference:

Project Direction ref: WPD EMID / DC Share

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Author:

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Approved By:

Sarah Carter

Date:

25 June 2020

Ricardo Energy & Environment reference:

Ref: ED11196- Issue Number 1

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1. Abbreviations

Abbreviation	Full Wording
AC	Alternating Current
BaU	Business as Usual
CPO	Charge Point Operator
DC	Direct Current
DNO	Distribution Network Operator
ENW	Electricity North West
EV	Electric Vehicle
FSP	Full Submission Pro-forma
GB	Great Britain
GTI	Grid Tied Inverter
LA	Local Authority
LV	Low Voltage
NDA	Non-Disclosure Agreement
NIC	Network Innovation Competition
REE	Ricardo Energy & Environment
TPS	Turbo Power Systems
WPD	Western Power Distribution

2. Executive Summary

2.1 Overview

The DC Share Project, “the Project”, is funded through Ofgem’s Network Innovation Competition (NIC) funding mechanism. The Project commenced upon receipt of Ofgem’s Project Direction letter in December 2019 and is scheduled to complete in March 2023.

The Project will explore:

1. The utilisation of latent capacity in distribution networks, which is difficult to access using traditional means.
2. How distribution networks will provide rapid charging facilities at scale and in the locations where they are needed. These are required for those without access to charging facilities at home or work, and for en-route charging.

The Project will be delivered via five workstreams comprising nine tasks and seven deliverables, as defined in Table 1.

Table 1: DC Share Workstreams, Tasks and Deliverables

Workstream	Task	Deliverable
WS1 Hardware Development and Deployment	Task 1: Site Selection	Deliverable 1: Site Selection Report
	Task 2: Preliminary Design phase	
	Task 3: Final Design Phase	Deliverable 2: Final System Design Report
	Task 4: Procurement / manufacture	Deliverable 3: Factory Acceptance
	Task 5: Installation support and commissioning	Deliverable 4: Installation Complete
WS2 Trials and Analysis	Task 6: Trial design	
	Task 7: Trial – interim	Deliverable 5: Trial Interim Report
WS3 System Benefits	Task 8: Trial report	Deliverable 6: Trial Results Report and EV Charging Customer Experience
WS4 Learning and Dissemination	Input from all tasks	Mandatory Deliverable: Comply with knowledge transfer requirements of the Governance Document
WS5 Project Reporting	Task 9: BAU	Deliverable 7: Close Down Report. Final Conclusions and BaU recommendation Mandatory Deliverable: Comply with knowledge transfer requirements of the Governance Document

2.2 Overall Project Progress

This first Project Progress Report (PPR) details the progress of the Project during the six month period January through June 2020.

After receipt of the Ofgem Project Direction letter on 19th December 2019, all Project Parties mobilised their respective teams and convened the Project kick-off meeting on 17th January 2020.

The kick-off meeting reconfirmed all Parties commitment, involvement and responsibilities, together with defining flows of communications, the programme, the commercial arrangements and summary of technical issues to be progressed and resolved.

Since concluding the kick-off meeting the following main activities have been progressed:

- All Party Contracts (WPD/REE, WPD/ENW, REE/TPS and REE/Vectos) have been drafted, discussed and signed.
- Finalisation and submission of the site selection report (Deliverable #1) and Ofgem approval granted.
- Post Contract signature and site selection report approval, further site visit to Taunton has completed to discuss, progress and plan ahead issues with the Local Authority, re-assess the physical “on-site” situation (including walking the proposed cable run route) and capture images of the substation layouts (internal and external) to aid equipment placement agreements.
- The necessary planning application process has commenced with intent to secure planning approvals by 30th September 2020.
- A series of technical meetings and workshops between all Parties to present, discuss and assess various issues associated with cabling, substation interfaces, earthing arrangements, stray currents, protection, control, communications and system architecture have occurred and are ongoing. All issues discussed are captured in concise minutes and actions assigned.
- The project website has been developed, tested and placed online.
- Charge Point Operator (CPO) identification, discussions and short-listing. Discussions (under cover of a NDA) ongoing with the preferred CPO to develop commitment and discuss, progress and plan ahead issues requiring their input both during the project and post project completion.

During the course of this reporting period the Project has been adversely affected by the ongoing restrictions imposed by the COVID-19 pandemic. This has resulted in inability to progress site visits necessary as part of the site selection process and it has hampered the intent to progress round-table meetings to efficiently discuss and close issues. However, all Parties have been collaborating as appropriate using remote access IT facilities during this extended period in best endeavours to progress the works.

The COVID-19 pandemic may also adversely affect our ability to meet downstream milestones as it is expected that there will be unavoidable delays procuring the specialist power electronic materials due to the various international supply chains ceasing/slowing production.

In an effort to mitigate any such delay we have agreed to advance payments for the long-lead items of equipment so that the procurement for that material can be initiated at an earlier stage in the project schedule. Whilst we acknowledge this means dispersing funds before final design is approved (and the planning application Gateway milestone achieved) it was collectively considered a necessary step by the Project team in an effort to mitigate any delays. The items to be procured in advance of the final design should not have an impact or influence on the design as they are generic raw materials, such as Silicone Carbide, that would be needed for this type of equipment regardless of specification. Upon

ordering such long-lead items we shall be able to further assess the situation and impact on the original baseline programme.

Despite the above we are pleased to report that significant progress has been made on a variety of project activities, all as summarised above.

2.3 Business Case

At the time of writing, there have been no changes to the anticipated benefits to be gained by the Project.

2.4 Project Learning and Dissemination

Project lessons learned and what worked well will be captured throughout the project lifecycle. These will be captured through a series of on-going reviews with stakeholders and project team members and reported within Section 8 of this report.

2.5 Risks

Two separate risk registers have been developed and are maintained for the Project.

One covers risks associated entirely with the COVID-19 pandemic whilst the other risk register concentrates on project-specific (eg non Covid-19) issues)

Each risk register is a live document and is updated regularly. To date, a total of 30 risks have been raised of which 5 are classified as “Severe” and 3 as being “Major”.

The “Severe” risks are all associated with the Covid-19 pandemic and it is expected that these will naturally disappear or become adequately mitigated.

For each risk, a mitigation action plan has been identified and the appropriate steps then taken to ensure risks do not become issues wherever possible.

The risk registers are reviewed and revised on a regular basis, so the data with them will be subject to change.

3. Project Managers Report

3.1 Project Partnering

The DC Share Project, “the Project”, is funded through Ofgem’s Network Innovation Competition (NIC) funding mechanism. The Project commenced upon receipt of Ofgem’s Project Direction letter in December 2019 and is scheduled to complete in March 2023.

The Project Partners are as follows:

1) Western Power Distribution (East Midlands) plc (WPD): The lead/funding DNO (licensee) and will provide the Alternating Current (AC) and Direct Current (DC) cabling, AC substation measuring equipment plus take responsibility for equipment and material installation
2) Ricardo Energy & Environment (REE) are providing the Project Management function on behalf of WPD and will procure the main supervisory control system, telecommunications cabling plus minor DC switches and meters
3) Turbo Power Systems Ltd (TPS) are providing the specialist electronic equipment required at each substation plus the EV charging points
4) Electricity North West Ltd (ENW) are providing a second DNO oversight of the Project
5) Vectos (South) Ltd are providing support during the planning application process

All individual Contracts (WPD/REE, WPD/ENW, REE/TPS and REE/Vectos) have been drafted, discussed and signed.

3.2 Project Background (Overview)

The aims of the Project remain unchanged since submission of the Full Submission Pro-forma (FSP).

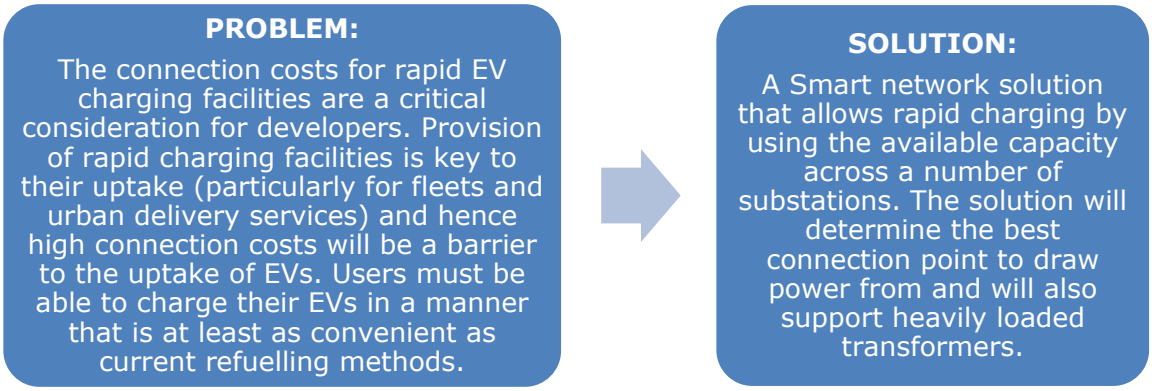
The aim is therefore to assist with rapid Electric Vehicle (EV) charging requirements by providing reliable facilities where they are needed, whilst making optimal use of the available network capacity without the need for immediate network reinforcement.

The aim is driven by the UK Government’s Clean Growth Strategy which strives to ensure that hybrid and combustion engine vehicles are removed from sale by 2040 and that the uptake of replacement EV’s is not hindered by the lack of rapid charging points throughout Great Britain (GB).

Essentially, rapid charging points will need to be installed in large-scale clusters to promote usage and customer confidence that they are able to arrive at a cluster site and rapidly charge their EV.

The problem the project aims to solve can therefore simplistically be shown graphically within Figure 1 below.

Figure 1: Project Problem & Solution



The Project will use an equalisation network to provide an alternative, cost-effective solution for rapid EV charging demands, more flexibly than a traditional AC reinforcement solution. The solution seeks to explore the comparative benefits of a DC network, where power flows can be actively managed, and fault level contained, over a traditional AC network reinforcement.

The Project will therefore use an equalisation network between four existing substations and make use of the differences in demand patterns to provide the required capacity. The Project will employ bi-directional power electronic converters to connect to each existing substation low voltage (LV) board and provide connections to vehicle charge points via a new high capacity DC cable network. The equalisation network balances demand such that transformers experiencing heavy demand receive support from those that are more lightly loaded. This offers benefits by evenly distributing loads between assets, reducing the probability of future stranded assets.

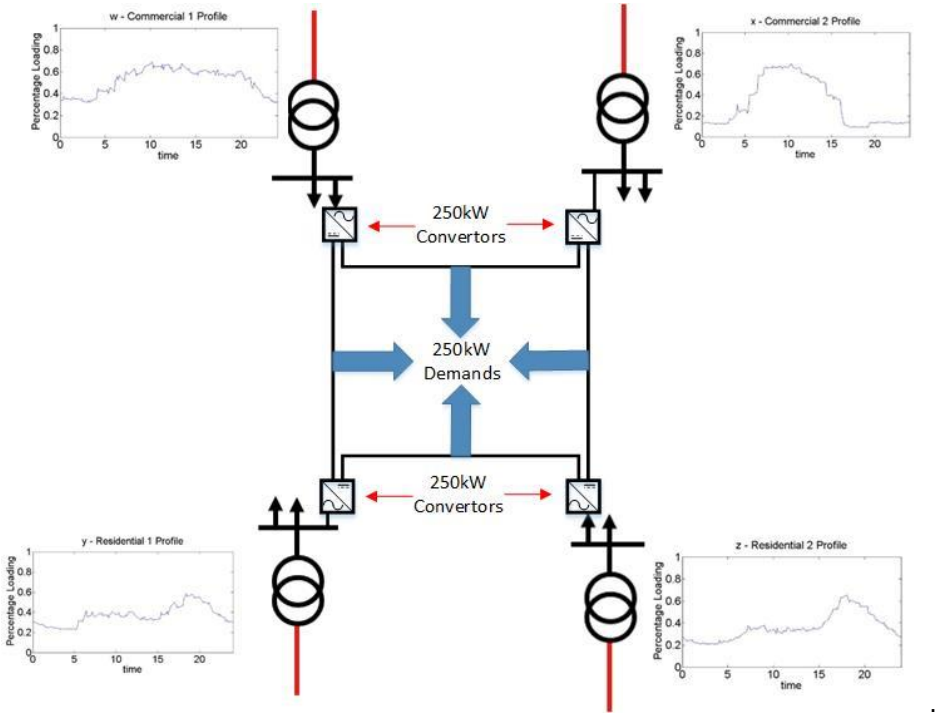
The Project will provide a means of sharing system capacity across AC secondary substations with different load profiles. Using a DC ring to provide the capacity for the rapid charging points leaves capacity on the existing LV AC cables for demand growth of the existing users.

Figure 2 below portrays the intended design solution. In total, a maximum of 1MW of latent capacity is planned to be extracted at any point in time and made available for network equalisation plus EV charging purposes.

Each AC secondary substation will have a bi-directional Grid-Tied Inverter (GTI) utilising specialist power electronic equipment to safely and efficiently convert up to 250kW of AC power to DC at 800V for injection onto a dedicated DC cable ring connecting all AC secondary substations together.

The EV rapid chargers (15 in total, comprising 10 x 50kW and 5 x 100kW) will be located in two geographically separated “hubs” each directly connected to the DC ring.

Figure 2: Intended Design Solution



Four areas of development will be undertaken.

1. A new control system will be required to manage the DC Share system, incorporating communication between the vehicles, the chargers and the substation converters. The system will autonomously assess the charging load, where to draw this demand from, and the level of equalisation possible. Management of the charging load and its impact on users will be investigated during the trial, to gain insights as to the optimum ratio of charging and converter capacity that should be installed to provide optimal system utilisation against capital expenditure.
2. DC Share will expand the equalisation concept into an equalisation network, balancing a wider area and offering broader benefits. DC Share will demonstrate this at LV, where the effects of aggregation are low (i.e. the number of connected customers is relatively small, and load generally reflects a distinct domestic or commercial/industrial profile) and the potential benefits are pronounced.
3. The AC-to-DC converters to be deployed in the trial will be an evolution of the “Soft Open Point (SOP)” technology developed by Turbo Power Systems Ltd in previous innovation projects. The new units will be smaller and will connect the DC bus to a cable circuit. The smaller unit means that siting devices within substations will be possible in more locations, which will reduce the visual and audible impact.
4. As existing commercially available EV rapid chargers are all AC network fed, new EV chargers that are fed from the DC network will be developed.

3.3 Project Plan

With recognition of the anticipated delays in the specialist equipment supply chains caused by the COVID-19 pandemic, the project plan has been revised as shown in Table 2 below.

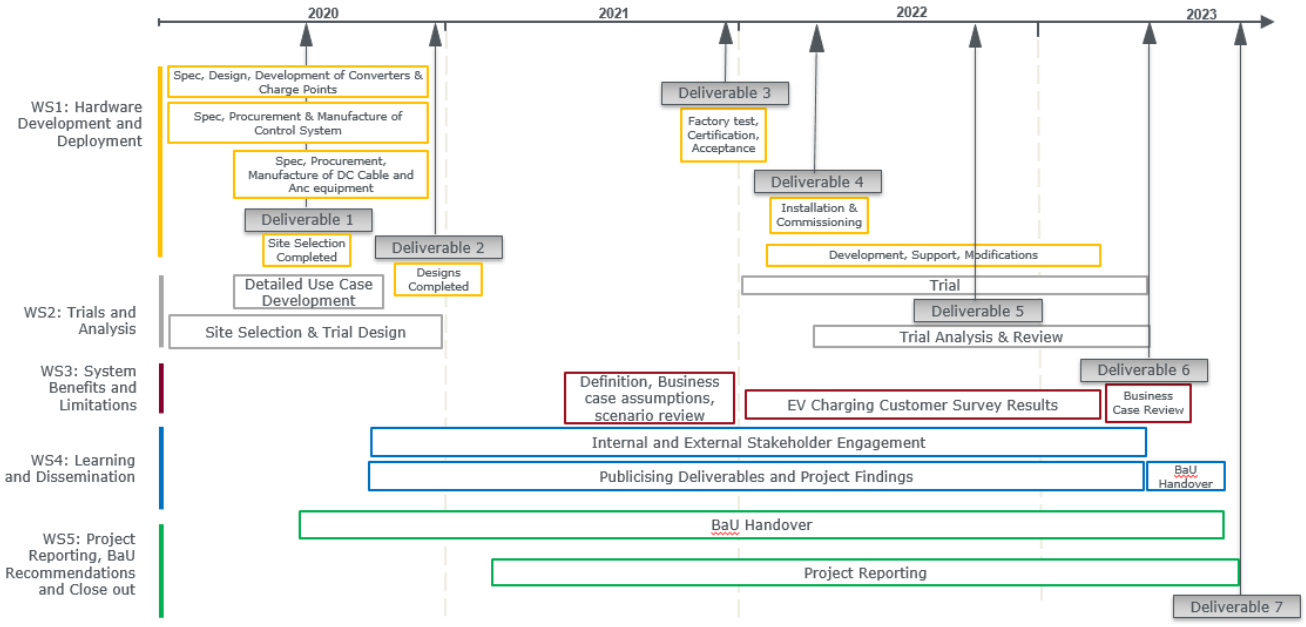
Table 2 details the anticipated contingency dates in light of the COVID-19 delays. These dates will only be realised once the long lead items have been ordered and manufacturer has confirmed a delivery date.

Table 2: Original and Contingency Key Milestone Dates

Reference	Project Milestone	Original Key Milestone Dates	Contingency Key Milestone Dates (*Estimated at time of Contract Signature*)
WP 1	Site Selection Completed	31 May 2020	31 May 2020
WP 2	Final System Design Report	30 September 2020	18 December 2020
WP 3	Factory Acceptance	31 March 2021	18 December 2021
WP 4	Installation Completion	31 July 2021	30 April 2022
WP 5	Trial Interim Report	31 January 2022	30 September 2022
WP 6	Trial Results Report and EV Charging Customer Experience	30 November 2022	30 June 2023
WP 7	Closedown Report. Final Conclusions and BaU recommendation	31 March 2023	30 October 2023
N/A	Comply with knowledge transfer requirements of the Governance Document	End of Project	End of Project

This has been further elaborated and can be shown graphically as per Figure 3 below.

Figure 3 – Project Plan and Key Milestones



All Parties will endeavour to accelerate the programme and regain some of the delays introduced by the COVID-19 pandemic but, at time of issue of the PPR, the effect upon the specialist long-lead equipment supply chain is unknown and can only be determined once the procurement process begins.

3.4 Progress During Reporting Period

During this PPR reporting period the project team have progressed the following activities:

3.4.1 Contract Signature

The principal Contracts been drafted, discussed and signed, with the ENW and WPD one due to be signed imminently. The respective Purchase Orders are in the process of being raised after which invoicing between Parties can commence and TPS can initiate procurement for the specialist long-lead items of power electronic equipment.

3.4.2 Site Selection

The site selection report (Deliverable #1) has been completed and formally issued for Ofgem review and approval on 29th May 2020.

Ofgem approval was provided on 4th June 2020.

The full evaluation process as described within the FSP, Section 2.3, including the following aspects, has been undertaken in order to conclude this deliverable.

- Location within the Western Power Distribution (WPD) area (South West, South Wales, East and West Midlands) and concluding a short-list of interested Local Authorities (LA), results of which are shown below in Figure 4

Figure 4: Conclusion of LA's in WPD License Area Expressing Interest & Considered Suitable

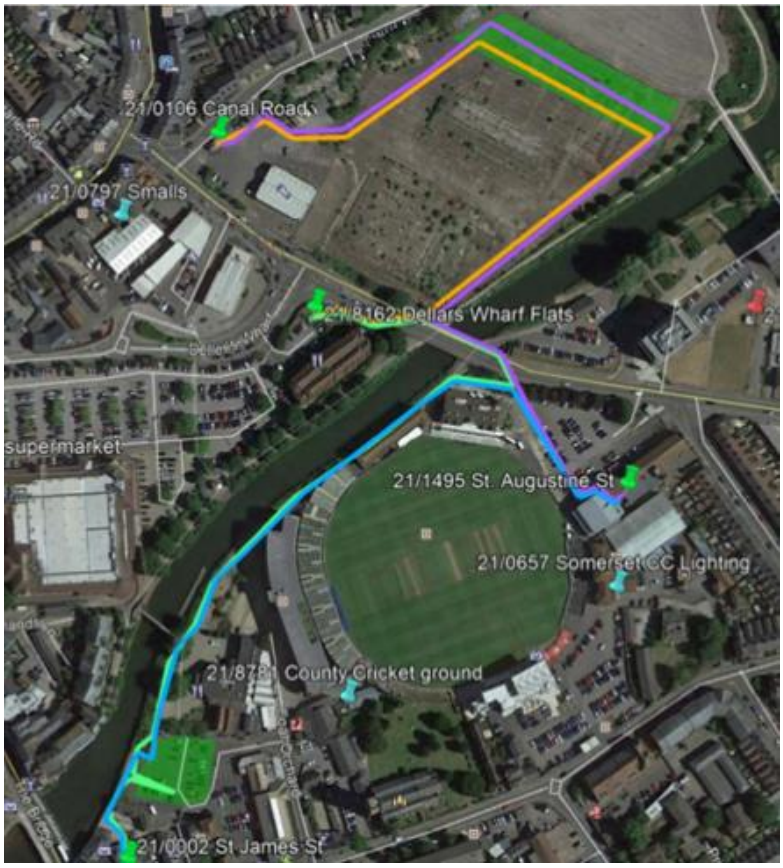
Local Authorities in WPD area	Local authorities reached out to (emailed)	Interest from Local Authorities	Number of local authorities engaged with	Percentage of existing EVs (Office for National Statistics 2019)	Number of existing rapid chargers
129 in total 41 discounted due to difficulty in access by public transport for the project team	88 Local authorities emailed with project proposal	15 Local authorities expressed interest in the DC Share project	Stratford upon Avon	0.02%	1
			South Hams	0.81%	0
			Somerset West and Taunton	0.56%	0
			East Devon	0.72%	1
			South West Devon	0.63%	1
			Newcastle-Under-Lyme	0.89%	0
			Warwick	1.61%	2
			Sheffield	0.6%	2
			Plymouth	0.21%	2
			Worcester	0.51%	3
			Bristol	0.56%	11
			Milton Keynes	7%	40+
			Coventry	0.39%	9
			Derby City Council	1.31%	2
			Gloucester	0.66%	4

- Commitment from the Local Authority (LA) to actively participate in and promote the Project
- Conurbation where the uptake of EVs is being encouraged, particularly with regards the LA's vehicle fleet.
- Location where a number of Rapid chargers will be well utilised assuming the following aspects can be accommodated:
  - Where fleets, taxis, private vehicles will stop to charge frequently and regularly.
  - Other local facilities in easy reach (food, drink, rest rooms).
  - Potential to collaborate with local fleet operators or businesses.

- Location where cars and vans can safely stop to park.
- Location where there is space on the pavement / side of the road for the chargers, or space for a “hub/cluster” arrangement.
- Surrounded by mixed use property (commercial/industrial/residential) within 1km square.
- Where it will be relatively easy to dig up roads to lay cable without being unduly disruptive.
- Located on public land.

An *example* of the type of option design investigated and reported upon within the site selection report is as shown below in Figure 5.

Figure 5: Example of DC Share Interconnected Substation Design



Following Ofgem approval we are initiating the planning application process in an effort to secure all required approvals by the Gateway date of 30th September 2020.

If the COVID-19 restrictions are still in place then we intend to undertake all such planning applications remotely, whilst at all times maintaining necessary level of dialogue with the concerned LA. In parallel, we shall also strive to conclude the local site investigations and finalise the cable dig and lay design so that the entire site selection process can be concluded.

3.4.3 Technical Matters

A series of technical meetings and workshops between all Parties to present, discuss and assess various issues associated with cabling, substation interfaces, earthing arrangements, stray currents, protection, control, communications and system architecture have been undertaken and regular weekly conference calls remain in place for the project partners to discuss and progress all recorded issues.

Despite the COVID-19 restrictions these conference calls have been working well and concise “Notes of Meetings” with assigned actions are captured and circulated for all party review and comment.

3.4.4 Project Website

The Project website has been developed to provide stakeholders with information about the overall project as well as providing project updates as the project progresses.

It has been placed live online during June 2020.

The domain name https://www.dcshare.org.uk has been registered and funded for 3 years (extendable as required).

The website comprises the following pages/tabs and Figure 6 provides a selection of website screenshots.

- "Home" Page
- "About the Project". This gives a summary of the project, the aims & objectives of the project trial requirement, technical matters, benefits expected to be achieved and funding arrangements
- "FAQs". A default set (examples as below) has been added which will be expanded as the project progresses and end-user comments are addressed
  - 'What's the problem that needs solving?'
  - 'How is the project funded?'
  - 'What is the aim of DC Share?'
  - 'What is the proposed solution?'
- "Feedback" form to allow end-users of the EV rapid chargers to submit feedback of their experiences whilst using the facilities. This will be an important part of information gathering during the project trial.
- "News" which will be updated every time there is a significant event to report. It may contain articles, pictures and videos, providing information on what is happening in the project. For example, the conclusion of the site selection report can be advertised here along with pictures extracted from the planning process.
- "Project Library" which will contain links to all project documents available in the public domain for download. This may, for example, include the following:
  - Project deliverables
  - Project information (useful documents and background information)
  - Project presentations
  - Project learning
- "Partners" comprises brief details of all the project partners with branding and links to their website.
- "Contact" is a generic form for anyone to make contact and request feedback via email. Users may also, if they choose, provide other contact details such as address and phone number.

Figure 6: Selection of DC Share Project Website Screen Shots

Figure 6.1 “Home” Page

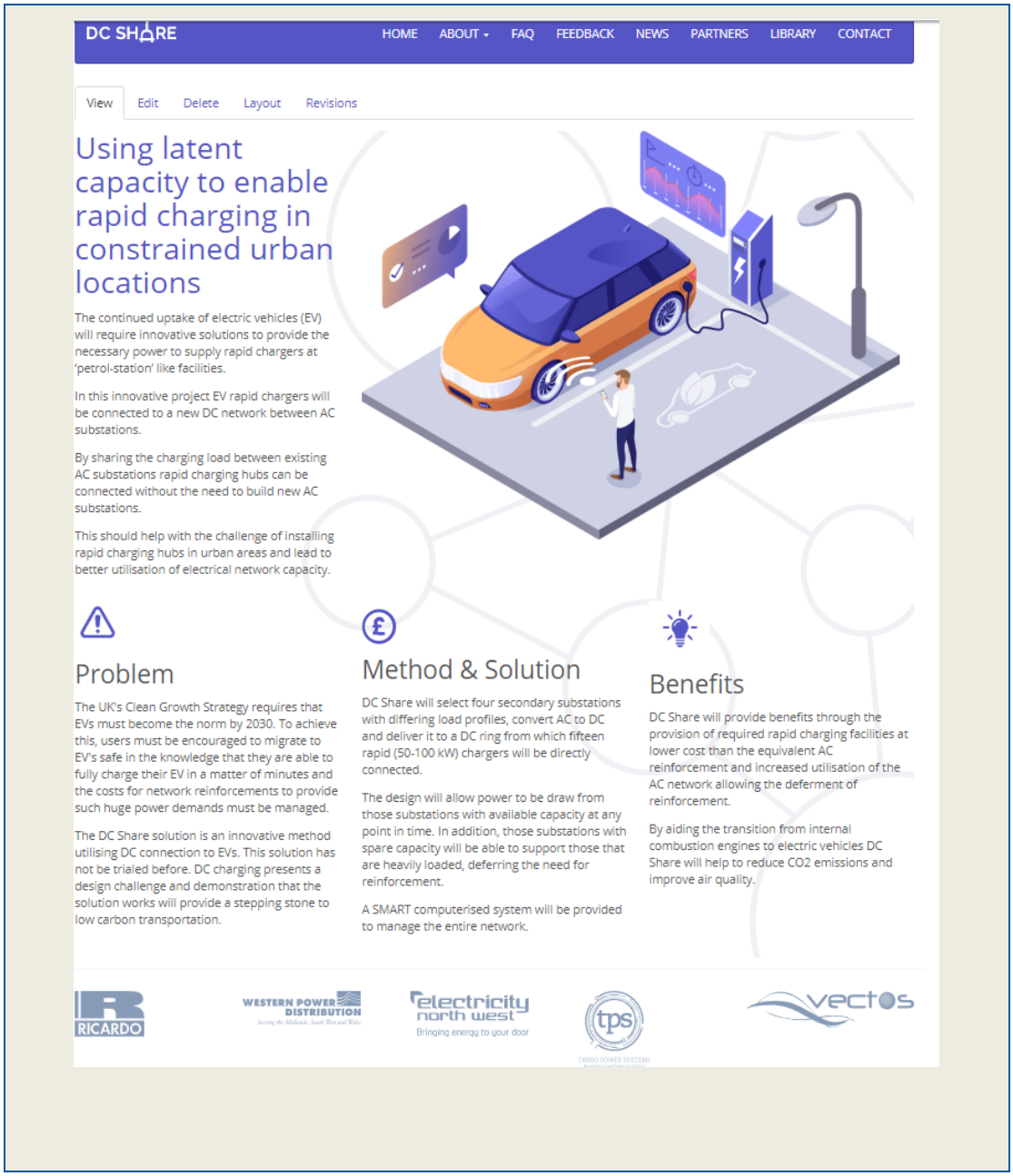


Figure 6.2 “About The Project” Page

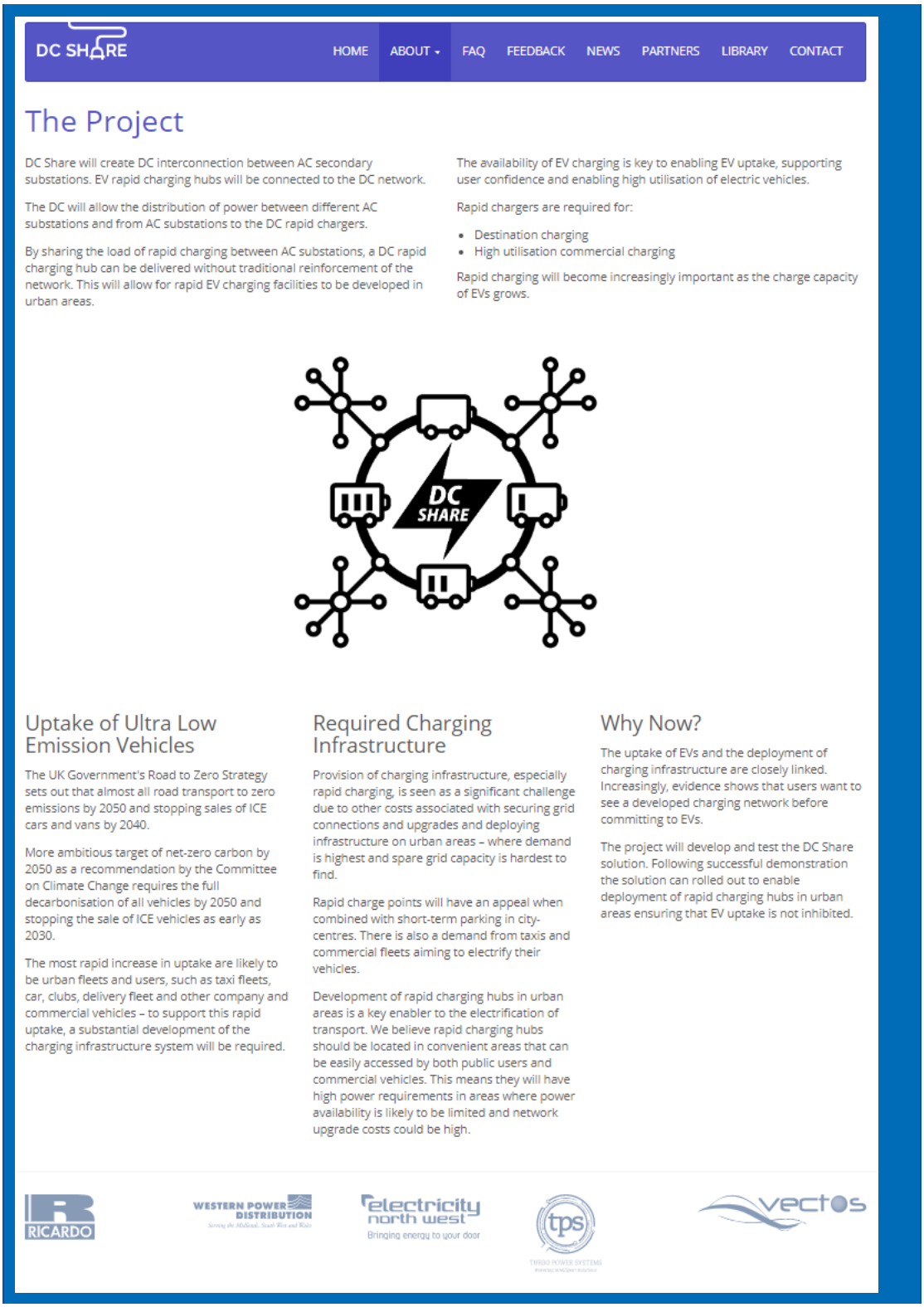
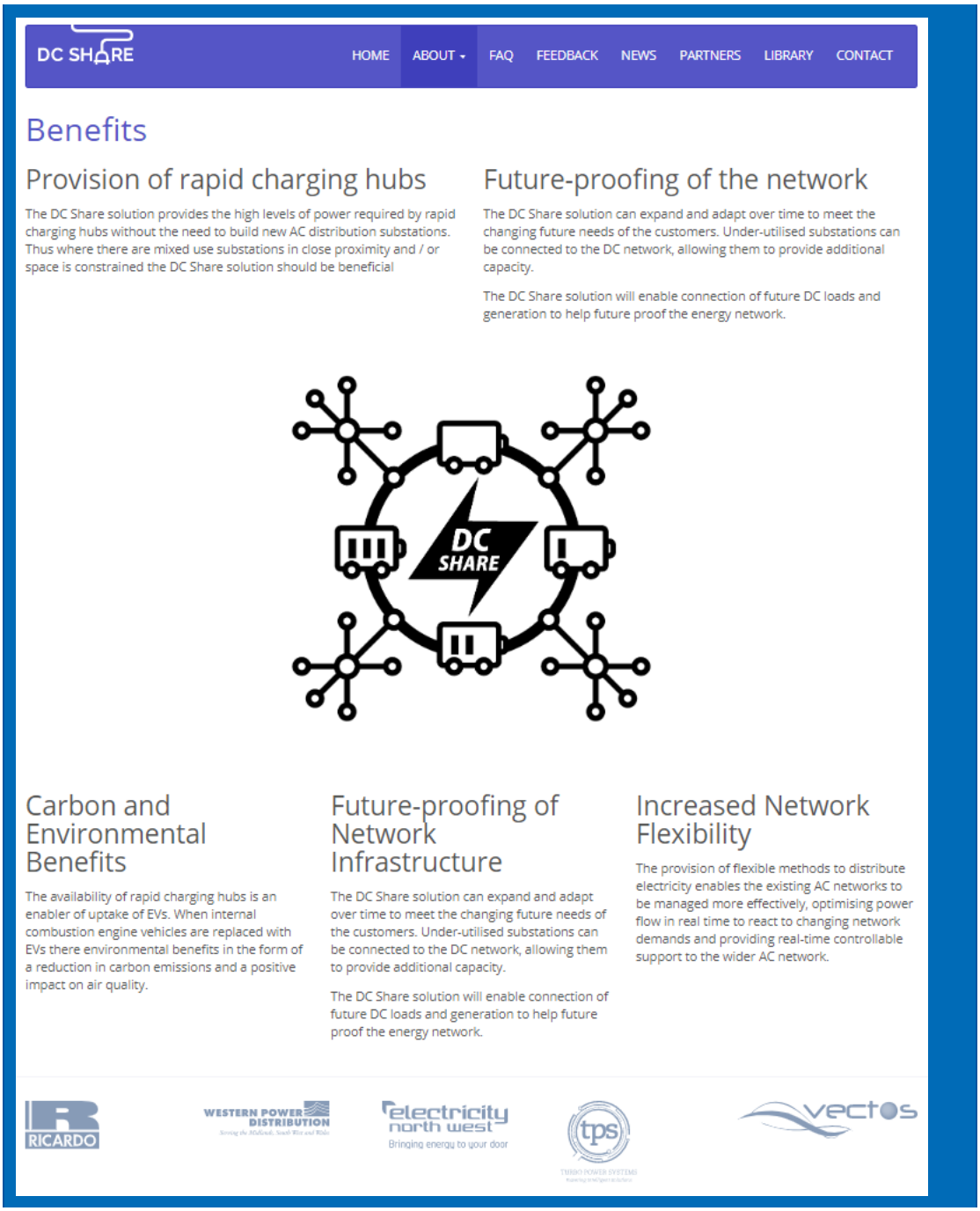


Figure 6.3 “Benefits” Page



3.4.5 Charge Point Operator (CPO) Issues

We identified seven UK CPO's and invited all to express interest in working with the project team during the design phase plus taking ownership of the EV rapid charging points upon project completion.

Five CPO's responded and were subsequently invited for separate conference calls to discuss the project, the level of interest in participating and what any next steps may be.

Upon completion of these conference calls we have ranked each according to how we viewed their suitability and willingness to proceed.

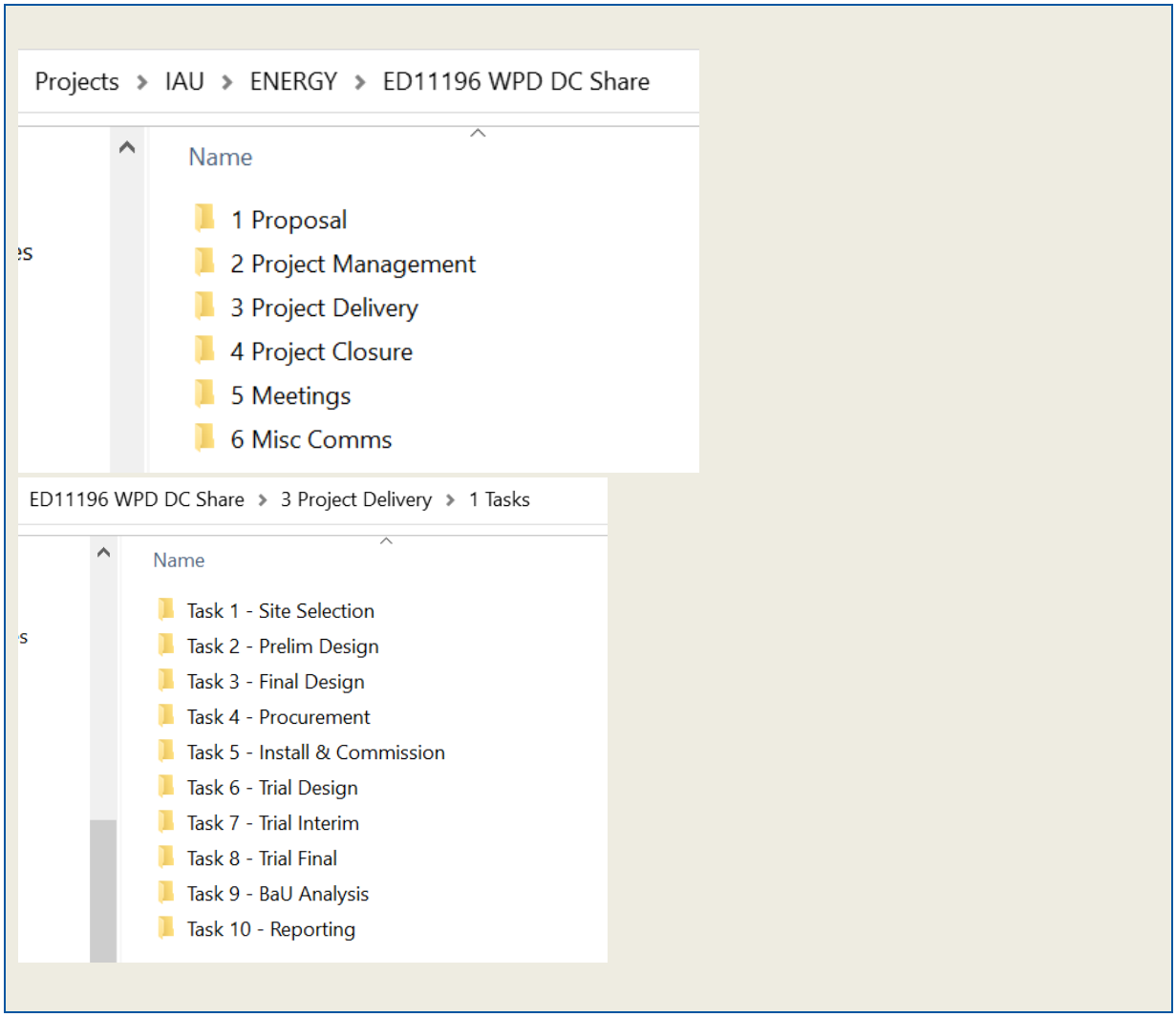
The first-ranked CPO has been issued with a Non-Disclosure Agreement (NDA) for signature prior to progressing further discussions, intended to develop commitment and discuss, progress and plan ahead issues requiring their input both during the project and post project completion.

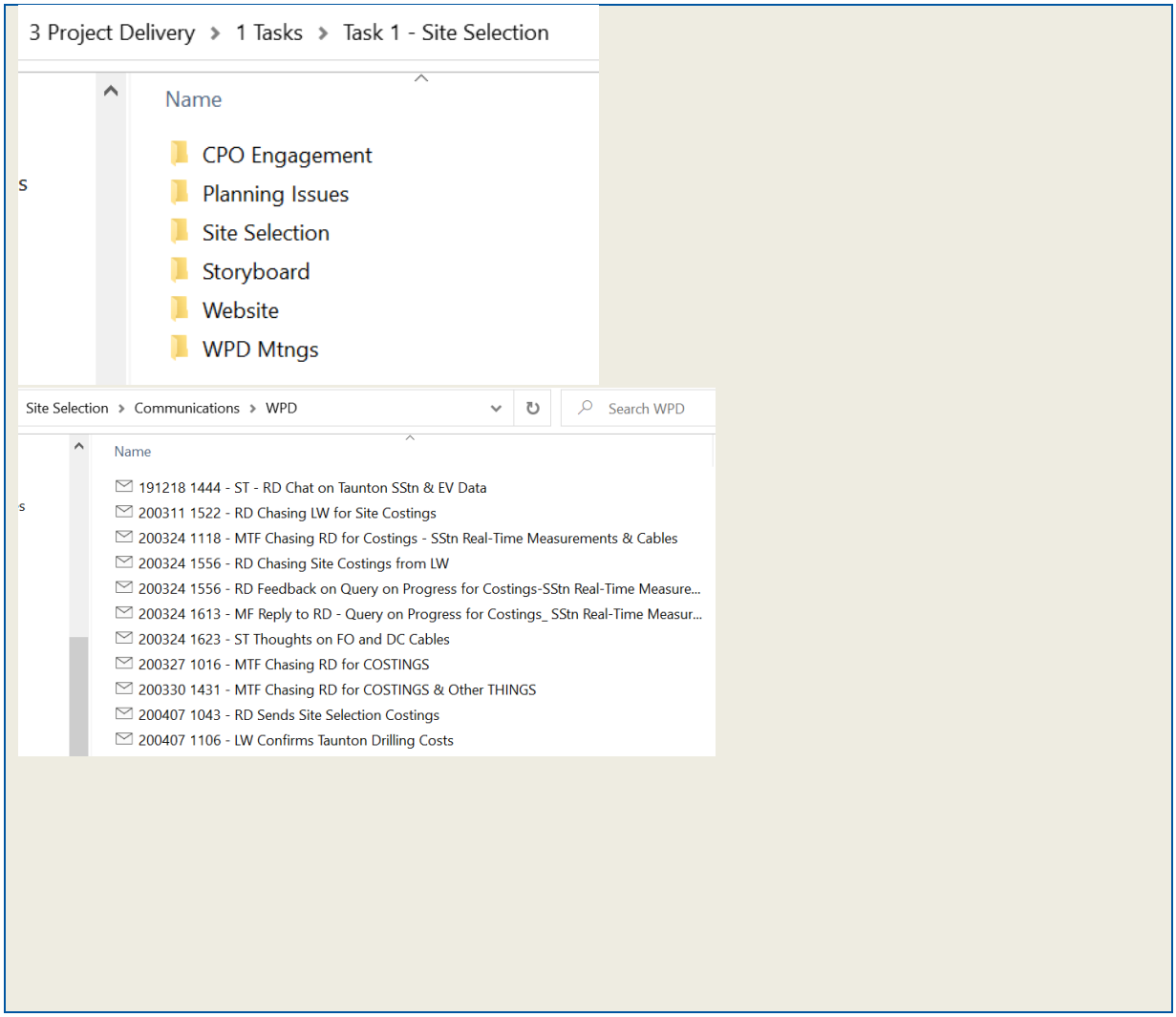
3.4.6 Project Directory

All electronic communications are stored to a project directory, designed in a logical manner to permit any item to be easily located. All communications are stored with date and time stamp and provided with a sensible title so that a concise record is maintained along with permitting ease of location.

Example screenshots of the project directory structure are provided below in Figure 7

Figure 7: Example Screenshots of DC Share Project Directory Structure





3.4.7 Project Sharepoint (the “Box”)

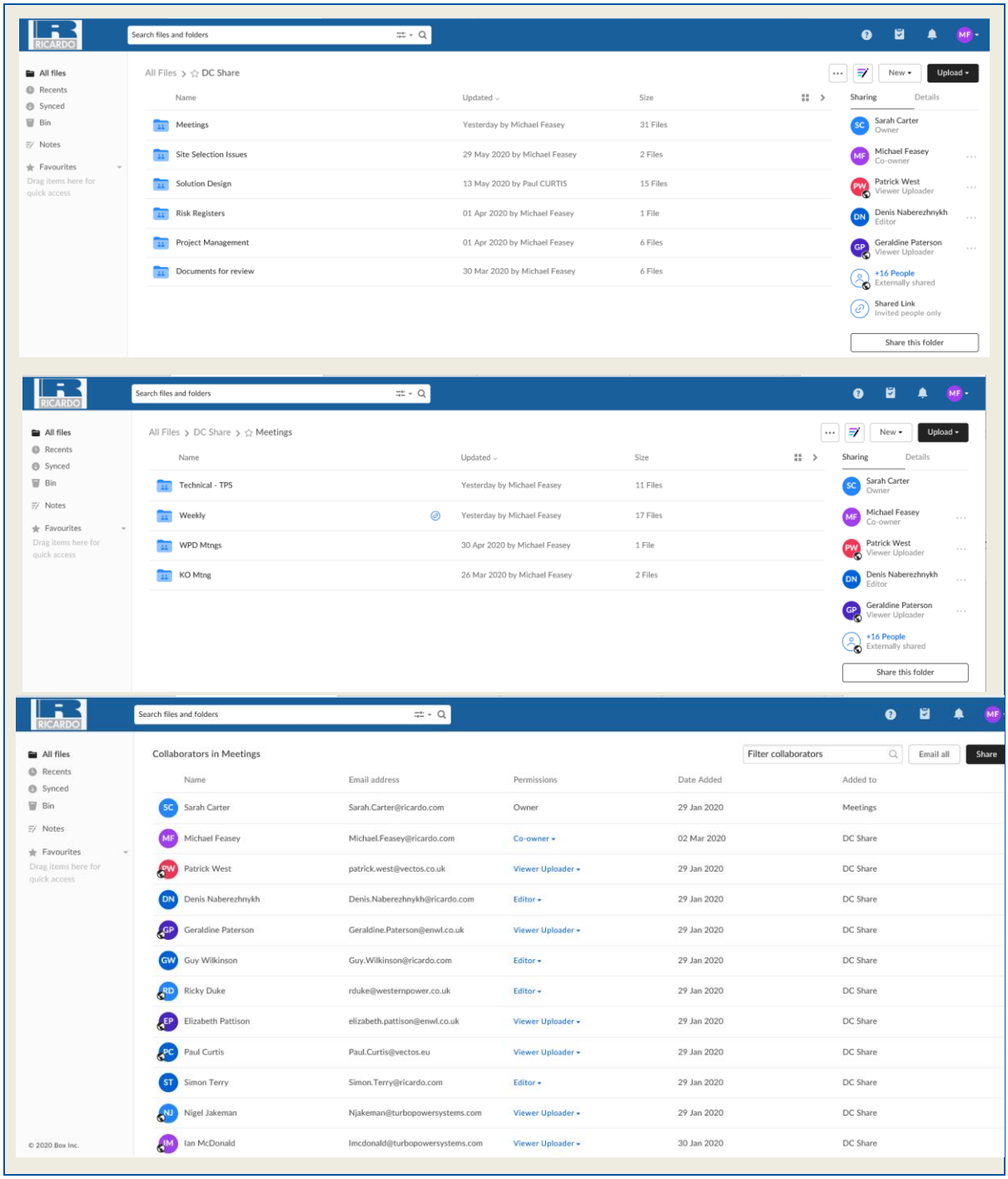
A web-based collaboration and sharepoint tool has been configured (the “Box”) to facilitate the sharing of data between all collaboration team members.

The Box is managed by REE who are able to add collaborators and assign access rights to them.

Any member can download/upload documents and share information.

Examples of the Box user interface are provided below in Figure 8.

Figure 8: Example Screenshots of DC Share Project Collaboration (“Box”) Tool


Search files and folders
All files
Recents
Synced
Bin
Notes
Favourites
Drag items here for quick access
All Files > DC Share
New
Upload
Name
Updated
Size
Sharing
Details
Meetings
Yesterday by Michael Feasey
31 Files
Site Selection Issues
29 May 2020 by Michael Feasey
2 Files
Solution Design
13 May 2020 by Paul CURTIS
15 Files
Risk Registers
01 Apr 2020 by Michael Feasey
1 File
Project Management
01 Apr 2020 by Michael Feasey
6 Files
Documents for review
30 Mar 2020 by Michael Feasey
6 Files
Sarah Carter
Owner
Michael Feasey
Co-owner
Patrick West
Viewer Uploader
Denis Naberezhnykh
Editor
Geraldine Paterson
Viewer Uploader
+16 People
Externally shared
Shared Link
Invited people only
Share this folder
All Files > DC Share > Meetings
Technical - TPS
Yesterday by Michael Feasey
11 Files
Weekly
Yesterday by Michael Feasey
17 Files
WPD Mtngs
30 Apr 2020 by Michael Feasey
1 File
KO Mtng
26 Mar 2020 by Michael Feasey
2 Files
Collaborators in Meetings
Filter collaborators
Email all
Share
Email address
Permissions
Date Added
Added to
Sarah Carter
Sarah.Carter@ricardo.com
Owner
29 Jan 2020
Meetings
Michael Feasey
Michael.Feasey@ricardo.com
Co-owner
02 Mar 2020
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Viewer Uploader
30 Jan 2020
DC Share
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4. Business Case Update

At the time of writing, there have been no changes to the anticipated benefits to be gained by the Project.

5. Progress Against Plan

5.1 This Reporting Period

Error! Reference source not found. summarises the progress in this reporting period against the project plan. Key issues encountered during the reporting period are provided in Section **Error! Reference source not found.**.

Table 3: Progress Against Plan

Reference	Project Milestone	Status	Original Key Milestone Due Dates	Revised Key Milestone Due Date *(Assessment from COVID-19 Impact)*
WP 1	Site Selection Completed	Completed *(Ofgem Approved 5th June 20)*	31 May 2020	31 May 2020
WP 2	Final System Design Report	In Progress	30 September 2020	18 December 2020
WP 3	Factory Acceptance	Not started	31 March 2021	18 December 2021
WP 4	Installation Completion	Not started	31 July 2021	30 April 2022
WP 5	Trial Interim Report	Not started	31 January 2022	30 September 2022
WP 6	Trial Results Report and EV Charging Customer Experience	Not started	30 November 2022	30 June 2023
WP 7	Close Down Report. Final Conclusions and BaU recommendation	Not started	31 March 2023	30 October 2023
N/A	Comply with knowledge transfer requirements of the Governance Document	In Progress	End of Project	End of Project

5.2 Next Reporting Period

When the procurement process for the specialist electronic equipment (including the *long-lead items*) commences we shall be able to re-assess the impact of any delays introduced by the COVID-19 pandemic on the various international supply chains and, at that time, provide updates to the key milestone dates as provided within table three.

At this current time, we are anticipating there may be up to a twelve-month delay in acquiring the necessary equipment and materials. Therefore, if they are able to be procured at an earlier stage, for example during August 2020, then we could expect delivery of that equipment by August 2021, allowing equipment build and internal test to proceed with formal FAT's being completed during December 2021.

Under these circumstances, there will be a resulting "knock-on effect" of delays to all subsequent Key Milestone dates as estimated within table three.

We are, however, anticipating that we can accelerate certain other activities and progress some in parallel in order to regain some of the COVID-19 induced delay, so that the final completion date of the Project may not be so adversely affected. Some of the activities that can be accelerated include the laying of DC cables at the trial site and installation of the fibre network, which will allow the focus to be put on the converters once the long lead items arrive and speed up the installation process. This will be confirmed in a change request once the anticipated delays are confirmed.

We shall be able to report a clearer picture of the revised key milestone dates and overall project schedule within the next PPR.

6. Progress Against Budget

Table 1: Progress Against Budget

	Total Budget	Expected Spend June 19	Actual Spend June 19	Variance £	Variance %
Labour	**490.95**	**88.26**	**6.79**	**-81.61**	**-92%**
WPD Project Management	98	12.46	6.79	-5.81	-46%
WPD Network Services	298.72	56	0	-56	-100%
ENW Costs	94.2	19.8	0	-19.8	-100%
Equipment	**1,189.06**	**0**	**0**	**0**	**0%**
Long Lead Hardware	119.2	0	0	0	0%
Converters & Charge Points	522.11	0	0	0	0%
Control System	395.88	0	0	0	0%
Misc Hardware	151.87	0	0	0	0%
Contractors	**2,693.37**	**539.92**	**0**	**-539.92**	**100%**
Site Selection	268.92	268.92	0	-268.92	-100%
Preliminary Design	786.78	271	0	-271	-100%
Final Design	183.29	0	0	0	0%
Procurement Activities	284.18	0	0	0	0%
Install & Commissioning	108.37	0	0	0	0%
Trial Design	189	0	0	0	0%
Trial Interim	260.09	0	0	0	0%
Trial Reporting & Analysis	159.81	0	0	0	0%
BaU Analysis	88.03	0	0	0	0%
Project Reporting	79	0	0	0	0%
Dig & Lay	286.09	0	0	0	0%
IPR Costs	**0**	**0**	**0**	**0**	**0%**
IT	**420.16**	**0**	**0**	**0**	**0%**
IT Costs (Fibre Ring)	420.16	0	0	0	0%
Travel & Expenses	**104.69**	**21.33**	**0**	**21.33**	**100%**
Travel & Expenses	104.69	21.33	0	-21.33	-100%
Contingency	**509.96**	**0**	**0**	**0**	**0%**
Contingency Costs	509.96	0	0	0	0%
Other	**220.38**	**0**	**0**	**0**	**0%**
WPD Cable costs	69	0	0	0	0%
Other Costs	126.38	0	0	0	0%
TOTAL	**5,628.56**	**649.51**	**6.79**	**-642.86**	**-99%**

Due to delays in signing the contract there has been significant underspend on both Contractors and ENW contract. At the time of writing the first Invoice has been raised from RICARDO to the amount of £463,995.62. This had been expedited through our payments system and is due to be paid on the 30th of June 2020. This means that 86% of the scheduled spend on 'Contractors' will be paid imminently.

Shortfall of the full amount can be attributed to the COVID-19 situation with the lack of travel and site visits undertaken that were needed to complete site selection.
Underspend in WPD network services can also be attributed to the COVID-19 situation as we were able to carry out any non-essential works on the network, such as the installation of monitoring systems, but it is anticipated that this will be caught up by the next reporting period.

7. Bank Account

The bank account statement for the project, for the reporting period is provided in a separate confidential Appendix.

8. Project Deliverables

The project deliverables as defined within the Project Direction letter are as defined in Table 5 below.

Against each deliverable we have added a narrative describing current status and any challenges encountered.

Table 5: Project Deliverables

Deliverable Item No.	Project Deliverable Description	Original Deadline	Narrative
1	Site Selection Report	May 2020	Activity and deliverable completed. Report issued to Ofgem on 29th May 20 and formal; approval received back from Ofgem on 5th June 2020. Planning application process can commence.
2	Final System Design Report	September 2020	Not yet started
3	Factory Acceptance	March 2021	Not yet started
4	Installation Complete	July 2021	Not yet started
5	Trial Interim Report	January 2022	Not yet started
6	Trial Results Report & EV Charging Customer Experience	November 2022	Not yet started
7	Close Down Report, Final Conclusions & BaU Recommendation	March 2023	Not yet started

9. Learning Outcomes

9.1 This Reporting Period

During this reporting period, we can categorise the "learning" against various activities that have taken place as follows:

Learning During Site Selection

Analysis of the various LA's and attempts to make initial contact was sometimes not easy, the LA's websites were sometimes cumbersome and it was proved difficult to track down the correct person to talk to who had oversight of the LA's "low carbon policies" etc.

Regardless of the above, after persevering with the contact process, it became apparent that several LA's did indeed have "low carbon" departments and a person responsible for progressing local initiatives. Lesson learnt is to research and target individuals with the LA and persevere with the process of calling "via the switchboard operator" in order to locate and secure the correct person to discuss the issues with.

Given the reasonably tight schedule and the need to secure planning permissions for the site works (essentially the installation of EV rapid charging points and conversion of existing car-parking spaces to become exclusive use for EV's only), it was also learnt that LA's who were able to offer land which was owned by themselves and possibly ear-marked for redevelopment (or nearby such areas) was a bonus as it meant that provision and/or conversion of car parking spaces for exclusive EV use could be more easily "wrapped-up" within the overall LA's existing/planned schemes.

We have also learnt that whilst several sites within WPD's license area could have been suitable, several had restrictions imposed due to events outside the project teams' control, such as the impending Commonwealth Games and hence reluctance of the LA to permit digging up of roads during the project period. Taking note of these issues allows us to eliminate sites that may simply introduce unnecessary risk.

However, in general, all the above information will be useful for any future roll-outs as it confirms that securing locations suitable for similar installations should not be a major issue.

Uptake of EV's

The uptake of EV's is still relatively low throughout GB. For this reason, it was important to locate a site that also had commitment from a LA that they would be procuring (or already had) a fleet of EV's for active use during the project trial period. Close proximity of other potential EV fleets (such as taxis, delivery firms etc) was also learnt to be a bonus.

System Design

Constructing the NIC proposal without any funding resulted in the inability to provide sufficient "preliminary design details" to provide the necessary level of assurance that the initial "concept" was well-founded and able to be developed to a fully working solution and successful delivery.

It is since the project has commenced that the combined/wider project team has been able to drill down to the specific technical issues and hence discover what the real technical issues indeed are, whilst striving to progress and close each issue in an efficient and technically correct manner.

Lesson learnt is that for detailed technical projects there should be an agreement on funding activities to permit more detailed discussions and investigations by the collaboration team members into the overall design concept, identifying the pertinent technical issues for discussion and early resolution during the proposal stage to avoid/minimise later complications.

CPO

We have learnt that the UK CPO's approached have, in general, been receptive to the DC Share project although some naturally more heavily focused on providing rapid charging facilities only at what they consider to be "prime transportation hot-spots" such as motorway service stations.

The feedback we have gained from the CPO's has, in general, provide some reassurance that the aims and objectives of the DC Share project are aligned with how the industry is expecting to develop.

Contracts

For future projects, works on drafting the specific detail of the Contracts should be commenced at an earlier stage to help avoid unnecessary delays.

10. Intellectual Property Rights

10.1 Overall IP Statement

Table 6 provides details of the Background IP that will be brought to the Project.

As Foreground IP is created during the course of the project, then this will be discussed and entered as agreed within the Schedule 7 of the Contract and the template log for this is shown in Table 7 below.
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Table 6: Background IPR

Background IPR Name	Custodian of Background IP	Description
Implementation of Soft Open Point Electronic converter architecture using a plurality of bi-directional DC:AC converters with associated control platform.	TPS	Achieves the necessary functionality between multiple Low Voltage feeders: • Network power (real) balancing • Phase power (real) balancing • Reactive power support • Harmonic cancellation • Voltage support • Power factor correction
Implementation of isolated, dual bridge, resonant DC:DC converter with Silicon Carbide devices to achieve efficient, fast switching, light weight and small size high power conversion stage.	TPS	Achieves the necessary conversion of power between high voltage (~750-850V) DC bus and Electric Vehicle.
Grid Tied converter operation.	TPS	Enables safe and reliable synchronisation and connection with the Low Voltage (LV) using phase lock loop techniques.
Droop control to achieve paralleling of multiple converters with common source.	TPS	Ensures load sharing between a plurality of converters without using complex communications between units.
Power Electronic simulations, models, analysis and design documentation.	TPS	Necessary to evaluate the design and performance of Power Electronic and control systems.
Silicon Carbide semiconductor device modelling and switching technique implementation.	TPS	Enables converter technology to achieve: • High efficiency • Low size & weight • Low acoustic noise signature
Magnetics designs and models	TPS	Implementation of low loss, lightweight materials to achieve high efficiency, compact solutions for use

		in harmonic filters, EMC filters and transformers
Implementation of Soft Open Point converter using a plurality of independent leg modules to create controlled phase limbs and separately controlled neutral leg.	TPS	Necessary to achieve design modularity for ease of service, whilst achieving necessary phase equalisation benefits.

Table 7: Foreground IPR Log

Item No	Foreground IPR (created or in the process of being created)	Brief Description of Foreground IPR (for identification purposes)	Brief History of Foreground IPR (i.e. how it's been created Parties involved; % of involvement)	List all Relevant Background IPR required for use of Foreground IPR (including Relevant Background IPR owner identity)	Proposed breakdown of ownership of Foreground IPR (Party names and % of ownership)
1					
2					
3					
4					
5					
6					

10.2 Current Reporting Period

There is no IPR generated or registered during this reporting period.

10.3 Overall IP Statement

It is not expected that we will register any IPR in the next reporting period.

11. Risk Management

Our risk management objectives are to:

- Ensure that risk management is clearly and consistently integrated into the project management activities and evidenced through the project documentation;
- Comply with WPDs and Ricardo's risk management processes and any governance requirements as specified by Ofgem; and
- Anticipate and respond to changing project requirements.

These objectives will be achieved by:

- ✓ Defining the roles, responsibilities and reporting lines within the team for risk management;
- ✓ Including risk management issues when writing reports and considering decisions;
- ✓ Maintaining a risk register;
- ✓ Communicating risks and ensuring suitable training and supervision is provided;
- ✓ Preparing mitigation action plans;
- ✓ Preparing contingency action plans; and
- ✓ Regular monitoring and updating of risks and the risk controls.

11.1 Current Risks

Two separate risk registers have been developed and are maintained for the Project.

One covers risks associated entirely with the COVID-19 pandemic whilst the other risk register concentrates on project-specific (eg non Covid-19) issues)

Each risk register is a live document and is updated regularly. To date, a total of 30 risks have been raised of which 5 are classified as "Severe" and 3 as being "Major", all of which are summarised in Table 8 below.

The "Severe" risks are all associated with the Covid-19 pandemic and it is expected that these will naturally disappear or become adequately mitigated.

For each risk, a mitigation action plan has been identified and the appropriate steps then taken to ensure risks do not become issues wherever possible.

The risk registers are reviewed and revised on a regular basis, so the data with them will be subject to change.

Table 8: Top Current Risks (Grouped by Rating)

RISK	MITIGATION
Severe WPD/REE/TPS/Vectos unable to support the delivery of the project due to staff issues caused by sickness or change of work priorities (COVID)	All Parties have confirmed that they have a Pandemic Policy in place and provided assurances that work will continue on the project and the project documentation is held centrally and main points are documented should key staff be taken sick to enable colleagues to step in

Severe GTI manufacture will be delayed due to delays in the supply chain	Contract payment schedule changed to permit advance purchase & payment for the specialist long-lead equipment
Major Planning application fails	During site selection only target LA's who can confirm willingness to co-operate and work with the project team to progress the necessary planning applications. Also target LA's who own the land where the EV charging points will be located
Major Failed procurements	Ensure sufficient and appropriate Vendors are identified and invited to bid and ensure the Contract terms are not overly onerous (agreed to use standard REE contract terms which are considered acceptable).
Major Injury to the public, damage to public property, DNO property or local authority property, caused by malfunction of equipment (power electronics, DC ring or chargers) or civil works	Both the charger and the converter to be developed and supplied by TPS who have extensive experience in protecting users and adjacent systems. For the civil engineering works, Western Power Distribution will employ known contractors familiar with GB safe working practices. Control system will be specified with safety as number-one criteria. The control system will monitor the substation transformer loading.

Figures 7 and 8 show graphically the split of risk categories across the respective registers.

Figure 7: Risk Graphical Log (COVID-19 Issues)

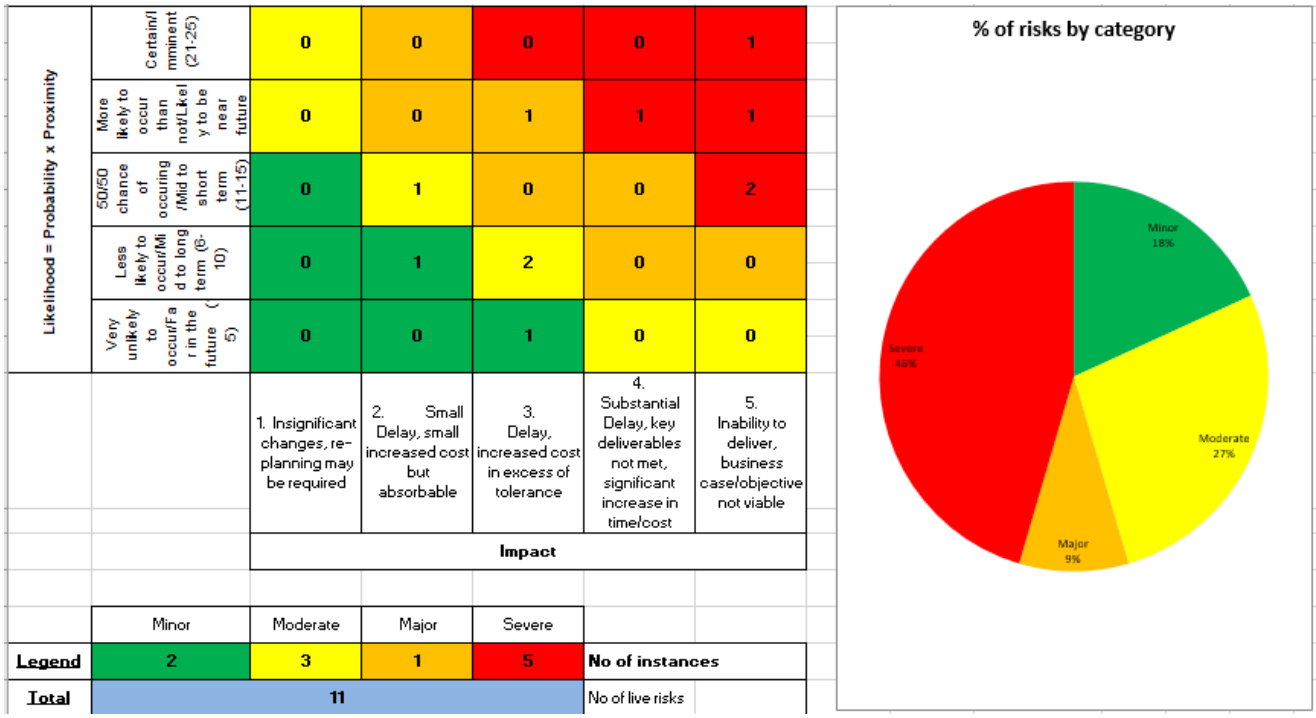
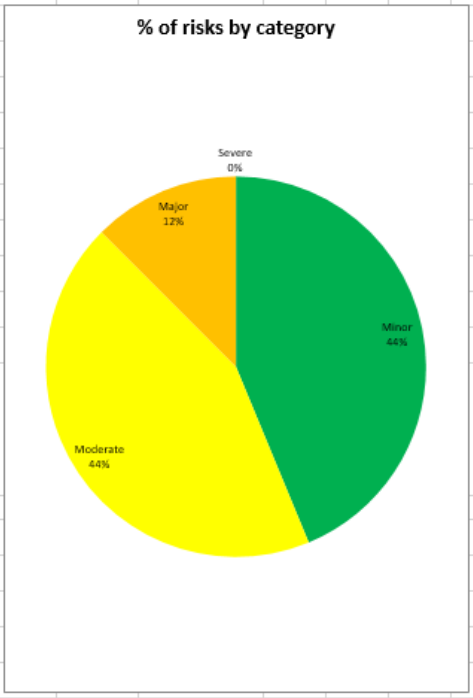


Figure 8: Risk Graphical Log (Project Issues)

Likelihood = Probability x Proximity						
	Certain/Imminent (21-25)	0	0	0	0	0
	More likely to occur than not/Likely to be near future (16-20)	0	0	0	0	0
	50/50 chance of occuring /Mid to short term (11-15)	0	0	1	0	0
	Less likely to occur/Mid to long term (6-10)	0	0	3	0	1
	Very unlikely to occur/Far in the future (1-5)	0	2	5	2	2
		1. Insignificant changes, re-planning may be required	2. Small Delay, small increased cost but absorbable	3. Delay, increased cost in excess of tolerance	4. Substantial Delay, key deliverables not met, significant increase in time/cost	5. Inability to deliver, business case/objective not viable
		Impact				

	Minor	Moderate	Major	Severe	
Legend	7	7	2	0	**No of instances**
Total	16				No of live risks



11.2 Update for Risks Previously Identified

Given this is the first PPR then no updates are required within this section at this time.

12. Accuracy Assurance Statement

This report has been prepared by the REE Project Manager (Michael Feasey) with contributions from the WPD Project Manager (Ricky Duke).

It has been recommended by:

Mr Roger Hey (DSO Systems and Projects Manager)

and approved by:

Mr Carl Ketley-Lowe (Project Sponsor)

Both REE and WPD confirm that this report has been produced, reviewed and approved following our quality assurance process for external documents and reports.

13. References

1. DC Share WPD Press Release https://www.westernpower.co.uk/news-and-events/latest-DC Share Ricardo Press Release news/wpd-and-partners-trial-new-way-of-delivering-rapid-ev-charging-hubs
2. DC Share Ricardo Press Release: https://ricardo.com/news-and-media/news-and-press/western-power-distribution-and-ricardo-to-lead-innovative-rapid-ev-charging-trial
3. Ofgem Project Direction Letter dated 18th December 2019 https://www.ofgem.gov.uk/ofgem-publications/160387
4. NIC Full Submission Pro-forma Document https://www.ofgem.gov.uk/publications-and-updates/electricity-nic-submission-dc-share-western-power-distribution
5. NIC Initial Screening Proposal Document https://www.ofgem.gov.uk/publications-and-updates/electricity-nic-initial-screening-submission-2019-dc-share-wpd

Appendices

A.1 Bank Account (Confidential)

The DC Share bank account statement has been attached to the submission email as a separate PDF document.