WESTERN POWER DISTRIBUTION

OPEN LV

OPENING UP THE SMART GRID

PROJECT PROGRESS REPORT
REPORTING PERIOD:
DECEMBER 2017 – MAY 2018

ea technology

RIIO NIC NETWORK INNOVATION COMPETITION

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Contents

Glossary

Term	Definition
Background IPR	Intellectual Property Rights owned by or licensed to a Project Participant at the start of a Project.
Customer Engagement Plan	The plan that the Network Licensee must submit to Ofgem setting out how it or any of its Project Partners, will engage with, or impact upon, Relevant Customers as part of the Project.
Distribution Network Operator (DNO)	Any Electricity Distributor in whose Electricity Distribution Licence the requirements of Section B of the standard conditions of that licence have effect (whether in whole or in part).
Expert Panel	A panel of independent experts who together provide knowledge and expertise under the following headings: energy network industries, environmental policy, technical and engineering, economics and financial and consumer interests. The panel is appointed by Ofgem to advise the Authority's decision making process on the selection of Projects for funding.
Foreground IPR	All Intellectual Property Rights created by or on behalf of any of the Project Participants, their sub-Licensees, agents and sub-contractors as part of, or pursuant to, the Project, including all that subsisting in the outputs of the Project.
Full Submission Pro-forma	A pro-forma which Network Licensees must complete and submit to Ofgem in order to apply for funding under the NIC.
Funding Licensee	The Network Licensee named in the Full Submission as the Funding Licensee, which receives the Approved Amount and is responsible for ensuring the Project complies with this Governance Document and the terms of the Project Direction.
Intellectual Property Rights (IPR)	All industrial and intellectual property rights including patents, utility models, rights in inventions, registered designs, rights in design, trademarks, copyrights and neighbouring rights, database rights, moral rights, trade secrets and rights in confidential information and know-how (all whether registered or unregistered and including any renewals and extensions thereof) and all rights or forms of protection having equivalent or similar effect to any of these which may subsist anywhere in the world and the right to apply for registrations of any of the foregoing.
ITT	Invitation to Tender
LV	Low Voltage
LV-CAP™	Low Voltage Common Application Platform.
NIC	Network Innovation Competition.

Project	The Development or Demonstration being proposed or undertaken.
Project Bank Account	A separate bank account opened and used solely for the purpose of all financial transactions associated with a NIC Project.
Project Direction	A direction issued by the Authority pursuant to the NIC Governance Document setting out the terms to be followed in relation to the Eligible NIC Project as a condition of its being funded pursuant to NIC Funding Mechanism.
Project Participant	A party who is involved in a Project. A participant will be one of the following: Network Licensee, Project Partner, External Funder, Project Supplier or Project Supporter.
Project Partners	Any Network Licensee or any other Non-Network Licensee that makes a contractual commitment to contribute equity to the Project (e.g. in the form of funding, personnel, equipment etc.) the return on which is related to the success of the Network Licensee's Project.
Project Supplier	A party that makes a contractual commitment to supply a product or service to the Project according to standard commercial terms that are not related to the success of the Project.
Relevant Background IPR	Any Background IPR that is required in order to undertake the Project.
Relevant Foreground IPR	Any Foreground IPR that is required in order to undertake the Project.
Successful Delivery Reward Criteria (SDRC)	The Project specific criteria set out in the Project Direction against which the Project will be judged for the Successful Delivery Reward.
WPD	Western Power Distribution

1 Executive Summary

The OpenLV Project "the Project" is funded through Ofgem's Network Innovation Competition (NIC) funding mechanism. The Project commenced in December 2016 and is scheduled to complete in April 2020.

The Project has three phases: 1) Mobilise & Procure, 2) Design & Build and 3) Trial, Consolidate & Share. This Report details the progress of the Project, finalising the first phase "Mobilise & Procure" and progress made in the "Design & Build" phase. This is the third Project Progress Report (PPR) for the Project and details progress on the last six months, December 2017 to May 2018.

1.1 Overall Project Progress

The key achievements in the reporting period are as follows:

- The Method Statements for the installation of the OpenLV platforms has been finalised;
- The first 4 OpenLV platforms were installed in WPD's licence area in December 2017;
- The OpenLV Core System successfully passed Site Acceptance Testing (SAT-1) in January 2018;
- The installation of the first 4 OpenLV platforms for Method 1 marked the official start for the Network Capacity Uplift trials. These platforms have been collecting data since the official trial start date of 13th December 2017;
- Site surveys have been completed for the Method 1: Network Capacity Uplift trials and 50 substation locations have been selected. The final 10 substations will be selected from a list of 22 potential sites that have been identified;
- At the time of writing the 50 OpenLV platforms to support the Method 1: Network Capacity Uplift trials have been installed and commissioned;
- The logic for the LoadSense™ software application has been agreed;
- The development work on the WeatherSense™ and LoadSense™ software applications has been completed;
- The first revision of SDRC 2, SDRC-2.1: Community Engagement Plan and Testing the Market for Methods 2 and 3 has been completed and delivered to schedule in December 2017;
- The project team has received 10 applications to take part in the Method 2: Community Engagement trials. All applicants have been interviewed and 7 community groups have been selected to take part in this trial;
- The project team had received 23 applications to take part in the Method 3: OpenLV Extensibility trials. All applicants have been interviewed and 17 organisations have been selected to take part in this trial; and
- The second revision of SDRC-2, SDRC-2.2: Target Networks, Update on the Market Potential for Methods 2 and 3 and Detailed Trial Design for all Methods, has been completed and delivered to schedule in May 2018.

1.2 Business Case

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

1.3 Project Learning and Dissemination

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

Key dissemination activity within the reporting period are as follows:

- A press release for the OpenLV project was released ahead of the LCNI conference in December 2017;
- The OpenLV project was represented at the LCNI conference on the WPD stand at the LCNI conference in December 2017;
- An article on the OpenLV project was published in Network Magazine in December 2017;
- Four news articles were published in January and February 2018 to advertise the application process for the Method 3 OpenLV Extensibility trials;
- A newsletter for the OpenLV project was published in February 2018;
- The OpenLV project was featured in a 3,000 word article published by Energy World in April 2018;
- A paper has been written and accepted as part of the CIRED Workshop in 2018. A poster presentation will be delivered at this event in June 2018. The title of the paper is as follows: "The Development and Implementation of a Common Application Platform to Support Local Energy Communities";
- A press release to celebrate the success of recruitment of participants for the Community Engagement and OpenLV Extensibility trials (Methods 2 and 3) was issued to 198 technology / energy media in May 2018; the news item is also on the project website and has been tweeted, with good uptake by partners and stakeholders;
- A total of 10 new documents have been published on the OpenLV Website within the reporting period; and
- In terms of overall media coverage, as of 4th May 2018, the OpenLV Project appeared in 59 news items. A list of the 17 news items within this reporting period is provided in Annex 1.

1.4 Risks

The OpenLV risk register is a live document and is updated regularly. A total of 46 risks have been raised, 22 of which have been closed, leaving a total of 24 live risks. Mitigation action plans are identified when raising a risk and the appropriate steps then taken to ensure risks do not become issues wherever possible. Of the 24 live risks none are ranked as severe or major, 3 are ranked as moderate and 21 are ranked as minor.

2 Project Manager's Report

2.1 Project Background

The OpenLV Project "the Project" is funded through Ofgem's Network Innovation Competition (NIC) funding mechanism. The Project commenced in December 2016 and is scheduled to complete in April 2020.

The Project Partners are as follows: 1) Western Power Distribution (WPD): The Lead/Funding DNO (licensee); and 2) EA Technology: The 3rd Party Lead Supplier who is responsible for the overall delivery of the Project.

The Project has three phases and four work packages as shown in Figure 1. This Report details the progress of the Project, focussing on the last six months, December 2017 to May 2018. The reporting period is depicted on Figure 1 by the grey shaded box.

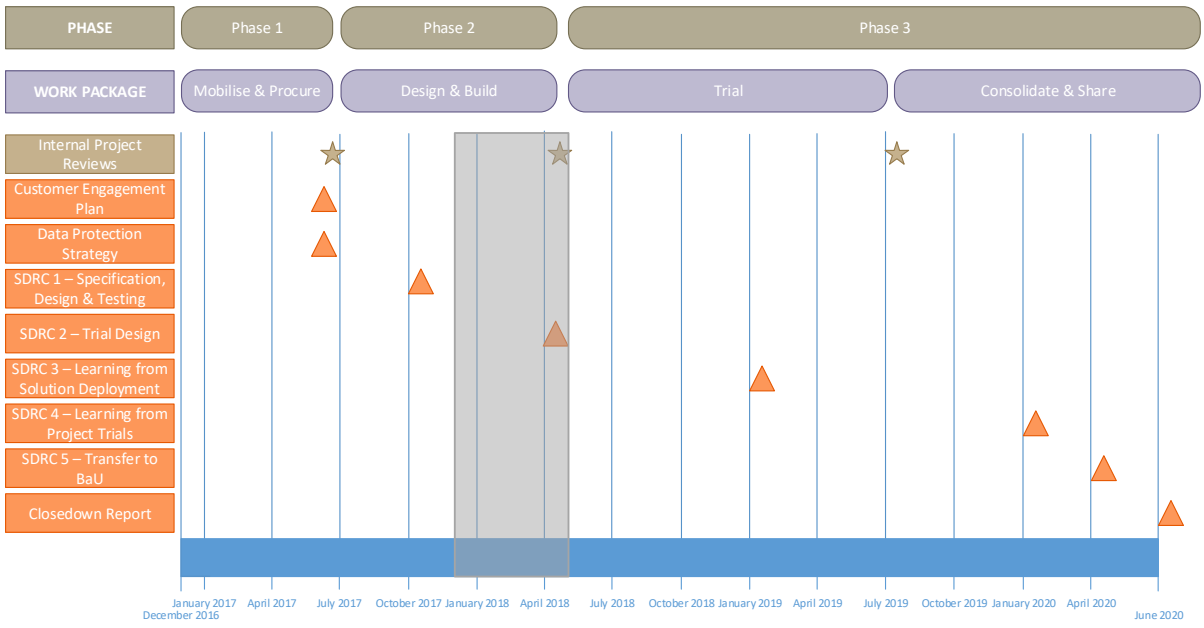

Figure 1: OpenLV Timeline

2.2 Project Progress

2.2.1 Overall Progress

During this reporting period, the final actions to close off the Design & Build phase. The key achievements in the reporting period are as follows:

- The Method Statements for the installation of the OpenLV platforms has been finalised;
- The first 4 OpenLV platforms were installed in WPD's licence area in December 2017;
- The OpenLV Core System successfully passed Site Acceptance Testing (SAT-1) in January 2018;

- The installation of the first 4 OpenLV platforms for Method 1 marked the official start for the Network Capacity Uplift trials. These platforms have been collecting data since the official trial start date of 13th December 2017;
- Site surveys have been completed for the Method 1: Network Capacity Uplift trials and 50 substation locations have been selected. The final 10 substations will be selected from a list of 22 potential sites that have been identified;
- At the time of writing the 50 OpenLV platforms to support the Method 1: Network Capacity Uplift trials have been installed and commissioned;
- The logic for the LoadSense™ software application has been agreed;
- The development work on the WeatherSense™ and LoadSense™ software applications has been completed;
- The first revision of SDRC 2, SDRC-2.1: Community Engagement Plan and Testing the Market for Methods 2 and 3 has been completed and delivered to schedule in December 2017;
- The project team has received 10 applications to take part in the Method 2: Community Engagement trials. All applicants have been interviewed and 7 community groups have been selected to take part in this trial;
- The project team had received 23 applications to take part in the Method 3: OpenLV Extensibility trials. All applicants have been interviewed and 17 organisations have been selected to take part in this trial; and
- The second revision of SDRC-2, SDRC-2.2: Target Networks, Update on the Market Potential for Methods 2 and 3 and Detailed Trial Design for all Methods, has been completed and delivered to schedule in May 2018.

2.2.2 Procurement

No change. All the required commercial agreements for the Project are in place.

2.2.3 Design and Build

This phase of the Project includes setting up the overall OpenLV Solution as defined in the FSP [Ref. 1] and underpins the ability of the Project to test each of the proposed Methods. This phase has provided the overall OpenLV Solution to be trialled for each of the three Project Methods: 1) Network Capacity Uplift, 2) Community Engagement and 3) OpenLV Extensibility.

For reporting purposes, the progress under the Design & Build phase was been split into the following categories:

1) **Enabling Works:** Provides an overview of the work completed on the overall OpenLV Solution that will support the three Project Methods.
2) **Network Capacity Uplift:** Provides an overview of the work completed to support the Project trials under Method 1.
3) **Community Engagement:** Provides an overview of the work completed to support the Project trials under Method 2.
4) **OpenLV Extensibility:** Provides an overview of the work completed to support the Project trials under Method 3.

It is confirmed that the following progress, under the **enabling works** category has been made within the reporting period:

- The Method Statements for the installation of the OpenLV platforms were finalised in January 2018;
- High-level threat model creation and cyber-risk assessment was completed in December 2017;
- End-to-end cyber-security assessment of the overall OpenLV Solution was completed in April 2018;
- The OpenLV Core Solution successfully passed Site Acceptance Testing (SAT-1) in January 2018;
- At the time of writing 50 of the 80 OpenLV platforms have been built and tested; and
- The OpenLV Data Protection Strategy has been updated and published following a review of the General Data Protection Regulation that comes into force on 25th May 2018.

It is confirmed that the following progress, under the **network capacity uplift** category has been made within the reporting period:

- The first 4 OpenLV platforms were installed in WPD's licence area in December 2017;
- The installation of the first 4 OpenLV platforms for Method 1 marked the official start for the network capacity uplift trials. These platforms have been collecting data since the official trial start date in December 2017;
- Minor software issues were encountered with the first 4 platforms. These issues were resolved remotely via over the air updates in January 2018;
- A total of 182 pairs (364 substations) were surveyed within the reporting period in order to select 60 locations for installation in line with the requirements of the FSP;
- The 25 pairs (50 substations) for the stage 1 network capacity uplift trials have been identified;
- A total of 11 potential pairs (22 substations) have been identified in order to select the 5 pairs of substations for the stage 2 network capacity uplift trials and deeper doors for LV cabinets have been ordered to enable installation of the Alvin Reclose devices;
- The fault and protection studies for selecting the 5 pairs of meshed sites for the capacity uplift trials was agreed with WPD in April 2018;
- Protection and fault modelling work is currently being completed on 5 pairs that could be utilised for the full meshing trials;
- At the time of writing 50 OpenLV platforms have been installed to support the network capacity uplift trials in: 1) Derby, 2) Cardiff, 3) Milton Keynes and 4) Northampton;
- The logic for the LoadSense™ software application has been agreed;
- The development work on the WeatherSense™ and LoadSense™ software applications has been completed;
- The techniques used to select the target networks for the network capacity uplift trials were delivered as part of SDRC-2.2 in May 2018; and

- The detailed trial design for the network capacity uplift trials has been completed and delivered as part of SDRC-2.2 in May 2018.

It is confirmed that the following progress, under the **community engagement** category has been made within the reporting period:

- The Community Engagement Plan was completed by CSE and delivered as part of SDRC 2.1 in December 2017;
- The assessment of the market potential for the community engagement trials was completed by CSE and the results were delivered as part of SDRC 2.1 in December 2017;
- CSE ran the formal application process for community groups during December 2017 and January 2018;
- A total of 10 applications were received for the community engagement trials. This included 8 established community groups, 2 housing groups;
- CSE/Regen interviewed all the applicants for the community engagement trials in February 2018 and selected 5 community groups and 2 housing groups to take part in the trials;
- Regen delivered a report outlining the trial data requirements for the community engagement trials in March 2018;
- Substations to support all the community engagement trials have been identified, site surveys have been completed and installations have been scheduled;
- The OpenLV platforms to support the community engagement trials are currently being built;
- The final results from testing the market to support the community engagement trials was completed by CSE and the results were delivered as part of SDRC-2.2 in May 2018;
- The detailed trial design for the community engagement trials has been completed and delivered as part of SDRC-2.2 in May 2018; and
- A Memorandum of Understanding document outlining the responsibilities of CSE and the community engagement trial participants has been completed. This document will be agreed with all trial participants.

It is confirmed that the following progress, under the **OpenLV extensibility** category has been made within the reporting period:

- The assessment of the market potential for the OpenLV extensibility trials was completed by EA Technology and the results were delivered as part of SDRC 2.1 in December 2017;
- EA Technology ran the formal application process for the OpenLV extensibility trials during January and February 2018;
- A total of 23 applications were received for the OpenLV extensibility trials. This included 16 businesses and 7 academic institutions;
- EA Technology interviewed all the applicants for the OpenLV extensibility trials in March 2018 and selected 12 businesses and 5 academic institutions to take part in the trials;

- Substations to support 3 of the OpenLV extensibility trials have been identified, site surveys have been completed for these 3 locations and installations are currently being scheduled;
- The OpenLV platforms to support the OpenLV extensibility trials are currently being built;
- The final results from testing the market to support the OpenLV extensibility trials was completed by EA Technology and the results were delivered as part of SDRC-2.2 in May 2018;
- The detailed trial design for the OpenLV extensibility trials has been completed by EA Technology and delivered as part of SDRC-2.2 in May 2018; and
- A Memorandum of Understanding document outlining the responsibilities of EA Technology and the OpenLV extensibility trial participants has been completed. This document will be agreed with all trial participants.

2.2.4 Key Issues

The following key issues were encountered and managed within the reporting period:

- **Funding for the community engagement and OpenLV extensibility trials:** No funding is available to support the organisations participating in the community engagement and OpenLV extensibility trials. This had an impact on the number of applicants to take part in the OpenLV project trials (Methods 2 and 3);
- **Selection of network capacity uplift trials for each type of LV network:** The FSP stated that that the project would target a minimum of 3 examples of 8 LV network type as defined by the WPD LV Network Templates Project. This was harder than expected. More site surveys were required, than anticipated, to select the required sites. In total, 182 pairs (364 substations), were surveyed in order to select 30 pairs (60 substations) for the Network Capacity Uplift trials (Method 1);
- **Geographic Areas:** At FSP stage it was proposed that the project would target 3 geographic areas with up to 20 installations in each geographic area to support the Network Capacity Uplift trials (Method 1). In order to meet the site selection requirements in the FSP the 30 pairs (60 substations) are currently being installed in 9 geographic areas. This means that it took longer than expected to arrange and complete the site surveys;
- **Fault and protection studies for full meshing trials:** Of the 5 pairs of sites initially identified for the full meshing trials only 1 pair passed the fault and protection studies. This meant that the project team had to go back through the list of the full 182 pairs and identify further pairs that could be utilised for full meshing trials. This meant that the selection of sites for the full meshing trials is taking longer than expected; and
- **Installation of Alvin Reclose devices for full meshing trials:** To enable installation of the Alvin Reclose devices deeper doors for LV cabinets had to be ordered. The lead time for these doors is 6 to 8 weeks which has in turn delayed the full installation programme.

The OpenLV FSP outlines an 18 month duration for the Method 1 Network Capacity Uplift trials. The trials of the first 4 OpenLV platforms started on 13th December 2017. As a result, the trials will run for an 18 month time period from January 2018 to June 2019.

This will enable the project team to collate the learning from the trials and report it in "SDRC-4 Learning Generated from the OpenLV Project Trials for All Methods", which is scheduled for delivery in January 2020. It is confirmed that the delays in the installation schedule will not have any impact on the planned delivery dates for key Project milestones or on the overall learning that will be generated by the Project.

2.2.5 Deliverables

The following key deliverables were completed in this reporting period:

- SDRC 2.1: Community Engagement Plan & Interim Results of Assessing Market Potential (Methods 2 & 3);
- SDRC 2.2: Target Networks (Method 1), Full Results of Assessing Market Potential (Methods 2 & 3) and Detailed Trial Design (All Methods); and
- Updated Data Protection Strategy following a review of the General Data Protection Regulation (GDPR) that came into force on 25th May 2018.

2.3 Outlook to the Next Reporting Period

During the next reporting period the Project will continue to complete key tasks to finalise the Design & Build work package and start the Trial work package. The project team will:

- Complete Factory Acceptance Testing (FAT-3) for the OpenLV LoadSense™ and WeatherSense™ Software Applications;
- Complete Site Acceptance Testing (SAT-2) for the OpenLV Full Solution. This includes the tests to sign off the LoadSense™ and WeatherSense™ Software Applications;
- Formally sign up and complete the individual trial design documentation for the Community Engagement trials (Method 2);
- Formally sign up and complete the individual trial design documentation for the OpenLV Extensibility trials (Method 3);
- Start the development of Software Applications for the Community Engagement and OpenLV Extensibility trials (Methods 2 and 3);
- Complete the installation of 80 OpenLV platforms to support the trials for all Methods;
- Continue the Network Capacity Uplift trials (Method 1);
- Start the Community Engagement and OpenLV Extensibility trials (Methods 2 and 3);
- Continue to share learning from the Project through newsletters and industry publications;
- Attend and present at CIRED Workshop in June 2018;
- Finalise the updated Method Statements for installation of the Alvin Reclose devices;
- Review the outputs from the full Cyber Security assessment that has been completed by NCC Group and implement any changes required to the full OpenLV Solution;
- Start making LV network data available to 3rd parties; and
- Ensure the trials for all Methods are assessed regularly to maximise the learning on the Project.

3 Business Case Update

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

4 Progress Against Plan

4.1 This Reporting Period

Table 1 summarises the progress in this reporting period against the project plan. Key issues encountered during the reporting period are provided in Section 2.2.4.

Table 1: Progress Against Plan

Item	Milestone Description	Status	Due Date	Actual Completion Date	Revised Due Date
1	Site Acceptance Testing (SAT-1) OpenLV Core System	Complete	20/09/17	25/01/18	N/A
2	Develop LoadSense™ application in-line with the OpenLV applicable requirements	Complete	Nov-17	11/06/18	N/A
3	FAT-3: OpenLV LoadSense™ and WeatherSense™ Software Applications	In Progress	Jan-18	N/A	Jun-18
4	Detailed Trial Design for all Methods	Complete	13/12/17	27/04/18	N/A
5	All LV network hardware available for installation	Complete	13/12/17	31/01/18	N/A
6	SDRC 2.1: Community Engagement Plan & Assess markets for Methods 2 & 3	Complete	31/12/17	08/12/17	N/A
7	All Equipment for Method 1 Installed	In Progress	15/02/18	N/A	Jul-18
8	Network Capacity Uplift Trials (start)	Complete	16/03/18	13/12/17	N/A
9	End-to-end cyber-security assessment of complete functioning system	Complete	12/04/18	23/04/18	N/A
10	SDRC 2.2: Detailed Trial Design for all Methods	Complete	30/05/18	25/05/18	N/A

There are two items that were scheduled to be completed within this reporting period that have not been completed. In terms of the development LoadSense™ application in-line with the OpenLV applicable requirements; it took longer than expected to translate and agree how the operational logic for LoadSense™ should be coded.

This meant that the development of LoadSense™ took longer than expected and the third Factory Acceptant Test (FAT-3) for the LoadSense™ and WeatherSense™ software applications was delayed.

The baseline date identified in the project plan, at FSP stage, for the installation of all the OpenLV platforms for the Method 1 capacity uplift trials was 15th February 2018. The FSP specified that the project team would target at least 3 examples of 8 LV network template types as identified in the WPD LV Network Templates project. This was harder than initially anticipated and the project team had to complete more site surveys than expected to meet this requirement. A total of 182 pairs (364 substations) were surveyed to select 30 pairs (60 substations). In addition, the project team found that deeper doors were required to install the Alvin Reclose devices to support meshing of LV networks, the lead time for the deeper doors is 6 to 8 weeks. As a result, the full installation of the 30 pairs (60 substations) has been delayed and is currently scheduled to be completed by the end of July 2018.

The OpenLV FSP outlines an 18 month duration for the Method 1 network capacity uplift trials. The trials of the first 4 OpenLV platforms started on 13th December 2017. As a result, the trials will run for an 18 month time period from January 2018 to June 2019. This will enable the project team to collate the learning from the trials and report it in "SDRC-4 Learning Generated from the OpenLV Project Trials for All Methods", which is scheduled for delivery in January 2020.

4.2 Next Reporting Period

Table 2 summarises the key planned activities for the next reporting period. Description(s) of key planned activities for the next reporting period are provided in Section 2.3. Items 1, 2 and 3 were scheduled to be completed within this reporting time period but have been re-scheduled. It is confirmed that re-scheduling these items has had no impact on key deliverables.

Table 2: Progress Against Plan

Item	Milestone Description	Status	Due Date	Revised Due Date
1	FAT-3: OpenLV LoadSense™ and WeatherSense™ Software Applications	In Progress	Jan-18	Jun-18
2	All Equipment for Method 1 Installed	In Progress	15/02/18	Jul-18
3	Site Acceptance Testing (SAT-2) OpenLV Full Solution	Not Started	Jun-18	Jul-18
4	Method 2 Communities identified, Apps developed and OpenLV devices installed	In Progress	06/09/18	N/A
5	Method 3 Organisations identified, Apps developed and OpenLV devices installed	In Progress	06/09/18	N/A
6	Method 2 trials (start)	Not Started	07/09/18	N/A
7	Method 3 trials (start)	Not Started	07/09/18	N/A

5 Progress Against Budget

Table 3 shows the baseline budget as outlined in the FSP.

Table 3: Progress Against Budget

Cost Category	Total Budget £k	Expected Spend to Date May-18	Actual Spend to date May-18	Variance £	Variance %
Labour	267.3	149.0	82.7	66.2	44%
Equipment	853.6	821.4	812	9.4	1%
Contractors	3775.1	2483.5	1825.6	657.9	26%
IT	2.5	0.6	1.5	-0.9	-151%
IPR Costs	0	0	0	0	0%
Travel & Expenses	29.7	16.6	9.2	7.4	44%
Payments to Users	0	0	0	0	0%
Contingency	451.5	451.5	0	451.5	100%
Decommissioning	66.0	0	0	0	0%
Other	0	0	0	0	0%
TOTAL	5445.7	3922.4	2731.0	1191.5	

In terms of the variances shown one line item is in excess of the 5% threshold and requires explanation. The FSP spread the IT costs across 3 financial years: 1) 2017/218 included a £290 budget, 2) 2018/2019 included a £1,760 budget and 3) 2019/2020 included a £440 budget. Following Project award, the IT costs have hit earlier in the Project than originally planned at bid stage.

6 Bank Account

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

7 Successful Delivery Reward Criteria (SDRC)

Table 4 details the status of each SDRC outlined in the Project Direction [Ref. 2]. The following SDRC reports were delivered within the reporting period:

- SDRC 2.1: Community Engagement Plan & Interim Results of Assessing Market Potential (Methods 2 & 3); and
- SDRC 2.2: Target Networks (Method 1), Full Results of Assessing Market Potential (Methods 2 & 3) and Detailed Trial Design (All Methods).

Please note that all SDRCs that are currently flagged as 'Not Started' were not planned on being underway at this point in the Project and so should be considered as on-schedule.

Table 4: SDRCs to be completed

SDRC	Description	Due Date	Status
SDRC 1	Specification, Design and Factory Testing of the overall OpenLV Solution	27/10/17	Delivered
SDRC 2.1	Community Engagement Plan & Interim Results of Assessing Market Potential (Methods 2 & 3)	31/12/17	Delivered
SDRC 2.2	Identification of Target Networks (Method 1), Update of Assessing the Market Potential (Methods 2 & 3) and Detailed Trial Design for all Methods	30/05/18	Delivered
SDRC 3	Learning from Deployment of the Overall OpenLV Solution & Standard Guidelines for Application Development	01/02/19	Not Started
SDRC 4	Learning Generated from the OpenLV Project Trials for All Methods	31/01/20	Not Started
SDRC 5	Knowledge Capture, Dissemination & Transferring the OpenLV Solution to Business as Usual	30/04/20	Not Started

8 Learning Outcomes

8.1 Learning Outcomes

The high-level learning outcomes recorded within the reporting period have been categorised under the following headings:

- Commercial, Project Management & Dissemination;
- Method 1: Identifying target networks & detailed trial design; and
- Overall learning points for each of the OpenLV Methods.

8.1.1 Commercial, Project Management & Dissemination

The commercial and project management learning points recorded within the reporting period are as follows:

- **Media Engagement:** The energy media "get" the OpenLV concept, but it's been harder to engage with the broader technology media as the project is very focussed on installing the OpenLV Solution in LV substations; and
- **Value of Dissemination:** The value and overall impact of dissemination should not be under estimated. The media coverage on OpenLV has generated interest from a network operator in New Zealand.

8.1.2 Method 1: Identifying target networks & detailed trial design

The learning points recorded foe identifying the target networks and detailed trial design for Method 1, within the reporting period, are outlined below:

Principal Learning Points

The **unintended consequences of seemingly separate decisions** combined to limit the number of substation pairs suitable for use in the project.

- Decisions made during the initial project development stage combined with on-site restrictions to decrease the number of sites suitable for use in the trials.
- Each decision or requirement added an additional, albeit small, restriction but these combined to rule-out a significant proportion of the network.
- These decisions were made for the right reason, in conjunction with necessary assumptions, but resulted in unintended consequences.
- Sufficient flexibility still remained to identify suitable locations, but the site selection process was more time consuming than expected for the eventual outcome.

The implementation of the project's trial system, utilising LV-CAP™ and Alvin Reclose™ devices is likely to be more difficult than deployment of other hardware mixes in the future.

Contributing factors (and the underlying rationale)

The above learning points arose from a number of indirectly connected criteria defined in the project bid documentation, resulting from hardware limitations, or subsequent design decisions taken during the initial project initiation phase.

1. Whilst the BAU implementation of an OpenLV platform will be smaller, self-contained unit, for the trials a modular system was determined as the most suitable approach.
   This was due to several reasons:

   - It was unknown at the time of specification and procurement what the requirements would be for Methods 2 & 3, and consequently, the system needed to be capable of communicating with as many different systems and devices as possible.
   - A single-unit platform for the LV-CAP™ software, suitable for long-term deployment on the network, did not exist at the commencement of the OpenLV Project.
   - It was deemed necessary in the event of equipment failure to be able to remove and replace any part of the system to minimise downtime within the trials.

1. This decision influenced the availability of substations suitable for installation.
   The project team elected not to utilise any Overhead Line (OHL) networks, specifically Pole Mounted Transformers (PMTs), within the project due to:

   - the additional complexities associated with installing and maintaining the equipment.
   - the size and weight of the equipment enclosure at such a location.
   - Connection to a Ground Mounted Transformer (GMT) enables easy access to the hardware if required.

2. In order to demonstrate the overall Distributed Intelligence capability of the OpenLV platform, a method of implementing a measurable network change, controllable by the OpenLV platform, was required. Whilst several alternative approaches were considered, the use of Alvin Reclose™ devices was considered to be the approach providing the best ability to deliver the project learning whilst minimising overall risk of delivery. However, this required consideration of:
   - The size of the Alvin Reclose™ units limited the substations that were suitable for implementation of the network meshing functionality; specifically, many of the LV enclosures surveyed did not have sufficient space to fit Alvin reclose units with the enclosure door closed. This problem was exacerbated as both substations at either end of the 'pair' needed to be compatible with the units so a single substation could block the pair from being suitable.
   - The use of Alvin Reclose™ units required that both substations in the pair were connected to the same HV network to prevent the possibility of a fault being back-fed along the inter-connected LV network.

- WPD do not operate a meshed LV network under normal operating circumstances and consequently, significant evaluation of the networks proposed for deployment of the Alvin Reclose™ units was required.

Alternative methods that were considered would not have experienced these restrictions but at a greater financial cost, and increased project risk through additional project suppliers being required.

3. It was stated that eight of the ten LV network types identified during WPD's LV Network Templates project would be utilised within the OpenLV Project, with at least three of each type utilised in Method 1. Some network types defined in the LV Network Templates project are highly specific, (e.g. Network Type 7 being defined as a rural setting). The other requirements above, combined to prevent some network types being significantly represented when the final shortlist was collated. For example, a significant proportion of rural areas are excluded by the combination of 'no OHL networks' and the requirement for a reasonable strength mobile network.

8.1.3 The Project Methods

The learning points recorded within the reporting period as part of the project methods are outlined below. The learning points have been recorded under the following titles: Network Capacity Uplift (Method 1), Community Engagement (Method 2) and OpenLV Extensibility (Method 3).

Network Capacity Uplift (Method 1) - Installation

- **Installation:** Some substations have LV boards fed by multiple connections, requiring either multiple sensors (one per cable) or oversized flexible rogowski coils capable of extending around all present. Either solution is possible to implement but is not recommended within the project due to the added complexity of utilising further bespoke installation approaches on a small subset of sites. For BAU scenarios, this would be less of a concern.

Community Engagement (Method 2) – Assessing the Market Potential

- **Community groups engagement:** Community groups have required a tailored engagement approach in terms of imagery and style of communications. This has been critical to engagement success in terms of understanding the appetite from community groups to take part in the project;
- **App ideas:** Community groups proposing potential app ideas under the banner of "policy, planning and retrofit programmes" has been a surprise. This is not an area that was covered in the initial list of six potential app ideas when the survey was sent out. A total of five app ideas have been received under this title (11% of the total). An example includes, using the data to input to neighbourhood development planning;
- **Number of units:** One group were interested in the project but did not put an application form in as the project could not supply enough units. Their idea was to

develop an app that would help identify the impact that an energy local club would have on peak shifting and peak flattening. However, the group hadn't realised that there would be so many substations within their area of interest. This shows there is clearly more potential if LV-CAP™ was rolled out at scale;

- **Community group interest:** There are enough groups with individuals who have an interest in data and electricity, combined with a drive to benefit the community they represent, to have met demand for this project;
- **Timescales – applications process:** A longer period of time between the launch of the application process and the deadline may have resulted in more applications. This would have given groups more time to work up their ideas;
- **Timescales – sites:** Allowing more time to assess suitability of substations before interviews would have been useful;
- **Application form:** The length of the application form may have deterred some groups from applying, but all those that did were sensible proposals that met the brief, so it may have acted as a filter to unsuitable projects;
- **Type of community group:** There was good engagement from existing community energy groups and housing associations, but it was much harder to engage with Parish Councils;
- **Technical complexity:** This is a technically complex project, that includes talking to community energy groups about software programming and getting them to think about LV network data and its uses. The selection process was further complicated by screening out applications that included Pole Mount Transformers (PMTs) and with a poor mobile signal strength. The technical complexity along with the lack of funding has meant that only the most committed groups have made it through the selection process; and
- **Inability to install LV-CAP™ on pole-mounted transformers (PMTs):** One of the full proposals didn't make it to interview as all the substations in their hamlet were PMTs. Anyone from a small rural settlement who responded to the original survey would have come across the same problem when looking to complete their application, and this would have probably meant a fair number didn't complete a formal application to take part in the project trials.

<u>OpenLV Extensibility (Method 3) – Assessing the Market Potential</u>

- **Guidance for Applicants:** A guidance document was drafted and published on the OpenLV website. This document gave organisations all the information they needed to know when applying to take part in the project trials;
- **Engagement:** We've had good engagement for the Method 3 Business & Academia trials with a total of 79 organisations showing some level of interest in taking part in the project trials and 23 organisations applying to take part. Given the lack of funding to take part in the trials this is a significant level of interest. The Marketing and PR completed on the project certainly helped drive this level of interest;
- **Workshop:** A dedicated workshop was held 2 weeks prior to the end of the formal application process. This workshop was attended by 39 people from 24 organisations and provided all the information the organisations needed ahead of

completing the application form. The workshop also included an "application clinic" to ensure organisations could ask questions regarding the completion of the application form to take part in the project trials. Holding this workshop helped to maximise the number of applications received;

- **Funding:** The lack of funding was an issue for a number of potential applicants which limited the number of applications received;
- **Resourcing/Business Case:** A number of companies were interested in taking part in the trials but could not justify re-allocating resource from fee paying work. This limited the number of applications received; and
- **Marketing & PR:** Marketing, PR and a good project website to host all the relevant documentation are key to getting the message out and providing the right information to potential applicants. The formal launch event at the WPD Balancing Act event was a great start.

Community Engagement (Method 2) – Trial Design

- **Approach and associated documentation:** The approach taken to signing up participants includes using the Memorandum of Understanding, Data Share agreement and trial design form. These documents provide a clear basis for the Method 2 trials
- **Length of trials:** All of the seven applicant community groups progressing to trial have expressed a need for at least 12 months' worth of data to make the trial viable. The flexibility of the project to install LV-CAP™ units from June 2018, and for them to remain in situ until December 2018 will be of significant benefit to the participating community groups under Method 2, and will support on-going extrapolation of learning and assessment of replicability and benefits going forward;
- **In-house app development:** The ability of CSE to provide in-house app development support will overcome one of the major barriers to community groups developing their own apps – i.e. access to funding.
- **Trial implementation and associated documentation:** A number of documents will enable the project team and applicants to design and implement the trials. This documentation is needed to ensure the trials are successful. Documentation includes: 1) OpenLV Point Measurement document, 2) Developing with the LV-CAP™ Virtual Machine, 3) The OpenLV Common Application Platform API and 4) The trials design form.

OpenLV Extensibility (Method 3) – Trial Design

- **Approach and associated documentation:** The approach taken to signing up participants includes using the Memorandum of Understanding, Data Share agreement and trial design form. These documents provide a clear basis for the Method 3 trials;
- **Telephone Interviews:** Following receipt of applications, prior to selecting organisations to take forward, telephone calls were held with each applicant to review their application. This enabled the project team to get a better understanding of the proposed ideas and maximise learning on the project;

- **Maximising Learning:** Following receipt of 23 applications, the project team took the approach to work with as many organisations as possible to maximise learning, rather than just allocate a single OpenLV platform to each applicant;
- **OpenLV Solution Architecture:** The systems architecture of the OpenLV Solution enables 3rd parties to: 1) Develop/deploy applications to utilise LV network data, and/or 2) Implement server to server links to utilise LV network data and/or 3) Enables LV network data to be downloaded for offline use. This architecture has enabled the project team to maximise project learning; and
- **Trial implementation and associated documentation:** A number of documents will enable the project team and applicants to design and implement the trials. This documentation is needed to ensure the trials are successful. Documentation includes: 1) OpenLV Point Measurement document, 2) Developing with the LV-CAP™ Virtual Machine, 3) The OpenLV Common Application Platform API and 4) The trials design form.

8.2 Learning Dissemination

The following dissemination activities have been completed within the reporting period:

- A press release for the OpenLV project was released ahead of the LCNI conference in December 2017;
- The OpenLV project was represented at the LCNI conference on the WPD stand at the LCNI conference in December 2017;
- An article on the OpenLV project was published in Network Magazine in December 2017;
- A news article was published in January 2018 outlining that the application process for the Method 3 OpenLV Extensibility trials was open;
- A news article was published in January 2018 outlining the interest from IBM in participating in the Method 3 OpenLV Extensibility trials;
- A news article was published in February 2018 outlining that there was only 3 weeks to go to apply to take part in the Method 3 OpenLV Extensibility trials;
- A news article highlighting the success of a workshop that was held in February 2018 for interested parties in the Method 3 trials was published in February 2018;
- A newsletter for the OpenLV project was published in February 2018;
- The OpenLV project was featured in a 3,000 word article published by Energy World in April 2018;
- A paper has been written and accepted as part of the CIRED Workshop in 2018. A poster presentation will be delivered at this event in June 2018. The title of the paper is as follows: “The Development and Implementation of a Common Application Platform to Support Local Energy Communities”;
- A press release to celebrate the success of recruitment of participants for the Community Engagement and OpenLV Extensibility trials (Methods 2 and 3) was issued to 198 technology / energy media in May 2018; the news item is also on the project website and has been tweeted, with good uptake by partners and stakeholders;
- The following documents have been published on the OpenLV Website within the reporting period:

  - The second 6-month Project Progress Report covering June 2017 to November 2017;
  - SDRC 2.1: Community Engagement Plan & Interim Results of Assessing Market Potential (Methods 2 & 3;
  - OpenLV PR Guidelines;
  - OpenLV Social Media Policy;
  - OpenLV PR Guidelines for Community Groups;
  - Application Form for Community Groups to take part in the Method 2 trials;
  - Application Guidance for Community Groups to take part in the Method 2 trials;
  - Application Form for Organisations to take part in the Method 3 trials;
  - Application Guidance for Organisations to take part in the Method 3 trials; and
  - Guidance for Developing Software Applications with the LV-CAP™ Virtual Machine.
- In terms of overall media coverage, as of 4th May 2018, the OpenLV Project appeared in 59 news items. A list of the 17 news items within this reporting period is provided in Annex 1.

9 Intellectual Property Rights

9.1 Overall IP Statement

Table 5 outlines the details of the Background IP that will be brought to the Project and the Foreground IP that either will or could be generated on the Project. No changes have been made to the IP Register during this reporting period.

Table 5: IP Summary

IP No.	Description	Detail of IP	IP Type	IP Created By	IP Assignment
IP001	Core LV-CAP™ system	Comprising the operating system image including Internal API, 3rd Party Developer API (v1.0) and the following containers: MQTT, Data Storage, Sensor Reads, Container Manager	Background	EA Technology & Nortech	EA Technology[1]
IP002	LV-CAP™ Comms. Container (Method 1)	Comprising of the Nortech iHost comms. container	Background	Nortech	Nortech
IP003	iHost (Application Deployment Server Method 1)	Pre-Existing iHost platform	Background	Nortech	Nortech
IP004	Container Management from iHost (Method 1)	Development of iHost capability to manage & deploy container	Background	Nortech	Nortech
IP005	Cloud Based Hosted Platform (Method 2 & 3)	Existing Lucy Electric GridKey platform	Background	Lucy Electric GridKey	Lucy Electric GridKey
IP006	LV-CAP™ Comms. Container (Methods 2 & 3)	Comprising of the Lucy Electric GridKey communication container	Background	Lucy Electric GridKey	Lucy Electric GridKey

[1] Pre-existing commercial agreement in place between EA Technology and Nortech for this purpose

IP007	WeatherSense™ Transformer RTTR (DTR App)	EA Technology implementation of University of Manchester algorithm	Background	EA Technology & University of Manchester	TBC
IP008	LoadSense™ the LV Control App for Method 1 (Network Meshing App)	Application developed on the Project to enable automation of LV network meshing	Foreground	Western Power Distribution (via EA Technology)	GB DNOs
IP009	3rd Party App Containers (Methods 2 and 3)	To be defined on the Project	To Be Confirmed	Dependent upon funding mechanism	App developer / funder
IP010	LV-CAP™ API v2.0	A second iteration of the API to allow third party Apps to be created on the LV-CAP™ platform following learning from Methods 2 and 3	Foreground	Western Power Distribution (via EA Technology)	GB DNOs
IP011	Method 1 Communication Container	Development of the iHost communications container and iHost server to enable the wide scale deployment of LV-CAP™ for the OpenLV project.	Relevant Foreground	Nortech	Nortech
IP012	GridKey LV Monitoring Equipment	Use of the Lucy Electric GridKey "substation monitoring equipment" as part of the overall OpenLV solution	Relevant Foreground	Lucy Electric GridKey	Lucy Electric GridKey

IP013	Method 2 & 3 Communication Container	Development of the Application container to enable communication between the LV-CAP™ platform and the Lucy Electric GridKey platform (allowing extraction of data through network monitoring and system updates)	Relevant Foreground	Lucy Electric GridKey	Lucy Electric GridKey
IP014	Alvin Hardware	Use of the EA Technology Alvin platform as part of the overall OpenLV solution	Relevant Background	EA Technology	EA Technology
IP015	Alvin Communication Protocols	Development of the Alvin communication protocols into the LV-CAPTM solution to enable communication links between Alvin devices.	Relevant Foreground	EA Technology	EA Technology
IP016	LV Monitoring Hardware	Use of the GridKey MCU520, as part of the overall OpenLV Solution, to provide monitoring of LV substations.	Relevant Background	Lucy Electric GridKey	Lucy Electric GridKey

9.2 Current Reporting Period

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

9.3 Overall IP Statement

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

10 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 EA Technology'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.

10.1 Current Risks

The OpenLV risk register is a live document and is updated regularly. A total of 46 risks have been raised, 22 of which have been closed, leaving a total of 24 live risks. Mitigation action plans are identified when raising a risk and the appropriate steps then taken to ensure risks do not become issues wherever possible.

Of the 24 live risks none are ranked as severe or major, 3 are ranked as moderate and 21 are ranked as minor. Table 6 details the three moderate risks. For each of these, a mitigation action plan has been identified and the progress of these are tracked and reported.

Table 6: Top current risks (by rating)

Details of the Risk	Risk Rating	Mitigation Action Plan	Progress
There is a risk that funding cannot be secured for the development of 'Community Apps'.	Moderate	Favour groups with clear, demonstrable app development skills or groups that can secure funds from quick turnaround sources.	Community groups have been selected and this risk will be closed once the trial MoU and data share agreements have been signed.
There is a risk that funding cannot be secured for the development of 'Apps' for Method 3.	Moderate	Active involvement with 3rd party organisations early in the Project and testing the market.	Organisations have been selected and this risk will be closed once the trial MoU and data share agreements have been signed.
There is a risk that the automated switching and meshing of the network leads to safety issues for operational staff.	Moderate	The design of the OpenLV Solution will be independently reviewed by WPD operational staff to ensure it is fit for purpose.	Documentation outlining the methodology for automated switching has been completed and reviewed by WPD.

Table 7: Graphical View of Risk Register

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	0	0	0
	Less likely to occur/Mid to long term (6-10)	0	1	0	0	0
	Very unlikely to occur/Far in the future (1-5)	8	6	6	3	0
		1. Insignificant changes, re-	2. Small Delay, small	3. Delay,	4. Substantial Delay, key	5. Inability to
		Impact				
	Minor	Moderate	Major	Severe		
Legend	21	3	0	0	No of instances	
Total	24				No of live risks	

10.2 Update for risks previously identified

There has been no change in the top 3 risks from the previous reporting period, in terms of classification, an update on progress has been provided in Table 6.

Descriptions of the most prominent risks, identified at the project bid phase, are provided in Table 8 with updates on their current risk status.

Table 8: Key Risks Identified at Bid Stage

Details of the Risk	Bid Stage Risk Rating	Current Risk Rating	Comments
There is a risk that funding cannot be secured for the development of 'Community Apps'.	Major	Moderate	See Table 6
There is a risk that the integration of LV-CAP™ with generic hardware and the use of Alvin switching devices is more complex than expected and delays the OpenLV programme.	Major	Minor	See Table 8
There is a risk that the last mile communications between the distributed LV-CAP™ devices and the switches on the LV network is not robust and the devices cannot be switched as expected.	Major	Closed	N/A

11 Accuracy Assurance Statement

This report has been prepared by: 1) the WPD Project Manager (Mark Dale) and 2) the EA Technology Project Manager (Richard Potter), recommended by: 1) the WPD Future Networks Manager (Roger Hey) and 2) the EA Technology Delivery Manager (Dan Hollingworth) and approved by: 1) the Resources & External Affairs Director (Alison Sleightholm) and 2) the EA Technology Smart Interventions Director (Dave A Roberts). Both WPD and EA Technology confirm that this report has been produced, reviewed and approved following our quality assurance process for external documents and reports.

12 References

1. OpenLV Full Submission Pro-forma: https://www.westernpowerinnovation.co.uk/Document-library/2016/OpenLV/NON-CONFIDENTIAL-OpenLV-NIC-Bid-2016-WPD_EN_NIC_02.aspx
2. OpenLV Project Direction: https://www.westernpowerinnovation.co.uk/Document-library/2016/OpenLV/Open-LV-Formal-project-Direction.aspx
3. SDRC 1: Specification, Design & Testing of the Overall OpenLV Solution, Version 1.1, 17th October 2017: https://openlv.net/resources/openlv-sdrc1-specification-design-testing-version-1-1_with-appendices/
4. SDRC 2.1: Community Engagement Plan & Testing the Market, Version 1.0, 8th December 2017: https://openlv.net/resources/project-information/
5. SDRC 2.2: Targets networks, market potential and detailed trial design, Version 1.0, 25th May 2018

Annex 1 – Media Coverage

Number	Organisation	Date	Link
1	Community Links	07-Dec-17	http://communitylincs.com/open-lv-project-invitation-parish-councils/
2	Community Open Energy Monitor	13-Nov-17	https://community.openenergymonitor.org/t/openlv/5643
3	Electrans	02-Nov-17	https://www.electrans.co.uk/openlv-looks-network-capacity-evs/
4	Energy Capital	08-Nov-17	https://www.energycapital.org.uk/uncategorized/open-lv/
5	Energy Networks Association	05-Dec-17	http://www.energynetworks.org/blog/2017/12/05/get-'appy'-western-power-distribution's-openlv-project/
6	Energy World	01-Apr-18	https://knowledge.energyinst.org/search/record?id=109571
7	ITS For Home	17-Jan-18	http://www.itsforhome.com/pub/index.php/2018/01/17/Companies-invited-to-take-advantage-of-OpenLV-electricity-data/
8	IMechE	21-Nov-17	https://www.imeche.org/news/news-article/the-smart-grid-gamechanger-openlv
9	LinkedIn	15-Dec-17	https://www.linkedin.com/pulse/openlv-what-great-initiative-robert-plant
10	LowCVP	18-Dec-17	https://twitter.com/theLowCVP/status/942741442904100864
11	Metering	21-Nov-17	https://www.metering.com/news/western-power-distribution-ea-technology/
12	Networks	17-Jan-18	https://networks.online/gphsn/news/1000838/companies-invited-advantage-openlv-electricity
13	Power Technology	23-Jan-18	https://www.power-technology.com/features/opening-electricity-data/
14	Power Technology	10-Jan-18	https://www.power-technology.com/features/future-power-technology-magazine-issue-94/
15	Western Power Distribution	23-Oct-17	https://www.westernpower.co.uk/Innovation/News-Events/News/A-Unique-App-ortunity.aspx
16	Wind Power Monthly	17-Nov-17	https://www.windpowermonthly.com/article/1450499/wpd-ea-technology-launch-project-open-substation-data
17	Your Electrical Equipment News	06-Dec-17	http://www.yourelectricalequipmentnews.com/openlv+project+to+help+minimise+costs+for+new+connections+on+local+electricity+networks+such+as+ev+charge+points_41672.html