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OPEN LV

OPENING UP THE SMART GRID

Community Learning Specialist: Deliverable 5

Mid-trial Report 2

ea technology

RIIO NIC NETWORK INNOVATION COMPETITION

Report Title	:	OpenLV Method 2: Mid-trial report 2
Report Status	:	Final
Project Ref	:	WPD/EN/NIC/02 - OpenLV
Date	:	27.06.2019

Document Control

	Name	Date
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Revision History

Date	Issue	Status
02.05.19	V.1.0	Draft
21.06.19	V.2.0	Final
27.06.19	v.2.1	Final amends made

Contents

1. Executive summary

1.1 Background

The OpenLV project is trialling an open, flexible software platform called LV-CAP™, which could be deployed in every low voltage (LV) substation in Great Britain. The aim of the trial is to demonstrate the platform's ability to provide benefits to the network, customers, commercial entities and research organisations, and to understand the revenue or savings that they could access by using local electricity substation data.

This report is part of Work Package 'Method 2 – Community Engagement', which looks to demonstrate the value of providing LV network data and an 'open platform' to communities, housing associations and local authorities who want to know more about local electricity and develop innovation ideas within a smarter grid. Trials are ongoing in seven communities that want to use the OpenLV platforms to provide information and data to their community, in order to better understand their electricity use (and generation) or exploit local supply options. In addition to the OpenLV platform, each of the communities has been given access to the Method 2 Application (App), which has been developed by the Centre for Sustainable Energy (CSE), to allow them to see and more easily analyse the data being provided.

Regen's objective, as the Community Learning Specialist, is to:

- Provide an assessment of the value and benefits of each community project and assess the replicability of community projects using the OpenLV technology and data

- Review the learning generated by the community engagement and trial process in order to produce a guidebook, so that other communities can start their own Community Project and develop/use an app to access data from the OpenLV platform.

This report is the second of three mid-trial reports for the OpenLV Method 2 community projects. The aim of these reports is to monitor and report on learning from the Method 2 progress during the trial period.

Through the three mid-trial reports Regen will be looking at the key areas of the project that can provide learning for future innovation trials involving community groups, or increase the replicability of future community projects using local substation data.

- The Mid-trial 1 report focused on the initial project progress, as well as providing an overview of community attributes and the technology relevant to replication of trials with other communities.

- The Mid-trial 2 report (this report) provides a mid-point evaluation of the learning so far and the interim project outputs. This report focuses both on the development process and use of the Method 2 App for the communities, along with a review of the anticipated project outcomes and evaluation approach for each community. This report draws heavily on a series of mid-trial interviews that were conducted with community groups during March 2019. These interviews are documented in Section 3 of this report.

- The Mid-trial 3 report will focus on engagement in the communities and lessons from how best to communicate substation information to households.

Delivery timescales for these mid-trial reports are presented in Figure 1.

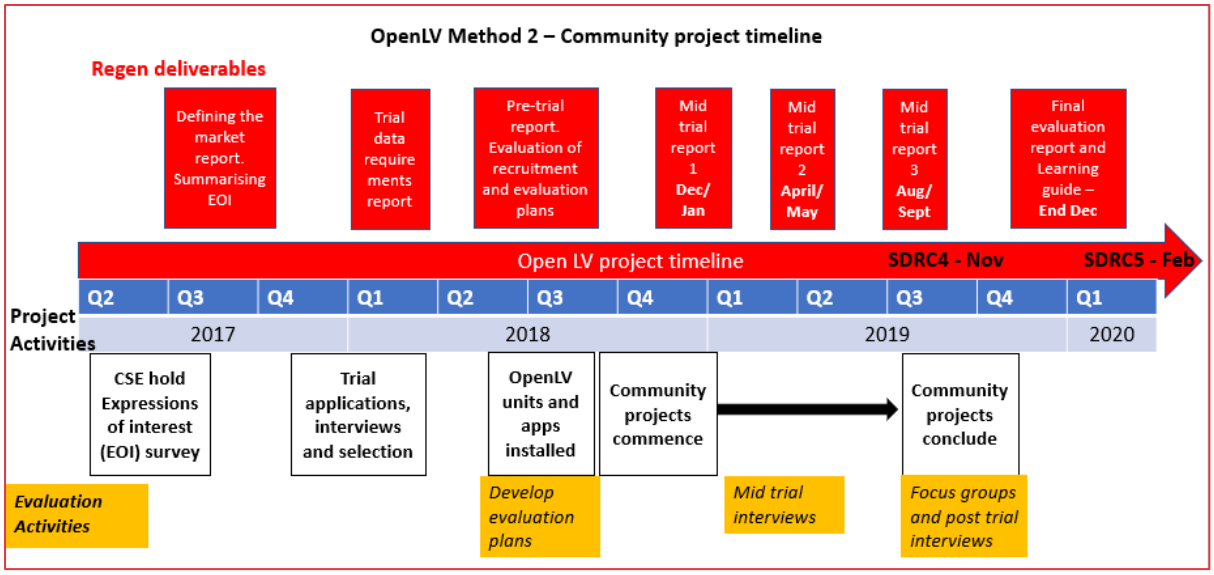


Figure 1: Project timetable and Regen activities

1.2 Summary of progress

The mid trial interviews, which were conducted between 6 March 2019 and 6 April 2019, revealed that most of the communities have been progressing well with their projects. Usage of the App has been consistently high across most communities. A breakdown of usage by community groups can be found in Section 2.5.

Highlights from the project interviews and feedback summaries include:

- **Tamar Energy Community** has made considerable progress with a dedicated resource leading engagement in the local community and school. A volunteer software engineer has also been working with CSE to interpret data from OpenLV for the group's website. Their original aims and evaluation plans remain on track.

- **Bath & West** has been using OpenLV data to complement a grant funded project to install solar and battery systems in local households. Data issues involving confusion of the substation configuration and an outage at the substation have impacted some of the baseline data for the evaluation plan. However, this has been resolved with the help of EA Technology and plans to run the batteries in different levels of configuration mean the project remains broadly on track for outcomes and evaluation.

- **Marshfield** has continued to engage with the App but has amended its plan for community engagement outcomes. Local demographics have meant that the group has discovered saving on energy bills is not the driver it might be in other communities. This has meant they have been unable to present the data with a compelling story to engage residents, as discussed in Section 3.5. The plan to use the data to understand outages and solar load in the area, then evaluate the project through an interview, remains unchanged.

- **Owen Square** has engaged with the App and OpenLV to develop business cases for further low carbon technologies in the area. They have reported that none of their current funding bids have been successful, but the planned outcomes and the evaluation of the project are also unchanged.

- **Exeter Community Energy** has found it difficult to use OpenLV data in its community project. This is despite a lengthy process to identify a suitable substation and area for the group to work on. Unfortunately, the chosen substations were not able to provide a straightforward view of the streets that the group had hoped to monitor. Exeter has also encountered funding issues which mean that their mobile phone app is unlikely to be developed during the project period. Their project outcomes and evaluation expectations have been changed to reflect this.

The WHG and Rooftop housing associations have both been unable to progress their projects at this stage. Unlike the community groups, these housing associations were both reliant on individual resources to drive the projects alongside an existing role and have been set back when this member of staff changed or left.

- Changing personnel in **Rooftop** has meant the project deliverables have stalled until recently. A new project manager is now working to understand what deliverables are possible within the remaining timeframe of the project. The outcomes and evaluation plan for this project will need to be confirmed.

- In **WHG** the project manager has now left the organisation and the project has been halted. The WHG project is included in the learning review in Section 3.6, but we will not be able to evaluate their project outcomes. They will be replaced in the Method 2 trial by **Yealm Community Energy,** who has been involved with Method 3 trail participant Engie, and will be included in future reports.

1.2.1 Data issues

In the mid-trial interviews, five out of the six remaining community groups noted that they had some problems with the data they received from their substation. Data issues have been as a result of problems occurring at different substations, with the LV-CAP or in the App, with nearly all having now been resolved with support from project partners EA Technology, CSE and Western Power Distribution (WPD).

Although these issues were expected during the trial period, communities have reported that these issues have caused delays or changed the scope of five of the projects:

- Missing data points from the LV-CAP unit. This impacted how Marshfield were able to identify outages in the villages which was a key outcome for its project. CSE's data quality checker has been used to diagnose this issue. The issue was resolved when a new version of the communication software was rolled out that addressed the situation.

- Poor mobile reception in Owen Square meant that the data was not being sent out from the substation. This was resolved with the installation of a new external aerial, meaning the communications unit is now fully functioning.

- There was confusion over the configuration of the substation at Elm Place as the labelling of feeders was back-to-front, so readings appeared to be wrong. This was resolved by EA Technology, CSE and Bath & West, so initial data could then be used for baselining.

- The OpenLV units had initially not been monitoring the feeder and street that was anticipated by the Exeter project. Monitoring was put in at a second substation at Parkfield Road, but by this point due to external issues with the group's app development and resourcing, the scope of the project had reduced, and they have not made use of this data.

- Tamar's development of its own app was setback due to a temporary loss of busbar data in April which was then resolved.

1.2.2 Method 2 App development

Project partners CSE have supported Method 2 participants by developing a common app for community groups to use. This was a change of scope to the original OpenLV method 2 project and the decision is explained in Regen's first mid-trial report. The CSE App presents substation data for community groups to analyse and use to support their projects.

The App was developed by CSE over the summer of 2018 and the first release was launched to the community groups in September 2018. Improvements were then made in two further development stages, before a final version was released in December 2018. There have since been further enhancements and bespoke modifications made by CSE at the request of the community groups, with four new versions released up to April 2019.

As the projects develop, communities continue to identify features that could improve the App for their purposes and make it more engaging for their community. This has provided key learnings that highlight the value of a shared App functionality combined with the ability to make bespoke modifications.

Communities have continually used the App since its launch, with the number of unique visitors increasing each month to nearly 200 during March 2019, as seen in Section 2.5.

Tamar has also been working on software development. They are looking to develop a separate OpenLV interface on their website, which will also use data from CSE's Method 2 App, deployed in the LV-CAP unit. This will mean the hits and users on the CSE App for Tamar is likely to reduce over time and this will be monitored in the third Mid-trial report.

In order to understand the cost-benefit analysis of App development for the project evaluation, CSE and the projects have been asked to record time spent on software development. The time taken for the CSE App development has reached 126 days as of the end of March 2019 with a total cost of £74,000.

1.2.3 Key learnings for future innovation projects with communities

The project so far, with particular reference to the App development process, has produced important lessons on how project partners can work to accommodate communities, and how communities can adapt to working with industry organisations. These lessons are relevant for

future innovation trials which look to engage communities or other third sector organisations. These include:

- OpenLV project partners provided expert resources such as software development to communities. This was helpful and necessary as few voluntary or community groups have the expertise and resources to carry out these complex and often time-consuming tasks. This approach should be taken in future innovation trials of this nature.

- Innovation budgets and timescales should be as flexible as possible to account for voluntary community groups' working patterns and ability to respond. This lesson came from deadlines being missed by communities to get App enhancement requests to CSE, as discussed in Section 2.3, making the process less efficient as CSE had to adjust their App development work accordingly.

- As part of the funding package for an innovation project, participating organisations could be allocated funding or resources to ensure they are able to engage fully with the project and prioritise it alongside existing work and responsibilities. In the case of the two housing associations, WHG and Rooftop, resourcing issues has meant that participation in the OpenLV trail has been given a lower priority compared to day-to-day workload. This issue is further discussed in Section 3.6 and 3.7.

- Communities bring unique local perspectives to projects, which can be hugely beneficial in an innovation trial as they have detailed knowledge of their local area and its demographics, which in the case of OpenLV has helped in identifying data abnormalities. Community groups also help local people to understand new concepts, such as energy shifting, and this widespread knowledge and engagement in a community can help to make innovations business-as-usual.

- Substation areas or feeders tend not to correspond to traditional geographical community areas. Involving multiple adjacent substations so that LV-CAP units cover entire communities, as with Marshfield, would help local engagement.

1.3 Methodology for data and information collection

Information for this report was collected by several methods:

- Information was provided to Regen by CSE and EA Technology about progress from the community groups in short bimonthly updates. CSE also provided Regen more detailed information about the App development cost, process and learnings. This was the basis of section 2 of the report.

- Information about App usage by the communities was accessed by Regen and CSE from the App monitoring software.

- Further information about the community progress was collected directly by Regen through semi-structured interviews with a community participant. These were conducted in March and April 2019. These interviews began at the OpenLV participant workshop in Exeter on 6 March, where each of the communities met with the Regen project team to answer a pre-arranged set of questions. This was also a chance for participants to make any comments or raise issues they had regarding the project.

There were 15 questions developed to help guide the semi-structured interviews, split into five sections:

Understanding the App development

1. *Were you involved in the community App development workshops? (yes/no)*
2. *Do you have any feedback on the App development process run by CSE?*
3. *Did the App meet your requirements?*
4. *Is there anything you might have changed or liked to have (that isn't already being developed)?*

Use of the App

5. *How often do you use the App?*
6. *Which functionalities do you use/find most valuable?*
7. *Is there anything else you would like the app to show you about the substation that it currently does not?*

Use of the data from the App (those engaging communities)

8. *How has the availability of local substation data helped you to engage your community in energy issues?*
9. *Have you been able to engage communities in the App/substation information? (How? Record what they've achieved)*
10. *If not, what are your plans to do so?*
11. *What has been the feedback/reaction?*
12. *What lessons have you learned in terms of how to present the information to communities?*

Use of the data (those just analyzing data)

13. *Has this data increased your understanding of local energy challenges?*
14. *Does the availability of substation data help you to achieve your energy goals?*

Lessons for future projects

15. *What would be your lessons for other communities who might be interested in accessing this information?*

The community responses to these questions and any additional points raised by interviewees were typed up as interviews were being conducted. For participants not in attendance at the Exeter event in March, phone interviews were conducted in the weeks that followed, using the same format as the face-to-face interviews.

Documented summaries of the interviews and responses were then sent to community interviewees to verify the information in them and raise any additional points or issues.

The interview findings were then used to write this report.

2. Method 2 – Community App development

2.1 Background to the App development

As outlined in the first mid-trial report, the original objective of the Method 2 OpenLV community trials was to provide OpenLV data to communities and then encourage them to develop their own software applications to analyse or present that information in a way that would be valuable for the local community.

Once the community groups were identified, it became clear that the community organisations had limited capacity to develop their own apps. One group, Tamar, had a volunteer software developer, and Exeter had secured limited development time from an external software developer for a mobile phone application. The relatively short project timetable meant that it would be difficult for communities to find funding to employ software engineers.

It was subsequently agreed by the project partners that CSE would develop a common, configurable Web App to be used by all the Method 2 participants to visualise and process information from the LV-CAP units. The community organisations were then able to focus their project activities on using this information to build business cases for new, low carbon technologies or community engagement activity.

This section looks in more detail at the process of the App development undertaken by CSE, and outlines learnings from the process that might be applicable to future community innovation projects.

Learning:

- Few voluntary or community groups have the expertise and resources for complex software development work. There are, however, opportunities for communities to collaborate and share software and/or development resource. It may be more effective for community projects to work with an industry partner to undertake this work.

- It's helpful to have flexibility of timescales and scope within an innovation project to adapt to a different approach, while still generating useful outcomes for participating communities and learnings for future trials.

2.2 App development timeline

CSE's App development process began with discussions during the selection process and interviews with community groups. They held an App design workshop on 21 May 2018 for the communities before the App development work started.

This workshop was held to establish what communities wanted from the App in terms of data points, features and functionality. Some groups had detailed functionality requests and others needed only basic data. This also allowed CSE to determine the commonality across the groups, as they worked towards a requirement specification.

OpenLV units were installed in substations, with data testing and improvements made to communications infrastructure by EA Technology and other project partners, across summer 2018.

Community workshops were followed up with further phone, email and webinar communications to finalise requests and get input from the communities on functionality and appearance. App progress webinars were held on 26 June and 31 July, before the webinar to launch the App for testing with user guidance on 4 September, and release of updates in November and December.

Following the initial development discussions, the initial App design included five key areas of functionality:

1. Being able to see, manipulate and view graphical information on all data points being measured as part of the OpenLV trials, in order to be able to see real-time electricity use data and identify data trends at the substation – e.g. energy use over time.
2. Integrate data external to OpenLV monitoring into the App (such as from local or national generation) and present that together with OpenLV data, for instance as the carbon intensity of electricity.
3. Embed the graphical information from the App in external websites.
4. Provide an alert function so that community users could be sent a message when certain conditions are reached in the substation or App (e.g. low carbon, high voltage etc.)
5. A modelling function for tariffs that allows groups to develop models for local matching between generation and supply, and see how the OpenLV information might interact with that.

2.3 Overview of App development process and costs

The App development process ran from May to December 2018, with a total of 126 days spent developing the app. This includes approximately 84 days developing the initial common App functionality and an additional 42 days working on specific requests from community groups. The key requests are described in Table 2-1.

The App development process was split in two parts;

1. The OpenLV and substation interface (the 'Method 2 collation app'). The substation interface required writing software to collect and supply data from the substation.
2. The community interface (the web App and additional tools). The second half of the process was focused on the community interface, writing software to give communities access to substation data, liaising with EA Technology and with the community groups while writing the App, engaging participants with the process through updates, phone calls, email and webinars, taking on requirements from communities.

In order to understand the costs of App development to inform future projects, participants were asked to closely record the time and resource spent, which then provided indicative costs based on the time CSE spent working on community requests.

This provides an interesting benchmark of two-thirds of the time on common design elements and one-third on bespoke elements (which may then be shared between communities).

Group	Description of functionality requested	Development Days	Indicative Cost
Bath & West Community Energy	Incorporating data from Moixa API; Carbon intensity; option to set y axis at 0	10	£6,000
Marshfield Energy group	Changes to the way graphs display, ability to add multiple y axes, ability to put in user generated multiplier, local solar estimated PV output, church solar PV array, school turbine	19	£11,250
Tamar Energy Community	SolarEdge APIs for solar installations; different colours in the graphs	3	£1,750
Exeter Community Energy	Details about how Tamar's software engineer worked with CSE's App to take learnings for their own app development.	5	£3,000
Rooftop Housing association	Graded smileys related to outputs.	5	£3,000

Table 2-1: Community Group requests for functionality

The majority of the 126 development days have been spent by CSE's Java Software Engineer, with additional design input from CSE's wider team.

The total days also include development of additional tools, such as the API for the 30 min data and a data quality checker. The data quality checker was discussed with EA Technology and developed to help identify data access issues being experienced by communities. CSE also developed App user guidance and individual support for communities working with the App. It also includes some direct costs associated with purchasing the domain and hosting the website.

The latest version of the Method 2 App can be found here: https://openlv-cse.uk/. Each Method 2 group has a login to their own user area and the ability to configure settings to meet their project needs. Graphs are then available for members of the public to see either on the Open LV website or can be shown on the community groups own websites using an i-frame.

The Beta App was delivered in September 2018, making real time substation data available to the participating community groups. However, not all the functionality was complete because of data access issues at substations, including missing data issues which were resolved by EA Technology, as discussed further in Section 0 in relation to each project. The groups asked for more time to learn how to use the App and the data before launching local projects in their communities. CSE agreed with EA Technology to move the project trials back by three months to allow improvements to the interface that could be developed once all the OpenLV data was available.

Since September 2018, there has been an ongoing process to create a more engaging interface, which involved taking feedback and requests from communities to make continual modifications to the App.

The total cost of developing the App, including the web app, all associated apps, the API, interfaces, data quality checker and direct website costs was £74,677, as of March 2019.

2.4 Community feedback on App development process

The communities were asked to feedback on the App development process during the mid-trial interviews with Regen. The six communities interviewed had overall positive experiences of engaging with the App development team during the process. Tamar and Marshfield in particular reported that it was an inclusive process and noted there had been continuous communication with the App development team throughout.

All communities who were involved in the process reported that CSE had been responsive to their needs. They had positive feedback about working with CSE's Java Software Engineer, Andrew Gonnet, who had updated the App as per their requests. Details of how each community engaged in this process with CSE can be found in

Method 2 project progress.

As communities developed their own specific use for OpenLV data, their requirements for more bespoke App functionality increased. There is therefore a need to balance the priority to develop a common shared App with the need to meet the requirements of seven specific applications for each community.

Some examples of the different ideas for data usage and App functionality included:

- Exeter Community Energy identified that a web-based App supports the projects in developing their outcomes and plans, but that it is not the right format to engage the wider community. To achieve this, they suggested that data needed to be available in a smartphone application, per their project goals.

- Tamar's project team said that they would like to be able to develop their own community interface. One suggestion is that the App could be layered to allow each community organisations to customise the presentation of information whilst the common App delivers the data collection and analysis functions.

- Tamar also want to be able to easily input the substation data into common desktop applications such as Excel and Google Sheets, rather than only viewing it on the OpenLV web App.

Learning:

- Working with community groups has given the OpenLV trial a different perspective on data usage and has helped the project develop an understanding of local issues from each community, by examining local electricity data with local knowledge, it provides more context and gives the data greater meaning.

- CSE have worked to integrate various additional features into the App that reflect local conditions and the interests of communities including regional carbon intensity data, local renewable energy generation data (in real time, via the Solar Edge API) along with estimated household level solar PV generation. This shows the benefits of community and industry partners working together on App development.

2.4.1 Data accessibility

It is likely in any trial project that there will be unforeseen glitches in new products and software, especially where there are multiple partners and complex inter-related issues with data, as is discussed in relation to specific projects in Section 0. The iterative development approach, which is now commonly used for accelerated App development, also carries a degree of "learning-by-doing".

Communities identified difficulty in access testing and working with data in the App during the development process. For community users this meant they were not able to see how the web App would visualise real-time data until a later stage in the process which also delayed development.

During the App development process, CSE dealt with several issues with electronic transmission of data, telecommunications signals, database design and security access to trial data.

A underlying data accessibility issue was the gaps in the data provided to the App by the LV-CAP which has impacted how communities can engage with the data. Marshfield, for example, has an objective to monitor outages in their village through the App, therefore it is important they can identify the reason for missing data, whether it is evidence of an outage or a data issue.

To address this, CSE developed a bespoke data quality checker tool to check which data points were missing and identify the cause of the data loss. An issue that it identified was then rectified by project partner Lucy GridKey. This has significantly improved data transmission across the whole OpenLV project.

Learning:

Project timescales dictated that the Method 2 groups were the first to work with the OpenLV data, meaning communities and CSE identified 'snagging' issues with the substations or data quality which then delayed the development of the community projects.

For future trials it may be more efficient for industry participants with more technical expertise, such as the Method 3 trial participants, to work with the data at the same time as communities so that initial tests and 'snagging' can be resolved more quickly.

2.4.2 Responding to community feedback

CSE engaged with community groups at the beginning of the App development process, however this was made difficult because most voluntary groups did not have a specific resource allocated to engage with the trial.

As well as engagement issues which were due to stretched resources and a lack of technical knowledge within the groups, some groups did not fully appreciate how the App might support their project. For example, Marshfield and Exeter said that initially they hadn't engaged with the development as they didn't anticipate needing the App but later decided to include it in their project.

As a result of this varying engagement, CSE reported that they continuously had to manage expectations around what the App was able to do, and the way the data would be displayed, despite regular updates and demonstrations of the emerging App.

During the interviews several community groups highlighted that being able to visualise data through the App and understand the story it presents about the community was vital to the groups' plans to engage residents. Some groups reported that their need for visualisation of the App data was not something that could be foreseen, so required a degree of iterative development. For example, during the mid-trial interview, Marshfield noted that they only clearly formed ideas about how to use the data once they started to see what was available.

This means that there needs to be some flexibility in terms of the development budget and timescales for App enhancement, and support for an iterative development approach.

Learning:

- A process of 'agile' software development process may offer advantages where functionality and design requirements are not fully understood at the beginning of the project. In this way, improvements are planned to be made at iterative stages in a staged 'sprint' development process.
- Innovation budgets and timescales need to be flexible to account for voluntary community groups' working patterns and ability to respond. For example, providing a budget to travel and meet groups to discuss their needs would be beneficial.
- It is important to build in additional 'user testing' improvements after an initial launch (both in terms of project timeframes and in time resource allocated to development).
- It is important for users to be able to visualise data and functionality as early as possible in the development process. Wireframing type techniques to present the overview of information flows and functionality in model form could help to visualise the user journey.

2.5 Community engagement with the App

Before the community groups could engage with the local communities, they first needed to understand the data being provided by the App. Even amongst highly motivated community groups with a very good understanding of electricity networks, the project teams found it a challenge to understand the specific data point measurements from the LV-CAP units, how they interact, and how best to use them in project delivery.

To address this issue, CSE produced guidance on using the App which also included descriptions of the different data points and examples of how they could be used in the context of the OpenLV Method 2 trials.

Additional guidance was also produced, such as on how to download the 30-minute data via an API specifically set up to run alongside the App and offering individual support to groups through meetings, phone calls and emails.

Learning:

Industry partners helping to up-skill and increase the technical capacity of community groups to use and manipulate complex data enhances project delivery. Accessible guidance for non-experts such as the description of data points and use-case examples provided by CSE would be useful in future trials.

Once the main phase of the App development process was complete, groups were then able to configure functionality within their version of the App. This involved setting up bespoke graphs, depending on the local electricity data that suited their project.

The usage data collected by the App illustrates that the communities had by this point started to engage with the data provided through the App in the development of their community engagement or business plans. The number of graphs set up within the App gives a good indicator of the level of use by the groups (although some groups only wanted very specific data which can be shown in one or two graphs). The first mid-trial report in January 2019 noted that only a small number of Graphs had been configured by the groups, but all have increased the number of graphical configurations within the last 2-3 months, as seen in Table 2-2.

The number of graphs configured varied significantly between groups, with Marshfield configuring 37 and Rooftop configuring three graphs. More information is available in Table 2-2. Few alerts have been configured so far, as some communities are completing other phases of their projects before encouraging residents or group members to use alerts. For example, Tamar are developing their own app and will look into alerts once this is ready, while Bath & West are still finishing their PV and battery installations, then will begin to engage residents in the App and encourage households with these installations to set up alerts.

Community	Graphs configured in January 2019	Graphs configured in April 2019	Alerts configured January 2019	Alerts configured April 2019	I-frames embedded in external sites
Bath & West	3	12	0	0	0
Exeter	2	6	0	0	0
Marshfield	3	37	0	0	0
Owen Square	2	6	0	0	0
Rooftop	1	3	0	2	0
Tamar	3	14	2	0	3
WHG	3	9	0	0	0

Table 2-2: Usage of the App functionality by community Groups (10/04/2019)

The number of unique visitors to the App has also increased over time to nearly 200 in March 2019, as seen in Table 2-3. Hits have varied but stayed over 2,000 in March. The hit data indicates when the communities have been particularly active with engagement.

In December 2018, after the App launched, Marshfield was the most active group, accounting for 126 hits. Bath & West was particularly engaged over the following months, over 40% of hits going to their graphs in January, while their graphs once again accounted for almost 3,000 hits in February. This suggests that Bath & West benefited from the extra time taken to engage with their community, explaining how to use the App and what the data means to local residents, while signing people up for their domestic PV and battery installation offer.

In March 2019, Marshfield and Tamar were engaged in the App, generating 30 and 19 unique visits to their graphs respectively as they continued their engagement work in the community.

Learning:

Time taken to engage with communities, explaining how the App functionality works and its data usage significantly increases the level of App usage.

	December 2018		**January 2019**		**February 2019**		**March 2019**		
Community	Hits	Visitors	Hits	Visitors	Hits	Visitors	Hits	Visitors	**Total Hits**
Bath & West	25	9	2702	64	2929	24	807	36	**6463**
Exeter	0	0	33	8	38	8	112	13	**183**
Marshfield	126	6	635	33	1917	72	499	60	**3177**
Owen Square	27	6	2	2	14	4	5	5	**48**
Rooftop	5	5	9	5	61	5	108	23	**183**
Tamar	54	24	342	22	470	34	557	61	**1423**
WHG	20	9	17	8	14	12	24	18	**75**
Total	**257**	**59**	**3740**	**142**	**5443**	**159**	**2112**	**198**	

Table 2-3: Usage of the App functionality by community groups.

3. Method 2 project progress

3.1 Bath & West mid-trial interview and evaluation

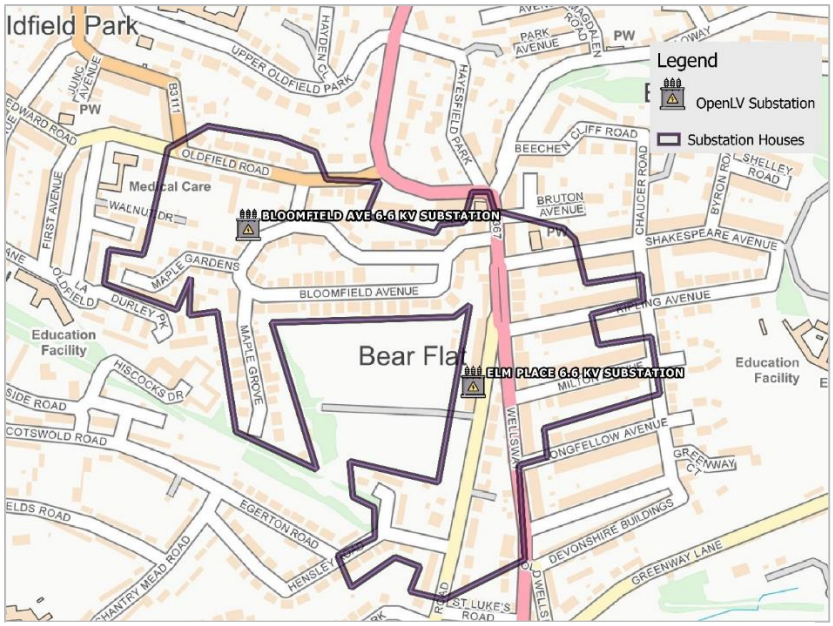


Figure 2: Bath & West OpenLV trial area

Bath & West Community Energy
Generating local energy

Bath & West Community Energy (BWCE) is one of the leading community energy groups in the UK.

They have installed over 20 MW of solar PV projects since their formation in 2010. They currently own 12.35 MW of their own PV capacity.

Over the next 3-4 years, BWCE aim to increase community renewables capacity, raise their local profile and develop innovative approaches to local energy markets, which has included launching a local energy supply tariff with Our Power.

The BWCE team consists of five non-executive directors, two executive directors, two co-opted directors, two employees, 16 volunteers and 650 members.

3.1.1 Summary of project

Bath & West is using OpenLV data as part of their Solar Streets initiative, to measure the impact of domestic PV and battery installations on the local substation and build a business case for further installations.

As of April 2019, Bath & West had installed solar PV on four of the houses connected to either the Bloomfield Road or Elm Place substations, with five more solar installations scheduled. They have yet to install battery storage systems on the 17 households signed up to this offer, but plan to have this stage of the project completed by the end of May. They have identified June and October 2019 as the two months to target for a community demand shifting campaign, with newsletters, door knocking and workshops to promote the campaign and explain the benefits of time shifting energy use, while helping local residents to understand the OpenLV data.

The original outcomes for the project were:

To measure the impact of substation data on energy use and behaviour, and to build a business case for further solar battery installations on households by measuring the impact of these low carbon technologies on the local substation.

The key outcome for Bath & West Community Energy is to use the OpenLV local data in conjunction with a domestic solar and battery installation programme. The installations have been partially funded to roll-out to a number of householders within the substation area. The data will help prove the impact of a domestic solar battery system on the substation. They will

also trial various operating modes for the batteries in order to understand whether and how the community could best provide future network services or avoid network upgrade costs. ***(Project monitoring sheet August 2018)***

The project also intended to use the OpenLV data to understand and influence behaviour change in the areas of:

1. How people use energy in their homes
2. The times of the day people use energy
3. How to work with neighbours and your local community around energy issues, liaising with an external organisation.

3.1.2 Progress so far

PV and battery installations

Bath & West's community engagement involves signing households up to their PV and battery installation offer, for either a joint PV and battery system or just a battery to be installed on their property. Prior to installations starting, householders met with installers and Bath & West to ask any questions, as one of the community meetings the group has held throughout the project to engage people in their PV and battery offer.

By February 2019 they had 18 households, connected to the Bloomfield Road and Elm Place substations, signed up to receive installations. They were originally planning to have the systems installed by 25 March, however they reported that installations fell behind schedule, due in part to stretched community resources and uncertain market conditions with the end of the Feed-in Tariff. Four solar installations have been completed, with five more PV systems still to be installed in the community, along with batteries for 17 households (one household signed up for the domestic battery offer and subsequently pulled out). Bath & West originally planned to have all scheduled installations completed by the end of May.

Bath & West's community PV and battery installation process shows that, even for a well-known and active community group, it remains difficult to get low carbon technologies installed on domestic properties. While unfavourable market conditions at the time played a part in the group's difficulties with this part of the project, longer time frames to reflect communities' stretched resources may be beneficial.

Data issues

The Bath & West project had initially thought there were gaps in the data they have been receiving from the substation. This was due to confusion over the configuration the LV-CAP unit at Elm Place substation, as it was labelled back to front, meaning readings from the feeders appeared wrong, as noticed by Bath & West. There was also an outage in mid-December that blew the Regowski coil on the feeder on the substation, destroying the LV-CAP sensor. This had meant that there was no data for the Elm Place substation between 14 December 2018 and February 2019. The LV-CAP sensor has now been replaced by EA Technology, the sensors have been re-labelled, meaning the data shows the domestic load that the group had wanted.

Learning:

Support from industry experts or intermediary organisations to communities to resolve data problems is vital. Innovation trials involving communities benefit from detailed local knowledge which can help identify data issues at an early stage, making it important to have a system of reporting data quality issues so that they can get solved as quickly as possible. This is a good example of strong communication between communities and key industry project partners.

3.1.3 Future plans

With the help of EA Technology, Bath & West has agreed to put energy monitors in the commercial buildings connected to the Elm Place substation, in order to distinguish between commercial and domestic energy data.

Once the remaining installations are completed, the group has identified two months to run a local demand shifting campaign, towards their behaviour change objectives. The campaigns will be aided by OpenLV data to measure the impact of PV and battery installations and demand shifting on the substation.

These campaigns are set to run in June and October 2019, which will involve community engagement through newsletters and workshops to promote the campaign and help residents understand the OpenLV data, and behaviour surveys to measure the success of the campaign towards project outcomes. Bath & West is planning to run a public meeting on 8 June to launch the first of their demand shifting campaign months in June, from which point they will start using the OpenLV data and encouraging local residents to use the App.

Updated outcomes

The original outcomes of the trial remain unchanged.

Updated evaluation plan

The project monitoring sheets noted the following quantitative approach to evaluation:

The project evaluation will focus on the extent that a substation impact can be seen and measured by the community group from the OpenLV data. The data will need to be correlated with the data taken from the participating households and understanding of how the batteries have been programmed to operate on particular time periods. A cost benefit analysis will then be undertaken by either Regen or BWCE to estimate the impact on the participants (e.g. through cost benefit analysis using anticipated bill savings) and what network revenues might be available for this aggregated domestic flexibility service in areas of network need.

The original evaluation plan for behaviour change was:

An online survey will be designed, aimed at local residents to establish their changes in energy behaviour, and compared with the findings from the pre-trial survey on energy behaviour. **(Mid-trial report 1, 2019)**

This qualitative part of the evaluation remains unchanged.

The quantitative part of the evaluation was originally intended to come from substation data, before and after the domestic solar battery installations, to measure their impact. Despite issues with gaps in the data, delays to battery and PV installations mean there should be

enough baseline data to measure the impact of installations. This will help the group to understand and build a business case for further installations.

3.1.4 Use of the App

Bath & West has been using the App to monitor pre-solar battery installation activity on the substation and promote the installation offer to households. They have also been using the App for their behaviour change objectives to engage their community in local energy issues and explain the motivations for demand shifting.

Figure 3 and Figure 4, have been taken from the OpenLV app, show a typical midweek day of energy use, pre-PV and battery installations. Bath & West will then be able to compare this to use profiles following installations and during their demand shifting campaign months as one of their measures of success.

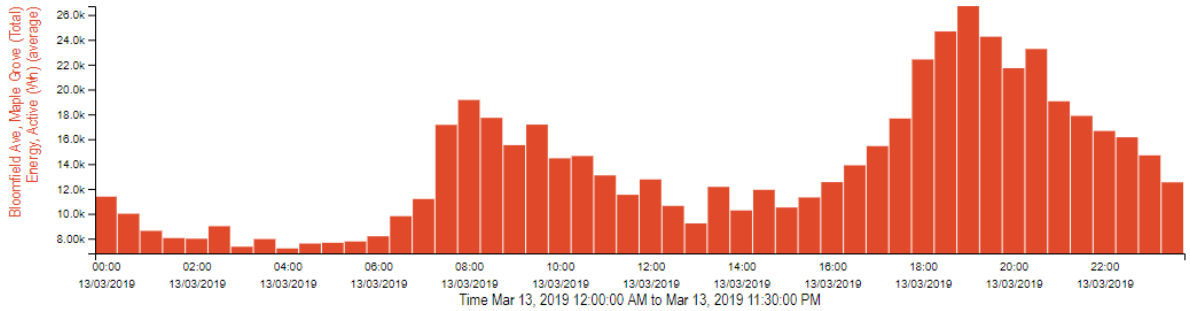


Figure 3: 13 March 2019

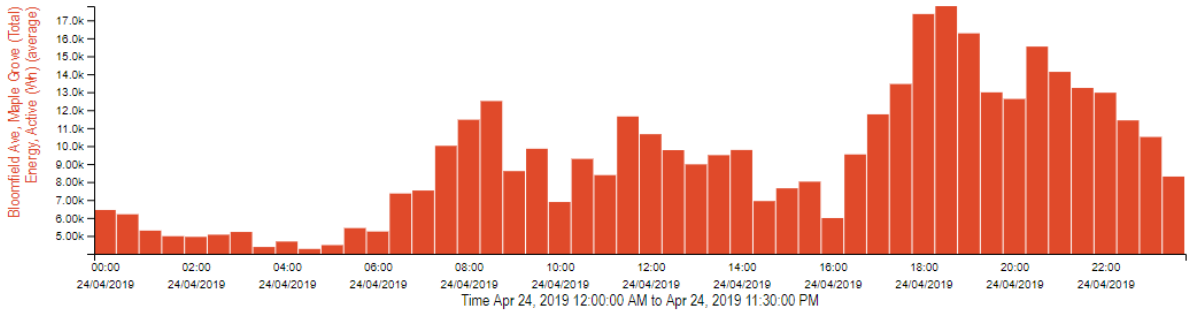


Figure 4: 24 April 2019

3.2 Tamar mid-trial interview and evaluation

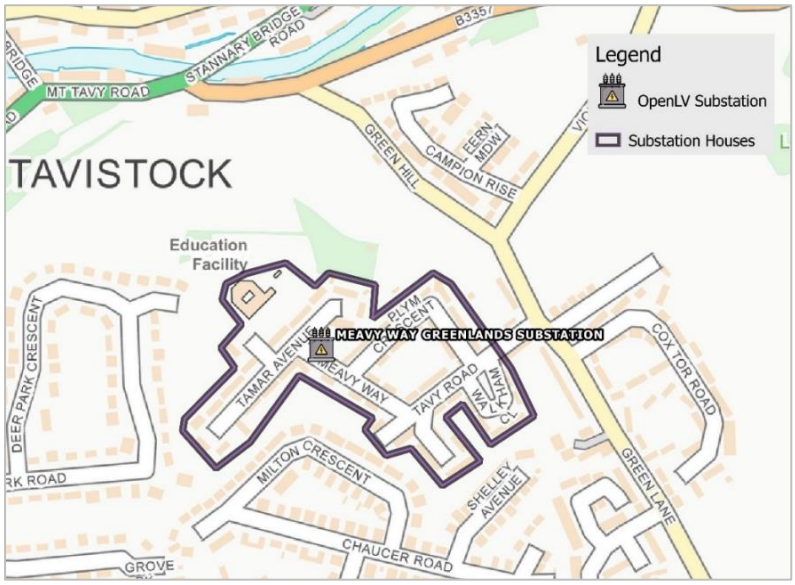


Figure 5: Tamar's OpenLV trial area in Tavistock, Devon

Tamar Energy Community

The Power in Your Hands

Tamar Energy Community (TEC) is a community energy group based in Tavistock, Devon, formed in 2014. As a community-run social enterprise, they provide free and impartial energy advice and support to people in West Devon and South East Cornwall.

Their mission is to localise energy, keep the money spent on energy in their local economy and help vulnerable people in fuel poverty. As part of this mission, TEC installed 265 kW of solar PV on rooftops in their community in 2016, with their team of 13 active volunteers.

3.2.1 Summary of project

Tamar has been using OpenLV data as part of its 'The Power in Your Hands' project to engage their community in energy issues and influence their energy behaviour. This has been done through educational after school 'Eco Clubs' in the local junior school, St Peters, to teach schoolchildren about energy concepts such as carbon emissions and energy efficiency, supported by graphs showing local substation data, which they've embedded into the Tamar Energy Community (TEC) website. Eco Clubs ran once a week over the course of a term for groups of 7-10 year olds.

Tamar has also been door knocking and doing home visits in the community to engage other residents in local energy issues and get people to use the OpenLV web app. They are on course to have knocked on all doors in the Greenlands area of Tavistock, served by the Meavy Way substation (approximately 130 homes) by mid-May 2019, while they will also be delivering a slow cooker course to local residents in June, helping them to take advantage of cheaper off-peak electricity or local renewable generation in the daytime.

Once they have completed this part of their community engagement, they will explore opportunities to develop alerts from the App which could notify users at the cheapest times to use electricity or when more renewable generation is going to the substation. This engagement sits alongside the group's energy advice work, and they want to use OpenLV data to model 'local time of use tariffs' which could provide cheaper or greener electricity to local residents.

The original outcomes for the project were:

1. To raise awareness of local energy issues and engage the community in their energy behaviour.
2. To determine the potential for a time of use tariff for residents.

Data from the OpenLV project community trials will be used in events and activities to raise awareness of local energy and to try to change the behaviour of residents around the times of their energy use. The data will be used to give a visual representation of demand at the substation and then send alerts to individuals in the community to identify the best times of day to switch on high electricity using appliances such as washing machines, tumble dryers and dishwashers.

A secondary objective for the project is to develop and test a local time of use energy tariff to understand whether by changing these behaviours under a time of use system there might be potential for residents to save money.

A key deliverable for the project will be getting individuals within the substation area signed up to receive alerts from the application. The focus of the evaluation plan will then be to understand whether and how much the engagement activities using OpenLV data have been successful in changing understanding or behaviours of these participants.

This will be done in two ways, first encouraging the use of attitude and behaviour tracker questions that have been developed for the trials during community engagement activities – and comparing results achieved at the beginning and at end of the trials. The second approach will be to hold a focus group with community participants in the trial hosted by Regen and CSE. The focus group will be used to understand or confirm the level of attitudinal or behaviour change.

If there has been a significant take-up of the alerts and evidence of behaviour change, the OpenLV data can then be analysed to see if there has been an impact on the substation operation. ***(Project monitoring sheet August 2018)***

3.2.2 Progress so far

Educational workshops

Tamar has delivered educational workshops in the school connected to the Meavy Way substation, St Peter's Junior School. These took the form of weekly after school Eco Clubs delivered to groups of 7-10 year olds over the course of a term (13 weeks) during the 2018/19 academic year.

The group used OpenLV data to start discussions around a range of energy issues such as carbon emissions, climate change, renewable energy, fuel poverty and energy efficiency. They found that once they had explained basic energy concepts to the schoolchildren, they took a keen interest in the data coming from the local substation and what it meant in terms of carbon emissions and renewable energy. The schoolchildren then took what they'd learned home to encourage their families to change their behaviour around energy use.

Community engagement

Following these school energy workshops, Tamar is now concentrating on engaging with the residents that live on the feeders they are monitoring in Tavistock. The availability of local substation data has helped Tamar to engage their community in energy issues by supplementing conversations about energy and helping residents to understand some of the more technical concepts and upcoming changes in the energy system which will transform consumers' electricity use.

They reported that having done the engagement work at the school, residents recognise the group and they've managed to develop a rapport easier. They plan to have knocked on all 130 doors in the area by mid-May, and will follow this up by running a slow cooker course for local residents in June, to use cheaper or greener electricity, working with the social housing association LiveWest and delivered with Learn Devon.

Once Tamar has gauged interest in the App and wider local energy issues from their community engagement activities, they will explore opportunities to develop mobile alerts and time of use tariff modelling as part of the TEC web and smartphone app they are developing.

These activities demonstrate the value of taking an educational approach to community engagement, beginning with schoolchildren, which also helped the group later in the project with recognition amongst the community. This should help Tamar in their project goals of changing the behaviour of residents around time of energy use, as whole families will better understand its significance in local energy issues.

Internal software developer

With the help of a software developer in their community, Tamar has been working on embedding graphs from the App into their website and have used the web App to create graphs and data in different formats, with support from CSE. Their software engineer is developing a TEC web and smartphone app, using OpenLV data to potentially enable local time of use tariffs to be modelled and allow users to set up energy alerts to their smartphone, notifying them of optimal times to use electricity based on price, carbon intensity, local generation or other factors. They experienced a setback in April, with the loss of busbar data they had been using, which was removed by CSE as it was duplicating data which was already in the App dropdown menu.

Updated outcomes

The original outcomes remain unchanged.

Updated evaluation plan

The original evaluation plan remains unchanged.

3.2.3 Understanding the App development

Tamar was involved in the App development process ran by CSE. In their feedback on the App development process, they said that they would ideally like the App to have been layered between collecting, marshalling, shaping and presenting the data. This would allow communities to modify the data presentation themselves, without having to make requests to CSE. They also wanted the option for data used for graphs in the App to be outputted as tables, which would make it more readily available for common desktop tools such as Excel or Google Sheets. Tamar has requested an estimate of solar output from the community's SolarEdge installation in the App.

3.2.4 Use of the App

The community uses the App several times a week, while their software engineer logs into the App every 30 minutes, to mine the data for the development of the TEC app. The OpenLV App has helped the community to better understand local energy challenges and concepts

such as local flexibility, as well as being used by residents and schoolchildren to start conversations about energy issues.

Figure 6 and Figure 7 show typical substation energy consumption over a day. These demand profiles differ to most residential areas, being flatter across the afternoon, as they are connected to the local school where Tamar is running Eco Clubs.

Figure 6: Energy use, 20 March 2019

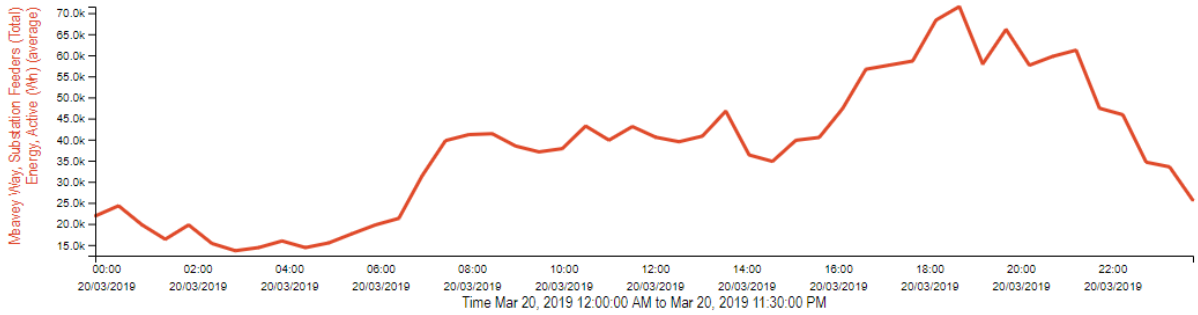
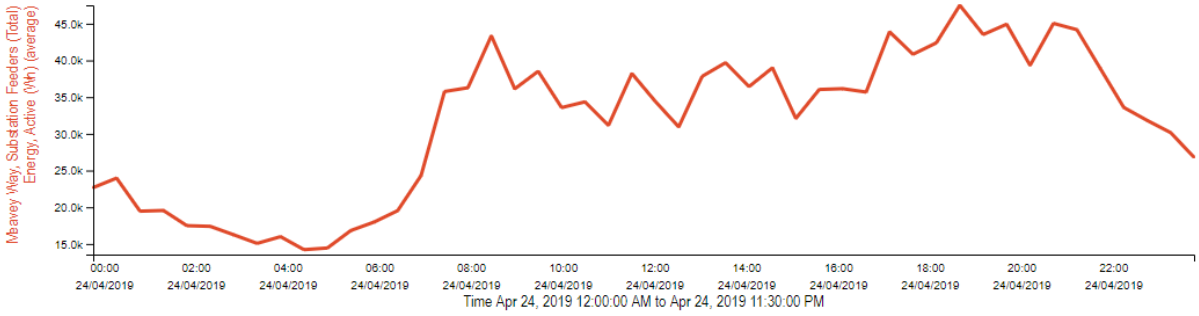


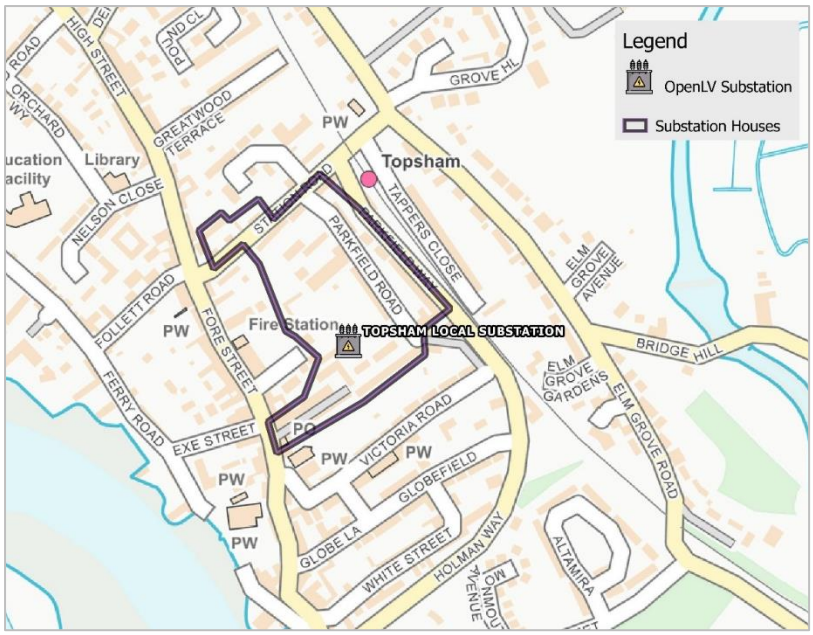
Figure 7: Energy use, 24 April 2019



3.2.5 Lessons for other projects

Tamar has noted that data needs to be made relevant to people's lives to get them engaged in their energy use. They have found engaging schoolchildren has helped, not only with their education on energy issues, but has also increased the group's recognition in the community, making conversations about energy more accessible and OpenLV data helps support these conversations.

3.3 Exeter mid-trial interview and evaluation



Exeter Community Energy (ECOE) is a community energy group started in 2014 by a group of eight local people, springing from Transition Exeter.

Their main projects have included community solar, with 300 kW installed on rooftops across Exeter, and Healthy Homes for Wellbeing, helping local people to lower their energy bills and alleviate fuel poverty. ECOE are also currently exploring developing a hydro project at Trews Weir on the River Exe, and Solar PV 3, the next stage of their solar project.

Figure 8: Exeter's OpenLV trial area in Topsham, Devon

3.3.1 Summary of project

The Exeter Community Energy project in Topsham has reduced significantly in the scope from the initial project and evaluation plan. As a result, there will be minimal deliverables from this project to be evaluated.

The project experienced issues with receiving the exact data for the street they had identified. This is partially due to the issue that substation feeders often do not cover discrete geographical areas. Although the issues were rectified from a technical perspective in early 2019, the project momentum within the community had been lost. Furthermore the 'in-kind' funding to develop a smartphone app for the project was not secured. Exeter need to now raise £8,000 for the smartphone application and this is not expected to be achieved within the project period.

The original outcomes for the project were:

Exeter Community Energy will be using the OpenLV data to develop a smartphone mobile application with around £10,000 in-kind funding. The mobile application will provide information to users about energy use at the local substation, as well as data on local generation and national grid carbon intensity. Once people have downloaded the app, the project are intending to provide alerts to users with the aim of changing behaviour of participants to use more local electricity, and to use electricity at times of the day with lower carbon intensity. ***(Project Monitoring Sheet, August 2018)***

Original evaluation plan

There will be a number of project deliverables that will be the focus of the evaluation. The first milestone will be the delivery of the smartphone app itself and then the number of users registered to the app, either from the area or specifically from the substation.

Stretch objectives for within the timescale of the project will be whether measuring the impact of the app on user behaviours or attitudes. It will be explored with the project team whether this can be measured by using a survey function in the mobile application, or whether the project would benefit from a focus group held by CSE and Regen to establish how attitudes may have changed in users. ***(Project Monitoring Sheet, August 2018)***

The original project plan involved:

- Delivery of the smartphone application
- Analysing the use and impact of smartphone application through the data from the application and users
- End of project focus groups with smartphone application users (supplemented if possible by pre- and post-trial interviews)
- Interviews with the project team about local control over energy.

3.3.2 Progress so far

The mid-trial interview conducted in March revealed that the project had experienced a number of issues that have resulted in significantly changed expectations and scope of this project.

The key issue for the project has been the problems faced in receiving the exact data for the street they had identified. Network maps suggested that the street the community group had identified was supplied from the substation at Topsham Local. Unfortunately, it was discovered after the OpenLV unit was installed that this substation did not in fact supply the identified street. To rectify this, an additional unit was then installed to monitor one feeder at a neighbouring substation at Parkfield Road. However, this feeder also had some issues, as the feeder also partially supplied a residential home which was felt to mask the domestic signals the community group were hoping to monitor.

From a technical perspective the issues with the monitoring had been rectified in early 2019. However, the delay and lack of straight-forward data for Exeter has meant that the project momentum within the community had been lost.

Furthermore the 'in-kind' funding to develop a smartphone app for the project was not secured. Exeter need to now raise £8,000 for the smartphone application and this is not expected to be done within the project period.

Learning:

Projects which involve community engagement and volunteers require momentum. To maintain this within OpenLV projects, it is important for groups to have access to data which is valuable to them and easy to understand from the beginning of a project. Technical issues and complexities with data, even if they are resolved quickly, can lead to disengagement.

Substation feeders not supplying 'discrete' areas

A key issue for Exeter has been the issue that substation feeder areas often not 'discrete' in that they supply one street, community or area. In the case of the Parkfield road feeder it supplies both a domestic street and partially a residential home. The community group felt that the residential home 'masks' a typical domestic signal that they'd hoped to monitor and use for their mobile phone application. As a result, Exeter do not currently intend to use the data.

Learning:

A key issue for community engagement in OpenLV and substation data is that communities and substation areas or feeders do not always correspond to a traditional geographical definition of communities.

If the technology and monitoring is rolled out more widely, potentially across all substations it would be possible for communities to monitor a group of substations in an area to understand usage across an entire community. This would more effectively match a community need as is being explored in Marshfield.

Funding issues

The second issue Exeter has faced has been in securing the 'in-kind' funding from the App developer Qbots. The developer has started the project by creating a prototype smartphone application presented in a slideshow, to illustrate the likely functionality and ideas. However, they are now unable to develop this further without funding. The developers have asked for £8,000 to finish the development of the smartphone application for the community group.

The project group do not expect to raise this money in the immediate term, and it is unlikely to be raised prior to the project conclusion.

Learning:

With many community energy activities being resourced by volunteers and the OpenLV trial being conducted on a non-contractual basis, changes in project scope and outcomes are to be expected. In this case these changes have been accommodated by project partners.

To reduce the risk of changes in project outcomes, organisations may be better placed securing funding prior to the project starting.

Activities

Exeter's key activity since the start of the project has been to work on the development of the smartphone application prototype with Qbots. The prototype modelled the type of information that could be presented and suggested some options for actions by the users such as switching times of use behaviour, switching energy suppliers or gamification between users. There was also functionality linking the information to the substation data, for example to alert uses to turn down demand when the substation was under stress.

A focus group was held with a small group of residents to show the prototype smartphone application, gather feedback on it and determine how much residents would be prepared to use the app to engage with their energy use. This was held at Regen offices in Exeter on 14 March 2019, attended by eight community members.

Feedback on the app prototype was positive. Comments included that the user interface should be improved to make the app easier to navigate, and that it will need to include sophisticated push notifications to engage people in energy behaviour.

The attendees wanted the app to show real time and personal data including how green their energy is, and those with solar PV would like to see what it was generating. Feedback also indicated that the competitive element of rewarding households for energy reduction was unhelpful and rewarding communities as a group would be more beneficial, moving towards eventually establishing substation energy saving clubs.

Exeter Community Energy are still exploring a parallel project which would collect household and building level energy usage data. Qbots have offered to provide controllers to gather data on an Exeter building that would allow the group to monitor and subsequently change their patterns of consumption. This would be the equivalent of a second-generation smart meter. The use and outcome of this monitoring is to be decided.

Updated evaluation plan:

The evaluation plan and anticipated outcomes from the project have been amended as a result of the significantly reduced scope of the project. Interviews will be conducted with the group at the end of the project to understand the issues with developing a smartphone application using OpenLV data.

Project outcomes:

The project will be exploring how OpenLV information can help facilitate more local and individual control over energy use by scoping the interest in, and potential for, a smartphone application.

They also intend to explore how OpenLV monitoring might facilitate community level demand side response, providing grid services to WPD.

3.3.3 App development

Exeter were peripherally involved in the App development process with CSE as they were expecting to develop their own smartphone application as part of the process with Qbots.

They were positive about CSE's support for and development of the App. They thought that the web-based App developed by CSE supports the projects in developing their outcomes and plans, but in its present form is not able or intended to engage wider community residents or people not involved in energy. They said that this would need to be a smartphone application, hence their project.

3.3.4 Use of the App

The community do not currently use the App due to the LV-CAP monitoring unrepresentative housing. Although this has been a disappointment, the idea behind the project was to use the OpenLV information as indicative for a larger community in Exeter rather than just for residents connected to the substation.

3.3.5 Learnings for other projects

Whilst being involved in the trial, the community group interest has moved away from a focus on individual action to delivering community demand side response. The group have found from community feedback that this needs to be automated (e.g. plug-in for every appliance). They believe that few people are going to engage with and respond to smartphone messages, regardless of how well-designed an application might be.

In order to do actual demand side response, they also noted that it was important to understand first how a house operates, and then what changes it is possible to make. Therefore, any application needs to be tailored to individual householders.

The group are also interested in how the substation data can be of use to WPD in the context of community action. They would like to better understand the parameters that WPD are most interested in e.g. substation temperature, and how local action can impact that. They want to know how many days per month WPD may need flexibility around the substation. Currently it seems that around 10% of substations need reinforcement, which is expected to increase over time.

3.4 Owen Square Project Summary

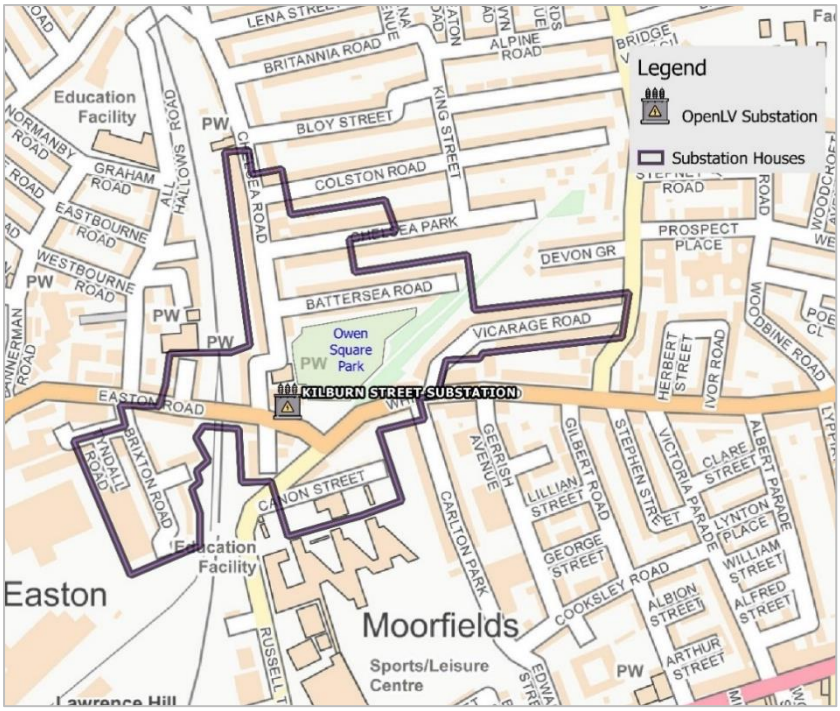


Figure 9: Owen Square's project in Easton, Bristol

Owen Square Community Energy

Owen Square Community Energy is a co-operative local energy supply company ran by Easton Community Centre, Easton Energy Group, an urban community energy group in Bristol, and microgrid developer Clean Energy Prospector.

Their mission is to supply low carbon heat and electricity to homes and businesses in the Easton area of Bristol, promote the uptake of low carbon energy and support energy efficiency amongst their customers.

They are based around Owen Square Park in Easton, a densely populated and relatively deprived urban area.

3.4.1 Summary of project

Owen Square has been using OpenLV data to run financial modelling and build a business case for their heat decarbonisation projects, which involve either retrofitting air source heat pumps with thermal storage in 34 homes in their community, or extending the local heat network in the area as part of their 'community microgrid' approach.

OpenLV data has supported three funding applications so far, including the Power to Change Next Generation Community Energy Fund, all of which have been unsuccessful. Owen Square has been progressing their project with the help of master's students from the University of Bath who have been analysing the OpenLV data, having overcome initial mobile signal issues at the substation which meant that data wasn't being received by the App.

Despite being unsuccessful so far in securing funding, Owen Square is planning to continue using the data to support applications beyond the end of the trial, with two more University of Bath students set to be recruited in late 2019.

The original outcomes for the project were:

The main outcome of OpenLV data will be in making a business case to install heat pumps and solar to the houses on the substations and securing funding for this. Data will be analysed by the project team to understand the operation and function of the local substation, to understand how much low-carbon generation the substation is currently able to support. This information will then be used to plan a local roll-out of community batteries and/or domestic heat and solar systems. ***(Project monitoring sheet August 2018)***

Original evaluation plan

The project in Owen Square will be evaluated through an evaluation interview with the project team at the close of the project. This will be held between Regen and the project team. The interview will focus on how the community was able to use the data provided by the unit to better understand their local energy needs and challenges, win funding or simulate and plan for future investment in low-carbon technologies. ***(Project monitoring sheet August 2018)***

3.4.2 Progress so far

Problems with mobile signal

Mobile signal issues meant that substation data wasn't being received by the OpenLV app, due to the aerial being sited inside the Kilburn Street substation. A high gain aerial was then installed externally at the substation by WPD, meaning the comms unit is now fully functional.

Learning:

Future trials may benefit from more thorough mobile signal tests, as Owen Square was believed to have good mobile signal during initial tests. Community engagement, education and awareness raising could also help to ensure that new equipment at substations is looked after by local residents.

Supporting funding bids

Owen Square has been using the OpenLV data as part of their applications to secure funding to develop a community heat network and household heat pump retrofits, with the data demonstrating how this could work financially and what effect increased electrified heat would have on the local substation.

They have so far used OpenLV data in three unsuccessful funding bids, which have included applications for the Power to Change Next Generation Community Fund and the Energy Redress Scheme. The community engagement part of the Owen Square project is dependent on securing funding as it relies on being able to go to local residents with a concrete offer for heat pump retrofit. OpenLV data would also be used in this part of the project to demonstrate the benefits of electrified heat and thermal storage for the substation and the household, through carbon and money savings.

Damon Rand, project lead at Owen Square, said that OpenLV data has been useful in all their recent funding applications, however in some cases the funder is looking for a specific type of project to fund which may not necessarily make use of OpenLV data. Furthermore, the Owen Square project itself involves the challenging decarbonisation of heat in Victorian homes, so naturally carries more risk for potential funders.

Support for analysis

Over the past four years, Owen Square has recruited ten master's students from the University of Bath to support the community's projects with data analysis as part of their research dissertations. Several students recently have been analysing OpenLV data to run financial models and help build a business case for Owen Square's decarbonised heat projects. They will also be recruiting at least two more students in late 2019 to continue working with this data to support further funding applications.

Updated outcomes

The project outcomes remain unchanged

Updated evaluation plan

The project evaluation plan remains unchanged

3.4.3 Understanding the App development

Due to the nature of their project where they do not have a community engagement process until later in the trial, Owen Square did not require any additional functionality during the App development process.

3.4.4 Use of the App

Owen Square has not yet started a community engagement process with the App. The group uses data from the App to support funding bids for community heat projects. The substation comms unit is now fully functional and data outages experienced earlier in the project should no longer be an issue. Figure 10 and Figure 11 show energy use by various feeders on the Kilburn Street substation, with different demand profiles as the area includes residential streets, several commercial buildings, a mosque and a community centre.

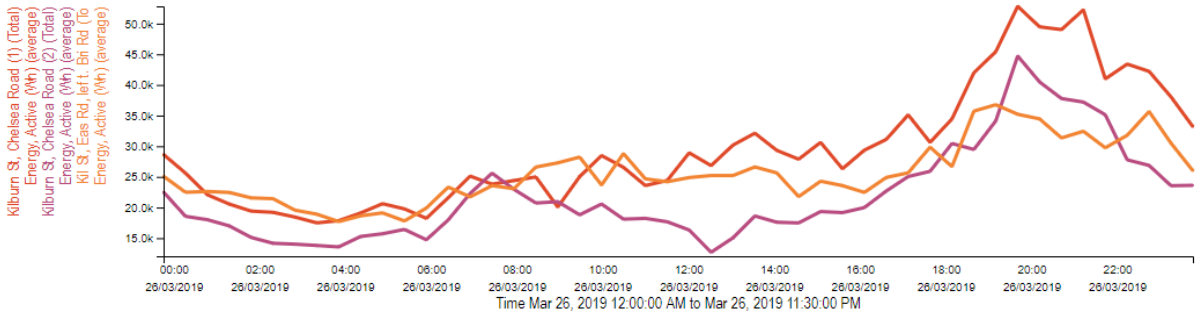


Figure 10: Energy use by feeder, 26 March 2019

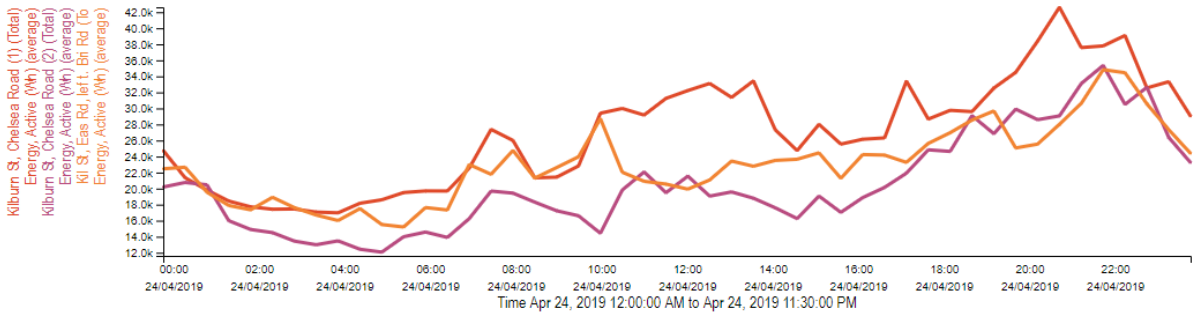


Figure 11: Energy use by feeder, 24 April 2019

3.5 Marshfield Project Summary

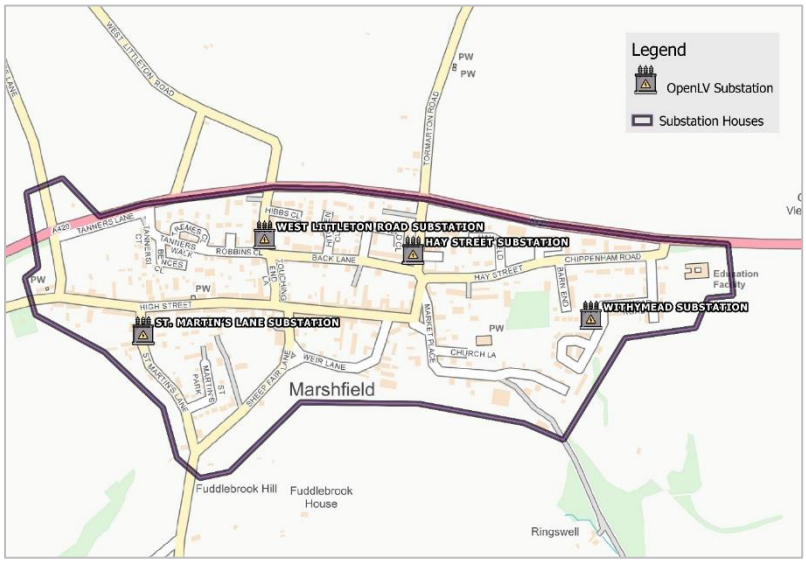


Figure 12: The OpenLV trial area covering the village of Marshfield

MARSHFIELD ENERGY GROUP

Marshfield Energy Group is volunteer-led, with support from the Community Land Trust.

The local community has been active in installing renewable generation with the local primary school installing a 12 kW wind turbine and there are 30 domestic PV installations in the village ranging between 3-4 kW each.

The community group has undertaken research in the past looking at installing further renewable generation in the village. Exploring the potential for a solar farm, wind, and anaerobic digester.

3.5.1 Summary of project

Marshfield has been progressing with their project and working to understand the information being provided by the OpenLV App. Most of the original outcomes are in progress, including developing a better understanding of the outages and pressures on the energy network in the village. However, plans for showing the information to residents is not progressing beyond the development of a network map for the village, as they have been unable to find a compelling narrative that would make the information engaging for the community.

The original outcomes for the project were:

A key objective for the Marshfield project will be to use the data to understand the level of outages currently experienced in the village. The data produced by the unit will be correlated to the health of the substations being monitored and the level of low-carbon technologies installed in the village. By the end of the trial period they hope to reach a good understanding of the drivers of any outages and have discussed this outcome with WPD.

A further objective for Marshfield is to use the data to provide an evidence base for the development of a village-wide energy strategy. With the area currently network constrained, they are currently unable to connect significant further generation within the village. Their strategy would look to use flexibility to increase capacity for additional renewable energy installations, this might include time of use tariffs, EV rollout and potential storage solutions. ***(Project Monitoring Sheet, August 2018)***

There was a further intention to scope whether it would be possible to use the information from the OpenLV App to help householders to see energy demand across the village, alongside data about grid carbon intensity and local generation.

Original evaluation plan

The original evaluation plan stated that: *the two key objectives for Marshfield will be evaluated through an evaluation interview at the close of the project. This will be held between Regen and the project team in Marshfield. This interview will focus on whether they and WPD were able to better understand outages and how the community was able to use the data to better understand their local energy needs and challenges.* ***(Project Monitoring Sheet, August 2018)***

3.5.2 Progress so far

Innovation and learning

Marshfield's Energy Working Group has been heavily involved in the App development and understanding the information that is being collected by the OpenLV unit. The information has been valuable to the project team members.

The project covers a residential village of around 850 households, and the group has learnt a lot about local energy challenges and the future value of electricity network system stability. Balancing the network at this local level deals with increasing local generation, electric vehicles, cooking and electric heat.

They will be using this information to help the community plan further renewable energy investments such as a PV field with battery storage and the potential for an AD unit outside of the village.

Data issues

Marshfield experienced some issues with the source data such as in the St. Martins substation, where they had missed data as the unit had lost power for a period and required a manual reset. To resolve this, EA Technology and WPD are now intending to replace the socket powering monitoring equipment.

As they are monitoring outages and the reasons behind this, non-continuous data is a problem as they cannot identify whether the dropped data is as a result of actual outages or data issues.

As part of the project, Marshfield have initiated a dialogue with WPD about the level of outages in the village. This has led to WPD bringing forward their plans for tree clearing around electricity lines in the village. Marshfield report that this has appeared to reduce the frequency of outages.

Lack of compelling story

Marshfield has not found a compelling story to present the App data to the village. They report that the information will be of little interest for the average user. The intention now is to provide some information about the data to the wider village but not to make this a focus of the project. Marshfield has used a volunteer with software experience to produce a village map that allows people to look at their substation in detail and understand what the feeder is doing.

However, they believe that to get a behaviour response from residents they would need to provide residents with a stronger driver for behaviour change. As a relatively wealthy

community, saving money from reducing usage would not be a sufficient driver as it is elsewhere.

They are exploring what angle could work to engage local people which might involve:

1. Information about reaching some sort of defined substation limit. The project team would like to understand more about what this might be.
2. Strong time of use tariffs. Though noted that this signal may be independent of the substation status. The project team would like to understand more about the potential for time of use tariffs, when they are likely to be developed and in what format they would take.

Updated outcomes

The project is continuing broadly with its stated objectives.

Updated evaluation plan

The evaluation plan is also unchanged.

3.5.3 Understanding the App development

Initially Marshfield was not involved in the App development process ran by CSE, as they had only just formed as a group when the first workshop was held. They had initially planned to use the data to inform a village-wide energy strategy, rather than focusing on community engagement and behaviour change.

Subsequently Marshfield decided what its project wanted to get out of the App once they started to see what data was available and how it could be presented. They reported that shaping the visualisation of the data is a key part of the process of understanding what data is being collected rather than something that can be determined beforehand. They recognized that this does have an impact on software development budgets.

Learning:

Agile software development is ideal for public engagement software. Some communities will find it difficult to determine up front what data they would find most useful. Despite some information, communities did not fully understand exactly what data would be available to them. When recruiting and engaging communities in projects of this nature, plain English, accessible explanations of complex data processes is helpful.

3.5.4 Use of the App

Marshfield is using the App regularly and have constructed a display for each substation for current and temperature. They are looking particularly at active energy, and the temperature comparison. During the summer they will be looking to understand whether the feeders with a high level of PV will have an impact on these factors.

Marshfield reported that CSE had been responsive and they had worked a lot with the CSE development team, who had updated the App as per their requests.

Figure 13 and Figure 14 show energy use on the West Littleton substation, showing a fairly typical demand profile for a residential area.

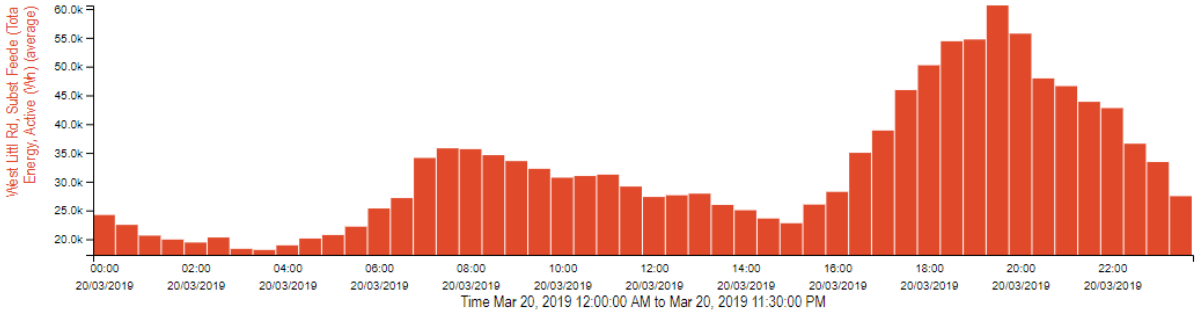


Figure 13: Energy use, 20 March 2019

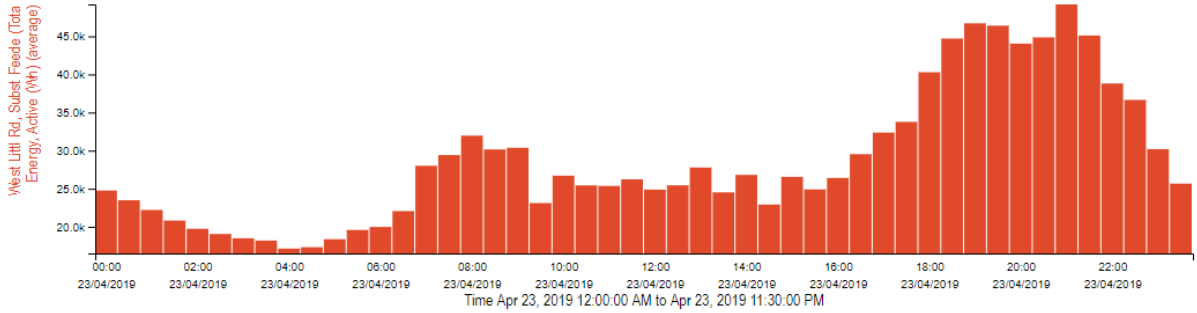


Figure 14: Energy use, 23 April 2019

3.5.5 Lessons for other projects

The group said that it is important for communities to be clear about what messages you could get out of the App and its data that might encourage people to change behaviour. To do this, it is important to understand the drivers for the local community, which could relate to climate change or saving money. For Marshfield a key issue was outages, as it is central to how the electricity network impacts lives in the village.

3.6 WHG

Walsall Housing Group (WHG) is a West Midlands Housing Association who own and manage 21,000 homes.

They are committed to providing affordable, good quality homes and community-based services to the local community.

As part of their local community offerings, WHG have an Energy Champions initiative who offer residents free, personal support for customers struggling to keep their homes warm or to pay their energy bills.

Figure 15: WHG's project focuses on Little London House in Walsall

3.6.1 Project Summary

The WHG project was intended to monitor the usage of a housing association tower block around the installation of new electric storage heating. The project manager had been difficult to contact and in early 2019 it was confirmed that he had left the housing association. Attempts to contact peers and seniors have been unsuccessful.

As a result, this project will not progress and no further evaluation will take place.

Learning:

There is a risk of non-delivery and drop-out when trials are non-contractual. Network innovation trials are complex projects and if no contract is signed or funding is allocated, other responsibilities will often take priority. In this case, organisational restructuring lost the resource allocated to the project, so it was dropped without consequence to WHG.

Original outcomes for the project were:

Data from the OpenLV project community trials will be used to raise awareness of energy usage around WHG properties in Walsall and demonstrate how residents could save money on bills by shifting demand at peak times.

Data will also be used to plan for energy saving improvements to WHG properties, including the installation of new night storage heaters. ***(Project monitoring sheet, August 2018)***

Original evaluation plan

The evaluation aim was to work with the OpenLV data and correlate this with the dates of the installation of the new storage heaters and engagement events around time of use tariffs. This was to help understand if the project was able to have an impact on the peak demand or when electricity was being used in the block. There was also the intention to conduct a focus group with engaged residents at the end of the project.

3.6.2 Progress so far

It was understood that the new storage heaters had been installed during the winter but there was no information provided about exactly when this happened or what engagement took place around this.

The OpenLV data also showed that there was a significant overnight peak for electricity demand on the sub-station which would correlate to using electric storage heaters in Economy 7 periods. Figure 16 shows a significant after midnight peak. As a result, it is unlikely that there would have been further significant shifts that could have been measured.

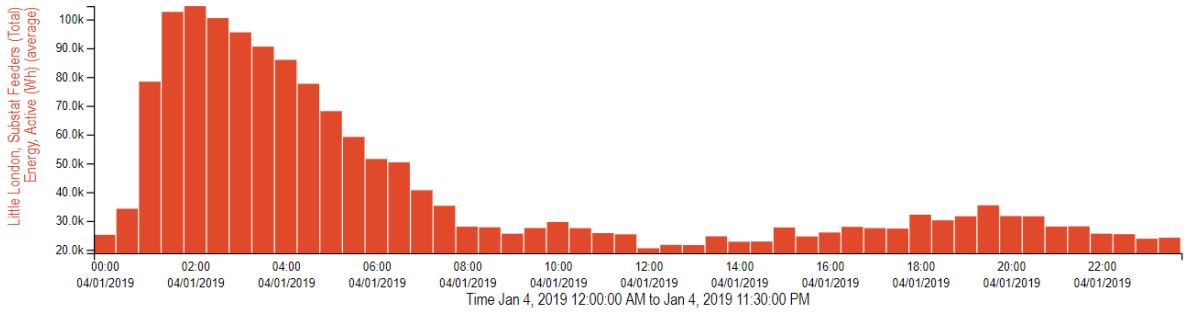


Figure 16: Energy use, 4 January 2019

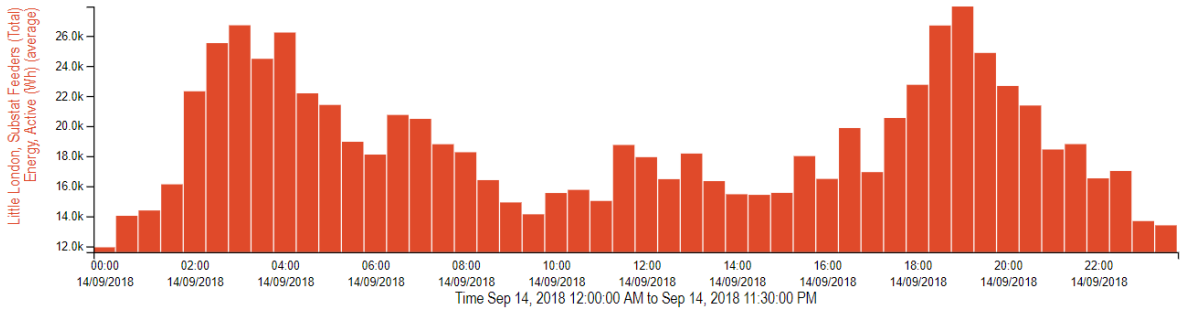
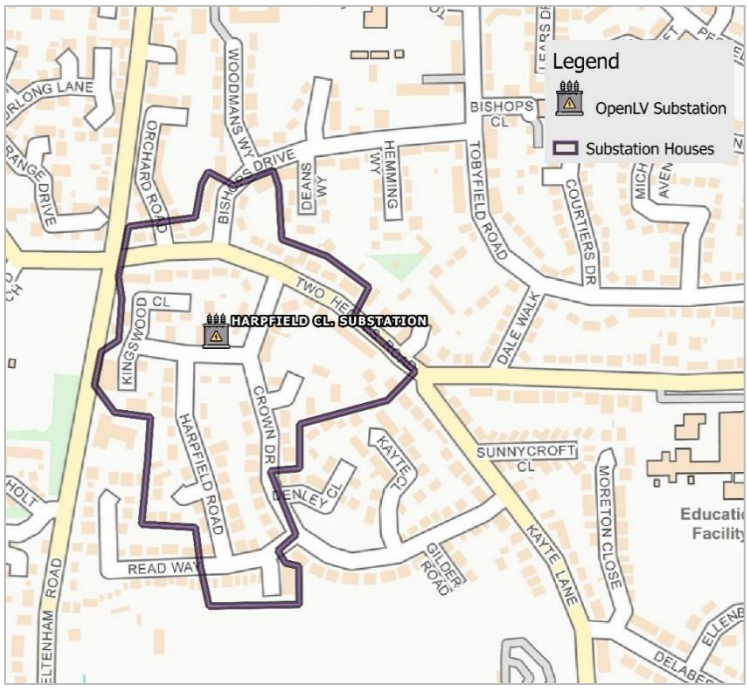


Figure 17: Energy use, 14 September 2018

3.7 Rooftop Housing



Rooftop Housing Group is a charitable housing association which focuses on provision of affordable housing for all household types and needs. Rooftop manage 6,000 properties and their main area of operation is in Worcestershire and Gloucestershire.

As a not-for-profit organisation, Rooftop reinvest surpluses back into the local community by building new homes, improving existing homes and supporting community initiatives.

Figure 18: Rooftop's trial area in Bishops Cleeve, Gloucestershire

3.7.1 Project Summary

Rooftop had originally hoped to engage their residents in energy use and carbon emissions whilst using the OpenLV data. However, engagement was delayed from autumn 2018 due to a change of project manager at Rooftop in early 2019. The continuation and approach to the project is still to be confirmed by the new project manager.

Original outcomes for the project were:

Within the Rooftop housing project, data from the OpenLV project community trials will be used to develop a web-based application to give residents in the trial area access to their community's real-time electricity demand. The project hopes to raise awareness of energy use and change behaviour of the residents.

As a secondary objective they hope the data will provide the housing association with data on which to base future decisions about projects to improve the housing stock.

Original evaluation plan

Key deliverables:

Engagement events for the local community will be the key deliverables for this project. Event details and numbers engaged are to be logged on Survey Monkey to track progress through the trial. The OpenLV community application will also automatically measure the numbers of people in the community accessing the data online.

Tracking behaviour change or changed understanding:

The focus of the evaluation plan will be to understand whether and how much the engagement activities using OpenLV data have been successful in changing understanding or

behaviours of participants. This will be done in two ways, first encouraging the use of attitude and behaviour tracker questions that have been developed for the trials during community engagement activities – and comparing results achieved at the beginning and at end of the trials. The second approach will be to hold a focus group with community participants in the trial hosted by Regen and CSE. The focus group will be used to understand or confirm the level of attitudinal change. ***(Project monitoring sheet, August 2018)***

3.7.2 Progress so far

A community consultation event about OpenLV was held on 19 July 2018 by the project manager and a local neighbourhood officer, conducting door knocking, leafleting and advertising the event, which was held at the local pub. They engaged around 30 householders with door knocking but the event itself was poorly attended with six attendees.

The decision was made after the event to delay further consultation until the data became available from the substation, which was in January 2019, by which time Rootfop's original project manager was on maternity leave.

Learning:
The engagement event was held during the day, when many people were working, so attendance was low. Evening events for community engagement may be more suitable as community members can fit these activities around work schedules.

The new project manager noted at the mid-trial interview that Rooftop was keen to keep working on the energy needs of their residents. He reported that the focus of fuel poverty and helping residents pay their energy bills might be a more suitable approach. He noted that many Rooftop households needed to understand some of the basics about energy such as using a thermostat efficiently and using less energy, saying that the OpenLV data could provide some useful background and context to those messages.

The project manager had accessed the App and created several graphs but was not planning to use the App to engage residents.

Smart meter trial

Rooftop is separately looking to run a project with British Gas on installing Hive smart meters in 15 homes. Their new project manager is planning to explore whether Bishops Cleeve could take part in this. The housing in the Bishops Cleeve project are all of the same or similar construction and therefore these meters might allow comparisons to be made across the households.

App information

The information collected by the substation shows that Bishops Cleeve has a relatively standard residential energy use with a substantial evening peak.

There is also evidence of a low level of electric heating with an increase in electricity demand being seen consistently after 2 am.

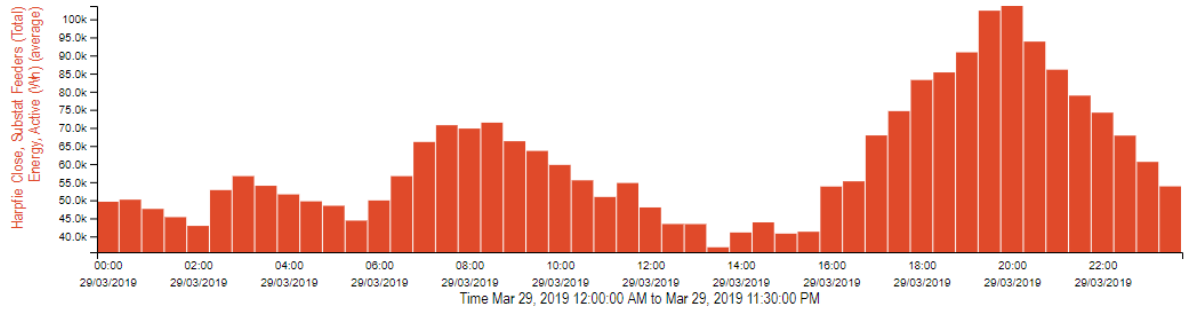


Figure 19: 29 March 2019