Scaling on Street Charging Infrastructure

D3.3 Report on design of 2nd cohort pilot sites.

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Introduction

This report only reports on the work of the SOSCI Partners who are working on the West of the Pennines. No installations have yet been delivered EoP.

Accepting that there is to be no one-size fits all approach to chargepoint installation, each site is now considered on its specific merits with the design adapted accordingly. However, there are some consistent challenges - groundworks, timescale, connectivity - which will inform our approach in the future.

As reported previously, integration with solar arrays and installation of battery storage is far from straightforward, but we now have a far better idea of the technical challenges and requirements. However, as is discussed in this report, we are now at the stage where the current battery storage solutions are not feasible with our cost-technical limitations.

With the high installation costs of chargepoints, the economic model is an ongoing cause for concern and is holding back infrastructure investment, particularly amongst smaller operators. Therefore, the potential for alternative uses is essential - the case for providing a neutral host location for 5G services is explored in detail in this report and will be explored further.

Completed Activity

2nd Phase EV chargepoint sites

Kendal College: This is the next installation and is due to be started on 10.08.20. This site has been fast-tracked due to the college being closed for summer/COVID-19 and we are connecting to the existing college electrical supply which has reasonable spare capacity. We hope to be able to complete the installation prior to college returning to normal. This also means we are not subject to ENWL's lead time to provide a new supply. We have found a vast difference in groundworks costs so are now conducting our own mini procurement process with different ground workers to help keep costs down. It also helps to avoid keeping 'all eggs in one basket'. This site includes expanded distribution equipment and ducting in the ground for potential additional EV chargepoints in the future.

Dalston, Carlisle is the next in line for installation. It has a new ENWL supply and has been paid for by Charge My Street and removed from the batch of Carlisle City Council sites as Dalston had initially and independently made enquiries for an EV charge point. The EV chargepoints will be located on the village car park. As part of the installation plan, lighting has been included as there is no immediate lighting in the EV charge point area. The initial quote received for ground works was extremely high and because the route from the new power supply point to the feeder pillar involved crossing over high-voltage cables, a quote was requested from ENWL for the groundworks, which was surprisingly much more competitive and has been accepted. A local contractor who is known to Carlisle CC is carrying out the other ground works.

Additional Use Cases

Anti-ICEing measures

Figure 1 – Chargepoint at Lancaster Boys and Girls Club with anti-ICEin measures

Lancaster Boys & Girls club: This installation has now been completed. The camera records live with the intention to ultimately provide a live feed into the Miralis - Charge My Street app. A user wanting to book a charge session will be able to use the app to see if the bays are free. Inlaid pressure sensitive pads in the parking bays are triggered by a vehicle's arrival and if a charge session is not initiated, then an alert is sent to the host and Charge My Street to investigate.

Solar and battery integration

A survey has been conducted by GlowSolar to assess the viability of an integrated energy supply with PV array and battery for the recent chargepoint installation at West Point House.

West Point House currently exports around 60% (~8000kWhs) of what is generated in electricity from solar a year and the rest is used to run the property. The vast majority of the 60% excess takes place in the summer months when their load is generally lower.

Three system solutions were provided, however none are currently deemed economically viable.

1. 3 x single phase AC connected battery systems on each phase.
2. Replace the inverters onsite with a 3 phase 10kW hybrid and a 3 phase 6kW hybrid
3. 30kW Giv energy 3 phase PCS with 64kWh of storage

Option one would generate a low total output of around 9kW (3kW per phase) and 30kWh of battery storage from that at a cost of around £20,000 which is higher than is budgeted for per site.

Option two is not recommended as it would cause problems with returns from the feed in tariff as the DC storage would cause losses in the storage process before it went through the FIT meter.

Option three is the best option as it is a dedicated 3 phase AC connected system which would offer all the power the charger would need, however the cost is around £50,000.

Generally, lithium systems are warrantied for 10 years but you could expect to get 15 from the batteries depending on how they are charged and discharged over time. It is unlikely that the cost of the battery will be made back over its lifetime, and it will not significantly affect electricity bills at West Point House due to the highest bills being in winter when the least amount of solar energy is generated and stored.

These options must now be considered taking into account the available energy tariffs. Charge My Street is currently in discussions with Octopus Energy about their Agile tariff which would provide West Point House with cheaper rates for charging the battery outside of peak times, allowing them to make a profit on any energy used the following day.

5G Chargepoint

The project intends to integrate 5G into chargepoints in different stages.

Initially this involves providing the passive infrastructure for 5G operators to deliver a service in the area around a chargepoint. As the costs, power requirements and size of equipment reduces over the next 12 months, it may be possible to integrate an active 5G service with a chargepoint.

The project has been working with existing members of the consortium plus: Quickline Communications, Telet Research, Lancaster City Council and Community Broadband Network. This encompasses a model for a commercial and technical solution. One of the unforeseen consequences of COVID-19 has been the proliferation of conspiracy theories relating to the 5G and its health impacts. There is concern that combining chargepoint installations with 5G will slow down progress on sites as Parish Councils and community organisations, which tend to follow consensus decision making. Decision makers may get confused and decide to defer or not to progress with the EV installation. This has a major implication if surveys and quotes have been obtained for the works.

5G Infrastructure

The three key assets that are useful to operators wishing to deploy their own 5G networks:

- Lamp posts (and other radio co-location sites) connected to dark fibre and power;
- Dark fibre linking the radio sites with exchange points;
- Carrier-neutral exchange points from where they can backhaul.

All these ‘passive’ assets are then brought together for 5G operators to deliver a service.

5G will use frequencies that can carry much more data (>1Gbs) but travel shorter distances so operators will deploy networks with antennas every 200m. These dense networks will be costly and challenging to build, but EV chargepoints have 2 of the key ingredients - power and connectivity.

5G will open the door to a range of “challenger operators” which will be able to offer 5G services as well the big Mobile Network Operators (MNOs). To find 5G sites MNOs work through intermediary organisations to find sites and then plan the network deployment against a complex set of commercial and technical criteria. In Lancaster, the City Council is aiming to make sites available through a cooperative neutral host, so that investing network operators can deal with a single body. Blackpool is able to offer a similar combination of assets in some areas but does not have ownership of its lamp posts apart from on the promenade. They are looking at an aggregator post that will offer EV charging points, 4G, 5G, Wi-Fi and lighting.

This offers potential for chargepoint providers to leverage their network to also offer a service to 5G operators. A "neutral host" model provides access to all of the participating 5G operators, reducing the need for them all to build infrastructure.

By sharing access to passive infrastructure - specifically dark fibre and exchange points - investing network operators can save costs on 5G network deployment.

5G technology offers far greater flexibility than 4G in the ability to set up services to meet specific needs, and the allocation of resources to those services. This creates the potential to extend the neutral host principle to the 'active' radio infrastructure as well.

A pilot conducted on behalf of DCMS has demonstrated:

- Two independent network 'instances' deployed on one set of small cell radio equipment;
- Handsets equipped with different SIM cards able to access services deployed on one network and not on the other;
- Successful hand-off between cells for both networks.

The neutral host concept can therefore be applied at two layers in 5G deployment:

- Passive: where operators are sharing access to co-location space for radio equipment, dark fibre connecting that equipment, and active equipment co-location in exchange points.
- Active or RF: where operators are sharing radio equipment as well as the passive infrastructure supporting that equipment.

Benefits of neutral host

Different forms of neutral hosting have different benefits and applicability depending on the use case:

- Passive neutral hosting offers the maximum scope for operators to differentiate their offer in the market with full control over the network stack. Thus, they are able to deploy the radio equipment of their choice, with all the implications that this has for operational efficiency. For this reason it fits more easily with the business model that MNOs are used to.
- Private, niche and vertical sector operators however are more interested in achieving good coverage than competitive differentiation. They are also budget constrained, so that any savings that can be achieved through neutral host sharing are useful. For this reason they may find active neutral hosting more valuable.
- While the passive assets are shared, passive neutral hosting nevertheless requires each MNO to deploy radio equipment, connect it with fibre and install its own routing and switching equipment at exchange points.
- The cost of rural deployments is high largely because of the investment required in radio equipment and fibre to serve a small number of users, so that passive neutral hosting has small impact, whereas active neutral hosting achieves maximum savings.
- The cost of dense urban small-cell deployments is high because of the spatial density of radio equipment and the high fibre count needed to service it. Here too passive neutral hosting has small impact, whereas active neutral hosting achieves maximum savings.

Thus the cost benefits of active neutral hosting (which implies passive neutral hosting at the same time) are greatest in rural and dense urban environments, and it is the niche and vertical sectors that are likely to be ready to use it.

There is however support from central government for the use of the neutral host model to accelerate or facilitate 5G deployment. This is in recognition of the high cost of rural deployment but also urban small-cell deployment:

> *"...the UK would continue to benefit from network competition between multiple national operators. National networks would be supplemented by 'neutral host' infrastructure and private networks to, for example, deliver small cell deployments in urban areas and inbuildings, or to expand rural coverage beyond that delivered by the MNOs, or to serve new micro-markets such as industry 'verticals'."*[1]

Leadership by central government may make it possible for local authorities to adopt neutral host radio equipment that will be more widely accepted. Rural Gigabit voucher schemes will cover costs of connections to buildings of fibre broadband up to £7K for a business. Combining with groundworks for EV charging infrastructure and power upgrades could reduce overall costs. The challenges of co-ordinating power and communications providers can be significant.

A passive solution

The project will provide a passive solution such as this one below to the lamp stand in Dalston which will be installed as part of the project. This "top hat" design will slot onto the top of the lamppost and enable 5G operators to install their equipment on it. The aerials on the photo are part of the active solution (see below)

Figure 2 - lamppost with active equipment attached

[1] Future Telecoms Infrastructure Review, 2018
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/732496/Future_Telecoms_Infrastructure_Review.pdf

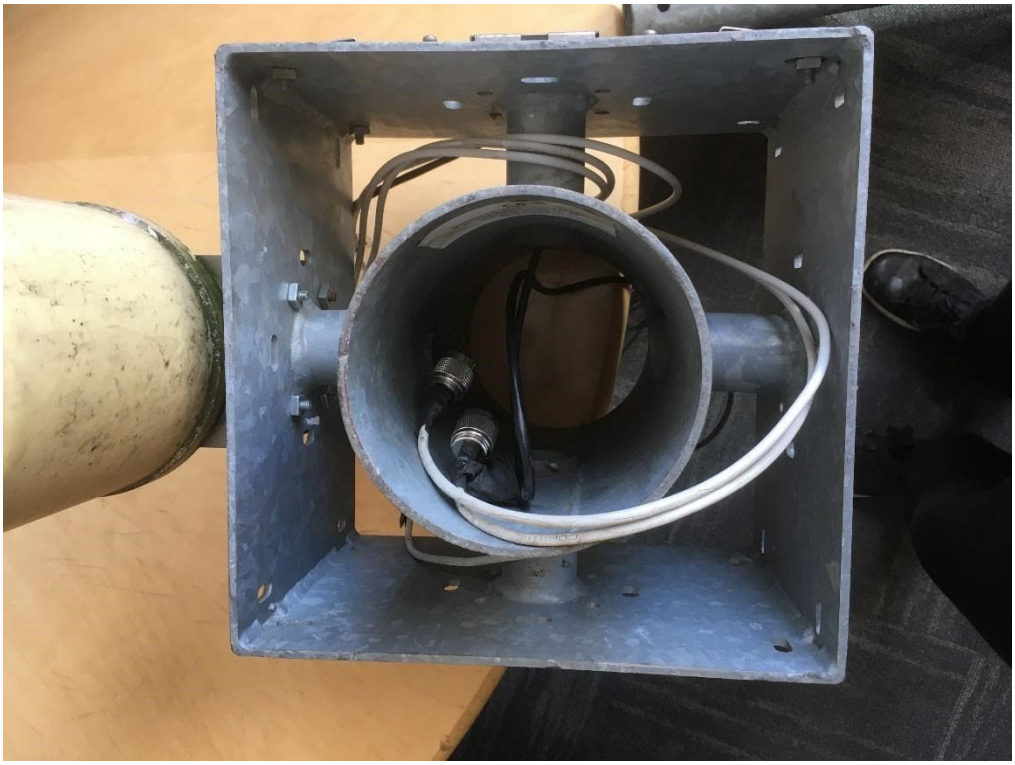

Figure 3 - The Top Hat stand view from above

Figure 4 - Lamppost with stand attached

Active Solution

In the next stage, an operator will deploy 5G equipment on the lamppost. This is more challenging as it requires a 330Mbs fibre internet connection, router and site - costing approximately £10K. The expected deployment will be two MIMO antennas with a power budget of 50-100W. The software

defined radios can operate on any frequency sub 6Ghz so can use whatever spectrum is made available in the area (by OFCOM and MNOs) to deliver 4G and 5G services.

Charge Point in a Box

As one of its outputs, the project is developing a 'Charge Point in a Box' how-to guide for communities and local authorities wishing to install EV charge points.

We have been tracking the activities of the first three quarters and are now starting the development of a story board which will inform the SOSCI partners of the plan will be presented by Cybermoor for feedback in four phases, with a draft version submitted to Innovate as part of the Q4 reports.

The guide will have two starting points – Community and Local Authority – and will merge at the implementation activities. It will include videos of the installation process and the additional steps to deliver a project which arise from the lessons learned on the SOSCI project.

Lessons Learned

Figure 6 – Chargepoint at Langdale Leisure

CP Install, Langdale Leisure – Connectivity Issues.

Installation went smoothly until it came to the IT set up, where we encountered difficulties in proving why the connectivity failed or dropped out, hampered by the absence of any mobile signal. With an initial bridge Wi-Fi connection, the CP appeared on the EO dashboard, but soon went offline which entailed checking the internet connection on a laptop, re-booting EO Hub, and changing chargers/EO Hub, a process repeated several times with checking of IP addresses, firewalls etc. with no success. Subsequently a hard-wired internet solution was fitted giving a physical connection, rather than a mapped one, to the same switch, and the commissioning process restarted. Charge my

Street and Bay Camera & Communications are working with EO to find a smoother commissioning arrangement.

5G Use Case

The complex web of stakeholders to coordinate to deploy a solution is challenging, particularly as the technology in itself is at a relatively early stage. When combined with the complexities of installing a standard EV chargepoint in a community setting, this provides a further complication.

The technical aspects and commercial models of 5G are more complex than EV charging. When dealing with lay people who control community buildings, it is best not to over complicate matters at an early stage and instead work when a level of trust has been developed.

Conclusions/Next Steps

For battery integration at West Point House, we must now discuss with the building owner the possibility of installing a smaller, modular (and therefore scaleable) system to give some real-world results. Given current battery technology and cost constraints a fully offgrid EV solution does not currently look practical.

For 5G, it has been important to understand the commercial models and drivers in the market so chargepoint providers can position their products and services to take advantage of the opportunities which will come forward in the next 2 years. This could include feeder pillars which can host routers, but also how we can work with teams delivering aggregator poles for City Councils. The project is working with councils and operators to identify potential 5G sites that could also be useful for EV charging points.

Develop the installation programme EoP and update this report for Q4 with the lessons learned etc.