From planning to deployment – insights into installing publicly-accessible journey EV charging infrastructure

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Abstract

Deploying publicly accessible electric vehicle charging infrastructure involves engaging with multiple stakeholders from various organisations to ensure successful project delivery. When installing a fleet of charging points across a wide area, the number of stakeholders increases often resulting in a disjointed or non-standardised experience for EV infrastructure developers. Based on real-world learnings, this paper suggests several improvements that could be implemented by distribution network operators that would help streamline infrastructure deployment and help accelerate the uptake of zero-carbon transport solutions.

1. Introduction

Planning the installation of publicly accessible electric vehicle (EV) charging infrastructure can be a challenging process due to the number of stakeholders involved. A typical deployment of a rapid (≥50 kW) EV charging point would likely involve:

- several departments in local authorities (including roads, planning, parking, procurement and finance),
- a regional transport partnership,
- a funding body,
- equipment suppliers and installers,
- a distribution network operator (DNO),
- an electricity supplier,
- land-owner(s),
- legal teams for land and wayleave negotiations,
- a metering company, and,
- a charge point operator (CPO).

When deploying a fleet of charging points across a wider geographic area, the number of relevant stakeholders will likely be increased due to the different geographic boundaries that agencies work across. This paper will outline some lessons learned relating to the deployment of a fleet of rapid charging points installed across several rural local authorities in Western Scotland. Recommendations will be made to help improve coordination between the connecting customer (connectee) and the DNO based on the experience of the authoring team.

2. Background

The FASTER (Facilitating a Sustainable Transition to EVs in the Region) project [1] is a €6.4 million European Union INTERREG VA co-funded project led by East Border Region Ltd in partnership with the PNDC at the University of Strathclyde and HITRANS (Highlands and Islands Transport Partnership). The project aims to deliver 73 new publicly accessible rapid charging points across Western Scotland and the border region between Northern- and the Republic of-Ireland. In Scotland, the project will deploy 24 charge points across three rural local authorities. Figure 1 outlines the Scottish FASTER region alongside the locations of existing rapid charging infrastructure in the country. These existing charge points are all operated by the national CPO, ChargePlace Scotland (CPS).

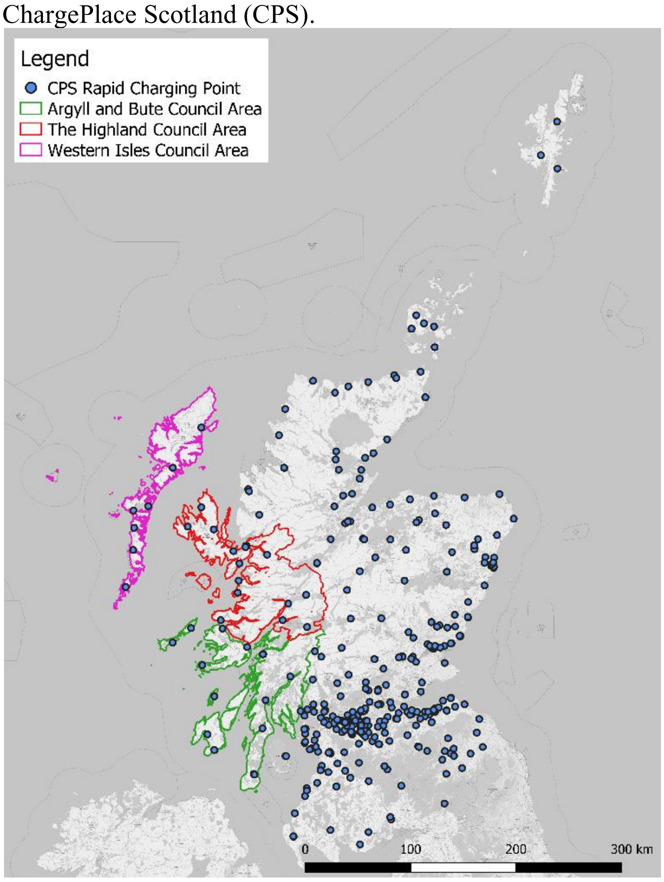

Figure 1: Scottish FASTER region and existing rapid/journey EV charging provision in the country

The team at PNDC developed a site identification process for the project which generated a ranked-order list of candidate sites for new infrastructure based on: geospatial coverage, forecast user demand and existing charging point utilisation. Power capacity analysis studies were conducted by the team to determine whether there was adequate grid capacity for the proposed equipment at potential locations to help de-risk sites before applying for formal DNO connection quotes. Connection applications were then submitted to the DNO for promising sites. The cost associated with establishing a suitable DNO connection for EV charging is often the biggest budgetary uncertainty for charging point developers as outlined in Figure 2. Once DNO connection applications were received, the total project portfolio budget could then be estimated ahead of formal EV charging point hardware and installation procurement activities.

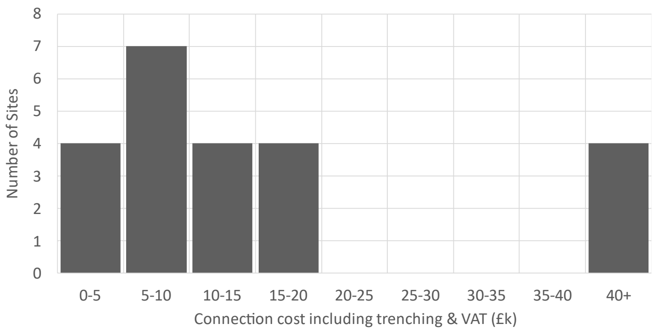

Figure 2: Distribution of DNO connection costs for 50 kVA three-phase connections at 22 sites

Further details on the project and the developments made to date are available through [2] and [3]. Note that this paper will use the term "rapid" EV charge points and "journey" charge points interchangeably.

3. Experience

The learnings outlined in this paper will predominantly focus on the grid connection element of journey EV charging point installation. Four main areas will be discussed in the subsequent subsections and are as follows:

- Time-scale coordination and quotation process
- Reserve site planning
- Post acceptance changes
- DNO connection teams

3.1. Time-scale coordination and quotation process

The coordination of the distribution network connections for 24 charging point applications was a challenging element of the project. The DNO aimed to provide a quotation within 90 days of application submission. Upon quote acceptance and payment, a local connection planner would make contact with the FASTER team to confirm delivery timescales for the site. An estimated connection date was provided at this point in the process. Note that the connectee, once securing an MPAN (Meter Point Administration Number) number from the DNO, is also required to liaise with the appointed supplier to organise the installation of the energy meter for the site. Meter installation has been noted in other projects, particularly for rural connections, as a challenging element to coordinate. Meters must be installed to allow charge points to be commissioned and onboarded into the CPO's backend systems. Charge points cannot be used by the public until these tasks have been completed. It is worth highlighting the negative public perception created by charge points being installed but remaining out-of-service for serval weeks, or months, after installation due to the absence of an energy meter preventing commissioning activities to be completed. Coordination of meter installation must be deemed a critical element in project planning.

During the project, a total of 47 formal quotations were requested. This number contains a mixture of initial quotations, revalidations and the provision of backup sites. Note that several sites did not require new grid connections to be established as the reuse or uprating of existing supplies was possible. The timescales required to process quotations for similar connections varied between each application, as presented in Figure 3, with an average turnaround time of 35 days, minimum time of 3 days and maximum time of 90 days.

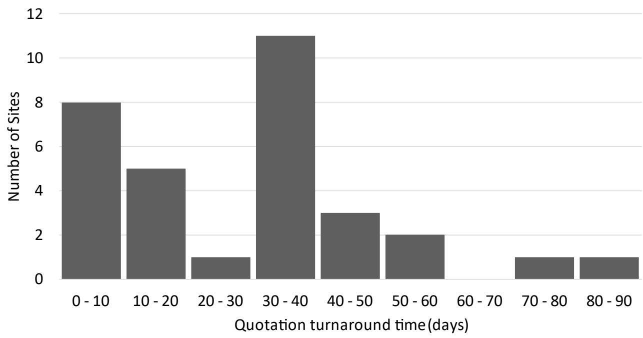

Figure 3: Turnaround time for 47 formal connection applications at 50 kVA

It is important that all sites are tracked by the connecting party to monitor the turnaround time, costing and expiry dates of received quotes. At several points in the project, the team experienced periods where quotations needed to be accepted without having complete sight of the full costs of the project portfolio. The evidence produced through Figure 2 helped to identify sites that represented good value for money in the context of the quotes received. To meet the project budget, it was necessary to balance sites which had high-grid connection costs, but that were deemed to be a priority by local authority partners, against sites where lower grid connections could be achieved. This balancing was required to ensure that the project remained in line with the total project budget of €1.3 million (~£1.1 million).

3.2. Reserve sites planning

During the project, the team actively evaluated reserve sites to ensure that should a main site fall through, for whatever reason, a suitable reserve site could be quickly on-boarded into the project portfolio. The order and priority of onboarding reserve sites were agreed upon by key stakeholders ahead of need and made use of a flow chart to outline the backup strategy for each site should it fall through. This diagrammatic approach facilitated a quick and agreed transition when sites fell through. The priorities from the hosting local authorities were considered in this flow chart to ensure that local project aims (e.g. ensuring geographic coverage of the network) were maintained.

3.3. Post Acceptance Changes

Several sites experience post-acceptance challenges during the project. There were three notable examples of this across the project portfolio.

The first learning related to the shut-down of an overhead 11 kV network to facilitate the upgrade of a 50 kVA transformer to 100 kVA. The DNO had recently shut down this line to facilitate another new connection and was unable to facilitate another planned outage for several months after this date. This new date was no longer compatible with the project timeframes and therefore the site had to be dropped from the portfolio. Communication of this outage at an earlier stage had the opportunity to save the DNO and the FASTER team both time and administrative overheads of having to process a refund for the site.

In the second example, a pole mount transformer had to be upgraded from a single pole to an H-pole configuration. This transformer was located in the garden of a private household where it was deemed that the visual impact of the H pole and larger transformer would be challenging to progress from a wayleave perspective. The implications associated with this reinforcement could likely have been spotted earlier by both the FASTER team and the DNO.

Finally, one site had to be re-quoted post-acceptance due to errors in the initial quotation. This re-quote was unfortunate but occurred twice at the site due to a second error being discovered. A secondary check, particularly after the initial error, would have been valuable. Since connection charges were a large variable and a considerable proportion of the project budget, post-acceptance changes by DNO errors could have had significant knock-on effects on the portfolio budget, procurement tenders and funding-body approvals.

3.4. Connection Teams

While this paper, but its very nature, will highlight areas that could be improved in the context of delivering connections quickly to enable net zero, it is worth noting several positive experiences during project deployment.

The workload and the complexities of DNO connections have become much more apparent during this multi-site project across the FASTER region in Scotland. The multi-site element of the project has exposed the team to a variety of challenges e.g. second comer chargers, scheduling of works and the rules surrounding network shutdowns to enable connections to name but a few examples. It has been affirmative that individuals within the DNO have offered solutions to challenges, such as temporary workarounds to avoid upgrade delays, or connection design changes to avoid wayleave issues. Several connection designers and local connection team staff have been very communicative and willing to help with queries and minor modifications. The cancellation policy has also been useful, allowing the cancellation of works with (and sometimes without) a minimal admin charge if site work had not started.

The implementation of the recommendations made through the Significant Code Review (SCR) into distribution connections has also been a valuable change in the way costs are apportioned when deploying infrastructure [4]. The SCR recommended that network upgrades are socialized with a "high-cost cap" to protect consumers from connections that would be too costly to deliver. Unfortunately, the implementation date for the code review did not align with the timescales associated with the FASTER project, however, sites that would benefit from these regulatory changes were passed on to local authorities for consideration at a future date. The removal of "second-comer" charges has been very welcome with possible savings of over £85k identified at one location in the project. With an average site budget of approximately £46k for hardware, installation, and grid connections, this regulation change will make previously unviable sites much more attractive to infrastructure developers going forward.

4. Discussion and recommendations

Based on the experience of the FASTER consortium in Scotland, several recommendations are summarised in the subsequent subsections.

4.1. Hosting Capacity

The hosting capacity of network assets is generally available for primary distribution infrastructure and voltages above this level. The connection of new low-carbon technologies is generally occurring at the grid edge (e.g., at low-voltage) where there is limited public information as to the capacities available at these locations. A notable piece of work in this area is the ConnectMore tool developed by SP Energy Networks', EA Technology, PTV Group and Smarter Grid Solutions. The ConnectMore tool outlines what future low-voltage connection capacity information may look like to connecting customers [5]. The team believe that more information relating to LV capacity should be provided to infrastructure developers. Tools like ConnectMore should be standardised and made available across DNO regions

4.2. Minor Relocation Studies

The location of EV charging infrastructure within a car park may have cost reduction opportunities for the site. A dialogue between the connection designer and the contectee at the quotation stage would be beneficial to identify optimal locations for infrastructure. This would be of particular benefit if the connecting customer did not have visibility of the location of low-voltage distribution assets or should they not understand the underlying engineering relating to where successful connections are likely to be achieved. Figure 4 provides an example where a local authority was considering hosting a charging point at a ferry terminal - 'Site A'. Power capacity analysis identified that significant reinforcements were required to support this connection. 'Site B' was proposed as an alternative as network upgrades were deemed to be more cost-efficient to deliver. Quotations received from the DNO indicated that deployment at Site B would save approximately £35k.

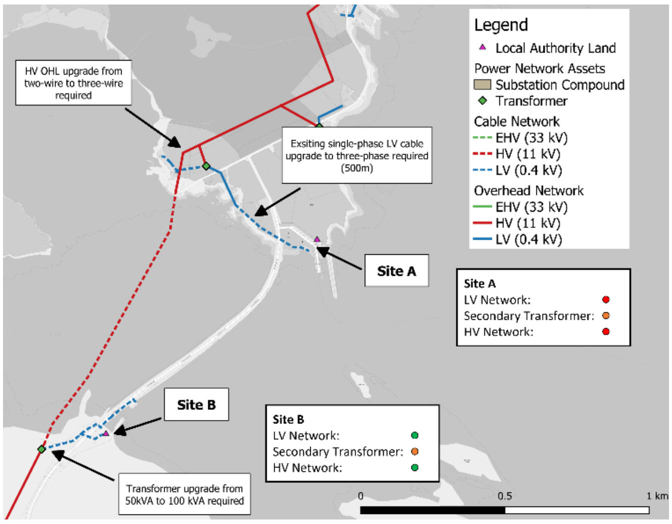

Figure 4: Example outlining the potential saving achieved through minor relocation of the candidate site

4.3. *Project Coordination*

Multiple projects being delivered in tandem may benefit from a single DNO project coordinator to help manage connection applications, quotations and delivery. For several sites in the FASTER portfolio, the team saw the benefit of a common point of contact with the DNO who managed several connections. This continuity of knowledge helped improve project efficiency as much of the information was common across installations thus saving time for the DNO and the FASTER team. It is believed that this approach would have been beneficial should it have been applied across the whole project portfolio. It is acknowledged that connections teams are managing a high number of applications, but an approach to help coordinate the deployment, of what will likely be critical public infrastructure in the future, may merit a slightly different approach – especially in the context of transitioning towards net-zero and the climate emergency.

4.4. *Timeframe and wayleaves*

The competition time frames quoted in formal connection applications were often six to nine months whereas, in practice, delivery teams were working on delivering projects in six to eight weeks. While this faster timeframe could be considered a benefit, it involved re-planning and re-dispatching the EV charge point delivery team. This team was responsible for completing the enabling civil works at sites to allow the DNO to establish a connection. A timeframe range outlining the best case, worst case and expected delivery dates would be helpful at the quotation stage for project planning purposes.

More communication regarding the wayleave process would be beneficial too to help identify sites 'at-risk' and to ensure replacement sites are readied should a replacement be sought. More generally, the wayleave process could be progressed informally by the connectee in advance to advise local landowners that they should expect to be contacted by the DNO. At this point any concerns could be captured and fed back to the connection team should minor changes to site design help promote the successful delivery.

5 Conclusion

This paper has provided an overview of some of the challenges and observations faced by the FASTER team in Scotland during the process of deploying 24 journey charge points across rural communities in the country. Several recommendations have been provided in the paper to help provide an improved user experience, particularly concerning the parallel deployment of multiple sites of similar specifications.

The key recommendations of the paper are as follows:

- Improved visibility of the availability of low-voltage network capacity
- DNO insight as to more cost-effective installation locations for connections when considering car parks and on-street applications for EV charging provision
- A project coordinator to support multi-site installations and ensure that a standardised process is applied across all sites
- Improved communications relating to wayleaves and earlier warnings of network shutdown constraints
- An additional design check stage to ensure connections quotes are correct and not liable for cancellation due to DNO errors

6 Acknowledgements

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7 References

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