Gwasanaeth Ynni
Energy Service

Llywodraeth Cymru
Welsh Government

Technical advice note

Electric vehicle charging infrastructure procurement

1. Introduction

To decarbonise Welsh Public Sector fleets, all vehicles must be replaced with battery electric vehicles (BEVs) by 2030. Effectively running a BEV fleet requires different processes to conventional internal combustion engine (ICE) fleets. The key difference is the need to consider electric vehicle charging infrastructure (EVCI) at vehicles' base sites. Installing depot-based EVCI will enable the fleet to recharge more easily and more cost-effectively than solely using the public infrastructure, although the latter can be a useful backup.

EVCI introduces a new procurement challenge for fleet and facilities managers, requiring additional knowledge and skills. EVCI also needs to be considered in conjunction with other electrification projects happening on site, such as moving to electrified heating (for example heat pumps), installing on-site generation (typically solar photovoltaics PV), and on-site battery storage. Electrification is a holistic, site-wide project, and not just an issue for the fleet.

There is much to consider when procuring EVCI, which is summarised in this technical advice note. There is no one size fits all approach to installing EVCI. The fleet's context, energy consumption, available downtime and charging strategies are all crucial factors when designing and procuring charging infrastructure.

2. Considerations for procuring EVCI

There are many factors to consider when procuring EVCI. This section outlines key elements to include in the design process, along with important considerations to ensure the selected charge point installer and/or operator adheres to the required procedures. Three aspects – smart and dynamic charging, AC/DC charging speeds, and energy and power requirements – are explored in greater detail in Section 3.

Electrical characteristics

Charge point power rating is a crucial part of effective EVCI design, and is further discussed in section 3. The charging system must comply with UK electricity standards: it should be rated for a system frequency of 50 Hz, with a phase to neutral voltage of 230 V AC for single-phase, or phase to phase voltage of 400 V for three-phase.

Charge point standards

All charging equipment should meet or exceed the necessary regulations and standards, as applicable. This includes compliance with the Open Charge Point Protocol (OCPP), and the Electric Vehicles (Smart Charge Points) Regulations 2021.

Physical characteristics

Consider the suitability of different charge point mounting options: wall, pedestal, pole, pillar, catenary etc. Dual-socket charge points, which split the available power when two vehicles are plugged in, may also be appropriate. Charge points must be protected against physical damage through the use of position and/or protection such as bollards. They must also include appropriate safety and security features, such as in-use locking mechanisms, locks, tamper seals, alarms.

Output types

Charge points can either be tethered (with a cable) or untethered (without a cable, providing only the sockets). Different connector types are available depending on the charge point and vehicle. AC charge points use Type 1, Type 2, or Commando, and DC charge points use CHAdeMO, CCS, or Type 2. Generally, BEVs are supplied with cables and connectors for use with most untethered charge points, but it is essential to ensure compatibility with all the vehicles that will be using the charge points.

Dynamic load management and smart charging

This is covered in more detail in section 3. The charging equipment must support demand load management functionality, and be compatible with the specific system to be implemented. The charge points must be able to send and receive information, and respond to changes in electricity demands and charging time. The demand load management system must provide all of the needed functionalities, such as the ability to prioritise certain charge points, coordination with other on-site demand, and electricity tariff optimisation.

Charge point management system (back-office)

This refers to the software platform (generally cloud-based), used to manage charge points. Connection can be established through 3G/4G/5G, Wi-Fi, or ethernet cable. The system must allow the operator to manage the charge points remotely, for example to schedule charging, obtain data and information, and see, diagnose, and fix faults.

Usage and access controls

This concerns the instructions and information displayed on the charge point for users, as well as the management of charging transactions, including payment if relevant. The unit should be intuitive to use, and the information displayed should be simple and easy to follow. Consider how users will need to authenticate to access the unit, and how payments will be processed (if relevant).

Equipment positioning

Consider organisational requirements for EVCI locations, whether distributed across multiple sites or concentrated in a single main location. It is generally recommended to group all charge points in one defined area of the site, rather than spreading them across a car park, for example. The physical positioning of units must account for accessibility and safety (for example trip hazards or occupying pavement space), and vehicle sizing. Additionally, consider the potential for vehicle impact damage, environmental factors (such as flooding or tree damage), obstructions and intrusions for access.

Accessibility

Although this is not a requirement for fleet EVCI, it would be recommended to consider and apply the PAS 1899 standards for accessible charge points when designing the infrastructure.

Survey, design, installation, commissioning, bringing into service

Ensure the service provider creates and maintains a suitable project delivery plan, covering all project phases of survey, design, installation and commissioning. Surveying will need to examine electrical and physical considerations, environmental factors (for example flooding), IT/communications (for example mobile signal), and cyber security. Consider that installing EVCI may require altering site emergency plans such as evacuation procedures.

Signage and markings

Signage and markings should be clear and concise, placed in appropriate locations, and should not contribute to clutter. All information and display must meet accessibility requirements.

Local connection assets, groundworks, civils

Use standard connections and methods to ensure ongoing maintenance, replacement, and future expansion are not hindered by the use of highly specialised equipment. It is strongly recommended to install all groundworks in one go, ready for a fully-electrified fleet, to avoid the need for disruptive groundworks at each EVCI expansion.

Permits and consents

All EVCI installed must comply with the relevant legal requirements.

Customer service

The charge point installer and/or operator must demonstrate excellent customer service. For example, the provider must ensure a 24/7 support contact, at minimum a telephone support line, with the ability to provide ‘first line’ support to guide users through possible remedies to issues, and remote charge point reboot (free of charge).

Maintenance, service, repair and replacement

The charge point installer/operator and the organisation must agree on who holds responsibility for routine and reactive maintenance. The parties should also agree on the expected level of operational availability (Service Level Agreement) before penalties are applied (for example 95% available over a 12-month period).

Health and safety

All suppliers, contractors, and sub-contractors must provide evidence that they adhere to the necessary health and safety regulations and standards. They should maintain full, relevant, up-to-date, and regularly reviewed health and safety policies.

Data provision

The charge point operator must provide the organisation with data on EVCI operation (for example charge sessions, energy delivered, charge point speed) as required, throughout the duration of the contract.

Cyber security

The service provider must have a cyber security policy and framework that comply with the organisation’s requirements.

Data protection

All systems and parties must comply with the Data Protection Act 2018 (UK GDPR).

Sustainability, waste, social value

EVCI procurement must align with the organisation’s sustainability, waste, and social value commitments. Consider durability, end of life disposal and recyclability.

3. Detailed examination

Smart charging, and load management

Smart charging is a system in which the BEV and charge point share a data connection, and the charge point is also linked to a back-office operating system. Basic ('dumb') charge points only allow a BEV to plug in and receive a charge. In contrast, smart charge points are connected to a cloud network, typically through Wi-Fi, ethernet or 3G/4G/5G. This connectivity allows the charge point to monitor, manage, and control usage remotely, optimising energy consumption.

Load management enables the operator to balance the available electrical capacity across charge points, ensuring that the total supply capacity is not exceeded. Smart charge points are essential to enable this load balancing functionality.

The simplest form of load management is static load management. Here, the operator distributes the available power to different charge points within the network, ensuring the total incoming supply capacity is not exceeded. The charge points analyse the vehicles' charging demands and the available supply capacity, distributing power accordingly. However, static load management cannot respond to real-time changes in the supply or site usage, as it relies on pre-determined input data.

Dynamic load management is more complex and can adapt to real-time changes in power availability across the site. This is particularly useful for sites with additional electrical demands on the same circuit as the charge points. The load balancing system accounts for these other electrical circuits when vehicles are charging. For example, if vehicles are plugged in during the day while the building's lighting is in use, the vehicles will receive a reduced rate of charge. Once the lighting system is turned off, more power becomes available for the electric vehicles, allowing the charge rate to increase.

Load management helps avoid the need for potentially costly increases in connection capacity and prevents peak loads that exceed agreed capacity, resulting in extra penalty charges. Fleet operations will not be restricted by load management induced slower charging, as vehicles can be plugged in after shifts and charge overnight during downtime. Without smart charging and load management, BEVs would begin charging immediately after being plugged in, potentially resulting in a large demand peak at the end of the working day, leading to increased costs for the organisation.

AC/DC and charging speeds

The power rating of a charge point determines how quickly it can deliver energy into a BEV battery. Higher power allows for faster recharging, although this is dependent on the vehicle's capacity to accept power. However, higher power generally comes at a greater cost, whether using the public network or installing depot-based infrastructure. Ensuring the correct charge point power for an organisation's operational needs is a vital part of EVCI procurement.

Charging infrastructure can be split into AC (fast), and DC (rapid). The power rating of AC charging systems ranges from 3.4 kW up to 43 kW, but are generally 7.4 kW or 22 kW. Charging speed is dictated by the vehicle, and most BE cars and vans available have a maximum charge rate of 7.4 or 11 kW, meaning that most cannot make use of a full 22 kW. DC charging systems range from 20 kW and up, with ultra-rapid systems now capable of delivering above 100 kW. As with AC charging, the maximum speed is dictated by the vehicle, so it is essential to verify compatibility between the charge points and the vehicles in terms of power they can accept.

For organisations with long periods of downtime whether at night or during the day, 7.4 kW AC charge points typically deliver sufficient power to recharge vehicles when they are not in use. For example, a 50 kWh battery would take around 7 hours to fully recharge using a 7.4 kW charge point. 22 kW charge points may be suitable for some heavy commercial vehicles (HCVs). In cases where HCVs have large batteries (300 kWh+), or where operational downtime is limited, rapid DC charge points may be more appropriate, or two 22 kW AC chargers can be doubled to give 44 kW. For example, a 50 kWh battery could recharge in around 1.5 hours with a 50 kW charge point, while a 300 kWh battery would take approximately 6.5 hours.

Where it is operationally feasible, opting for the slowest viable charging speed possible can help minimise costs, and sustaining AC charging can promote battery health and longevity.

Estimating energy and power requirements

For more information on using data effectively to transition to BEVs, please refer to our Technical Advice Note – *Using data to inform the transition to electric vehicles.*

When designing an EVCI system for a fleet, it is important to consider the fleet's actual working processes. Accurate fuel and mileage records must be used to calculate the daily energy consumption of current vehicles, which can then be used to estimate the energy needs of a BEV fleet. Available downtime and locations for charging must be identified, whether overnight, between jobs, or while vehicles are 'at work' but not in use.

Once the fleet's energy consumption and available downtime are understood, the EVCI can be designed to meet these needs, delivering the appropriate amount of energy at the right speed and time, while reducing costs. The most straightforward solution is when fleet vehicles return to a depot every or most nights, typically allowing for at least 12 hours downtime in a consistent location. In such cases, cars and vans will generally only require 7.4 kW charge points, and for many vehicles 3.7 kW, or 7.4 kW dual chargers (providing half of 7.4 kW to each vehicle when two are plugged in) would be sufficient.

For larger HCVs and/or where operational downtime is limited, more rapid charging may be required. However, it is essential to remain realistic and consider the actual fleet use. Over-specifying EVCI, by installing higher-powered charge points than necessary increases project costs, and can delay decarbonisation if further site upgrades are required. Charging BEVs is a different process from refuelling conventional petrol and diesel vehicles, and it is generally unnecessary to replicate the rapid refuelling process by installing ultra-rapid chargers at depot locations.

4. Summary

When specifying and designing an EVCI system for a BEV fleet, it is essential to examine the actual usage patterns of the fleet vehicles. There are many elements to consider in EVCI procurement, and the appropriate charge point installer and/or operator can guide the organisation through this process. For Welsh Public Sector Bodies, please refer to your EVCI report delivered by the Welsh Government Energy Service for analysis of your specific fleet operation.

Find out more about how the Welsh Government Energy Service can help your community enterprise or public sector organisation:

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