

NHS Wales

Decarbonisation

Strategic Delivery Plan

Initiative 17: Electric Vehicle Charge Point
Best Practice Guidance - Summary

Published November 2023





NHS Wales Decarbonisation Strategic Delivery Plan (2021 - 2030)

Summary of Initiative 17: Electric Vehicle Charge
Point Best Practice Guidance

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NHS Wales Decarbonisation Strategic Delivery Plan (2021 - 2030)

Summary of Initiative 17: Electric Vehicle Charge Point Best Practice Guidance

November 2023

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1 Introduction

NHS Wales has set an ambitious commitment to decarbonise its operations. To meet this, NHS Wales must decarbonise its vehicle fleet, in line with the UK Government commitment to ban the sale of petrol, diesel and hybrid cars and vans by 2035, and HGVs by 2040. This is a summary of Best Practice Guidance document sets out guidelines and advice for the different fleets, vehicle types and sites across NHS Wales.

The reader is invited to refer to the full version of the Guidance at this location: <https://nwssp.nhs.wales/ourservices/specialist-estates-services/publications-and-information/>

1.1 Vision and Objectives

'NHS Wales will continue to support the commitment of procuring zero or ultra-low emission vehicles by developing a comprehensive fleet charging network across its estates. Where possible, cross-sector opportunities will be utilised to ensure value for money and work within grid capacities.'

This vision is supplemented by four objectives to support the successful delivery of the vision:

1. Prioritise deploying electric vehicle charging infrastructure where it will have the greatest impact in reducing carbon emissions in the vehicle fleet. Solutions will not comprise rural accessibility, nor critical hospital services, and will improve fleet operations through cost savings and emissions reductions.
2. Maximise opportunities for quick wins and early improvements given the Welsh Government climate emergency declaration, targeting high mileage vehicles and lighter vehicles initially.
3. To deliver the greatest return on investment and avoid infrastructure duplication, expenditure should be driven by value-for-money assessments and public sector collaboration. For NHS Wales to stay abreast of Electric Vehicle Charging Infrastructure (EVCI) developments future-proofing should lie at the heart of decision-making.
4. Where possible, integrate new charging opportunities with renewable energy generation and consider the wider impacts of climate change.

1.2 Policy Context

A review was undertaken of national, regional and NHS Wales policies surrounding the decarbonisation of transport, particularly for fleets. From these policies, the key targets are as follows:

2030

No new petrol and diesel only cars will be sold from 2030 onwards

2035

All new cars and vans will be fully zero emissions by 2035
Non-zero emission HGVs weighing 26 tonnes and under to be phased out

2040

All new HGVs sold in the UK are expected to be zero emission by 2040

As a result of these national targets, NHS Wales has committed to:

- All new cars and Large Goods Vehicles (LGVs) procured across NHS Wales after April 2022 will be battery-electric wherever possible. In justifiable instances where this isn't suitable, ultra-low emission vehicles should be procured.
- All new medium and large freight vehicles procured across NHS Wales after April 2025 will meet the future modern standard of ultra-low emission vehicles in their class.

The Wales National Electric Vehicle (EV) Charging Strategy outlines the key actions required:

- Improve charging provision at key public locations for all types of charger, especially fast.
- Establish Welsh quality standards to improve the customer charging experience.
- Increase public awareness and confidence in transitioning to EVs.
- Create synergies with spatial planning and other public sector bodies to share charging infrastructure.

2 Infrastructure Requirements

2.1 Typologies

Key typologies for the organisations within NHS Wales have been identified to understand their fleet vehicle compositions and operational purposes and requirements, and thus determine the required charging infrastructure. These include:

- Health Boards (Major Hospitals, Community Hospitals, Specialist centres and Other facilities)
- Central All Wales Support Services (NHS Wales Shared Services Partnership (NWSSP-SES), Digital Health and Care Wales and Health Education Improvement Wales)
- Wales Ambulance Service NHS Trust (WAST)
- Public Health Wales

2.2 Charging Hardware

The required charging hardware is highly dependent on the types of vehicles, the operational purposes, vehicle downtimes and daily mileage. Broadly, the types of required chargers can be summarised as follows:

- A Type 2 7kW AC socket for vehicles that can be recharged overnight, which can be shared among multiple vehicles if the average daily mileage is below the typical range of an EV.
- If overnight charging is not possible, then a minimum of 22kW AC¹/DC² should be specified for recharging cars within a minimum of 3 hours or 5 hours for LGVs.
- At least 20kW CCS DC charger, recommended 50kW or higher, should be provided where daily mileages are high, which can be shared among multiple vehicles for rapid top ups. CHAdeMO cables may also need to be provided where legacy vehicles are used.

It is recommended that actual requirements should be worked out per organisation and use case.

2.3 Prioritisation of Charging Infrastructure

The deployment of charging infrastructure across NHS Wales for the fleet will also have competing priorities between departments for a finite electrical grid connection and public funds. Therefore, the following hierarchy for charge point provision is proposed:

- Ensure that WAST ambulance vehicles and HCS Blue Light Fleet have power immediately when required, charging at rapid or ultra-rapid speeds.
- Power operational and estates vehicles that are plugged in and charging to ensure their duties can be fulfilled when required at fast or rapid speeds.
- If any capacity in the local network is available, share the power among grey fleet vehicles plugged in at fast or rapid speeds. Otherwise, the public network could be utilised.
- Remaining network capacity could be provided to staff or visitor charging bays (if present), at slow or fast AC speeds. Otherwise, the public network could be utilised for these vehicles.

¹ AC: Alternating Current, where the flow of electrons in a current reverse regularly and rapidly.

² DC: Direct Current, where the flow of electrons in a current is unidirectional.

2.4 Estimating Charging Infrastructure Requirement

To determine appropriate charging infrastructure requirements, the following approach is suggested as an approximate guide.

- All daily mileages should have an additional 10% buffer added.
- If the daily mileage is under 50% of the typical range of the EV, then a single 7kW AC socket could be shared with two vehicles for charging over long dwell times (e.g., overnight).
- If the daily mileage is within the typical range of the EV, then one 7kW AC socket would be required per vehicle for long dwell times (e.g., overnight).
- If overnight charging is not possible, then a minimum of 22kW AC/DC should be specified for recharging cars within a minimum of 3 hours or 5 hours for LGVs.
- If the daily mileages are beyond the typical range of EVs or the dwell times are short, then a DC charger should be specified to be shared among multiple vehicles for rapid top ups.

2.5 Usability and Operations

When deploying charging infrastructure, the positioning should be a key consideration, as well as the following operational factors.

2.5.1 Tariffs

The cost levied for the use of charging infrastructure is referred to as a tariff, measured per kWh drawn from the charger. Any tariff should be set at a rate that is comparable to other public sector organisations and sustainable for users and the operator, covering the following direct and indirect operational costs:



2.5.2 Other operational factors to consider

- **Maintenance.** Any hardware installed needs to always be safe and comply with product regulations, relevant standards and operation. There should be clear responsibility for charge point maintenance (planned and reactive), replacement, and cleaning services with the designated service provider.
- **Access, Activation and Billing.** After plugging in a vehicle to a charger, it requires some form of activation to start the charging process. It is recommended that Radio Frequency Identification (RFID) cards or auto-charging are used due to the convenience and the limited pool of vehicles accessing the network. These can also integrate with the national public framework for multi-supplier fuel cards.
- **Open Charge Point Protocol.** It is recommended that at least version 1.6 of Open Charge Point Protocol (OCPP) is supported on EVCI installed across the NHS Wales estate. Critically, any chargers with OCPP 1.6 or above are interoperable and compatible with multiple network operators.

2.6 Key Recommendations

- The required charging infrastructure depends on several factors including the vehicle type, the daily mileage, and the type of site. These factors should be weighed up and accounted for when planning charging infrastructure.
- The types of chargers required depend on use case, however generic requirements have been outlined based on average daily mileage.
- WAST require specialist rapid charging facilities at or near A&E departments to facilitate the transition to EV for emergency response vehicles, in addition to infrastructure at ambulance stations.
- Between 7 to 22kW AC should be installed for fleet with average mileage, with 50kW+ recommended for large daily mileages beyond the typical range of EV.
- Following critical hospital services, the prioritisation for EV fleet recharging should be given to emergency response vehicles, followed by operational vehicles, grey fleet and staff/visitors.
- Tariffs should be implemented for all NHS Wales chargers that cover all associated costs, with no revenue cost to the organisation and at a rate comparable to other public sector organisations.
- The method of activating a charger should be hassle-free for users, with RFID cards or auto charging recommended for fleet.
- All chargers should feature at least Open Charge Point Protocol 1.6 or above.

3 Car Parking and Space Planning

3.1 Relevant Policies and Legislation

There are a range of key legislation and car parking policies that should be initially consulted when reviewing car park requirements in conjunction with installing EV charging facilities to ensure adequate provision. EV charging bays should form part of the overall parking provision, and not in addition.

- **Local Authority Car Parking Standards.** Council areas across Wales publish their own parking standards for new developments, which typically cover:
 - Maximum and minimum parking requirements for a range of land uses (e.g., number and size of parking bays).
 - Proportion of parking bays to be allocated for blue badge parking.
 - Servicing parking or loading requirements for industrial purposes.

10 to 20% additional space per parking bay should be considered to account for the positioning of the charging ports on vehicles. This decision should be made by NHS Wales.

- **PAS 1899– Electric vehicles – Accessible Charging Specification.** The British Standards Institute PAS 1899 current edition guidance is intended to outline requirements for the inclusive design of public charging infrastructure on a voluntary basis. Key recommendations include:
 - Ensure the user interface is accessible for all.
 - Positioning of the charge point in such a way not to restrict mobility.
 - Reduced trailing cable lengths as much as possible.
 - Sufficient height of charging connectors or cables, with weight reduced as much as possible.
 - **Positioning charge points and adapting parking policies for EV.** The guidance from Energy Savings Trust provides information on:
 - Recommended positioning of charge points within car parks.
 - The use of crash barriers to protect EVCI.
 - Appropriate signage in car parks for charging bays.
 - Potential parking incentives for EV.
 - Case studies.
- **Car park design, inspection, maintenance, and management.** The Institute of Structural Engineers provides detailed guidance on design, construction, maintenance, and reuse of car parks, and on responsibilities, actions, legal obligations and good practice for car park owners and operators to ensure that car park structures are maintained in compliance with health and safety legislations.

3.2 Operational Requirements

The operational purpose of each vehicle would vary across NHS Wales organisation, department and estate. However, common recommendations have been collated for the purpose of this Best Practice Guidance:

- **Critical NHS Fleet Vehicles.** Dedicated parking bays are recommended for vehicles within the NHS Wales fleet that are critical to the day-to-day operation of the service:

- One charging socket per parking bay with high maximum daily mileages, or where the vehicle is operationally critical (i.e., ready to go at all times). Recommended for BEV only.
- Some parking bays may not need to have charging sockets if daily mileages are low, in which case, it is dependent on the operators to rotate vehicles between charging bays when required.
- Pool vehicles should have dedicated parking bays with a charging socket to ensure the vehicle is always recharged or recharging.
- **Rapid Response Vehicles.** Although WAST are likely to provide appropriate charging infrastructure at ambulance stations, additional charging infrastructure is also required at A&E departments. Designated parking bays for ambulances and rapid response vehicles are therefore recommended. These should feature at least one high-powered charger (75kW or more) reserved for ambulance use.
- **Staff and Visitor Parking.** To enable charging for grey fleet owned by staff, other staff members and visitors, a minimum 10% of parking should be applied when deploying charging infrastructure in new developments on NHS Wales estates.
- **Blue Badge.** Blue badge parking provision should follow local authority planning guidance. Typically,
 - **Up to 200 spaces:** 6% of total capacity with a minimum of 3 spaces.
 - **Over 200 spaces:** 4% of total capacity plus 4 spaces.

EVCI provision should not reduce accessible spaces.

3.3 Positioning of Charging Infrastructure

The positioning of charging infrastructure relative to parking bays is a key consideration in its usability and deployment effectiveness:

- **Car Parks.** The Energy Saving Trust published guidance on positioning charge points and adapting parking policies. Generally, this can be summarised as follows:
 - Single socket infrastructure should serve one parking bay, positioned at the 'head' of the space.
 - Dual socket infrastructure should be positioned between parking bays to ensure each socket is equidistant to both spaces.
 - Multiple-socket deployments should be positioned appropriately to serve the number of bays that can be concurrently charged by the chosen infrastructure.
- **Parking Location and Footways.** Vehicles stored in regular car parks should follow the charging infrastructure positioning guidance outlined, with fleet vehicle charging bays clearly marked to deter other vehicles blocking the bays. Vehicles should not be recharged within buildings, with charging infrastructure located a suitable distance away from critical infrastructure. Charging infrastructure should not be located on footways, in order to prioritise people walking, wheeling and cycling, particularly for people with disabilities. Where there is no other feasible option, there should be an absolute minimum of 1.5m clear.
- **Other Considerations** include Signage, Bay Marking, Parking Enforcement, Car Park Usage Monitoring and Fair Use policy.

3.4 Key Recommendations

- Local authority car parking guidelines are recommended to be reviewed in conjunction with EV charging specific requirements to ensure appropriate provision. EV charging bays should be accounted for within car parking standards, and not in addition.
- Where infrastructure available to the public is introduced, ensure that it is compliant to PAS 1899:2022 accessibility standards. This may also be introduced for fleet or staff use.
- EVCI should be positioned such that it is not a hazard to users, either from trips or falls, and should not block footways.
- EVCI must be given the appropriate spacing from critical infrastructure, as per Section 10 Fire Safety.
- Parking bays should be clearly marked for EVCI, with DfT approved signs used where chargers are available to the general public. These should be supported with parking enforcement, where appropriate.
- Monitoring of EV infrastructure should be included in any specification to maximise efficiency of provision and develop a timeline for installations.
- A fair usage policy should apply to charge points. This may include overstay fees to incentivise users to disconnect when fully charged.

4 Town Planning Considerations

4.1 Permitted Development Rights

The **Town and Country Planning (General Permitted Development) (Amendment) (Wales) Order 2019** ('the GPDO') grants permitted development rights – and effectively planning consent – for a range of development subject to whether they qualify and meet the relevant criteria.

Hospitals and Healthcare facilities are not afforded specific Permitted Development rights; however, Class D and Class E of Part 2 Minor Operations of the GPDO 2019 enable the installation of EV Infrastructure within lawfully used off-street parking facilities. The wording 'lawfully used' refers to the requirement that there is a lawful planning consent which regularizes the use of the site where EV infrastructure is to be in a car park. As such, this will need to be checked on a case-by-case basis. In the absence of formal planning consent granting the use of the site as a private car park, it is advised that a Certificate of Lawful Use (CLU) for existing use is obtained prior to installing any EV Infrastructure and exercising these rights.

The GPDO outlines size and location limitations on the EV Infrastructure installation based on whether the electrical outlet is mounted on a wall (Class D) or on an upstand (Class E). Where electrical outlets are unable to meet the Permitted Development requirements full planning permission would be required.

4.2 Planning Permission

Should full planning permission be required, applications would need to be accompanied by:

1. Clear location/site plans showing the exact location of EV infrastructure to be installed.
2. Details and dimensions of the outlets to be installed as well as any associated structures.
3. A description of the application site and locality.
4. An assessment against relevant national and local planning policy.

National policies of Wales are supplemented by Technical Advice Notes, providing detailed planning advice.

4.3 Listed Building Consent

Although there are limitations within the Permitted Development rights in regard to Scheduled Monuments there are no such limitations with regards to Listed Buildings within the rights. Listed Building Consent may be required if the installation of EV infrastructure would affect the character of the Listed Building. Where possible EV infrastructure should be located away from Listed Buildings so as not to obstruct key views or maintenance regimes.

4.4 Key Recommendations

- EVCI generally has permitted development rights to be installed in lawfully used off-street parking facilities, however sites should be checked on a case-by-case basis.
- Planning permission should be sought where Class D and Class E of the GPDO cannot be satisfied, particularly if chargers are large (e.g. DC).
- When planning an installation, guidance should be sought from the local council to confirm whether planning permission is required or not, and/or seeking out published guidance notes.
- EVCI should be located away from listed buildings, however where this is not possible, consultation with the local planning authority may be required.

5 Electrical Infrastructure

5.1 Electrical infrastructure technical requirements

To provide electricity supply to the EV chargers from the electric grid, the EV chargers would need to be connected to the private Low Voltage (LV) network, via a new or existing 11kV/LV substation on site. This substation would then be connected to the DNO or IDNO substation through an 11kV network ring.

5.2 Assessment of connection requirements

During the design process of the grid connection infrastructure, the following aspects should be considered:

- New load requirements (based on type and number of EV chargers to be installed)
- Assessment of existing electrical limits (based on new and existing load versus existing asset ratings)
- Impact of additional load to upstream connections and existing assets
- Earthing requirements at the point of connection
- Wiring system, including routing of all cabling

5.3 Footprint

Dimensions of EV chargers vary with charger type and ratings. When designing the spatial arrangements of EV chargers, the following aspects need to be considered:

- Space allowance between EV chargers would need to be at least 2m.
- Distance between chargers would need to be maximized to reach as many parking bays as possible.
- EVs can use charge points within five meters as most charging cables are 4m-8m long.
- Space allowance for impact protection, such as protection guards and bollards.

Footprint of substation will vary with the total capacity connected. A typical clearance allowance around the substation would be a 2m-wide footpath all around the area and 5m-wide footpath at the main point of access.

5.4 Metering, control and communication devices

Metering shall be installed for energy management purposes, this could be either built-in or installed in a separate feeder pillar. The EV charging equipment should provide the required control and communication features for monitoring, management, and data collection and processing.

5.5 Vehicle to Grid (V2G)

There are also possibilities to utilise Vehicle to Grid (V2G) on site when two-way power flows are enabled. This would require regulation, protection and design practices for generation and loads as charging infrastructure would be seen as energy storage.

5.6 Key Recommendations

- Assess the local existing electrical infrastructure to understand electrical constraints.
- Assess the connection requirements and additional load for the EV charging infrastructure to understand whether network upgrades are needed. Additional details on understanding the existing network capacity, additional demand requirements and grid connection process are outlined in **Section 6 Electrical Demand**.
- Develop an appropriate footprint plan and assess the electrical constraints of the existing infrastructure to prevent electrical issues.
- Understand metering, control and communication requirements.
- Consider potential use cases for Vehicle to Grid applications to manage grid load.
- Ensure compliance with relevant standards and planning requirements.

6 Electrical Demand

There are already significant pressures on the grid capacity across the main hospital sites, especially in rural areas. Therefore, any additional load sought for these locations would be initially prioritised towards hospital equipment with the remaining capacity needs balanced between other decarbonisation objectives as well as EV charging.

6.1 Understanding additional electrical demand requirements

The amount of energy supplied to an EV is not always the same as the power rating on the charge point. While AC-chargers are known to supply a constant power output to the car throughout most of the charging cycle, DC-chargers initially deliver high power output, and once the battery is around 80% charged the power supplied to the car follows a decreasing charging curve. The relationship between power and vehicle charging time depends not only on the charger, but also on the battery management system (BMS) of the EV, which dictates how much power the vehicle will accept and at what rate. The charging curve is unique to each vehicle and is dependent on factors such as age, battery chemistry, size, weather conditions, battery degradation, and the battery's state of charge. When quantifying the additional demand due to the connection of the proposed EV chargers, it is recommended to consider a worst-case scenario where the load of each charging point should be added together and no diversity factor applied. However, it is unlikely that all charge points will be used simultaneously 24/7.

6.2 Understanding current load and installed equipment ratings

Understanding the current load of a site involves assessing the existing electrical infrastructure and measuring the electrical demand. The following key points should be considered in this process:

1. Gather information about the site's electrical infrastructure, including main electrical service panel, distribution panel, transformers, and electrical loads, noting voltage and current maximum current capacity.
2. Review electrical blueprints or drawings of the electrical system. These documents provide insights into the layout, capacity and distribution of electrical circuits and panels.
3. Assess existing electrical loads on site and determine the power ratings and the current they draw.
4. Calculate available capacity by comparing the electrical demand with the maximum current capacity of the site's electrical infrastructure to ensure that the additional load from EV charging points can be accommodated without causing issues on the network. Additionally, allow room for safety margins.
5. Incorporate future thinking into planning for the installation of charge points by accounting for the future growth and potential expansion of EVs on site, as well as considering other additional loads.
6. The operation of existing critical loads and backup generators should not be compromised by the connection of EVCI. A risk assessment should be performed to identify those critical assets and guarantee their continuous operation. An appropriate load prioritization should be considered during the EVCI design and connection process, supported by an effective EV charging load management strategy.

6.3 Grid connection process

For additional grid capacity to then be provided to meet the new demand, the local Distribution Network Operator (DNO) or IDNO (Independent DNO) would need to be contacted early in the process to understand the connection requirements in terms of technical constraints and planning.

An indicative connection process for the installation of electric charging infrastructure is summarised below:

1. Assess existing infrastructure and demand
2. Quantify additional capacity requirements
3. Assess existing headroom for grid connection
4. Engage with Distribution Network Operator (DNO) to confirm capacity to connect and provide required information
5. Assess whether a generation license is needed
6. Complete grid application process
7. Obtain required planning permissions
8. Perform grid connection works

6.4 Load management strategies

Load management strategies can be used to ensure EV chargers are operated efficiently and address potential issues with adequacy of supply. Integrated control devices can be installed to provide control features such as:

- Timed charging, to perform charging during off-peak periods when electricity tariffs are lower.
- Demand limiting, to mitigate the risks related to capacity constraints of the existing electrical infrastructure and/or the distribution network.
- Integration with renewable generation and energy storage systems to optimise operation of the EV charging. Such integration can optimise both local generation and EV chargers.
- Load balancing across charge points: multiple platforms that manage charging offer load balancing when two vehicles are plugged into the dual charger or multiple vehicles need to charge across the network.

6.5 Risks

The following risks need to be considered when assessing and designing the connection to the electric grid of EV charging infrastructure:

- Insufficient electrical capacity: overloads, tripped circuit breakers, voltage drops, power quality issues.
- Delays in communication with the DNOs.
- Health & safety issues when assessing electrical demand.
- Inadequate grid connection for installation of charge points presents complexity and high cost for site operator.
- Lack of future planning does not allow for system scalability at moderate cost.
- Incompatibility with electrical system.
- New installation has negative impact on power quality, causing more works.
- Unanticipated high costs of site preparation and installation make project unviable.

6.6 Key Recommendations

- Understand required additional capacity to be connected.
- Understand existing infrastructure ratings and constraints, as well as existing demand.
- Consult local DNO to determine grid connection requirements.
- Complete grid connection process.
- Obtain required planning permissions before performing grid connection works.
- Develop a reliable load management strategy to ensure adequate efficiency of charging network.
- Assess potential risks and impact on existing electrical grid due to the connection of the EV charging infrastructure.

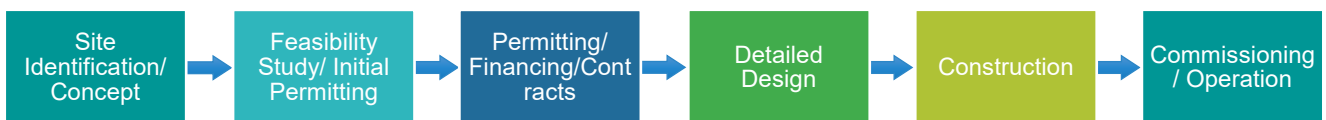
7 Renewable Energy

The incorporation of renewable energy sources such as solar and/or wind offers the potential to reduce exposure to rising energy costs and on-site carbon emissions, contributing to wider net-zero targets.

Planning for EVCI with renewables in mind can help mitigate limited grid capacities and contribute towards meeting on-site electricity requirements. As such, this section outlines key considerations to be made for the development of solar and wind to help mitigate limited grid capacities and contribute towards meeting on-site electricity requirements.

7.1 General Considerations for PV and Wind development process

When developing a renewable energy project, there are multiple factors to consider at various project stages:



The following factors should be considered when implementing a renewable energy project include:

- Available land/area
- Planning and environmental considerations
- Energy yield estimation
- Technical and project considerations
- Project costs
- Solar PV and Wind key differences
- PV and Wind location considerations

7.2 EVCI Considerations

The following considerations should also be made when developing EVCI:

- **On-site generation.** An on-site RE solution connected to the internal electrical infrastructure, might be a preferable option where there are no power constraints to meet the expected new demand from the grid, and the internal infrastructure can accommodate the new EVCI. This allows the RE system to contribute to the decarbonisation efforts on site.
- **Integration with Energy Storage.** A dedicated RE solution combined with a storage system can be proposed in cases where the EVCI cannot be connected to the internal infrastructure and access to the grid is not feasible for the EVCI.
- **Power Purchase Agreements (PPAs).** A direct PPA from a private generator of renewable energy (located nearby) to cover the energy consumption on-site could be implemented if the development of renewable energy on-site is not found to be feasible from a technical-economical perspective. The EVCI can be connected to the internal infrastructure if there are no constraints. If this is not the case, two PPAs may be required (one covering EVCI requirements and the other covering the site demand requirements).

7.3 Key Recommendations

- Where grid capacity is constrained across the NHS Wales estate, investigate the possibility for the installation of renewables to complement EVCI.
- Ensure the range of renewables technology available is appropriately investigated, using the outlined process, to effectively support wider energy and cost requirements.
- If possible, integrate renewables with EVCI deployment to reduce dependency on the grid.
- Ensure any deployment of renewables does not interfere with the backup generators on-site for critical patient care infrastructure.
- Ensure that renewable energy procured is compliant with relevant standards.

8 Carbon Savings Analysis

8.1 Calculation Methodology

The carbon savings analysis uses UK Government emission factors (2023) from the Department for Energy Security and Net Zero (DESNZ) and the Department for Transport (DfT) as well as current fleet composition data. Emission factor values are given in kilograms of carbon dioxide equivalent (kgCO_{2e}) and capture all six greenhouse gases (GHGs) defined by the Kyoto Protocol. Emission factors vary by vehicle and fuel type. As such, an appropriate emission factor is applied to the vehicle type.

Table 8.1: Carbon savings calculation: scenarios assessed and assumptions

| | |
|---------------------------|---|
| Scenarios assessed | <ul style="list-style-type: none"> • Baseline: The baseline scenario uses the fleet composition data as outlined in the NHS Wales Initiative 17: Electric Vehicle Charging Point Best Practice Guidance (Baseline) Report. • 50% EV uptake: The 50% EV uptake scenario reflects half the total fleet transitioning to EV, whilst the other half remains as the baseline fleet composition. To achieve this, the assessment considered half the mileage using the baseline fuel type, and the other half using an EV fuel type. Heavy goods vehicles (HGVs) are excluded from this assumption and are assumed to remain as diesel. • 100% EV uptake: The 100% EV uptake scenario assumes the whole fleet composition as reported in the baseline report transition to EV and as such, use EV emission factors. HGVs are excluded from this assumption and remain as diesel. |
| Assumptions | <ul style="list-style-type: none"> • All cars and light goods vehicles (LGVs) in the fleet composition are assumed to be average sized as defined by UK Government conversion factors. • All HGVs in the fleet composition are assumed to be classified as “All rigids” as defined the UK Government conversion factors using average laden. • All HGVs in the fleet composition are assumed to be diesel. • Vehicles identified as “Other” in the fleet composition are assumed to be LGV diesel vehicles, including ambulances which are more like LGVs than HGVs. As such, these vehicles will be assumed LGV plug-in hybrid vehicles in future scenarios in line with the NHS Wales Decarbonisation Strategic Delivery Plan. • 2023 conversion factors have been used including the use of grid electricity emission factors. • Where annual mileage was not given, it was calculated by multiplying the daily mileage. |

8.2 Results

It is evident that the EV transition will reduce the annual carbon emissions for the NHS Wales Fleet in both 50% uptake and 100% uptake scenarios for all the organisations. It is likely that the carbon savings would increase year-on-year as the UK continues to decarbonise grid electricity. The intensity of carbon emissions from electricity generation would then decrease in line with UK Government projections. It is important to consider the embodied carbon emissions with the uptake of EVCI and EVs as implementing new EVCI will carry embodied emissions which can often be significant.

8.3 Key Recommendations

- Significant reductions could occur from converting the existing fleet to EVs, ranging from 44% to 74% reduction depending on the organisation.
- When planning the rollout of EVCI, the embodied emissions of the infrastructure is an important factor to consider. Design, procurement and construction should minimise emissions where possible.
- When planning the rollout of EVs, the embodied emissions associated with the EVs is an important factor to consider. It is recommended the existing fleet is assessed for age and condition and be utilised as much as possible before switching to EVs.
- In line with Section 10, explore the use to renewable energy sources as this would further reduce emissions compared to using grid electricity.

9 Climate Change Resilience

Climate change has led to an increase in heavy rainfall events, the frequency and intensity of these are anticipated to increase. The UK is also experiencing more frequent and intense heatwaves, and severe cold snaps during winter. Therefore, when installing EVCI, consideration should be made for in relation to flooding or temperature extremes to support safety, continuity of services, and protection of assets.

9.1 Risk Assessment and Mitigation

The risk assessment should consider physical resilience planning to address the particular needs to amenity and operational charging, where different factors will apply:

- Understand threats in the siting of EVCI. Reference should be made to any Flood Risk Assessments for the site to avoid unnecessary cost/interruption of service associated with predicted flooding.
- Address environmental impacts, mitigate as far as practical excessive external ambient temperature and humidity, particularly for operational charging. Consideration should be given to solar shading.
- Management of access to charging infrastructure should be considered alongside existing protocols for managing car parks during extreme cold where snow or ice build up could present a hazard.

Typically, chargers can operate across a wide temperature range, however their resilience should still be assessed, where blue light holding bay operation is concerned. The implications of extreme heat on the electrical infrastructure are part of the infrastructure design, however the combination of heat directly applied to chargers in conjunction with air-conditioned ambulances should be risk assessed and mitigated against.

9.2 Loss of Service

A risk assessment and mitigation plan should be developed to address environmental factors resulting in loss of service. This should be considered alongside existing protocols, namely the hierarchy provided by Welsh Health Technical Memorandum 00-07 to define a baseline load and load control for the EVCI.

Blue light vehicles both discharging patients and on stand-by for service duty would be considered the highest level of need ('critical') and should have fully rated stand-by power support, provided by the site's embedded power generation. Other operational fleet vehicles may be considered 'essential' rather than 'critical'. Whilst stand-by support is required, consideration should be given to the application of diversity to the anticipated connected load. A balance of cost versus operational needs should be established, and it would be expected that not all chargers be supported by the embedded site generation system.

A business continuity plan should be developed including an EV distribution strategy which reviews the availability of non-NHS public charging infrastructure to 'soak-up' part of the operational charging need off site in the event of power failure. The plan should also assess the likelihood of a wider power failure.

Conceptually, stand-by power provision design should include a growth strategy allowing EV network charging power capacity to increase with the size of the electric fleet. The strategy should acknowledge the need to replace/upgrade central plant is costly and disruptive, and mitigation should be included.

9.3 Key Recommendations

- Focus on safety, continuity of services and protection of assets when positioning and planning for EVCI.
- Ensure the site risk assessments accounts for potential environmental hazards, including those arising from climate change such as extreme heat or cold and flooding.
- A stand by power support should be available for rapid response vehicles when power supplies don't prevent a loss of service. Other essential vehicles should also have access to stand-by power.
- Develop a business continuity plan to outline actions when extreme weather or power cuts interrupts service, including actions such as using the public charging network.

10 Fire Safety

Fire safety engineering considerations for EVCI should focus on life safety and space planning, but also give considerations to property and asset protection, business continuity, and environmental protection.

The fire safety section includes general fire requirements and best practice to facilitate the installation of EV charging across hospital sites and better operational service planning. A site-specific fire risk assessment or fire strategy should be developed to suit specific site conditions and the type of EVs (e.g. smaller electric cars/vans vs larger EVs) deployed.

People can leave
the area in
reasonable safety

Fire Fighters can
operate in
reasonable safety

Collapse of
structures does not
endanger people

Fire spread does
not affect occupants
or surrounding
buildings

10.1 Fire Engineering Objectives

The main life safety objectives in the event of a fire are:

Other objectives include property protection, business continuity and environmental protection.

10.2 Current Design Guidance and Best Practice

EV chargers should be located externally. Indoor EV charging within or adjacent to inpatient or sleeping risk premises is prohibited until such times as the fire service develop suitable EV fire extinguishment techniques.

There is a range of best practice, guidance and legislation for fire safety with EV charging, which should be fully met when deploying infrastructure including:

- Building Regulations – For most EV charging sites which are located externally, the Building Regulations do not apply. For external parking and charging areas there are usually relaxation on fire safety requirements therefore best practice should be applied to these areas.
- Fire Safety Order – when EVCI or EV parking is newly located adjacent to an existing facility, a fire risk assessment (FRA) should be completed for the buildings/areas that could be affected by the external parking and charging area. Once in use, the management regime for a building should be maintained and any changes assessed. Failure to do so may result in the prosecution of an employer, building owner or occupier under legislation such as the Regulatory Reform (Fire Safety) Order 2005 (RRO)
- Best Practice Guidance – Refer to section 13.2.2 of the full Electric Vehicle Charge Point Best Practice Guidance for further detail on relevant documents. To achieve compliance with the Building Regulations with respect to fire, the following design guidance will be used for NHS Wales hospital sites:
 - WHTM 05-02: Firecode – Fire safety in the design of healthcare premises; supplemented by:
 - Approved Document B (ADB), Fire Safety, Volume 2 – Buildings other than dwellinghouses (2006 Edition incorporating 2010, 2013, 2016, 2017, 2020 and future amendments – For use in Wales); or
 - BS 9999: Fire safety in the design, management and use of buildings – Code of practice (current edition).

10.3 Fire Safety Requirements

Fire Risk Assessment – A fire risk assessment (FRA) should be carried out to identify the fire hazards and mitigation measures for EV charging/parking areas. RC 59 (Risk Control – Fire safety when charging electric vehicles) is a useful design guidance on the FRA for EV charging/parking. A more detailed fire strategy may be required for new building projects (e.g. a new covered carpark) where building regulations apply.

Fire Safety Engineering - As an alternative to the prescriptive approach, fire safety engineering may be suitable for a design that otherwise could not be achieved by following the provisions in WHTM 05-02 or ADB/BS 9999. BS 7974 and supporting published documents (PDs) provide a framework for and guidance on the application of fire safety engineering principles to the design of buildings.

10.3.1 General Fire Safety Provisions

Application of this fire risk guidance – Below outlines specific guidance to the fire hazards of an EV charging/parking area. The recommended fire safety provisions could form part of a full site-specific FRA/fire strategy report.

- a. Designers must consult the Organisation's Fire Safety Manager/Fire Safety Team at the earliest stage of any proposals, as well as the Authorised Engineer, care of NWSSP-SES and the fire service. If applicable, the designer should also consult with the insurers for any additional fire requirements.
- b. For outdoor EV charging, the designer should consider the following minimum fire requirements. RC 59 should be followed to assess the fire risks and mitigation measures.
 - i. Fire protection measures, e.g. battery monitoring system, EV charging isolation switch.
 - ii. Impact of an EV fire on means of escape provisions, including but not limited to, separating distance to external escape routes.
 - iii. External fire spread control assessment to identify the separation distance to assets/buildings. This includes but not limited to, fire classifications of the building envelope, calculation for the allowed unprotected areas on the building envelope with regard to building height and separating distances, fire barriers.
 - iv. Vehicle-to-vehicle separation distance needs to be considered on a site by site basis. This is more of an asset protection consideration.
 - v. Access and facilities for the fire service, e.g. nearby fire hydrants.
 - vi. Operational response, e.g. recovery of a fire incident EV and potential disruption to operations.
 - vii. The designer may consider the application of BS 7974 to justify a suitable level of EV fire risks on property protection/asset protection.
 - viii. Management procedures to reduce combustibles and mitigate the risk of ignition.
- c. Indoor EV charging within or adjacent to inpatient or sleeping risk premises is prohibited until such times as the fire service develop suitable EV fire extinguishment techniques.
- d. Where there are exceptional reasons for indoor EV charging (such as FM maintenance garages), they should consider risk to life and services. They will be subject to FRA and approval. As a minimum, the designer should outline the fire safety provisions in accordance with WHTM 05-02 or ADB/ BS 9999 requirements to comply with Building Regulations (in addition to the fire risk considerations in item (b) above). This should be documented in a fire strategy report and agreed with the approving authority. The following minimum fire requirements should be considered:

- i. Means of escape provisions, including but not limited to: exit widths, travel distances, exit signs, emergency lighting.
- ii. Internal fire spread (linings and structures), e.g. fire separation/compartimentation.
- iii. Fire suppression system, e.g. sprinklers.
- iv. Smoke ventilation system.
- v. External fire spread control.
- vi. Fire service interventions, e.g. 'let burn' or actively tackling an indoor EV fire.
- vii. Contingency planning, e.g. relocation of the fire incident EV(s) outside the building to a place of relative safety, away from the buildings/structures.
- viii. Any other site-specific fire risks and associated fire protection systems/mitigation measures.

10.4 Fire Separation Requirements

The EV charging bays should be located at a minimum safe distance away from adjacent buildings/assets. Prescriptive separation distances are not provided in WHTM, ADB, BS 9999 or RC 59 yet, therefore the recommended separation distance is mainly driven by insurance guidance documents. *Zurich guidance - Risk Insight: Electric Vehicle Charging*.

- a. **Prescriptive approach on separation distances** - It is recommended that a 10m separation distance is maintained from EV charging bays to adjacent building/critical assets. Such distance can be relaxed to 7.5m from unprotected openings/extensive glazing in non-combustible walls. There is currently no prescriptive separation distances from sensitive receivers such as AHU intakes in hospitals. It is recommended this is addressed through risk-based fire engineering analysis, with the general 10m separation distance for a minimum spacing as good practice.
- b. **Alternative risk-based approach on separation distances** - A risk-based approach is necessary where the type/size of vehicles should be considered to confirm the separation distance is appropriate, for example when locating adjacent to sensitive receivers or where larger EVs (rather than smaller EV cars/vans) are proposed. With a risk-based approach, a more detailed FRA should be carried out to suit site specific conditions and type of EVs. There are also some sensitivity scenarios (e.g. jet fires and secondary fires) which are more suitable to be addressed in detailed site-specific FRAs, as currently there is limited fire testing data on these fire risks.

Fire Barriers - Fire barriers may be required to enhance fire life safety and property protection or as an alternative to providing separation distances.

10.5 Other Considerations

Fire Detection and Alarm System - The site-specific FRA/fire strategy should outline the fire protection measures of the proposed EV charging system. For outdoor EV charging, there are currently no reliable and cost effective fixed fire detection means in outdoor weather conditions. EV charging in a building is not preferred until such times as the fire service develop suitable fire extinguishment techniques. Automatic fire detection and alarm system should be provided in accordance with BS 5839 for indoor EV charging. The type of fire detection and alarm system should be considered in a fire strategy report.

Impact on Fire Escape Routes - The EV charging locations should not impact on escape routes. Occupants should have alternative safe escape routes away from the EV charging bays, without passing by fire incident EVs. Sensitive occupants and critical areas of the buildings should be considered in a fire strategy.

Fire Suppression - Fire suppression system (e.g. sprinklers) is recommended for indoor EV charging bays. Note, these are not expected to extinguish and EV fire but can be effective in

reducing the potential of fire spread to other EVs. For outdoor EV charging locations, a fixed fire suppression system is generally less effective. Sprinkler systems should be provided in accordance with BS EN 12845 recommendations. Insurers may require additional LPC rules to apply.

Smoke Ventilation - For outdoor EV charging, smoke will ventilate by natural means in the open air. For indoor EV charging, smoke ventilation system should be considered in a fire strategy to provide tenable conditions in a building.

Fire Services Interventions - It is recommended to coordinate with the fire service on firefighting strategies on EV fires. It is noted that Lithium-Ion Batteries have re-ignition risk after an initial fire. The recovery plan of fire damaged EV(s) and the service interruption risk to the vehicle fleet should be discussed with the fire service and documented in management procedures.

Environmental Protection - A significant amount of water is required to extinguish and cool the batteries (when compared to traditional ICE vehicles). Any water used to fight an EV fire should be appropriately managed to prevent environmental harm. Fire water must not be discharged to the drainage system unless advised by the Fire Service to do so and with permission from Natural Resources Wales.

Management Procedures - Management procedures in line with 'Risk Control – Fire safety when charging electric vehicles (RC59, current edition)' should be followed as part of the FRAs.

10.6 Key Recommendations

- Ensure compliance with relevant fire legislations.
- Continue to monitor changing legislations to ensure ongoing compliance
- Provide high quality, integrated, prevention and warning systems in areas where EVCI is implemented.
- Carry out fire risk assessments (FRAs) as per RC 59 guidance.
- Mitigate the risk of potential fires by ensuring 'good housekeeping', use of fire drills as well as awareness raising
- The majority of EVCPs will be retro-fit to the existing NHS estate; therefore, the existing FRAs must be updated to reflect the potential risks associated with EV charging and parking.
- Outdoor EV charging is preferred. Indoor EV charging within or adjacent to inpatient or sleeping risk premises is prohibited until the fire service develop suitable EV fire extinguishment techniques
- It is important to consider mitigating service interruption risks.

11 Procurement and Operating Models

The Welsh Government has granted NHS Wales stakeholders with significant discretion over their chosen approach to EVCI procurement.

11.1 Joint Procurement

Once NHS Wales stakeholders have identified sites and EVCI requirements, stakeholders should consider whether to procure charging infrastructure separately or as joint buyers. Through joint procurement, buying parties put forward sites to make available for EVCI, as well as the charger specifications. A nominated lead buyer then manages the procurement exercise, reducing the administrative and financial burden.

Table 11.1: Joint Procurement points to consider

| Advantages of Joint Procurement | Disadvantages of Joint Procurement |
|---|---|
| <ul style="list-style-type: none"> Joint procurement can facilitate knowledge and resource sharing. Greater coordination in EVCI roll-out means high priority sites can be developed faster. Helping to manage CPO resources and network capacity more efficiently. Reduced need for duplicate procurement activities, saving time and money. Joint procurement may unlock economies of scale benefits. For instance, the cost of a 24/7 Customer Helpline to support EVCI users, is shared between buyers. Consistent user experience across the network. Through joint procurement, buying partners broaden the scope and number of chargers delivered through a single contract, potentially making their collective offer more attractive to the market. This may increase market competition for the tender and deliver more competitive bids. | <ul style="list-style-type: none"> Collective agreement on contract terms and infrastructure specifications may become harder to reach as the number of cooperating buyers increases. Demand currently exceeds the supply of EVCI installation and management services. Therefore, suppliers are at risk of becoming overstretched. Buyers should use the procurement exercise to gauge whether a supplier has the capacity and experience to deliver and manage infrastructure development at the scale required. Risk that site specific challenges are not fully considered in the procurement exercise. Similarly, risk that the strengths of some stakeholders may not be fully utilised. |

11.2 Pre-market engagement

Pre-procurement market engagements should aim to provide the buyer(s) with knowledge of the different technical options, service offerings and costs given the buyers requirements.

11.3 Operating Models

Operating models provide the organisational and commercial framework to deliver and manage EVCI.

Table 11.2: EVCI Operating Model Overview

| | A – Privately owned and operated | B – Concession Agreements: Privately operated with risk share | C – Public sector owned and operated |
|---------------------------------------|----------------------------------|---|--------------------------------------|
| Existing and new EVCI asset ownership | Private | Public (concession model) | Public |
| Operator | Private | Private | Public |
| Risk to NHS Wales | No | Yes | Yes |

| Revenue stream to NHS Wales | N/A | Yes | N/A |
|-----------------------------|---|--|---|
| Tariff setting | Private | Private / Public | Public |
| Advantage | <ul style="list-style-type: none"> No capital risk to NHS CPO heavily incentivised to provide good end-user experience by maintaining and upgrading charge points to encourage utilisation Given the level of control this operating model, offers the private sector, it is usually preferable to potential suppliers | <ul style="list-style-type: none"> Greater NHS Wales control over network development and maintenance decisions, CPO is likely to want some influence in these decisions Limited capital or revenue risk to NHS Low NHS resource commitment Likely viability to the private sector | <ul style="list-style-type: none"> NHS retains full ownership of the charging network NHS has significant control over the speed of EVCI deployment This operating model may be more familiar with NHS Stakeholders and therefore, procurement route may be less resource intensive Procurement frameworks could streamline the process and ensure greater confidence in suppliers Flexibility over back office management NHS retains control over charge point tariffs |
| Disadvantage | <ul style="list-style-type: none"> CPO control over tariffs NHS unlikely to retain ownership of the grid connection point, reducing control over the quality of the service. In addition, this could hinder switching to a different CPO Challenges in exit planning and re-tendering if NHS becomes over-reliant on incumbent supplier Likely to involve very long agreement periods | <ul style="list-style-type: none"> Likely less control by NHS Wales lessor than Public own and operate model | <ul style="list-style-type: none"> Network development requires significant capital expenditure Requirement for NHS to cover costs for ongoing operation, maintenance, and upgrades NHS may become the owners of redundant equipment as the charging infrastructure market and technology is developing rapidly (10-year lifespan) NHS carries the risks of unexpected costs such as, electricity price increases Although a service level agreement (SLA) should be in place, the charge point operator is less incentivised to repair faults Operational and reputational risk if the network is unreliable |

11.4 Managing Charge Point Tariffs

If the charge points are owned and operated by the private sector, the CPO will have some level of control over the £/kWh tariff charged. Actions can be taken to mitigate the risk of CPOs significantly elevating tariffs:

- NHS Wales could use current energy costs to establish a maximum tariff that a CPO would be allowed to charge. Bidders then respond illustrating how they would deliver and maintain infrastructure while charging at the rate, which is reviewed at least annually to accommodate for energy price fluctuations.
- NHS Wales may also request data on CPOs network costs. This gives insight into how the CPO has responded to past energy price fluctuations.
- Long contracts may bind buyers into relationships with CPOs who have influence on tariffs, however they also insulate CPOs from energy price fluctuations and the need to pass costs onto users.

- NHS Wales stakeholders may also consider setting up a tariff review process to be conducted during both scheduled reviews and during unexpected change requests from a CPO.

11.5 Routes to Procurement

The Welsh Government is developing a framework for the procurement of EVCI.

Figure 11.1: Welsh Government framework lot structure

| Lot | Lot 1 Electric Vehicle Charge Points | Lot 2 Emerging Charging Technologies | Lot 3 Advisory Services | Lot 4 End-to-end service |
|----------|--|--|---|--|
| Services | 1a. Planning and Design 1b. Supply, Installation, Construction, Commissioning 1c. Network Operation, Back-office Solutions 1d. Service and Maintenance 1e. End-to-end Service | 2a. Renewable Energy Generation 2b. Energy Storage Solutions 2c. Pantograph and Megawatt Charging ³ 2d. Wireless Charging 2e. Mobile Charging 2f. Bi-directional Charging and Services | N/A | N/A |
| Scope | Covers the procurement of EV charge points through purchase, lease and concession. Customers can select individual services or an end-to-end service via the lot structure. All relevant mature charging types are covered in this lot i.e., Type 1, 2, CCS 1, 2, AC and DC etc. This lot will service: <ul style="list-style-type: none"> • Cars, vans, mopeds and motorcycles • Large vehicles e.g., HGVs and PSVs • Personal Light EVs (PLEVs) e.g., e-scooters • Electrically Assisted Pedal Cycles (EAPCs) • Specialist vehicles e.g., Blue Light Vehicles | Covers the procurement of new, developing or collaborative technologies in the service areas listed. It is no longer limited to only HGVs or PSVs. This lot also covers bi-directional charging services from back-office providers and aggregators. This lot assumes end-to-end service provision for each service area covered. | Covers the procurement of expertise/services to support EV charging projects and initiatives including: <ul style="list-style-type: none"> • Strategic partnering guidance • Site planning and feasibility • Energy capacity assessment and demand forecasting/research • Grant funding support • Specification guidance • Power network assistance | Covers the procurement aspects of the goods, works and services required to provide and operate a smart EV charging network from Lot 1 to Lot 3. <i>Note: the appointment mechanism for Lot 4 will be determined.</i> |

11.6 Key Recommendations

- Strategic cooperation between organisations is advised to facilitate, knowledge share and ensure the sustainable expansion of the supporting charging infrastructure for fleet and users alike.
- Develop a high-quality EVCI specification to ensure that a CPO develops and maintains the network as appropriate, so the network meets the needs of its users.
- Develop KPIs in conjunction with the network operator to ensure a resilient and effective EVCI network.
- Fleet EVCI operating models should prioritise only NHS Wales stakeholders.
- Mitigations can be taken during the procurement phase and service delivery to mitigate NHS Wales's exposure to significant tariff increases. However, a collaborative approach to tariff setting should be sought to allow CPOs to generate sufficient revenue to maintain EVCI.

