What to consider when installing fleet electric vehicle charging infrastructure

A support package of important topics that will factor into any fleet charging infrastructure planning.

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Assessing your fleet

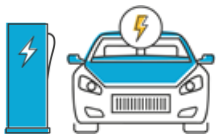
What type of vehicles do I operate?

Different vehicles will have different energy requirements and therefore have different sized batteries, different efficiencies and the ability to charge at different rates. Vehicles with larger batteries such as eRCVs will likely require higher rates of charge to ensure that they are fully charged for their next shift, compared to smaller vehicles like cars.
It is important to keep details of each vehicle in the fleet, some of the main factors are, the battery sizes, efficiencies, max charging rates and the type of power (AC or DC) they can accept.
Combining this information with what the vehicles do allows you to determine the energy requirement of the vehicles.

Where are the vehicles parked and charged?

As not all vehicles are parked in the same location, different charging solutions will be required depending on where they are parked.
If all your vehicles are parked in a depot you might be able to charge them all there. However, if some vehicles go home with staff, you might want to charge at staff homes. If this isn't possible or if vehicles are travelling long distances, they may need to charge on the public network.
It is most likely that a mix of solutions will be needed so knowing where all your vehicles are parked will help you assess what charging locations you need solutions for.

What is the long-term strategy for EVs and charging infrastructure?



The internal combustion engine (ICE) fleet will not transition to EVs overnight, therefore it is important to consider future EVs and their needs when planning infrastructure rollout. Planning where future vehicles might park and charge will make it easier to install chargepoints in the future when the need arises. It will also be useful to plan any ground works for future installations and potentially install ducting to the site of future chargepoints at the start of the infrastructure project. This will reduce the need for disruptive groundworks in the future. As more chargepoints are required there will also be an increase in power demand. It is useful to consider early in the process if there may be a need for more power at the site.

What do the vehicles do?

Knowing your vehicles energy demand is the first step in selecting the most appropriate chargepoint for the vehicle. Once you know the kWh of electricity that is needed to charge the vehicle you can get an idea of the required rate of charge and how powerful your chargepoints need to be.
To figure this out you need to know what your vehicles are doing. This includes, how far they are driving and the types of routes they are doing. The efficiency of EVs will be better in urban driving and lower on the motorways. If the routes are very hilly this will also detrimentally impact the efficiency of EVs.
The method to analyse vehicles and their energy requirement is shown in detain in section three of 'Document 4 – Site Assessment Methodology'.

How long are the vehicles parked for and when?

You need to consider how long vehicles are parked for to determine how quickly you need to charge a vehicle so that it has the range it needs for its next shift.
When a vehicle charges is equally important. Depending on when vehicles are parked, multiple vehicles may be able to use a single chargepoint in a day, which if leveraged will increase utilisation of chargepoints and reduce the number you need.
If you have a time of use tariff you will want to charge vehicles at the cheapest time (usually overnight). Knowing when vehicles are parked will also help you avoid power constraint issues. If all vehicles park at the same time and plug in to charge, there could be a spike in power consumption at the site leading to issues. An example of this is shown in figure 4, section 5.2.1 in 'Document 4 – Site Assessment Methodology'.

Who else might be using the chargepoints?

Not all parking locations for vehicles will be in private depots. Vehicles may well use shared car parks or there may be a need to supply charging infrastructure for visitors to the site as well. Considering all the possible users of the site will ensure that the optimal number of chargepoints are installed.
Accessibility of chargepoints is also an important consideration. Not all users will have the same degree of movement or flexibility therefore, installing chargepoints in a way that at least some are easily accessible will ensure equal access to the infrastructure. This is highlighted in the PAS1899 policy that is currently under consutation. This is more relevant to public charging than fleet, however, it is useful to bear in mind.

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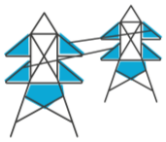
Assessing your fleet and where it parks

Site constraints?



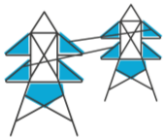
It will not always be easy to install chargepoints at all parking locations. There may be no space to install chargepoints, especially if vehicles are parked closely together and there could be other issues such as a lack of an electricity connection. Assessing these constraints will help you whittle down charging locations and help you understand any issues early on in the project. Some of the main questions you want to answer are:

- Where do I have access to power,
- Where do I have space for power distribution,
- Where do I have space for charging infrastructure and
- Where can I install chargepoints in relation to power supply.

Should I consider passive provision for future EV charging infrastructure?

Ground works can be a substantial portion of the cost of chargepoint installations. Therefore, limiting the amount of times major works have to be done should save money in the long run. If more power is required from the grid for current chargepoints, you should consider installing cabling and infrastructure that is suitable for your future power demand. This passive provision will ensure a smooth transition to EVs in the future.

Do I need a DNO upgrade?



After assessing the power demand, if there is still greater demand than supply, an electricity connection upgrade will likely be required.
This upgrade will need to be completed by your DNO and therefore, you will need to get in touch with them about your upgrade request. The DNO will then quote you for the works, this is split into contestable and non-contestable costs. The non-contestable works must be completed by the DNO, however, the contestable costs can be completed by a third party. These are things such as ground works.
There can be substantial lead times on DNO upgrades, depending on the size of the upgrade, therefore it is important to begin this process early in the planning stages of the charging infrastructure installations. Section 6.1 of 'Document 3 – Site Assessment Methodology' goes into more detail on the process, costs and timescales of connection upgrades.

What electrical capacity do I have available and when?

A major constraint to consider is how much spare electrical capacity you have and when it is available. Charging multiple EVs, even on lower powered chargepoints can quickly use up the power you have available on site. Early in any charging infrastructure project you should assess how much capacity you have available, when it is available and you should also get in touch with your Distribution Network Operator (DNO) to find out early on if you are able to increase your capacity or if there are any issues. They will also be able to give you a cost estimate for the work.
Section one and two of "Document 4 – Site Assessment Methodology" goes into detail about understanding electricity supply.

Should I consider load management?

Once the current and future demand of EVs charging on the site has been understood, if the unmanaged demand is greater than the supply, solutions to reduce the demand should be considered.
Load management is the process of controlling when charging happens and the power delivered by the chargepoints to avoid exceeding local power constraints.
Load management can reduce spikes in power demand by smoothing the charging over time which can reduce the peak power required by the site. Depending on the level of load management (how intelligent the system is) the price can vary. For an introduction to load management please refer to "Document 3 – Introduction to Load Management". The effect it will have on site energy demand is further explained in section five of "Document 3 – Site Assessment Methodology".

Should I consider on-site storage and generation?

On-site generation of electricity (commonly through solar PV) and storage of the electricity in batteries can be used to reduce peaks in power demand. The power generated can be used to directly charge vehicles or charge up a battery when there is no demand. The suitability of this solution is site specific and depending on available roof space, orientation of the roof and other factors the efficiency of the system will vary. However in certain circumstances such a system could negate the need for a costly electricity connection upgrade. If the site is not suitable for solar PV then a battery storage system could be implemented independently to manage demand. With or without on-site generation, the spare grid import capacity will need to be sufficient to recharge the battery storage system at times of low vehicle charging demand. For more information on this, please see section 6.2 in "Document 4 – Site Assessment Methodology".

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Choosing the right chargepoint

What power output do I want from the chargepoints?

The most common chargepoint power ratings are slow 3.6kW, standard 7kW, fast 11-22kW, rapid 23-50kW, and ultra-rapid 50kW+. The power output is based on the requirement from the vehicles and in most cases the lowest powered chargepoint that satisfies the charging requirement will be most suitable. This is because charging vehicles slowly over as long a period as possible will keep any spikes in power demand to a minimum. However, charging on a higher powered chargepoint can give more operational flexibility.

Do I need a smart chargepoint management system?

Chargepoints have different levels of smart capabilities, from being able to remotely see if a vehicle is connected to the chargepoint to varying the power output based on the site demand.
The smarter the chargepoints the easier it will be to manage EV charging as the number of EVs and chargepoints in your organisation grow. It is important to consider from an early stage the interoperability of software. If you use one piece of software for some chargepoints and a different type for others, this will be more difficult to manage.
In a software-based system each chargepoint communicates with a chargepoint management-system (CPMS). The CPMS allows remote access through the internet, typically making use of the mobile network.
The CPMS can provide remote load management functionality as well as billing and authentication. Advanced CPMS' can also offer vehicle scheduling and tariff optimisation and can support with energy systems integration and on-site renewables and battery storage. Typically the more functions the CPMS has, the more it will cost and these are often monthly or annual subscriptions. More information on this can be found throughout '[Document 3 – Introduction to Load Management]' and in particular section 2.2.5.

Do I want AC or DC output?

Chargepoints can deliver AC or DC charging. AC charging is typically slower than DC and this is because DC charging bypasses the vehicles on-board charger, which is limited in the power it can accept.
DC chargepoints have a dedicated charger incorporated into the unit and because they are more complex than AC chargepoints, they are typically more expensive.
The decision whether to go for an AC or DC chargepoints will likely come down to the rate of charge you require from a chargepoint. However, it is also important to consider the power and type of charging that the vehicle can accept as this will vary from vehicle to vehicle. This is because some niche vehicles will only accept AC power and others DC power.

Do I want single phase or three phase power supply?

Some chargepoints can operate using single phase and others three phase power. Single phase chargepoints will usually be 7.4kW and under, three phase power will be required for more powerful chargepoints.
Depending on the power supply to your site you may be restricted to single phase chargepoints if you do not want to upgrade the existing supply. If you currently have single phase power, upgrading the supply may future proof your supply for future charging infrastructure installations.

How robust do my chargepoints need to be?

Depending on the location of a chargepoint, the unit may need to be more robust so that it can handle harsher conditions. Chargepoints will have different impact (IK) and ingress (IP) protection ratings so this should be considered if it is likely that chargepoints will be knocked or bumped into by vehicles or machinery. Most chargepoints are rated so that they can be installed outside, but this should be checked before procuring units if they are to be installed outdoors.
If there is potential for collision with the unit, there are further steps that can be take such as installing impact protection mechanisms. These mechanisms can be things like bollards or bump stops installed in front of the chargepoint that stop vehicles accidentally colliding with the chargepoint.

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Choosing the right chargepoint

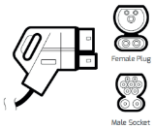
Do I want tethered cables or sockets?

A chargepoint that is tethered has a charging cable permanently attached, whereas a socketed chargepoint has a socket and the EV driver brings their own cable to plug in. Socketed chargepoint are useful for low powered chargepoints such as lamppost chargers. Socket outlets are most commonly used for public charging where tethered cables, which add cost and are more likely to be misused or vandalised. Tethered cables are often found on higher powered chargers. This is because the cables have to be larger to handle the power going through them and it would not be feasible for drivers to carry these around. In a depot it is likely that all chargepoints would be tethered as this is the most convenient for operators. If installing chargepoint in public or semi-public areas you might want to consider using socketed chargepoints for the lower powered chargers.

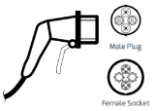
What connectors do I want?

Type 2

CCS



CHAdeMO



There are three main connectors in use in the UK. For AC charging the dominant standard is “Type 2” and this is typically used for relatively low power charging (<22kW). For DC charging there are two standards in use in the UK, CCS and CHAdeMO. These will typically deliver charge at power output of above 22kW.
CCS is the most dominant DC charging standard in the UK and Europe, whereas CHAdeMO is only used by Japanese manufacturers such as Nissan and Mitsubishi. However, even Nissan are using CCS for more recent EVs such as the Ariya. More detailed information on connectors can be found in section one of “Document 2 – Introduction to EV Charging”.

Do I want the chargepoints free standing, wall or post mounted?

Chargepoints can be mounted in different ways and in most cases there will be a solution that will work in any locations. The most conventional mounting solutions are;

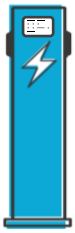
- To have a chargepoint mounted directly on a wall. This is generally cheapest as there is no need to buy any other mounting equipment.
- To have a chargepoint mounted on a free-standing post. This solution would use the same type of chargepoints as in wall mounted but it would be installed on a post that had been erected in the ground.
- To have a free standing chargepoint. This is when a chargepoint comes in a form that is mounted directly on the ground.

It is useful to bear in mind that there will often be a compromise between the best installation position (from a mounting perspective) for chargers, and the distance from a point of supply.

How many connectors or sockets do I want per chargepoint?

Most chargepoints below 22kW will have one or two outlets. Typically, it is cheaper to buy a double outlet chargepoint rather than two single outlet chargepoint because the two outlets will share a single housing. The two outlets will usually be able to charge at the same time at the rated power of the chargepoint and allow two vehicles parked next to each other to charge off the one unit.
More powerful chargepoints usually have two or three connectors and can offer multiple different connector types (CCS, CHAdeMO and Type 2). However, If you are installing these in a depot, you will want to configure the connector types based on the socket types of the vehicles.

What features do I want my chargepoints to have?



There is a large variety of functions that can be chosen from when purchasing chargepoints. A common function is whether or not the chargepoint has a display screen. Most high powered chargepoints will have a display screen. However, you may get the option of a display screen with lower powered chargepoints. In a public setting this may be useful to show status, tariff or chargepoint information, but in a private depot setting this may be less important. Selecting only the functions that are required will keep costs down while ensuring that chargepoints are still useable. The EVSE database provides information about the functions different chargepoints have. Use this to help you select the most appropriate chargepoint for your site.

Do I need charging to be authorised?

There are multiple different methods to start and stop charging on a chargepoint. Depending on the location (public or private parking) you might only want approved users to be able to access the chargepoints. This functionality is possible in different ways, some chargepoints use RFID readers to authorise charging, others use apps, keys or tokens. However, if chargepoints are installed in a private depot authorisation may not be required and chargepoints without this functionality can be cheaper. If a user is paying for charging, authorisation will be required.

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Other considerations

What are the ownership models?

There are different ownership models to be considered when procuring EV charging infrastructure. The difference between each is the level of private and capital funding, the revenue that is retained by the host and the control the host has over the system. In a fleet context there will be no revenue generation as charging tariffs will not be used. Because of this, an own and operate model is often used. In this case the host will pay all capital costs. However, this means that the host has control over every aspect of the system. The costs of the charging infrastructure will then be repaid through savings in fleet operating costs, particularly due to the reduction in fuel costs by switching to electric vehicles.

How should I procure chargepoints?

As each organisation will have different procurement rules these should be followed. There are, however, specific frameworks that are suitable for local authorities to use such as the Vehicle Charging Infrastructure Solutions (VCIS) framework.
Energy saving Trust produced some useful guidance on procuring electric vehicle charging infrastructure, this can be accessed via this link: Local Authority Guidance – Procuring Electric Vehicle Charging

Who else should I consider speaking to for advice?

Other organizations that might be useful to talk with around EV charging infrastructure are the likes of Energy Saving Trust (EST) who can provide information on how to save money and carbon and how to access a variety of support and funding.
The Association for Renewable Energy and Clean Technology (REA) have several resources on their website that go into detail on the ever-changing landscape of EVs and EV charging infrastructure.
Sub-national transport bodies such as the Midlands Energy Hub and Transport for the North may also be useful contacts to discuss charging infrastructure in the wider context of the region. Cenex can offer independent impartial advice on EVs and charging infrastructure and has a suite of resources and case studies online that can help you.

How do I manage different charging sources and payments?

When charging is done at a fleet depot, managing the payment of electricity is easy. This is because the electricity used is already billed directly to the organisation. However, if charging is done on the public network or at staff homes a solution to repay staff or ideally to pay for the electricity used without it coming out of the employees' pocket is needed. There are cards similar to fuel cards that are available that staff can use to charge EVs on the public network, using these will allow staff to charge without paying for it themselves. There are also software-based solutions that can be used to pay directly for staff charging at their home without them ever being out of pocket for the electricity consumed.

Who should I engage with?

In the past the fleet manager was likely the only staff member that would manage vehicles their procurement and refueling. However, with EVs, a wide range of departments will need to be consulted and involved in deploying charging infrastructure.
A non-exhaustive list of departments that may need to be involved are energy, facilities, environmental, infrastructure and of course fleet. These departments need to be consulted as it will help bring any issues to the surface that may not be immediately recognizable. These could be things like not having enough power available on site, future expansion plans and changes to infrastructure layouts. However, as this is a new technology and will be a sizeable change for users, they will also have to be consulted. Ensuring staff know how to use chargepoints will build confidence in the technology and build buy-in to the transition.
Encouraging buy in to EVs will promote a smooth transition. Initially users need to understand why the transition is necessary, this means they need to be educated in the environmental and health benefits of moving from ICE to EV.
Once they are on board with the concept, it is important to make sure they are comfortable with the technology. This means training users on how to drive an EV and the differences between them and an ICE vehicle. Following this, showing them how to charge an EV is crucial. This will make sure that EVs are fully charged when they are next used.
For an introduction to low carbon road transport, Cenex has developed a course that is available on the FutureLearn platform here.

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