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EV Charging Installations

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PRESENTATION / SLIDE TITLE

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Be. EV – Physical charger types. Connectors types, Smart/dumb, AC/DC & public networks.

EA Technology on *"The practical considerations before installing EV chargers."* This would be things like network capacity and the connections process, harmonics, grants, back office software/management etc. Basically what you need to understand before you even consider purchasing and installing a charger.

If you stick to the practical things on installation that an electrical contractor needs to know then you should be good.

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Introduction to Cenex

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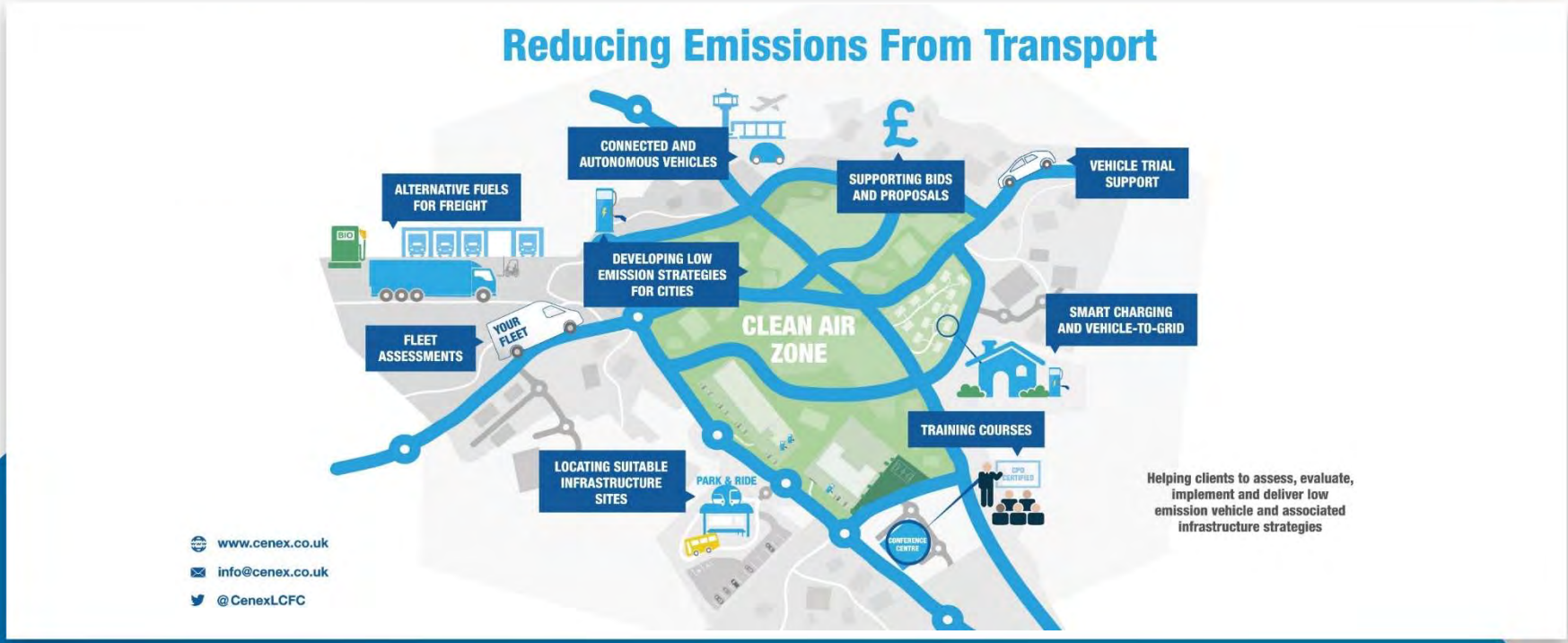

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Contents

- OZEV grant schemes
- Regulations and standards
- Installation specifics
- Disabled users
- Future proofing
- Site surveys
- DNO notification process
- Manufacturer approvals

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OZEV Grant Schemes - Intro

Office for Zero Emission Vehicles

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- The Office for Zero Emission Vehicles (OZEV) has three grant schemes for charging infrastructure:
  - Electric Vehicle Homecharge Scheme **(EVHS)**
    - £350 inc VAT per chargepoint or up to 75% cost of purchase and installation
    - Customer must have private off-street parking
  - Workplace Charging Scheme **(WCS);**
    - £350 inc VAT per socket or up to 75% cost of purchase and installation
    - Limited to 40 sockets for all sites per applicant
    - ≤ 22 kW AC or DC charging only
  - On-street Residential Charging Scheme **(ORCS);**
    - Administered by the Energy Saving Trust (EST)
    - A maximum grant fund of £7,500 per chargepoint, rising to £13,000 for locations with high DNO connection costs
    - Can include rapid charging

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Becoming an OZEV approved installer

Office for Zero Emission Vehicles

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- To access **EVHS** and **WCS**, you must become an approved installer. This requires:
  - Manufacturer approval
  - Competent Persons Scheme membership (e.g. NICEIC, NAPIT)
  - Commit to:
    - Retaining install information
    - Testing functionality of chargepoints
    - Complete and submit evidence of EIC to BS 7671 and DNO notifications
    - Install chargepoints in accordance with IET Code of Practice for Electric Vehicle Charging Equipment Installation
  - Banking information
  - Details of any sub-contractors
  - Note you can also become an “installer representative” – this is essentially an entity that is applying to become approved to sub-contract the installation work to other businesses.
  - OZEV guidance documents EVHS guidance, WCS guidance and OZEV Application form.

- For ORCS, the application is managed by the Local Authority, and therefore they will procure installation services themselves. However minimum requirements are likely to mirror those for OZEV grants.

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Claiming OZEV grants

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- For **ORCS**, the application and claim is managed by the Local Authority
- For both the **WCS** and the **EVHS**, the installer claims the grant funding on the customer's behalf.

EVHS

- Installer surveys, verifies that customer meets EVHS requirements, quotes and completes the installation
- The installer invoices the customer for total cost less the grant
- Installer compiles the grant claim information and submits the claim form to the DVLA
- OZEV pays the installer the grant

WCS

- The customer applies using online application form
- Successful applicants receive a voucher and pass to their chosen installer
- Installer surveys, quotes and completes the installation
- The installer invoices the customer and receives payment (pending customer approval) for total cost less the grant
- Installer then claims the grant using the voucher provided by the customer

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Grants – The Future?

- **EVHS**, **WCS** and **ORCS** were extended until end of FY 2021/22 [announced: Feb 2021].
- What about FY 2022/23 onwards?
  - EVHS will change to only be accessible by those living in rental and leasehold properties
  - EVHS is moving to a more digital process, potentially similar to that for the WCS (due second half of 2021!)
  - ORCS, WCS: future uncertain
  - Recent news of upcoming legislation for all new homes and offices to include EV charging

Photo: Electrek

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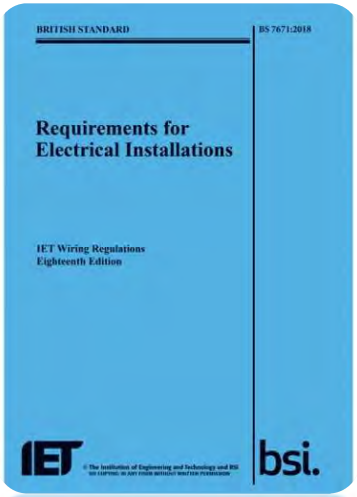
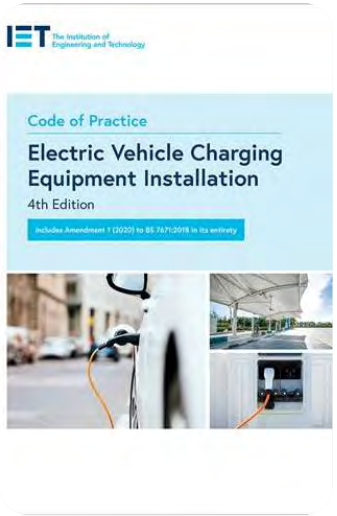
Standards

BS 7671 – "The IET Wiring Regulations"



The IET Code of Practice



Key aspects:

- Electrical:
  - RCD Protection
  - Earthing
- Physical:
  - Parking bay layouts
  - Impact protection
  - Considering disabled users
- DNO notification

Installation Specifics – Electrical - Earthing

- Since V18 of BS 7671 you cannot always safely install an outdoor EV chargepoint on a TN-C-S (PME) supply.
- There are 5 methods to get around this, of which only 2 are usually practicable:

Part of BS 7671 722.411.4.1	Method	Comment
(i)	Install on 3-phase supply with balanced loads such that touch voltage ≤ 70 Vrms.	3-phase only. Not often practicable except on very large sites.
(ii)	Connect an earth electrode to the MET to reduce touch voltage to ≤ 70 Vrms	Impracticable to achieve low enough electrode resistance.
(iii) - (v)	Install a device which disconnects the supply and protective earth when there is a PEN fault	Common. Device may be built into the chargepoint or a separate device
N/A	Convert the entire installation to TT	Not often practicable
N/A	Install a separated TT earthing system for the chargepoint	Common. Still requires some other considerations to be made to be done compliantly.

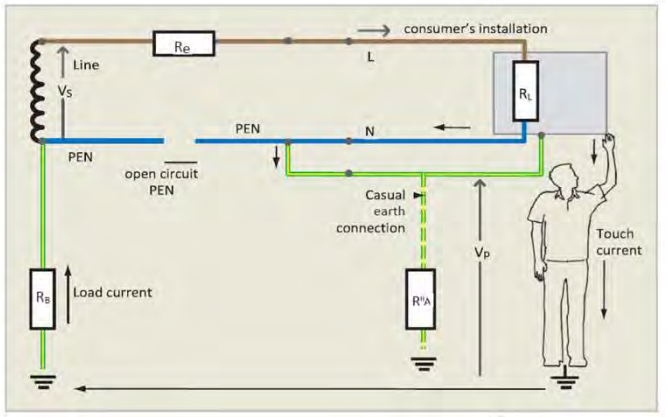


Image: IET Code of Practice

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Installation Specifics – Electrical – Earthing

PEN Fault Detection Devices

Either built-in to chargepoint or provided with a separate device to be installed in the supply.

Pod Point Solo

Andersen A2

MyEnergi Zappi

Rolec O-PEN

Matt:e

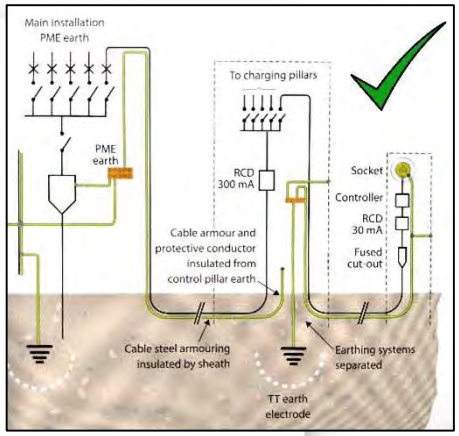
Safevolt

Images: Google

TT Earthing – the pitfalls

When installing at TT earth for the chargepoint, you need to consider the following:

- The **TT earth must be separated from the premises (TN-C-S) earth**, otherwise you're just using option 722.411.4.1 (ii) which is very hard to get a low enough earth electrode resistance to get the touch voltage reliably ≤ 70 Vrms.
- You need to do a risk assessment to confirm:
  1. No possibility of simultaneous contact between TT installation and exposed/extraneous conductive parts of the PME earth of the main premises or adjacent installations on PME. **Recommendation = 2.5 m separation**
  2. Adequacy of separation between earth electrode (or alternative) of the TT system and buried metalwork connected to a PME system. **Recommendation = 2.5 m separation or 2.0 m for on-street installs.**
  3. No risk of striking buried services when installing earth electrode
- Potentially challenging installs:
  - Buildings with exposed steelwork (1)
  - Driveways with service pipes (e.g. outside tap) or close to lamp-posts (1)
  - Small curtilage properties (2)
  - On-street installations with lots of buried services (3)



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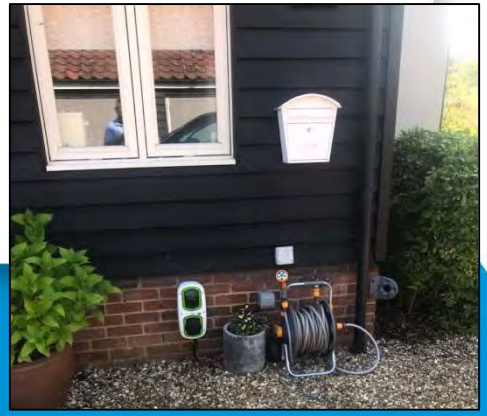

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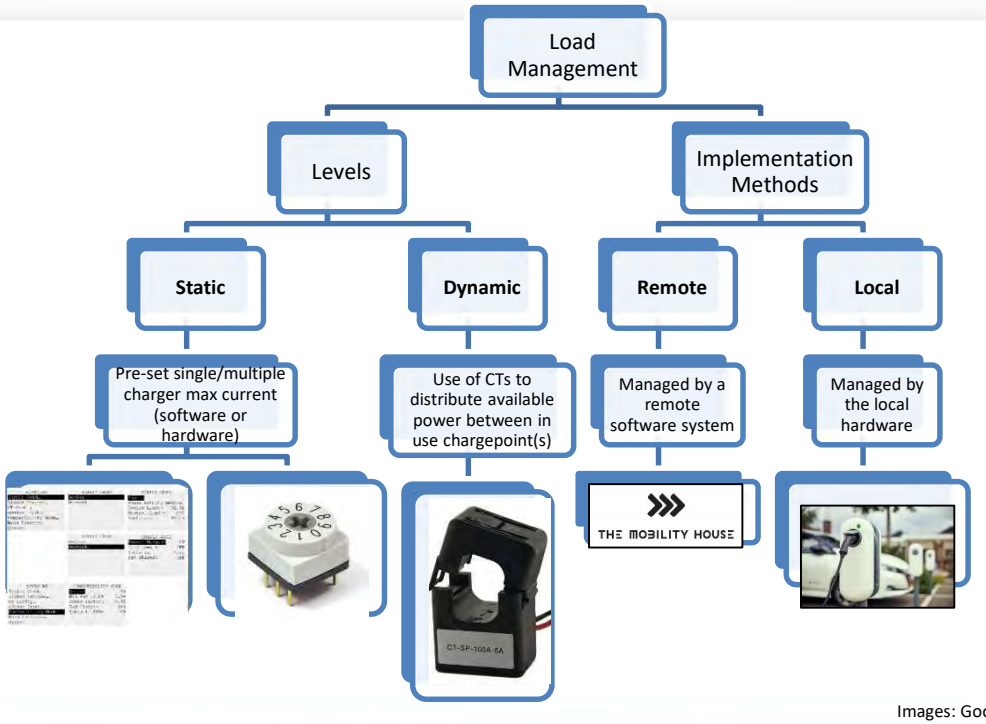
Installation Specifics – Electrical – Adequacy of Supply

- An adequacy of supply assessment will be required.
- Must consider loads on each phase for 3-phase sites.
- Watch out for looped supplies!
- No diversity factor can be used for EV charging unless installing large numbers of chargepoints (>20), or **load management** system is used.
- Will also need to consider suitability of adding load to existing distribution equipment.

Remember, it is the installer who is responsible for determining the new maximum demand and ensuring it does not exceed supply capacity.

Installation Specifics – Electrical – Implementing Load Management

- It may be the case that some form of load management is simpler and more cost effective than upgrading the supply.
- The installer will have different responsibilities depending on the load management system used.
- Ensure CTs are installed correctly.
- Need to make site aware that any future changes to site loads will not be accounted for by static load management systems.



Images: Google

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Installation Specifics – Electrical – RCD Protection

- RCDs provide protection against fault with the charging system.
- Another key part of BS 7671 (722.531.3 in V18 Amendment 1:2020)
  - ≤ 30 mA operating current
  - DC fault current protection
- Two methods:
  - RCD Type A or Type F plus residual direct current detecting device (RDC-DD) to BS IEC 62955
  - RCD Type B
- In practice:
  - The **vast majority** will have the DC protection built-in
  - The **majority** also have an RCD Type A built-in
- Therefore, installer therefore needs to ensure that:
  - Correct RCD protection is provided at point of distribution for cable and/or chargepoint depending on specification of chargepoint
  - RCDs are correctly labelled
  - RCDs are tested (where possible)
  - Ensure selectivity and ordering of RCDs

The RCD Handbook - Guide to The Selection and Application of Residual Current Devices (RCDs) (beama.org.uk)

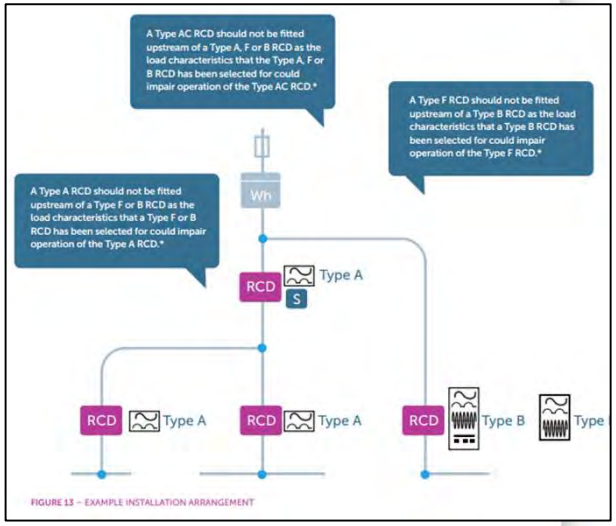

Image: BEAMA

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Installation Specifics – Communications & Cables

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- Expect to need to install communications for EV charging!
  - EV chargepoints currently installed using EVHS grant funding must be smart
  - For WCS and ORCS, the applicant will need to ensure they can provide usage data to OZEV, and therefore the chargers need to be connected to a back-office system
  - Government is legislating that all private (domestic and workplace) chargers are smart
  - All public chargers require a data connection to be operated

- This can be provided in one of three main ways:
  - For domestic:
    - Connection to a local WiFi network – **WiFi strength?**
    - Fixed connection to local network – **consider use of specialist EV cable types.**
  - For workplace/public:
    - Connection to a mobile network – **network strength?**

Cable selection considerations:

- Is the cable suitable for the environment and mechanical protection provided?
- Would a cable that can provide an integrated data connection be useful?

Image: Doncaster Cables

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Installation Specifics – Physical – Civils

- Two options for mounting floor-mounted chargepoints:
  1. Poured concrete base
     - Cheap
     - Curing time
     - Issues with flatness, surface finish
     - Coordination of civil and electrical teams
  2. Specialist “universal” mounting systems:
     - NAL sockets
     - EV Blocks
       - Standardised between chargepoints with adaptor plates
       - Integrates nicely with ducting
       - Designed for local earth electrode if required
       - Allows for same-day install
       - Expensive

- Also need to think about any required trenching for cable runs and the ground conditions
- Selected location for chargepoints may be a compromise to minimise cabling and civils

Images: NAL Ltd

Images: EV Blocks

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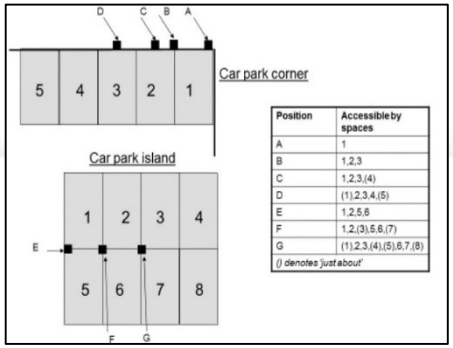
Installation Specifics – Physical – Parking Layout

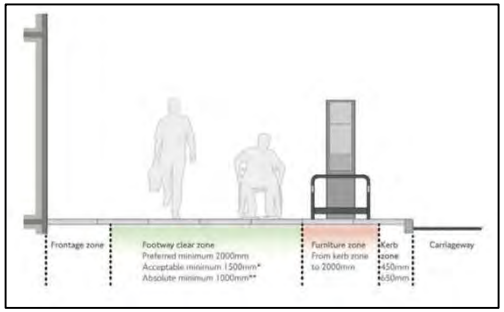
Consider the bays that will be served by each chargepoint:

- General recommendation is to locate chargepoints away from corners of car parks.
- To maximise potential “reach” of a chargepoint, chargepoint islands are great.
- However, locating chargepoints between rows of parking can increase risk of vehicle damage if there is no kerb.
- Therefore, as a minimum chargepoints should be located at the corner of two spaces (position B).

Also consider the impact of the chargepoint on the surrounding space:

- Chargepoints should be located at kerb-edge of pavements, but set back to avoid impact damage.
- Recommendation for on-street designs is that 2 m of clear footway should be left.
- May not be possible for car parks with narrower pavements, however ensure that trailed cables are not going to cause a trip hazard.





[London's electric vehicle charge point installation guidance (tfl.gov.uk)]

Images: EV Clicks

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Installation Specifics – Physical – Signage, Bay Marking & Impact Protection

- Signage should be included to indicate that the parking is for EVs only.
- Bay marking can be useful in addition to deter ICEing or give visibility to EV users. Particularly useful in public locations.
- In large car parks, signage to direct the EVs to the chargepoint area can be important.
- For chargepoints that are either high value (rapids) or in a highly exposed position, impact protection is recommended:
  - Bump stops
  - Barriers or bollards

Images: EV Clicks

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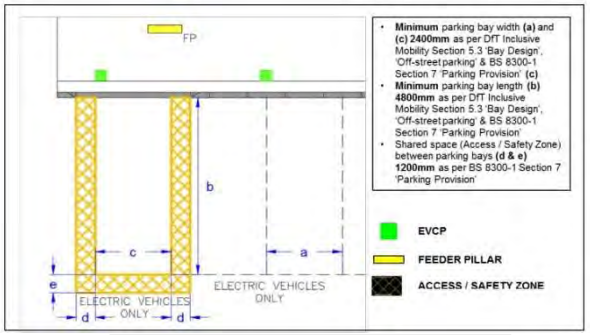
Disabled users

- This topic is getting more and more attention. The need is to prevent disabled drivers being left behind in the electric transition:
  - 1 in 5 people in the UK reports a disability
  - 1 in 10 new cars are bought for/by a disabled person
- Current rates of EV uptake among disabled people is behind UK average

Measures to take:

- Parking bay design (BS 8300-1)
- Providing sufficient lighting, shelter
- Ensure impact protection does not impede disabled access



Images: EV Clicks

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Future Proofing

- An installation can be made more future-proof by passive provision.
- **Passive provision** is the concept of including infrastructure or systems as part of the deployment that enables more chargepoints to be deployed easily at a later date. Three main methods:
  1. Provision of an electrical supply and distribution equipment that is oversized for initial development but can support more chargepoints.
  2. Using a dynamic load management system that may not be 100% necessary at first but will allow more chargepoints to be added in the future.
  3. Provision of civil works such as trenching, ducting, standard ground mounts ready for more chargepoints to be added.
- How much? Depends on the customer's strategy.

← Better to do one large supply upgrade than two smaller ones? Most likely

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Site Surveys

- A site survey is necessary to cover all of the aspects discussed:
  - Supply rating, load survey and adequacy of supply
  - Earthing – Premises earthing type; equipotential bonding; risk assessment if installing a TT earth
  - Electrical distribution design including plan for RCD protection
  - Civil works required
  - Physical design for parking bays, impact protection, signage etc
  - Mobile or WiFi signal strength at charging location

- As well as:
  - Hazardous zones
  - Isolation plan for conducting works
  - Land ownership
  - Site access
  - Environmental exposure

Images: Google

DNO Notification

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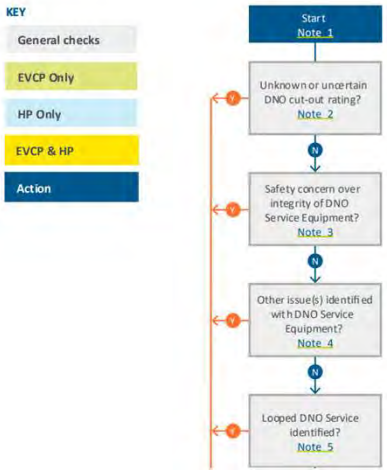
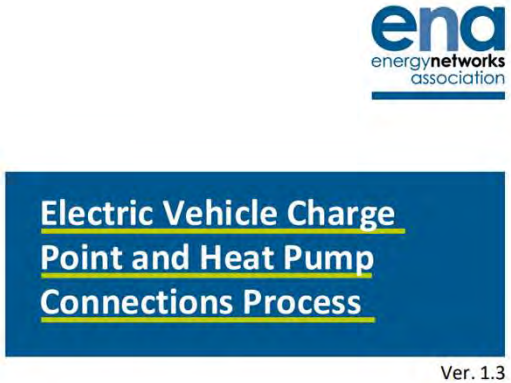
Connect & Notify or Apply to Connect?

Apply to connect if any of:

- EV charging and heat pump
- Maximum demand > 60 A per phase and max AC output of chargepoint > 30 % of MIC
- DC charging and not in ENA database
- V2G > 16 A per phase





low-carbon-technologies-combined-installation-process-flow-chart.pdf (energynetworks.org)

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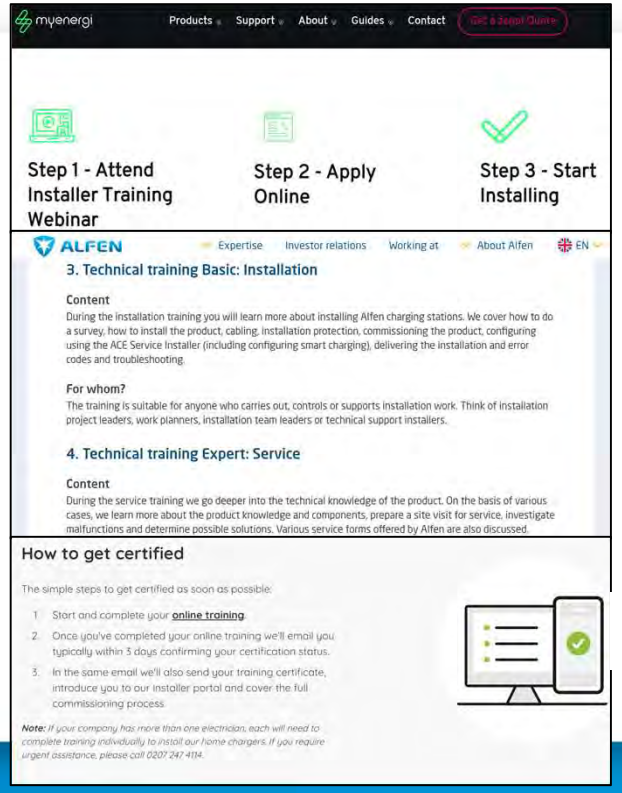
Manufacturer's Instructions and Approvals

- Many manufacturers require you to complete training to become an approved installer of their products.
- These can be in person or virtual training sessions, and may have refresher periods.
- There may be levels of training offered, with "installer" training being more basic than "service".
- As well as those aspects we've covered, training will include instructions on:
  - Overcurrent protection
  - Cable type selection and termination
  - Mounting arrangements
  - Commissioning process
- OZEV's approved chargepoints list is a good resource if unsure where to start – EVHS, WCS



MyEnergi

Alfen

Pod Point

Images: MyEnergi, Alfen, Pod Point

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Thank you for listening

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