How to Choose Your EV Charging Solution

What type and brand of electric bus to choose is key when moving away from internal combustion power.

The bus fleet must meet criteria of autonomy, comfort and ergonomics that can be adapted as required to suit future requirements.

It is therefore relevant to include in this reflection charging station suppliers. Here's what you need to know:

How Will You Charge Your Buses?

In most cases, electric buses are charged at the depot. However, if that isn't sufficient to maintain vehicle autonomy, other solutions outside the depot can be considered.

Depot Charging

When not in service, buses return to the depot. This might be a short stop to complete battery charging (often during the day) or a longer break to allow a full recharge (usually at night).

The depot can be equipped with **charging systems** in the form of terminals or a **gantry**.

Charging Stations

During long breaks, buses can be recharged using an AC terminal (where the charger is carried on board). For more limited charging periods and where buses have high-capacity batteries, DC charging is

preferred as it delivers more current and therefore energy in a limited time.

DC chargers can charge one or two buses simultaneously. In this case, the power is adapted and distributed according to the needs of each bus. If the pedestrian crossing near the bus is to be freed up, the power electronics can be housed in a cabinet and only the gun(s) will be made available to the driver on a dedicated stand. These are the notions of proxi (proximity) or remote charging.

Gantry Charging

In this case, the gantry carries devices that connect to the roof of a bus. The main advantage is that the system can carry high DC power, allowing fast or even ultra-fast charging.

Drivers also do not have to handle the cables and connectors. They simply have to park the electric bus under the gantry. However, there are two disadvantages: the depot must be able to accept this type of structure and the bus must be equipped with the appropriate device on its roof.

Non-Depot Charging

There are two types of non-depot charging: end-of-journey charging and opportunity charging.

End-of-Journey Charging

If the return journey is incompatible with the bus's autonomy, it could make a top-up charge at the terminus first. Depending on the break time, a fast charge is carried out via a terminal or an ultra-fast charge via a pantograph. The size of the installation (power of the charging point) will depend on the amount of energy to be produced in the time allowed.

Opportunity Charging

A **dome** installed at the bus stop will allow the batteries to be recharged in a few minutes by connecting to the bus roof. This fits in well with the urban landscape, but the electrical distribution network near the stop has to have the necessary power.

Minimum Charging Power and Managing Charging Time

Set the Charging Power

The batteries on a bus will vary in capacity depending on the bus's desired range.

To recharge a battery, it must either be supplied with more current in a limited time or with a limited current for a longer period. The aim is to give the bus sufficient autonomy for its next journey, i.e. to complete the battery charge to a sufficient level.

The maximum charging time available depends on the bus's use schedule. The charging current must be adapted based on the available time. This will affect whether an AC charger or a DC charger is more suitable.

Ideally, a DC charger should be flexible throughout its life, being able to receive additional power modules for new types of battery later.

Define the Charging Time

In a terminal format (proxi or remote), the gun and associated CCS socket limits the maximum current. For higher-power and ultra-fast charging, domes or gantry and pantograph are preferred.
The bus, capacity of the on-board batteries and the route characteristics will determine estimated power consumption. Together with the bus usage schedule the maximum charging time can then be calculated.
This will inform the power of the charging station to guarantee the autonomy of the next journey.

Infrastructure Upstream of the Chargers

In order for chargers to deliver energy to buses, they need to receive energy, meaning they must be connected to **electrical infrastructure**.

It may be relevant to monitor or control the chargers from the depot offices, to have them synchronise with the bus usage schedule and to co-ordinate with each other for smart charging. The chargers could send a message via the web when maintenance is required. It could therefore be necessary to connect them to the computer network.

Electrical Infrastructure

Each terminal is supplied with low voltage via a protective circuit breaker.

The circuit breaker protects the terminal and its power cable; it can also integrate a measurement of the distributed energy or even communicate information via a

computer network. A low-voltage switchboard groups together all the circuit breakers and receives its energy from a delivery point of the national electricity network.

If the depot installation has many terminals or if high power levels are used, several switchboards and/or delivery stations may be necessary. The availability of electrical energy can also be secured by connecting each switchboard to two sources (e.g. national grid and site installations such as photovoltaic panels) or to a back-up unit.

In addition to the physical connection to the grid, the electricity supplier will be chosen according to various criteria. Being able to predict consumption and to modulate it as needed are assets for negotiating good purchasing conditions. The use of a **smart-charging** system can lead to rapid savings.

IT Infrastructure

Each charging station has an integrated computer system to manage the exchanges between the vehicle and the station. This device makes it possible to identify the vehicle and modulate its charging needs. It may be appropriate to interconnect all these devices to allow dialogue and synchronisation with the depot's activity management tools.

The charging stations, once connected, can be controlled by a smart-charging solution that will synchronise the charges according to the time the buses are stopped and their use schedule, thus optimising the site's energy consumption. The smart-charging system interconnects with the depot's IT network and communicates with planning tools to take into account last-minute changes.

If a (secure) external link is set up, the terminals can transmit their operating information for analysis by a remote application. The compilation of this information will provide graphs, history, operating reports or periodic consumption reports. Each charging station could directly send a message to request preventive or curative maintenance. They can also send a message directly to a smartphone. The operator can then connect, via smartphone or tablet, to the supervision platform to have a complete and real-time overview of the situation at the depot.

To summarise: in order to **choose the right charging station for electric buses**, the type of charging (at the depot or outside), the charging time, and the infrastructure upstream of the chargers all matter. **There are many different charging solutions** and some products perfectly complement the choice of bus type or provide the right solution for a particular line in an urban network.

It is therefore best to take into account both the bus manufacturer and the charging solution supplier when defining a strategy to incorporate electric buses.