JST France

THE QUALITY CONNECTION

ELECTRIC VEHICLES CHARGING EQUIPMENT

ELECTRIC VEHICLES CHARGING EQUIPMENT

DEFINITION
ISSUES &
ADVANTAGES

JST ELECTRIC VEHICLES CHARGING EQUIPMENT

DEFINITION :

The connectors in electric vehicle charging equipment are essential to ensure a secure and efficient connection between the vehicle and the power source. Here are some key points to consider.

Sockets types :

Domestic

For a domestic appliance, which is a simple but rather a daily time-consuming solution (may cause the electrical circuit to overheat)

Reinforced or Green'up

It's an intermediary between a domestic socket and a wallbox-type terminal.

Its design is like a domestic socket but is more powerful and robust (also known as a reinforced socket)

Type 1

Mainly used in Asia and in the United States, replaced in Europe by Type 2. (single-phase use)

Type 2

The most widely used in the EU, it allows for single-phase or three-phase charging with several charging modes

CCS Type

Considered as an extension of the type 2 socket, it enables rapid charging with direct current

Type 4 or CHAdeMO

Allows fast charging with direct current, but not alternating current, which requires two sockets for the vehicles concerned

Charging stations types :

- Wallbox charging station : wall-mounted charging station, the most common and practical to install.
- Floor-standing charging station : bulky and more difficult to install.
- Fast charger : often available at motorway service stations, shopping centers and petrol stations, but can also be installed at home.

Please note : from 2026 onwards, electric charging stations with a capacity of at least 400 kilowatts (kW) will have to be installed every 60 km along the main motorways of the European Union.

Hydrogen refuelling stations, intended mainly for heavy goods vehicles, should also be available every 200 km by 2031.

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Compatibility :

The connectors must be compatible with the vehicle to ensure efficient charging.
Charging stations are often equipped with several types of connectors to accommodate different vehicles, but thanks to regulations, compatibility between stations and vehicles is becoming widespread.

Security :

The connectors are designed to be robust and secure, minimising the risk of short circuits or overheating.
They often incorporate locking mechanisms to prevent accidental disconnection during charging.
They must comply with European safety standards, in accordance with IEC 61851-1; this ones establishes criteria for charging modes, safety, communication and terminal equipment.

Communication :

The connectors also enable communication between the vehicle and the charging station.
This includes information on the charge status, power output and other parameters essential for optimising the charging process.
When charging in a condominium or on public roads, charging stations are equipped with a communication module, an identification control or a supervision system that facilitate the billing process while ensuring secure charging.
There is also a standard named OCCP: Open Charge Point Protocol, exists; more and more stations are complying with it.
This is an open standard for electric vehicle charging stations that allows them to communicate with a centralised management system.

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Standards and regulations :

Charging equipment must comply with some standards and regulations to ensure safety and efficiency. This includes specifications on the materials used and the connectors performance.

- NF C 15-100 : electrical standard for the installation of a home charging point.
- Decree No. 2021-546 : the intervention of a professional qualified “Electric Vehicle Charging Infrastructure” for any infrastructure with a power equal to or greater than 3.7kW.
- IEC 62196-1:2022 : Plugs, socket outlets, mobile vehicle plugs and vehicle connector outlets – Conductive charging of electric vehicles – Dimensional compatibility requirements for AC pin and socket devices.

In summary, the connectors in charging stations are crucial. They ensure not only the compatibility and safety, but also the efficiency of the electric vehicle charging process.

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ISSUES :

Plug compatibility and standardisation :

It is essential to ensure that all vehicles can be charged at any charging station.
The Type 2 plug is the single European standard for AC charging. It's the intermediate solution between the reinforced plug and those used for fast charging. You will find it on charging stations for home installation and on most public charging stations. This one offers a power charging ranging from 7.4 to 43 kW, which reduces the charging time.

Infrastructures :

The development of charging infrastructure is essential; it includes not only a certain number of charging stations, but also their strategic location to meet user needs (especially on long trips).

- Target of 400 000 charging stations in France by 2030.
- The goal is to have an electric charging station with a capacity of at least 400 kW every 60 km across Europe.

Security :

The connectors must be designed to ensure user safety, taking into account : protection mechanisms against overloads, short circuits and other potential risks.

- Selecting a terminal suitable for your electrical installation : three-phase or single-phase.
- Modify the meter power to prevent circuit breakers from tripping : it must be higher than the terminal power.
- Have a dedicated electrical panel for the charging station to isolate it from the rest of the installation.
- Use a residual current device in your home to protect occupants from potential electrical hazards.

Accessibility :

Charging stations must be accessible to everyone, including people with reduced mobility.
This requires consideration of the design and location of the terminals :

- Ensure there is sufficient space around the vehicle and enough parking spaces.
- The terminals must be located in highlight and safe areas to ensure user safety during charging.
- Screens must be at an accessible height for any person, with clear information in all conditions (lighting, weather). They must be easy to use with universal payment and easy access.

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Technological developments :

With the rapid evolution of charging technologies, it's important that connectors can adapt to new innovations, such as ultra-fast or induction charging (static or dynamic charging).

- Smart charging stations automatically adjust voltage and current to enable more efficient charging. (This prevents the power surges risk when charging at home).
- Thanks to apps, connected top-ups enable remote, real-time management.

Costs :

The cost and installation of charging stations can be a barrier to their deployment. Efficient, standardised connectivity can help to reduce these costs.

- Purchase : this is a long-term investment for a company, allowing total control over the equipment, from maintenance to updates. Costs will be optimised thanks to the long-term depreciation of the terminal.
- Long-term rent : allows costs to be spread over several years, including maintenance and support services, without tying up cash-flow. It should be noted that the global cost may be higher than a direct purchase.
- Installation, whether in offices or at home, offers a particular advantage in terms of optimising total cost of ownership (TCO). By charging at private stations, you can benefit from more attractive electricity rates than at public stations, thanks to off-peak rates.

In summary, the integrated connectivity challenges in charging stations consist in providing smart, secure solutions that ensure better energy management while reducing CO2 emissions.

A thoughtful, collaborative discussion is needed to achieve these goals and to encourage the promotion and adoption of electric vehicles.

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ADVANTAGES :

Compatibility between vehicles and charging stations :

Charging stations must be compatible with a wide variety of electric vehicles, as there are several types of connectors and protocols.
This ensures standardization, which simplifies charging for all users.
Here are some common types :

- Type 1 (J1772) : mainly used in North America, for EVs that do not have fast charging.
- Type 2 (Mennekes) : European standard for charging stations and vehicles.
- CHAdeMO and CCS (Combo) : for fast charging stations, particularly for Asian (CHAdeMO) or European (CCS) vehicle brands.

Charging stations with multiple connectors or adapters contribute to a greater flexibility and better EV adoption.

Two-way communication :

Modern charging stations can establish two-way communication with the vehicle. This enables information exchanges to optimize charging.
This may include:

- Smart charge management : the vehicle and charging station can communicate to determine the optimal power based on the battery capacity, the energy demand and grid conditions.
- V2G (Vehicle-to-Grid) : this technology allows an electric vehicle to feed energy back into the grid. The connectors enable charging stations to manage this interaction.

Access control and security

Charging stations can be equipped with access control systems, such as RFID cards, mobile applications, or security keys to authorise use.
Connectivity plays an important role in these locking and authentication systems.
This makes it possible to :

- Limit access to authorised users : to prevent energy theft or misuse of the station.
- Track charging history : to facilitate billing and consumption monitoring.
- Secure charging processes : by integrating systems to detect short circuits, overloads, or abnormal temperatures.

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Remote monitoring and management :

The connectivity allows data collect on charging and monitoring in real time. This information can be used to :

- Optimize the management of the charging infrastructure : by identifying the most popular charging stations or those that require maintenance.
- Provide charging statistics to users : for example, via a mobile application, to track consumption, cost or remaining capacity.
- Offer dynamic pricing : depending on the time of day or energy demand, some stations can adjust charging prices.

Integration with smart grids :

Charging stations are more and more connected to smart grids.
Connectivity enables :

- Optimal management of energy consumption : depending on supply and demand on the grid. For example, during periods of low demand, the station can charge faster or at a lower cost, while during periods of high demand, charging can be slowed down to avoid overloading the grid.
- Reduction of demand peaks : smart stations can adjust the power delivered according to fluctuations in the grid, which can help balance the electricity supply.

Scalability and remote update :

Thanks to connectivity, terminals can be updated remotely, without the need of physical travel.
This leads to :

- Benefit from the latest innovations and software improvements, without any hardware change.
- Add new features such as compatibility with newer communication protocols, new payment options, or integration services with other infrastructures.

Fast charging and energy efficiency :

Fast charging stations use specific connectors and protocols to enable much faster charging.
CCS (Combo) and CHAdeMO connectors deliver high power (up to 350 kW for some stations), which significantly reduce charging time.
The connectors used for these stations enable :

- Faster and more efficient charging.
- Less energy loss during transmission between the station and the vehicle.

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Support for energy transition :

Charging stations equipped with smart connectors can be used to support the transition to more sustainable energy systems.
For examples:

- Charging with renewable energy : some charging stations can be connected to solar panels or other green energy sources.
- Use of storage batteries : battery systems can be integrated into the charging infrastructure to store energy generated during periods of low demand or surplus and release it when EVs are being charged.

Accessibility and ease of use :

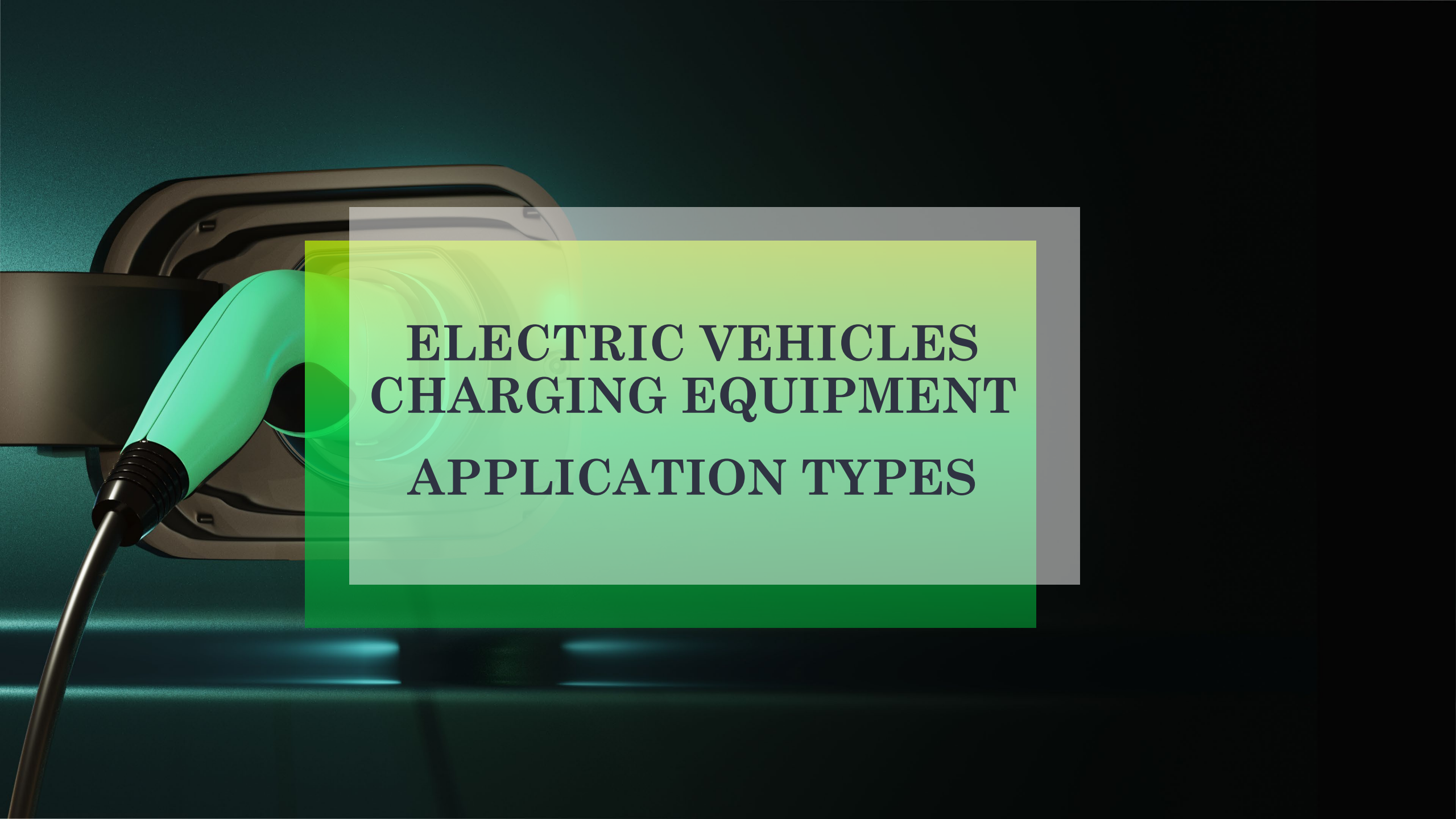
The connectors also make the daily use easier for EV drivers.
This includes:

- Ease of use : users can simply plug their vehicle into the charging station, which automatically detects compatibility and initiates charging.
- Clear information display : on the charging station or via a mobile app, users can check the charging status, estimated cost, and remaining time before the vehicle is fully charged.

In summary, there are many advantages to connectivity in electric vehicle charging stations.

These range from compatibility and flexibility with different vehicles and charging types to safety, energy management, and integration into smart grids.

These technologies make not only the charging experience smoother and more efficient for the user, but also play a key role in optimizing the overall energy network, contributing to the transition to a more sustainable future.



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APPLICATION TYPES

ELECTRIC VEHICLES CHARGING EQUIPMENT

APPLICATION TYPES:

Smart charging and optimized energy management

Charging stations equipped with advanced connectivity enable smart charging management.

- Off-peak charging :

By connecting the charging station to the energy management system (thanks to a smart grid), charging can be scheduled during off-peak hours, which contributes to cost reduction and the optimization of the use of energy resources.


NH


AYU2T

- Charging power optimisation :

The charging station can adjust the delivered power according to the vehicle's battery status, to the charging station's capacity, and grid demand.


SH


PUD


PND


BSS


VH

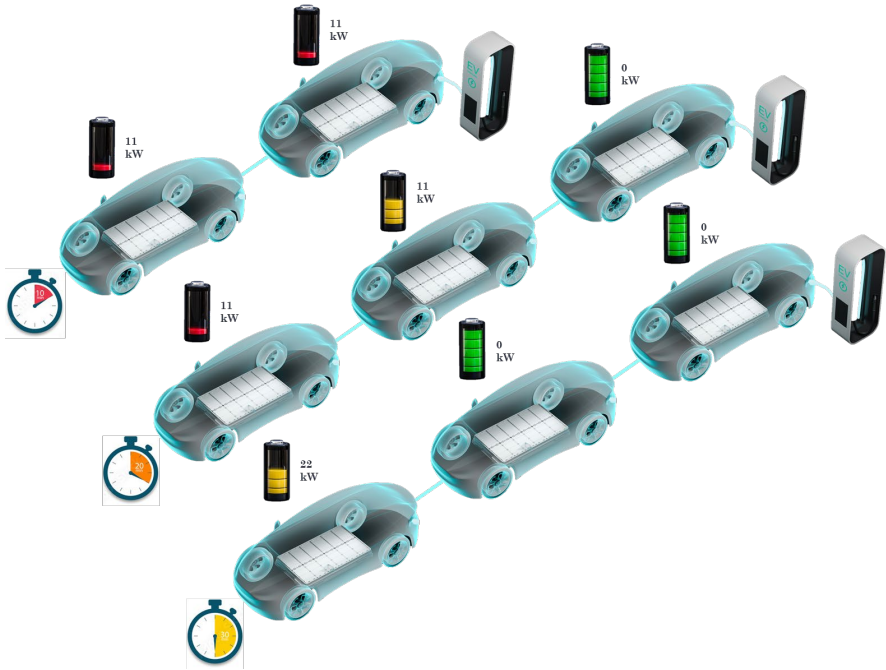
- Balance managing between multiple terminals :

At charging equipment stations with multiple terminals, the connectors allow an equitable Energy distribution between vehicles; this prevents overloading of a specific terminal and infrastructure usage optimisation.


FHA


FMN


SH



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Vehicle-to-Grid (V2G) and energy backflow into the grid

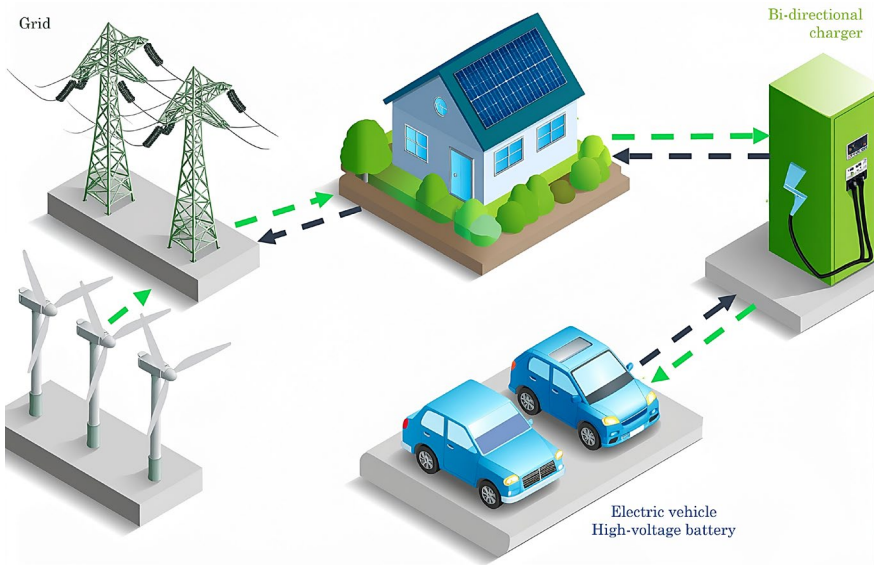
V2G (Vehicle-to-Grid) technology allows electric vehicles to feed energy back into the power grid. This is possible thanks to bidirectional connection systems, which enable the control and management of energy supply.

- Energy storage and distribution :

Once charged, vehicles can serve as "mobile batteries" and supply energy to the grid during high demand periods (e.g., consumption peaks in winter).

- Network stabilisation :

This can be particularly useful for balancing supply and demand on the grid, especially with the rise of intermittent renewable energies such as wind and solar power. EVs can thus act as temporary energy reservoirs and contribute to the stability of the power grid.




PICO H


RHU


RAD


FAH


HVGT


HVGW


MSA

ELECTRIC VEHICLES CHARGING EQUIPMENT

Remote monitoring and predictive maintenance

Thanks to connectivity, modern charging stations are often equipped with technologies that enable preventive maintenance and remote monitoring.

- Remote diagnosis :

Charging stations can send alerts or reports on their operating status to a central platform. This allows faults or malfunctions to be quickly detected before they become critical.

- Remote software update :

The terminals can be automatically updated to incorporate new features, security enhancements, or communication protocols, without requiring physical intervention.

- Consumption monitoring :

The connectivity allows real-time monitoring of each terminal's usage, which is useful for billing, infrastructure management, and profitability analysis.

 FHTG

 SHLV

 RVE

 ASU

 EA2

 UBC

 UBC 2.0

 UBC 3.2

 UBC 3.2
WATERPROOF

ELECTRIC VEHICLES CHARGING EQUIPMENT

Payment services and user management

Connectivity plays an important role in user authentification and in payment management, when using charging stations.

- Identification systems :

The terminals can be equipped with RFID cards, QR code readers, or mobile application systems to limit access to authorized users and ensure access control.

- Flexible billing :

The terminals can integrate payment systems via online platforms, bank cards, or mobile applications. Some terminals also allow users to track their specific energy consumption and generate detailed invoices.

- Dynamic pricing :

Depending on demand and time, charging rates may fluctuate (similar to dynamic pricing based on usage). The connectivity allows an effective management of these prices in real time.


FXZT


FHA


FMN

ELECTRIC VEHICLES CHARGING EQUIPMENT

Integration with vehicles for customized services

Modern vehicles are equipped with onboard communication systems that can interact with charging stations via their connectors.

- Charging planning :

The vehicle can send a charging request to the charging station based on its battery level or on the user's settings via an app.

- Load optimisation based on route :

Some applications allow you to manage the load so that it's optimised for the planned journey (considering the distance to be travelled, energy consumption, etc.).

- Remotely track of the charge state:

Users can monitor their vehicle's charge status in real time using apps, which makes it easier to manage charging (e.g., knowing whether the vehicle is already charged or is currently charging).

 ACH WTB

 ACH WTW

 GH

 PA

 BSS

ELECTRIC VEHICLES CHARGING EQUIPMENT

Loading vehicles in shared environments

Charging stations equipped with connectivity allow a simultaneous management of multiple users an Energy distribution optimisation.

- Shared charging stations :

In public parking lots, hotels, or shopping centers, multiple users can access charging stations. The connectors allow fair and smooth management of access and energy distribution.

- Reloading in complex environments :

In locations such as urban centers or high-density areas, connectivity enables centralized management of charging stations, thereby avoiding conflicts of use and ensuring that each user receives a fair share of charging time.


ZIM


ZWP


JWPF
WTW & WTB


WMCB


JWPS WTB

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Connection to public transportation and logistics infrastructure

Connectors in charging stations play a significant role in the integration of electric vehicles into public transportation or logistics networks.

- Recharging public transport fleets :

The charging stations can be used to manage the recharging of electric vehicles designed for public transportation. Such as electric buses. The connectors allow recharging to be scheduled during periods of low activity or overnight.

- Commercial vehicle fleet management :

In the logistics sector, where fleets of electric vans or electric trucks are used, connectivity enables the charging of these vehicles to be managed in a coordinated and efficient manner, while ensuring that vehicles are available for delivery schedules.

 PAMU

 BMSC

 EVZ2

 ZRO

ELECTRIC VEHICLES CHARGING EQUIPMENT

Integration with renewable energies

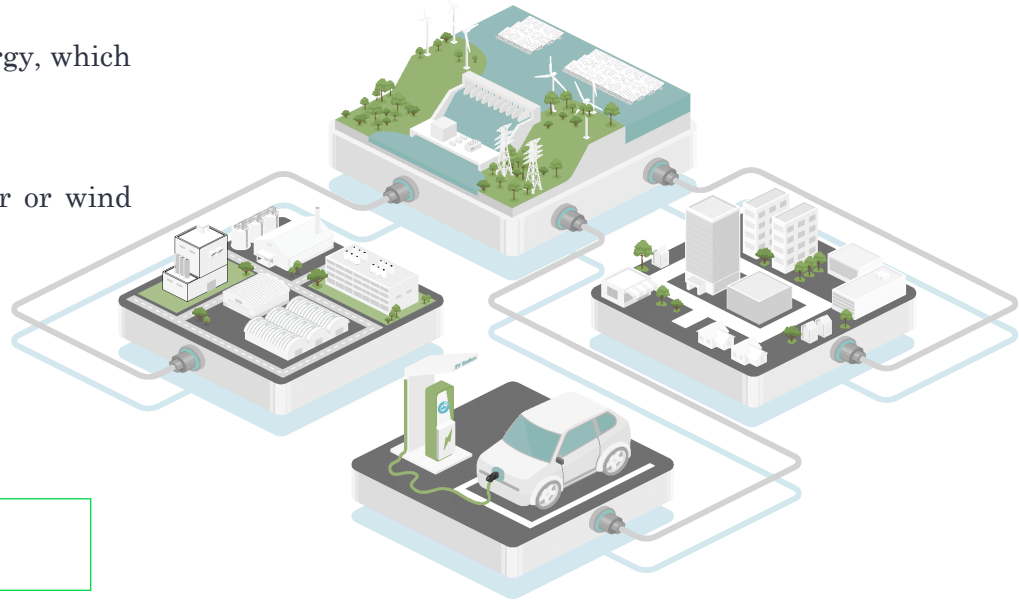
The connectors allow renewable energy sources (such as solar or wind power) to be integrated directly into the charging system.

- Charging via solar panels :

The charging stations can be connected to photovoltaic systems, allowing vehicles to be charged using solar energy, which makes charging more environmentally friendly and less dependent on the grid.

- Balancing energy sources :

The connectivity system optimizes the use of different energy sources, depending on the availability of solar or wind energy and the grid demand.




ZWP


JPWF
PANEL LOCK


WMC


JFA J300


JFA
J5000

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Interoperable charging infrastructure network

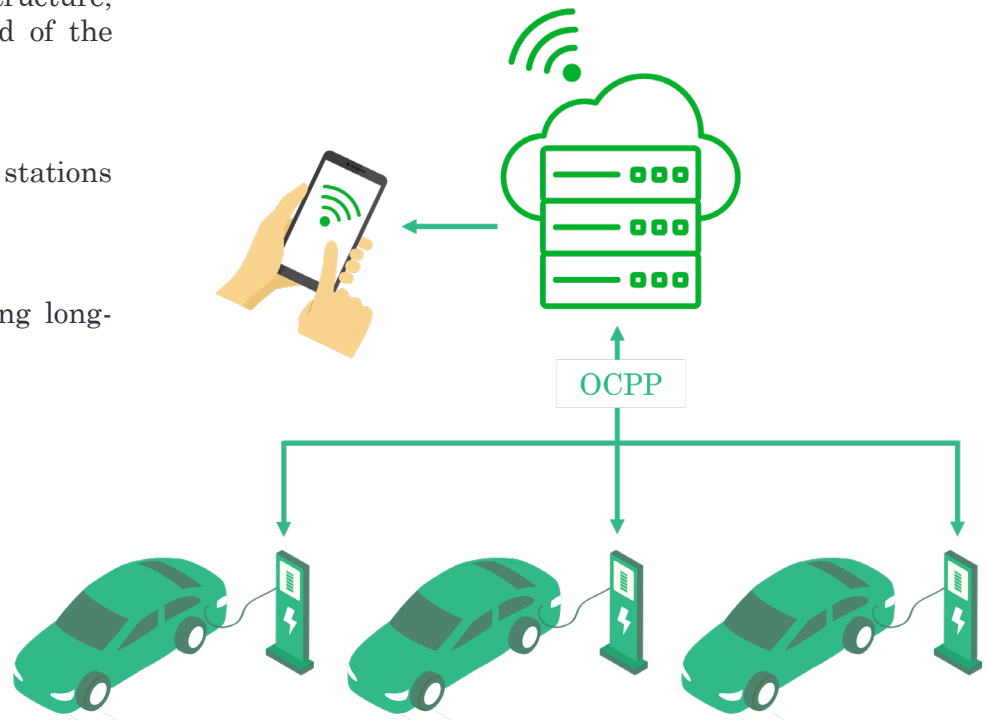
Standardized connectivity allows charging stations to easily connect to a global network of charging infrastructure, creating an interoperable system, where users can charge their vehicles regardless of the operator or brand of the charging station.

- Universal access to charging :

Thanks to communication standards (such as OCPP – Open Charge Point Protocol), users can access charging stations from different suppliers without worrying about technical specifications or multiple subscriptions.

- Easy access for travelers :

EV drivers can charge their vehicles at public or private stations through a wide, integrated network, making long-distance travels easier.

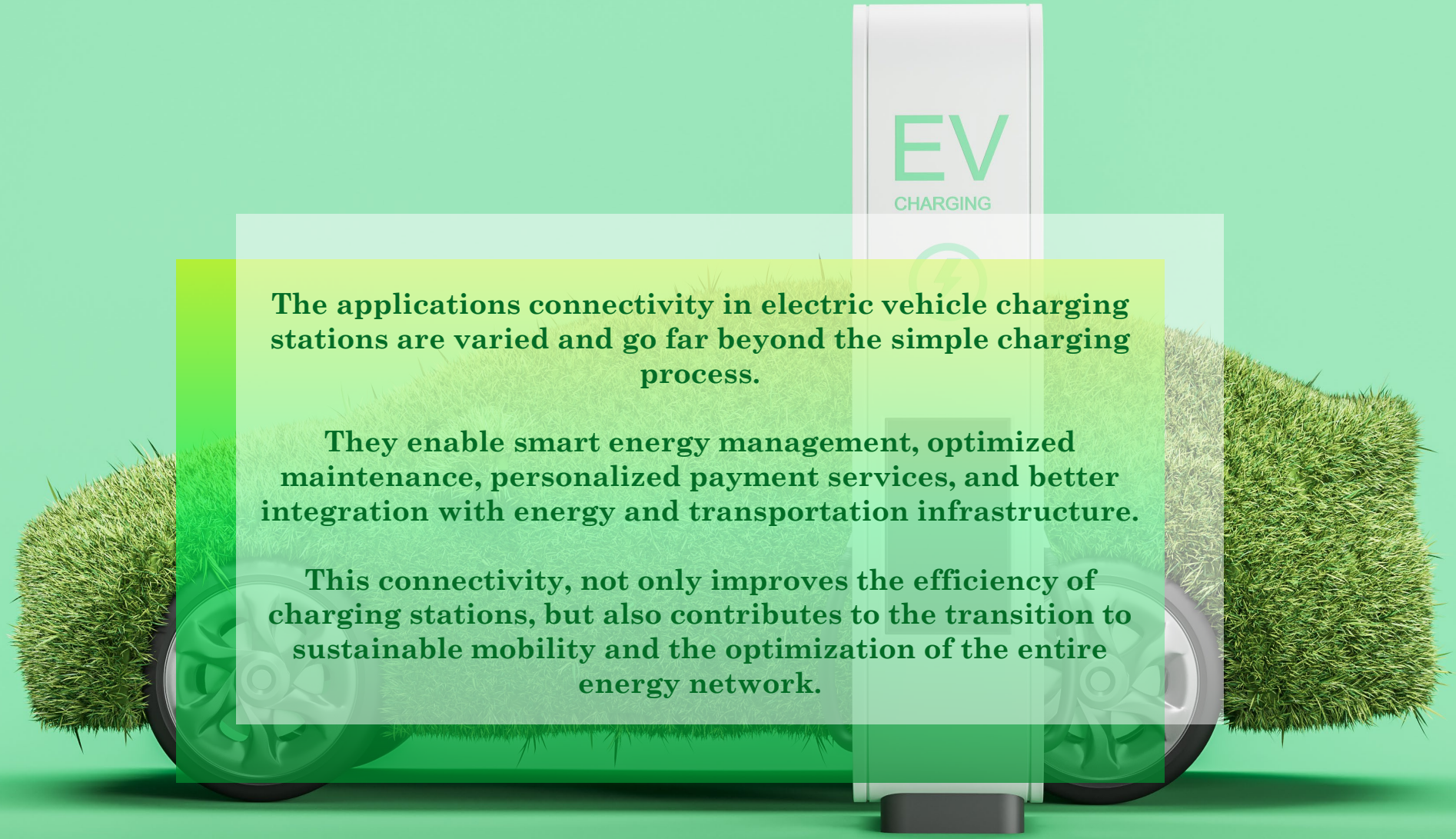



ASU


AYU2T


EA2


HIE



The applications connectivity in electric vehicle charging stations are varied and go far beyond the simple charging process.

They enable smart energy management, optimized maintenance, personalized payment services, and better integration with energy and transportation infrastructure.

This connectivity, not only improves the efficiency of charging stations, but also contributes to the transition to sustainable mobility and the optimization of the entire energy network.

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- **Smart charging & optimized energy management**
  - NH
  - AYU2T
  - SH
  - PUD
  - PND
  - BSS
  - VH
  - FHA
  - FMN
  - SH
- **V2G & energy feedback into the grid**
  - PICO H
  - RHU
  - RAD
  - FAH
  - HVGT
  - HVGW
  - MSA
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  - SHLV
  - RVE
  - ASU
  - EA2
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THANK YOU

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