

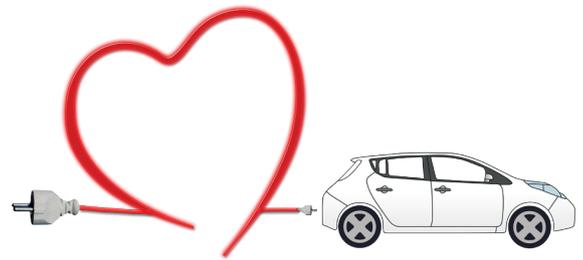
A new era for road mobility

The consumption of fossil fuels (diesel, gasoline, LPG, methane) is one of the main pollution factors in urban areas, because it produces fine dust, hydrocarbons, carbon monoxide and nitrogen oxides, as well as contributing to the increase in CO₂ in the air and thus enhancing the greenhouse effect.

In order to reduce polluting emissions, local authorities are increasingly activating restrictions on the circulation of cars that do not comply with precise traffic parameters.

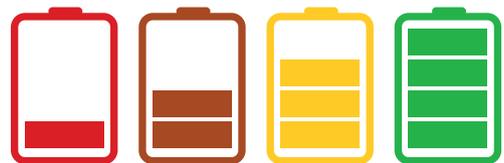
For this reason, the automotive industry and energy suppliers have turned to e-mobility.

Electric mobility is a solid reality today, after having passed an initial phase of experimentation. Technological developments and public funding from national governments are pushing the sector into rapid and continuous growth.



Electric car types

- **FCEV** (Fuel Cell Electric Vehicle) = fuel cell vehicles are equipped with a system capable of producing electrical energy through a chemical process between hydrogen and oxygen and storing it inside a high-voltage battery, and then using it to power the vehicle's electric motor
- **MHEV** (Mild Hybrid Electric Vehicle) = cars equipped with a combustion engine plus an electric motor, which is limited to integrating the power of the combustion engine in the acceleration phases
- **FHEV** (Full Hybrid Electric Vehicle) = are similar to Mild Hybrid cars, but equipped with a more powerful electric motor, which allows you to travel a few kilometres in fully electric mode
- **PHEV** (Plug-in Hybrid Electric Vehicle) = are Full Hybrid but with greater electric power, which allows greater autonomy without the use of fuel. In addition, they can be charged from a power source via cable
- **BEV** (Battery Electric Vehicle) = vehicles equipped exclusively with an electric motor



The market has established itself on the last two types of cars because:

- Fuel Cell solutions have found high production costs, compared to other cars, and little or no possibility of distribution in the territory

- the MHEV and PHEV solutions, over time, have been put in the background as the electrical contribution is limited, as it is only for support, and does not meet the needs of medium/ long trips

Charging classes

- **Slow Charging** (up to 7,4kW): for domestic recharge in the private sector. The charging time of the car is 6/8 hours and the charging mode is in AC current.
- **Quick Charging** (from 7,4kW to 22kW): for private and public recharges, such as condominium, hotel, shopping centre or company car parks, where the stops are of short/medium duration (a few hours). The charging mode is in AC current.
- **Fast Charging** (higher than 22kW): ideal for recharging during short stops or on non-urban roads or motorways in the presence of petrol stations. The recharge time is considerably reduced, even up to just 15/20 minutes. The charging mode is in DC current.

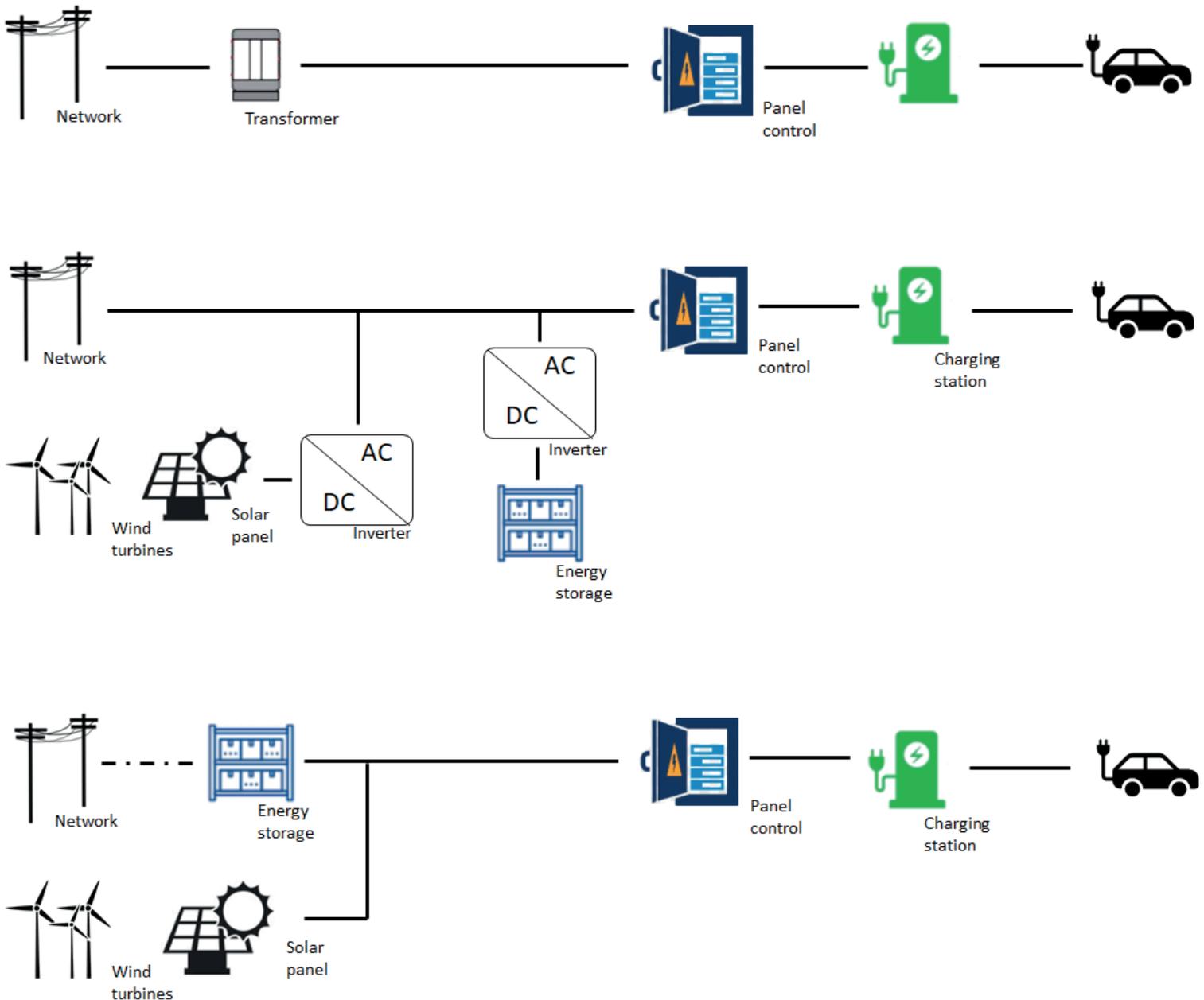
In the early periods when electric cars appeared on the market, the major installations were low power and therefore slow and quick charging. In recent years, however, there has been an increase in the installation of charging stations with higher power ratings, with capacities of up to 40.50 kW and some solutions in the sector have gone as far as a few hundred kW, reaching 350kW.

Charging modes

- o **Mode 1** (domestic recharge): uses normal plugs and sockets. In this charging mode the vehicle is connected directly to the power socket. It is suitable for light vehicles (bikes and some scooters) and is not applicable to electric cars.
- o **Mode 2** (safe domestic/company charging): is similar to the previous mode, but on the power cable there is a control device that guarantees the safety of operations. The sockets are either domestic or industrial.
- o **Mode 3** (recharging for public areas): system for large installations and public charging stations, which uses plug sockets and special safety systems.
- o **Mode 4** (direct charging in direct current): uses a charger that is outboard the car, the AC power supply is converted to DC in the conversion station. There are two connection standards CHAdeMo and CCS Combo.

Charging Infrastructure

The kind of infrastructure upstream of the charging station depends on how the charging station powers the electric car, i.e. whether it is AC or DC charging. Below are 3 examples of infrastructure: the first two in AC and the last one in DC. The structure can also be presented as a hybrid solution, i.e. with both AC and DC charging stations in the same place, to meet both requirements.

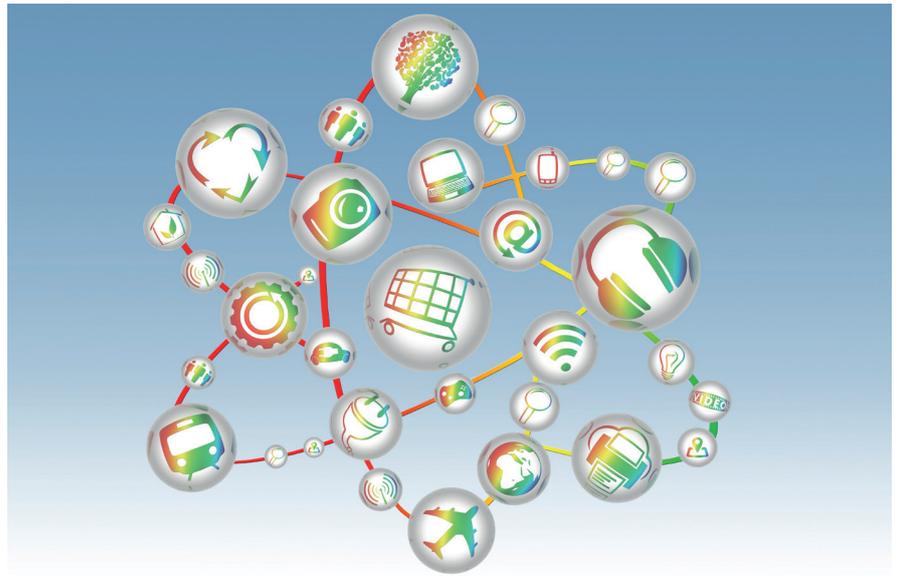


Smart Grid and Renewable Sources Integration

The key factors for the development of e-mobility are:

- **integration with smart grids:** a set of electricity grids and technologies that make it possible to manage and monitor the distribution of electricity from different production sources.
- **the use of energy produced from renewable sources,** especially wind and solar energy.

The grid will be fully networked, interconnected and monitored, so as to be an integral part of the smart city system, capable of responding quickly, effectively and targeted to the needs of citizens, including energy needs. From the charging stations to the supply devices, everything will be supervised, to make the grid more efficient and activate quickly in the event of breakdowns or even carry out proactive predictive maintenance activities.



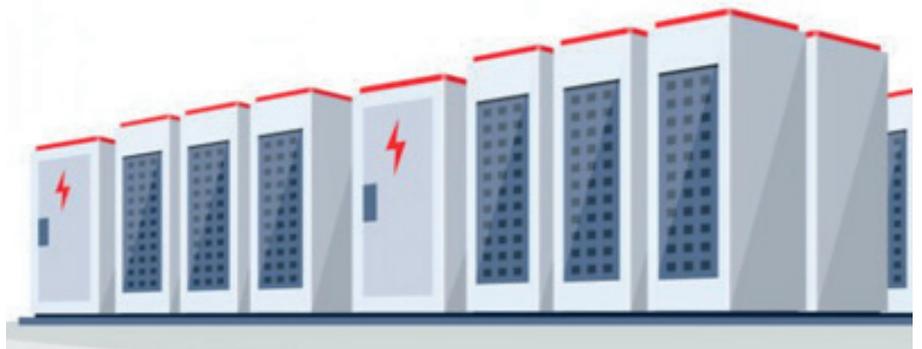
In low-voltage solutions without the use of conversion cabinets, electrochemical electrical energy storage is exploited with the use of batteries. This solution makes it possible to facilitate the network in the distribution of energy to the various columns, in the event of more than one vehicle being charged at the same time. Energy storage becomes the link between the wind or solar system and the charging station, compensating for the availability of generation from non-programmable renewable sources (e.g. variability in the presence of wind and sun). It is also able to manage weekly/seasonal fluctuations, regulation services and grid balancing, peak shaving or isolated systems.

Future Scenarios

The whole system requires the presence of more and more devices inside the power station. There is therefore a need to find solutions that combine high performance and optimised layout; this leads to a higher density of electronic control components, worsening the thermal conditions of the system. Continuity of service is a must; it is thus necessary to protect the components from environmental pollution and high temperatures. It will be more and more crucial in the future to find cooling solutions that intervene on the various devices present in the charging infrastructure and the entire smart grid system.

Which part of the infrastructure needs to be cooled?

Transformers: they can usually operate in high temperature conditions and maintain high efficiency by using only the external air recirculation. However, when high output power, high outside temperatures or too dirty air (dust, sand) are present, it becomes necessary to cool the transformer cabinets in order to maintain an acceptable operating temperature.



Cabinets for inverters: as inverters undergo a considerable yield downgrade with increasing temperature, they need to be conditioned so that they work at temperatures not exceeding 35°C.

Storage batteries: they must work at temperatures in the order of 25°C. The increase in temperature leads to an inevitable ageing of the device and a significant shortening of its service life.

Wind turbines: at their base there is a management and control section with internal electrical panels, which must be cooled.

Charging columns: the ever increasing power installed directly leads to the need for an air flow with the outside for the disposal of the heat produced, while at the same time ensuring adequate protection from external agents.

What Cosmotec products offer

Protherm Outdoor CVO air conditioners are the suitable solution for cooling cabinets containing transformers and/or inverters. The wide range of cooling capacities and electrical power supplies allow for adequate and easy installation. Furthermore, driven by the growing need to reduce consumption, the air conditioners are strongly oriented towards maximum efficiency, while maintaining robustness, reliability and compactness.

For the cooling of **switchboards for energy storage** Cosmotec offers units powered by direct current, for power up to 700W with the CVO range and for 1 and 2 kW with the **Predator range**. The air conditioners are designed to operate full time, ensuring maximum reliability and operational continuity.

SlimIn wall mounted air conditioners are the perfect solution for the cooling of electrical cabinets for wind turbines, considering the possible reduced space available. The range is designed for external, semi-flush or flush installation, and is therefore ideal for installations that require reduced overall dimensions and limited panel projections. Alternatively, the **TOP range** of air conditioners are available, designed for roof mounting of the electrical panel.

Kryos3 GS ventilated grilles represent the optimal solution when the ambient temperature is lower than the one required inside the panel, a feature useful in cooling high power columns for fast recharging. Kryos3 grilles can be installed on different types of cabinets thanks to their reduced depth.

In detail, the products offer:

Protherm Outdoor - CVO

What is needed	Why	What Protherm CVO offers
Efficiency	Energy Savings	<ul style="list-style-type: none"> High EER
Reliability	Avoid Network Dysfunction	<ul style="list-style-type: none"> IP54/55, Nema4/4x Protection Degree Electronic board in the internal circuit Sequencing available
Connectivity	Remote Monitoring	<ul style="list-style-type: none"> Modbus RTU
Easy Installation	Reduced installation time	<ul style="list-style-type: none"> Quick Connection Testing Procedures Inserts for easier positioning
Low Noise	Proximity to residencial areas	<ul style="list-style-type: none"> Low Noise Version



Predator - PRT

What is needed	Why	What Predator PRT offers
Efficiency	Energy Savings	<ul style="list-style-type: none"> Direct Free Cooling system Modulating Compressor (PRT20 48Vdc) High EER
Reliability	Avoid Network Dysfunction	<ul style="list-style-type: none"> IP54 Protection Degree Electronic board in the internal circuit Sequencing available on request
Connectivity	Remote Monitoring	<ul style="list-style-type: none"> Modbus RTU
Easy Installation	Reduced installation time	<ul style="list-style-type: none"> Quick Connection Easy cleaning/filter replacement
Low Noise	Proximity to residencial areas	<ul style="list-style-type: none"> Condenser fan speed adjustment



Slim In - CDE

What is needed	Why	What Slim In CDE offers
Efficiency	Energy Savings	<ul style="list-style-type: none"> High EER, not just at nominal conditions but even at high ambient temperatures
Reliability	Avoid Network Dysfunction	<ul style="list-style-type: none"> IP54 Protection Degree Electronic board in the internal circuit Operation up to 60°C with peaks up to 62°C
Connectivity	Remote Monitoring	<ul style="list-style-type: none"> Modbus RTU (on request)
Easy Installation	Reduced Installation time	<ul style="list-style-type: none"> Gasket already installed Quick Connections Testing Procedures Inserts for easier positioning
Flexibility	Reduced Installation Space	<ul style="list-style-type: none"> Reduced projection from the panel External, semi-flush or flush installation No additional space inside the panel



TOP II- ETE

What is needed	Why	What TOP II ETE offers
Reliability	Avoid Network Dysfunction	<ul style="list-style-type: none"> IP54 Protection Degree Electronic thermostat in the internal circuit Condensate dissipator from 1400W unit
Easy Installation	Reduced Installation time	<ul style="list-style-type: none"> Quick Connections from 1400W unit
Flexibility	Reduced Installation Space	<ul style="list-style-type: none"> Width and depth dimensions allow installation on all cabinets Modular installation on several cabinets



Kryos³- GS

What is needed	Why	What Kryos ³ GS offers
Reliability	Resistant in harsh environments	<ul style="list-style-type: none"> IP54/Type12 Protection Degree IP56 Protection Cap High fans MTBF Mechanical and UV resistance
Easy Installation	Reduced Installation time	<ul style="list-style-type: none"> Screwless mounting system Easy grid opening for cleaning / filter replacement Quick Electric Connection (GSV15...30) Gasket already installed
Flexibility	AC or DC power supply Air Flow	<ul style="list-style-type: none"> Power Supply 230/115 Vac Power Supply 24/48 Vdc Fan Reversibility

