Services associated with electric vehicle charging terminals

by Philippe Vollet

Executive summary

Electro-mobility has become a reality. Whether society will be able to turn the environmental advantages of electric vehicles to good account depends to a large extent on the method used to power and charge the vehicles' batteries. This white paper addresses the various services developed around electric vehicle charging infrastructure and answers questions about operating a charging terminal. It is intended for those responsible for vehicle fleets, maintenance and sites, mobility operators, integrators, installers, and drivers.

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Summary

Services: engines for the development of electric vehicles

The electric vehicle is the obvious strategic solution for tackling one of the major challenges of our energy future: the environmental impact of transports.

Electro-mobility and its associated energy management are becoming a reality. This new means of transport and the infrastructures that are developing around it allow users to charge their vehicle on the basis of their needs, whilst at the same time enabling those responsible for general services and the companies that produce and supply electricity to optimise resources.

The key success factor: ensuring vehicle mobility

Whether it is a question of ensuring that vehicles and charging infrastructures are available or even the quality of the energy available to charge them, the success of clean transport is related to the deployment of tools that facilitate the mobility of people and goods.

These services ensure the provision and relevance of the information required to operate a charging infrastructure that is safe, practical, energy efficient and economical for all the electro-mobility players.

This white paper addresses the various services developed to meet the needs of electro-mobility. It is intended for those responsible for vehicle fleets, maintenance and sites, mobility operators, integrators, installers and drivers.

Services are essential for meeting the needs of users, whilst at the same time ensuring operators that their resources are being optimised.

Introduction

The development of electro-mobility is creating the opportunity to rethink our modes of transport.

The autonomy of electric vehicles, which varies according to type and model, is in the region of 150 km for a city car, i.e. approximately 4 times less than its thermal counterpart. It is now useful to consider this problem differently in order to put things into perspective and understand that for a considerable number of uses, the autonomy of electric vehicles does not play any part.

In fact, the charging infrastructure has been set up to enable electric vehicles to be charged wherever they stop (at the office, at home, at the roadside, etc.), unlike thermal vehicles, which have to be specifically driven to a service station to be filled up.

It is therefore preferable to think in terms of daily, rather than potential use. If 86% of journeys cover less than 64 km per day[3] and charging points are available to enable electric vehicles to be charged wherever they stop, a 100% electric vehicle is suitable.

Nevertheless, the question of knowing whether society will be able to turn the environmental advantages of electric vehicles to good account depends to a large extent on the method used to produce the electricity that will supply the batteries installed on the vehicles and when these batteries will be charged.

If users charge their batteries during consumption peaks, the electricity producers will have to compensate for the increased demand with the high CO_2-emitting thermal power plants, which are currently the only energy producers able to meet a fast rise in demand. Charging during dips in power consumption could be instrumental in reducing fluctuations in demand.

The many service offers developed around charging infrastructures will answer the questions from users who are learning these new uses:
- What is the mobility of tomorrow?
- How can energy efficiency be applied to charging infrastructures?
- What information and when?
- What specialist skills are required?

30 %

Transport is responsible for 29% of CO_2 emissions from the 27 members of the European Union[1] and for 33.1% of emissions from the USA[2]

[1] *LCO2 emissions in the transport sector for the 27 European Union countries. From a 2008 analysis of data submitted to the United Nations Framework Convention on Climate Change (UNFCCC) European Federation for Transport and Environment (EFTE). August 2010.*

[2] *http://www.eia.doe.gov/oiaf/1605/ggrpt/index.html*

[3] *Pike Research LLC, publication du 4ème trimestre 2011*

What is the mobility of tomorrow?

The electric vehicle: a player in tomorrow's mobility

The electric vehicle is much more than a simple substitution for the thermal vehicle. It is a fantastic opportunity to redesign our relationship with mobility and our modes of transport. And in terms of mobility, mentalities are changing!

For reasons of costs and convenience, companies and communities are moving from the vehicle ownership era to the era of mobility services for an increasing proportion of uses.

It is now more sensible and more economical to consider the cost of using a vehicle, rather than its purchase price to which several other costs have to be added (fuel, servicing, etc.).

Companies and communities are increasingly entrusting their fleet management to mobility operators that are predominantly long-term vehicle-leasing companies (some already have a fleet of electric vehicles). They are therefore optimising their fleet management by using specialists and reducing their costs at the same time.

Mobility services: a new way of rethinking our journeys

If companies find it worth their while to lease a vehicle rather than to buy it, it is logical for individuals to wonder whether to do the same.

If they consider the overall costs (including insurance, servicing, individual or collective parking, etc.), a purchased vehicle is more expensive, particularly when it is not in use for an average 95% of the time. Even if the car still has a certain «social status» or is part of a certain way of life and many people cannot imagine doing without it, mentalities are changing with the information era and the arrival of young generations for whom the car is less of a social necessity than it was for their parents.

And this is happening at the same time as public opinion is becoming aware of environmental issues, the need to relieve traffic congestion in towns, purify the pollutant-saturated air, and so on. That is why electric vehicles are being offered on short leases (from one to several days), or can be leased for a very short period (a few hours). Users therefore only pay for this mobility service when they really need it.

Very short leasing in the form of car sharing or self service is also becoming popular. Mobility operators are already offering their expertise in setting up such systems.

«Save»: the Seine-Aval ecological mobility system

The SAVE (Seine Aval Véhicule Electrique) project is a «full-scale» electric vehicle trial taking place in the Yvelines (France).

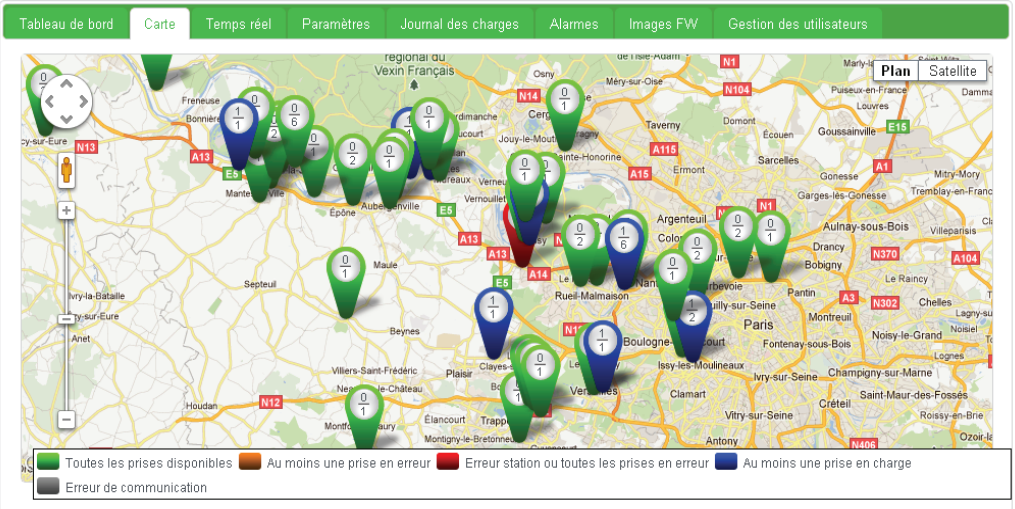
Several pioneering companies from the sector, the Yvelines General Council, EPAMSA and the Ile de France region are actively participating in the development of this project.

The SAVE project began at the beginning of 2011 and is intended to run for between 12 and 18 months.

The trial is taking place in the Yvelines, an area with 370,000 inhabitants. Fifty-one communes (four of which have more than 30,000 inhabitants) and five intercommunal areas will be involved in this project.

What are the objectives of the project?

- Test the electro-mobility products on offer (vehicles and infrastructures)
- Demonstrate that electric vehicles meet the needs and usage requirements of private and professional customers
- Confirm the CO_2 balance of electric vehicles
- Test different operational charging solutions and whether they are acceptable to customers
- Capitalise on charging infrastructure rollout information



Map showing the location of electric vehicle charging terminals.

How can energy efficiency be applied to charging infrastructures?

Vehicles always ready to go

The managers responsible for general services and fleets of cars of varying sizes have one thing in common: they must ensure that the vehicles are ready to be driven away. The challenge is to guarantee that the vehicles are available, whilst at the same time optimising the organisation's energy bill.

Connecting a network of communicating charging terminals to a remote control or monitoring system can give them the information they need to optimise vehicle use, charging and energy costs.

Consequently, optimising the operating costs of a fleet of electric vehicles depends on several factors. The fleet management system has to take account of usage and optimise the following data:

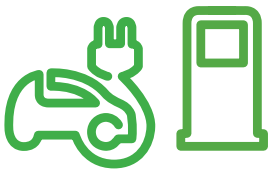
- the rate periods and type of energy (from low-carbon sources) supplied by the energy provider (see Smart Grid)
- how available energy is controlled within the building
- availability of vehicles and charging terminals.

What is the *Smart Grid* ?

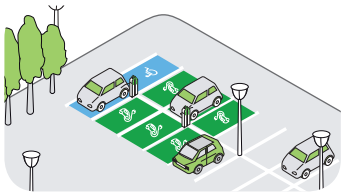
The *Smart Grid* is an intelligent electrical distribution system that uses information technologies to adapt the production of electricity to demand and optimise the use of all the energy sources, including renewable energies.

Mode 3 connection allows charging to be controlled in real time by integrating communicating functions. Consequently, charging can be programmed according to various scenarios, depending on vehicle availability or energy cost requirements. In addition to being able to control vehicle charging, the remote control system can also provide managers with the information they need to review and optimise their energy bill.

The different levels of energy management: from the vehicle to the Smart Grid



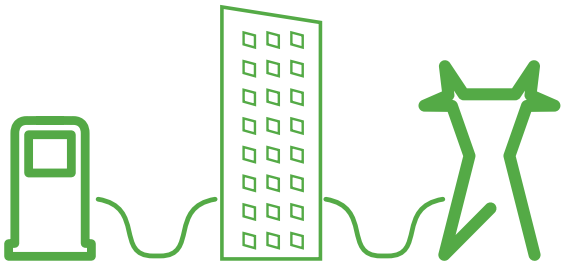
Modulating delivered power
Mode 3 charging provides the unique opportunity to control the power delivered to the vehicle and thus adjust the charging power according to the mobility needs and the total consumption of the building.



Cluster management
The power of the station varies according to the number and characteristics of the vehicles being charged. Its automated control measures the power continuously and can issue modulation orders to the terminals.

Energy histograms and balances
The presence of energy indicators and meters combined with processing software gives a continuous view of how the station is behaving. This information is used to optimise the management scenarios and to supervise the station efficiently.

Carbon balance
This assessment, which is compatible with the International ISO-14064 standard, is carried out by the management system. It allows the amount of CO_2 that has been saved to be monitored in real time.



Optimising the energy contract
When a charging station is added to the site, its impact on the electrical power purchased from the energy provider must be minimised. Optimisation includes defining the electrical power allocation rules on the basis of the peaks and dips in power consumption of the building.

Controlling consumption and costs
Consumption during the cheapest tariff periods is encouraged, but the charging profiles should be adhered to.

Available energy distribution
Energy for non-critical devices can be temporarily reduced to promote the charging station. The latter can also be regarded as non-essential with respect to the devices used in the building.

What information and when?

The position of the electro-mobility operators

Electric vehicles are part of a system involving many players, from car manufacturers to mobility operators, including charging infrastructure suppliers, car park managers and energy providers.

Each operator, whether public or private, is an important link, working with the others in a new mobility system that is consistent and efficient for its users.

The mobility operator works upstream with all the system players. He therefore provides a single package combining all the services required by the customers, whatever their needs and geographical location (on the same model as telephone network roaming or motorway electronic toll collection, etc.). He should also offer the maximum number of services possible, which should be accessible in real time.

Information services via the Internet

Smartphones have contributed to the emergence of a new type of mobility that aims to rationalise the ways in which we travel and to preserve our environment.

The web portals made available by the mobility operators provide a large number of services:
- locating and reserving vehicles, parking places or charging terminals
- remote charging management
- information on consumption, CO_2 emissions, environmental impact, etc.

Charging infrastructures are now listed as points of interest on route services. These points of interest should be dynamic, so that they provide more than simply information on the density of the charging infrastructure network. The terminals marked can therefore be reserved online to ensure that they will be available to the user and connected to the power supply during the desired period of use.

Various Web services are also being developed to assist electric vehicle users. These applications work on most smartphones and tablets. They provide a wide range of useful information:
- the location of the car or terminal
- the charge level of the battery
- the distance it can still travel
- the charging schedule
- the cost of energy expenditure, etc.

Customised information available in real time

To manage a charging infrastructure, the operator needs accurate, centralised information on its behaviour at all times. Similarly, he requires remote controls to allow him to run the station remotely.

Depending on the players, customising the information provided opens up a wide range of operating possibilities:

Maintenance manager
Centralised management of alarms, map and state of the station network, real-time or occasional statistics, online help, etc.

Site manager
View of CO_2 savings, station usage statistics, etc.

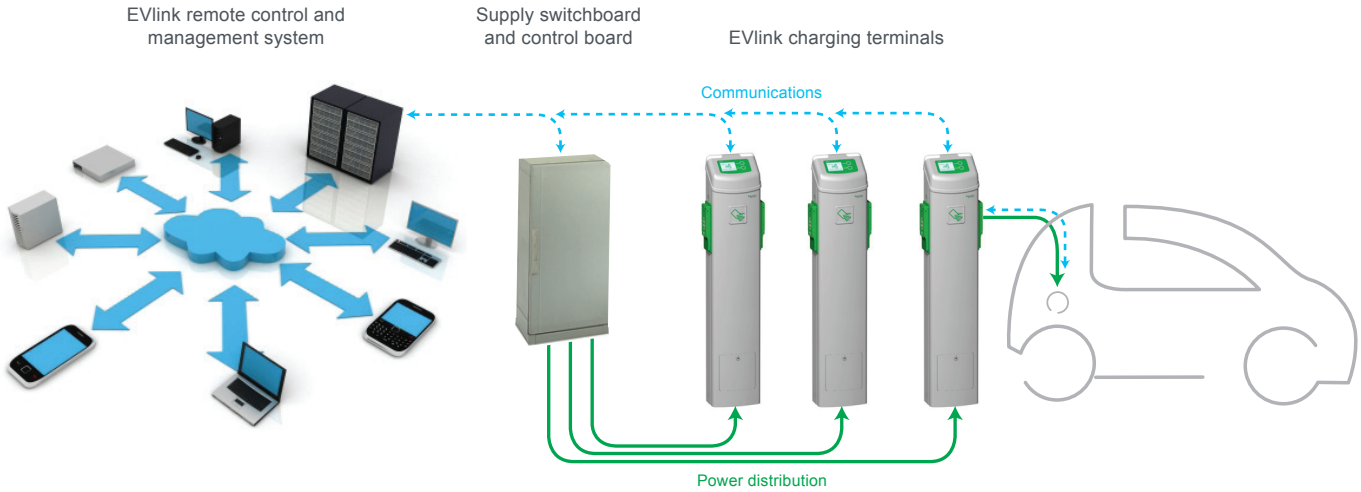
Fleet manager
Vehicle usage, reservation and availability rates to calculate the exact return on investment, etc.

Vehicle driver
View of the usage, charging history, reservation of terminals and vehicles, etc.

Building energy manager
Estimated consumption, carbon balance, etc.

Mobility operator
Estimated needs in terms of vehicles, terminals, etc.

Configuring services helps visibility. As each customer request is unique, a customised chart can be built up by ranking users' preferences thanks to the toolbox of available widgets and charts.



Station with three charging terminals, architecture model with energy protection and availability, remote control and management

What specialist skills are required?

Specialist services

A large range of services are made available to the various players to assist them in setting up, managing and operating their charging infrastructures.

Draft project


Needs audit


Infrastructure integration


Project management installation


Training


Commissioning

Exploitation


Operation audit
Usage audit


Contracted-out management


Software upgrading


Spare parts


Maintenance

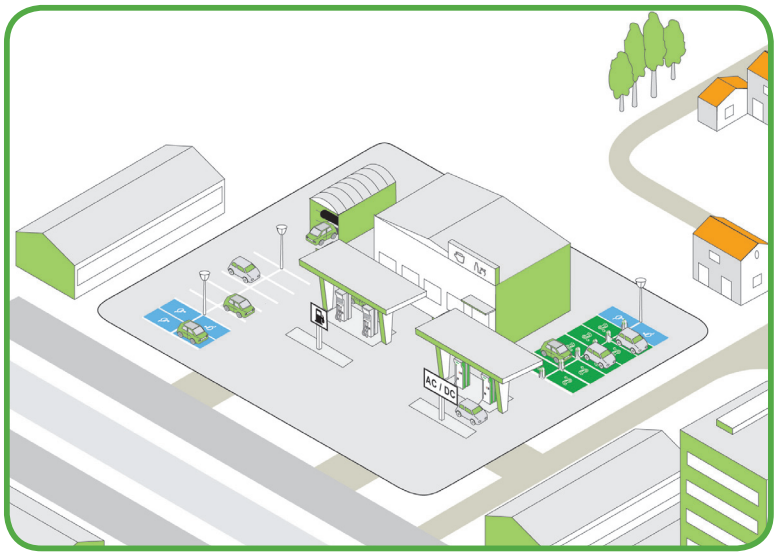

Online support

Going further

Fast-charging terminals allow service-stations to be created on the same model as those currently used for thermal vehicles.

In fact, a fast fifteen-minute charge provides 80% battery capacity and gives the vehicle sufficient autonomy to reach the usual charging point (home, company, etc.).

Fast-charging terminals can also be integrated into thermal vehicle service-stations by making adjustments to the existing facilities and setting up an energy management system.



Main conclusions

The widespread use of electric vehicles meets the need to reduce the carbon footprint of the transport sector.

This new means of transport and the infrastructures that are developing around it allow vehicles to be charged as and when required and on the basis of resource optimisation objectives.

The services supporting the emergence of electro-mobility ensure the availability and relevance of the information required to operate a charging infrastructure. The information thus collected is being used to set up an efficient energy management system.

Electro-mobility and the associated information services partly resolve the energy dilemma.

The facts

x 2

Energy demand in 2050
Electricity demand in 2030

Source: IEA 2008

vs

The requirement

÷2

CO_2 emissions to avoid dramatic climate changes by 2050

Source: GIEC 2007, Figure (vs. 1990 level)

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