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# Electric Vehicles' contributions to reaching EU policy goals, recommendations and the ongoing standardisation initiative

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**Abstract**

In the framework of its Task Force on Electric Vehicles, EURELECTRIC is currently discussing the contribution of Electric Vehicles in reaching European energy policy goals (sustainable development, security of supply, competitiveness, energy efficiency) and summarizes public policy measures that would help to kick-start the market for Electric Vehicles and overcome existing barriers. This includes in particular the grid – vehicle standardisation needed to facilitate a market for both electric vehicles and the electricity supply for the vehicles.

*Keywords: energy policy, policy recommendations, standardisation, charging infrastructure*

## 1 Introduction

In the framework of its Task Force on Electric Vehicles, EURELECTRIC is currently discussing the contribution of Electric Vehicles in reaching European energy policy goals (sustainable development, security of supply, competitiveness, energy efficiency) and summarizes public policy measures that would help to kick-start the market for Electric Vehicles and overcome existing barriers. This includes in particular the grid – vehicle standardisation needed to facilitate a market for both electric vehicles and the electricity supply for the vehicles.

This paper discusses the following statements:

Plug-in electric vehicles can contribute significantly to reaching the European energy policy goals.

Actions from the European policy makers are needed to assist making plug-in electric vehicles a success.

Ongoing standardisation efforts of the electricity and automobile industry for grid/vehicle connection help the mass market to develop.

## 2 Electric vehicles help in reaching European energy policy goals

### 2.1 Sustainable development

#### 2.1.1 Carbon dioxide emissions

Replacing conventional internal combustion engines (ICEs) with electric vehicles (EVs) would result in major reductions in $CO_2$ emissions. With the current carbon intensity of the European electricity sector [1], a typical electric car results in $CO_2$ emissions of around 80g/km. This compares favourably to the current EU market average of

CO2 emissions from passenger cars – about 160g/km. However, the European electricity sector will reduce in carbon intensity over coming years – particularly with increased use of renewables and carbon capture and storage. EURELECTRIC estimates that the carbon intensity of EU electricity in 2030 [2] implies emissions from electric cars of less than 30g of CO2 per km.

#### 2.1.2 EVs enjoy synergies with wind energy and other renewables

Wind power generation is intermittent in nature, as are some other forms of renewable power, and therefore presents challenges to balancing supply and demand on the grid. With the increased penetration of renewables needed to fulfil the EU's 2020 Renewables target, significant use of energy storage and demand regulation will be needed. Electric vehicles provide a solution here. The charging of the vehicles can be regulated in accordance with the supply of intermittent renewable electricity. The batteries of the cars may be used to supply back to the grid in periods of low renewable generation but high demand. The ability of electric vehicles to assist in balancing networks could reduce the use of less efficient "peaking" plant, thus increasing efficiency and reducing the cost of the whole power system.

#### 2.1.3 Energy efficiency

An electric powertrain can be up to four times more energy efficient than a standard internal combustion engine (ICE). In other words, electric vehicles can lead to a decrease in overall energy consumption, as less energy per km made is needed.

### 2.2 Security of supply

Unlike the electricity sector, the transport sector depends almost entirely on one particular fuel: oil. Indeed, the vast majority of the energy consumed (almost 97%) in transportation in the EU-27 derives from crude oil.

The EU is more than 80% dependent on oil imports, much of it from regions of political instability. In 2007, the EU-27's net imports reached 571 Mtoe [3].

Generating part of the energy necessary for road transportation from electricity (of which less than 4% is currently generated from oil in the EU-27) would help reduce these imports and ensure a diversified supply of energy for the road transportation sector.

### 2.3 Competitiveness

Assuming an oil price of $80/barrel, oil imports into the EU in 2007 represented a net transfer of around 250 billion euros [4]. If used to buy electricity, these huge amounts of money would be re-injected in the European economies to the benefit of both consumers and producers. This would generate investment and create jobs.

Reducing energy imports would result in economic savings and help to maintain the competitiveness of the European economy, particularly in the recent climate of volatile oil prices. Europe will be less exposed to the uncertainty of the oil price thus reducing risks for domestic industries and consumers.

## 3 European Policymakers need to help kick-start the market for electric vehicles

Many European electricity companies are already engaged in pilot projects testing integrating electric cars in the electricity grid thereby demonstrating commitment to make this technology a success.

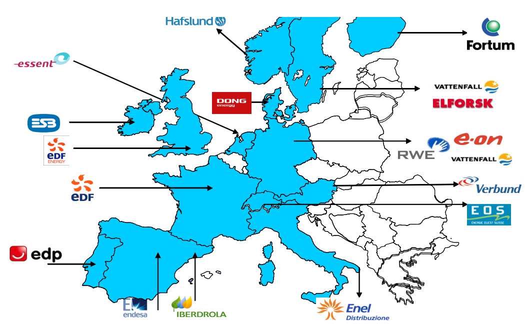



Figure 1: European electricity companies are engaged in several pilot projects with electric vehicles

Efforts are needed from policy makers, whether on national or EU level, to encourage consumers and industry to choose the cleanest and most efficient solution for road transport. This can be achieved by providing accurate information and implementing policies that internalise externalities in the market place. They should take the lead in fostering a market demand for grid-connected vehicles. The following measures are indicative policy measures which EURELECTRIC promotes:

- **The European Union should help in standardisation of charging infrastructure for electric vehicles**

- **The European Union should develop a common assessment system for the efficiency and CO2 emissions attributable to electric vehicles.** CO2 emissions of electric vehicles in CO2g/km are evaluated based on their energy consumption in kWh/km and the carbon intensity of the electricity system in gCO2/kWh. Should measurements be made on a national or EU basis?

- **The European Union should use available powers to encourage Member States to use CO2 emissions as the standard tax base** for car purchase and circulation taxes. Inconsistent taxes based on archaic power and engine capacity ratings are creating an uneven market which runs counter to EU principles.

- **The European Union should prioritize R&D funds for electric vehicle research**. A positive approach to EV demonstration projects could be given under the Intelligent Energy Europe framework. It is important to test network integration of electric vehicles in different environments due to different customer behaviour and existing infrastructure.

- **Member States and National Regulatory Agencies should remove administrative and planning barriers** to the installation of fast charging poles for plug-in vehicles

- **Member States should support infrastructure investments** such as public charging stations.

- **Member States should facilitate the use of electric vehicles in cities**. Examples include :
  - -exempting EVs from road tolls or congestion charges
  - -allowing EVs to use bus and taxi lanes
  - -reducing parking fees or reserving city parking places with plugs for charging EVs

# 4 Standardisation Initiative

## 4.1 Although electric plug-in vehicles can already be charged using existing plugs, for a mass deployment additional possibilities are needed

Back of the envelope estimations show that in the (impossible) scenario of 100% electric vehicles as of tomorrow electricity demand would increase by 15% in the EU-27. In reality mass deployment of electric vehicles would take longer allowing the generation capacity to adapt to the demand increase. Also the additional capacity needed would highly depend on the time of charging and discharging of the vehicles with the possibility of load shaving and better utilisation of capacities. This is in particular advantageous with the rising share of intermittent sources as expected form the rising share of renewable energy in the EU.

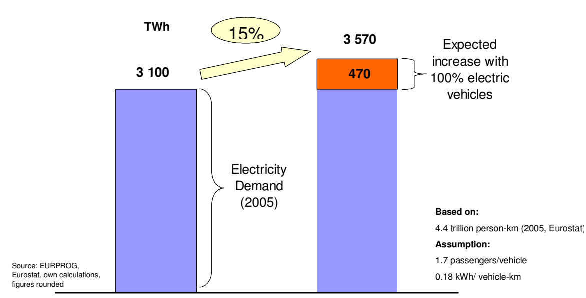



Figure 2: 100 % EVs as of tomorrow would increase EU-27 electricity demand by 15%

In contrast to other new individual transport concepts the “refuelling” infrastructure for electric plug-in vehicles is already in place. However for electric plug-in vehicles to become a success, both hardware (connector/cable) and communication software standards are a prerequisite in order to provide security for investment in infrastructure, promote customer convenience and drive forward the development of a global market in electric vehicles.

An alliance of electricity companies and original equipment manufacturers (OEMs) for automobiles made further progress towards agreement on standards for connecting electric vehicles to the power grids. The group, which started up last November, comprises some 20 international companies. Most of the electricity companies involved are represented in EURELECTRIC's Task Force on Electric Vehicles. The initiative aims to accelerate and improve standards definition with the following goals:

- One single position to speed up the standardisation process.
- Create one common standard for the first generation infrastructure/vehicles
- Clarify development roadmap

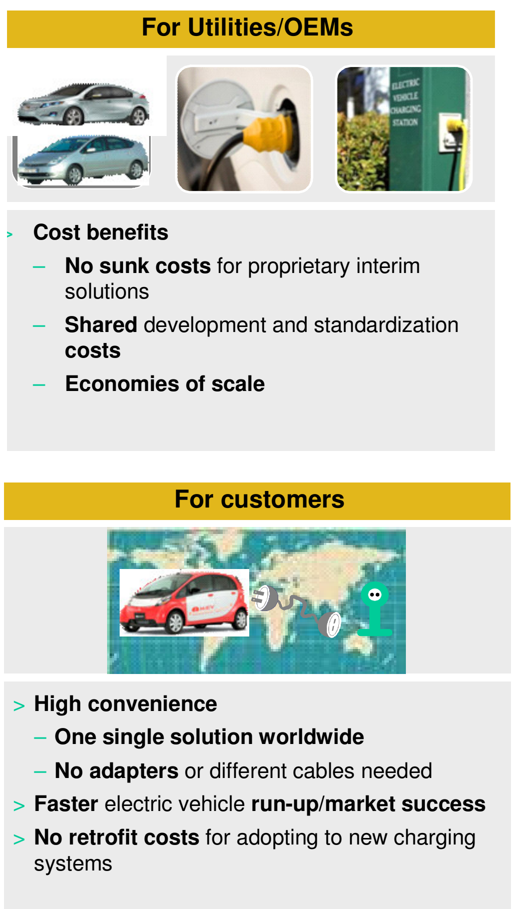



Figure 3: Standardization benefits

## 4.2 Physical connection

Following specifications set out by the group, one manufacturer has already developed a model that showed the expected differences in price and weight depending on the amperage of the connector. The new plug design enables bandwidth from single-phase 16A supply up to a high power 3-phase-supply at 63A with 5 power pins 500V.

In comparison to the standard IEC 60309-2 plugs it realizes a handy design and adds the possibility of interlocking and safety communication over two data pins. Technical specifications and test requirements for the new connector still have to be specified. It is expected that the requirements for the IP protection will be different for the car and for the charging pole.

Experience has shown that local authorities may prefer individual colour and specification of the charging cable to fit in the public environment. To avoid different solutions for different countries a standardized solution fixed in the ISO/IEC standards would be preferred.

The design details of the charging spot (which will probably need to be inter alia "hooligan-proof") and the location of the connection at the car will be left to individual companies. Therefore, the bended plug has to compatible with both open access to the socket and charging stations with a closed flap covering the socket.

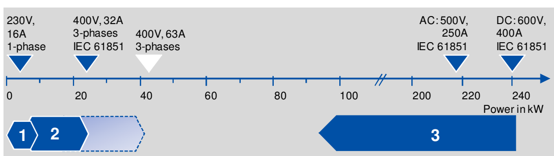
Figure 4: An OEM/Utility standardization initiative was started end of 2008 to accelerate and improve standards definition

A draft proposal is expected for end of April that will then start its journey through the official standardisation bodies.

## 4.3 Fast Charging

The working group on hardware set up under the initiative has recommended that in addition to "default" - overnight - charging at home with conventional plugs, two other modes should be provided for in the infrastructure. "Normal" charging should enable the customer to "fill up" while parking in the city centre. "Fast" charging would mean the customer having to wait only a few minutes (< 10 Minutes for approx. 150 km driving range). In terms of power, fast charging should be in the range of approx. 200 kW. Lower power may be possible, depending on battery size and condition and provider of charging station.

There is a significant gap between the upper limit of normal charging and the lower limit of fast charging with ~200 kW. However, customers are not expected to ask for a closing of this gap.




| | | 1. Default (home) charging | 2. Normal charging | 3. Fast charging |
|---|---|---|---|---|
| Maximum power | | up to 3.7 kW | up to 22/43 kW | up to 240 kW (DC) up to ~220 kW (AC) |
| Charging duration* | 10 kWh | ca. 3 h | 15-30 min | <5 min |
| | 20 kWh | ca. 5.5 h | 30-60 min | ca. 5 min |
| | 40 kWh | ca. 11 h | 60-120 min | ca. 10 min |

- Fast charging defined by charging duration (~10 min)
- In terms of power, fast charging should be ~200 kW

* simplified, basic calculation for duration: Capacity / Power

Figure 5: Definition of Fast-Charging

## 4.4 Communication

For communication, the group decided to use a wired connection such as power line communications (PLC) in order to ensure clear identification of a given vehicle. Several "use cases" have been defined that provide a blueprint for data-containers used for identification, billing and paying.

Examples of use cases:

- Charger requires information about connected battery
- Battery requires information about the charger
- Warnings and alarms
- User authentication, authorisation and administration

Messages and required data fields should be developed based on the use cases. However cars that have limited/no communication ability should be accommodated for. Overall, the transmission rate is expected in the range of few kB.

The idea of creating a "clearing house" has been suggested in order to enable the customer to "roam" with his supply contract to different areas and countries, as is the practice in the field of mobile phoning. The messaging process (via the already widely used TCP/IP) is also being discussed.

## 4.5 Way forward

The alliance is due to start work with standardisation bodies International Standards Organisation (ISO) and International Electrotechnical Committee (IEC) in March 2009. With a view to creating worldwide standards, representatives of the USA and Japan, which have existing standards, will be invited as well.

The EURELECTRIC Task Force is currently drafting a political declaration with the aim of having it endorsed cross-industry and by the European Commission as a commitment to e-mobility and backing for the standards.

# References


[1] Around 130g CO2 /kWh, according to the *Role of Electricity*, EURELECTRIC, 2007

[2] Around 130g CO2 /kWh, according to the *Role of Electricity*, EURELECTRIC, 2007

[3] Estimate based on oil price of 80$/barrel price and exchange rate of 1.3 dollars to 1 euro.

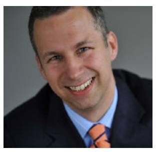
[4] *Eurostat,* Energy – Monthly Statistics, Issue number 4/2008, 23 April 2008 http://epp.eurostat.ec.europa.eu/cache/ity_offpub/ks-bx-08-004/en/ks-bx-08-004-en.pdf

See also:

EURELECTRIC *Electric Vehicles Brochures,* November 2008.

E-Mobility Infrastructure Standardisation, *Initiative Documents,* 2009.

## Author



Gunnar Lorenz is Head of Unit - Networks at EURELECTRIC, the European electricity industry association. Since January 2008 he is leading a new team managing the Network Committee and its groups within the EURELECTRIC Secretariat. The new focus of EURELECTRIC's Networks Committee is to represent European DSOs with one voice towards European Institutions and stakeholders. Several international working groups have been created to support the Committee on issues such as Smart Grids, Electric Vehicles, Network Regulation, Network Customers, Transmission and others.