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Red Eléctrica backs the electric vehicle

September 2010

The energy and environmental challenges our society currently faces have shown the importance of developing electric mobility as the new form of transport, as it represents an excellent opportunity for our country to reduce its high energy dependency on petroleum and to reduce the emission of CO₂ into the atmosphere, in addition to contributing to improve air quality and to take advantage of energies of a renewable origin which already represent 26 % of electricity generation and that in 2020 shall represent 40 %.

In this way, electric mobility represents an effective tool for contributing to fulfilling the objectives of the European Union for 2020 regarding energy — 20 % reduction in greenhouse gas emissions compared to 1990 levels; a 20 % reduction in primary energy consumption in relation to the projected levels for 2020, and 20 % of energy consumed to come from renewable sources—.



Model of the electric vehicle acquired by Red Eléctrica de España.



Support for the electric vehicle, a national strategy



Recharging of an electric vehicle.



Recharging point.

Electric vehicle recharging at the Head Office of Red Eléctrica de España.

The electric vehicle is above all a great challenge in which all players from the automotive industry, electricity companies, IT companies and even the public administrations are involved.

Spain considers that the electric vehicle is an industrial, technological, energy and environmental opportunity and opens up a pioneering field for the development of smart grids and mechanisms for demand side management.

As a result of this conviction, on 6 April 2010 the Spanish government presented the Integral Strategy for the Promotion of the Electric Vehicle and a set of specific measures that shall be developed through an action plan over the next two years in order to reach the established objectives.

In November 2009 an Electric Vehicle Summit was held and at which a memorandum for the promotion the electric vehicle was ratified and signed by more than 40 institutions which included companies from various sectors: electricity, including Red Eléctrica, automotive, construction, petroleum and renewable energy companies, among others, and also public organisations, as well as all the autonomous communities.

Similarly, three working groups were set up to draft the strategic plan presented in 2010; one regarding infrastructure and energy management, another regarding promoting demand and the third regarding industrialisation. Since January 2010, Red Eléctrica has led the infrastructure and energy management working group, comprised of 19 members, whose objective was to contribute to the promotion of efficient recharging taking advantage of those hours with lower electricity consumption, and to the development of the necessary facilities.

• Integral Strategy for the Promotion of the Electric Vehicle

The objective of the strategy is to promote the electric vehicle so as to reach the figure of 252,000 electric vehicles (pure and plug-in hybrids) in 2014.

On one hand, the 2010-2012 action plan, which anticipates that by the end of the period 70,000 electrical vehicles will have been registered in Spain,

consists of 15 measures grouped into diverse actions aimed at stimulating demand; supporting industrialisation and R&D&i; optimising electricity demand management, and disseminating electromobility to society.

On the other hand, project MOVELE has also begun, within the framework of the Energy Savings and Efficiency Action Plan 2008-2011, with the aim of demonstrating the technical and energy viability of electric mobility in urban environments. MOVELE foresees the incorporation of 2,000 electric vehicles between 2009 and 2010, as well as the installation of some 500 recharging points, and the provision of financial assistance when acquiring a vehicle.

The electric vehicle, an opportunity for the operation of the electricity system

The electric vehicle will be a new energy consumer which, nevertheless, can become an ally for a more efficient operation of the system, reducing the great differences which occur between the peak hours of high electricity consumption and valley hours of low electricity consumption and facilitating the integration of renewable energies.

The demand for electrical energy presents a typical profile throughout the day, with two periods at which more energy is consumed, at noon (due to business activity) and late afternoon (due to high commercial and home activity), whereas the hours of lower electricity consumption occur between midnight and eight in the morning.

In order to be able to operate the electricity system better it is very important that demand is displaced towards those moments at which the consumption is lower, and this is where the electric vehicle can play a fundamental role, as advantage can be taken of these hours for a slow and intelligent recharging of the electric vehicle. In addition, in this way, the users of these cars benefit from a much lower price of electricity during these hours of reduced demand.

It can even go one step further, to the point where the electric vehicle can become a reversible energy storage system, as it could feed back into the grid, during periods of maximum demand, that energy which it has stored during the night. Thanks to this complementary service, the vehicle owner can obtain a financial benefit when feeding energy back into the grid at a more expensive price than that of when it was stored.



Red Eléctrica signage to identify recharging points.

Parking space for electric vehicles in the Head Office of Red Eléctrica.



An electric vehicle parked in a London street.



This interaction will serve to take advantage of the storage capacity of the batteries, and will require a bidirectional relationship with the electricity grid, that will be developed within the framework of smart grids.

As demanders of electricity, these vehicles are new consumers for the system and in 2020 they can, in addition, represent up to 2 % of the electricity demand. According to the studies carried out by Red Eléctrica, it is possible to integrate at least 6.5 million of these vehicles into the electricity system without additional investment in generation and the transmission grid, providing recharging takes place during valley hours of lower demand, under controlled conditions and following the recommendations of the electricity system operator.

To this end, it is important to promote mechanisms for demand side management which in turn promote recharging during the preferred night-time hours. In this way, it is very important to count on a tariff and pricing scheme where the cost of electricity is dependent on the time of day it is used.

The installation of intelligent meters will allow the development of these options, and will be a fundamental element in the operation of the electricity system of the future.

Integration of renewable energies

At the same time, the electric vehicle can play a fundamental role in the integration of renewable energies under secure conditions, especially wind power, which is difficult to manage and extremely variable, but every day with an increased presence in the energy mix.

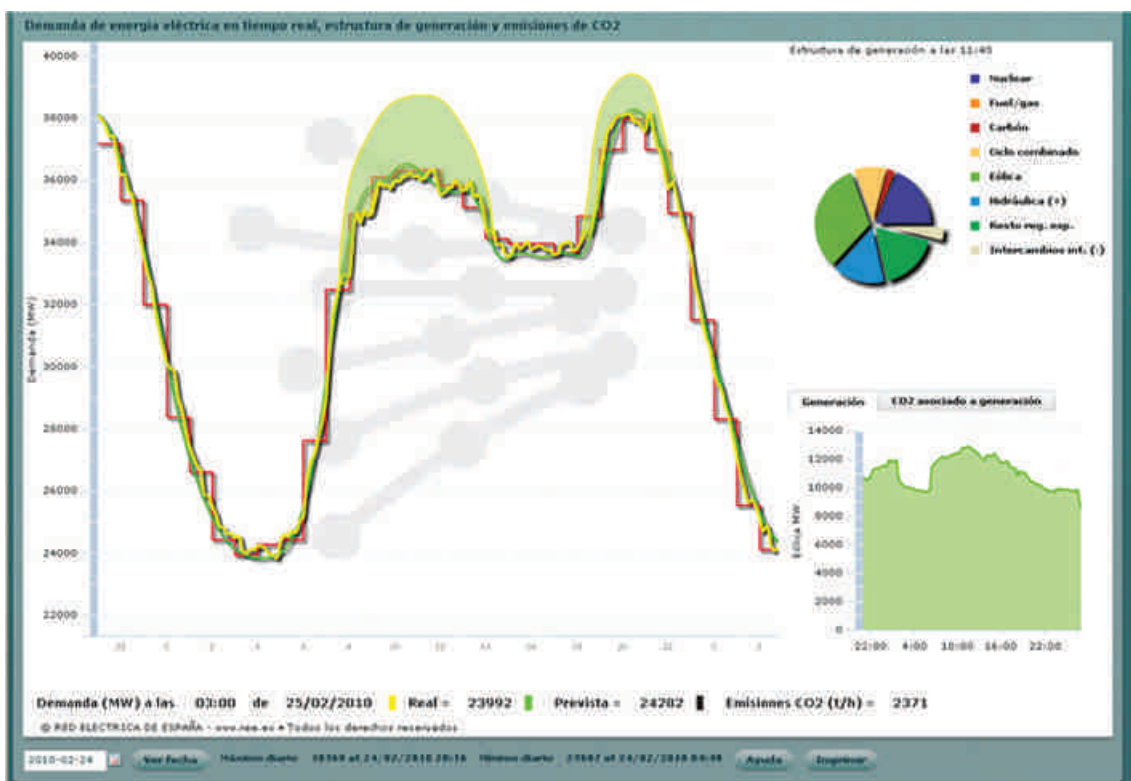
As electricity cannot be stored, when the supply of wind power energy is very high and the demand is very low, a situation which takes place especially during the night, in some cases wind power production may need to be interrupted as the relationship between supply and demand is not balanced. Firstly the choice is to reduce conventional generation until it is no longer possible to reduce it further as it may be needed at that moment or in following hours. From this point on, the reduction of wind power production begins.

For this reason, recharging electric vehicles during night-time hours reduces the possible disconnection of the wind farms in the case where its production exceeds the safety limits that the system sets.

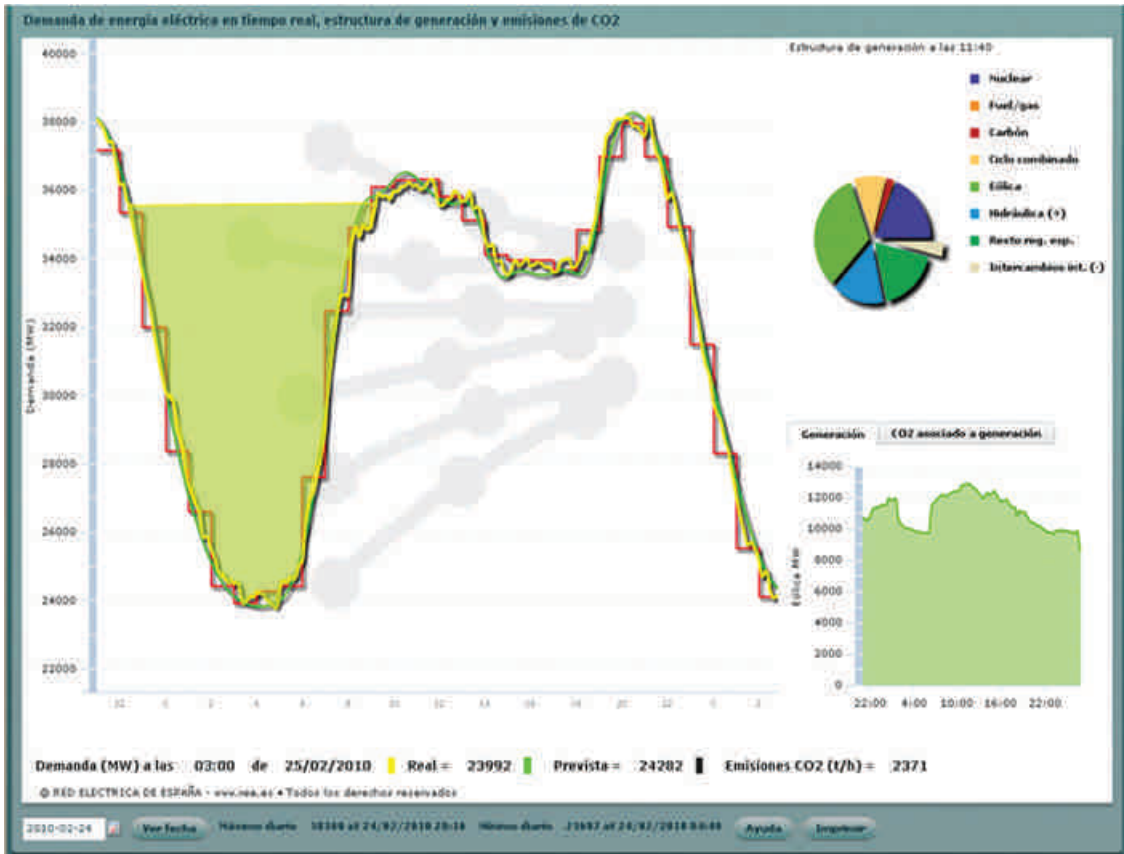
At the service of demand side management

The intelligent recharging of electric vehicles means taking into consideration the behaviour of the electricity demand throughout the day to determine the best time in which recharging should take place.

SCENARIO I: Inefficient system



If the recharging of the battery of these vehicles is carried out solely during the day, the national demand curve will undergo a greater imbalance between the periods of higher and lower consumption increasing the difference even more, which will increase at the same time the inefficiency of the system.



SCENARIO 2: Efficient system

The electric vehicle is an opportunity to improve the efficiency of the electricity system if the electricity demand is managed intelligently. The recharging of electric vehicles during night-time hours flattens the demand curve and enables a greater integration of wind power energy.

Red Eléctrica's backing

The backing of Red Eléctrica for electric vehicles is reflected in its active participation in different working groups and projects, as well as in initiatives such as the installation of recharging points in its facilities.

For this reason, in addition to promoting and driving the use of the electric vehicle, Red Eléctrica participates in other projects such as:

- **Installation of recharging points**

Red Eléctrica has become one of the pioneering companies in using recharging points in its facilities to promote electric mobility.

It already counts on nine recharging points, five in its Valencia offices, three in its Head Office in Madrid and one in its Seville office and, in addition, it has incorporated several electric cars that will form part of the company's vehicle fleet.

- **GREEN Project**

An initiative which began in 2009 and whose main objective is to develop, together with SEAT, an electric vehicle prototype which allows an efficient integration in the grid. The project has a budget of 39.7 million euros, of which Red Eléctrica will contribute 1.22 million. The company is taking part with the aim of looking for a better use of existing electricity infrastructures and allowing a greater integration of renewable energies into the system by means of the development of intelligent systems that allow the management of this new demand

- **VLPGO (Very Large Power Grid Operators) working group**

This working group is formed by the TSO (operators and owners of the transmission grid) of large electricity systems throughout the world, in particular the United States of America, France, Japan, Spain and Italy and has, as its aim, to study the effects of these vehicles on the electricity systems, as well as to establish a series of recommendations for manufacturers and regulators.



Interior of an electric vehicle.

An electric vehicle in its recharging process.





Electric motorcycle.

- **REVE Project (Wind power regulation with electric vehicles)**

A plan financed by the Ministry of Commerce, Industry and Tourism, and led by the Spanish Wind Energy Association with the aim of analyzing the technical and economic aspects derived from the contribution of electric vehicles to the guarantee of wind power energy evacuation.

- **MERGE Project (Mobile Energy Resources in Grids of Electricity)**

Included in the seventh framework programme of the European Union, its object is to evaluate the impact of electric vehicles on the European electricity systems. The participation of Red Eléctrica is based on the planning and operation of grids.

- **Technical specifications of the electric vehicle**

Technology	PHEV Plug-in hybrid electric vehicle	BEV Battery electric vehicle
Energy	5-16 kWh	15-25 kWh
Range	20-60 km	100-200 km
Top speed	180 km/h	100-130 km/h
Consumption	0.15-0.25 kWh/km	



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