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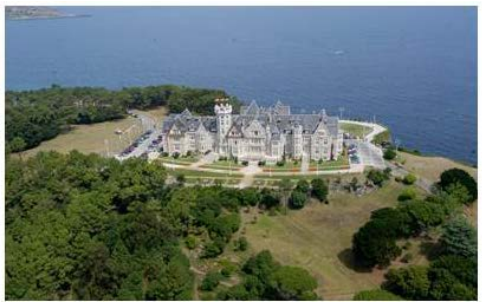

International Annual Symposium on Electric Vehicles

Launching edition

Santander, 26-29, August, 2014

A forum to assess values and deficiencies of an industrial revolution potentially leading to a new age of wealth

A holistic approach to environmental quality and energy efficiency: Enabling Technologies, Investment Needs, Integral Profits

A meeting point for corporation leaders, R&D engineers, environment and contamination scientists, economic forecasters, sociologists and policy makers to get the best prospect on Electric Vehicles development

Electric Vehicles: the onset of a new industrial paradigm?

Spain's International University "Menedez Pelayo" considers that Electric Vehicles can produce a sort of new Industrial Revolution with impressive effects on environmental quality and long-term economic bonanza, including a parallel development of the energy sector, particularly electricity generation, distribution and consumption. The latter should be enlarged for extending electricity availability in higher power rates, and the electricity generation will have to include cost-effective renewable energies in a sizeable share; which creates a link between EV and Energy Sustainability.

Electrically-powered Automobiles still have to overcome important barriers concerning their autonomy, the durability of the batteries and the cost thereof, plus the deployment of charging infrastructure and the adoption of management modes of electricity generation, storage and demand of much greater complexity than current activities in these fields. If Technology succeeds in this quest, the following consequences can change at depth our living scenario:

• Increased overall energy efficiency in transportation by vehicle, so that to satisfy the same need for transportation, energy consumption would drop to less than half the current value (even if used exclusively hydrocarbons in electricity generation).

• Dramatic reduction, to less than one third of the current values, in the total CO2 emissions, counting the whole life cycle.

• Reduction, even more, of local pollutants, especially particulates.

• Lower cost of fuel in the car, with reductions by a factor of three or higher (which should allow offset the higher initial investment, even if it is 50% greater than that of an automobile with internal combustion engine)

Let us take the example of an average petrol car, in moderately congested street circuit, with real consumption of 10 liters per 100 km. This means 70 grams / km, which amounts to 0.66 moles of octane per km, which involves the emission of 5 moles of CO2 in round numbers, per km , which means a mass flow of 220 g / km (this is almost double the values required for new cars by EU legislation , but these "administrative" values refer to ideal running conditions, in which consumption lowers to 6 liters per 100 km or less, which conveys emissions of 130 g /km or less) .

The value of the mechanical energy to drive an average car is 0.12 kWh , i.e. 0.432 MJ . The heat load in the combustion of 70 g of gasoline is 700 kcal, equivalent to 2.92 MJ , which indicates that the actual efficiency of the characteristic automobile is 15% (the optimum engine performance at its best regime, is almost double 28 %, but the inefficiencies of the engine out of its optimum, accelerations, and idle periods make the figure go down to that value).

An electric motor has the advantage of not having idle periods, because it stops when the car stops. And its performance is very high for most of the regimes of the system,

which is finely controlled by power electronics. On average it can support an 88% yield, which must be multiplied by the charge and discharge performance of the battery, which can be estimated conservatively at 75 % , making an overall efficiency of 66%. So its consumption (from the electric grid) is 0.18 kWh electric, for every kilometer traveled.

We must add grid losses and losses in generation to the former figures, which can be estimated in 10% total loss, which ends up with generating 0.2 kWh in the electric system to satisfy 1km of car travel.

Imagine octane burned in a combined cycle Brayton + Rankine , which currently yields 60 % are achieved and in the near future 70%. Taking the latter figure, which best represents the future, we arrive to a primary (thermal) energy consumption of 0.28 kWh per km travelled (afterward) by car, which is equivalent to 1 MJ. This means that we will need to burn 24 grams of octane in an electric power plant to produce the required electricity, just over a third of the direct consumption of a gasoline car.

Similarly occurs with the generation of CO_2, which is reduced from 220 g / km to 75, counting the whole energy chain (except before the arrival of gasoline, which is neither accounted for in the combustion engine nor in the electric one). But it is inevitable to note that CO_2 emissions would be much lower if the batteries were recharged with electricity from nuclear or renewable sources, where emissions , counting the whole life cycle, are in the range of 30-40 g / kWh (elec,) which means that emissions would be 10 g/km , .i.e , one-twentieth of that emitted by the combustion vehicle.

As for the cost to the user, with a price in electric domestic market of 20 c€/kWh (elec) the cost per km would be 3.6 c€/km, and therefore 3.6 euros per 100 km . With gasoline at 1,5 €/liter, 10 liters per 100 km in a characteristic car, the cost would increase to € 15 per 100 km , ie 4 times, (although this value includes the very high tax burden to gasoline). At 100,000 km the electric car would save more than 11,000 €, which in principle should compensate for the cost of the big battery and ancillary systems.

In summary, the largest environmental cleanup in both global and local pollutants, increased energy efficiency of automobile transportation and the positive economic impact on the consumer's pocket, point out that the Electric Car is a challenge to be solved, but above all a promise to conquer.

Ground and underground transportation has been partially electrified for more than one Century, particularly in railways, but the dominant field of automobiles is absolutely dominated by internal combustion engines and direct consumption of hydrocarbons.

Can the case for Electric Vehicles become a reality in a non-distant future?. Will it have the economic and environmental positive effects that some theoretical studies are pointing out from the side of EV friends?. And above all, will there be any advantage for pioneering countries setting forth the infrastructure for the deployment of electric vehicles?

Answers to these questions are rooted in the barriers that will be found in said deployment and the ingenuity to overcome them; and the symposia will mainly focus on these points, applied to both ends of the problem: the vehicle as such, and the electric industry evolution (or revolution) demanded by this challenge.

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