



RECHARGING YOUR ELECTRIC CAR BATTERY, WHY IS IT SO COMPLICATED?

By Serge Pelissier, senior researcher - AME department . Ifsttar

In order to run, our vehicle needs energy. In a few minutes, we can fill the tank of a combustion engine car with enough fuel to travel several hundred kilometres. This is quick and easy, and difficult to duplicate in an electric vehicle. To make the same journey, it may take several hours to recharge the battery. Why is it so complicated to recharge your electric car quickly?

The battery: central to the debate

Electric vehicles store their energy in lithium-ion batteries. This type of battery is preferred to a lead-acid battery because it is much lighter (by a factor of 4 or 5) and can be recharged faster (1 hour for a lithium-ion battery compared to 6 to 8 hours for a lead-acid battery). To recharge a 30kWh battery in 1 hour (the Renault Zoé has a 40kWh battery), around 30kW of electrical power must be available. Our domestic plugs are restricted to 3 kW, so it takes 10 hours to recharge this vehicle's electric battery in our garage.

However, there are fast charging points that recharge 80% of the battery in less than an hour. These have high power ratings (up to 120kW now, and even 350kW in the future) but require the battery to be sufficiently discharged before it can be recharged. This is because the power capacity of a battery varies with its state of charge. An empty battery can take high power. Above a state of charge of 70 or 80%, the maximum wattage decreases. Even when connected to a fast charging point, a battery that is only slightly discharged takes longer to fully recharge.

Electricity - so omnipresent we forget its value

We are using more and more portable battery-powered devices. They are very easy to recharge because they are small. Electric cars are different because the battery stores a vastly greater amount of energy. The wattages involved can be very high. We are used to the easy energy transfer provided by liquid fuels, and it is not easy to compete with this. For example, if we take the amount of energy contained in a petrol tank and divide it by the time it takes to fill it, we obtain a power of about 20MW¹. It is unrealistic to want to handle this level of electrical power easily. This would require either huge cables several centimetres in diameter or dangerous voltages of several tens of thousands of volts. We must not forget that although energy is, obviously, a physical concept, it has a material existence and its collection, storage, transfer and conversion carry a cost. A simple electrical socket conceals a whole technology.

¹ This should be compared to the 10MW power of a TGV. You wouldn't think it, but when we fill a petrol tank we are handling a colossal amount of power.

Which solution: technology or energy saving?

Electricity provides EVs with tremendous advantages (lower urban pollution, very high efficiency, recovery of braking energy, etc.) but recharging is necessarily more difficult than with fuel. Rather than considering expensive and hypothetical solutions to shorten battery charging time, it is probably better to realize that energy is precious. Despite their apparent ease, energy storage and transfer involve complex technologies and energy use is often underestimated. These are all good reasons for saving it..

Power: whizat?

A device (car, computer, radiator, etc.) is characterized by its power. Power is expressed in Watts (W).

The energy required to operate a device for a given length of time is the product of its power and the operating time. Energy can therefore be expressed in watt-hours (Wh).

Find out more

Autonomie des véhicules électriques : un enjeu durable ? Serge Pelissier, IFSTTAR

Bilan transversal de l'impact de l'électrification par segment. IFP Energies Nouvelles, projet E4T. ADEME, 2018.
www.ademe.fr/mediatheque

Les potentiels du véhicule électrique. Les avis de l'ADEME – Avril 2016, www.ademe.fr/mediatheque

La France amorce le virage vers le véhicule électrique. Carbone 4, 2018. www.carbone4.com

Autonomie des voitures électriques, quand le mieux devient l'ennemi du bien» Serge Pelissier, The Conversation
<http://theconversation.com/autonomie-des-voitures-electriques-quand-le-mieux-devient-lennemi-du-bien-106099>



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