



## EDF Electric Transportation

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## RECHARGING MODES ADAPTED TO USE

Battery recharging technology is at the center of the debate surrounding the deployment of recharging infrastructure. In the short and middle term, two principal charging modes – rapid charging and normal charging – will fulfill the established requirements. Other charging methods are under study for utilization at a much later date, such as the so-called “gentle charge”. In its national plan for the development of electric and hybrid rechargeable vehicles, the French Government is anticipating **the installation of 4.4 million recharging points for an estimated 2 million vehicles between now and 2020**, with around 90% to be located in private residences and at user work sites (all of which will supply normal charge), and the remaining in public parking facilities and along roadways. The majority of the two latter will provide normal charge, and a small percentage, rapid charge.

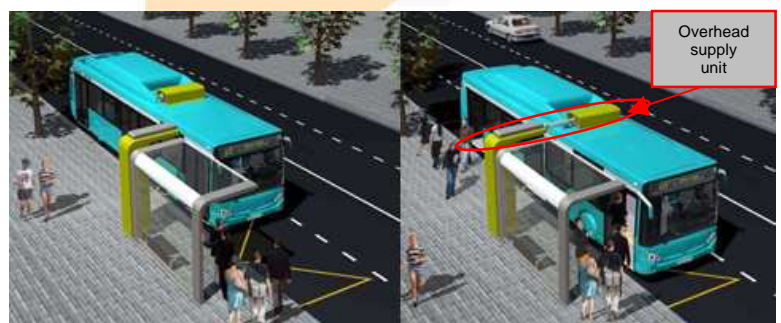
- **Normal charge (3 kVa) is carried out through dedicated sockets installed in vehicle parking areas:** such as private homes, business parking locations, train or airport lots, and the like. This type of charge requires no significant modification of the electric network, and solicits tolerable levels of the power supply. **Fully charging a 25 kWh battery requires somewhere from 8 to 10 hours, (at a charging strength of 3 kVA),** which is compatible with the observed parking time span of private cars, and rests on the assumption that batteries will seldom arrive completely depleted of charge. A national survey on family travel shows that other than when leaving cars overnight, private cars are parked for 4-hours at least two times during an average day, primarily at home and workplace locations. As a consequence, **it is without a doubt normal charging that will be most widely adopted.**

- **Rapid charge** (above 24 kVA) involves strong current (32 to 63 Amp) and high tension (400V); its use necessarily requires security measures. This charging mode, answering charging needs for “contingencies” or extraordinary situations, will be available at dedicated locations (for example, in public parking facilities) and should allow for complete recharging (of a 25 kWh battery) in under an hour.

Rapid charging will put a much greater strain on electricity supply than normal charging, and will demand significant investment, most notably for the reinforcement of the electric grid. **Strategy applied to their placement will require consideration of optimizing infrastructure technology and costs, and of a deployment best adapted to the real needs of vehicle users, including that of providing for “contingencies”.**

**Mechanical battery exchange stations represent a unique mode of rapid recharging.** Still under development, this technology will allow drivers to have depleted vehicle batteries exchanged for fully charged units in only a few minutes.

**Among innovative ideas for optimizing battery recharging** are two projects underwritten by ADEME “demonstration funds”: the WATT project, whereby electric buses equipped with onboard supercapacitors would be able to recharge via overhead supply systems installed at bus stops; and the Ellisup (in partnership with Irisbus, EDF, and the CEA) project, and its rapid recharging stations for lithium-ion battery packs and supercapacitors for electric buses.



*Rapid charging system through overhead supply units (WATT Project) PhotoDR*

- **In the very long term**, other avenues are under study for recharging electric vehicles. The gentle charge, with its use of a weak current (charging strengths on the order of 1 kVA) will allow a leveling of electricity demand spikes, with vehicles recharging slowly over longer time periods. Or **induction charging**, which may one day allow recharging of a vehicle in motion!

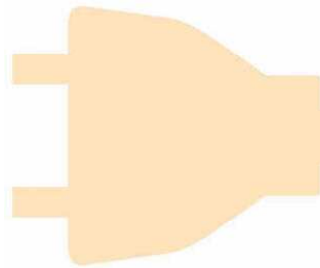
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