Electromobility: Challenging issues

THE FUTURE(S) OF ELECTROMOBILITY

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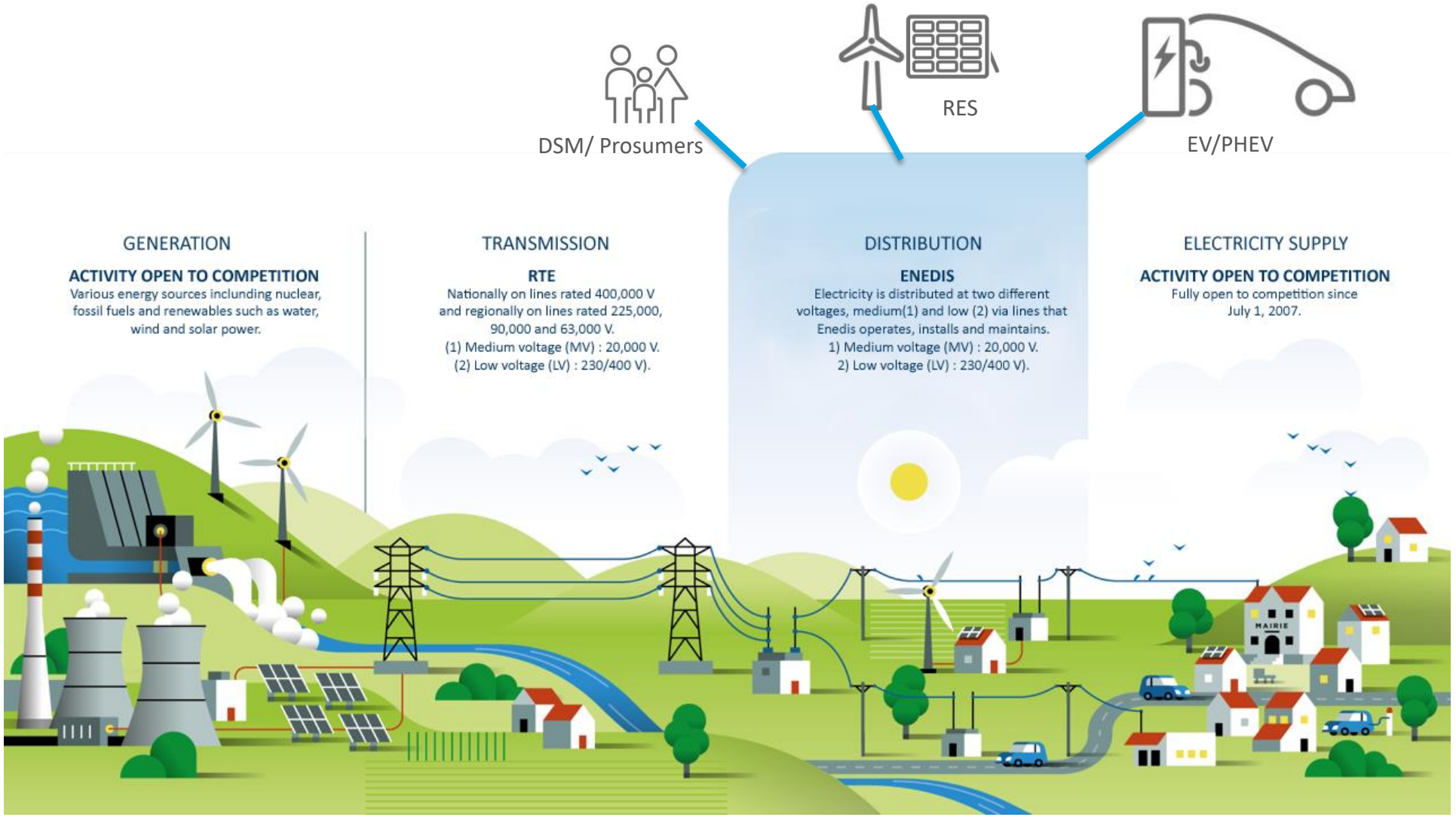
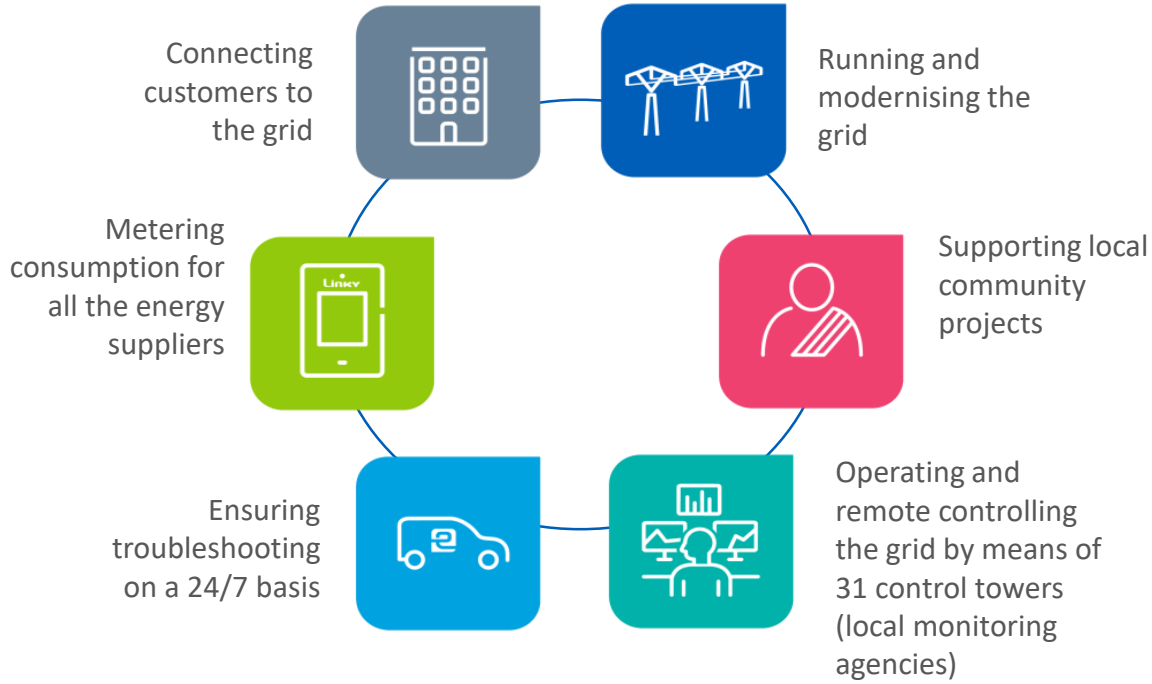
Enedis plays a crucial role in the evolution of the electricity system



Enedis public utility missions

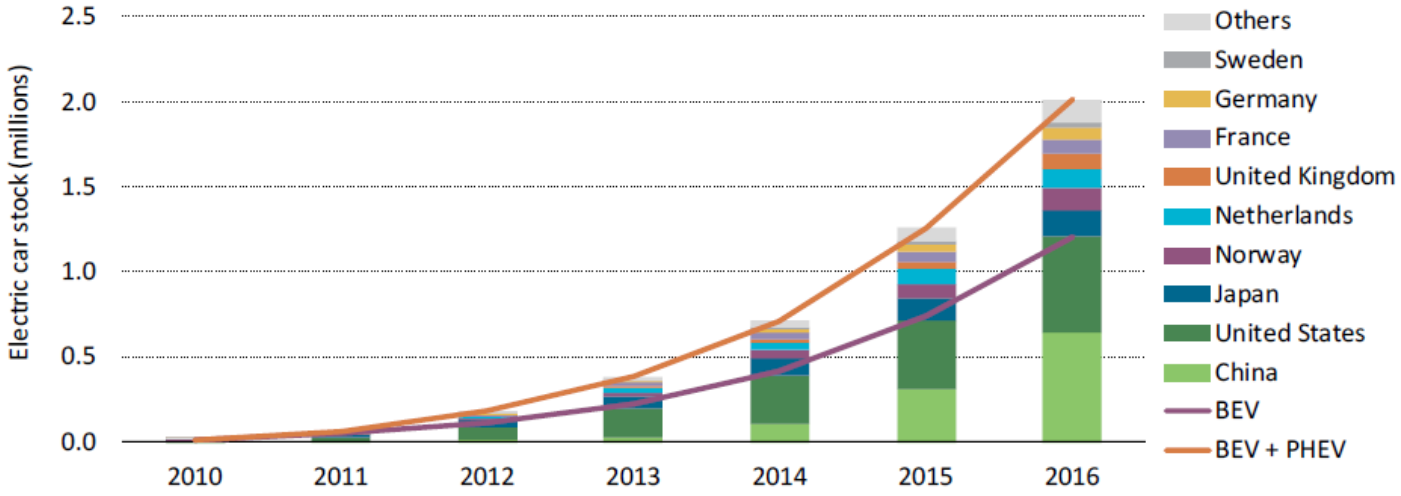


Electricity distribution in France

- **The public electricity distribution network belongs to local authorities**
- **They entrust their maintenance and development to Enedis**
- **Enedis is the main operator of the French distribution network,** covering **95% of the national territory**

Acceleration of electric mobility around the world

Evolution of the number of EVs worldwide between 2010 and 2016

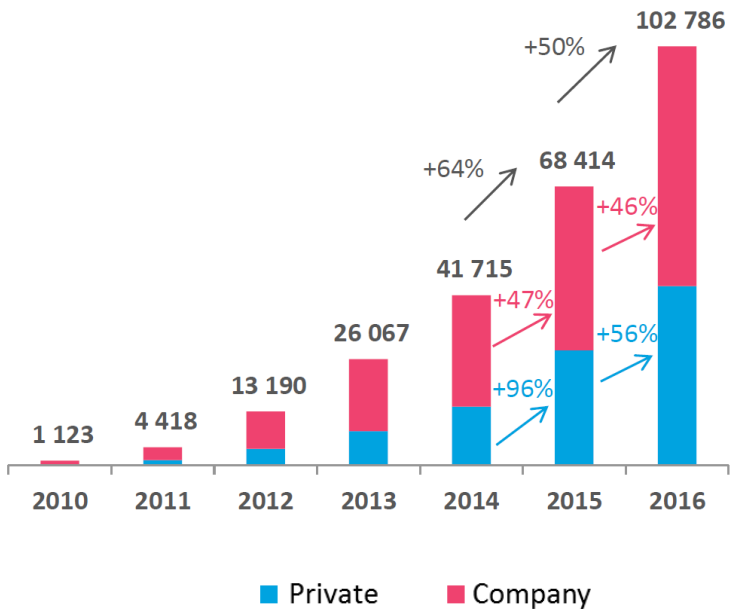


- Drivers:
  - Financial incentives to encourage purchasing,
  - Ecological stakes in cities,
  - European regulations,
  - Innovation by manufacturers,
  - Efficient solutions in terms of recharging and range
- The acceleration in the penetration of electric vehicles (VE) and plug-in hybrid vehicles (VHR) is notable worldwide.
- By the end of 2018, all European manufacturers will have electric vehicles in their catalogue.

Source: IEA, Enedis, AAADAta, Gireve

Current deployment in continental France (end of 2016)

EV and PHEV: only 0,2% of the total French car fleet… but a sharp growth since 2010

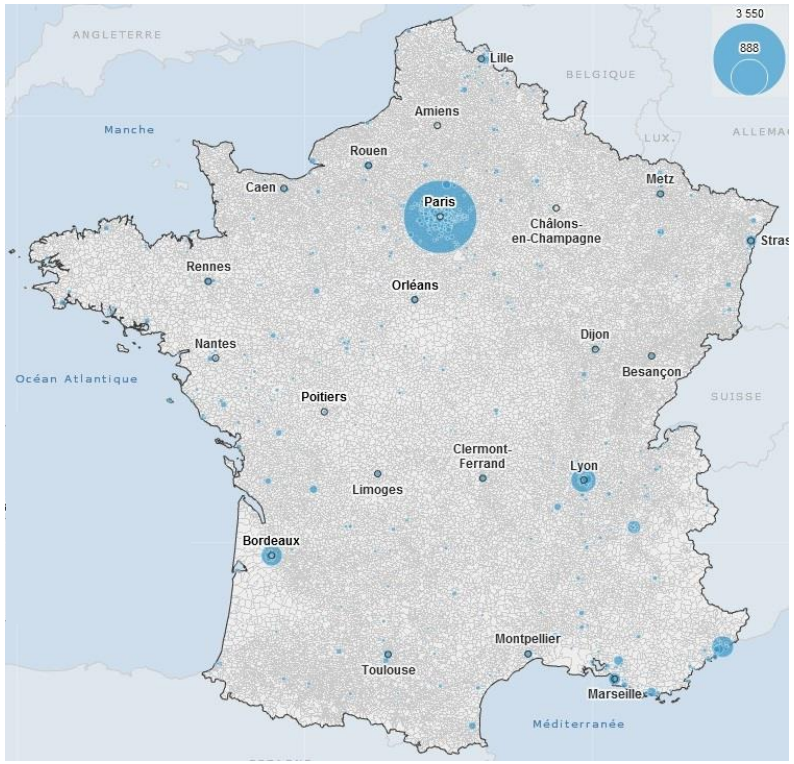


Increase of private owners higher than companies

Number of Electric (EV) and plug-in electric vehicles (PHEV) registered

Almost 90 000 vehicles registered in more than 13 000 towns (85% are EV)

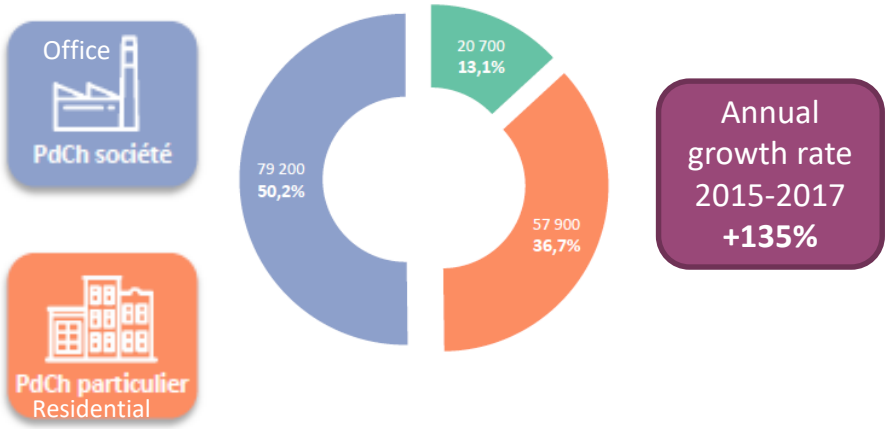
Number of public charging points installed



More than 14 000 public charging points located in almost 2 000 towns

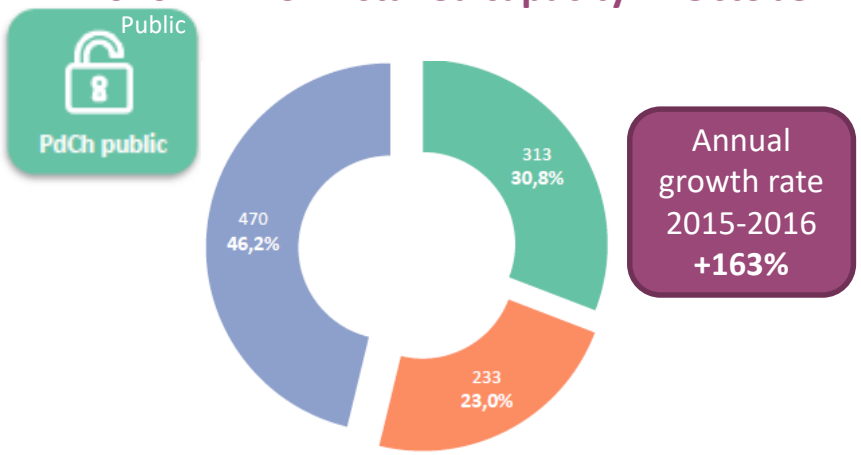
In France, the Energy Transition Law sets an ambitious target of 7 million charging points by 2030, and 1 million by 2020

157 800 charging points in October 2017



Annual growth rate 2015-2017 **+135%**

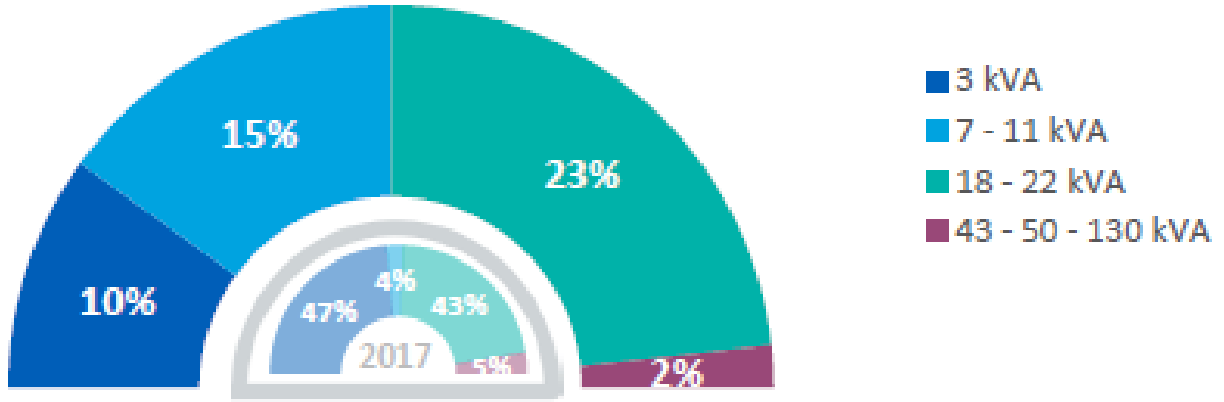
1016 MVA of installed capacity in October 2017



Annual growth rate 2015-2016 **+163%**

Installed capacity is growing faster than the number of charging points due to the development of quick public charging points

20 700 public points in October 2017 → 37 000 to 108 000 public points in 2019



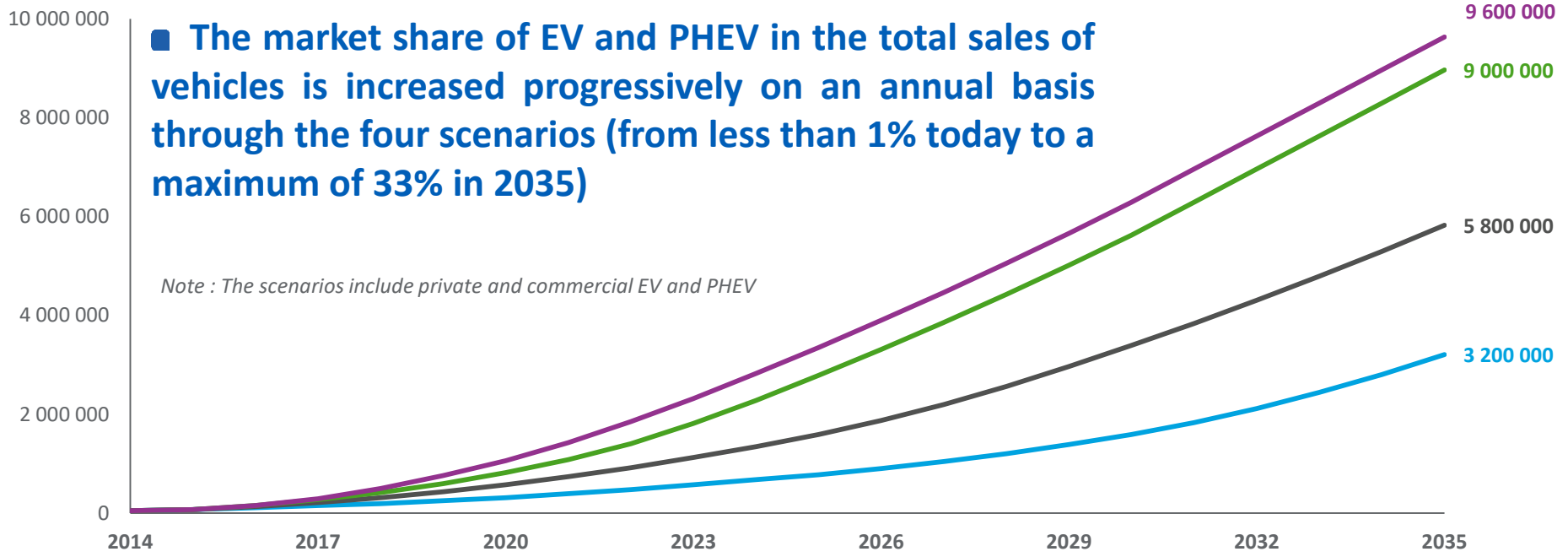
- **The number of public charging points should be increased almost fourfold by 2020 (46 000 to 154 000)**
- **Installed capacity of the public charging points will grow even faster**

Charging capacity and consequences for distribution network

	Duration	Impact in terms of power	
Normal charging	**1 hour** for an autonomy of 20 to 30 km **7 to 8 hours** for a full charge	**From 3 to 7 kVA** Equivalent to **1 electric water heater**	
Quick charging	**1 hour** for a full charge	**22kVA** Equivalent to **20 washing machines**	
Fast charging	**30 minutes** for a full charge	**43 kVA in alternating current** **54 kVA in direct current or more** Equivalent to **10 households**	
Ultra-fast charging (for specific vehicles)	**30 minutes** for an autonomy of 270 km	**120 kVA** Equivalent to **20 households**	

- Charging method, location of charging points (above all public charging points) and management schemes of the charge (above all smart charging) will have a significant impact on the infrastructure cost associated to the development of EV and PHEV
- **This leads to a dire need for anticipating long-term scenarios of deployment of EV and PHEV, and charging points on a local scale**

EV and PHEV development result from the combination of a bottom-up approach collected in the territories, cross-referenced with a top-down approach based on public policies



- **The market share of EV and PHEV in the total sales of vehicles is increased progressively on an annual basis through the four scenarios (from less than 1% today to a maximum of 33% in 2035)**

Note : The scenarios include private and commercial EV and PHEV

Blue scenario
- Depressed economy (+0,5%/year) and low demographic growth
- Slow energy transition
- Slow deployment of EV and PHEV

Grey scenario
- Economic (+1,5%/year) and demographic growths
- Development of renewables, energy efficiency and electric transport
- Development of EV and PHEV

Green scenario
- Economic (+1,5%/year) and demographic growths
- Significant energy transition efforts
- Strong development of EV and PHEV

Purple scenario
- High economic (+1,9%/year) and demographic growths
- Massive transport electrification
- Strong development of EV and PHEV

EV and PHEV scenarios are used to estimate what could be the deployment of charging points and associated network costs

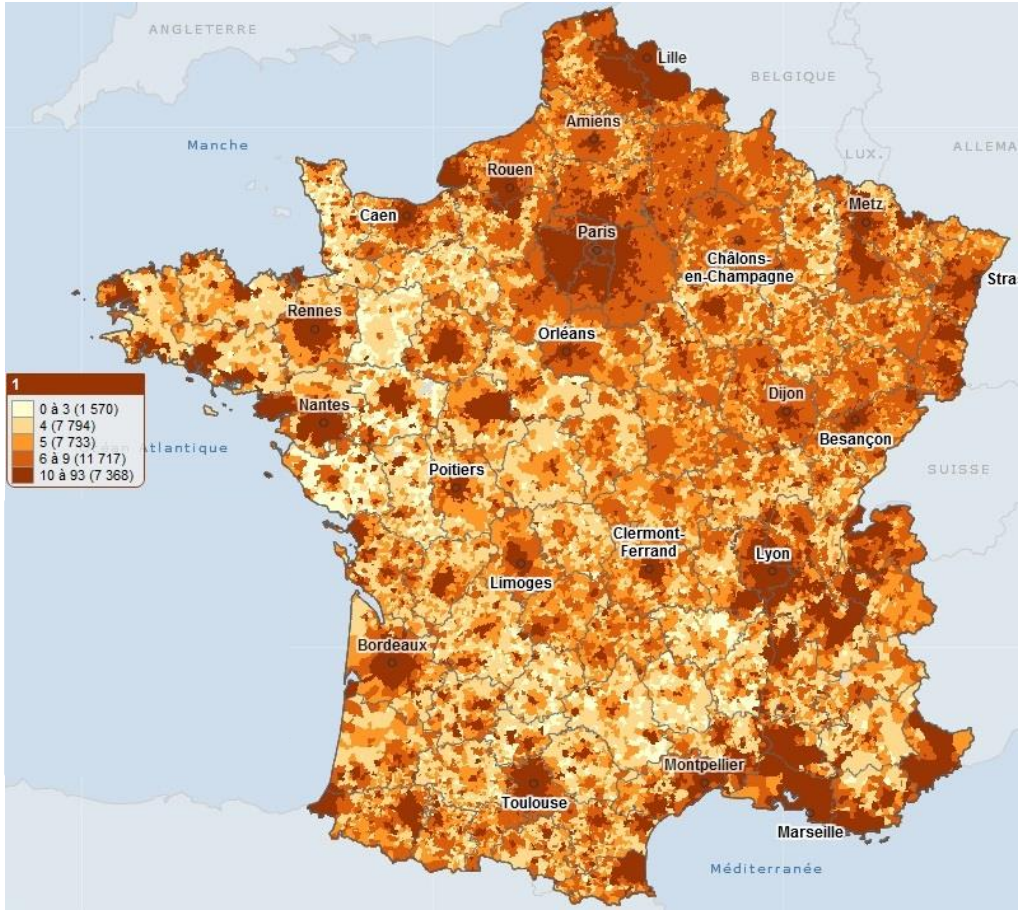
Scenarios of EV and PHEV deployment are used to estimate what could be the development of charging points, based on:

- Assumptions on the number of charging points per vehicle according to the type of vehicle (private, commercial, car-sharing)
- And the type of area (density and population)

This second step provides some results to estimate what could be the reinforcement and development costs of the network, based on:

- Assumptions on the charging profile and on the behaviours of agents depending on the type of vehicles and area
- This study is still in process

Proportion of EV and PHV in the total car fleet per town in 2035 in the green scenario (in %)



Take away: The development of electric mobility is compatible with the current electrical system if we know how to anticipate it.

2035

9 million vehicles is:

- 30% of the 2016 passenger vehicle fleet
- 5% of electric consumption 2016
- 20% of the 2016 peak consumption without optimizing the refill
- **4% of peak consumption** 2016 with optimized charging patterns

In the long run

Four recent changes in the environment could lead to the switch from all-electric mobility :

- new regulations,
- ability of vehicles to interact with the network as a standard,
- accelerated development of the autonomous vehicle
- announcement of electric trucks

-> break with shared mobility and paradigm shift in private and public transport modes ("100% shared autonomous electric vehicle")

In the long run, to support the deployment of the electric car, it is crucial to

- **ensure as soon as possible interoperability for users** of all charging infrastructure installed
- establish a **national director scheme** of charging infrastructure to ensure geographical and technical coherence
- anticipate the impact (peak effects) of the deployment of electric vehicle on networks by setting up **an incentive tariff signal** and using **smart technologies and communication** associated

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