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E-mobility: impacts and opportunities for electrical networks

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1. Transport vs Energy

Needed Energy for Evs' in 2030

350M EV in 2030

430 Mtoe Energy

18% of total transport energy
vs 0,4% in 2020

Needs of:

Additionnal elec. production capacities

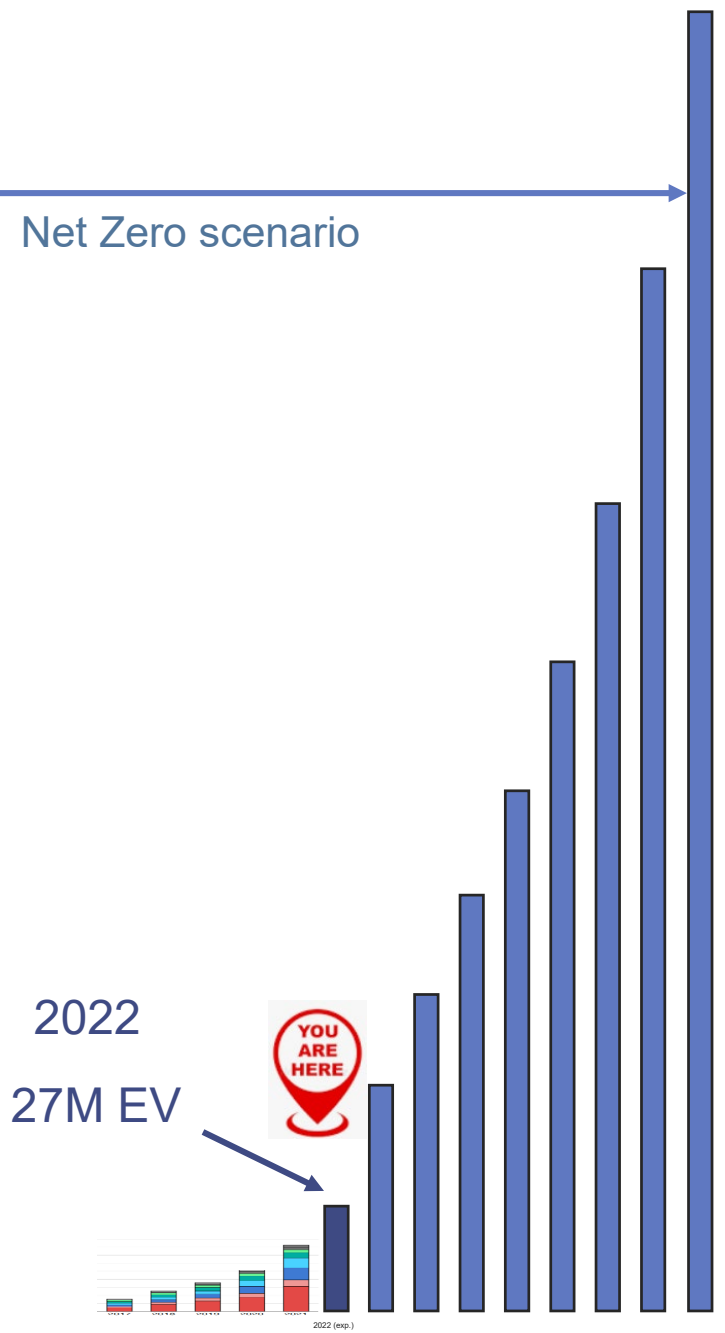
Infrastructure reinforcement

Energy management for charging

Millions of tonnes of oil equivalent (Mtoe) = 11 630 GWh

Net Zero scenario

700M to 1200M EV in 2050



Energy management for EV charge

EV Charge can be controlled permitting flexibility on networks and production

SMART CHARGING

"Smart charging means adapting the charging cycle of EVs to both the conditions of the power system and the needs of vehicle users. This facilitates the integration of EVs while meeting mobility needs."
(IRENA definition)

BENEFITS

- Allow to integrate EV in networks
- Reduce and/or postpone grid infrastructure investments
- Network congestion
- Peak shaving / Load shifting
- Provision of ancillary services

2. Solutions and opportunities

EV opportunities for networks

Smart Charging – Typical use case

Charge

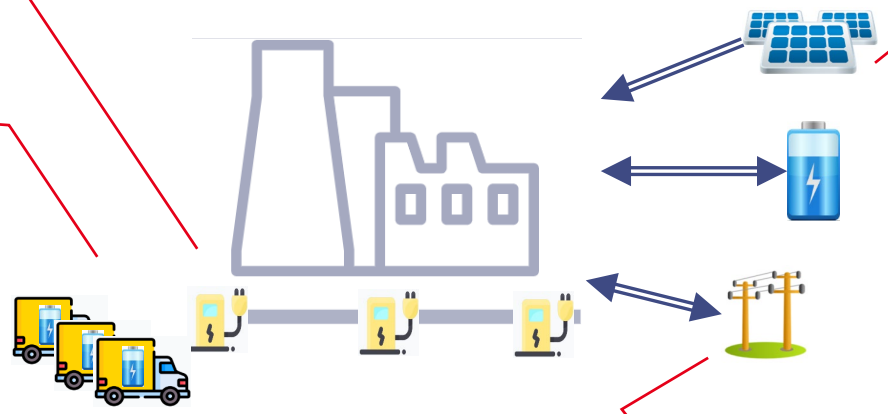
How many points ?

- Charging point power
- Nb parking points
- Communication / Control

Operation modes

Usage impacts ?

- Site consumption
- Frequentation
- Operations (Logistic, Incentives…)
- Types of vehicules / Autonomy
- Time to charge
- Season / Weather
- Security / Insurance



Energy feeding

How to use local energy ?

- PV Production
- Storage
- Other energy vectors

Grid

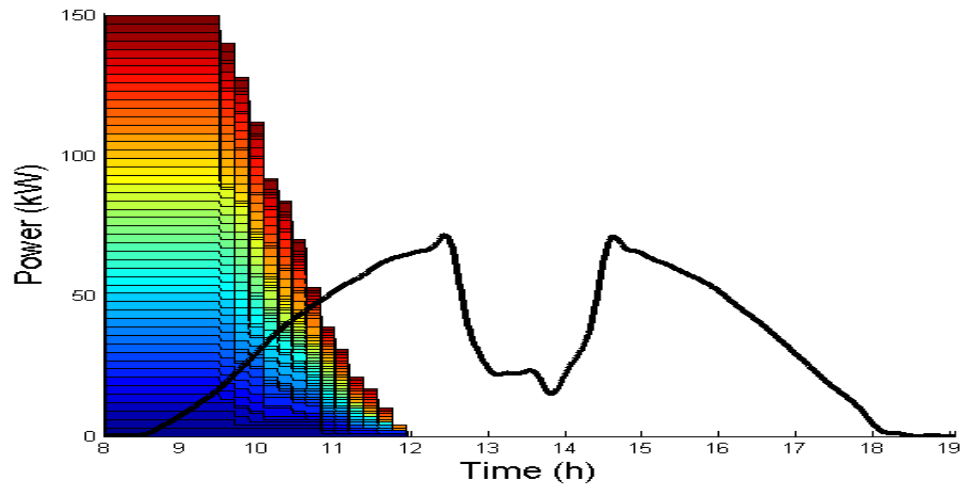
Grid connection impact ?

- Grid connection (transfo / Switchboard / Power)
- Global site energy mngt
- Flexibility / Ancillary services / Arbitrage
- Energy markets / / Revenues (Consumption / Production)
- Multi sites / Aggregation

Solar harvesting optimization

- Increase rate of REN self-consumption
- Provide flexibility to the grid
- Maximise use of local solar energy
- With or without stationnary storage
- Increase battery lifetime

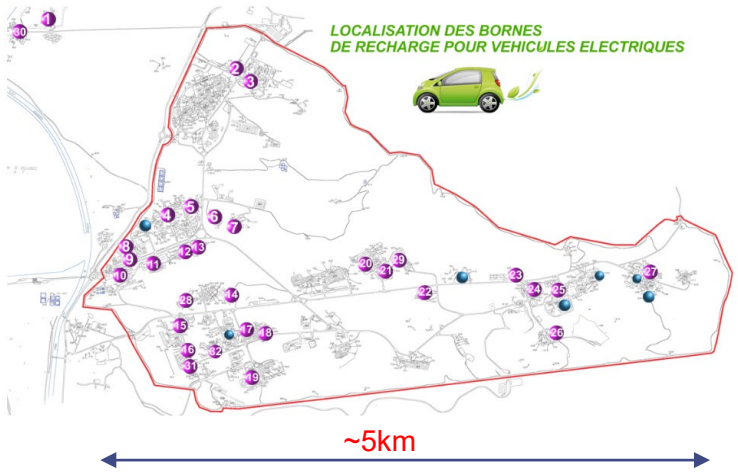
Solar Prod. Curve vs Charge points



Evolve project with (French TSO)

- 400 daily charged vehicules over 100 charge points
- One year experiment
- Battery friendly cycling

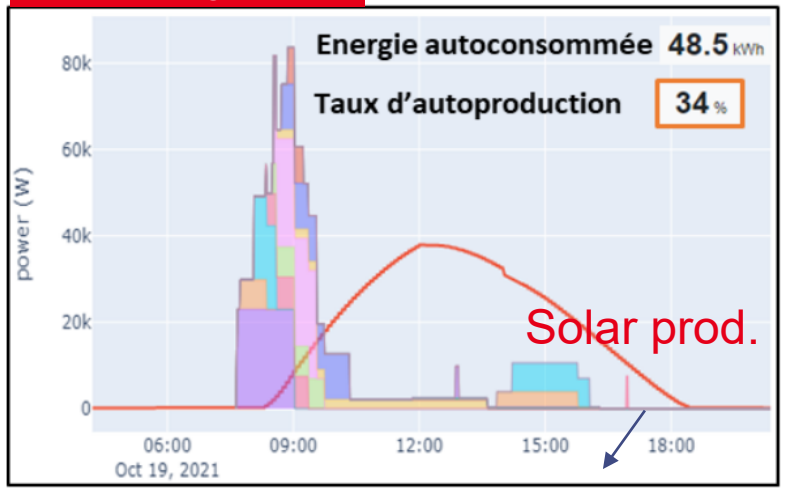
District scale digital system



User APP

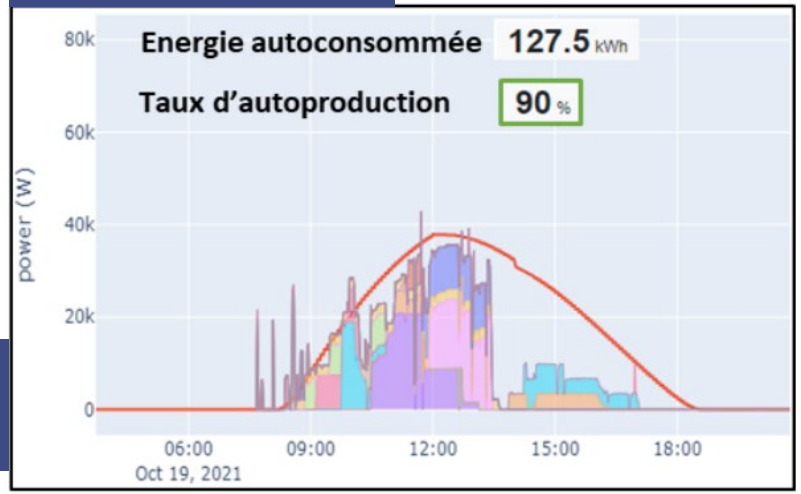
Offered services → **EV charged + User needs + Limited grid impact**

No management



Charge slots

With management

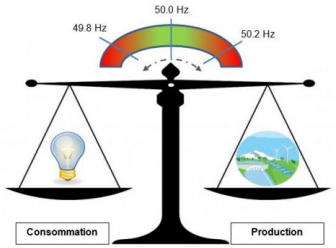


www.cea.fr/presse/Pages/actualites-communiques/energies/ajouter-energie-solaire-mobilite-electrique.aspx

V2X Solutions

How to benefit from EV's batteries for grid support ?

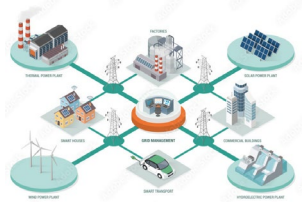
- **Network stability and services**



- **Electricity market demands**

€

- **Power aggregation controls**

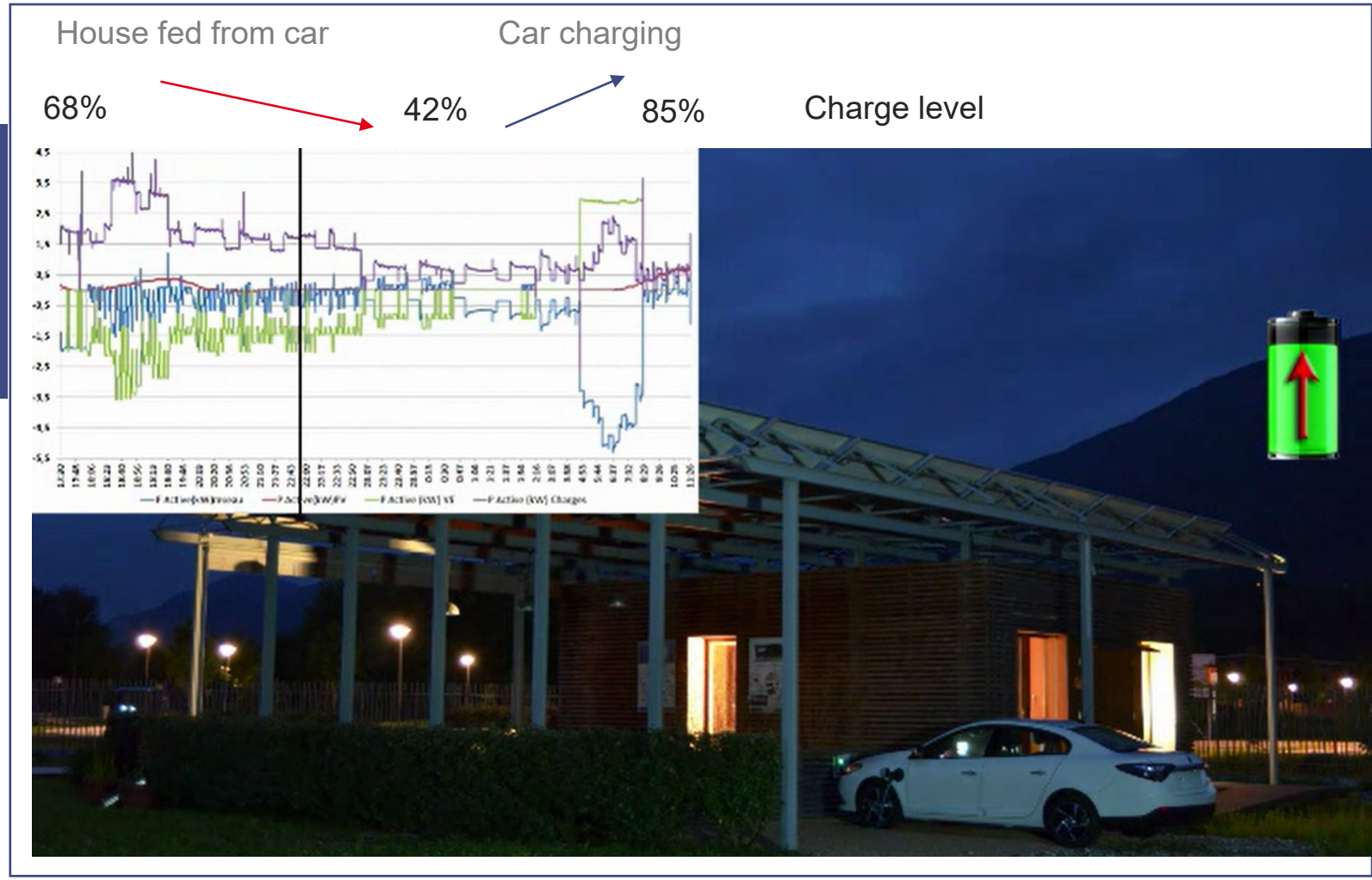


Example of V2H – « Vehicule to Home »

Experiment of V2H principle

Use of bidirectionnal customised car

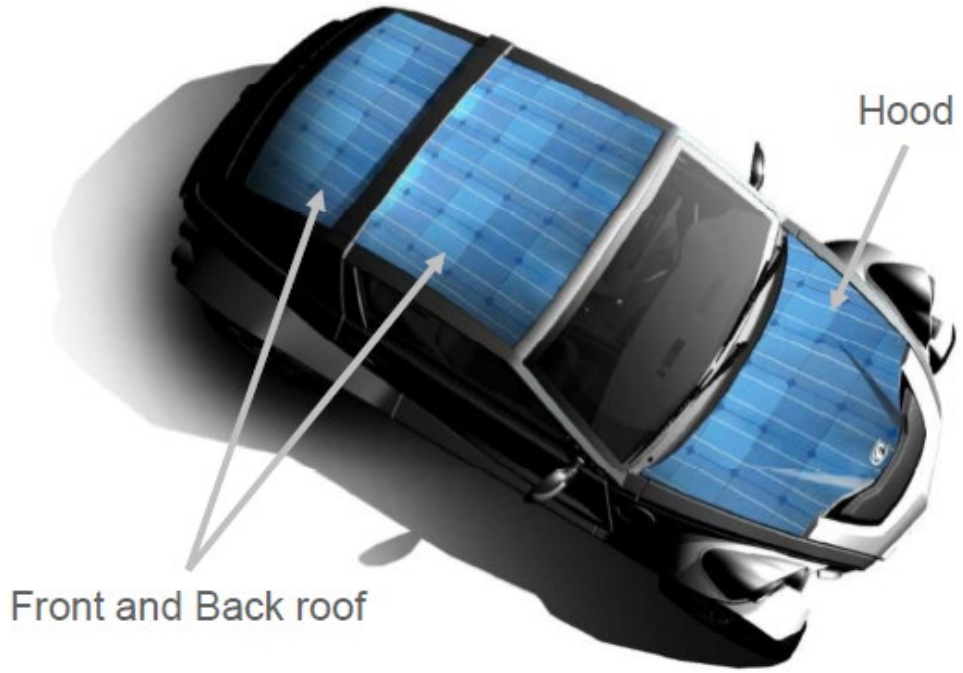
…and charging station



- Use of EV as a local energy source
- Play scenarii of CO_2 reduction
- Contribute to grid peak shaving
- Balance energy prices
- Benefit from solar day charging

ViPV – VEHICULE INTEGRATED PV

- Contribution to reduce elec consumption from network
- Most of cars are 90% of the time parked
- Maximization of electrical production
- Aesthetic integration, adapted to car curvature



A sunny week
in August in France

up to 10 km/day

For a 206 Wp
STC cover
(1,3m²)

3. Take away and conclusions

Main take away

- Massive deployment of EV within the decade
- Significant electricity demand to feed mobility sector instead of oil
- Infrastructures to be strongly adapted
- Solutions for EV
  - Local self production using REN sources
  - Use of EV as “battery on wheels” to support grids
  - “Autonomous” vehicules thanks to PV integration

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Thank's for your attention