Charging infrastructure deployment

Theory and practice
Enedis détecte les pannes d'électricité avant qu'elles n'arrivent. C'est une sacrée bonne nouvelle.

Avec Linkey et l'intelligence artificielle, Enedis analyse l'état du réseau pour prévenir d'éventuelles pannes. Un réseau plus fiable et plus sûr, et ça c'est bien vrai.

Bienvenue dans la nouvelle France électrique

L'énergie est notre avenir, économisons-la!

Enedis a déjà raccordé quatre fois plus de bornes de recharge qu'il n'y a de stations-service. C'est une sacrée bonne nouvelle.

Que ce soit sur les routes, les autoroutes ou même en bas de chez vous, Enedis raccorde chaque jour de nouvelles bornes de recharge électrique. Vous en croiserez sûrement une sur votre chemin.

Bienvenue dans la nouvelle France électrique

L'énergie est notre avenir, économisons-la!
E-Mobility in France: The market took off in 2020 and is expected to reach 15 million vehicles by 2035

2020 – The turning point

The market took off as nearly 200,000 EVs sold in France, i.e. +180% compared to 2019
EV sales represented more than 10% of light vehicles sales

2021 – The pace is keeping up

Sales have kept growing over the first 10 months: EV + PHEV ~ 18%

2035 – The exponential

According to a scenario built in line with the French Multi-years Energy Program (PPE), 15 millions of EVs are expected in France by 2035, i.e. an increase of over 30 times in the next 15 years

EVs Deployment forecast in France

Ban on the sale of new petrol and diesel cars
EU « Fit for 55 »
14th July 2021
Enedis is at the forefront of this transition

Clean mobility is part of energy transition at a local level, that matters local authorities

Charging points are connected to the distribution grid

Electric mobility is an active part of smart grids, driven by innovation

Enedis is a key and a pro-active player in this transition

Enedis unlocks and accelerates the deployment of E-Mobility at an industrial scale

Enedis is a partner of all E-Mobility projects

Enedis is preparing the future by studying and experimenting innovative solutions

Enedis addresses the E-Mobility challenge in partnership with all stakeholders: policy makers, locals authorities, car manufacturers, building professionals, electricity suppliers etc.
More than 200 projects supported by Enedis in both rural and urban areas, for all types of mobility, some of which are moving towards the industrialization of the solutions implemented.

Projects toward industrialization

Enedis sets the example!

With 18,000 light vehicles in its fleet, Enedis is taking up the challenge of converting 100% of its fleet by 2030 (20% done).

Enedis’s own fleet

Numerous charging solutions for buses, boats - on motorways, urban and rural charging networks have been implemented throughout France in partnership with Enedis.
Enedis unlocks and accelerates the deployment of E-Mobility at an industrial scale

At home
- 90% of charging is done at the workplace or at home
- 44% of French households live in collective buildings.

In public Spots
- Public communities are incentivized to plan and organize deployment of E-Mobility
- The target is 100,000 public charging points by the end of 2021

In highways
- The French national highway network is composed of 413 services areas
- 1 out 4 are equipped with high-speed Charging stations (HPC).

Making it possible to charge at home is a key driver: Enedis is involved in all different schemes to equip buildings with charging equipment

Enedis has developed a unique expertise
- State of the art
- Prospective vision of the E-mobility market
- Estimation of the needs, down to the municipal level
- Mapping and evaluation of impacts on public distribution network

In partnership with the majors highways networks companies, Enedis has been proactive and made proposals for adapting connection procedures to optimize lead times
Enedis is preparing the future by studying and experimenting innovative solutions to optimized insertion of E-Mobility in Distribution Network

As E-Mobility is a key part in smart grid shift for distribution network, ongoing experimentations are lead on V2G, metering adapted to E-Mobility, charge management, synchronization between EVs and Renewables Energy Sources...
Enedis studies and publishes assessment of E-Mobility integration on the distribution grid

2019 Integration of E-Mobility within the distribution network

2020 Charge management of EVs

2021 Long distance need of E-Mobility

+ Forecasting of Distribution network by 2050

The E-mobility is manageable for the distribution system
Thanks for your attention
Annexes
Impact of highway fast charging infrastructure on DSO + TSO grids

- What is ahead: expected massive increase of EV, and quick roll out of fast charging infrastructure (150 kVA+)
  - French government will spend 100 M€ on improving EV charging points on highways. Almost 100% of highway service area expected to be equipped by 2023
- Enedis and RTE have provided a forecast (2028 and 2035) of power needs, and grid investments (connections and reinforcement)
- Scope of Work
  - 415 highway service areas
  - Long-distance journeys of light BEV vehicles
  - MV connections to DSO grid
General overview of the following analysis

Input

- EV deployment assumptions
- Traffic assumptions

Analysis

- Step 1. Assessment of the needs (MW)
- Step 2. Cost assessment (€)

Output

- New MV feeders
- HV/MV transformer cost
- TSO cost

Sources:
- TMJA 2017
- ENTD 2008
- Mobility for touristic purpose
- Autoroutes.fr
## MW needs under the main scenario

**2028**: Max need mainly below 2 MW per area  
**2035**: Max need 4 MW on average per area

<table>
<thead>
<tr>
<th></th>
<th>2028</th>
<th>2035</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of connected service area</td>
<td>415</td>
<td>415</td>
<td></td>
</tr>
<tr>
<td>Total installed capacity</td>
<td>&lt; 1 GW</td>
<td>2 GW</td>
<td>Does not take into account the diversity factor between service areas (peak hour is different for every area)</td>
</tr>
</tbody>
</table>
| 30th annual max need per area on average | 1.5 MW | 4 MW | Peak demand calculated as the 30th highest hourly demand during the year  
Average peak (for every stations) below 2 MW by 2028 |
| Assessment of number of 150 kW CP | 4 000 | 12 000 |                                                                      |
MW needs under the main scenario

* Estimation de la puissance moyenne à la 30ème heure pour les aires co-localisées en 2035

<table>
<thead>
<tr>
<th>Need</th>
<th>Some examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 MW</td>
<td>A4 (Paris &lt;&gt; Strasbourg) : Bussy-Saint-Georges, Tardenois-Sud</td>
</tr>
<tr>
<td></td>
<td>A13 (Paris &lt;&gt; Caen) : Vironvay Nord, Rosny-Sur-Seine Nord</td>
</tr>
<tr>
<td></td>
<td>A26 (Calais &lt;&gt; Troyes) : Rumaucourt, Baralle</td>
</tr>
<tr>
<td>2 – 5 MW</td>
<td>A1 (Paris &lt;&gt; Lille) : Vémars-Est, Ressons-Ouest</td>
</tr>
<tr>
<td></td>
<td>A10 (Paris &lt;&gt; Bordeaux) : Poitou Charentes Nord, Châtellerault Usseau</td>
</tr>
<tr>
<td></td>
<td>A61 (Toulouse &lt;&gt; Narbonne) : Port Laugarais Sud, Toulouse Sud Nord</td>
</tr>
<tr>
<td>5 – 10 MW</td>
<td>A8 (Aix en Provence &lt;&gt; Nice) : Vidauban Sud, Le Canaver</td>
</tr>
<tr>
<td></td>
<td>A10 (Paris &lt;&gt; Bordeaux) : Saugon Ouest, Limours Janvry</td>
</tr>
<tr>
<td>&gt; 10 MW</td>
<td>A9 (Orange &lt;&gt; Espagne) : Montpellier Fabrègues Sud, Ambrussum Nord</td>
</tr>
<tr>
<td></td>
<td>A7 (Lyon &lt;&gt; Marseille) : Montélimar Est, Lançon de Provence Est</td>
</tr>
<tr>
<td></td>
<td>A6 (Paris &lt;&gt; Lyon) : Beaune-Merceuil, Beaune-Tailly</td>
</tr>
</tbody>
</table>

étude auroroute Rte/Enedis - juillet 2021
### CAPEX assessment – main scenario

#### 2021 – 2028: 260 M€, 80% on DSO grid
#### 2021 – 2035: 300 M€

<table>
<thead>
<tr>
<th></th>
<th>2028</th>
<th>2035</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td>14</td>
<td>No need to build new MV main stations</td>
</tr>
<tr>
<td>405</td>
<td></td>
<td>405</td>
<td>Assumption: a new MV feeder to the MV station is created for every area by 2028 Those feeders support the needs foreseen in 2035</td>
</tr>
<tr>
<td>260</td>
<td></td>
<td>300</td>
<td>80% of CAPEX = DSO connection and reinforcement costs vs 20% TSO 300 M€ DSO + TSO cumulated CAPEX 2021-2035 vs 4 000 M€ CAPEX spent by Enedis in 2019</td>
</tr>
<tr>
<td>500</td>
<td>500</td>
<td>600</td>
<td>Installation costs « behind the meter » not taken into account</td>
</tr>
</tbody>
</table>

- **HV/MV transformers upgrades**: 3 in 2028, 14 in 2035
- **New MV feeders Area <-> MV station**: 405 in 2028, 405 in 2035
- **DSO + TSO cumulated CAPEX M€**: 260 in 2028, 300 in 2035
- **Average DSO connection cost (k€)**: 500 in 2028, 600 in 2035

*étude auroroute Rte/Enedis - juillet 2021*
Conclusion

1. No major reinforcement works on the grid are needed to enable HP charging
   ❖ Only a few MV stations to create or upgrade by 2035
   ❖ Peak demand for EV charging on motorways does not add to peak demand for heating during the winter (except ski vacations)

2. Network costs stay within the expenditure plans of Enedis and Rte
   ❖ About €300 million (central scenario) for the 2021 to 2035 period vs €4 billion investment by Enedis in 2019
   ❖ 80% of cost on the DSO grid

3. Anticipation is key
   ❖ In order to deliver the coverage expectations (100% service are covered by Jan. 2023)
   ❖ To match the needs (MW) of the EV market and minimize sunk costs
   ❖ Most of demand connection (MW) for areas in 2021 are compatible with expected needs in 2028