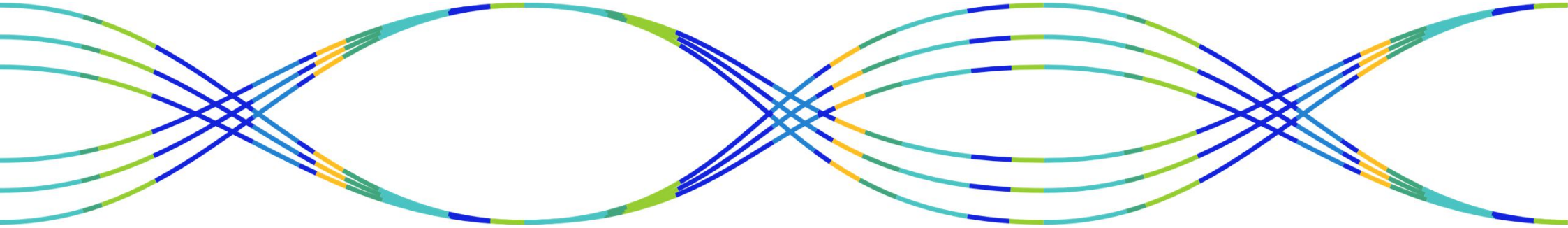
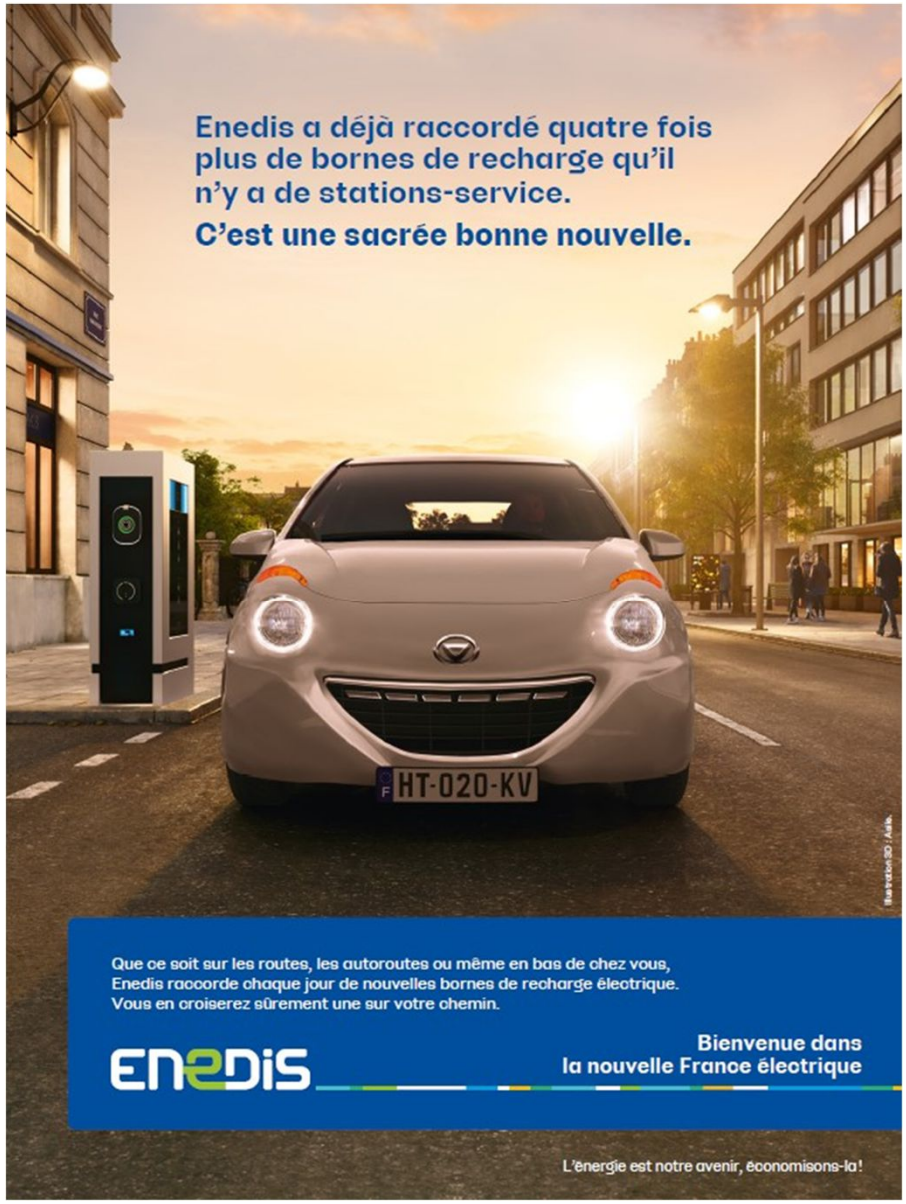
Charging infrastructure deployment

Theory and practice



09 /12 /2021


Enedis détecte
les pannes
d'électricité
avant qu'elles
n'arrivent.
C'est une sacrée
bonne nouvelle.
Avec Linky 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 réel.
ENEDIS
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.
HT-020-KV
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.
ENEDIS
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 millions 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

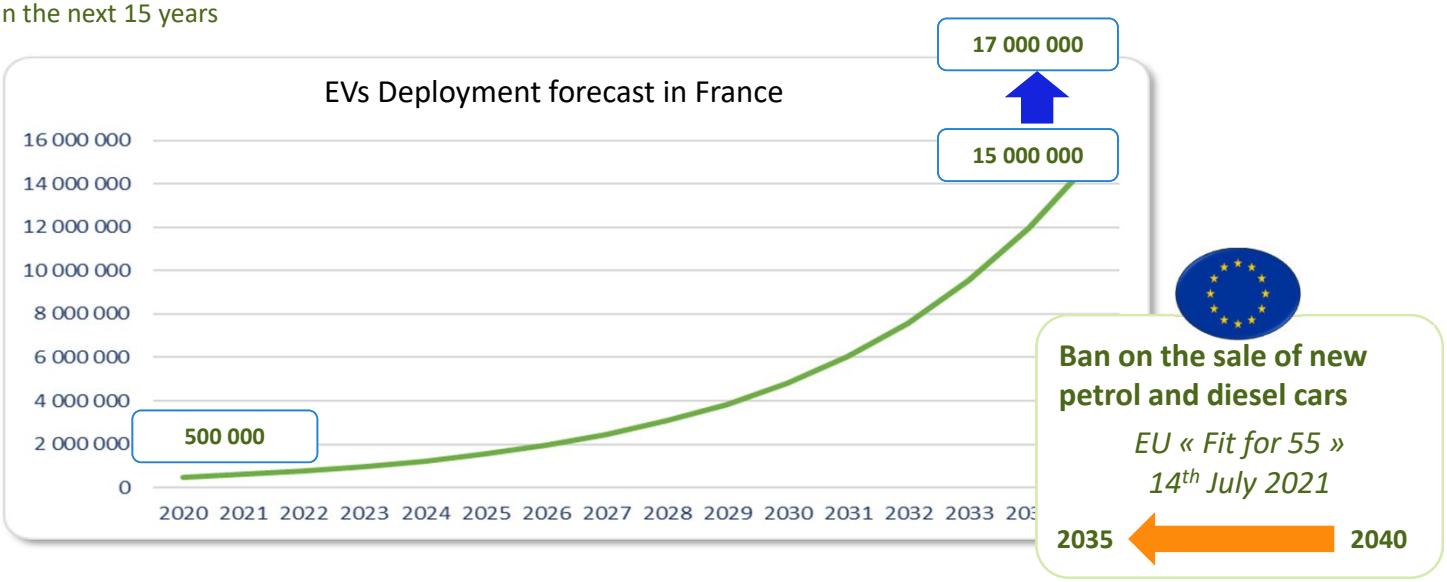
EV sales represented more than 10 % of light vehicles sales

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



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**

ENEDIS
L'ELECTRICITE EN RESEAU

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.

ENEDIS

Enedis is a partner of all E-mobility projects in France

Numerous charging solutions for buses, boats - on motorways, urban and rural charging networks have been implemented throughout France in partnership with Enedis :

Projects toward industrialization

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

Enedis's own fleet

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)**

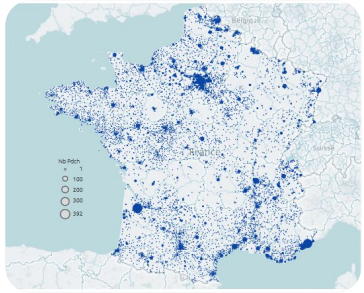
Enedis unlocks and accelerates the deployment of E-Mobility at an industrial scale

At home

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

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

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

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 highways

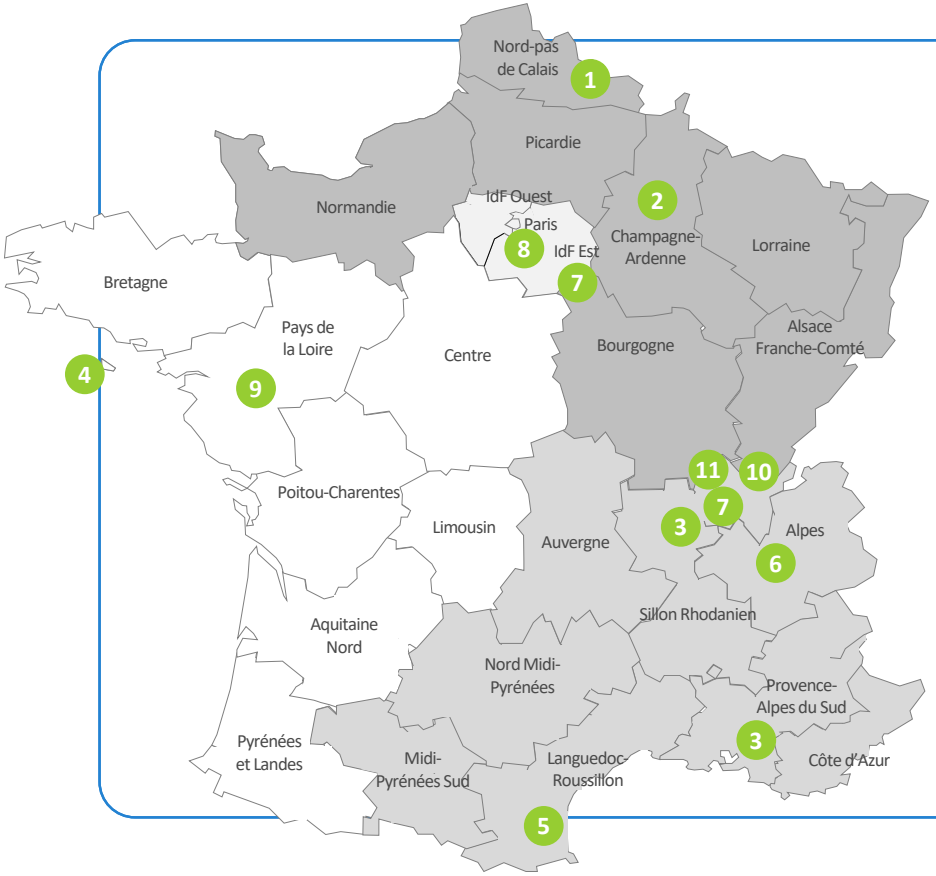
- The French national highway network is composed of 413 services areas
- 1 out 4 are equipped with high speed Charging stations (HPC).

In partnership with the majors highways networks companies, Enedis has been **proactive** and made proposals for adapting connection procedures to **optimize lead times**

ENEDIS

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**…

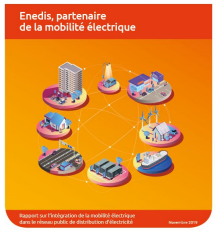


Ongoing Projects

1. **So MEL So Connected** — DR Nord Pas de Calais
2. **SMAC** — DR Champagne-Ardenne
3. **aVEnir** — DR Sillon Rhodanien et DR Provence Alpes du Sud
4. **FlexMob'île** — DR Bretagne
5. **MobelSol** — DR Laro
6. **Tarif Dynamique** — DR Alpes
7. **Flex-e** — DR IDFE + DR Sirho
8. **Incit-EV** — DR Paris
9. **Projet IRVE** — DR PDL
10. **Contrat Unique** — DR Sillon Rhodanien
11. **Vallons d'Ecully** — DR Sillon Rhodanien

Enedis studies and publishes assessment of E-Mobility integration on the distribution grid

2019 Integration of E-Mobility within the distribution network



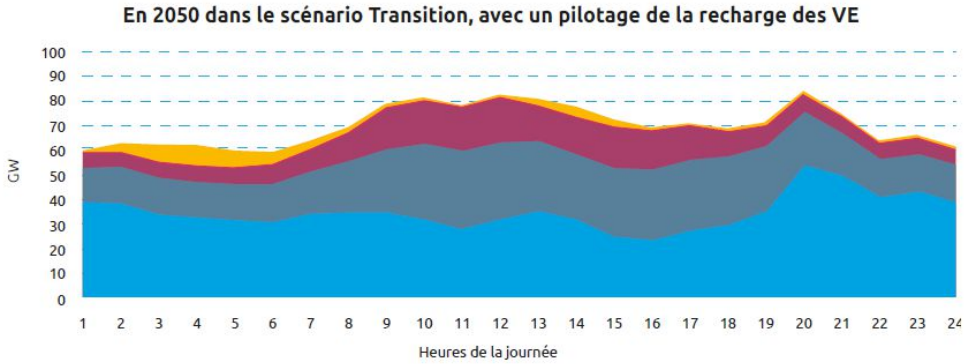
2020 Charge management of EVs

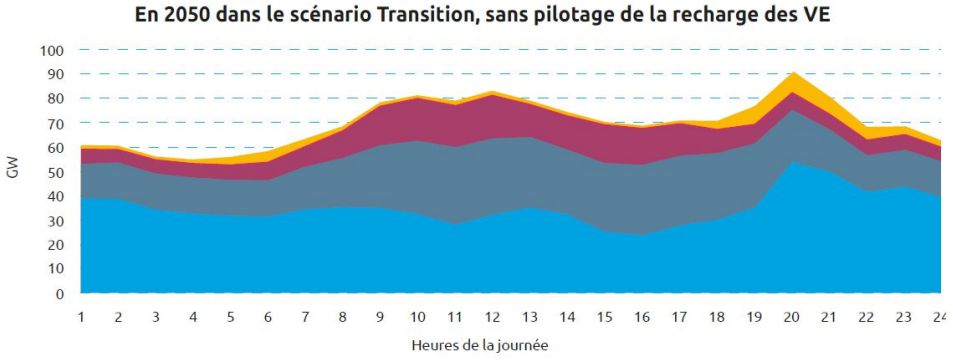
2021 Long distance need of E-Mobility

\+

Forecasting of Distribution network by 2050

The E-mobility is manageable for the distribution system

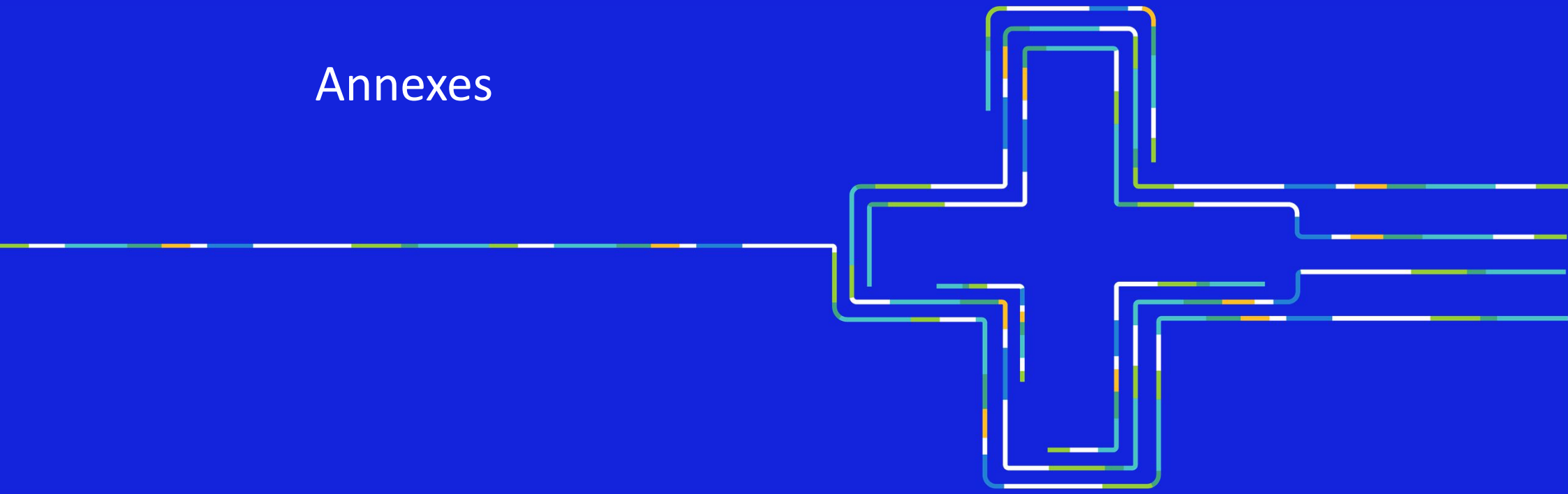




Transports Agriculture Industrie Tertiaire Résidentiel

Thanks for your attention

Annexes

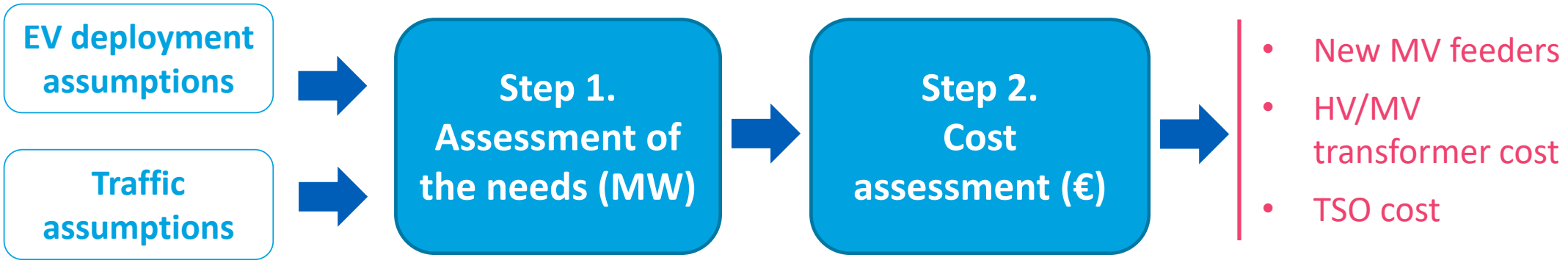


Impact of highway fast charging infrastructure on DSO + TSO grids

- 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 ---------- Analysis ----------▸ Output



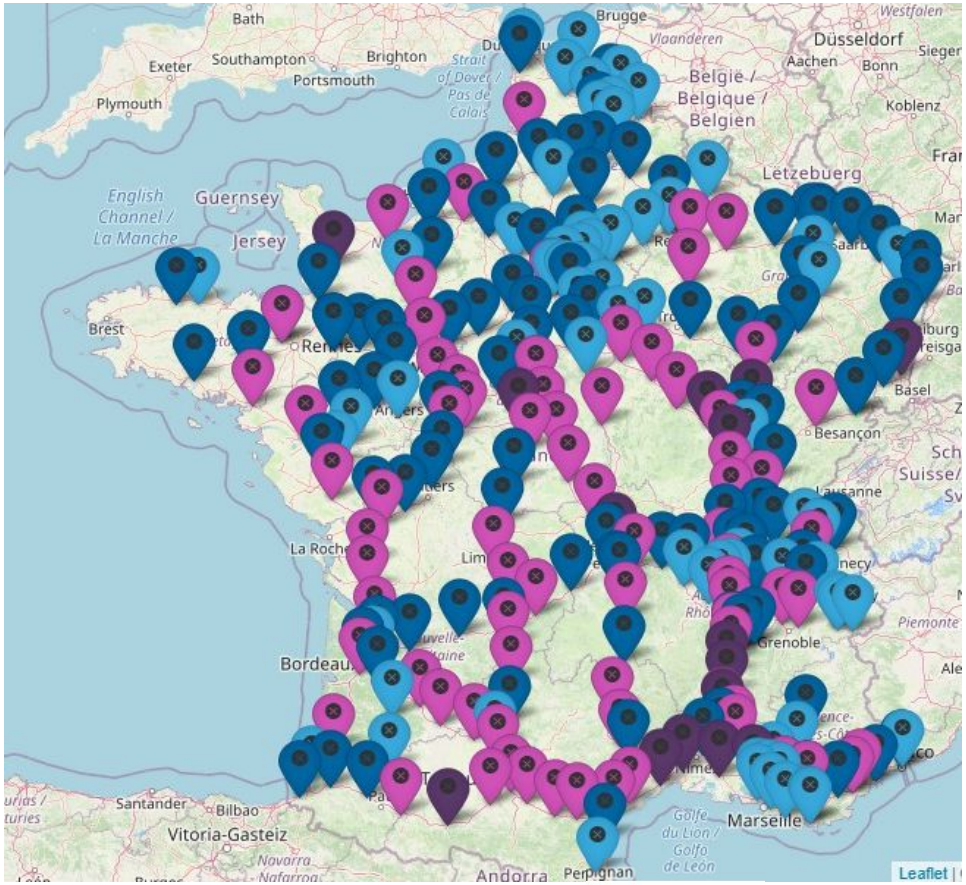
Sources :
- TMJA 2017
- ENTD 2008
- Mobility for touristic purpose
- Autoroutes.fr

MW needs under the main scenario

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

2028		2035	Note
415	Number of connected service area	415	
< 1 GW	Total installed capacity	2 GW	Does not take into account the diversity factor between service areas (peak hour is different for every area)
1,5 MW	30th annual max need per area on average	4 MW	Peak demand calculated as the 30th highest hourly demand during the year Average peak (for every stations) below 2 MW by 2028
4 000	Assessment of number of 150 kW CP	12 000	

MW needs under the main scenario



Need	Some examples
< 2 MW 114 areas	A4 (Paris <> Strasbourg) : Bussy-Saint-Georges, Tardenois-Sud A13 (Paris <> Caen) : Vironvay Nord, Rosny-Sur-Seine Nord A26 (Calais <> Troyes) : Rumaucourt, Baralle
2 – 5 MW 165 areas	A1 (Paris <> Lille) : Vémars-Est, Ressons-Ouest A10 (Paris <> Bordeaux) : Poitou Charentes Nord, Châtellerault Usseau A61 (Toulouse <> Narbonne) : Port Laugarais Sud, Toulouse Sud Nord
5 – 10 MW 110 areas	A8 (Aix en Provence <> Nice) : Vidauban Sud, Le Canaver A10 (Paris <> Bordeaux) : Saugon Ouest, Limours Janvry A20 (Vierzon <> Montauban) : Pech Montat, Beaune-Les-Mines Est
> 10 MW 26 areas	A9 (Orange <> Espagne) : Montpellier Fabrègues Sud, Ambrussum Nord A7 (Lyon <> Marseille) : Montélimar Est, Lançon de Provence Est A6 (Paris <> Lyon) : Beaune-Merceuil, Beaune-Tailly

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

CAPEX assessment – main scenario

2021 – 2028 : 260 M€, 80% on DSO grid

2021 – 2035 : 300 M€

2028		2035	Note
3	HV/MV transformers upgrades	14	No need to build new MV main stations
405	New MV feeders Area <> MV station	405	Assumption : a new MV feeder to the MV station is created for every area by 2028 Those feeders support the needs foreseen in 2035
260	DSO + TSO cumulated CAPEX M€	300	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
500	Average DSO connection cost (k€)	600	Installation costs « behind the meter » not taken into account

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