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Electric mobility deployment in France - Necessity for uses adaptation in a constrained system

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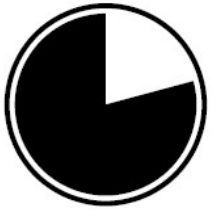
T&M strategy ADEME 2020 – 2025 :

Fuel decarbonisation is not enough to reach carbon neutrality by 2050

En 1 : Limit

Act on demand and behaviors

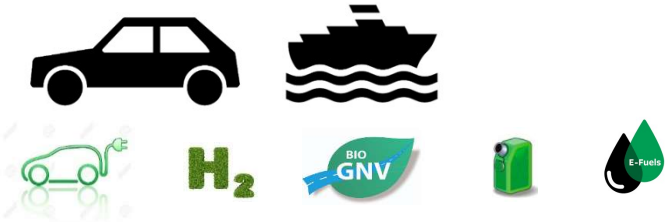


En 2 : REPORT

Choose the less impacting transport modes

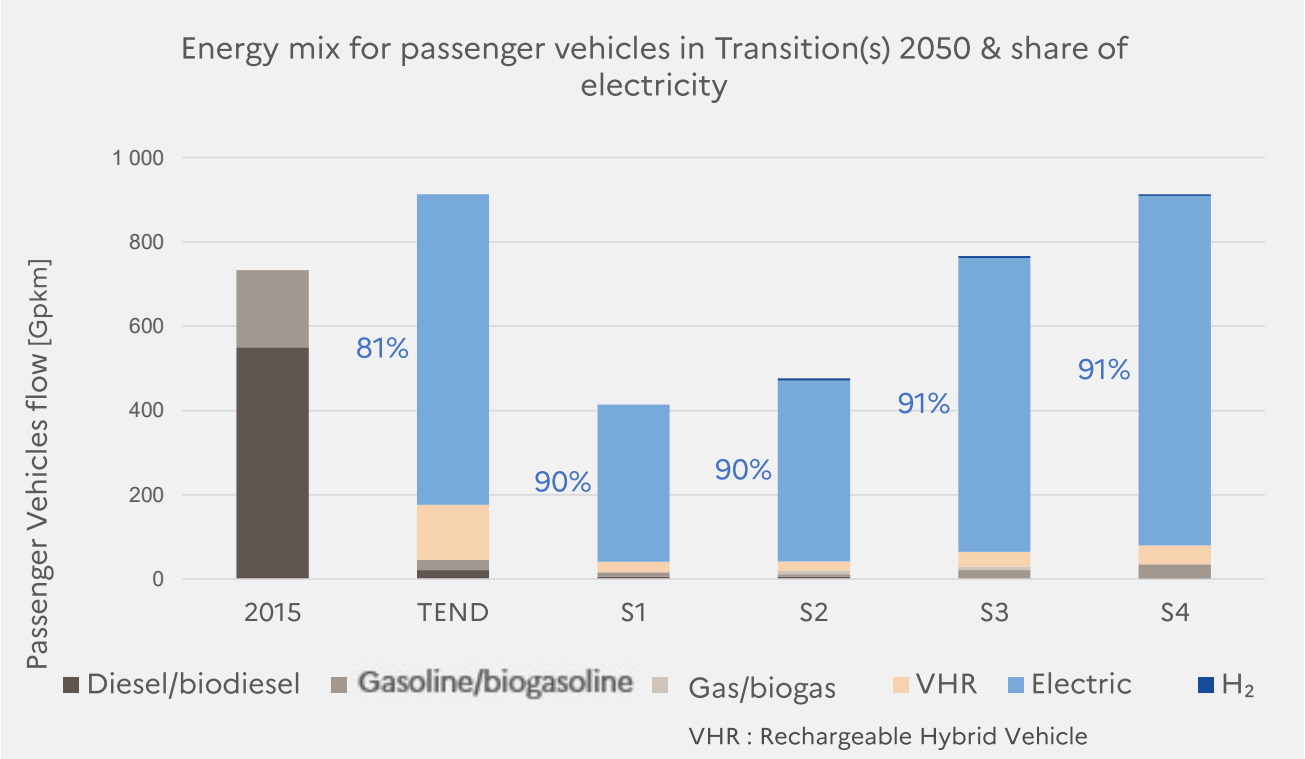
En 3 : Improve

Improve existing technologies to limit their environmental impacts



Electric mobility evolution towards 2050

According to Transition(s) 2050, prospective scenarios from ADEME

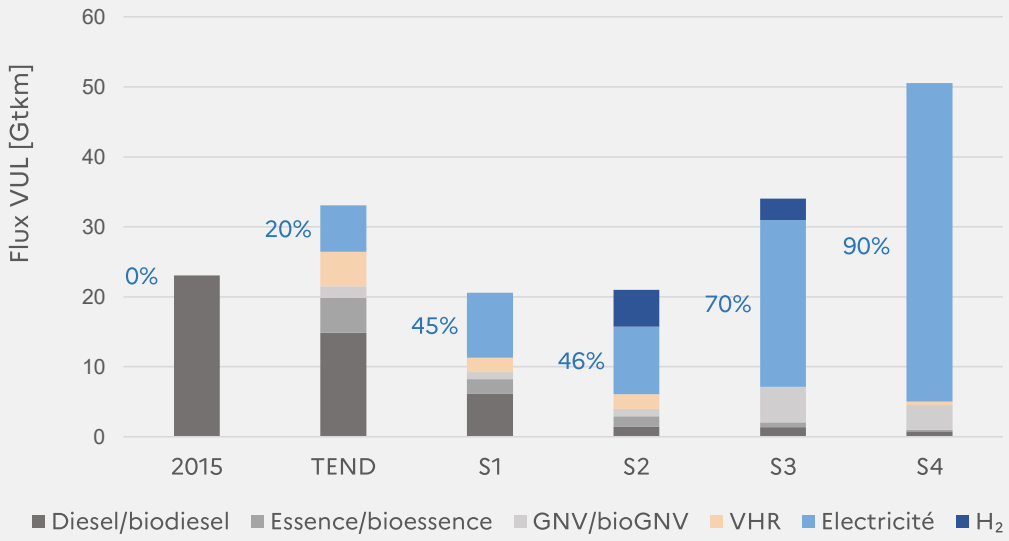


90%

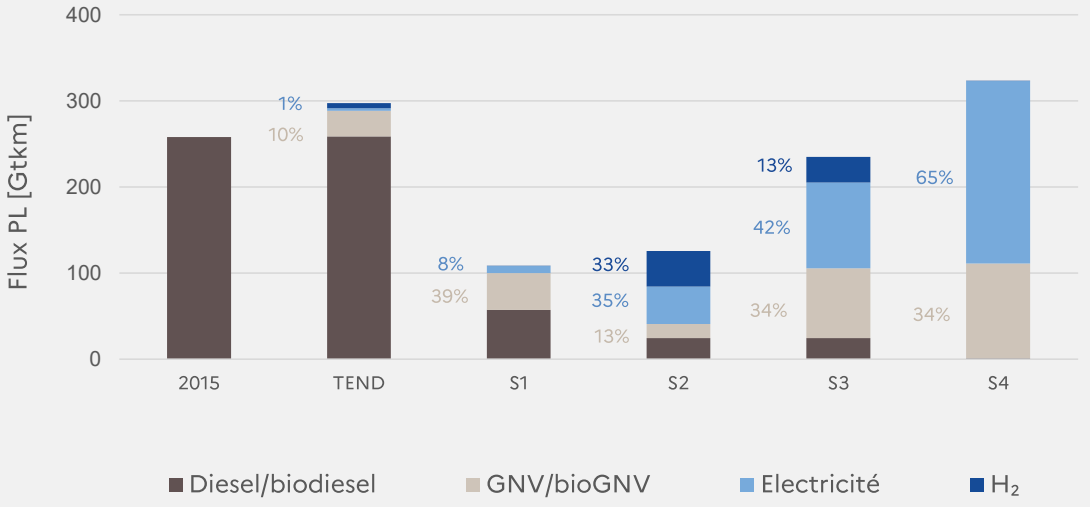
Minimal share of electricity in all scenarios

Light and Heavy duty vehicles

Energy mix and share of electricity for freight transport by Light Duty Vehicle in T2050 scenarios towards 2050.

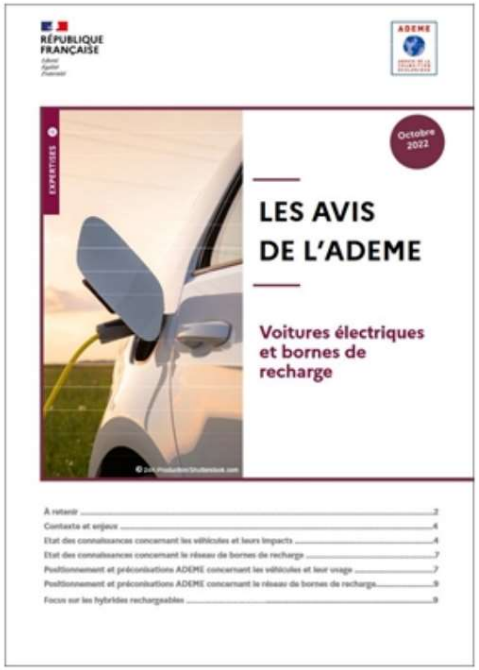


Energy mix and share of electricity for freight transport by Heavy Duty Vehicle in T2050 scenarios towards 2050.



Important electrification in all scenarios. For Heavy duty vehicles, battery electric **will not meet all uses** and big batteries will have **an important environmental impact** → Necessity for an **alernative fuels mix**, relying on **biogas** towards 2035, and shifting to **hydrogen** later.

ADEME's take on the electric vehicle and its charging infrastructure



Key messages:

- **<u>The environmental impacts of electric mobility are not nil, its deployment has to be orchestred</u>**
  - ✓ **Carbon footprint** 2 to 3 times lower than its thermal equivalent IF **Small batteries (<60 kWh)**
  - ✓ Vehicles have to be sized for **everyday uses**
  - ✓ Need for deployment of **industrial battery recycling**

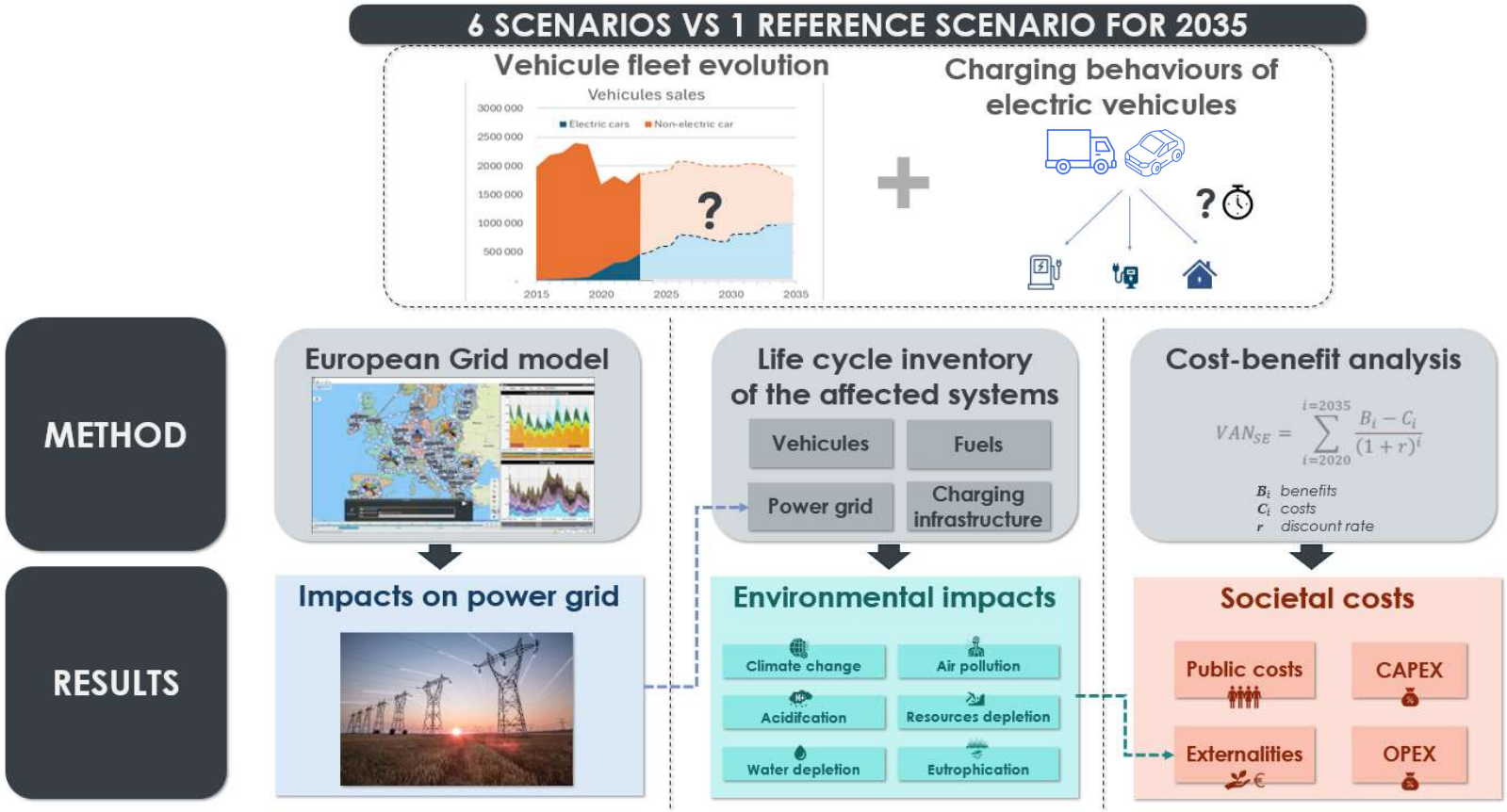
- **<u>Electric mobility has to be affordable</u>**
  - ✓ **TCO of electric vehicle is lower than thermal** IF small battery (< 60kWh) and charging at home
  - ✓ Need for deployment of **second-hand electric vehicles**
  - ✓ Support for the adoption **of intermediary vehicles** for every-day uses

- **<u>The impacts related to charging infrastructure have to be contained</u>**
  - ✓ **Territorial planification** is needed, involving private and public actors
  - ✓ High power public charging must be limited to very specific needs and locations
  - ✓ Most charging must happen at home or at work on low power devices
  - ✓ Load control has to be developed, especially for a better renewable electricity synchronization

- **<u>Electric vehicles must be considered as one element in a wider mobility ecosystem</u>**

Question our cultural and practical relation to cars, change practices and develop infrastructures for shared and active mobility.

Consequential Life Cycle Assessment of electric mobility deployment in France towards 2035 - On-going work at ADEME – Release May 2025



Key elements of the scenarios

Mobility (based on Transition(s) 2050 :

- **REF :** Business As Usual
- **S2 :** Sobriety and high energy efficiency, high change in behaviors → **Lower on-road mobility** energy demand, less vehicles on the road with smaller batteries.
- **S4 :** No behavioral change, relying on technologies not yet mature → **higher energy demand** (met with **additional renewable electricity production** plants), more vehicles with bigger batteries

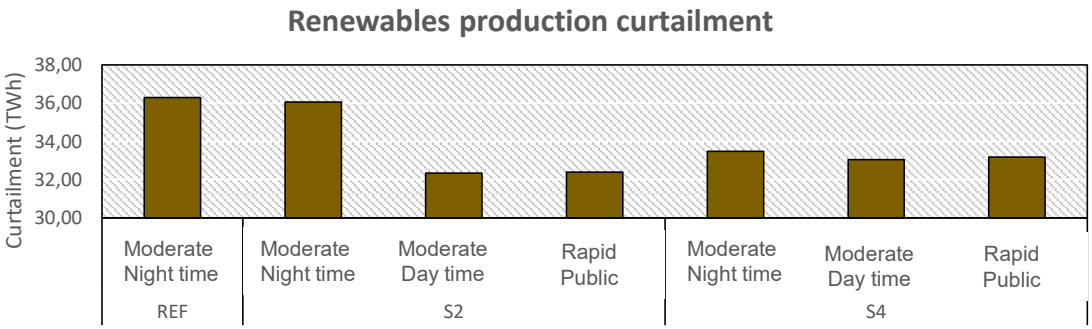
Charging behaviors :

- **MN - Moderate Night time :** Business as usual, high **access to charging at home** at night, low power. Limited deployment of public infrastructure, **low power.**
- **MD - Moderate Daytime : s**ame power repartition and access to private charging, but **load sessions are aligned to PV production** during the day, through load control.
- **PR - Rapid Public : Limited access to private charging**, heavier deployment of public charging infrastructure with **high power.**

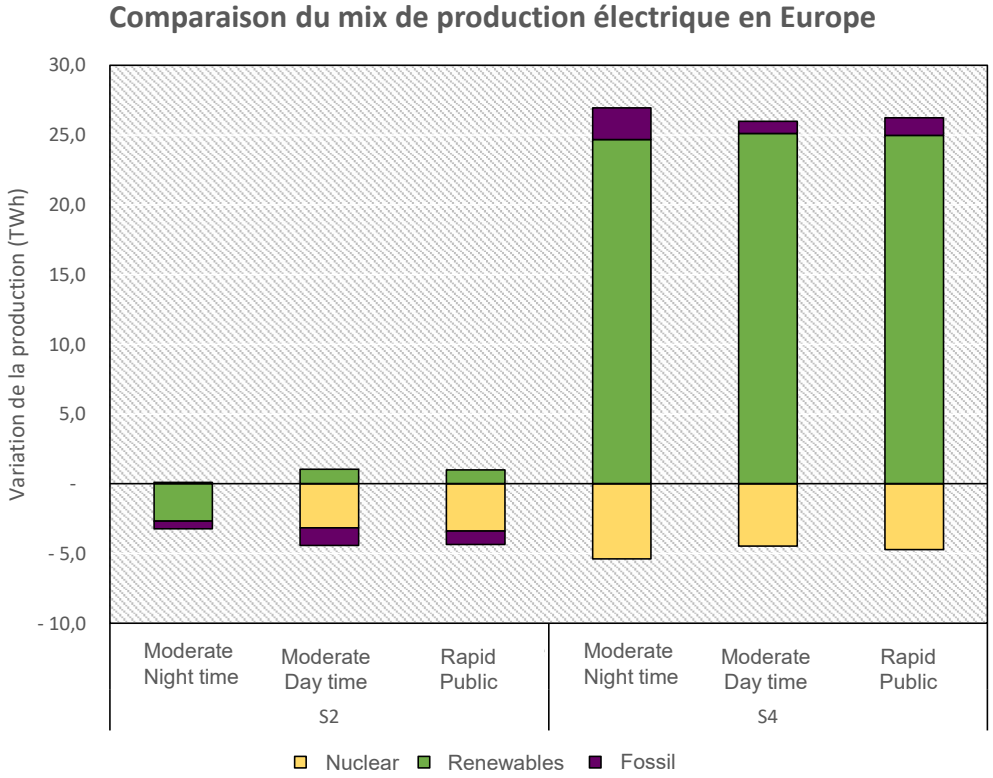
Preliminary results – Electricity production

High impact of **additional renewable electricity** production.

The better coupling of charging with renewable generation in the Moderate Daytime and Rapid Public scenarios leads to a **reduction in the amount of curtailment** (loss of production) from renewables.

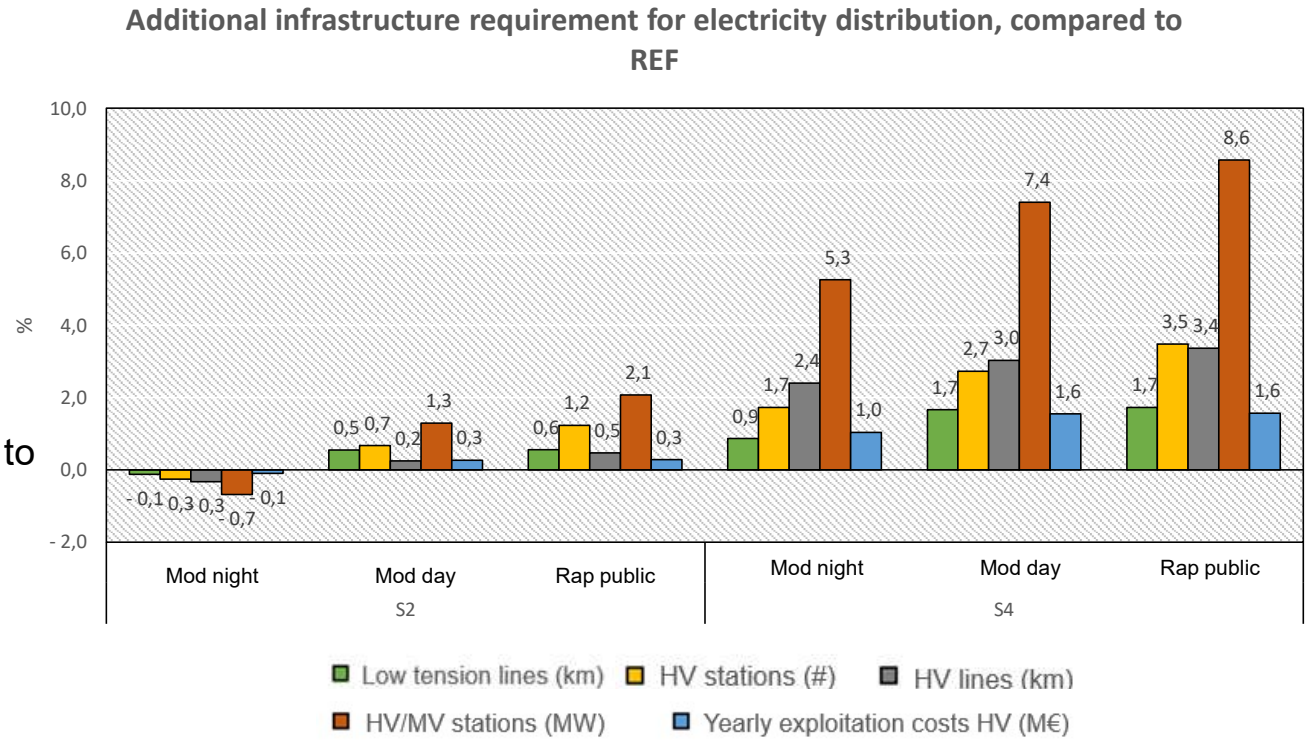


Fossil production increases for the scenarios with a higher mobility demand (S4).



Preliminary results – additional infrastructure requirement for electricity distribution

- Almost all scenarios **require additional distribution infrastructure**, compared to REF.
- The charging scenarios with the most limited impacts are **Moderate night time**.
- **Rapid Public scenarios cause the most impacts.**
- **Investment requirement increases in S4**, due to a higher mobility demand, especially during daytime**.**



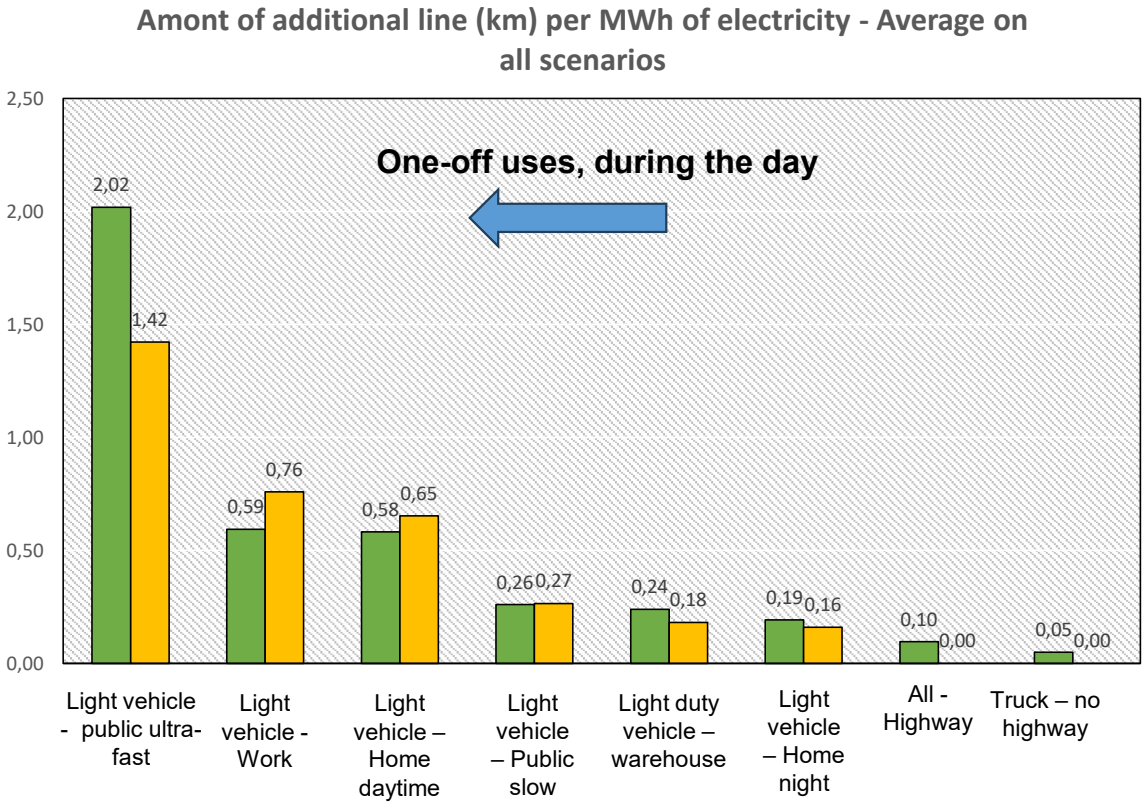
Preliminary results – infra. requirement vs load type

- In absolute, charging at home, work and public ultra-fast have the **most impact on distribution infrastructure** needs.

  But when compared to the amount of energy loaded, **fast charging has a significantly higher impact.**

- At the same power, **daytime charging has higher impacts** on infrastructure requirements than night time charging. (x4 home charging).

- **Heavy vehicles charging has a low impact** because of the important amount of energy loaded per session, and the mostly nocturn charging behavior. Highway impact is limited because localised on the 200 service areas of the French highway.



Preliminary Results – Total System costs

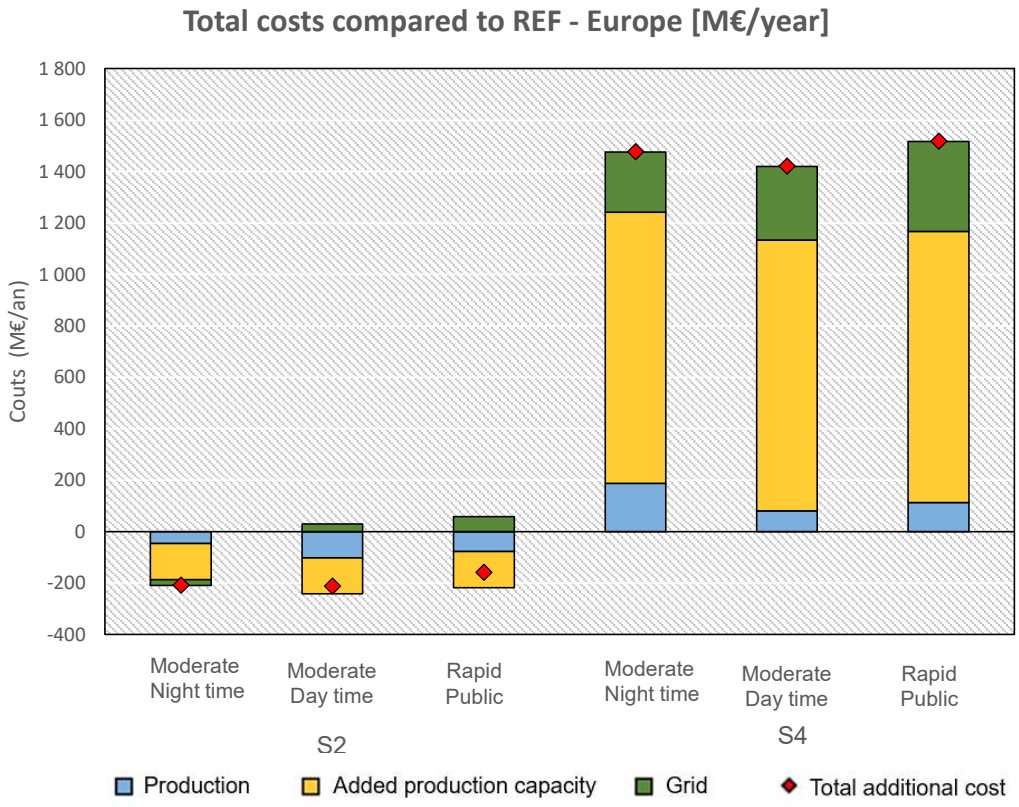
The **added renewable electricity** production capacity weighs for **70 to 75% of additional costs** of the energy system.

S2 scenarios have lower costs than REF because of a lower mobility demand and have less need for peak fossil production.

Investment requirements lead to **higher costs for Moderate nightime and Public Rapid charging** scenarios, for a given mobility scenario.

In S4, grid investments represent **20%** of additional costs, whereas production costs represent **9%.**

The additional costs for the system, per electric vehicle are 313 €/year for the lowest (S4-MN) to 335 €/year for the highest.



Conclusion

- **Electric mobility cannot be envisionned as a one-for-one replacement of diesel and gasoline vehicles**, but as **the ultimate step in a global shit** in the ecosystem (after limiting and reporting).
- The prospective vision at ADEME includes **high EV penetration**, but with attention towards **sizing and uses** : limited battery size and sober charging behaviors highly depending on low power charging at home and renewables coupling through load control.
- On-going work at ADEME will quantify the **environmental impacts** (climate change but also dependancy on rare materials, effects on ecosystems, etc.) of electric mobility **including the vehicles and the charging infrastructure**.
- Preliminary results show the importance of coupling mobility deployment and charging behaviors with **renewable electricity production** (for limited additional costs). **Fast public charging imposes a heavy burden** on the electricity system.
- Full results will be available by May 2025.

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Thank you. Feel free to contact me to exchange more on the subject

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