Le réseau de transport d'électricité

Electrification and evolution of the power system: between ambitions and realities

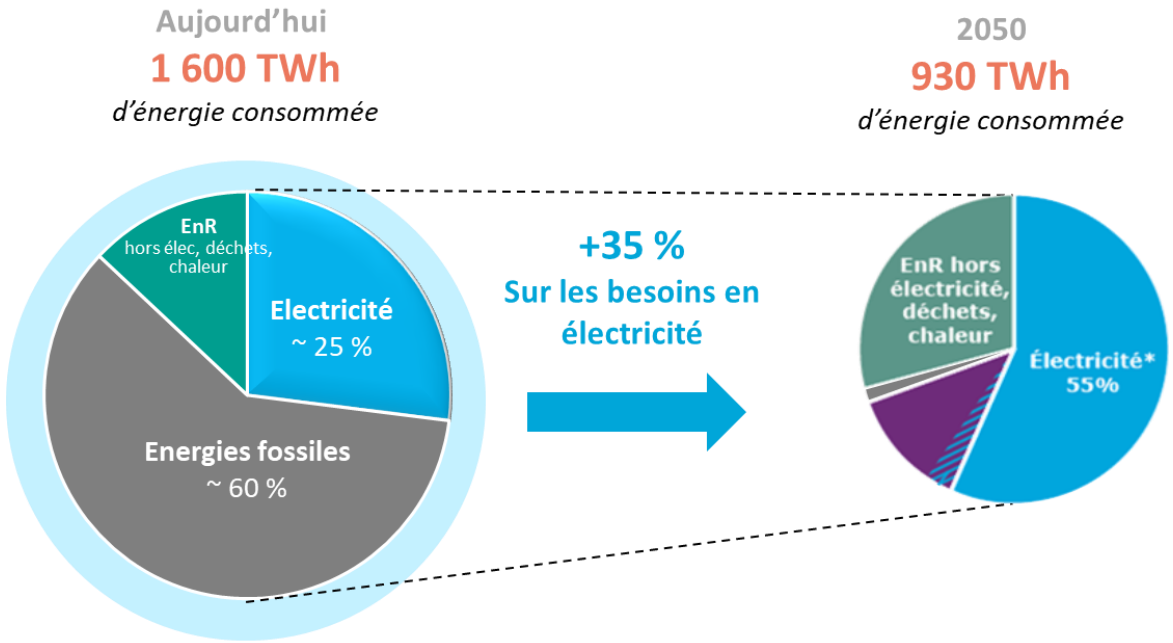
Thomas VEYRENC,
Director-general in charge of economics, finance and strategy

Ecole polytechnique, October 1st 2026

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RTE carries out prospective studies as part of its legal missions in order to inform the public debate on the exit from fossil fuels

- As part of its legal missions, RTE develops prospective scenarios on the evolution of the electricity system in the long term in order to inform public decisions.
- These studies are part of the objective of phasing out fossil fuels in France and achieving carbon neutrality.
- Phasing-out fossil fuels as part of a net-zero agenda is a climate policy but also a security policy, as highlighted by the ongoing energy crisis.



RTE carries out prospective studies as part of its legal missions in order to inform the public debate on the exit from fossil fuels

All studies aim at informing public policy and debate by assessing (i) the evolution of electricity consumption and generation prospects, taking into account the global context and policy targets, (ii) the levers to ensure the French power system's competitiveness, and the technical robustness of each scenario or energy policy option.



Energy Pathways 2050

(2021 – 1st edition)



Bilan prévisionnel 2025

(update on the 2025-2035 period)



Strategic grid plan

(2025-2040 period)



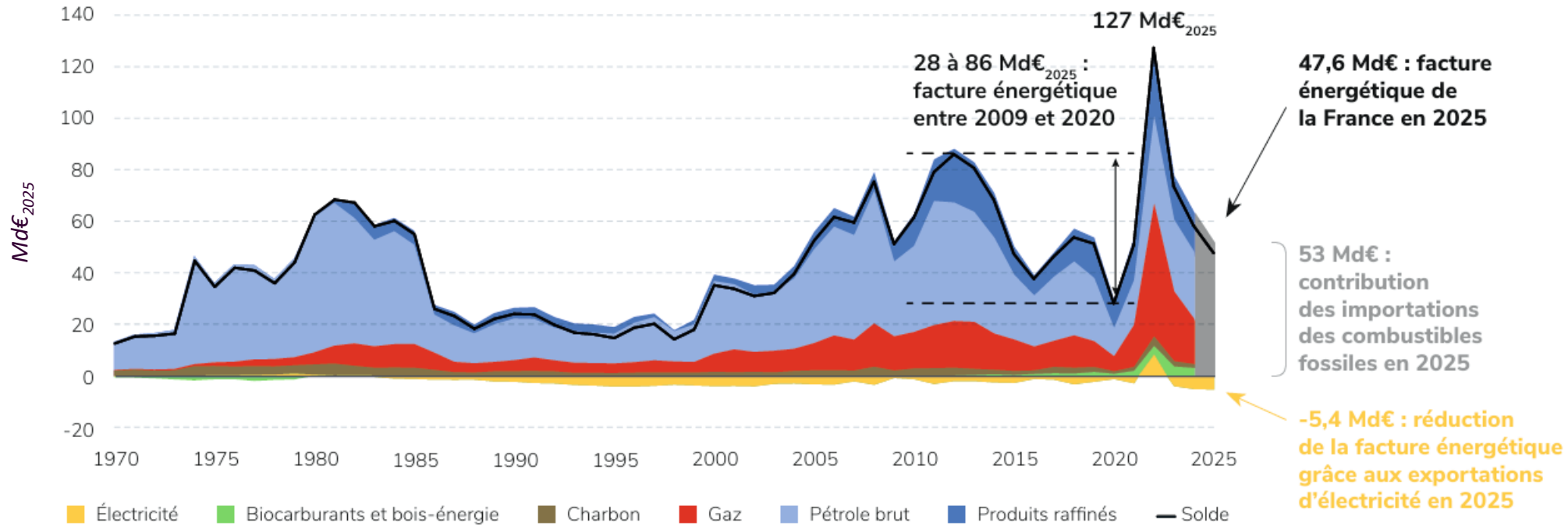
Update of the 1st edition – to be published by end-2026

The starting point: the imperative to phase out fossil fuels

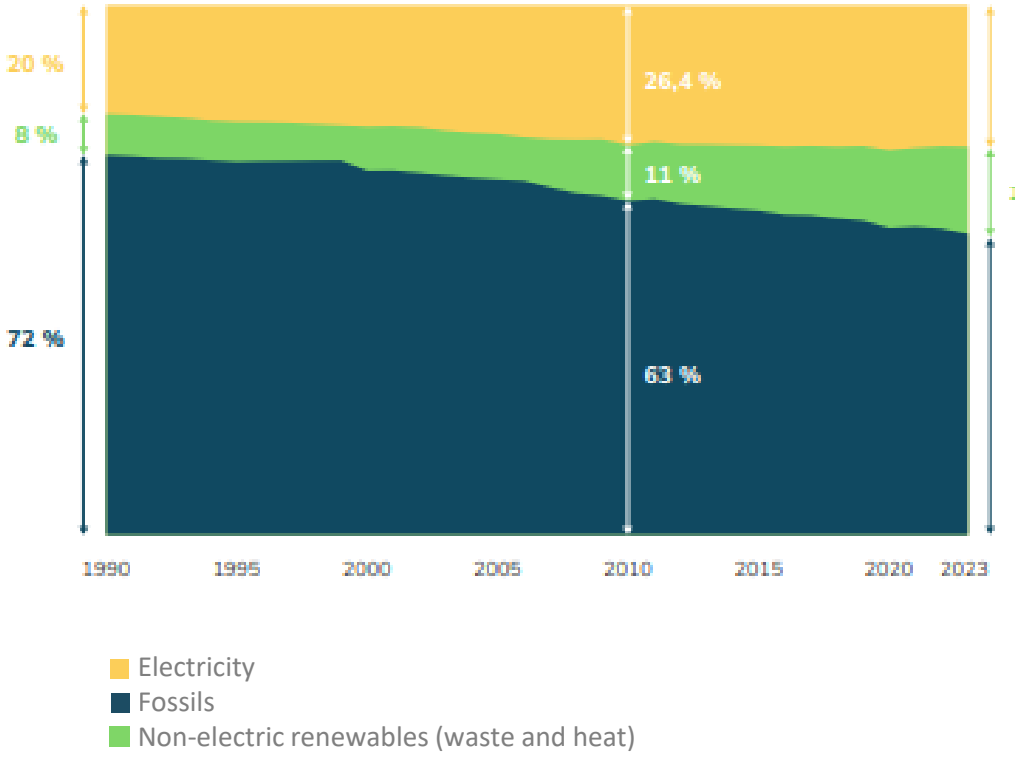
The main challenge for the French energy system is to achieve the long-term decarbonisation target.

This is not only a climate imperative, but also a matter of rapidly reducing the French and European geostrategic dependence on fossil fuels

Evolution of France's energy bill (1970–2025)



The state of energy consumption in France: a country that still consumes large amounts of fossil fuels



In 2025, electricity accounted for only 27% of energy consumed in France

56.8% of energy consumed came from fossil fuels (including 38% from petroleum products)

The share of electricity increased by only 0.2% in 10 years

→ The current pace of greenhouse-gas emission reductions is insufficient to meet public-policy targets

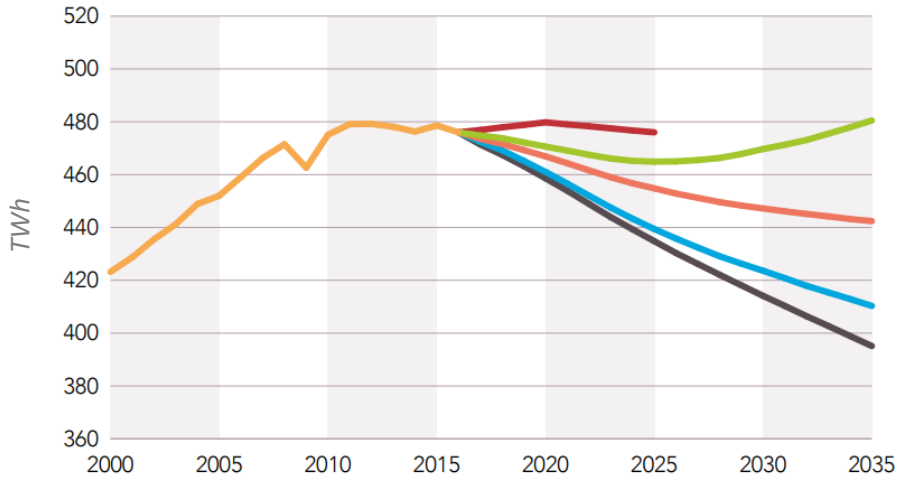
Decarbonisation will inevitably involve an increase in electricity consumption to replace fossil fuels

Forecasts

Bilan prévisionnel 2017:

RTE indicated that France's electricity consumption would now follow a well-established downward trend (desindustrialisation, progresses in energy efficiency, absence of strong public policies in favor of electrification that would reverse this assessment)

→ the evolution of consumption since has confirmed this analysis



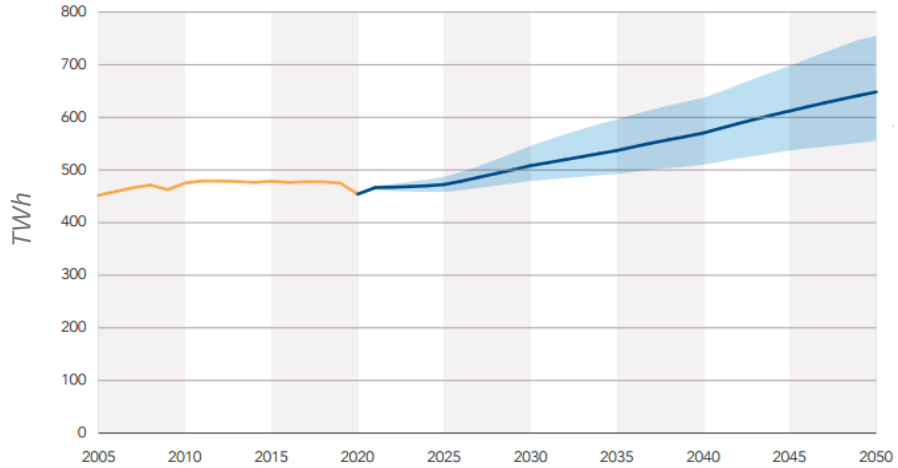
Prospective

Energy Pathways 2050 :

Publication of the consumption pathways that France must follow if it wishes to achieve carbon neutrality by 2050

Updated in 2023 by integrating new policy objectives (European "Fit for 55" package, reindustrialisation, etc.)

→ RTE has underlined that this would be a major change in the evolution of electricity consumption. Scenarios of failure to meet public targets are also studied



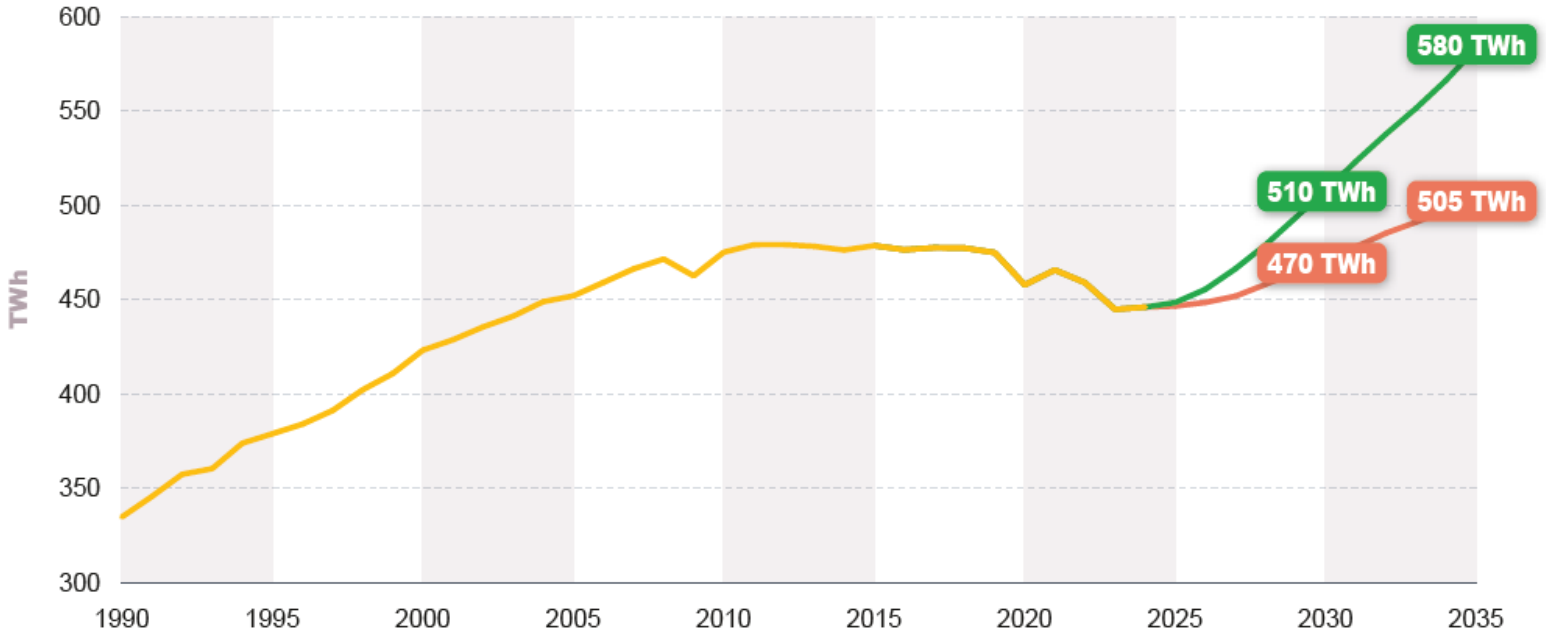
In its most recent analyses, RTE has considered various consumption scenarios and paces of electrification for the very next years

FAST DECARBONISATION — public-policy targets are met

France meets Fit for 55 targets and achieves economic and industrial recovery

SLOW DECARBONISATION — public-policy targets are not met

French consumption follows a pathway incompatible with climate targets



A rapid decarbonization of France to reduce its dependence on imported fossil fuels would bring significant benefits

The *Energy Pathways 2050* and the *Bilan prévisionnel 2025* have underlined the relevance of rapidly decarbonising the country to reduce its dependence on imported fossil fuels.

Namely, following the "fast decarbonisation path" would directly translates into the following climatical, geopolitical and economical benefits for the country:

- Share of fossil fuels in French energy consumption in 2035: **~30–35%** (vs. ~60% today)
- Share of electricity in French energy consumption in 2035: **~40–45%** (vs. 26% in 2024)
- Fossil-fuel imports in 2035: **-500 TWh** (compared with 2024)
- CO_2 emissions in 2035: ~210 $MtCO_2$ (**-60%** gross emissions compared with 1990)

France currently has an abundant electricity supply, creating particularly favourable conditions for electrification

1 France's low-carbon electricity generation potential has now been restored and is growing at the pace required to decarbonise the country

- Global improvement of nuclear generation following Covid and stress-corrosion issues
- Global improvement of hydropower generation after the historic 2022 drought (but low generation was again encountered during the 2026 summer)
- Continued increase in renewable generation (from ~3 TWh/year between 2011–2015 to 9 TWh/year since 2021), in line with public-policy targets

2 Consumption remains sluggish and is not following the rapid decarbonisation pathway

- Consumption decreased significantly following the Covid and 2022-2023 energy crises (-6% vs. its pre-Covid level)
- Continued effects of energy efficiency

France currently has an abundant electricity supply, creating particularly favourable conditions for electrification

This situation results in:

1. **very significant exports, under favourable economic conditions**

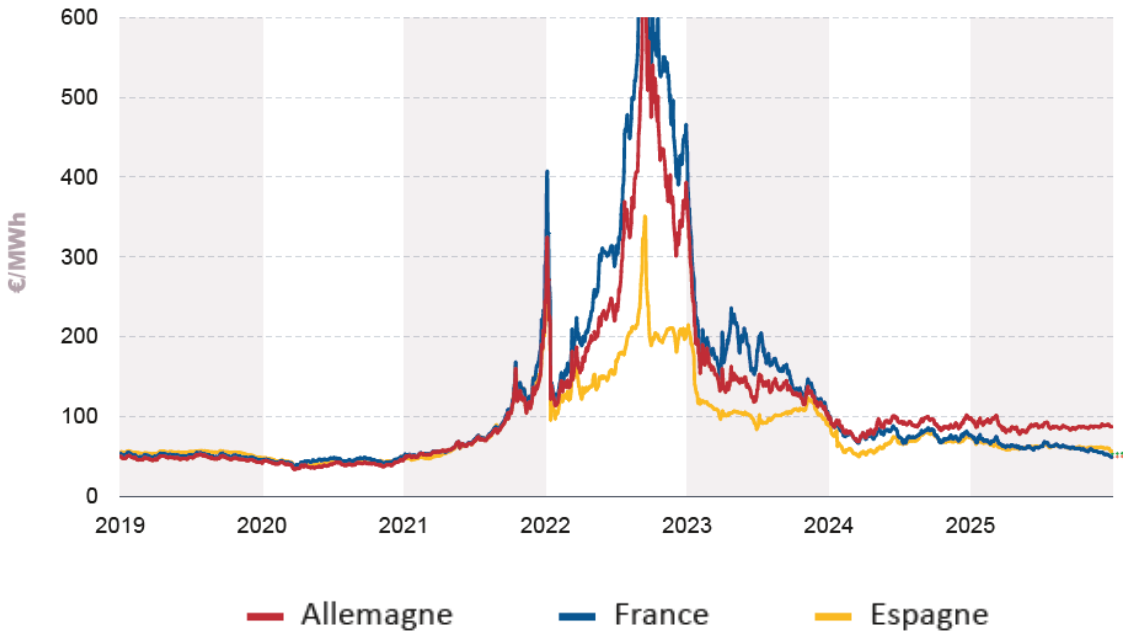
   2024 : 89 TWh (previous record since 2002)

   2025 : 92 TWh (latest record)

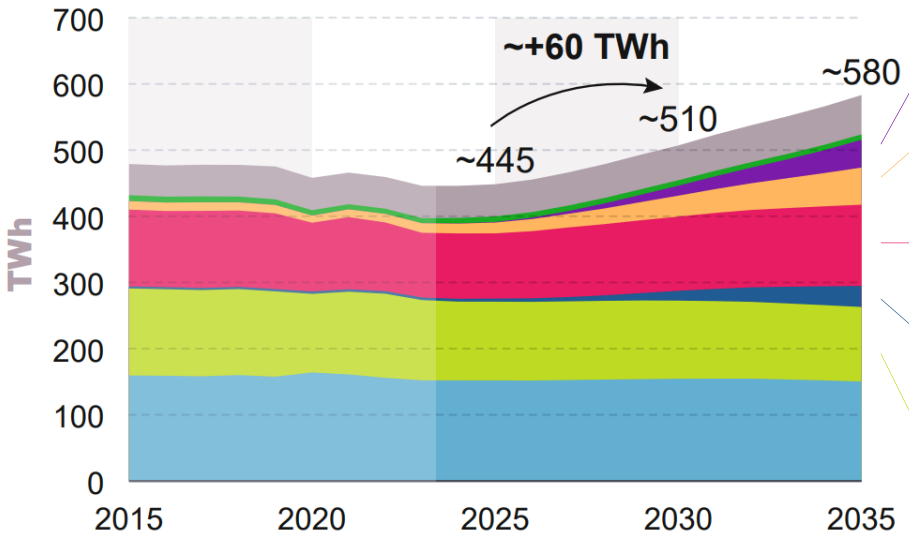
   First semester 2026: 52 TWh (latest record for a first semester)

2. **sustained competitiveness of French wholesale prices** (~€50/MWh for delivery next year during all S1 2026, ~€85/MWh closer to delivery) **compared with prices in all neighbouring countries** (~€125-150/MWh), with the exception of Spain, which also has a competitive, low-carbon electricity system

Evolution of baseload forward prices for delivery the following year in France, Spain and Germany



The consumption pathways are now underpinned by concrete projects and a government electrification plan that must now be implemented



Sources of electricity-consumption growth in the rapid-decarbonisation pathway

Moderate development of hydrogen and derivatives

→ deliver 60% of projects having already secured grid-access rights (+2.9 GW)

Expected impact: +12 TWh of electricity consumption

Rapid development of electric mobility

→ x3 sales rate vs. 2025 to reach ~1.2 million/year and ~8 millions EVs in 2030

Expected impact: +17 TWh of electricity consumption

Acceleration of reindustrialisation and industrial electrification

→ deliver 60% of projects with grid-access rights (+3.4 GW)

Expected impact: +13 TWh of electricity consumption

Strengthening digital sovereignty through rapid data-centre development

→ deliver 60% of projects with grid-access rights (+4.3 GW)

Expected impact: +10 TWh of electricity consumption

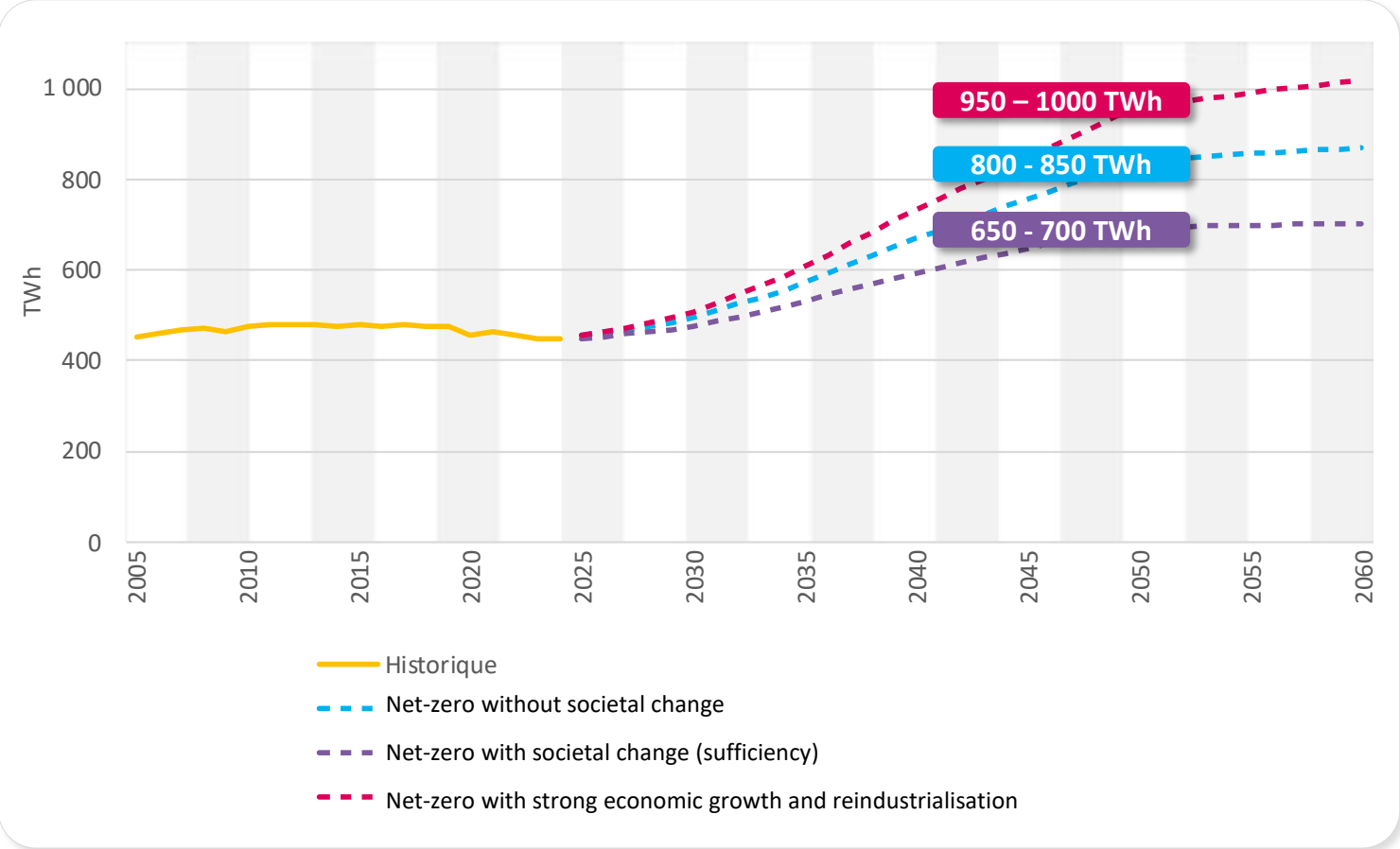
Continued efforts to renovate buildings and electrify heating through the rollout of heat pumps

Expected impact: gradual phase-out of fossil fuels, very limited impact on electricity consumption (high heat-pump efficiency)

Detailed view

	2024	SLOW DECARBONISATION	RAPID DECARBONISATION
Buildings	~270 TWh	~ 0 TWh	~ 0 TWh
Mobility	~15 TWh 2 M EVs 450 k sales/year	+ 9 TWh 6 M EVs in 2030 ~500-600 k sales/year	+ 17 TWh ~8 M EVs in 2030 ~1,2 M sales/year
Hydrogen	0 TWh	+ 5 TWh Delivering 1 GW among projects with grid-access rights (15% of the total)	+ 15 TWh Delivering 2,9 GW among projects with grid-access rights (60% of the total)
Industry	~100 TWh	+ 4 TWh Delivering 1,4 GW among projects with grid-access rights (10% of the total)	+ 13 TWh Delivering 3,4 GW among projects with grid-access rights (60% of the total)
Datacenters	~5 TWh	+ 6 TWh Delivering 2,4 GW among projects with grid-access rights (30% of the total)	+ 10 TWh Delivering 4,3 GW among projects with grid-access rights (60% of the total)

Since 2021, the consumption paths in the update are even steeper than in the previous edition of the *Energy Pathways 2050*

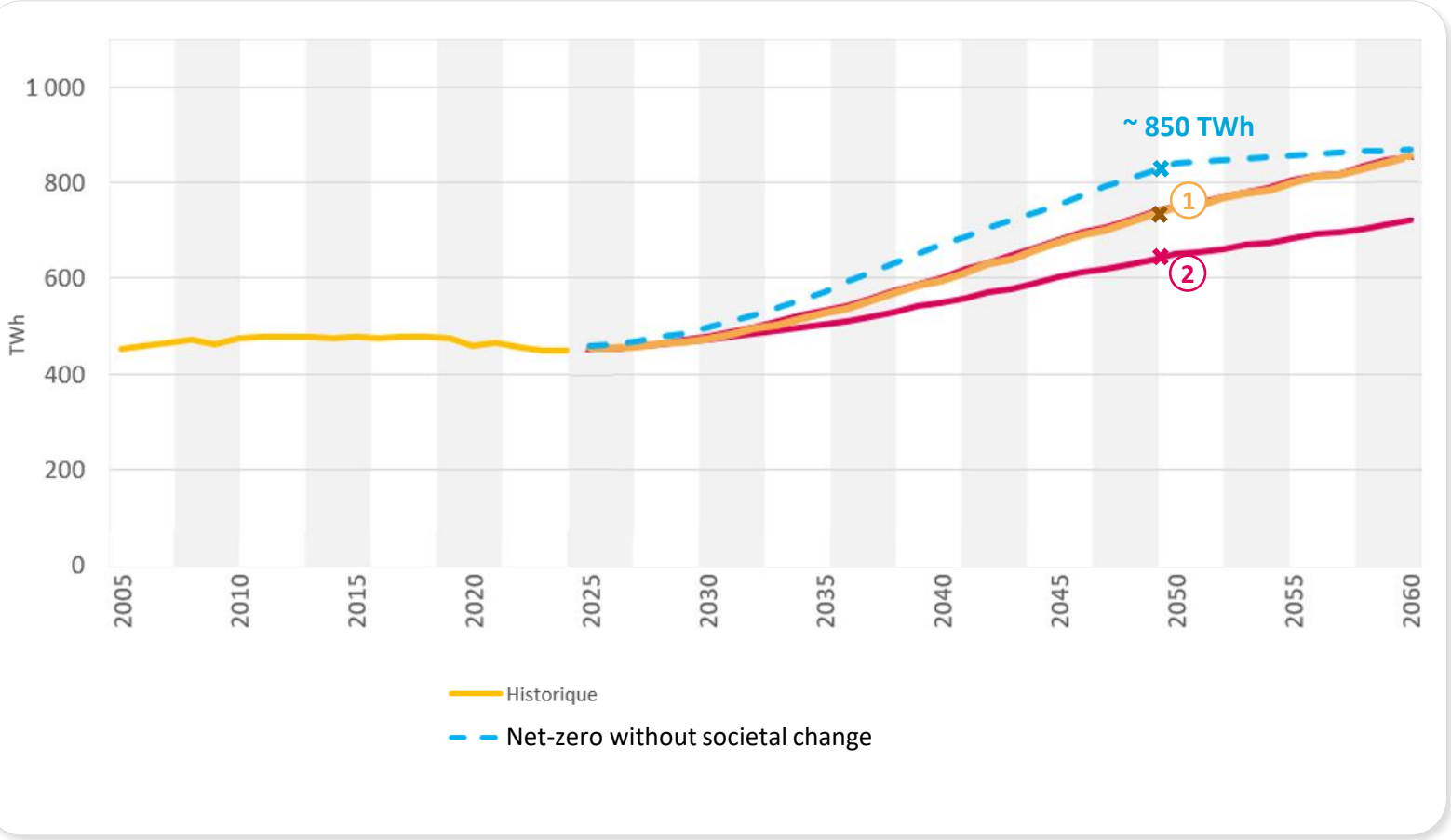


In the long term, the consumption levels needed to reach net-zero in the update of the *Energy Pathways 2050* are **higher than those envisaged in the 2021 edition** (revised assessment of available biomass amounts, reduction in carbon sinks, increase in the ambitions for air transport decarbonization and data centres development)

The beam formed by these trajectories extends from ~700 TWh to ~950 TWh in 2050

They reveal a very significant deviation from the current trend (stagnation). Scenarios with delays in achieving net-zero are also studied.

The update will also include scenarios for delays or failure to achieve carbon neutrality



1 Deep decarbonization path
(carbon neutrality by 2060, achievement of 90-95% of the 2050 emissions reduction target)

→ In this trajectory, consumption would reach ~750 TWh in 2050

2 Slow decarbonisation path
(longer delay in the emission reduction target + a degraded economic growth)

→ In this trajectory, consumption would reach ~600-650 TWh in 2050

The study will also extend to the generation mix trajectories fit to support these electrification prospects

Trajectories without new nuclear power

Trajectories with new nuclear power:

A matter of addition or substitution to existing nuclear power

Accelerated development of renewables and early closure of existing nuclear power
(achievement of 100% renewables by 2050)

- *Which renewable technologies, what volumes?*

Development of renewables and extension of existing nuclear power to the safety limit

- *Which assumption/bet to make on maximum lifespan of existing reactors?*
- *Types of renewables (large or diffuse)?*

Under consultation

New nuclear program (8 EPR 2 in 2050) and development of renewables

- *New nuclear power in addition to or in substitution to the current fleet?*
- *Types of renewables?*

Large new nuclear program (14 EPR 2 + SMR in 2050) and development of renewables

- *Volumes of SMRs?*
- *New nuclear in addition to or in substitution to the current fleet?*
- *Types of renewables?*

Very large nuclear program and halt to the development of solar and wind power

- *Which nuclear technologies, what volumes?*
- *What future for existing renewables?*

As grid operator, RTE has also prioritized major grid evolutions to allow for the decarbonization of the French economy

P1 **3 main industrial zones**

Dunkirk, Le Havre,
Fos-sur-Mer

Ongoing works, commissioning as of 2029

P2 **7 other industrial zones**

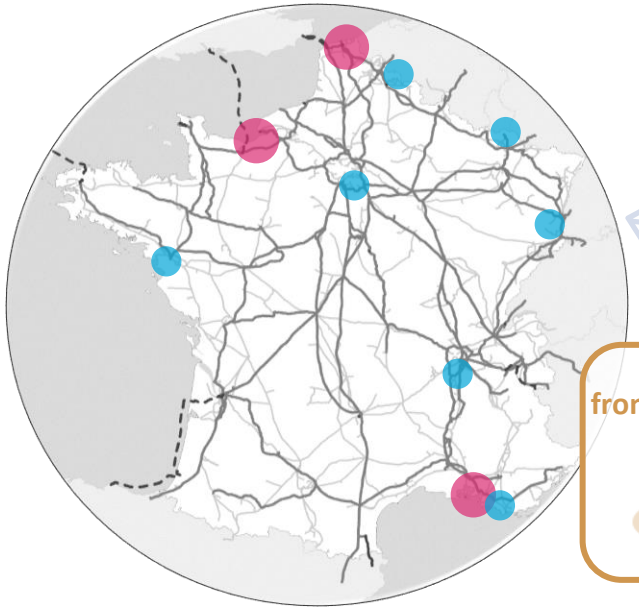
Valenciennes, St Avold, Sud Alsace,
Vallée de la chimie, Plan-de-campagne,
Loire-Estuaire, Sud Ile-de-France

Commissioning around 2030, depending on the progress of industrial decarbonisation projects

P3 **Potential other industrial zones**

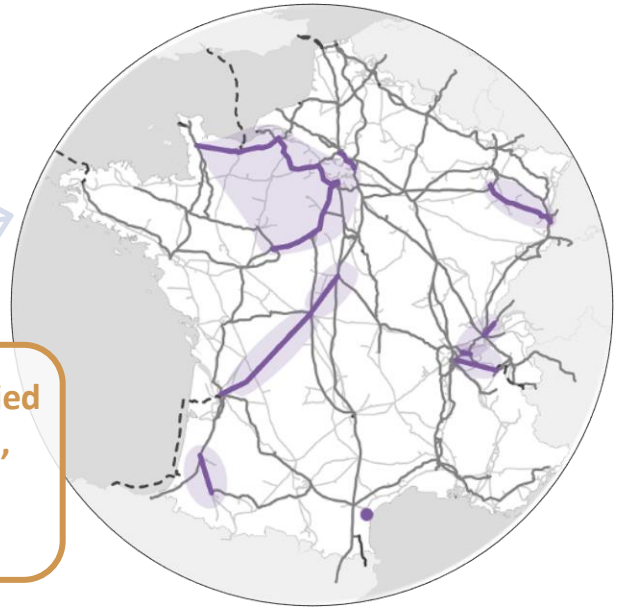
Châteauroux, Pyrénées, Paris region,
Alsace, Port-la-Nouvelle, Lyonnais

Zones where grid investments can be accelerated at the State/regions' request



+

from 2028 **Fast-track process for pre-identified sites ready for large consumers, e.g. data centres to favor their implantation on European soil**



A flagship example: ongoing grid investments to welcome new, low-carbon industrial plants in the Dunkirk zone

New substation: "Puythouck"



New 2x400 kV line

New substation:
"Flandre Maritime"
(biggest in Europe)