

Dlaczego atom? Miejsce energetyki jądrowej w kontekście transformacji energetycznej

Wielkopolskie Dni Energii Jądrowej

Poznań, 22 September 2026

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1. EU Context and Why Nuclear?



Decarbonisation

- ~23% of EU electricity today (higher in FR, SE, FI, SK etc.)
- Zero-carbon at point of generation
- Complements high-renewables mix
- Contribution depends on national choices and LTO (life time extension) decisions



Security of Supply

- Firm, dispatchable capacity
- Low fuel-volume needs, but fuel dependencies remain
- Diversified fuel
- Regional value is highest where alternatives are highly constrained



Competitiveness

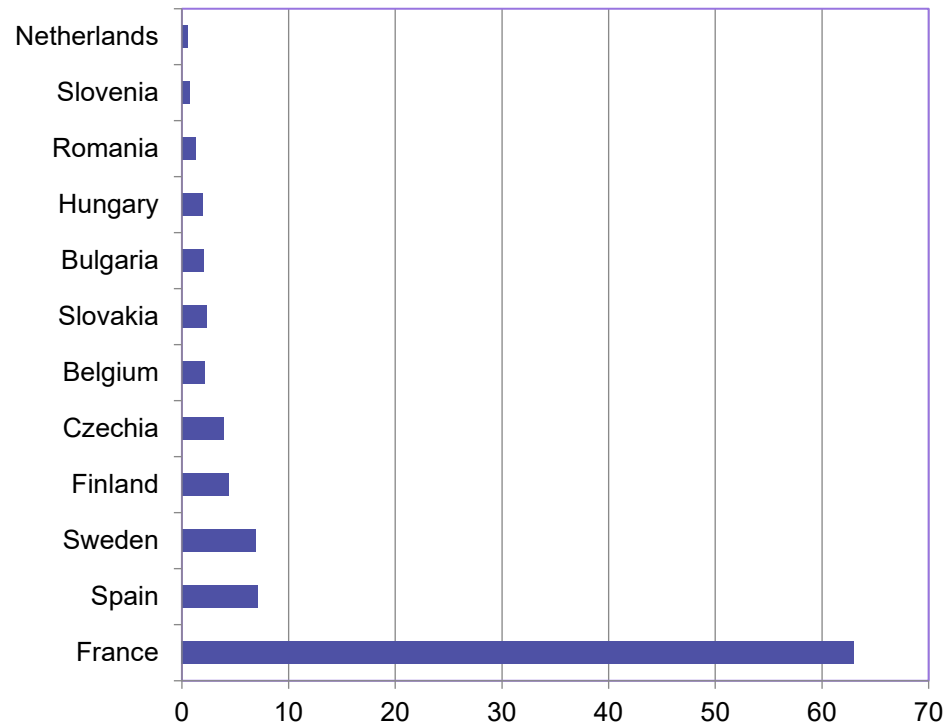
- Stable long-term prices, high capital intensity and long construction times
- Industrial heat & H₂ options
- High-value jobs & supply chain
- Clean Industrial Deal alignment
- Intensive cost of new build vs LTO expenses of current units

2. Regional context: where nuclear matters most today?

North-West & Central Europe

- France: large existing fleet; LTO will have a strong impact.
- Belgium, Netherlands, UK (neighbouring): life-extension decisions and limited new capacity affect regional balances.
- Nordic countries (FI, SE): nuclear as firm capacity complement to hydro and growing VRES.
- System value is highest where interconnection is limited or where coal/gas phase-out is rapid.

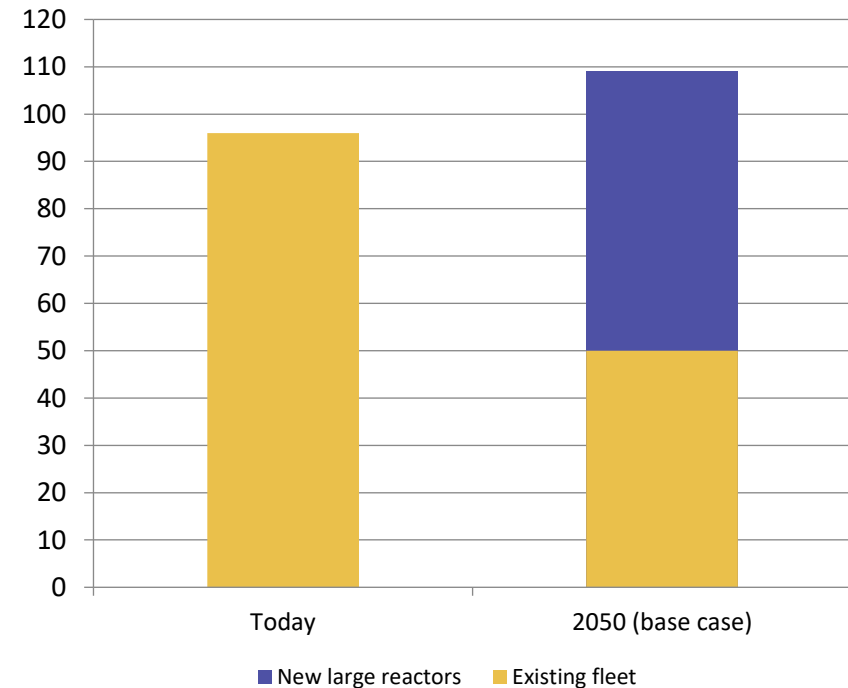
Current capacity by MS (~96 GWe)



Central & Eastern Europe

- Czechia, Slovakia, Hungary, Bulgaria, Romania, Poland (plans): nuclear remains or is planned as a firm low-carbon option.
- Security of supply and industrial competitiveness arguments are particularly strong.
- Fuel diversification and supply chain localisation are active policy priorities.
- New build projects face the same capital, schedule and skills constraints seen elsewhere in the EU.

Base case outlook



3. Nuclear Illustrative Programme (PINC)

Article 40 Euratom Treaty — 8th Programme (2025/2026)

Key Objectives

Provide a fact-based overview of nuclear development trends and investment needs across the EU, aligned with decarbonisation targets, REPowerEU and the Clean Industrial Deal. Facilitate transparent discussion among Euratom members on trends and required investments.

June 2025

Commission adopts
8th PINC

Dec 2025

EESC Opinion
adopted

Mar 2026

Final PINC
Communication

4. Key insights from PINC

96 GWe

Current capacity
(large reactors)

109 GWe

2050 base case
(with LTO + new build)

up to 144 GWe

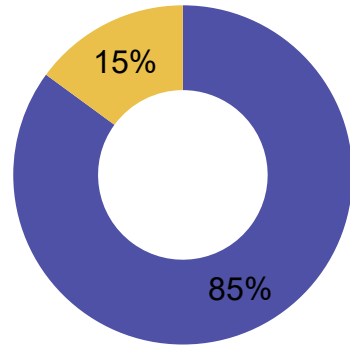
Higher scenario
(extended LTO)

17–53 GWe

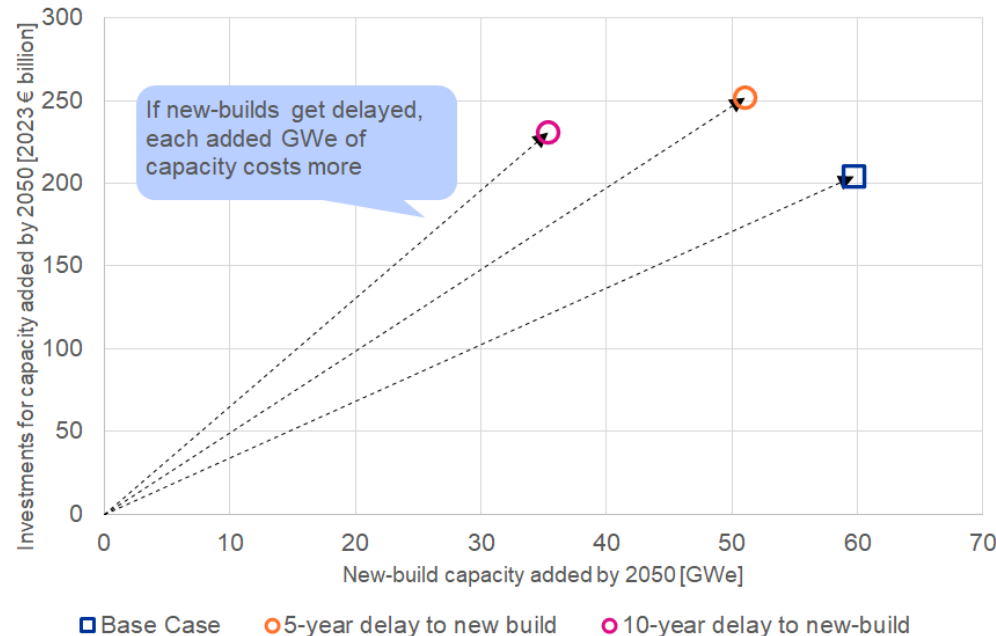
Additional SMR
potential by 2050

- Base case reflects Member States' NECPs: modest net growth driven by lifetime extensions (LTO) of existing fleet plus new large-scale reactors.
- Without LTO, existing capacity would fall sharply (to ~70 GWe by 2050); new build (~60 GWe) is essential to reach base-case levels.
- SMRs (including AMRs and microreactors) are additional; first commercial units in the next decade, wider deployment from 2040.

5. Investment needs until 2050 (PINC)



■ New large-scale reactors (€205 bn)
■ Lifetime extensions – LTO (€36 bn)



€241 billion

Present-value total (base case)

New large-scale reactors

€205 billion (≈ 85%)

Lifetime extensions (LTO)

€36 billion (≈ 15%)

Additional investment needed for SMRs, AMRs, microreactors and fusion (not included in the €241 bn).

5-year delay → ~9 GWe less capacity and >€45 bn extra cost.

6. POTEnCIA CETO 2025 Scenario

CETO (Clean Energy Technology Observatory):

- **Objective:** Monitoring EU clean technologies maturity and market prospects (e.g. deployment rates, R&D investment)
- **Core outputs:** Annual technology reports¹ (on key clean technologies, since 2025 including on nuclear energy)

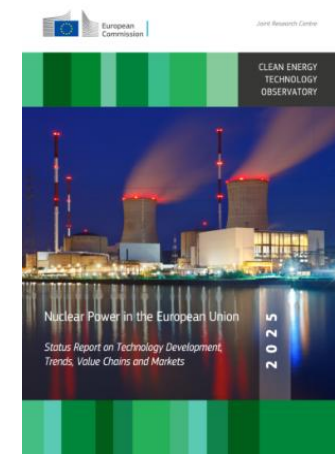
POTEnCIA (Policy-Oriented Tool for Energy and Climate change Impact Assessment):

- **JRC in-house development**
- Hybrid partial equilibrium **model of the EU energy system**
- Widely used in recent EC Impact Assessments (2040 Climate Target, ETS review...)

POTEnCIA CETO 2025 Scenario²:

- Dedicated, **technology-driven scenario** using CETO insights
- **GHG emissions** aligned with **European Climate Law**
- Inclusion of latest **NECP targets** and Nuclear Illustrative Programme (**PINC**)

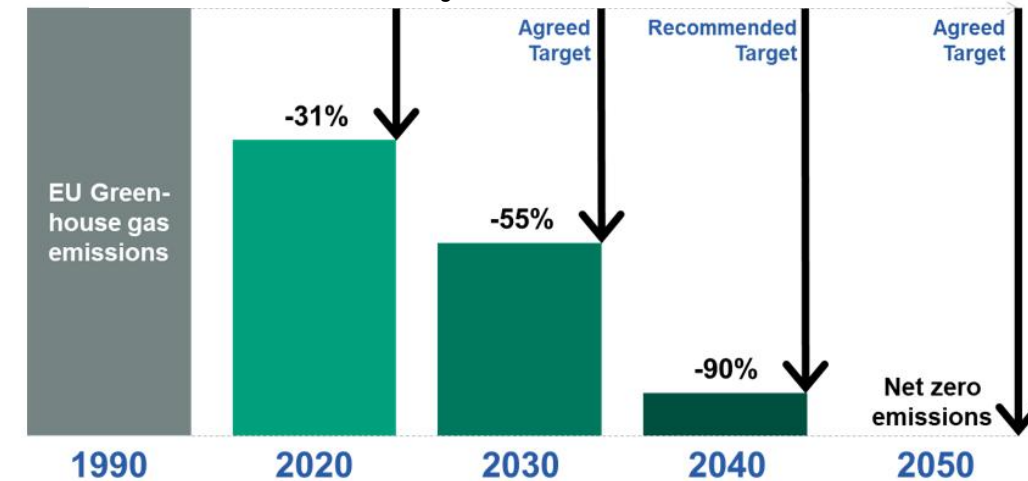
CETO 2025 Nuclear Energy report



POTEnCIA CETO 2025 Scenario report



EU Emission targets in the CETO 2025 Scenario



¹ Displaying the CETO 2025 Nuclear energy report on the top left. More info on CETO technology reports can be found on the [CETO Website](#) ;

² Displaying on the top right the [POTEnCIA CETO 2025 scenario report](#)

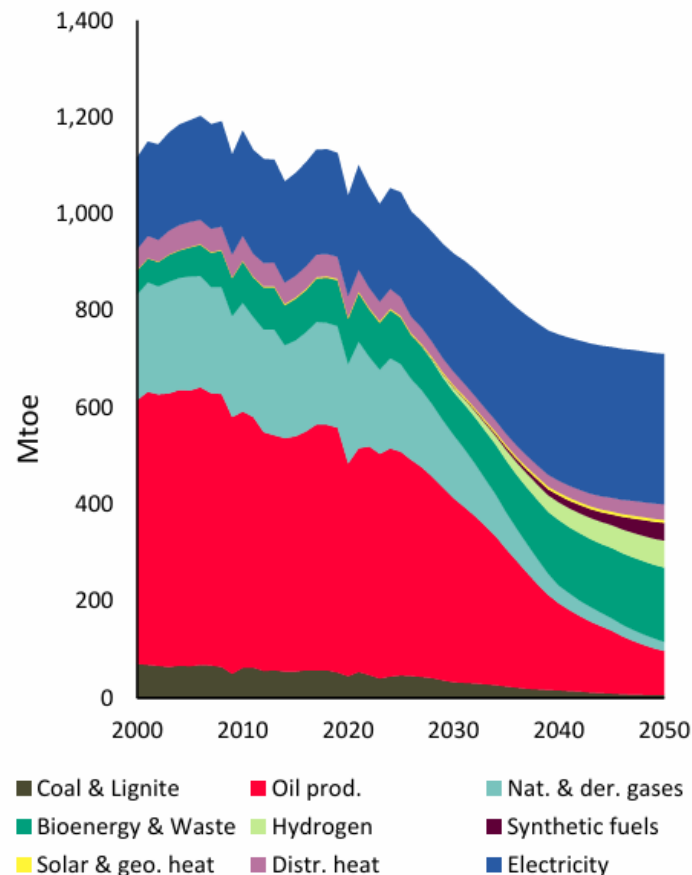
7. Electricity demand to more than double by 2050

To reach EU **emissions targets**, the fuel mix of the **EU energy system** changes profoundly from a fossil-fuel-dominated to an electricity-dominated system.

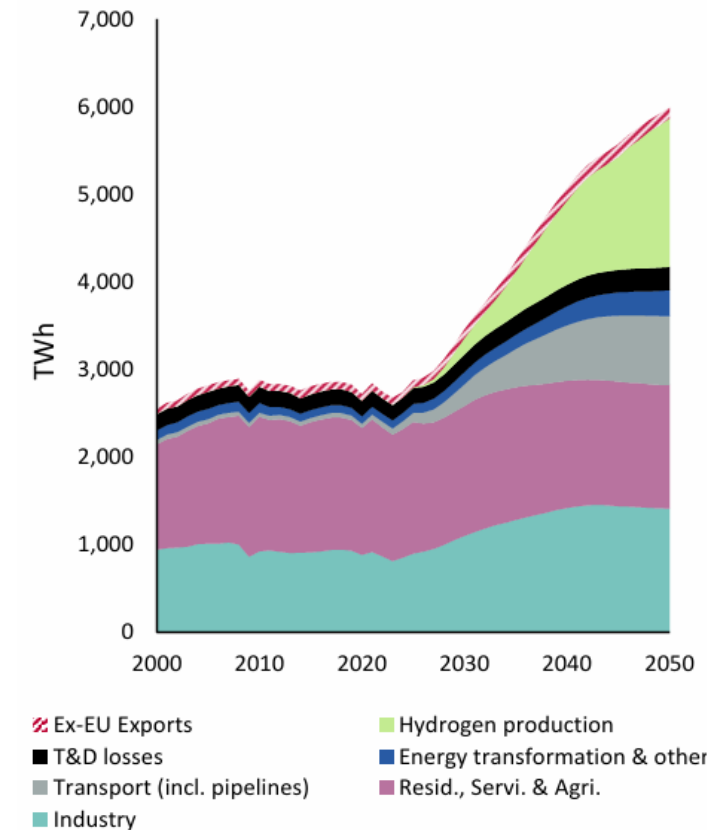
System-wide electrification:

- **reduces overall energy consumption**, especially of fossil fuels
- **Almost doubles electricity demand** by 2040 across **all sectors**, especially in industry, transport, and for hydrogen production, surpassing **5000 TWh in the 2040's** (compared to 2600 TWh in 2023)

Energy consumption by fuel¹



Electricity demand by sector²

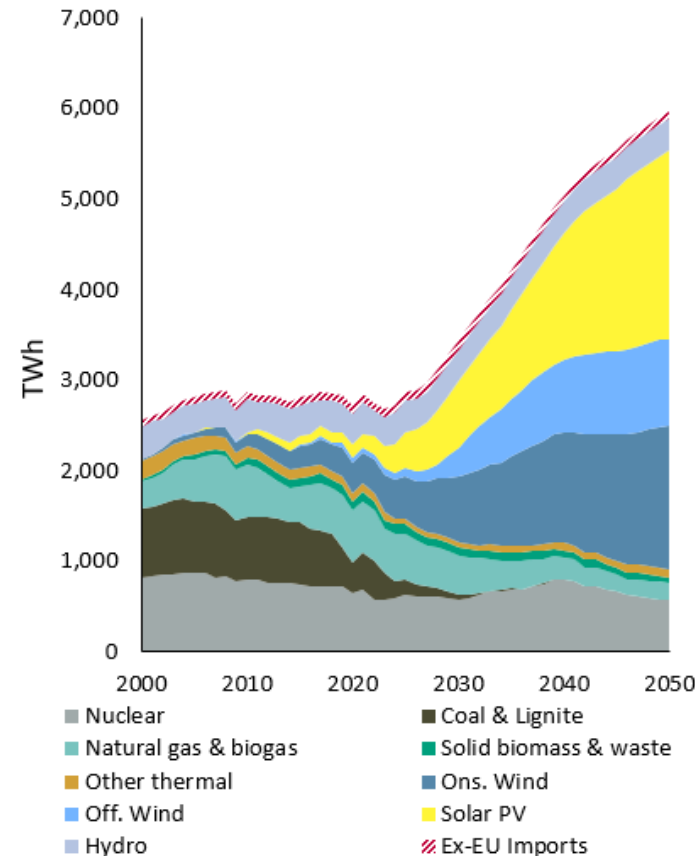


8. Nuclear remains essential for baseload generation

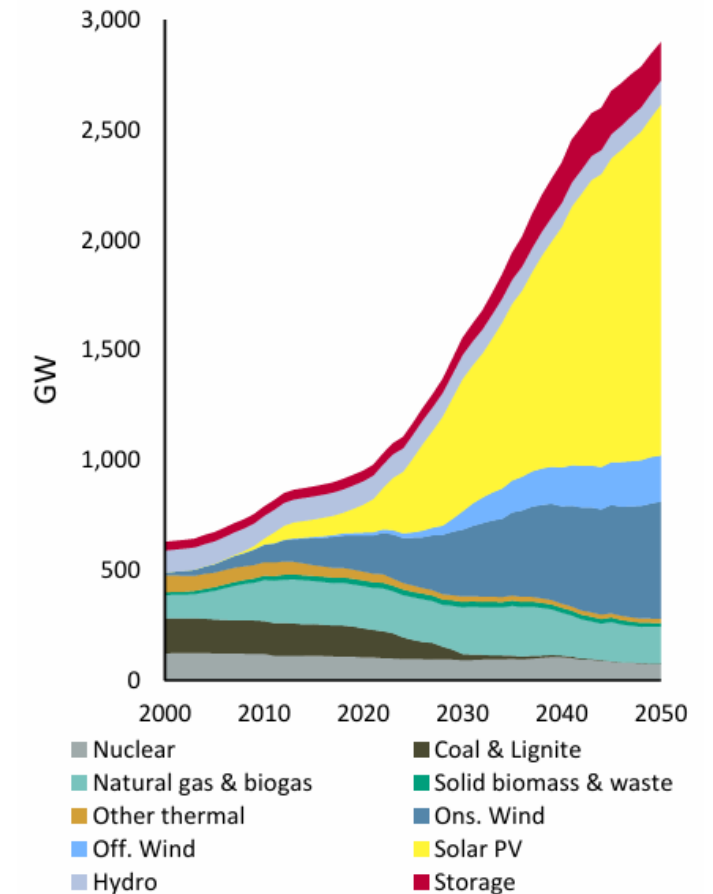
The **power sector** is almost fully decarbonised by 2040, where

- **Nuclear remains important with 106 GW capacity for baseload** providing 16% (~800 TWh) of stable electricity generation
- **Variable renewable energy (VRE) sources become dominant** growing their generation share from 28% to 68%
- **Coal is phased out** almost entirely
- **Natural gas** remains but mostly with **CCS**

Net electricity generation by technology¹



Net electricity generation capacities²

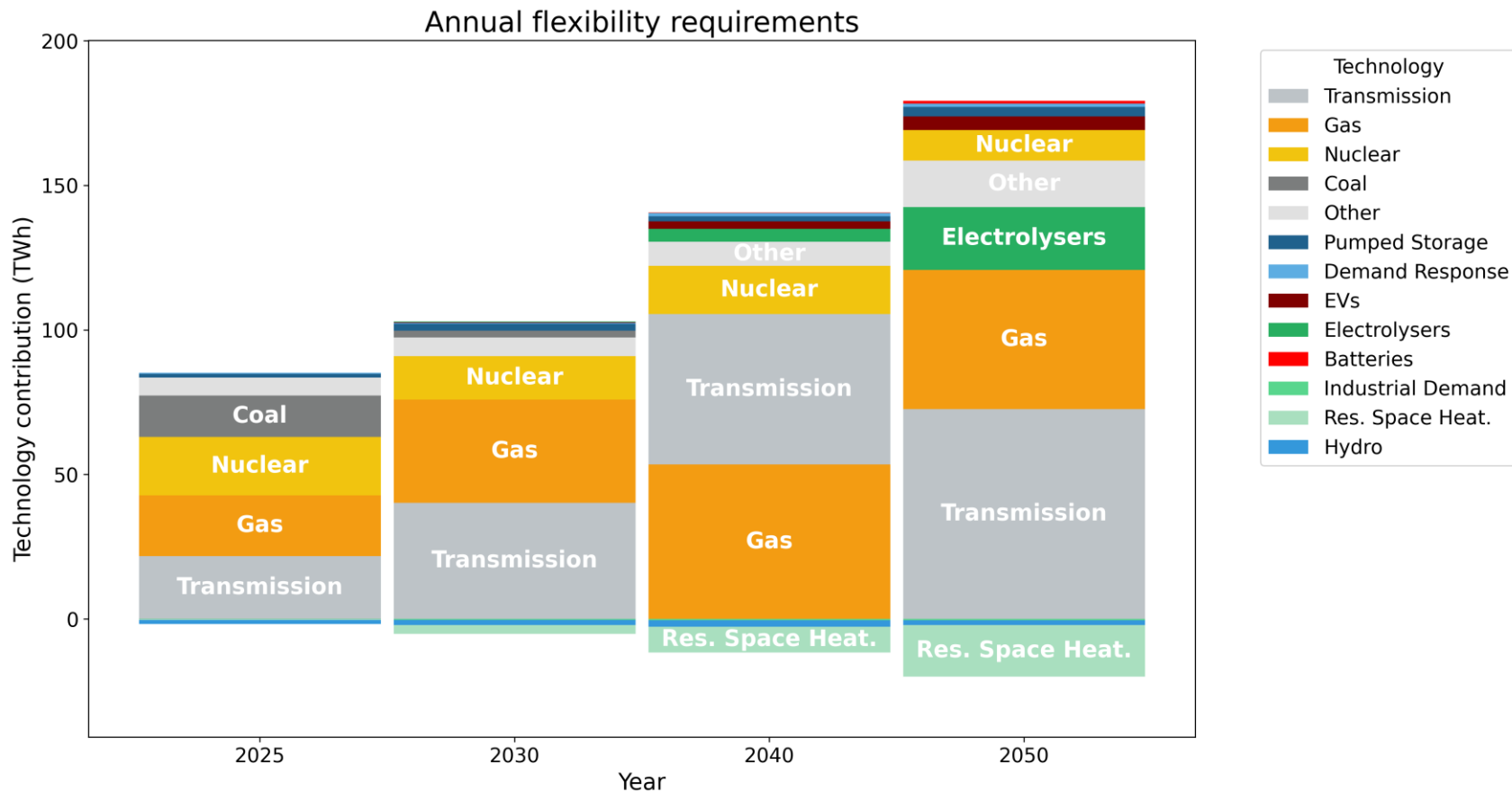


10 1 Hydro includes run-of-river and hydro dams, and tide, wave, and ocean, but excludes hydro pump storage; Other thermal includes derived gas, refinery gas, diesel oil, fuel oil, solar thermal, and geothermal

2 Storage includes batteries and pumped hydro storage; Hydro includes run-of-river and hydro dams, and tide, wave, and ocean, but excludes hydro pump storage; Other thermal includes derived gases, refinery gas, diesel oil, heavy fuel oil, solar thermal, and geothermal



9. Yearly & seasonal flexibility and role of nuclear



Key takeaway

Nuclear provides a non negligible contribution to yearly/seasonal flexibility.

Together with interconnectors, hydro and gas it supports seasonal adequacy while batteries and EVs dominate daily/weekly needs.

Source: JRC144042, Terça et al. 2026.

10. Key takeaways

- 1 Several zero and low carbon energy solutions are needed to decarbonise the EU's energy system.
- 2 Nuclear is a national choice that, for many Member States remains, essential for decarbonisation, security of supply and industrial competitiveness alongside renewables.
- 3 PINC projects modest capacity growth (96 → ~109 GWe) requiring ~€241 bn (present value) for large reactors and lifetime extensions; SMRs and fusion need additional investment.
- 4 Nuclear remains important for baseload generation and provides a non-negligible contribution to yearly/seasonal flexibility

Thank you

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