

BEYOND NATURAL GAS – THE ROLE OF GAS POWER PLANTS IN ELECTRICITY MARKET DECARBONISATION

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REKK Regional Conference

20 October 2026

Introduction

CONTEXT

Europe aims to **decarbonise its electricity system by 2040.**

At the same time, many European countries are **planning or already expanding their natural gas capacities.**

KEY QUESTIONS

- 1 Is decarbonisation achievable by 2040?
- 2 What role do gas-fired power plants play in the transition and in the decarbonised end state?
- 3 Is investing in new gas-fired power plants economically viable?

PROJECT: BEYOND NATURAL GAS 5 target countries

Bulgaria
CSD

Germany
E3G

Greece
The Green Tank

Hungary
REKK

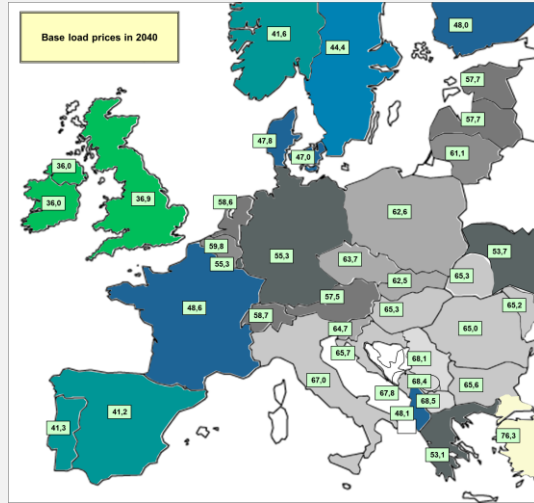
Romania
EPG

Funded by the European Climate Initiative (EUKI)

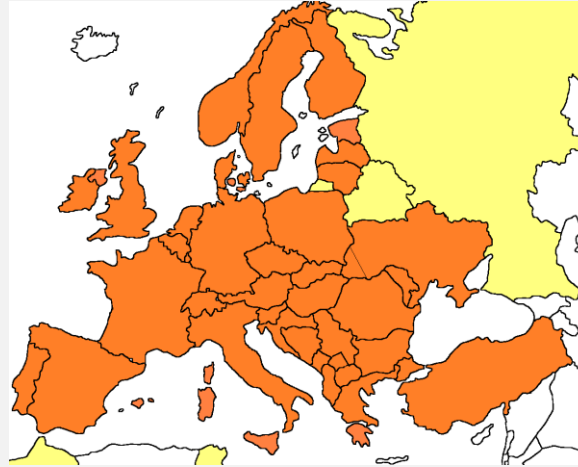
DRAFT RESULTS | Final report to be published in early December

European Power Market Model (EPMM)

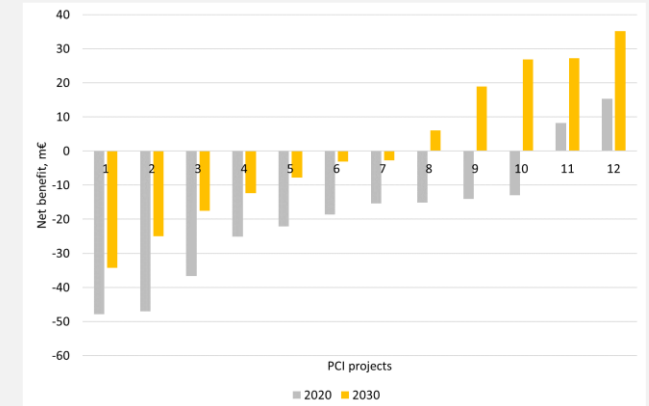
PRICE FORECAST



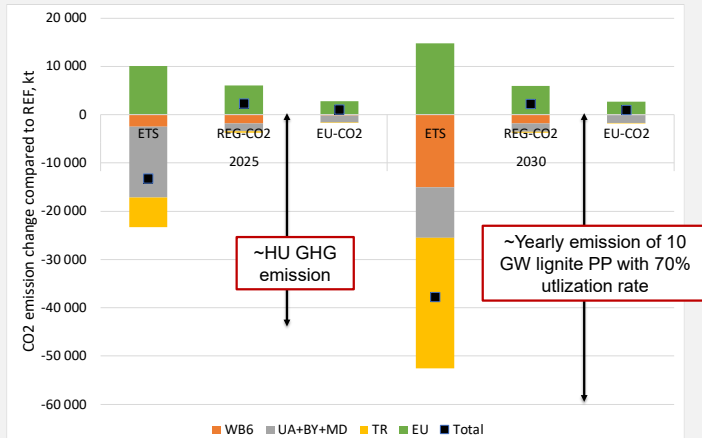
EUROPEAN POWER MARKET MODEL



INFRA EVALUATION

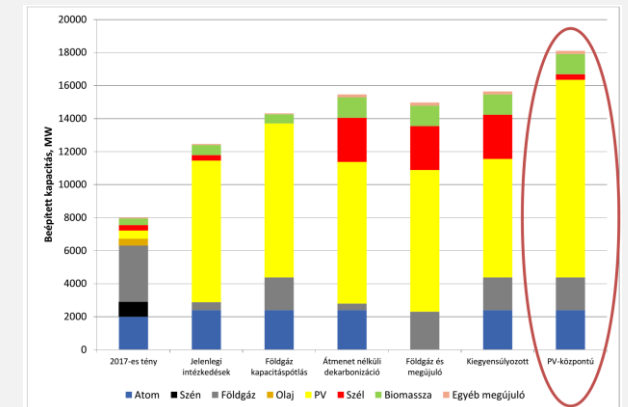


REGULATORY IMPACT ASSESSMENT



- 42 countries
- 12 reference weeks per year
 - 3500 units
- 110 connection lines
- Perfect market assumptions
- Wholesale and reserve market modelling

GENERATION FORECASTS



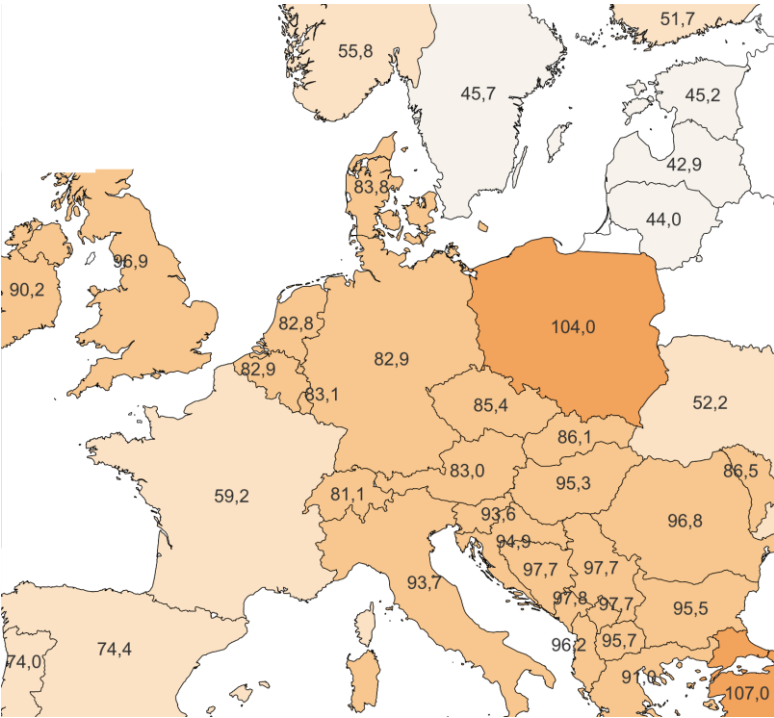
Scenarios

	Present trends (PT)	Gas-heavy (Gas)	Decarbonisation (Decarbon)
Storyline	Current trends continue, with no full decarbonisation of the electricity sector by 2040.	Lower-than-expected RES and storage deployment, but significant gas-fired power plant capacity additions. All modern gas-fired power plants (built after 2005) switch to hydrogen-based operation by 2040.	Higher-than-expected RES and storage deployment, with gas-fired power plant capacity declining over time. All modern gas-fired power plants (built after 2005) switch to hydrogen-based operation by 2040.
Demand increase	Moderate	Moderate	Large
RES+storage deployment	Expected (Moderate)	Slightly lower than expected	Intensive
Gas PP capacity	Constant capacity	Increasing capacity	Decreasing capacity
Gas-to-hydrogen switch date	Not mandatory until 2040	2040 (mandatory)	2040 (mandatory)

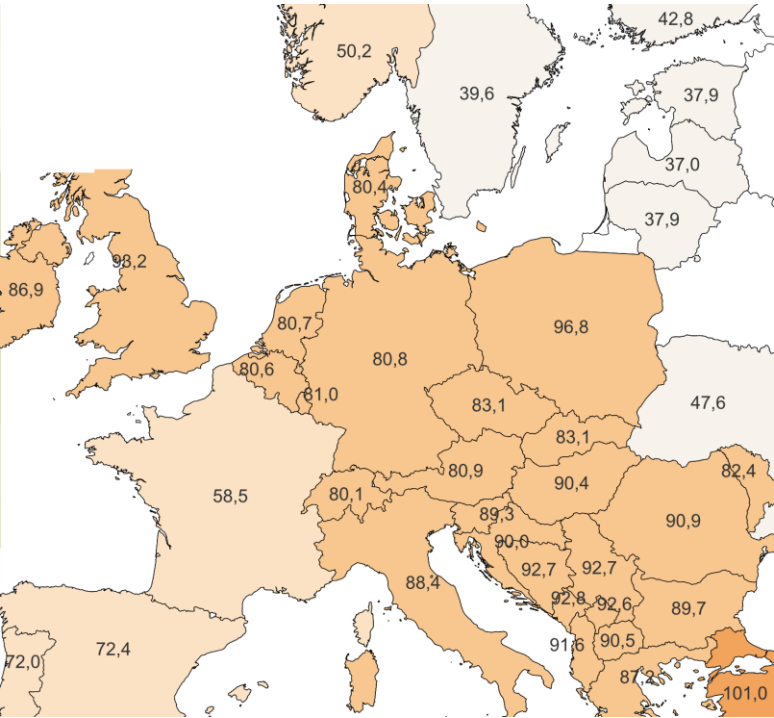
HYDROGEN PRICE ASSUMPTION 120 EUR/MWh in 2035 → 90 EUR/MWh in 2040 for all countries

By 2030, the Germany–Eastern EU price spread disappears in Decarbon

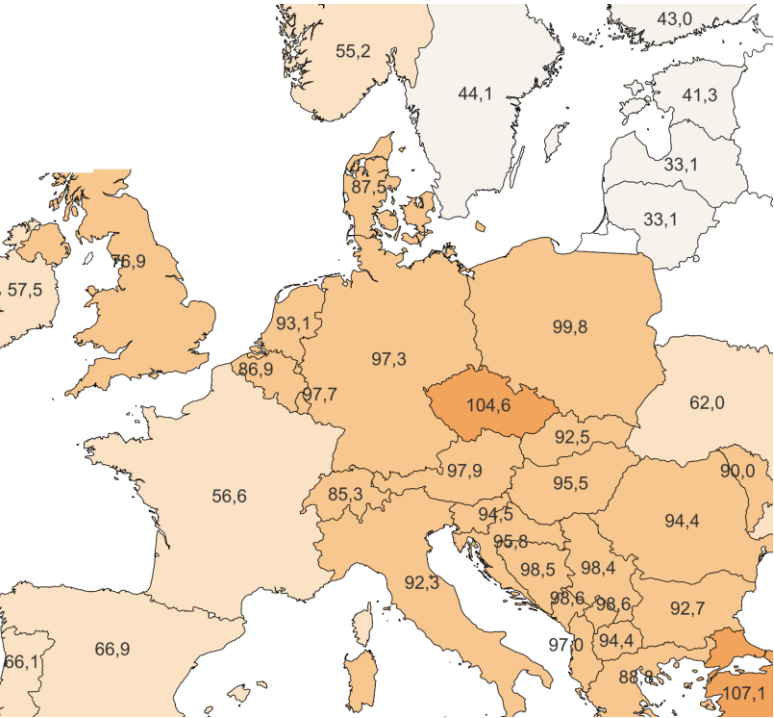
Present trends (PT)



Gas-heavy (Gas)



Decarbonisation (Decarbon)

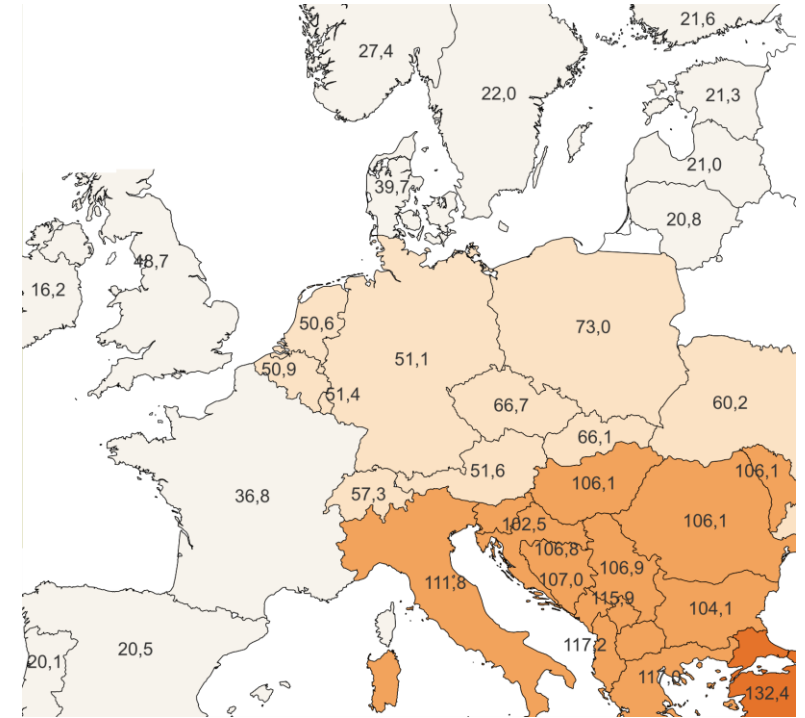


Baseload price, €/MWh

0–50	50–75	75–100	100–125	125–150	150–175	175–200	200–1000
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2030

Decarbonisation (Decarbon)

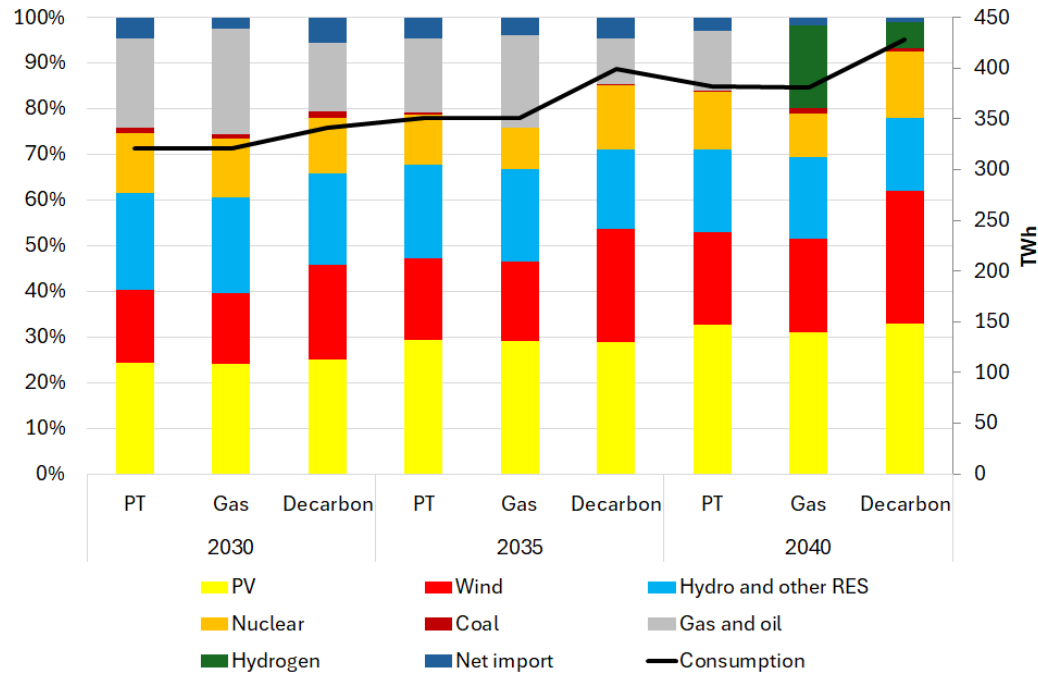


■ 200–1000

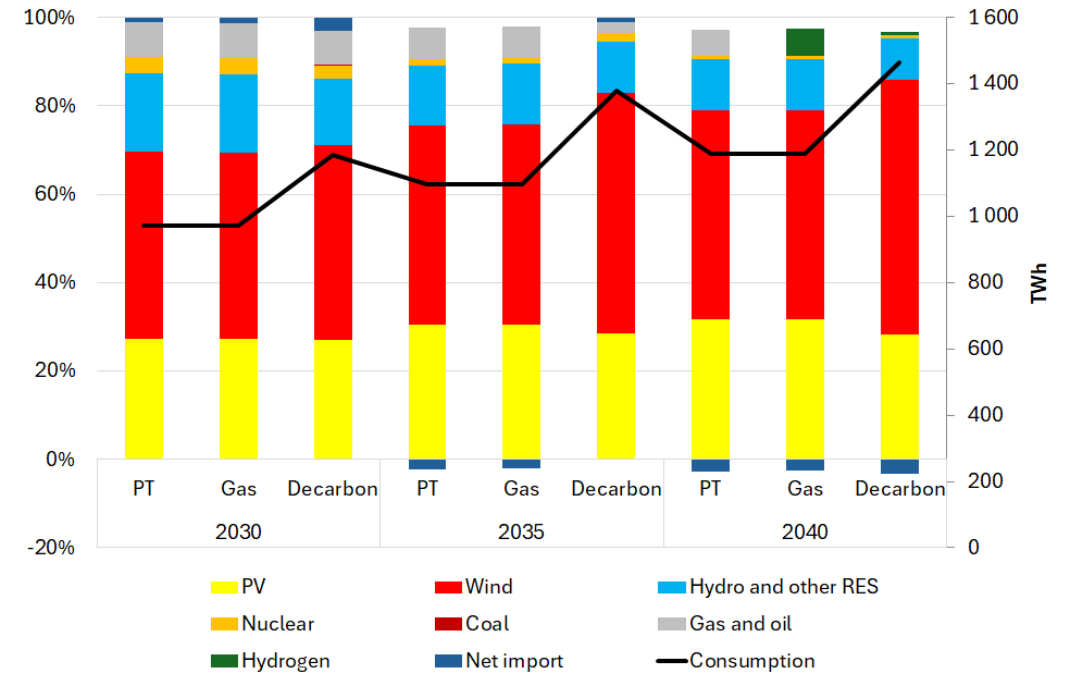
2040

Differing electricity mixes in the East and West

CENTRAL-EASTERN REGION BG, GR, HR, HU, MK, RO, SI, WB6



WESTERN REGION AT, BE, CH, DE, DK, LU, NL



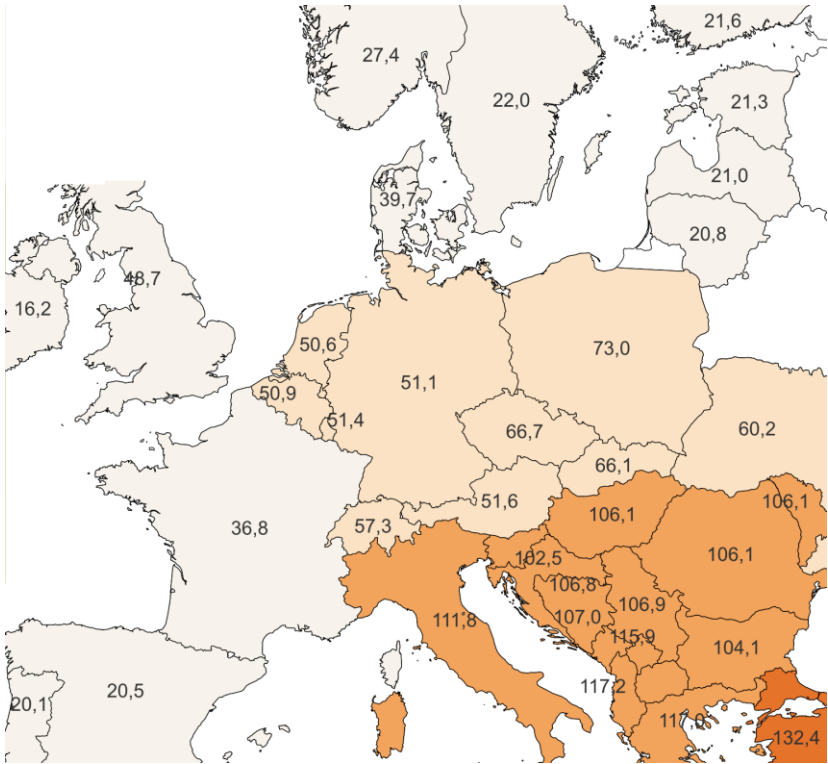
There are significant differences in **PV and wind deployment** between the two regions.

In the western region, **the role of natural gas and, later, hydrogen is smaller.**

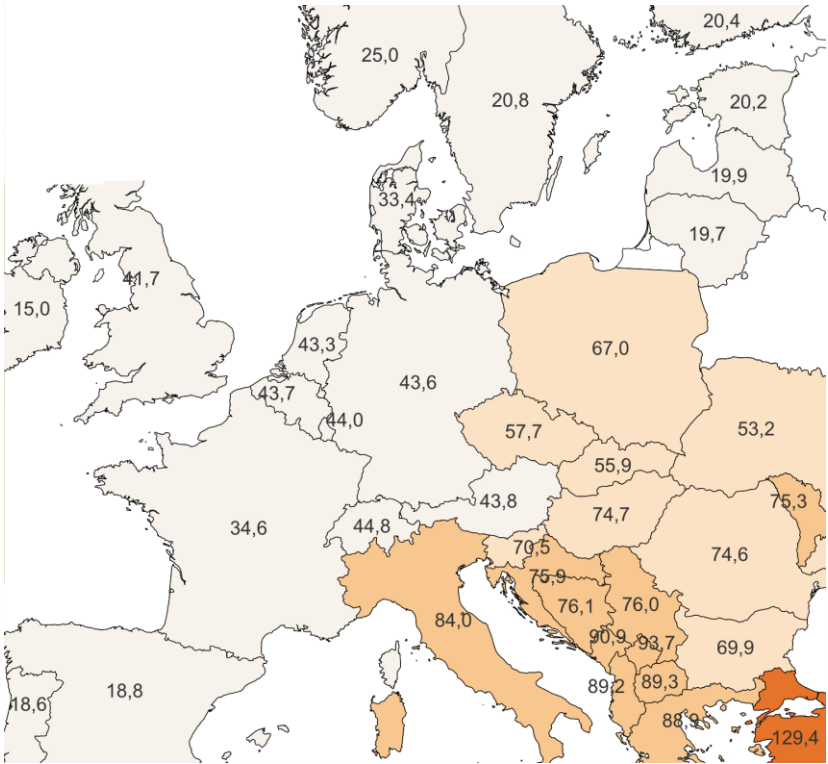
In the Gas scenario, hydrogen is used extensively in both regions. In the Decarbon scenario, however, **hydrogen is used extensively only in the central-eastern region.**

Additional RES+storage or lower demand leads to price convergence

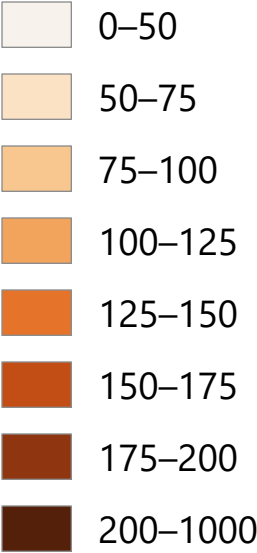
Decarbon



Decarbon+



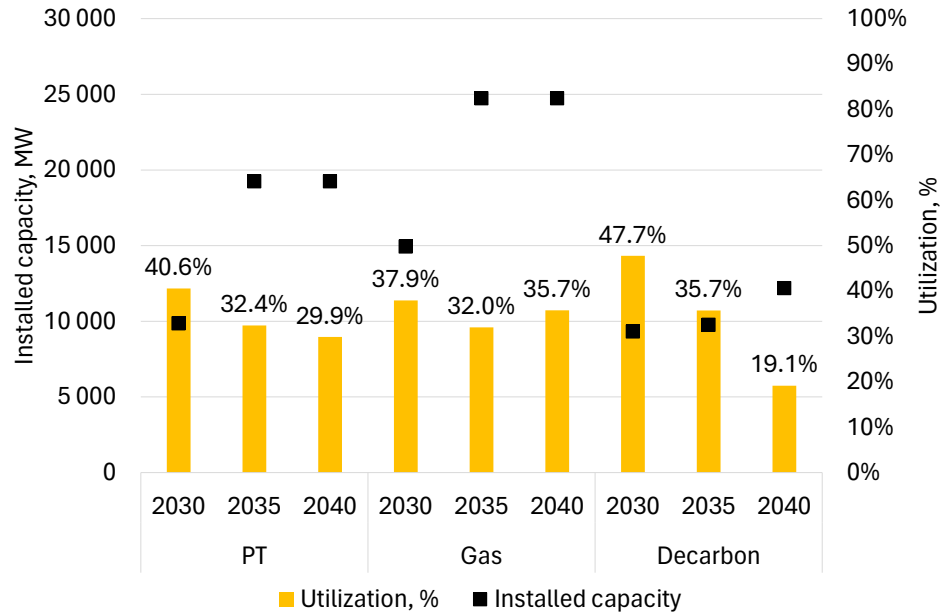
Baseload price
€/MWh



15% higher wind and storage deployment in the eastern high-priced region relative to Decarbon scenario

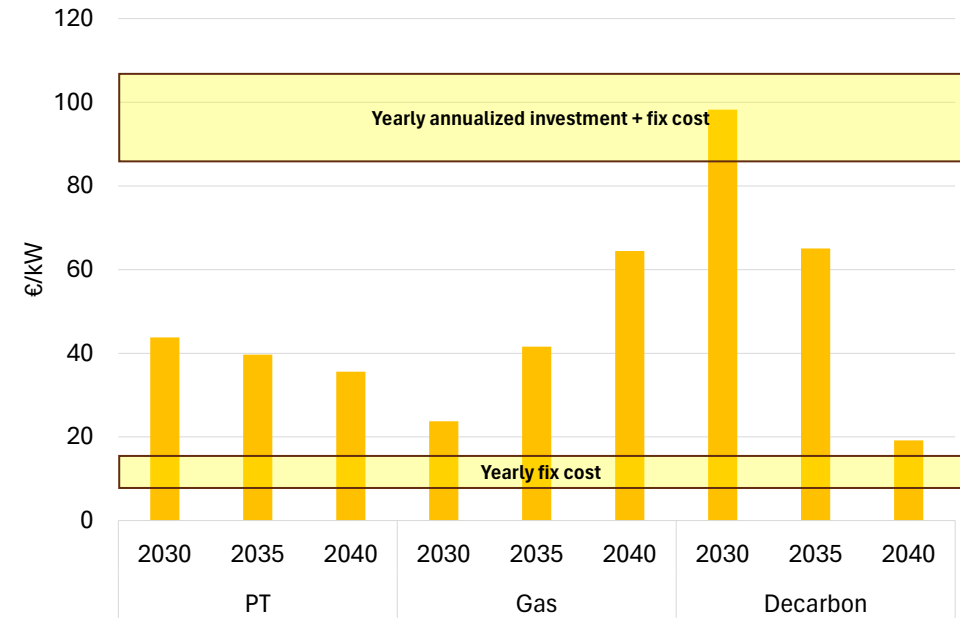
Planned new investments are not profitable

NEW GAS/HYDROGEN PP UTILISATION (BG, DE, GR, HU, RO)



- **Average utilisation remains relatively low** across all scenarios and modelled years, as RES expansion is significant even in the Gas scenario.
- Gas power plant utilisation **decreases over time** (more RES) in almost all scenarios and years.

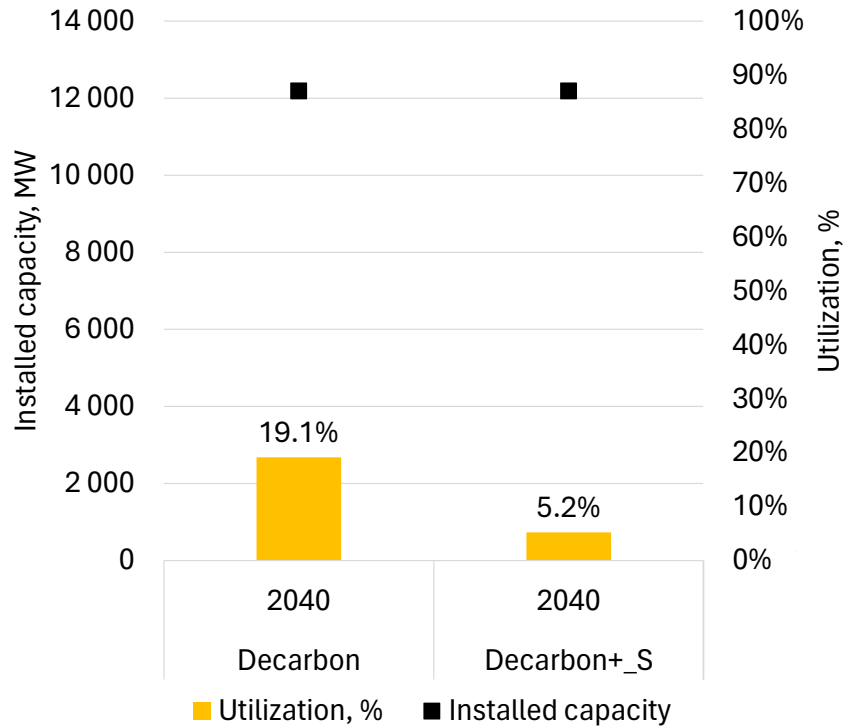
NEW GAS/HYDROGEN PP PROFITABILITY (BG, DE, GR, HU, RO)



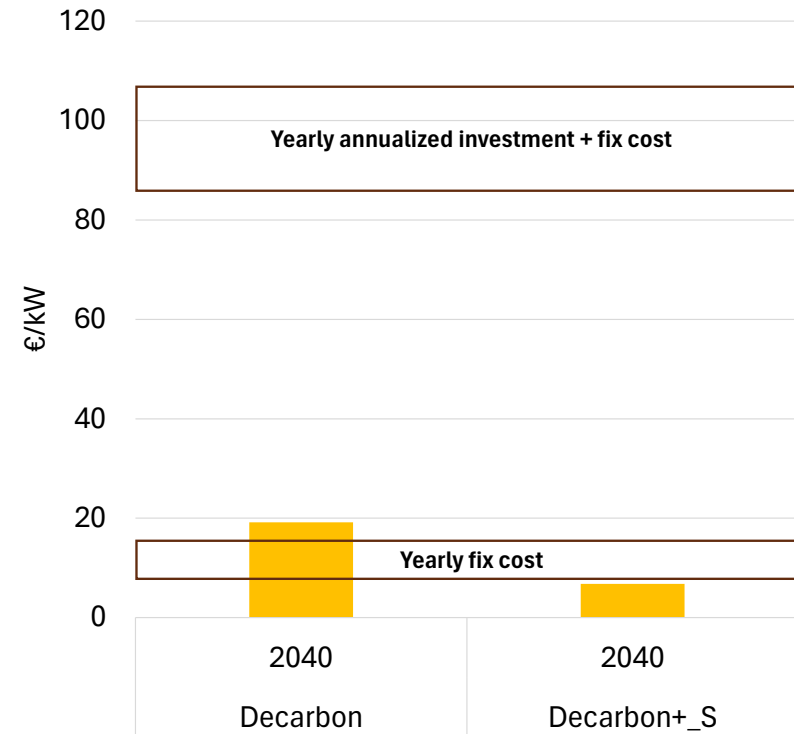
- Annualised profit reaches profitable levels **only in the Decarbon scenario in 2030**, with high demand.
- **In all other years, profits do not cover investment costs.**
- Higher RES and storage deployment reduces profitability, while higher demand increases it.

Additional RES+storage or lower demand decreases profitability

NEW GAS/HYDROGEN PP UTILISATION (BG, DE, GR, HU, RO)



NEW GAS/HYDROGEN PP PROFITABILITY (BG, DE, GR, HU, RO)



Both the demand reduction and the extra RES and storage investment **further reduce utilisation and profitability.**

Conclusions

1

Decarbonisation is feasible by 2040, but it requires substantial investment, particularly in wind power and storage, to prevent electricity prices from rising above current levels. Energy efficiency and demand-side flexibility can also contribute to achieving this goal.

2

Gas-to-hydrogen-based decarbonisation is not a viable path for Europe: average baseload prices in 2040 will be significantly higher than both current prices and the prices of alternative options.

3

A gas-to-hydrogen switch is only conceivable in a coordinated way, since even at the EUA prices expected for 2040, gas-based generation remains more economical than hydrogen-based generation.

4

The currently realistic but intensive decarbonisation pathway creates a highly favourable scenario for Western Europe, while Central and Eastern Europe face prices close to current levels.

- The main reason is the much heavier utilisation of hydrogen capacities, because of the slower-paced RES (especially wind) deployment.
- **With more storage and/or RES capacity, and/or lower demand (energy efficiency), a significant price decrease is achievable.**

5

Gas/hydrogen power plant investments are typically not profitable even in a high-demand, low-flexibility world. With energy efficiency, demand-side response, or higher-than-expected renewable and storage penetration, they are even less profitable.

A large industrial facility, likely a power plant or refinery, with several tall, white smokestacks featuring red horizontal bands. The facility is complex with various structures, pipes, and scaffolding. The sky is a clear blue with some light clouds. The foreground shows some trees and a fence.

THANK YOU FOR YOUR ATTENTION!

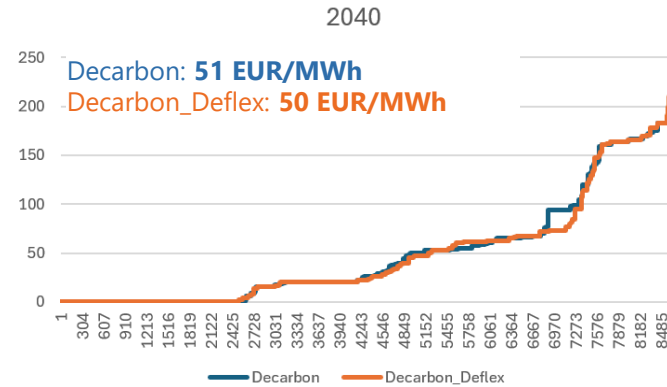
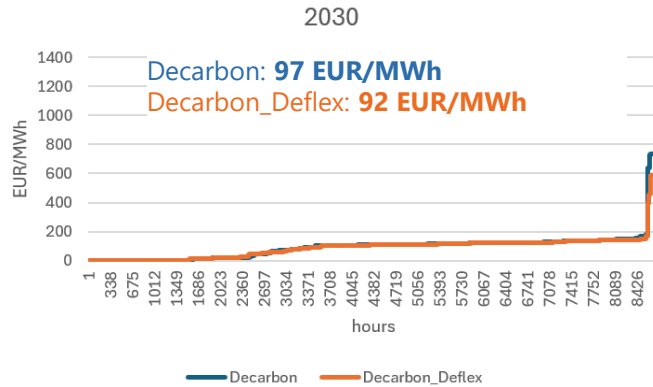
Contact:

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Case study: Germany

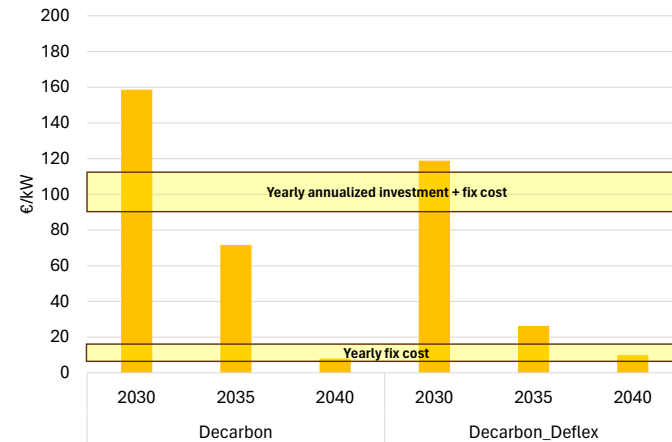
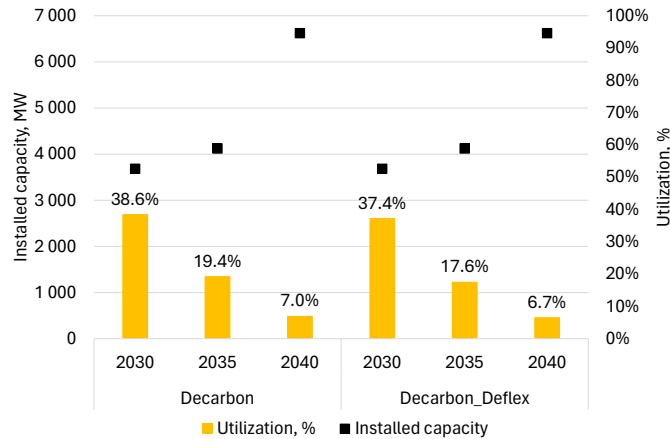
Demand-side flexibility matters

HOURLY PRICES



NEW GAS/HYDROGEN PP UTILISATION

NEW GAS/HYDROGEN PP PROFITABILITY

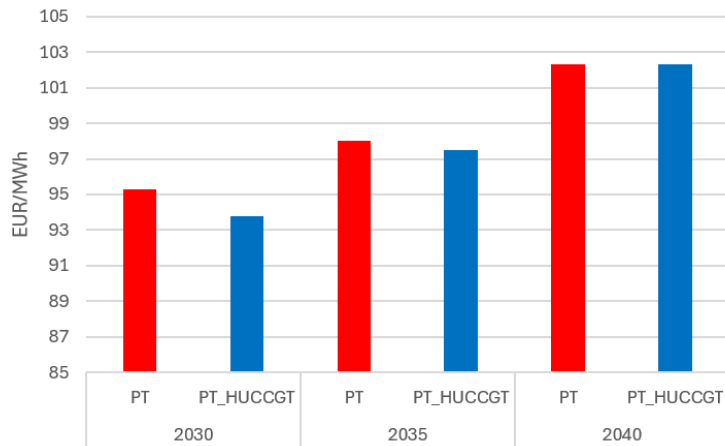


- **More flexible demand:** instead of 5 TWh, **30 TWh (3% of total in 2040)** of consumption can be shifted (Agora: 50–100 TWh in 2040).
- Extra flexibility reduced the German baseload price in 2030 from **97 EUR/MWh to 92** and from **51 to 50 EUR/MWh** in 2040.
- Extra demand flexibility **reduced the need for gas power plants.**
- Utilisation and profitability of German gas PPs both decreased.

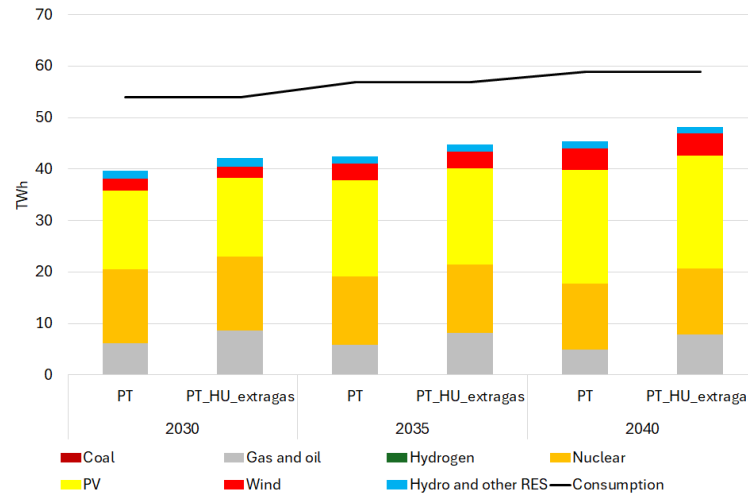
Case study: Hungary

Extra gas power plants increase CO₂ emissions but do not drastically decrease prices

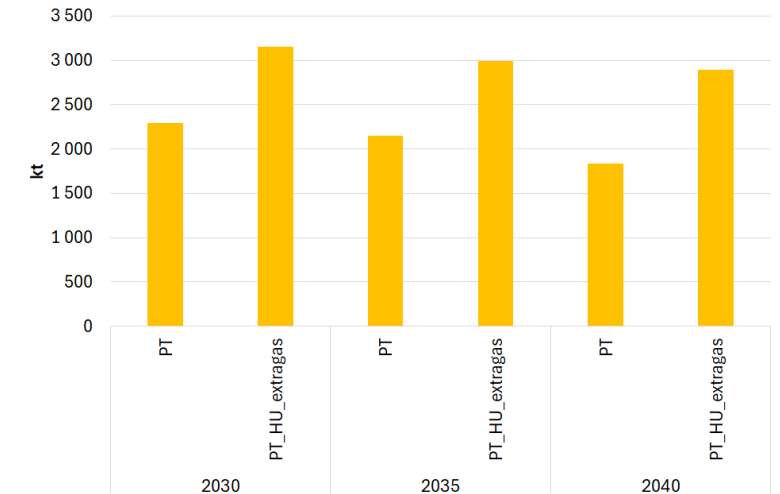
BASELOAD PRICE



ELECTRICITY MIX



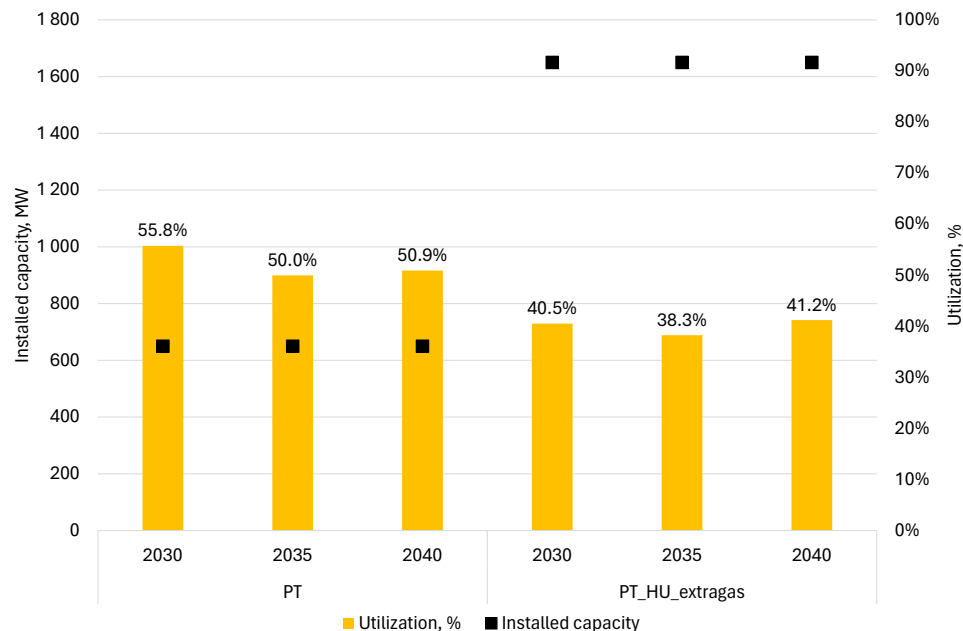
CO₂ EMISSIONS



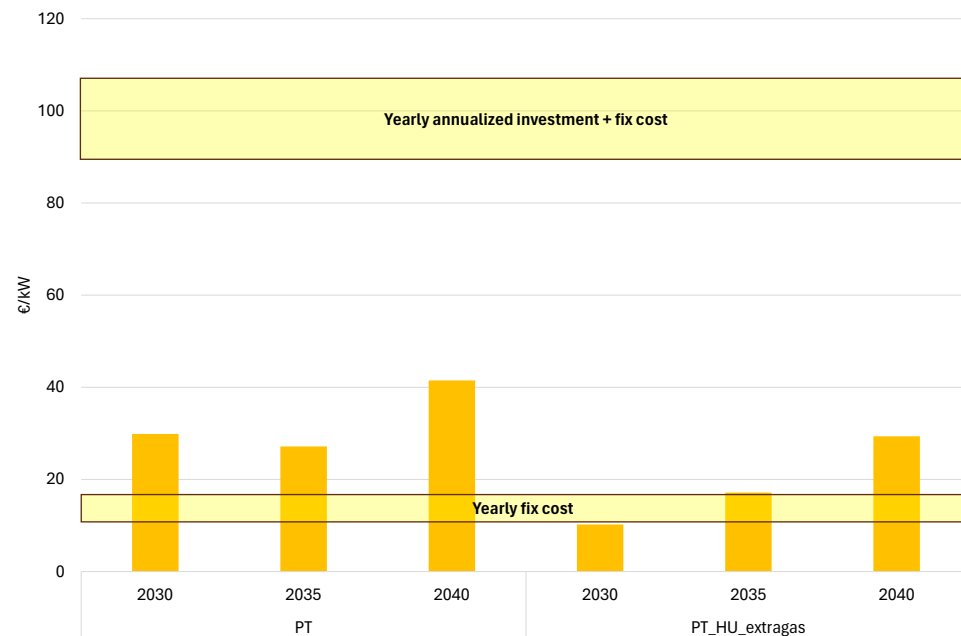
- In PT, only the Mátra CCGT is completed (650 MW), while in PT_HUCCGT, Tisza is also commissioned (1,000 MW).
- The two new CCGTs **reduced the price only in the early 2030s** (no price effect in 2040).
- **Gas-based electricity generation, and thus the country's CO₂ emissions, increased significantly.**
 - Modern Hungarian CCGTs outcompete less competitive gas power plants in the region.

Even the original Mátra CCGT is not profitable

NEW GAS PP UTILISATION (HU)

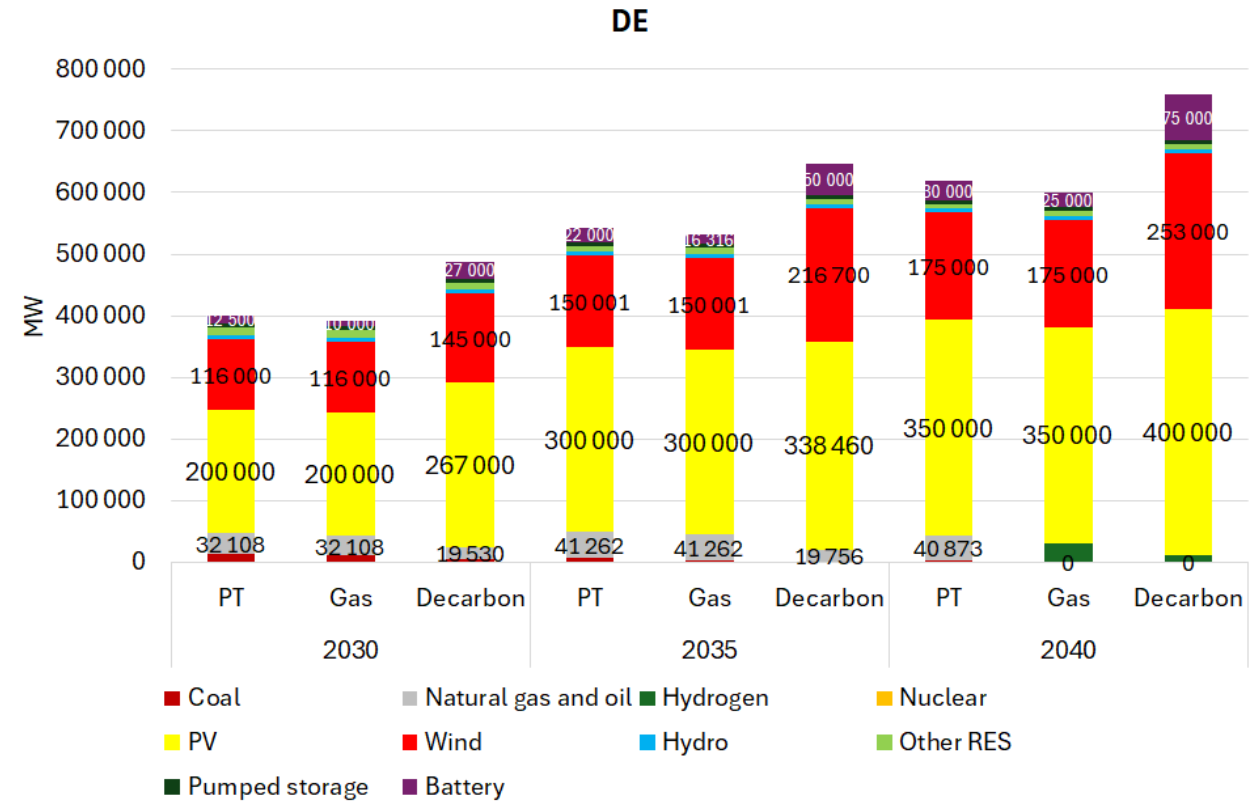
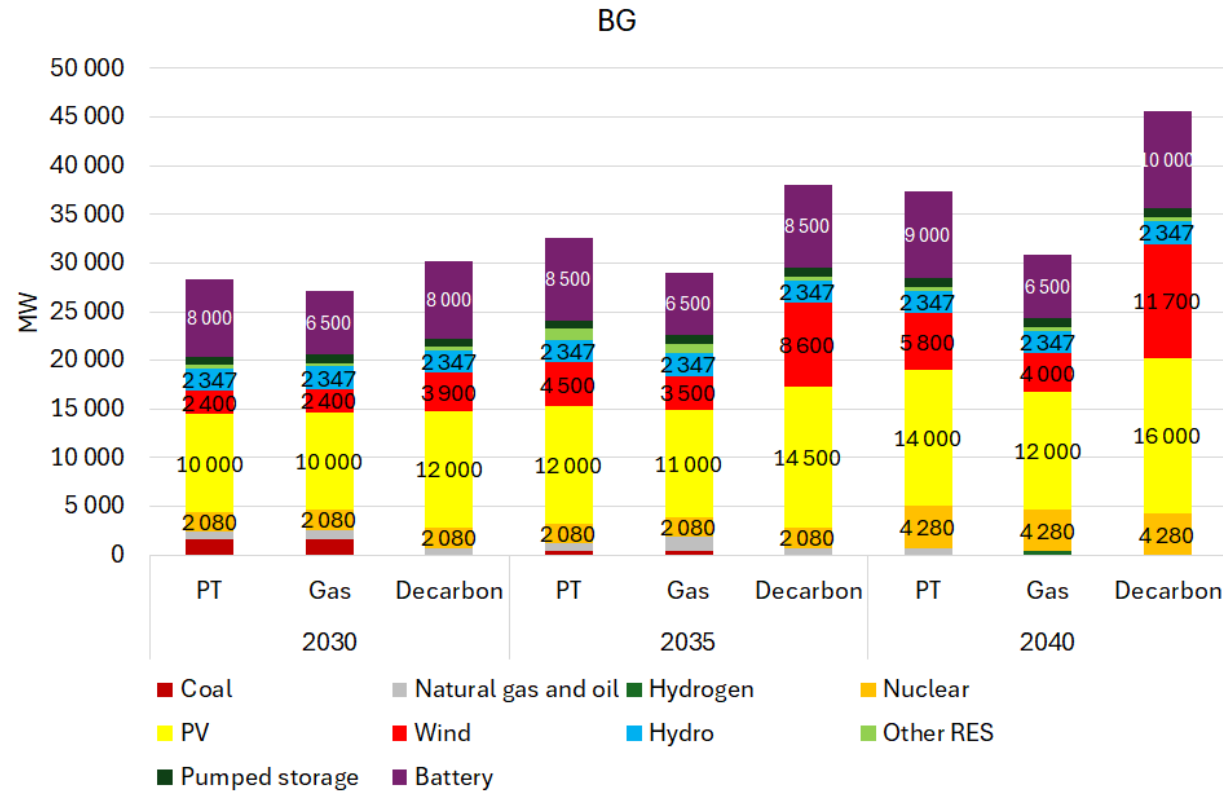


NEW GAS PP PROFITABILITY (HU)



- The original Mátra plant would have a relatively high **55% utilisation rate**.
- With the completion of the new CCGTs, the average utilisation of the three plants would **fall to 38–40%**.
- Despite the relatively high utilisation, **even the original Mátra plant would not be profitable**.
- **Profitability** of the gas power plants **decreased with the completion of Tisza**.

Final capacity mix in the modelled scenarios – I.



Final capacity mix in the modelled scenarios – II.

