E3 Analytics

Hungary at the Crossroads

Exploring Future Pathways for Hungary’s Power System

April 2026

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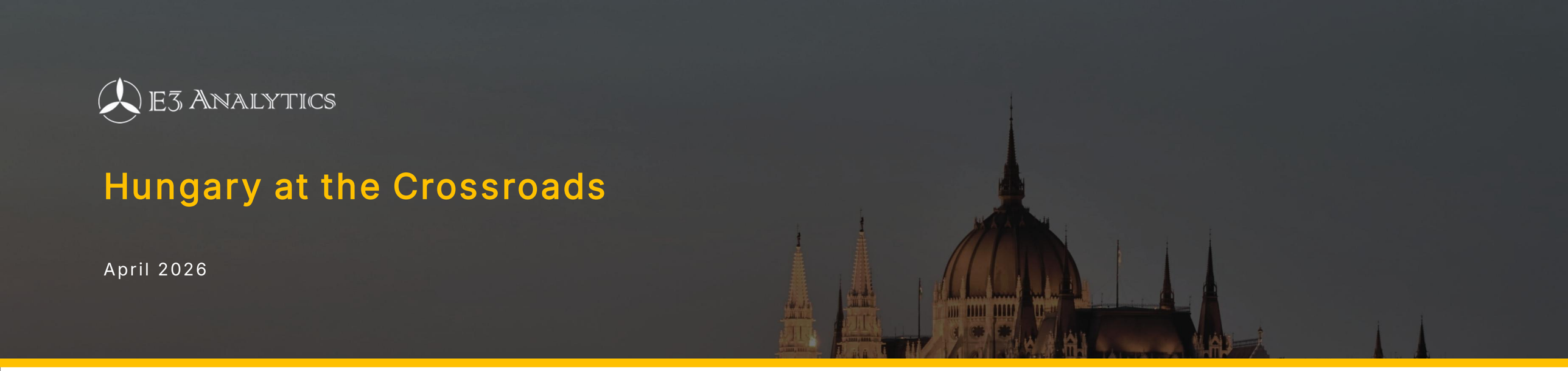

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Introduction

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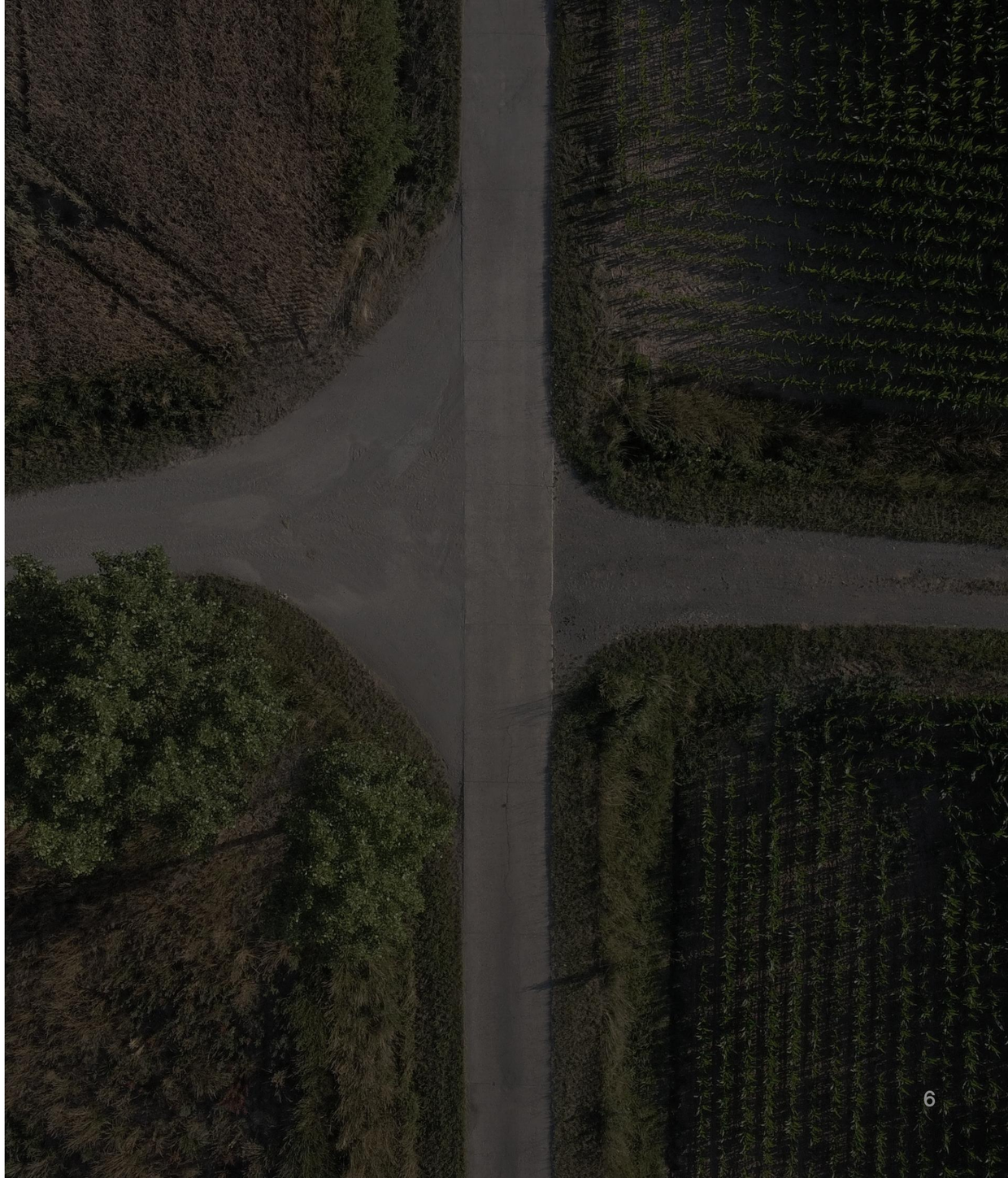
Hungary is weighing two fundamentally different futures for its energy system:

One built around imported gas and nuclear fuel, and another based on locally-produced renewables backed by storage

Current government plans point to the development of new nuclear and gas plants

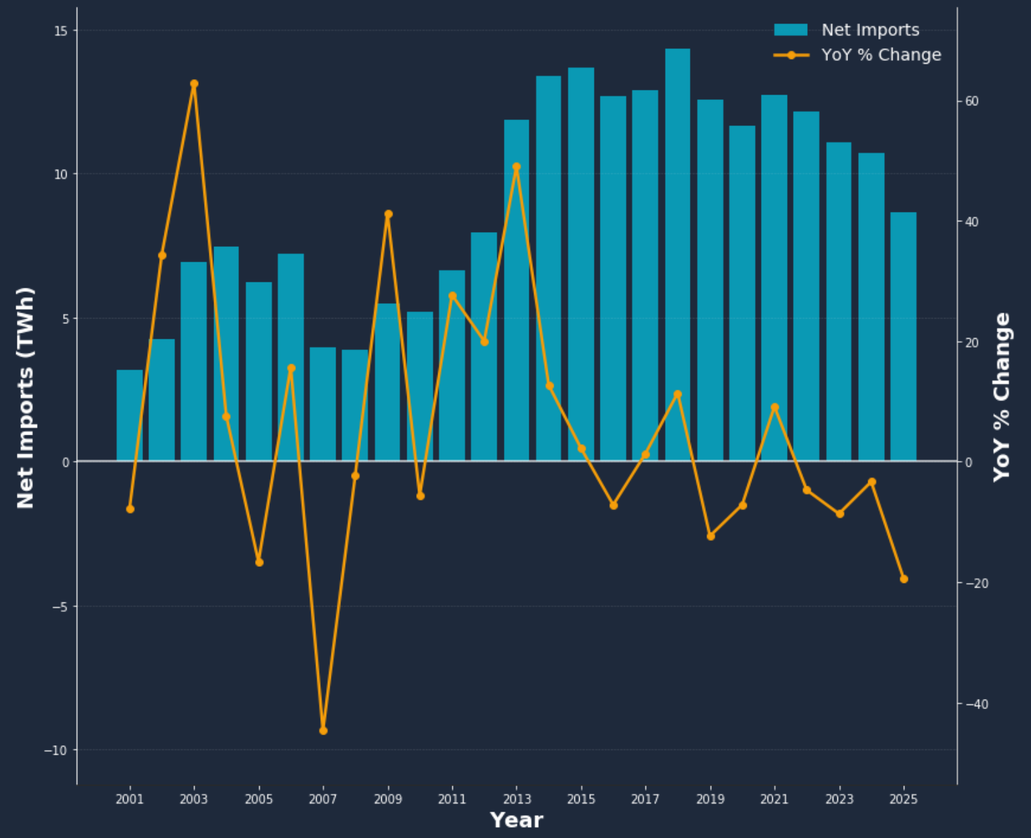
- This strategy carries major risks for the country and its energy security, and is likely to fuel major price increases for households and businesses in the years ahead
- Another pathway is possible: renewables backed by storage technologies offer greater energy security at lower cost
- Local supply combined with expanded interconnectors also entails far lower risk for customers



Hungary’s import reliance surged after 2014

- **Net electricity imports** have ranged between 8-14TWh per year
- This represents between 20-35% of the country’s total annual electricity demand

Figure 1. Hungary is heavily dependent on electricity imports

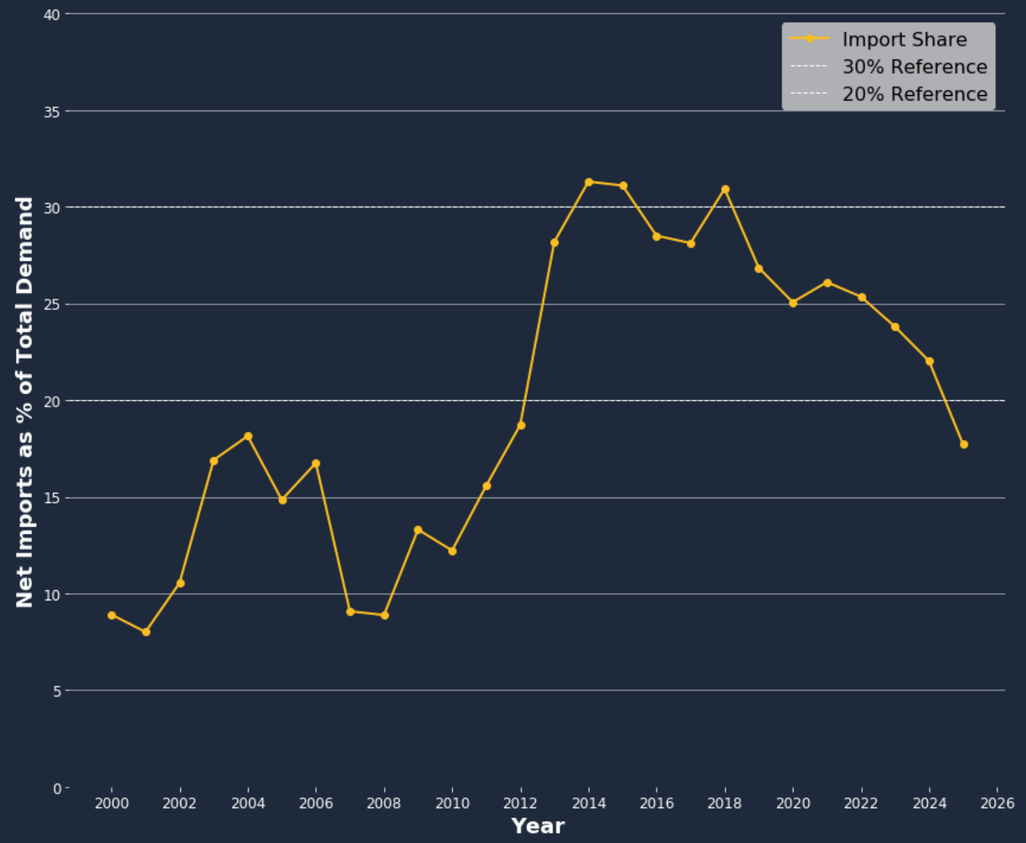


Source: Ember – Yearly Electricity Data Europe (2026)

The decline in electricity imports has been driven by the growth in solar PV investments.

- The rise of solar PV has translated into a significant drop in the country's reliance on gas in particular

Figure 2. Hungary's reliance on imports has declined as domestic solar power has surged

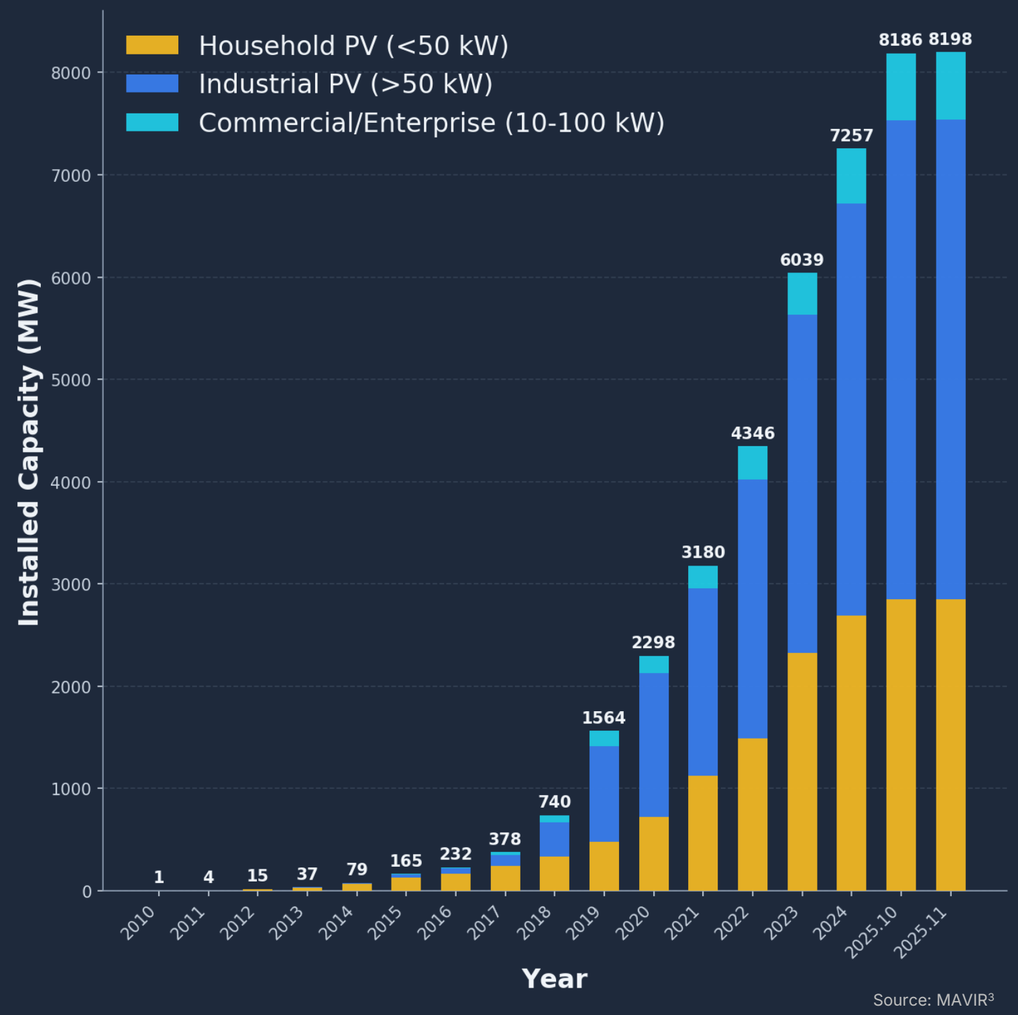


Source: Ember – Yearly Electricity Data Europe (2026)

Hungary’s solar PV installations have surged in recent years

- The country now has over 8,3 GW of solar PV capacity[1]
- **24,1%** of national electricity demand is now met with solar power[2]
- **Solar PV has surpassed gas** as the second most important source of electricity after nuclear[2]

Figure 3. Solar PV capacity growth in Hungary

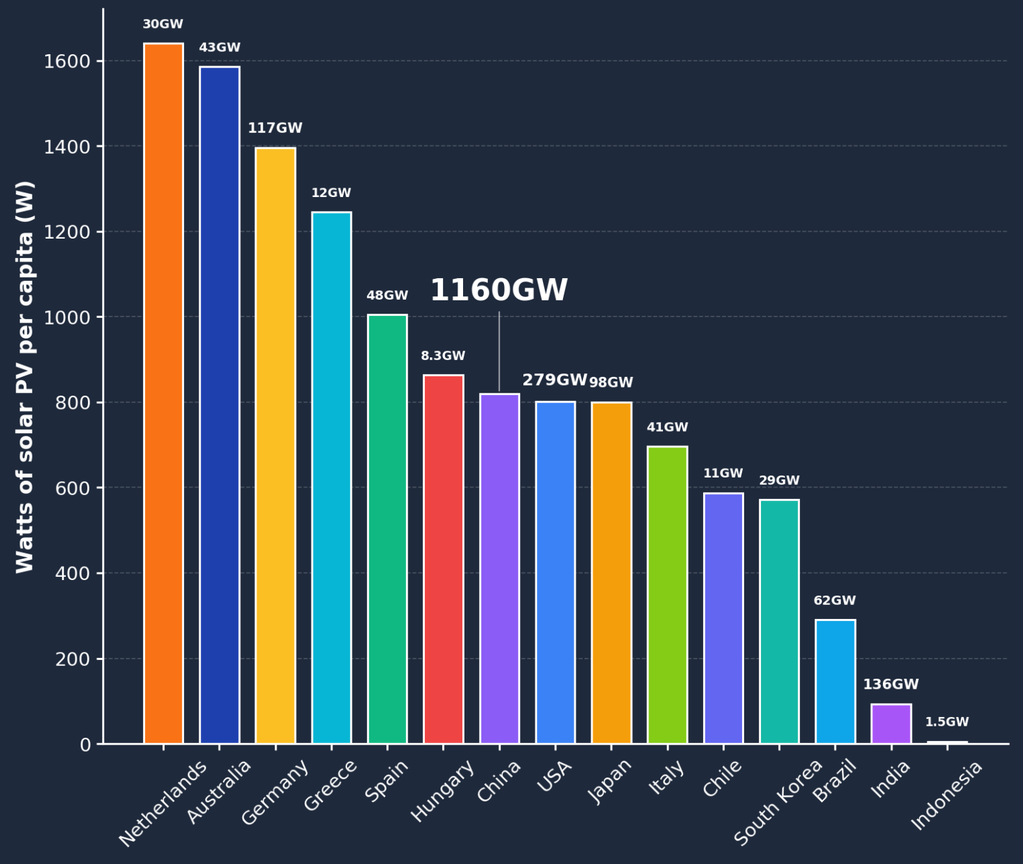


Source: MAVIR[3]

Hungary now has one of the highest per capita shares of solar PV worldwide

- And Hungary's national targets envision the country going even further
- It aims to increase solar capacity from 8.3 GW today to 14 GW by 2030[4]

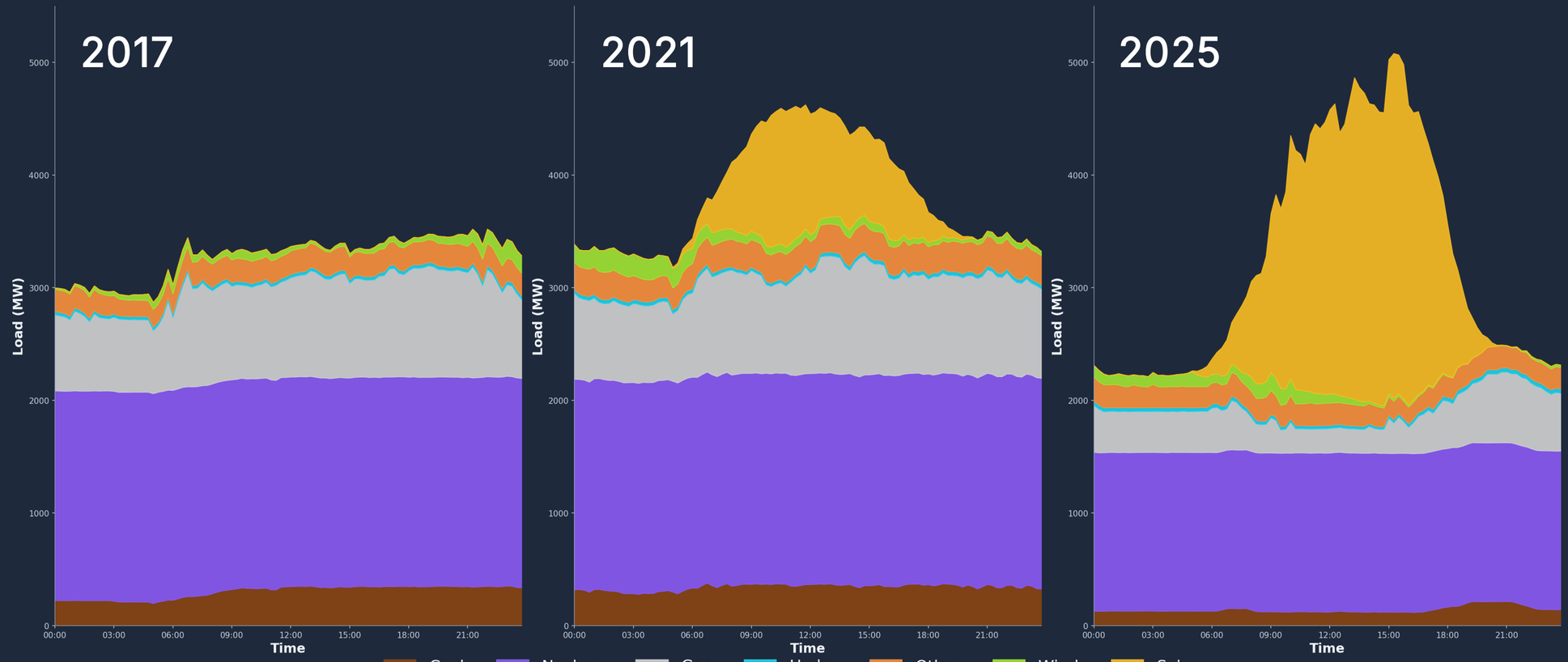
Figure 4. Hungary currently ranks 6th in the world in its per capita share of solar PV



Source: E3 Analytics[5]

The result is that Hungary's power generation profile has changed dramatically since 2017: coal, gas, and nuclear are all down

Figure 5. Hungary's electricity generation profile on the second Monday of June



Source: ENTSO-E Transparency Platform

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How did Hungary get here?

Hungary’s power system has undergone significant reforms in recent decades

Post WW2 (1945 – 1989)

Large, vertically integrated energy systems were built under public ownership, focusing on modernisation with Soviet influence.[6] Natural gas imports from Russia began in the 1970s.[7] The first nuclear reactor went into operation in 1982.[8]

EU era (1990– 2014)

The fall of the Berlin Wall spurred Western orientation: price liberalisation started in 1990, followed by privatisation of power plants and suppliers in 1995-1996.[9]Electricity sector liberalisation began in January 2003 (first for industrial users), while the unbundling of vertically integrated monopolies started around 2007.[10]

2014 - Currently

The second Fidesz government attempted to move back to a state-owned energy system and implemented mandatory utility price cuts, resulting in a focus on nuclear, gas and oil-fired power generation, further deepening Hungary’s dependence on Russia.[11]

Hungary remains reliant on baseload nuclear plants

Paks Nuclear Power Plant[12]

- 4 reactors, total of 1.916 MWe
- Largest single source of generation (45%)

Largest gas plants[13]

Danube Power Plant (794 MW)
Gönyű Power Plant (428–433 MW)
Csepel II (403–410 MW)

Coal-fired plants

Mátra Power Plant (950 MW)[14]

- One 200 MW unit has been phased out
- Full decommissioning has been delayed to 2028

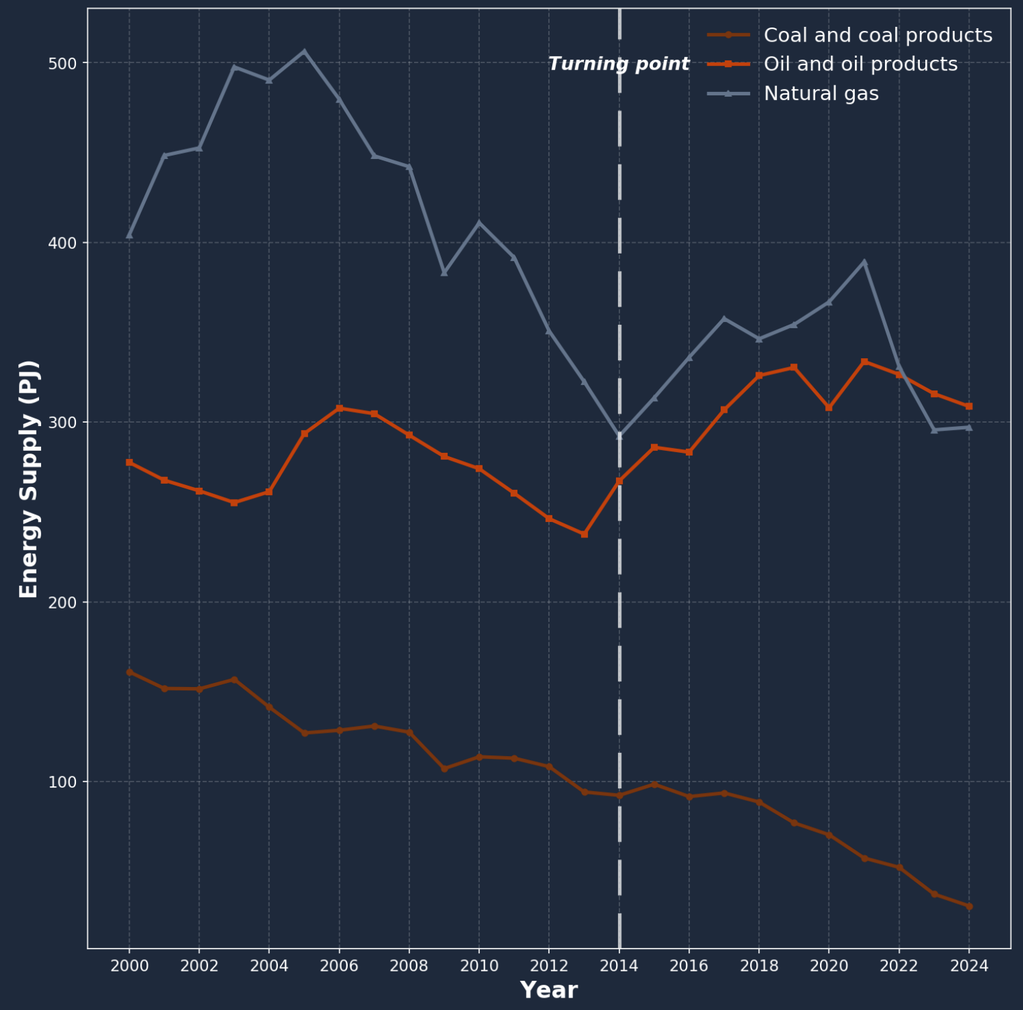
The Danube gas plant entered into operation in 1963, while the Paks nuclear unit came online between 1982 – 1987.

Both are nearing the end of their scheduled operating life.

The share of coal in Hungary’s power mix has continued to drop

- Coal has been on a steady decline since the 1990s

Figure 6. 2014 was an inflection point, signalling a rise in Hungary's dependence on imported oil and gas in the country's overall energy mix

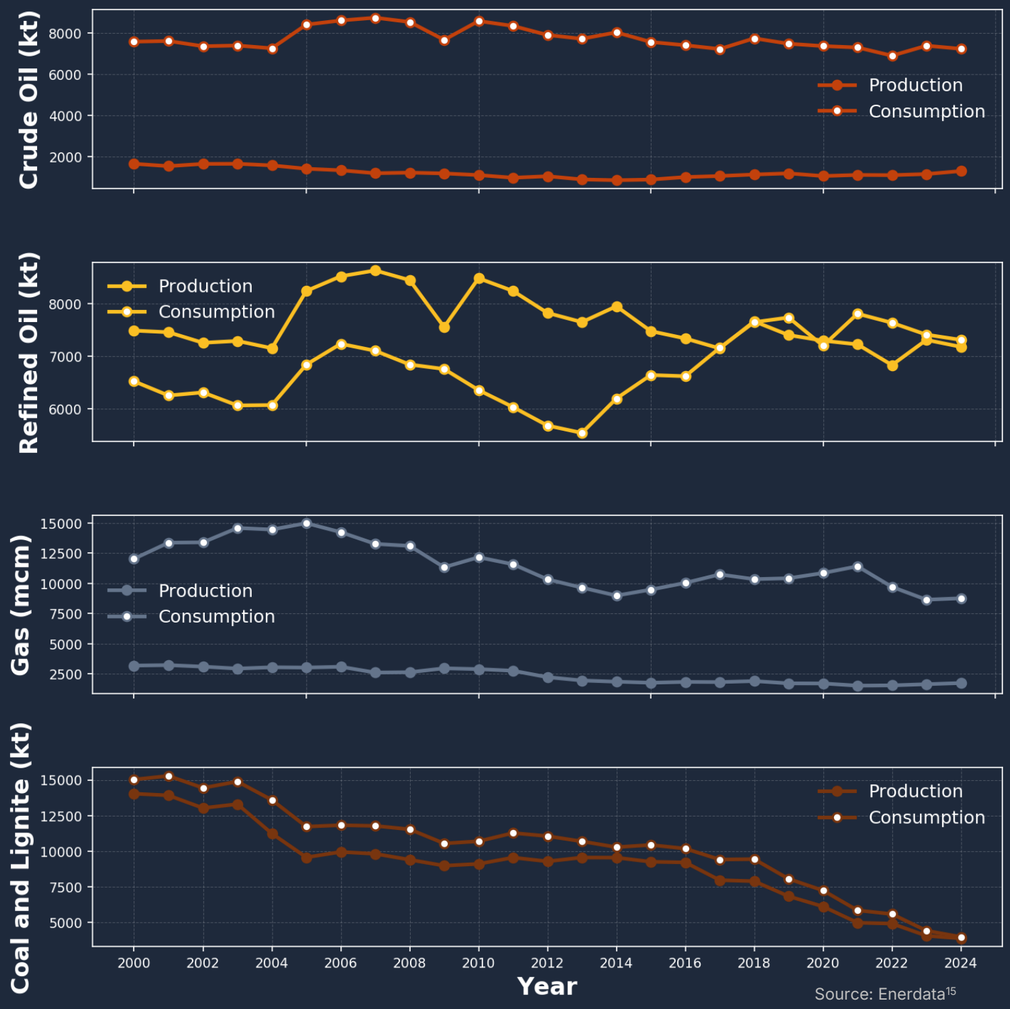


Source: IEA – Hungary Energy Mix[6]

Looking beyond the electricity sector to all forms of energy, fossil fuels still account for 65,9% of total final energy consumption (TFEC) in the country

Hungary imports nearly all its oil and gas

Figure 7. Hungary's import dependency by energy source



Source: Enerdata[15]

Hungary's main utility MVM has recently signed agreements for two new gas plants, and is also planning two new reactors at Paks

Tiszaújváros combined-cycle gas plants[8]

- 1000 MW CCGT
- Turkey-based and Italian consortium
- 7.500 GWh annually
- Designed to be "hydrogen-ready"

Mátra Power Plant[9]

- 600MW CCGT
- Domestic and Egypt-based consortium
- Replacing the old coal-fired power plant

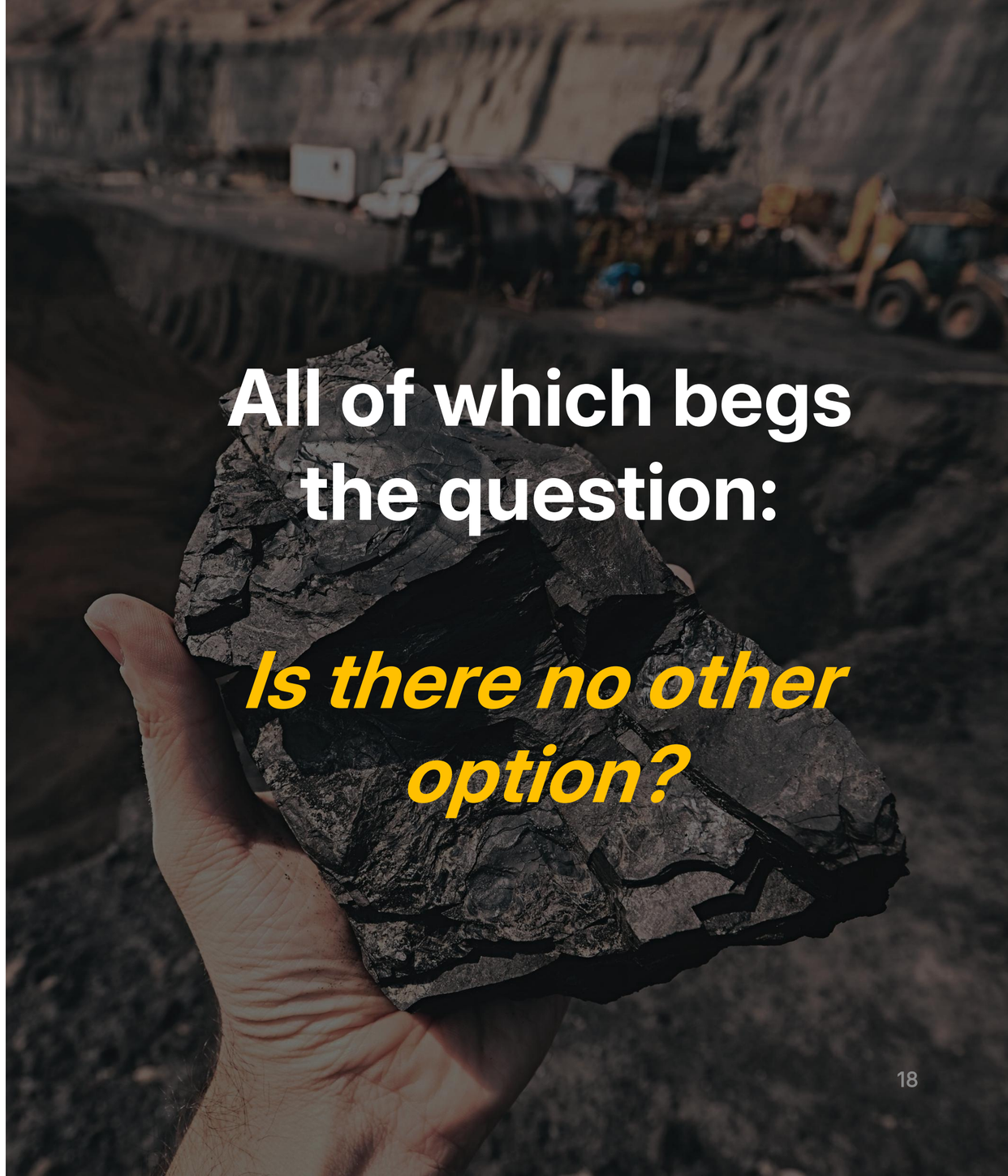
Paks 5&6 nuclear plants[12]

- 1200 MW, expected in 2032
- Est. cost around €12 billion, financing deal with Russia
- Fuel supplied by Rosatom for first 10 years

MoU with US-based Holtec[10]

- 10 SMRs with a potential cost of USD $20 billion

Just as Hungary's energy security situation is improving, the country is weighing a U-turn and is set to significantly deepen its reliance on energy imports and on exorbitantly expensive nuclear power



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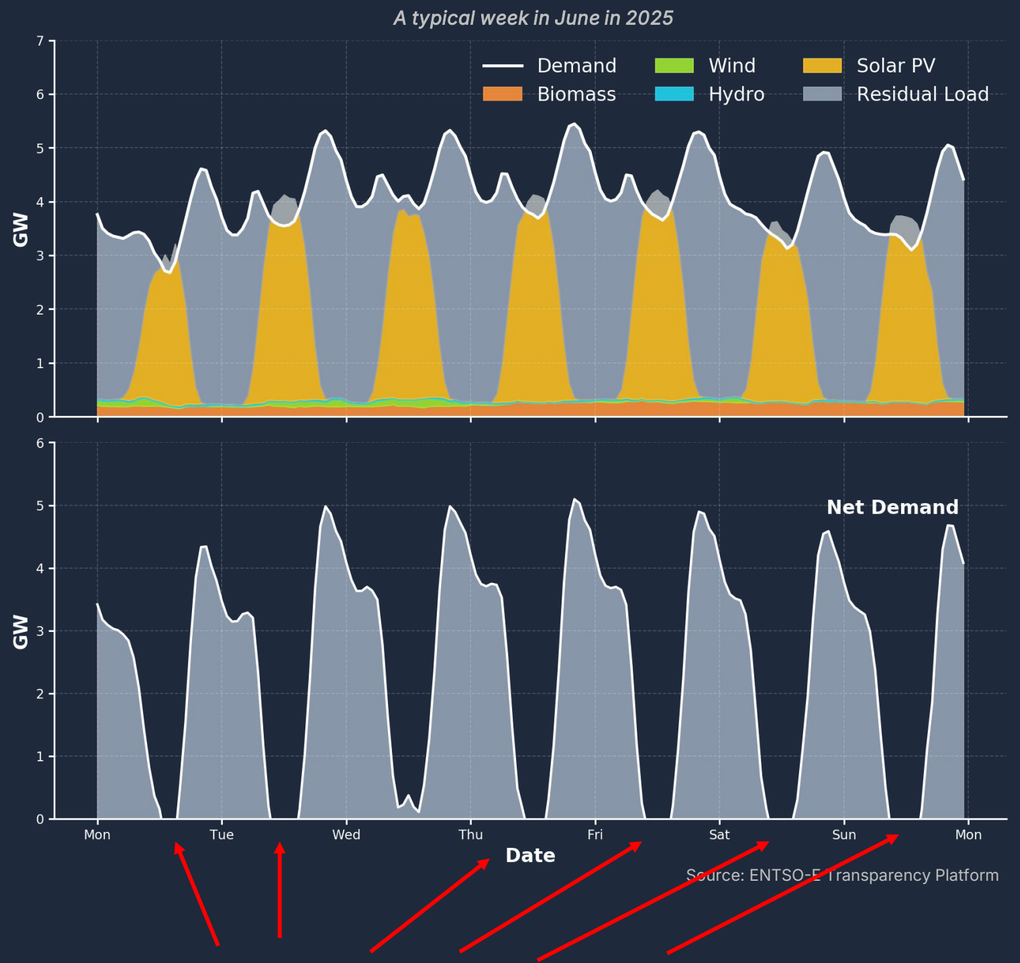
Hungary at the Crossroads

Solar and baseload power plants like nuclear are like water and oil

- As the share of solar PV grows, it often comes into conflict with baseload power plants which rely on steady output and high capacity factors to remain in operation
- And yet, **under the "merit order", the cheapest sources of electricity are dispatched first**
- This puts low-cost sources of generation like solar in conflict with inflexible or "baseload" sources of generation like nuclear

Figure 8. Residual load (net demand after renewable energy is used) shows high peaks and variability. There is a growing number of hours in the year when there is no "room" in the system for baseload generation



Residual load = 0 (or negative)

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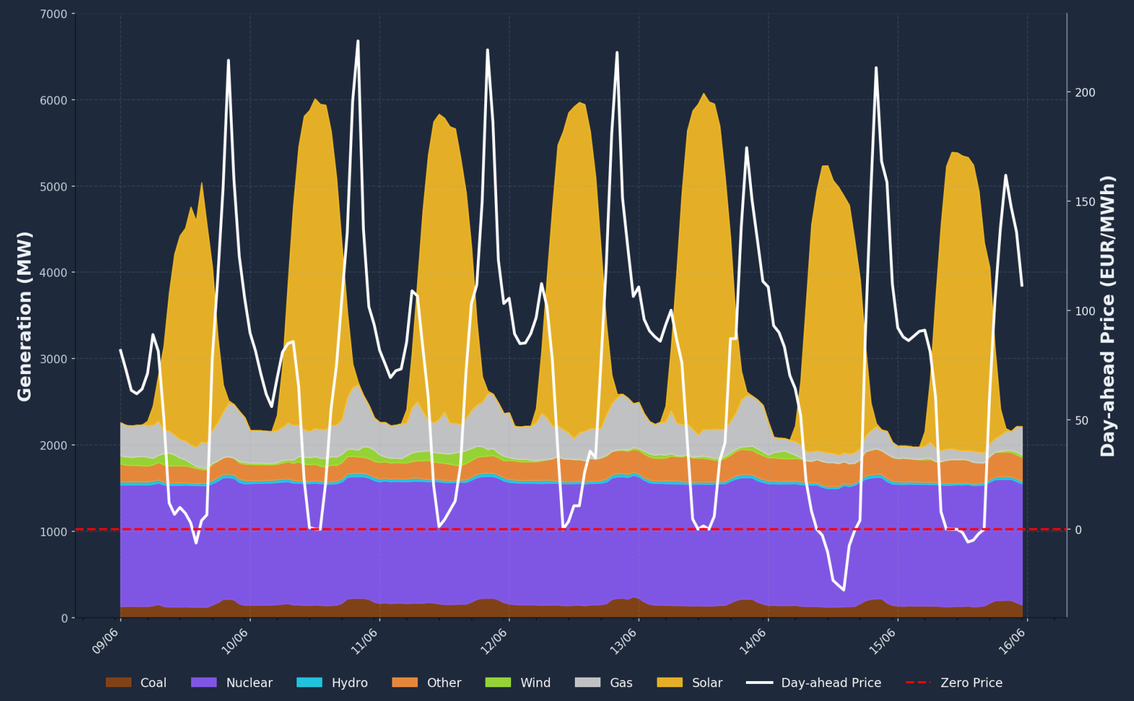
The effects of abundant solar are already being felt

- Significant price spikes now occur frequently in Hungary as the sun sets, and reliance on gas plants grows
- **This is costly and puts upward pressure on electricity prices for households and businesses**
- At the same time, Hungary is also experiencing a growing number of periods with **negative wholesale market prices**

Figure 9. Hungary's daily price spikes match the drop-off of solar power and reflect the ramp up of more expensive sources such as coal and gas

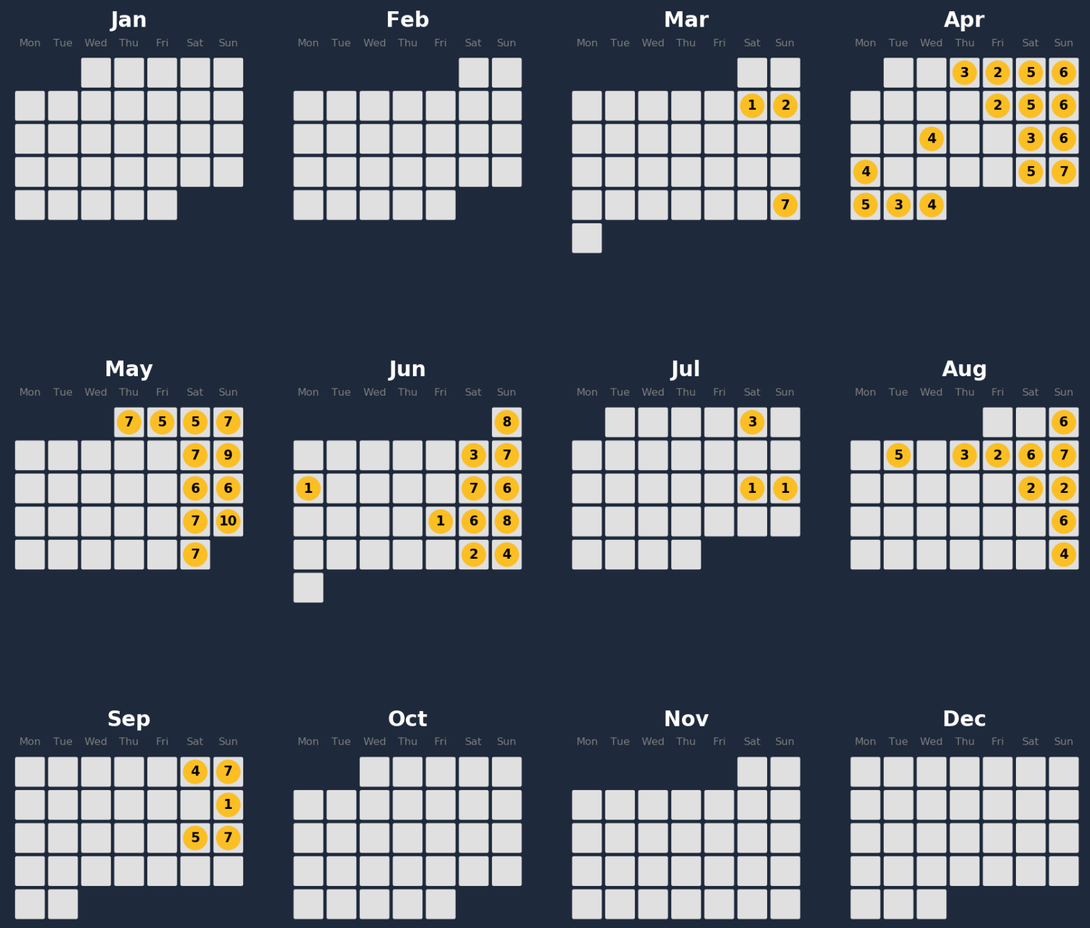


Source: ENTSO-E Transparency Platform

Negative prices are becoming more frequent

- During times with abundant solar, Hungary now faces regular periods with **negative** wholesale electricity prices[11]
- In 2023, Hungary experienced 93 hours of negative wholesale prices; by 2025, that number increased to 281 hours
- Experience around the world suggests that **storage would be more effective at dampening this price volatility**, as it would enable Hungary to harness more of its daytime solar power, while further reducing reliance on volatile gas

Figure 10. Negative wholesale electricity market prices occurred during 281 hours in Hungary in 2025: the most frequent occurrence is on sunny weekends



Every yellow circle indicates the number of negative price hours on that day in 2025
Source: Ember – Yearly Electricity Data Europe (2026)

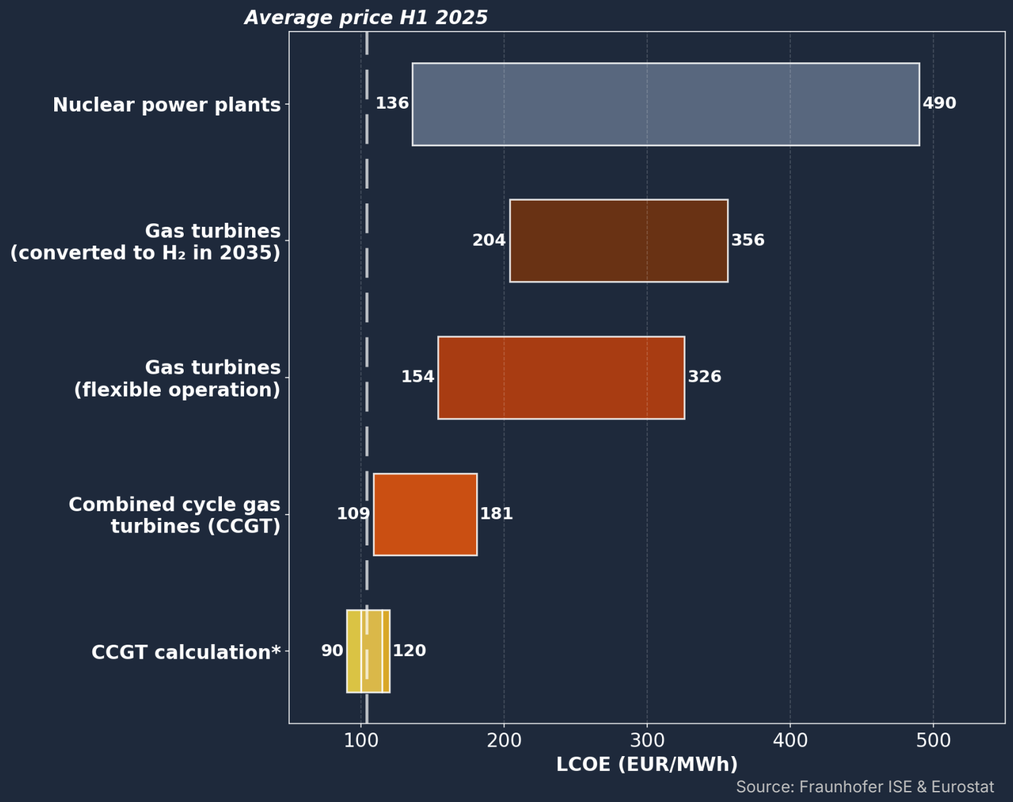
This price volatility is causing headaches for baseload plant operators

- The merit order reduces the number of hours that baseload plants are needed
- Increasing the amount of baseload nuclear power in a power system like Hungary's will only make the problem worse, fueling a **surge in curtailment**

Against this backdrop, the economic viability of new baseload power plants remains doubtful

- Reduced operating hours is making baseload power plants unfinanceable without massive government support
- To make baseload plants bankable, governments increasingly have to intervene and provide either volume guarantees, above-market prices, or both

Figure 11. Average electricity price in H1 2025 does not reach the lowest end of LCOE on nuclear and gas

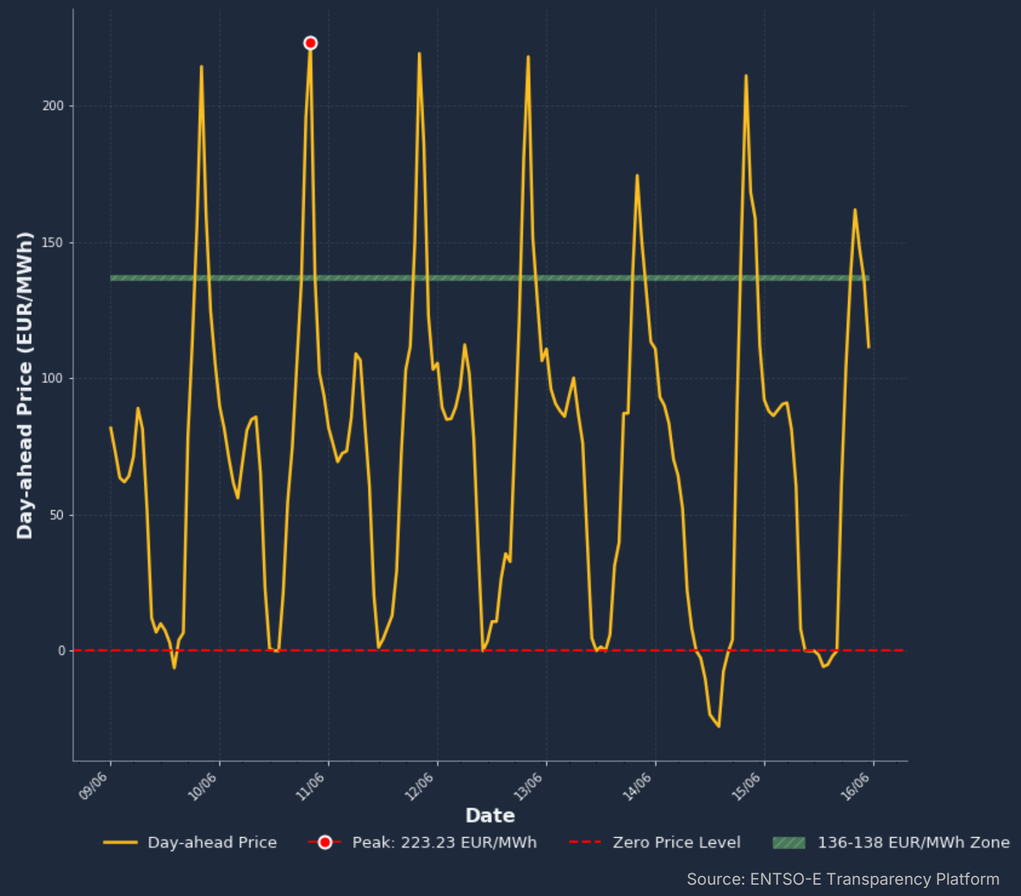


Source: Fraunhofer ISE & Eurostat

On current trends, the new nuclear reactors at Paks would be loss-making over 90% of the time

- The only time nuclear would be “in the money” would be during occasional periods of price spikes
- And yet, the rise of battery storage is likely to reduce such price spikes in the years ahead, making it even harder for nuclear to be economically viable

Figure 12. Day-ahead price in Hungary spends most of its time below the cost of generation if new nuclear



Source: ENTSO-E Transparency Platform

Future demand growth is being shaped by a battle between demand creation and demand reduction

Forces fuelling demand creation:

- Rise of EVs
- Growth in heat pump adoption
- Data centers
- Industrial demand
- Economic growth

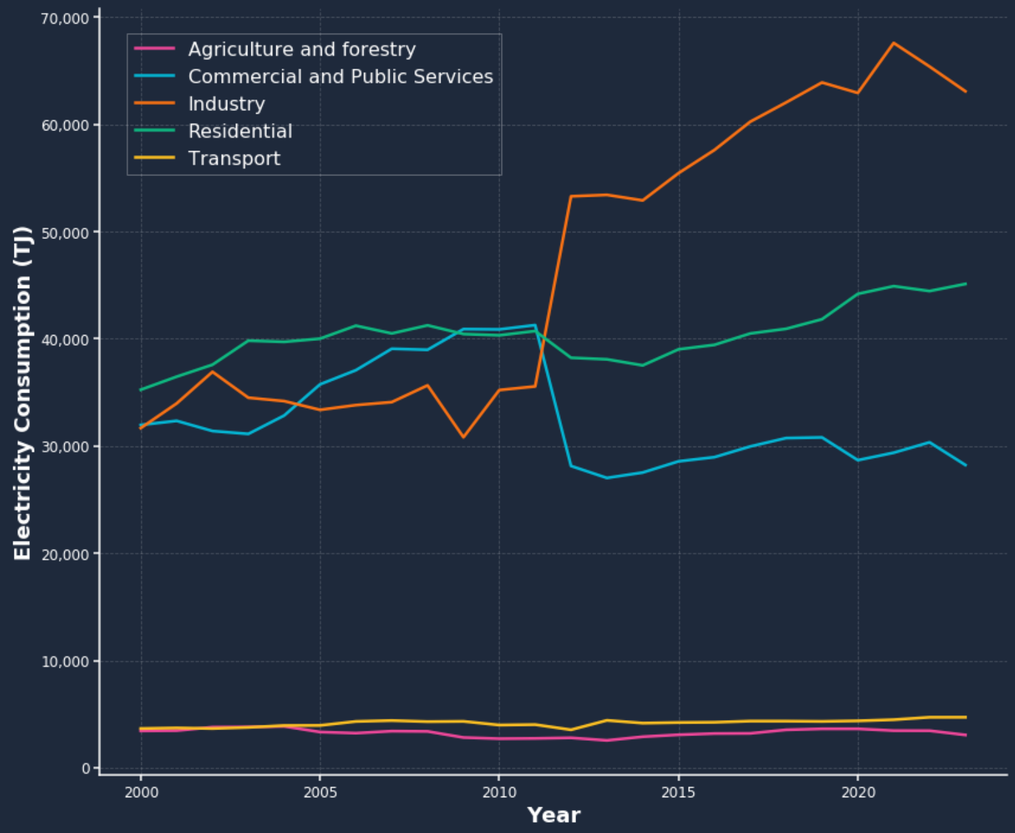
Forces fuelling demand reduction:

- Customer-sited generation (mainly solar PV)
- Demographics
- Out-migration
- Demand response
- Energy efficiency

Indeed, Hungary's industrial demand in particular has grown steadily since 2011

- Industrial energy demand made up 43,6% of final electricity consumption in 2023[16]
- If industrial electricity demand continues to grow, this would put further pressure on the power system and require new supply

Figure 13. Despite strong growth since 2011, industrial power demand in Hungary has experienced a decline since 2021

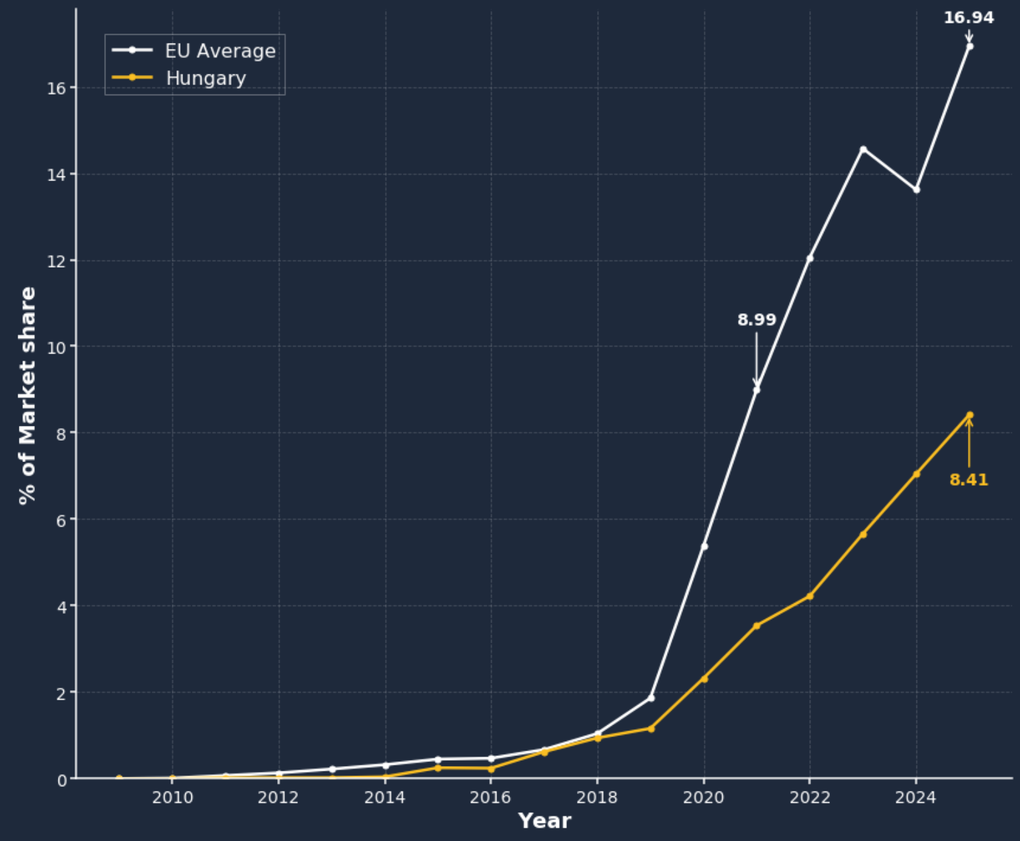


Source: IEA

By comparison, Hungary's EV adoption lags that of many other EU countries

- And yet, more robust growth in EV uptake can be expected in the years ahead as EV prices continue to decline, and charging infrastructure improves
- Hungary has recently launched an Infrastructure Expansion Program that includes a focus on building-out the charging network[17]

Figure 14. Hungary's EV adoption is starting to gain momentum



Source: Alternative Fuels Observatory

Hungary’s government faces a delicate balancing act

- Energy security is rising the political agenda across Europe
- Rising share of renewables is providing access to low-cost electricity
- Storage projects coming online in 2026/27 are poised to soften price spreads, and are likely to further reduce the need for baseload nuclear
- Role of gas in setting wholesale electricity prices also likely to decline

- Baseload business model requires relatively stable off-take prices and high capacity factors
- Neither is likely to be present in Hungary in the future without the government fixing either the volumes sold, or the off-take prices
- Propping up baseload assets likely to become an increasingly expensive proposition

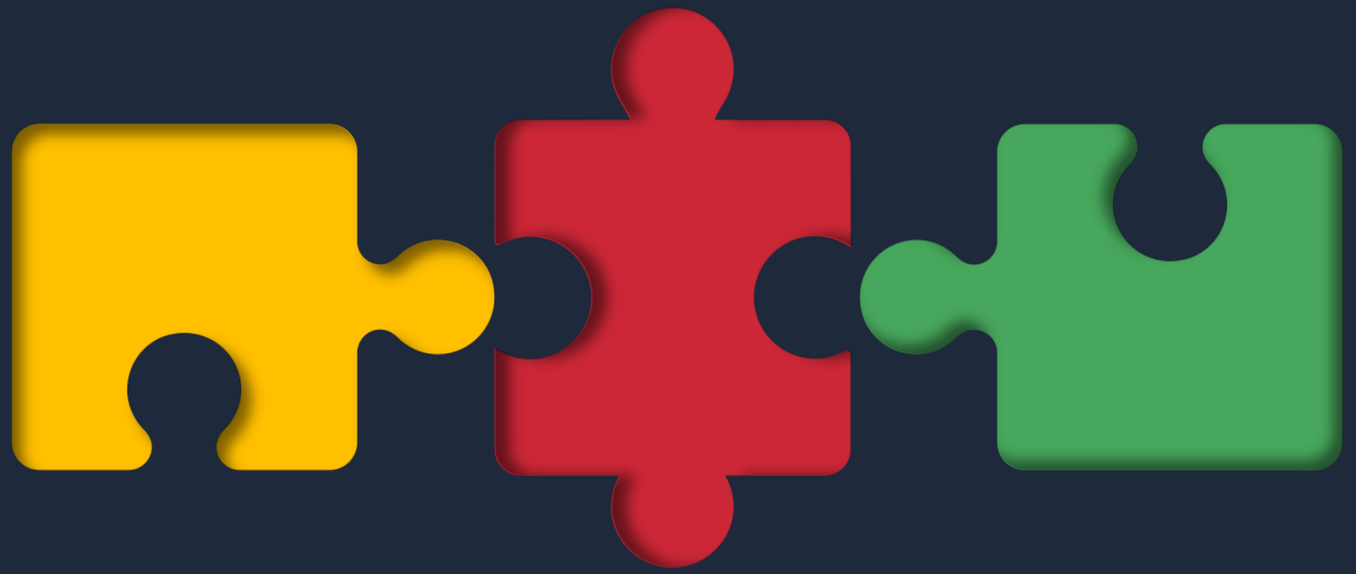
It is becoming increasingly clear that countries cannot invest heavily in *both* baseload *and* variable renewables

Countries like Hungary must choose

04

Putting the Pieces of the Puzzle Together

Many pieces of the puzzle of a more secure energy system are already in place in Hungary today



Expand renewables

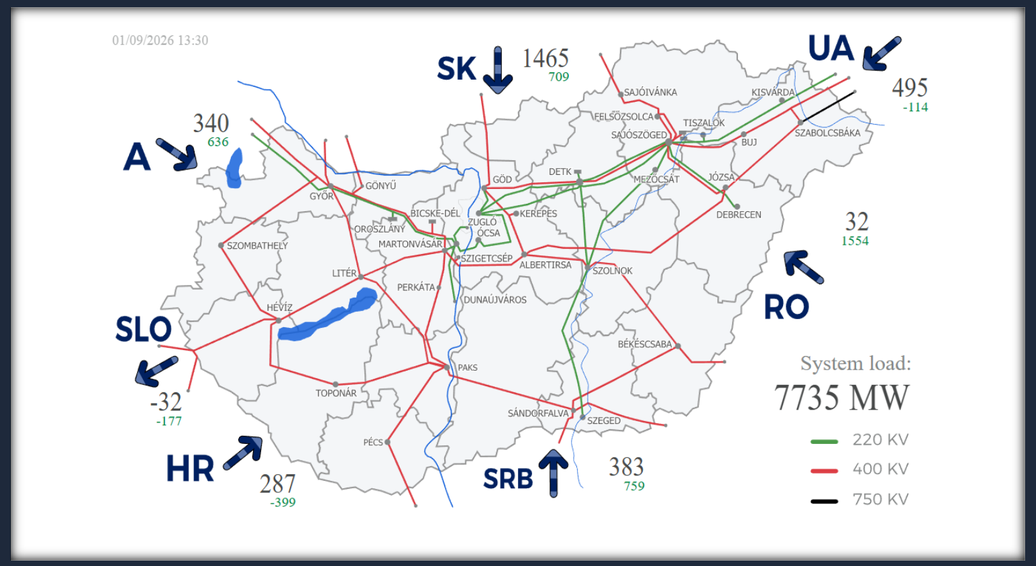
Transmission & Interconnection

More storage and flexibility

Hungary's power system is deeply interconnected with its neighbors

- The grids exist, and are already being reinforced: reinforcements with Slovakia, Serbia and Romania are planned by 2030[18]

Figure 15. Map of transmission grid within Hungary showing connections with neighbours



Source: MAVIR

Hungary can make smarter use of its interconnectors

- Many of Hungary's neighbors are planning to expand their reliance on gas and nuclear
- Hungary is in a strong position to **leverage its interconnectors** and play a more important role in central Europe's evolving power market
- Increasing storage capacity and demand-side flexibility opens up significant **arbitrage opportunities**
- Hungary's demographics are likely to support this, creating greater surpluses in the years ahead

Country	Currently increasing reliance on gas and/or nuclear
Austria	→
Slovakia	↗
Slovenia	→
Croatia	↑
Serbia	→
Romania	↑
Ukraine	↗

Adding storage can deliver major gains

- Low-cost renewables supply can be stored and deployed during demand peaks, lowering wholesale market prices while opening valuable export opportunities
- This also helps improve energy security by fostering greater domestic power generation
- Storage can also provide valuable ancillary services to balance and stabilize the grid

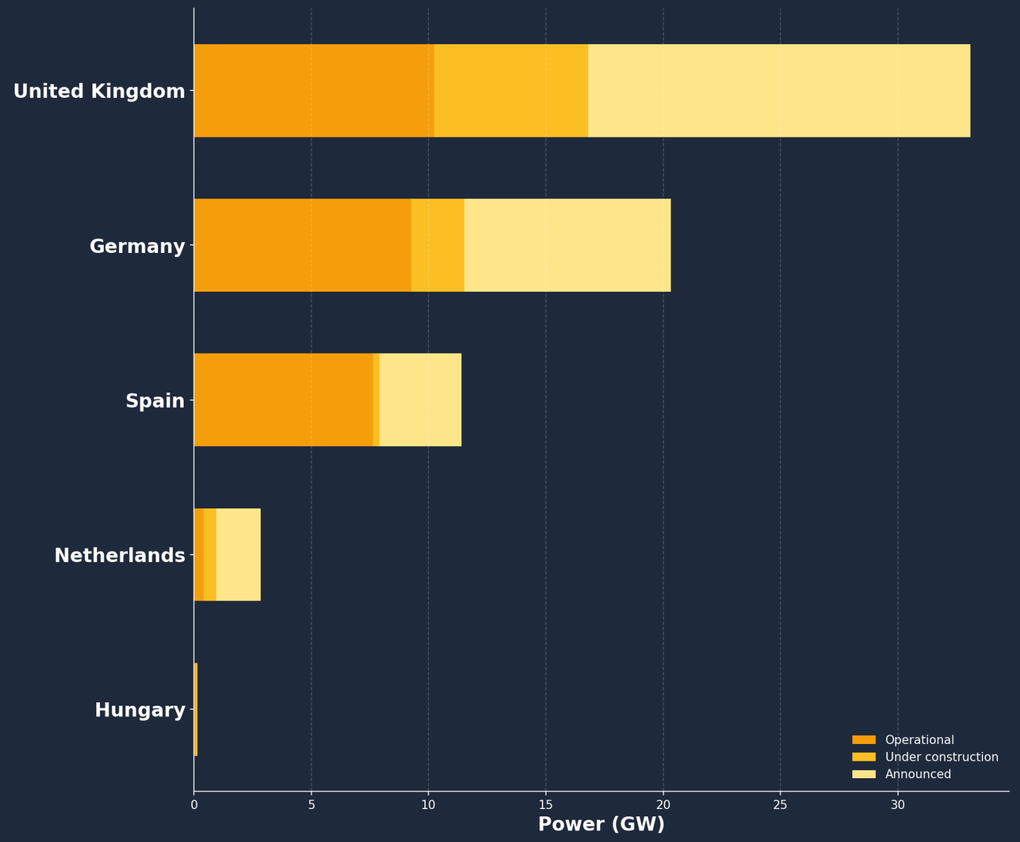
Figure 16. Storage has the potential to fill in demand and supply gaps with excess solar power

Source: ENTSO-E Transparency Platform – storage is illustrative

After years as a laggard on storage, Hungary is taking steps to accelerate BESS adoption

- Regulatory reforms in 2025 removed a host of barriers for co-located BESS and PV systems while improving grid access[7]
- In December 2025, the previous government launched a HUF 100 billion ($303 million) residential energy storage program[19]
- Several BESS projects are scheduled to come online in 2026/27

Figure 17. Hungary's BESS pipeline is projected to grow in the coming years

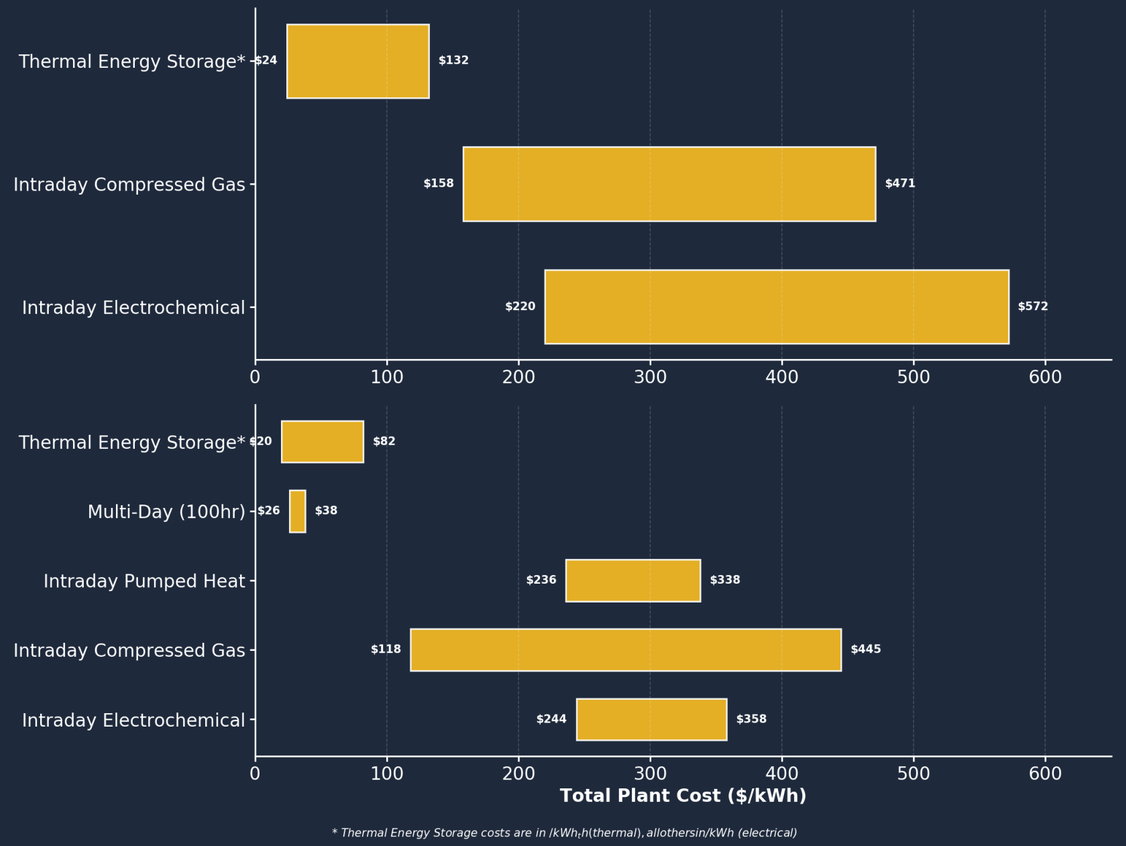


Source: European Energy Storage Inventory

A mix of short and long duration energy storage is key

- Utility-scale and residential battery storage are both poised to grow: this helps navigate the short-term daily surpluses generated by abundant solar energy
- In the meantime, Long Duration Energy Storage (LDES), including low-cost thermal energy storage, is poised to play a greater role, providing support during winter cold snaps and Dunkelflaute events

Figure 18. Current and projected cost-overview of Long Duration Energy Storage options



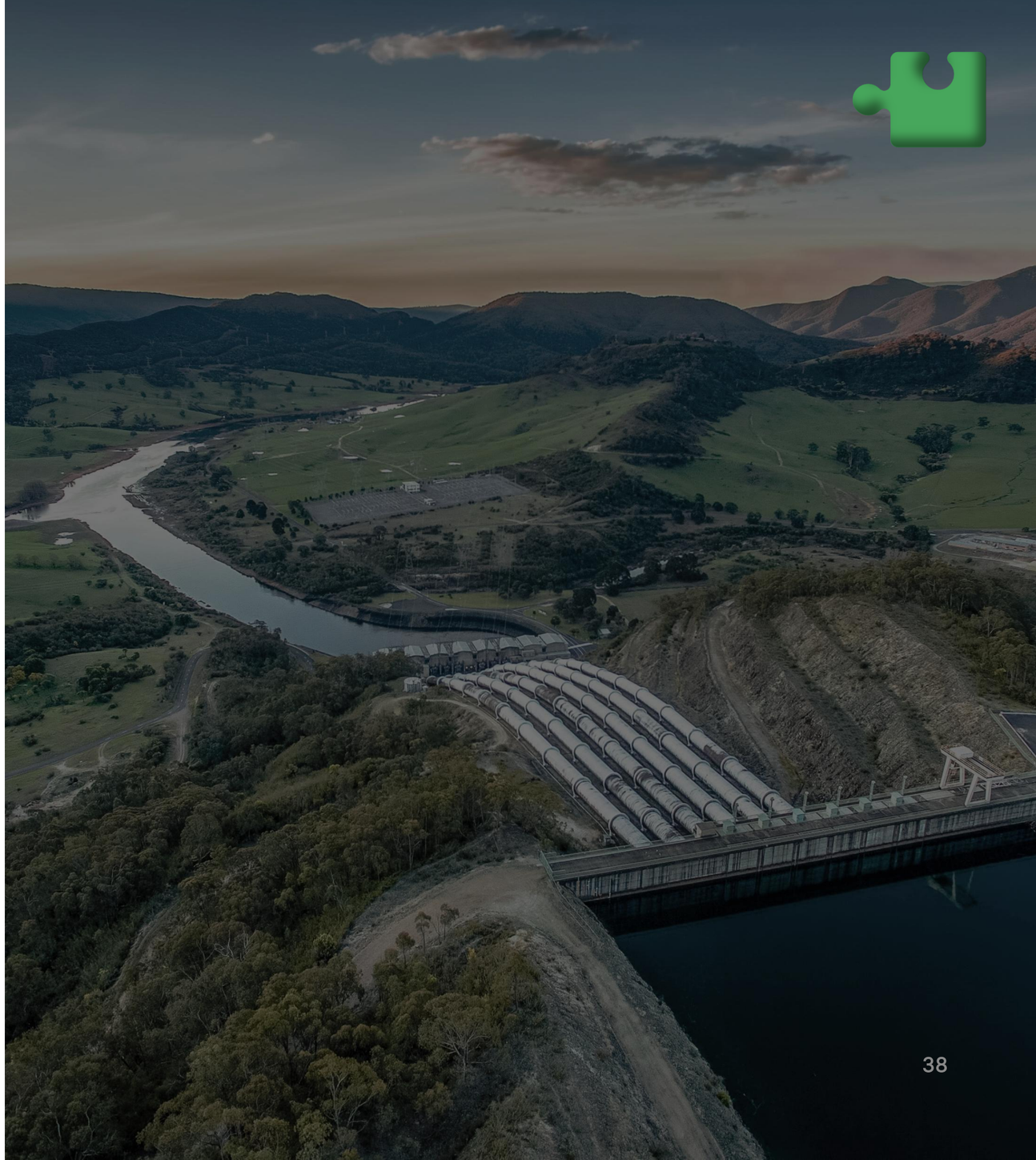
** Thermal Energy Storage costs are in /kWh$_{th}$h(thermal), allothersin/kWh (electrical)*

Source: LDES Council Cost Benchmarking - 2025 Technical Report

Hungary also has significant pumped hydro potential that remains untapped

- Pumped hydro plants are widely used to integrate variable renewables and could help secure long duration power supply, including during the winter months[20]

- Exploratory drilling for a pumped-storage plant has already started in Borsod and Heves counties in northern Hungary[20]



Improving efficiency and demand-side flexibility can also deliver major gains

- Increasing efficiency increases the amount of electricity available for export

- Demand-side flexibility, including from heat pumps, thermal storage technologies, and electric vehicles can help unlock significant cost-savings, helping mitigate price spikes

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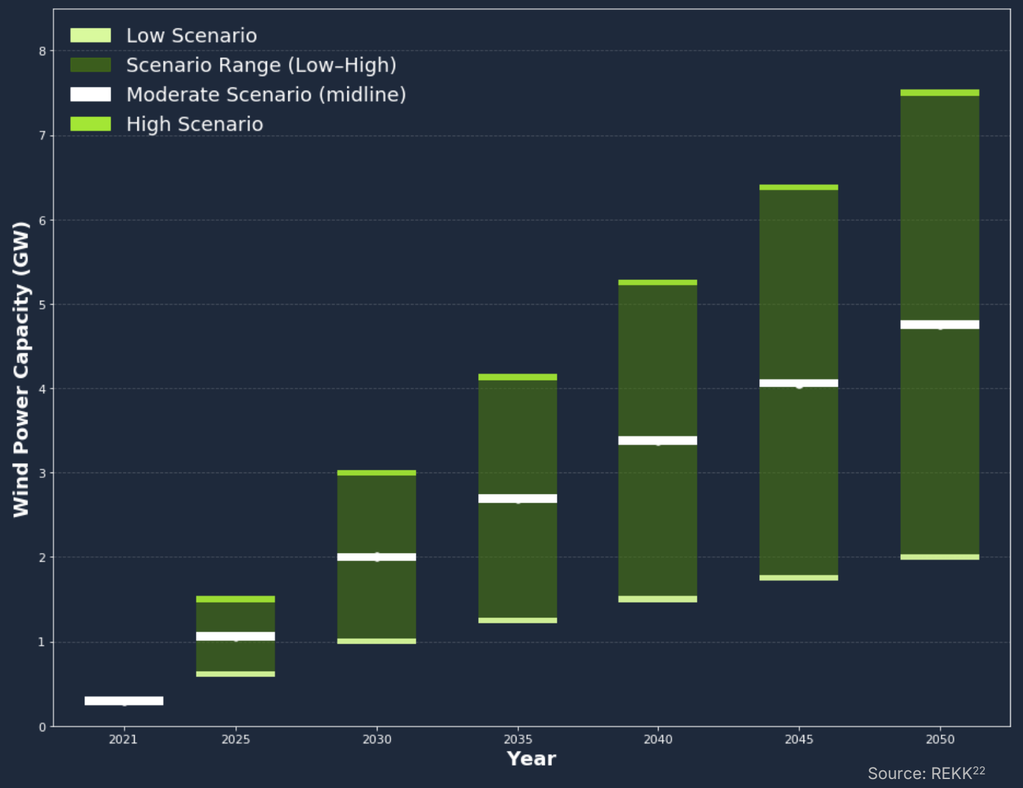
Untapped wind energy potential provides another source of low-cost power supply

- The average LCOE of onshore wind is low, ranging from €39–84/MWh[21]
- Hungary has substantial untapped wind power potential[22]
- Officials in Hungary have started to recognize this potential and have set out eight “simplified zones” to support wind power development[23]

Figure 19. On current trends, Hungary is aiming for a low wind penetration scenario: and yet, the potential for low-cost wind power remains high

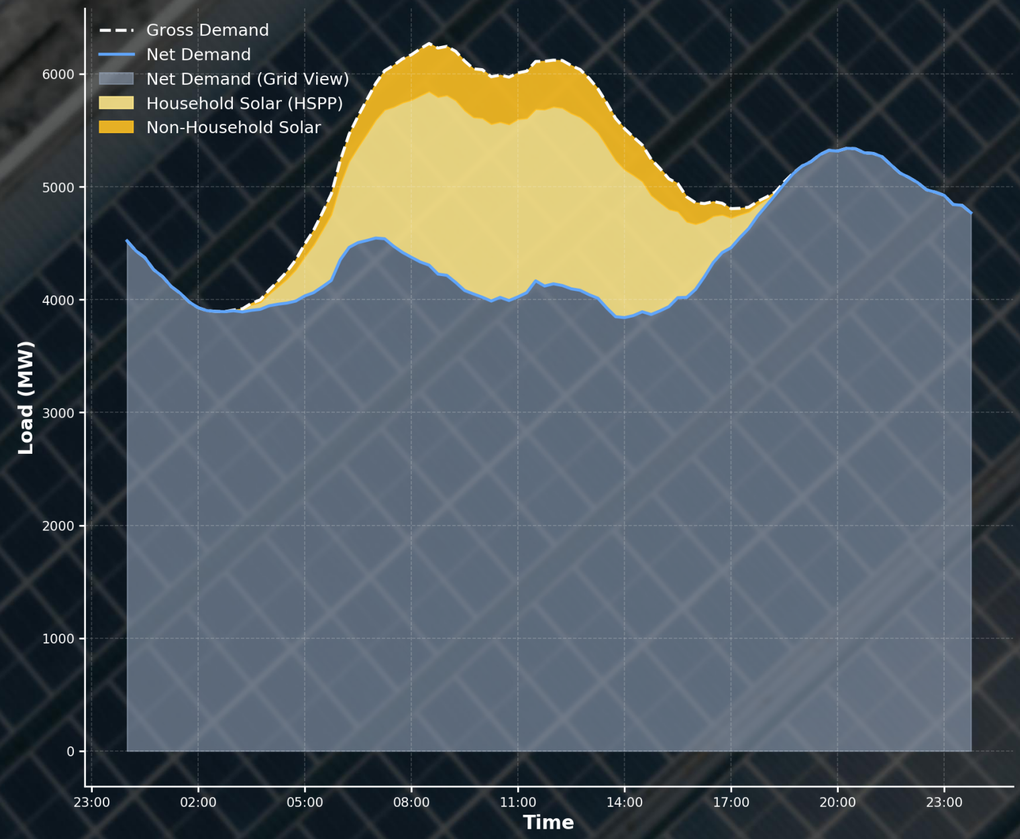


Source: REKK[22]

Since Russia's war on Ukraine, solar PV is scaling rapidly

- The global average LCOE of solar stood at $39/MWh in 2025, and is expected to fall below 30$ by 2035[24]
- **Concerns over energy security** are leading a growing number of households to vote with their wallets
- Increased adoption from residential projects (including balcony solar projects), as well as ground-mounted and farmer-adopted solar projects is spreading throughout the country

Figure 20. Locally produced solar power is pushing down "net" power demand across the system



Source: ENTSO-E Transparency Platform & MAVIR[3]

No individual solution can solve the Dunkelflaute. But together, as part of an integrated system, a diversified toolkit can

Sustain renewables investments

Maintaining a good investment environment helps ensure an abundant supply

Expand LDES & Seasonal storage

Longer-term storage can reduce vulnerability and increase overall energy security

Improve short-term flexibility

Demand response, more EVs, and more battery storage can significantly mitigate the impact of Dunkelflaute events

Diversify renewables portfolio

Drawing on multiple different RE sources reduces the impact and frequency of Dunkelflaute events

Expand interconnections

Building stronger interconnectors helps reduce Dunkelflaute risk by widening the geographic area over which wind, solar, and hydro are harvested

Enlarge the balancing area

Larger balancing areas enable greater cross-border power flows, and allow surpluses in one region to flow to other regions

05

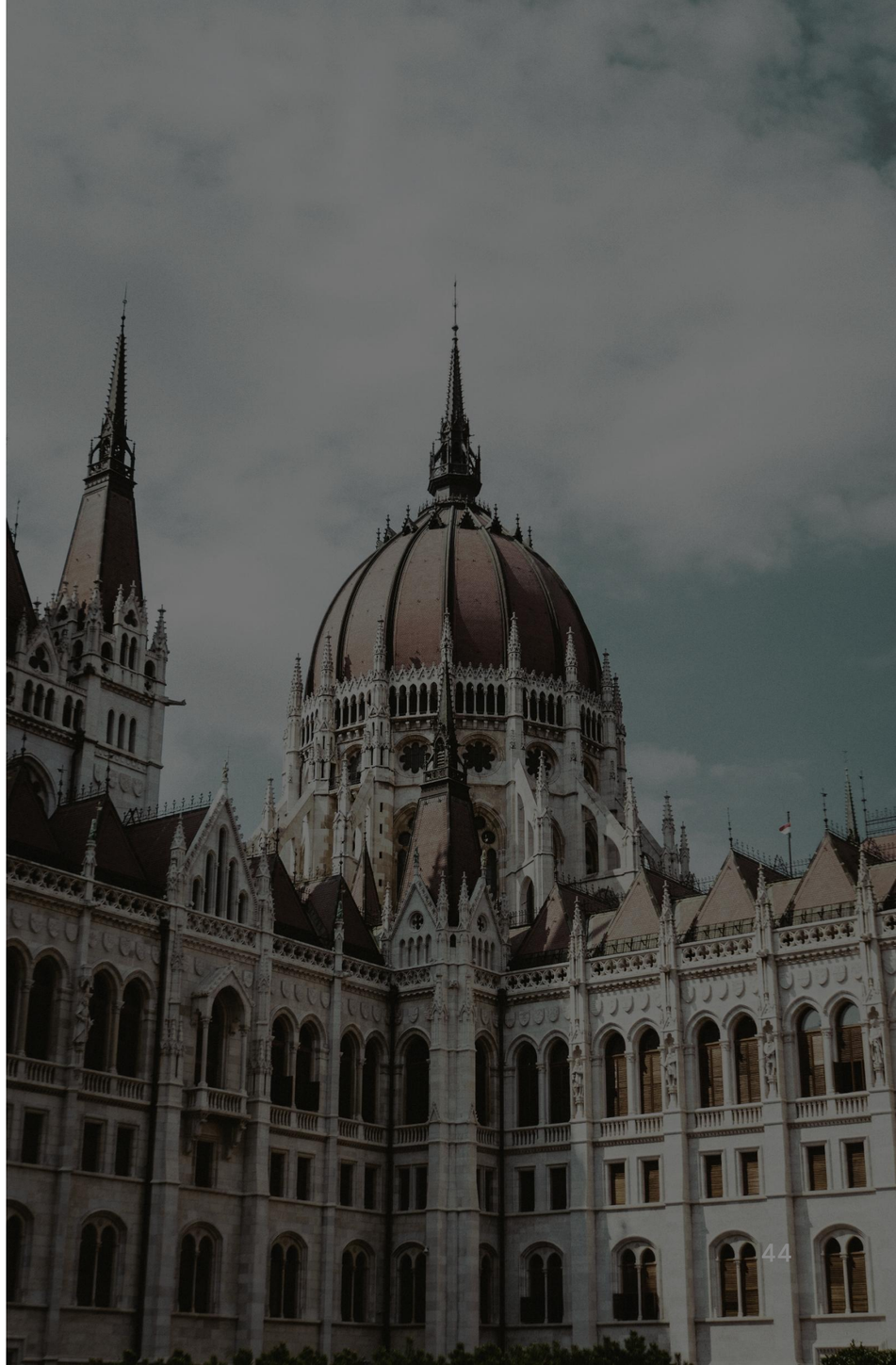
Conclusion

Hungary is at a crossroads

The country currently faces a choice between two fundamentally different energy futures:

1. Locking-in costly, baseload nuclear power while deepening energy import dependency through the addition of new gas plants

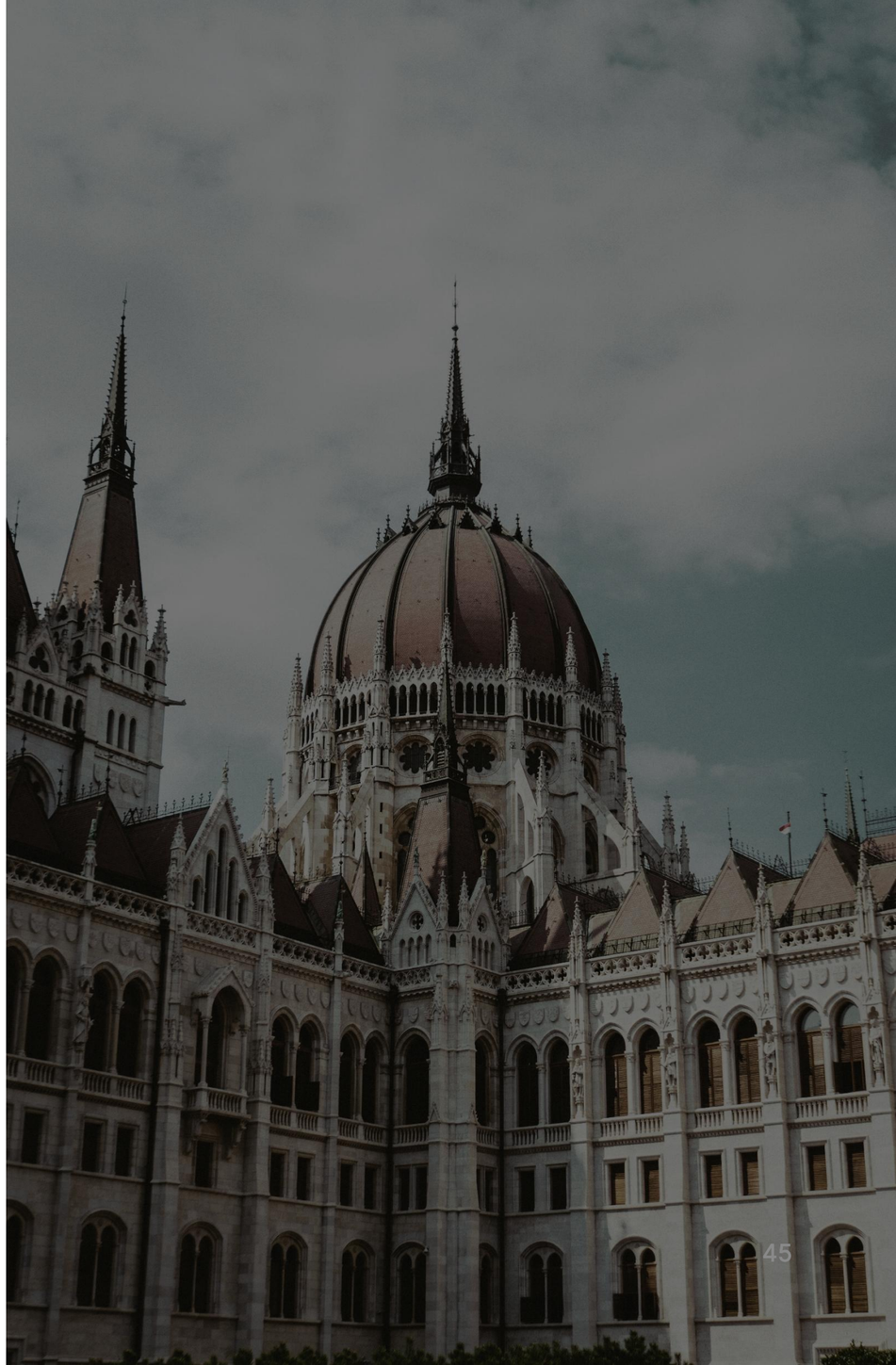
2. Making smarter use of its interconnectors, diversifying its power supply by adding more wind and storage, and investing in greater demand-side flexibility

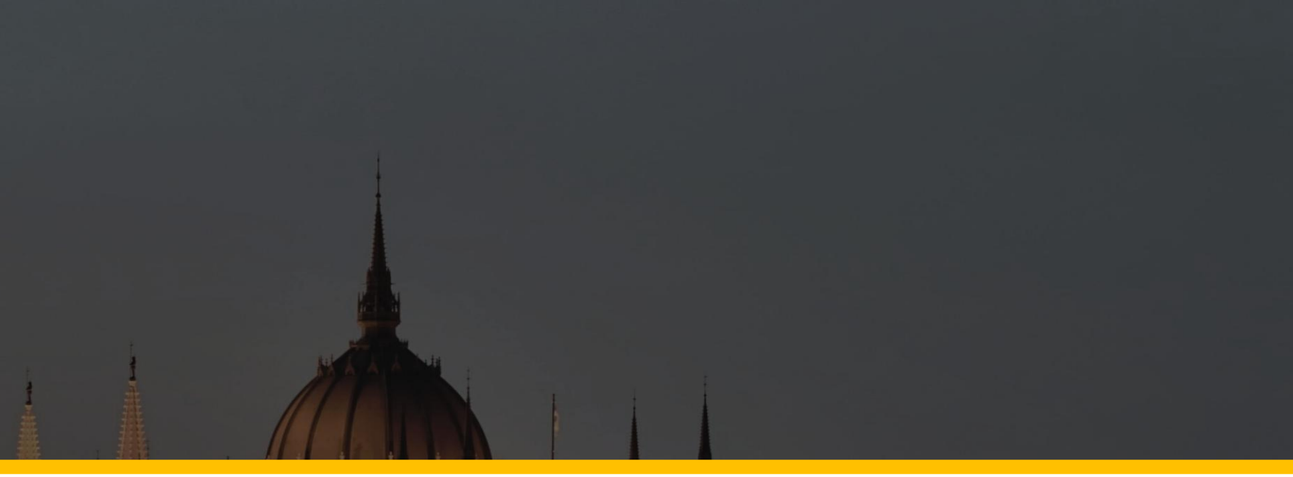


Genuine energy security cannot be achieved by deepening import dependency

- Market forces are increasingly favouring investment in low-cost renewable supply, with renewables now representing 90% of new power generation capacity being added worldwide.[25]

- **Countries like Hungary must choose.**





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