



FUELING THE ENERGY TRANSITION WITH NUCLEAR

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Panel 4: Enhancing Energy Security by Keeping the Balance

Daniel Dean, Chairman of the International Bank for Nuclear Infrastructure

- Keith Everhart, Energy Analyst, Renewables Integration and Secure Electricity, International Energy Agency
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Nuclear Energy's Role in Secure Low-Carbon Power Systems

Keith Everhart, Energy Analyst – Renewable Integration and Secure Electricity, IEA

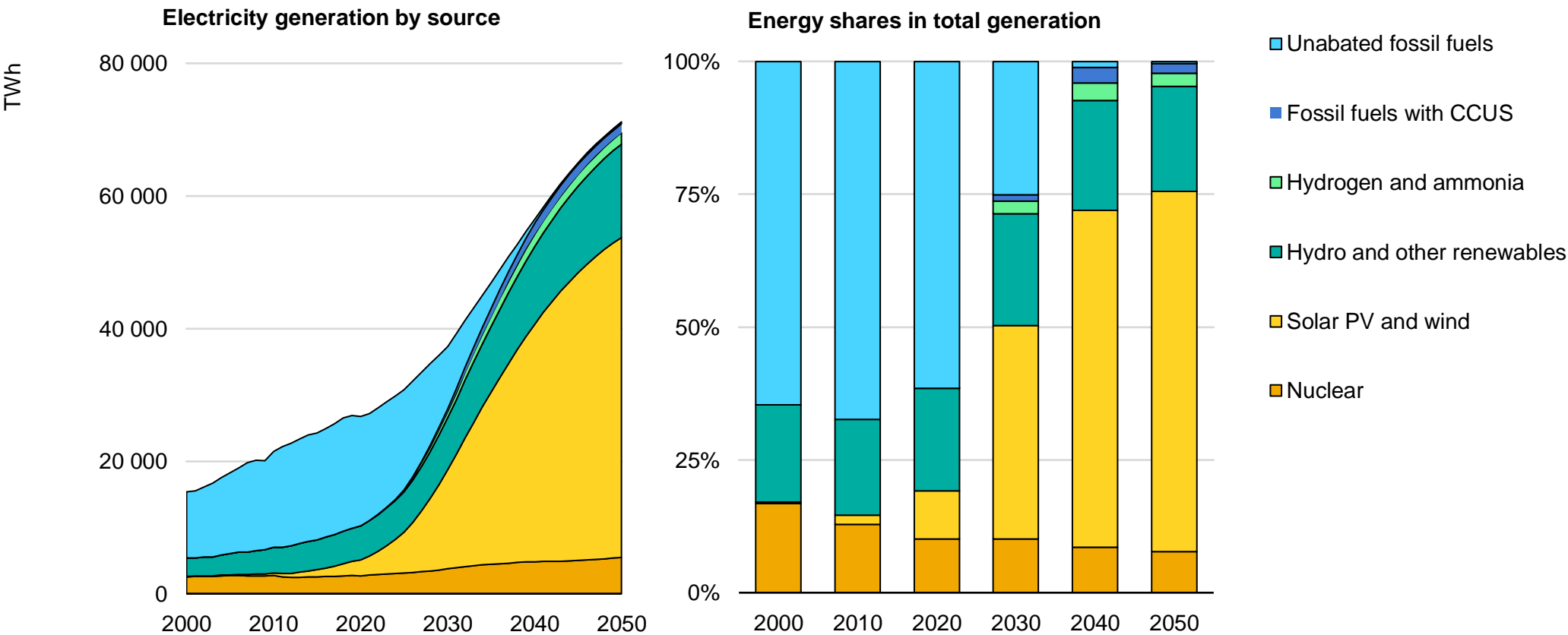
New Nuclear Watch Institute

Budapest, 20 June 2023

- Russia's invasion of Ukraine
 - Re-orientation of global natural gas market
- Extreme weather events
 - Winter storms (Texas 2021)
 - Hurricanes (New Orleans 2021)
 - Forest fires (California, Canada)
 - Hot and dry (Europe summer 2022)
- Decarbonisation
 - Increased climate ambition led by renewables
 - VRE integration – need for complementary flexible energy sources
 - Critical minerals

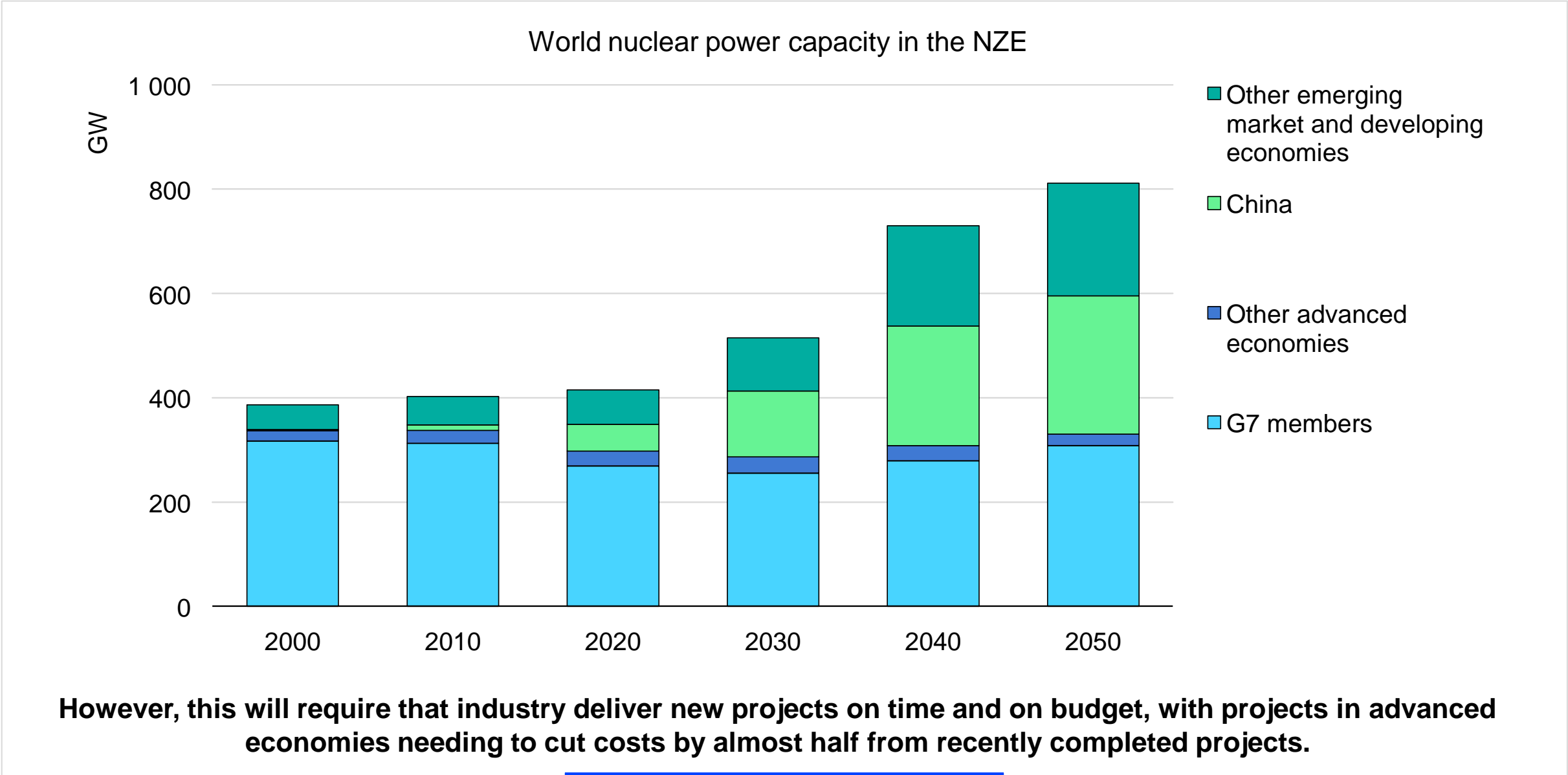
Wind and solar PV growth is accelerating

World electricity generation by source in IEA's Net Zero Emissions Scenario



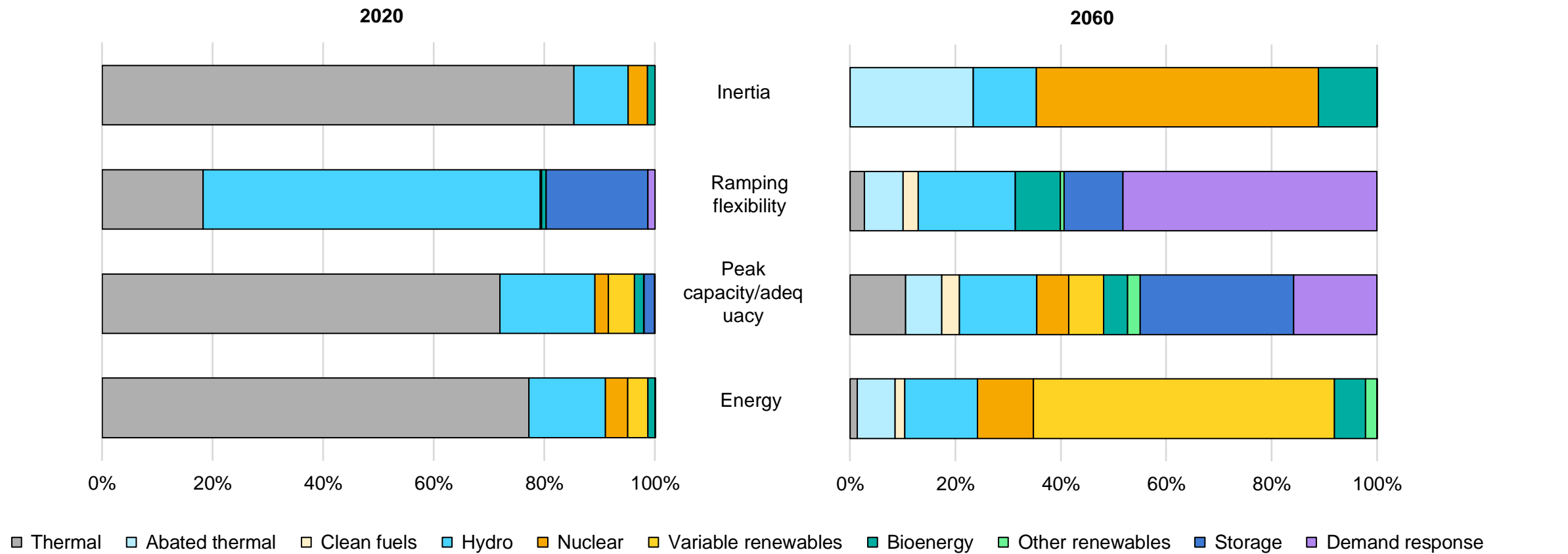
Renewables will overtake coal as the largest source of electricity generation by 2025

Nuclear capacity doubles to 2050 on the path to Net Zero



The role of each technology in providing key system services will evolve

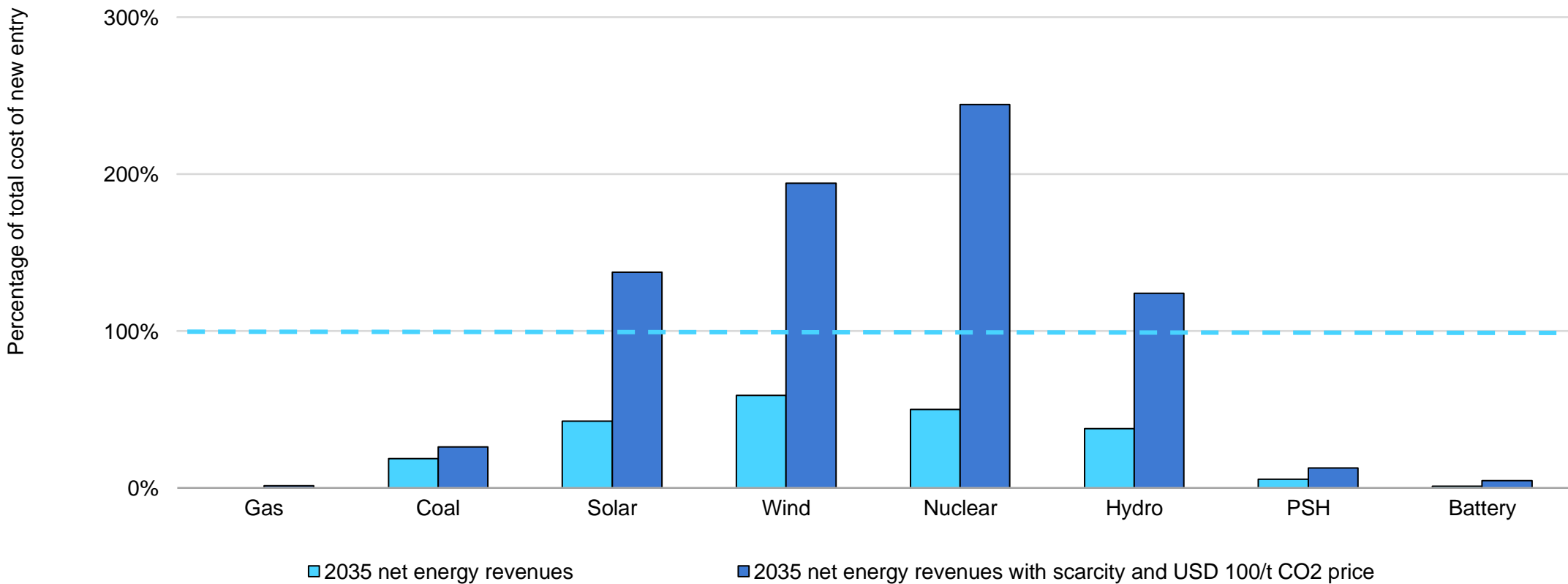
Contribution of each technology to ensure electricity security in Net Zero Emission pathway in China, 2020 and 2060



Power system services will increasingly need to be provided by a more diverse range of assets

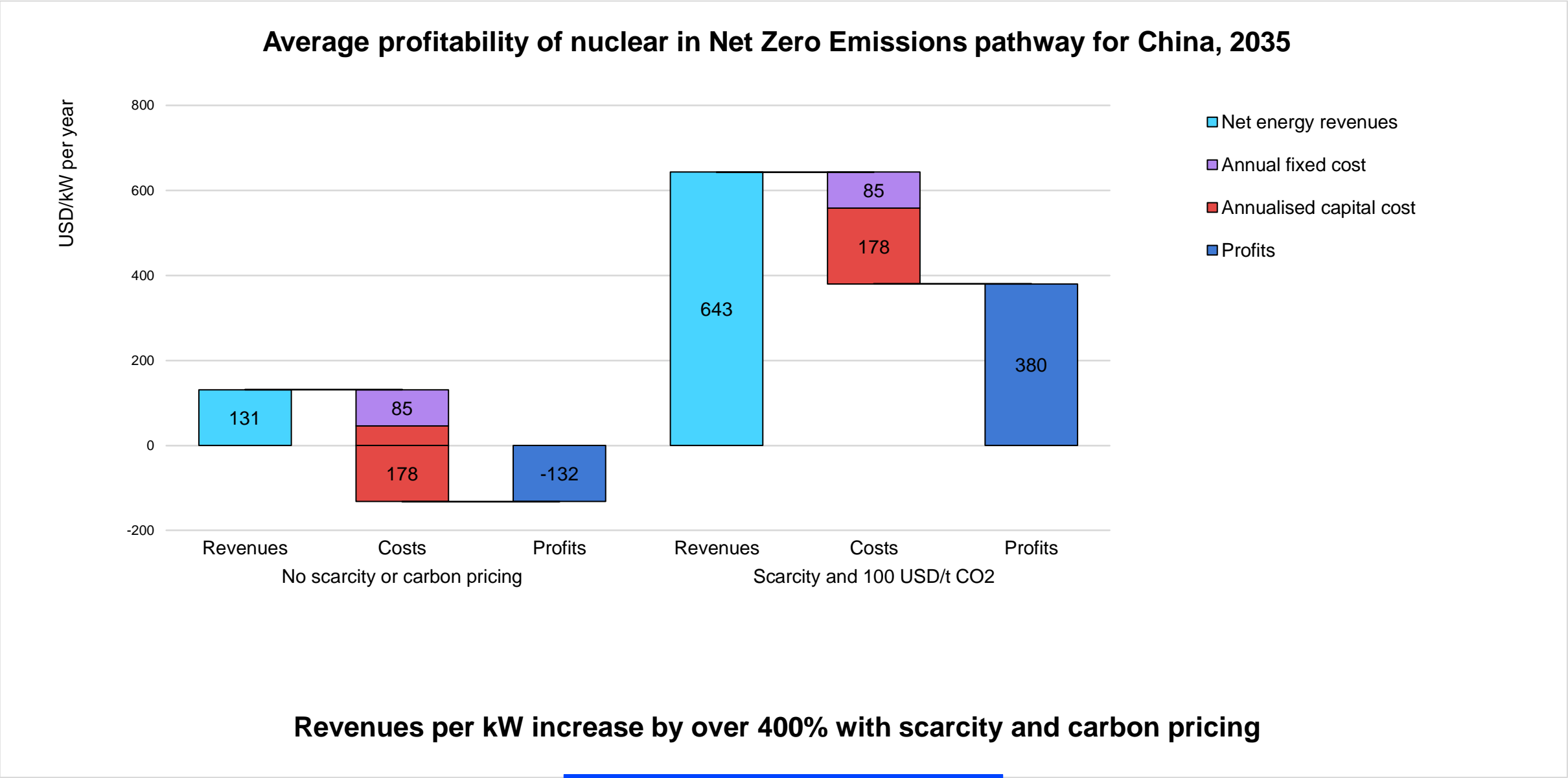
- Wholesale energy market
 - Marginal pricing with high price cap (scarcity pricing)
 - Based on merit order, or variable cost of generation
 - Carbon pricing can be included to shift the merit order
 - Additional value to generate during periods of tight supply/demand (or low reserves)
- Capacity market
 - Additional payment for availability

Average profitability for generating types by pricing method in Net Zero Emissions pathway for China, 2035

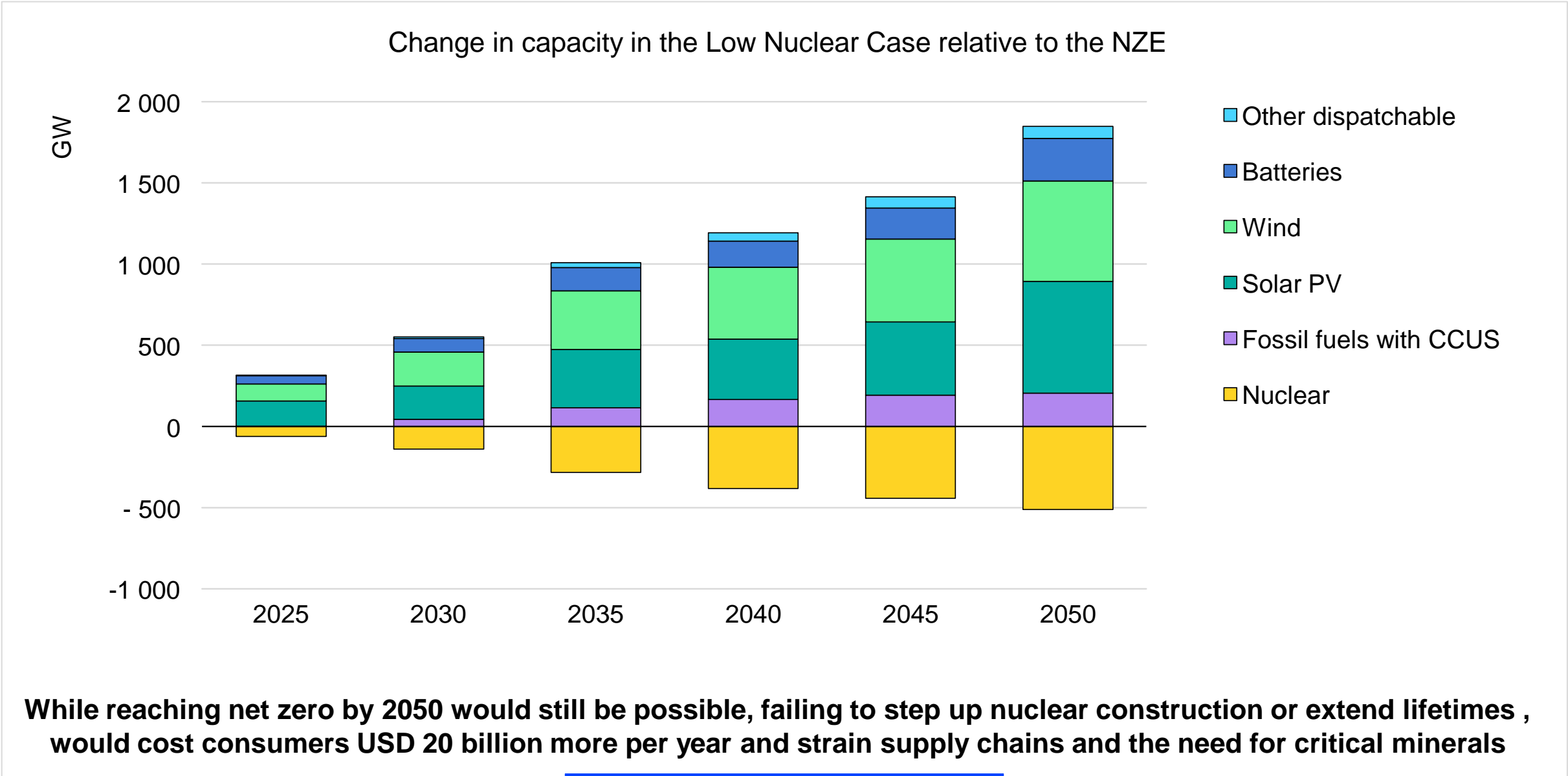


Scarcity and carbon pricing provide additional incentive for flexible and low-carbon generation

Nuclear capacity benefits most from the changes to market design



The path to net zero with less nuclear is narrower



- Nuclear is increasingly seen as a key pillar of a country's energy security and decarbonisation strategy
 - US (subsidies to avoid early retirement, SMR development), Korea (construction restart, export), Japan (restarts), UK, France, Poland and more
- Nuclear supports reliability by offering firm capacity to the power system
 - System services should be compensated according to their contribution to secure operation
- Non-economic factors such as safety and spent fuel management should be addressed to build public support

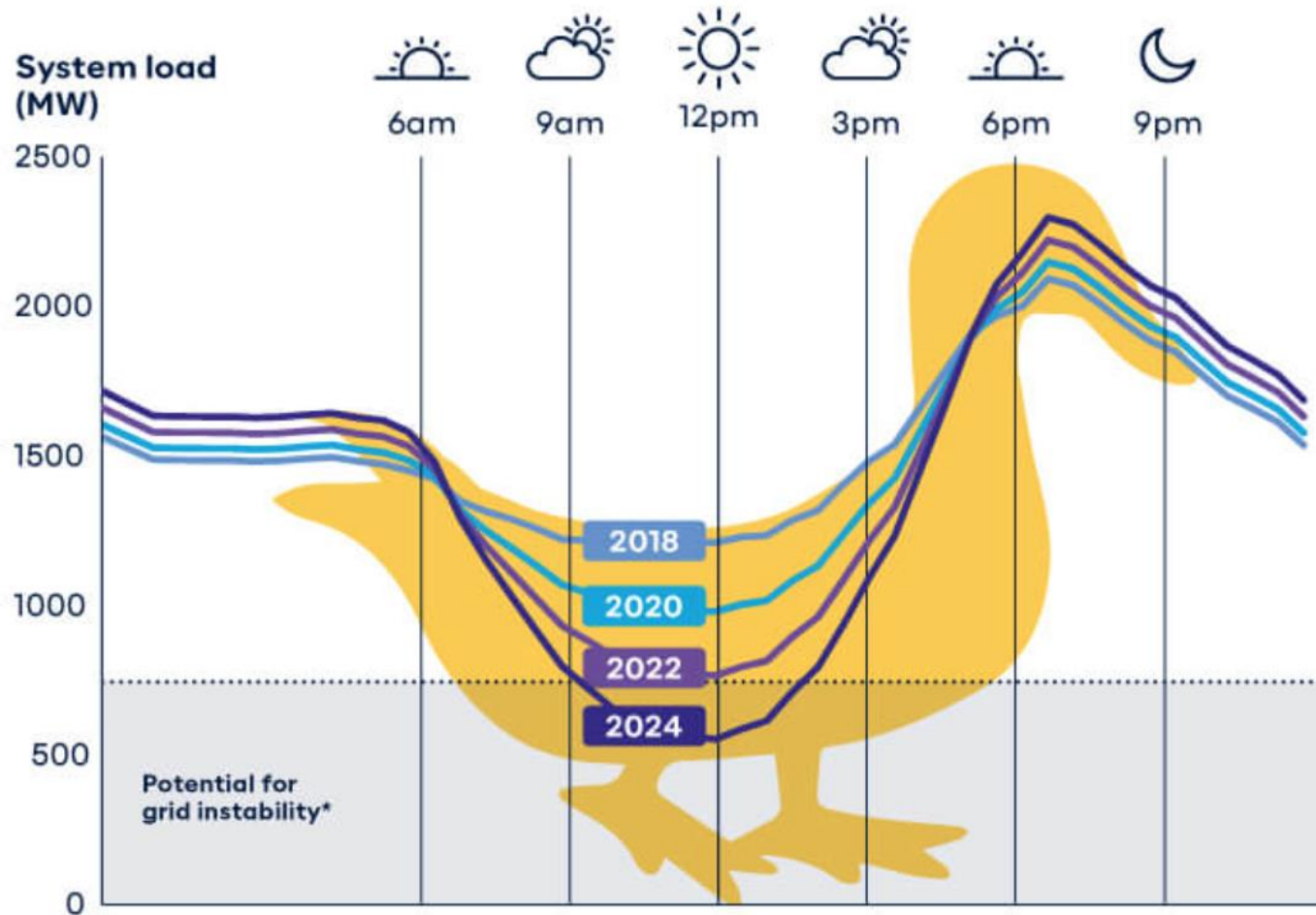
iea

How to handle the ,duck curve'?

Panel 4: Enhancing Energy Security by Keeping the Balance
NNWI Conference Budapest, 20 June 2023



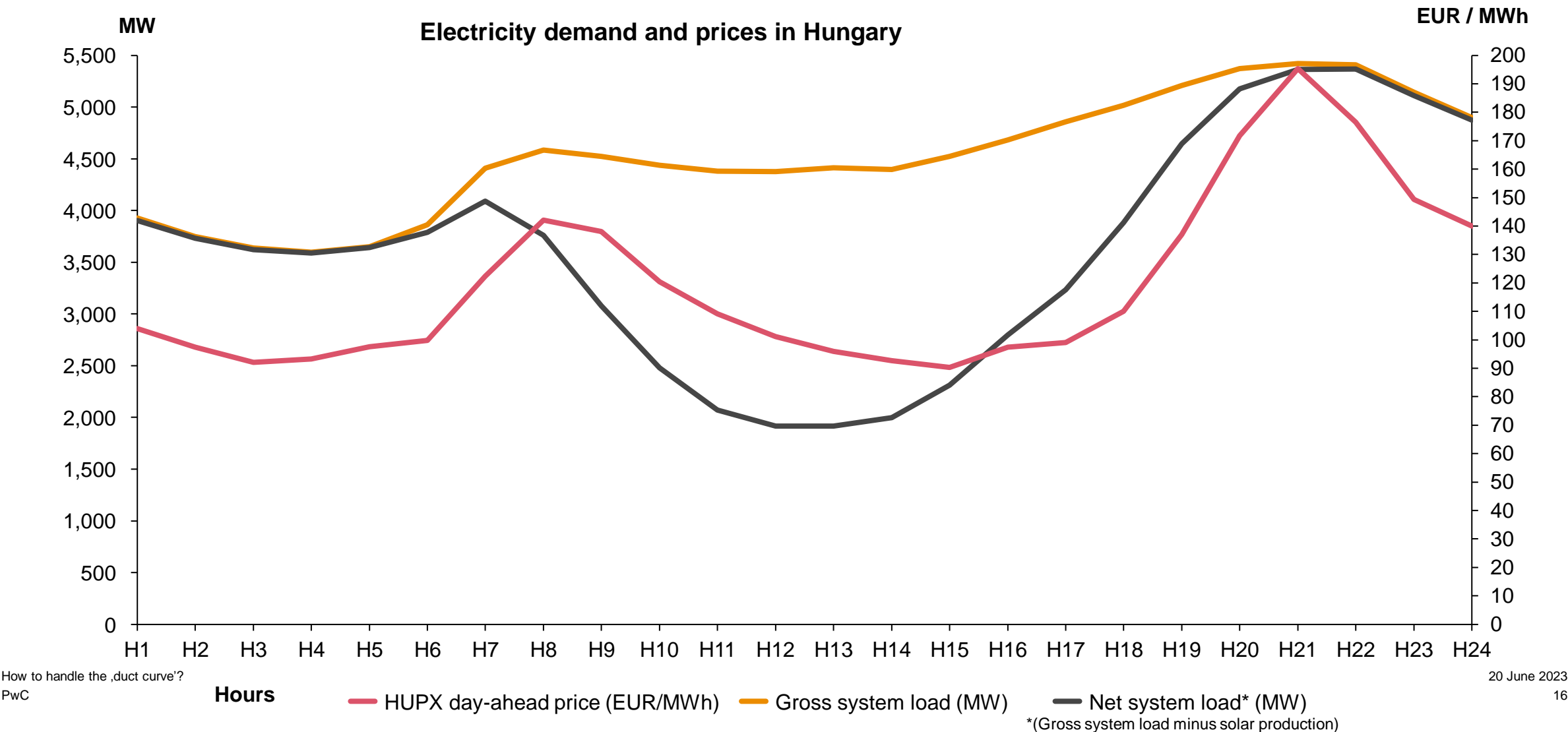
On sunny days the net power demand takes the shape of a duck which is not easy to handle for the TSOs



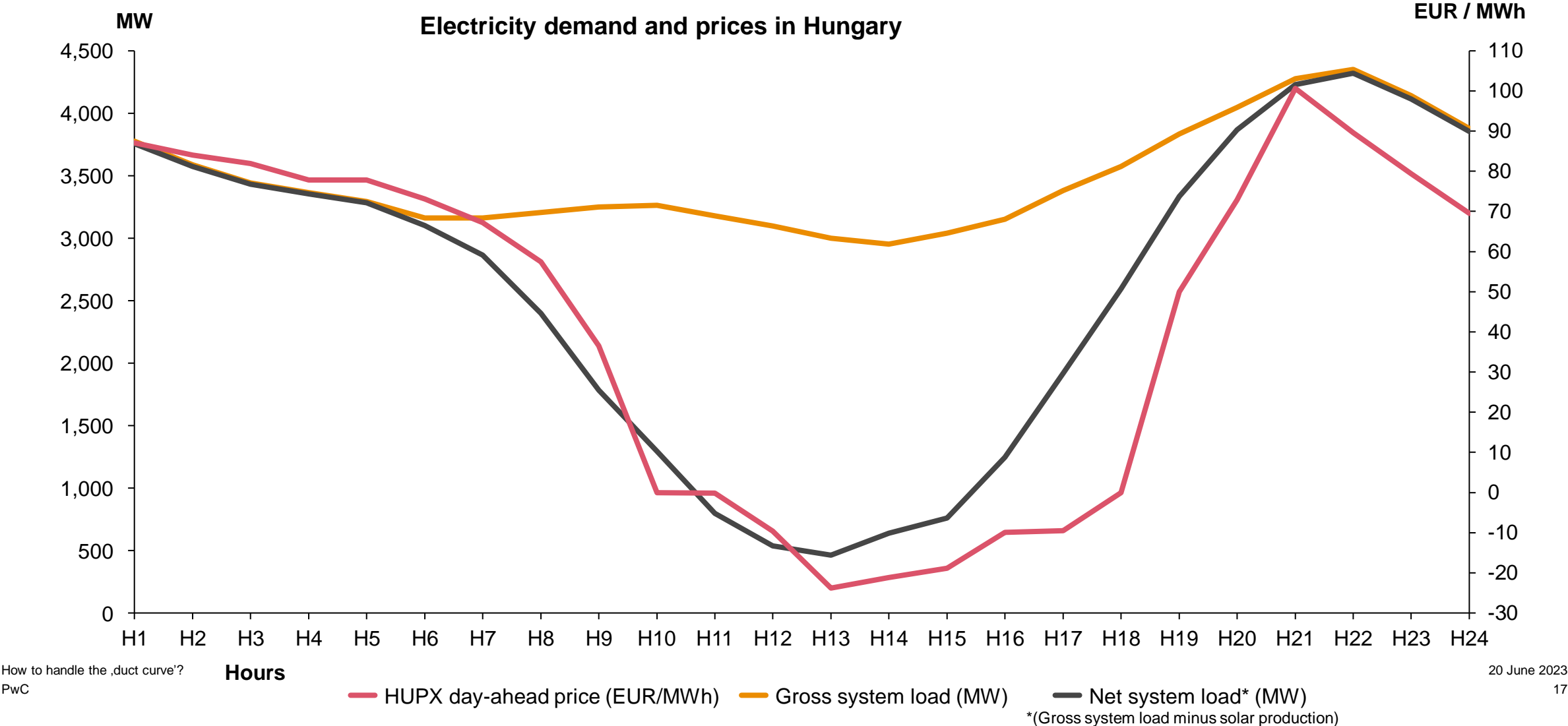
Source: www.synergy.net.au

- Traditionally, power companies supply the **least amount of power overnight** while most consumers are sleeping, **ramping up during the morning** and peaking in the evening.
- Nowadays, **net demand curve** (gross demand minus solar production) **takes the shape of a duck**, due to the rapidly developing solar power generation.
- The duck curve gets **more pronounced each year**, as more solar capacity is added and net demand dips lower and lower at midday.
- It is a **key challenge for the TSOs** and also for the energy industry to handle the duck curve and keep the balance. This is the prerequisite of the green transition.

Duck curve of Hungary – 19th June, 2023 (sunny, but not hot Monday)

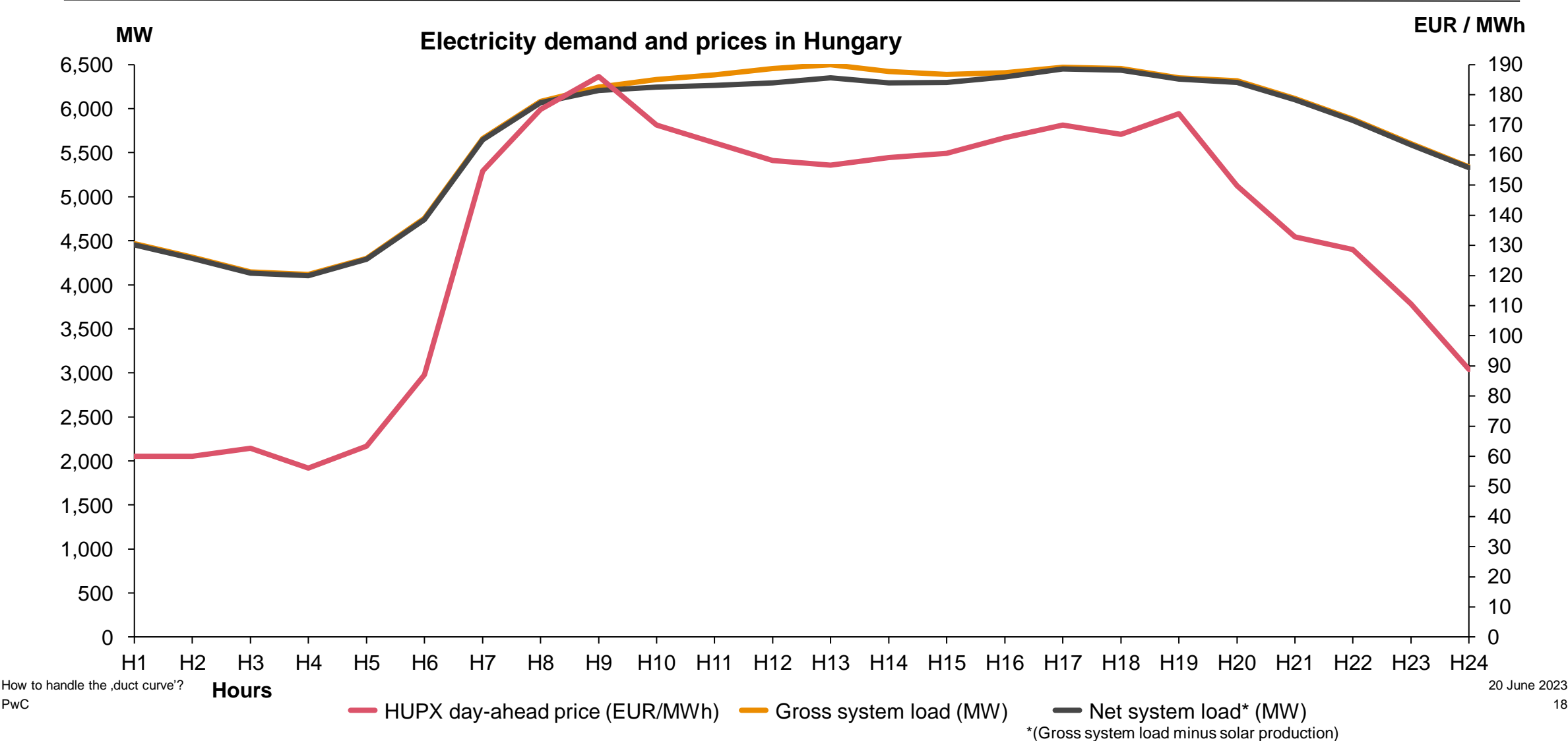


Duck curve of Hungary – 28th May, 2023 (sunny, but not hot public holiday)



Shape of electricity consumption in Hungary – 16th January, 2023

(cloudy winter Monday with mild temperature)



Potential technical solutions to meet both the 'duck curve' and the 'traditional curve' type of net demand

- **PVs and wind power plants** – although causing balancing challenges, intermittent renewables will be cornerstones of the energy system of the future and drivers of the green transition. Some steerability of PVs will be also needed.
- **Hydro power plants** – still important, although their production may decrease in case of hot and dry summers
- **Flexible fossil power plants (mainly gas fired)** – they will be needed to balance the short-term demand&supply changes and also to handle the sharp increase and decrease of the net demand (e.g. the neck of the duck)
- **Battery Energy Storage Systems** – they will be major players of balancing and in the future they may be capable for 'day-to-night storage' (but not for seasonal energy storage)
- **Demand response (incl. electric boilers and active charge management of battery electric vehicles)** – they provide flexibility and also an opportunity to use the excess electricity around noon
- **Hydrogen economy** – this is a less mature technology, but it is essential to decarbonise some industries (e.g. steel, cement) and in the long run hydrogen economy may enable seasonal energy storage
- **More flexible baseload power plants (e.g. nuclear)** – at the time being it is not possible to meet the electricity demand only with renewables, especially on cold and cloudy winter days. Nevertheless, some flexibility and dispatchability of baseload power plants will be also needed.

Besides intermittent renewables and new&flexible technical solutions like BESS and hydrogen facilities, dispatchable power plants will be also needed to meet the electricity demand under any weather conditions.

We are looking forward to your questions and feedback!



András Lengyel

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GO GREEN GO NUCLEAR

ONE COMPANY, ONE MISSION

Nikola SOBOTKOVÁ, 20/6/2023

Fueling the Energy Transition with Nuclear, BUDAPEST

Supporting your energy





Nikola SOBOTKOVÁ, Czech Republic BU

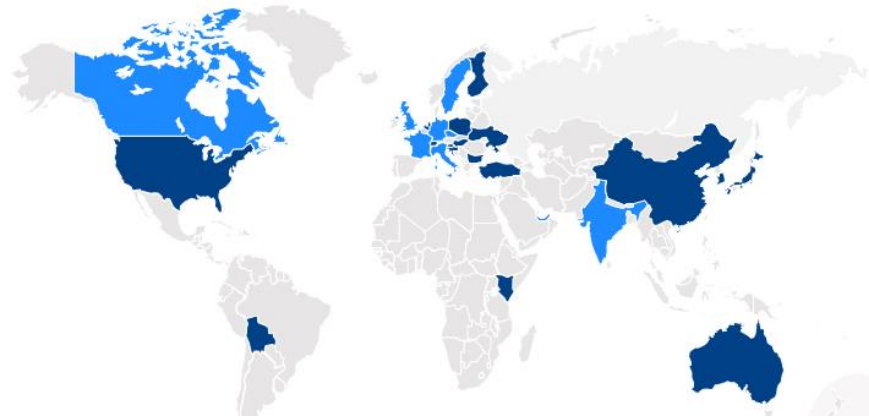


INTRODUCE

- **NUVIA company**
- **Women in Nuclear Czech**
- **Young Generation of Czech Nuclear Society**



60 years of experience



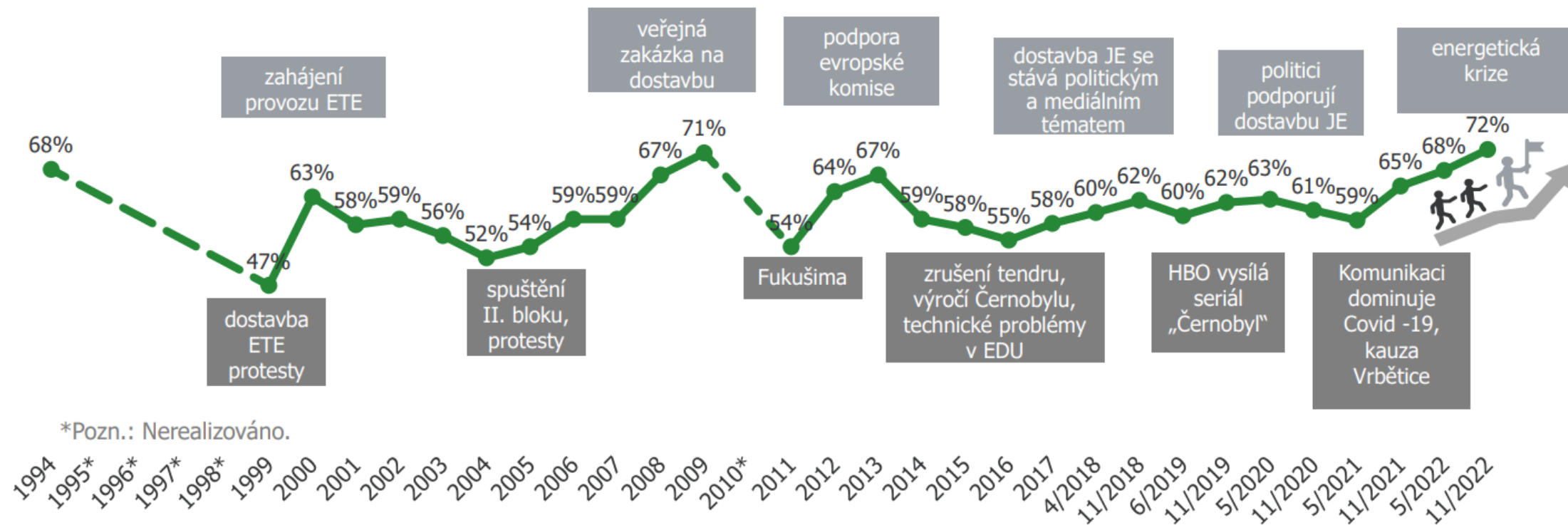
Supporting your energy

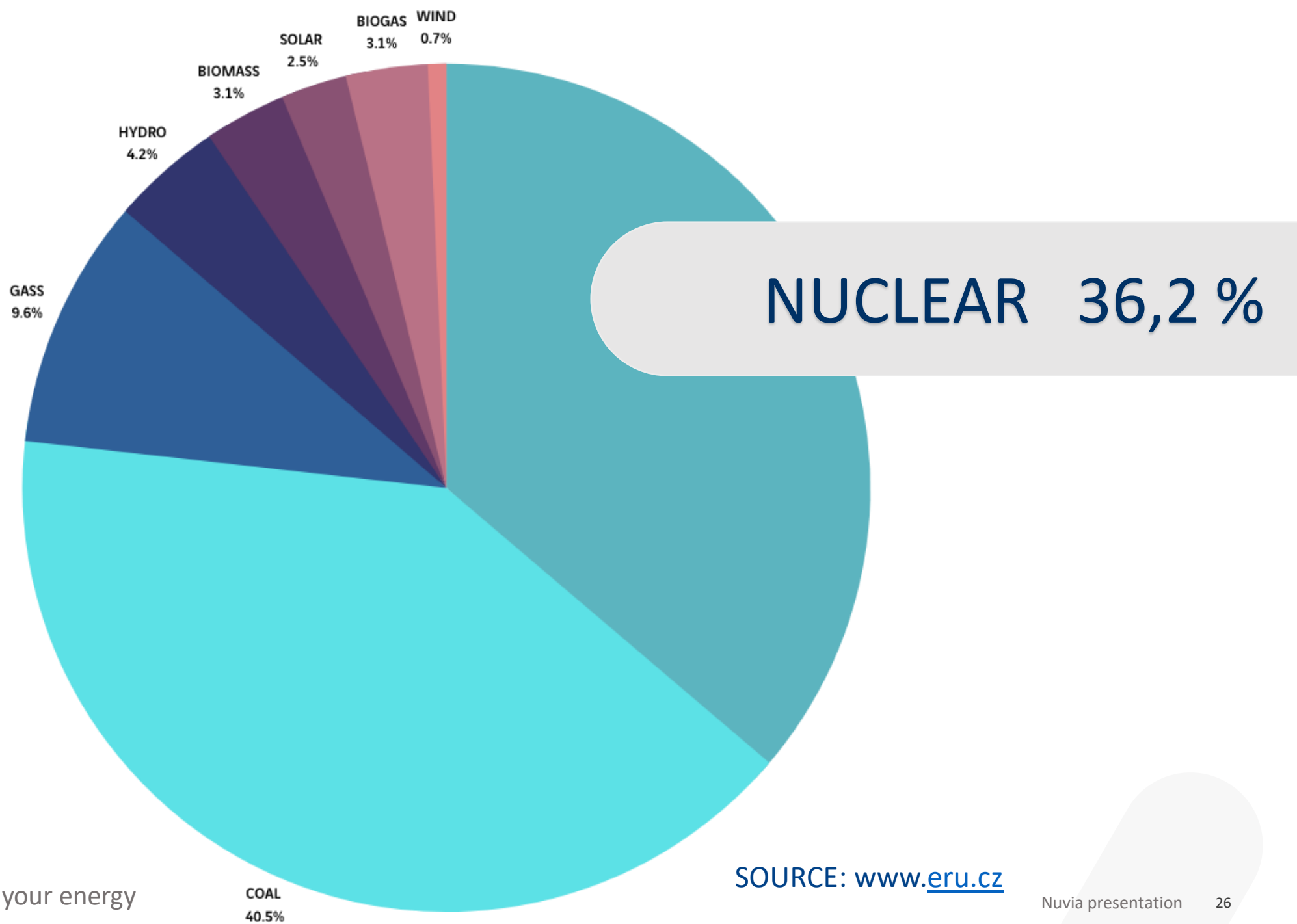


TEMELÍN NPP



DUKOVANY NPP





NEW SOURCE IN DUKOVANY EDU

Probably 2 units + 2 in Temelin site ETE

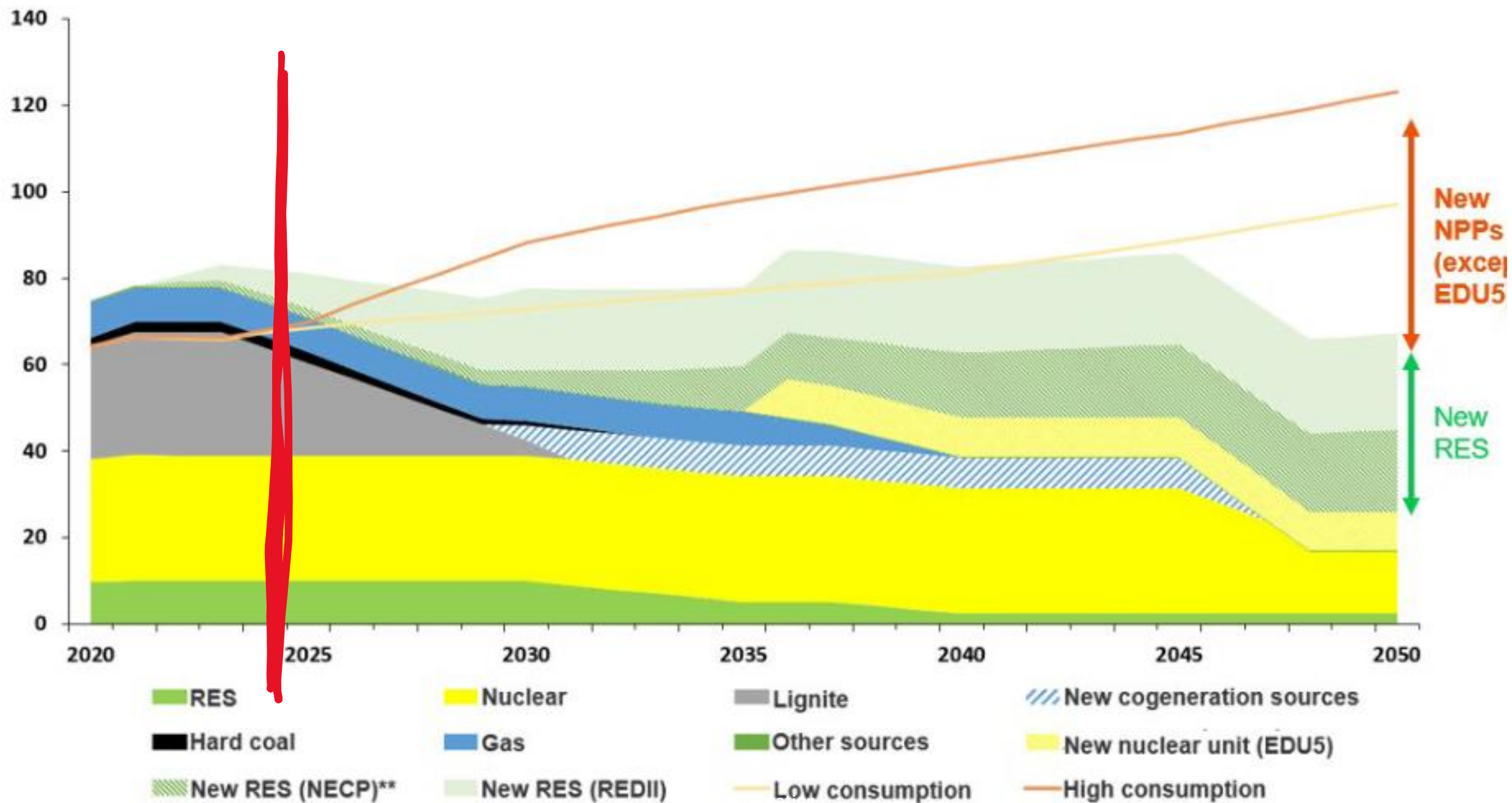
- EDU 1: to 2045
 - EDU 2: to 2046
 - EDU 3 a 4: to 2047
-
- EDU 5: 1,2 GW from 2036
 - ETE 3: 1,2 GW from 2040
 - ETE 4: 1,2 GW from 2044
 - EDU 6: 1,2 GW from 2048



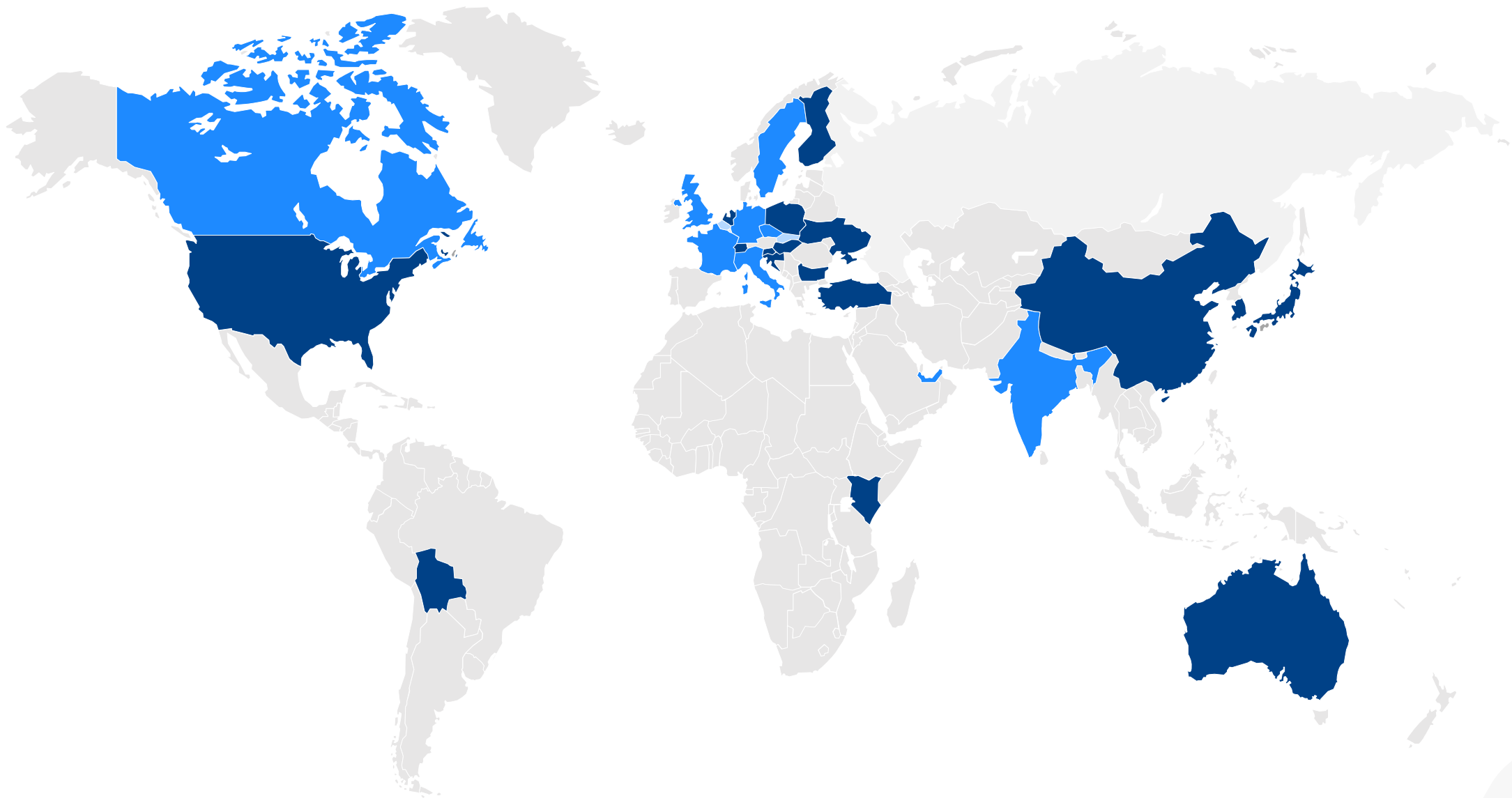
Current parameters

- Limit 1200 MWe
- Not the first of kind
- PWR technology

1. Result – EDF, KHNP and Westinghouse
2. Tender is open
3. Spring 2024 selection





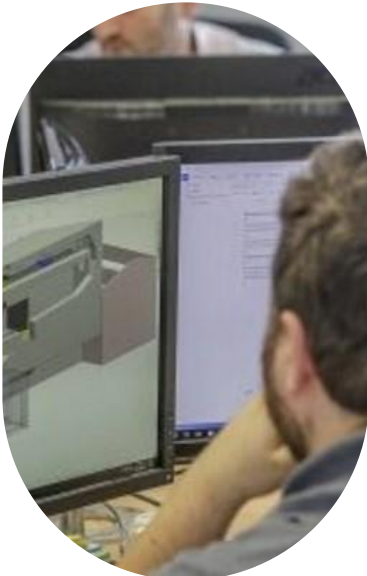


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KEY SPECIALTIES

Health Physics, Safety
& Measurement



Engineering & EPC



Mechanical Systems
& Processes



Support Services



Passive Protection
of installations



Civil Engineering
& Special Works







DECOMMISSIONING

Spectrometry - Radioactive waste characterization - Radiation protection and monitoring - Continuous (real-time) measurement of chemical parameters – Radiochemistry - Information technology - Diagnostics

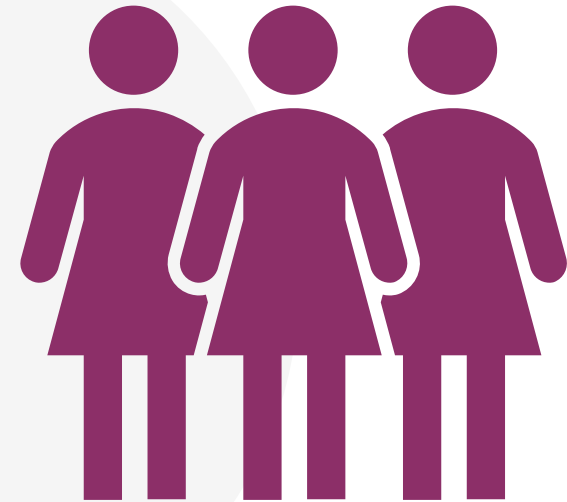


MORE INFORMATION ON WEBSITE

WWW.NUVIA.COM



- Since 2000
- Part of WiN Global
- More than 100 members





Nuvia presentation



PUBLIC EDUCATION

WEBINARS

- Ondrej Novak - ondrej.novak@fjfi.cvut.cz
- Podcast
- How to attract more young people to nuclear
- Done - > webpage with job and internship opportunities



Podcast

Jad(e)rné hovory

Mladá generace ČNS

SLEDOVAT

...

Následující

Jaderný reaktor VR-2 budeme mít v provozu do konce roku 2022 (Filip Fejt; ČVUT)

Vedoucí reaktoru VR-1 na Fakultě jaderné a fyzikálně inženýrské, ČVUT v Praze Filip Fejt popisuje v rozhovoru s Martinem Ševečkem přípravu nového jaderného zařízení VR-2 a aktuální dění na reaktoru...



únor 2022 · 31 min 46 s

O umělci

Odborný podcast Mladé generace České nukleární společnosti nejen o jaderné energetice a souvisejících tématech.

Věda



Thank you Děkujeme

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