

# Energy perspective in a changing energy transition

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# Key facts about Hungary



- Inhabitants: 9,6 million
- Located in Central Europe
  - between West and East
- Land locked
- Area: 93 028 km<sup>2</sup>
- Mostly lowland area
- Agricultural land: ~59%



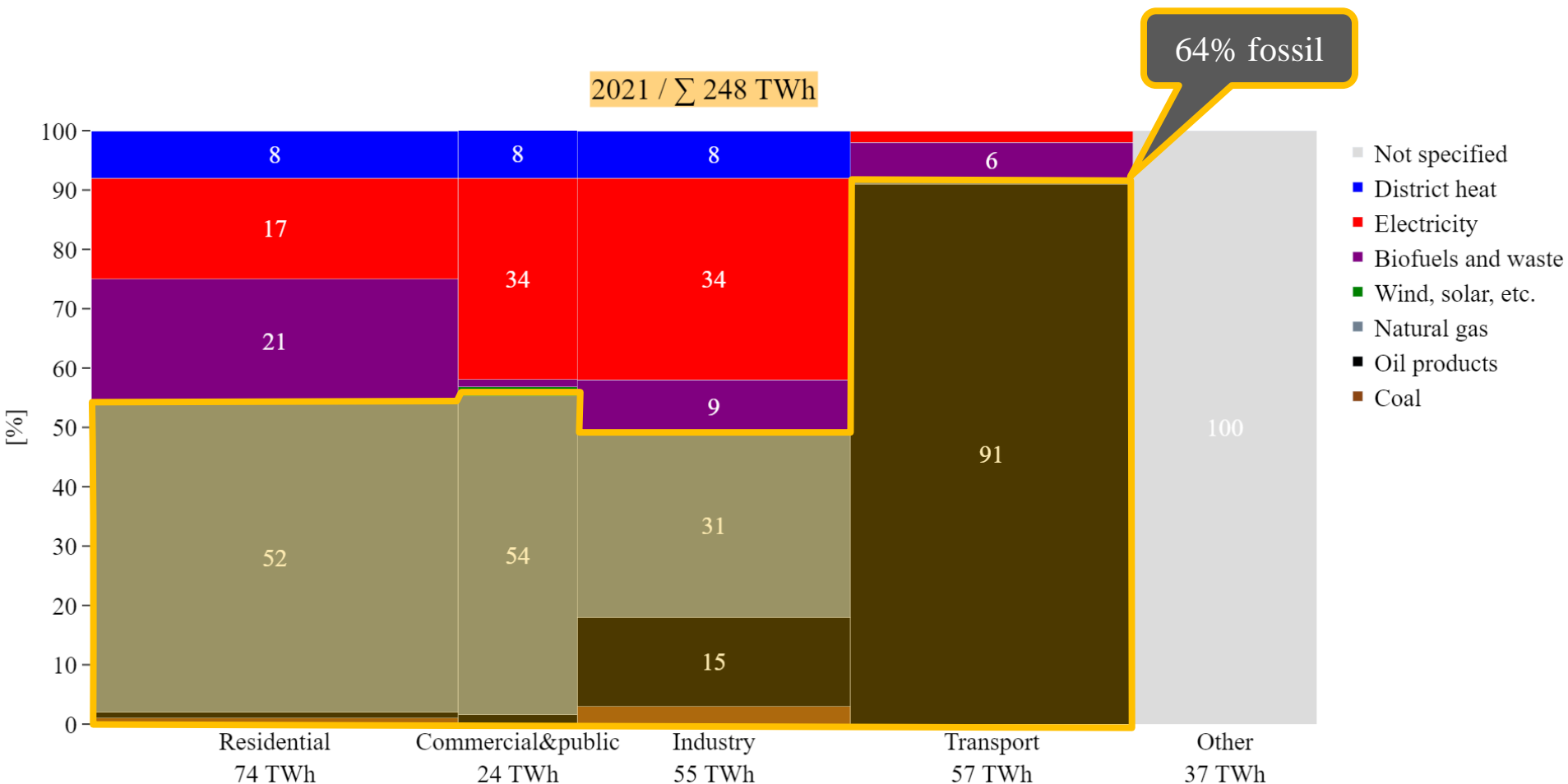
# Key facts about Hungary



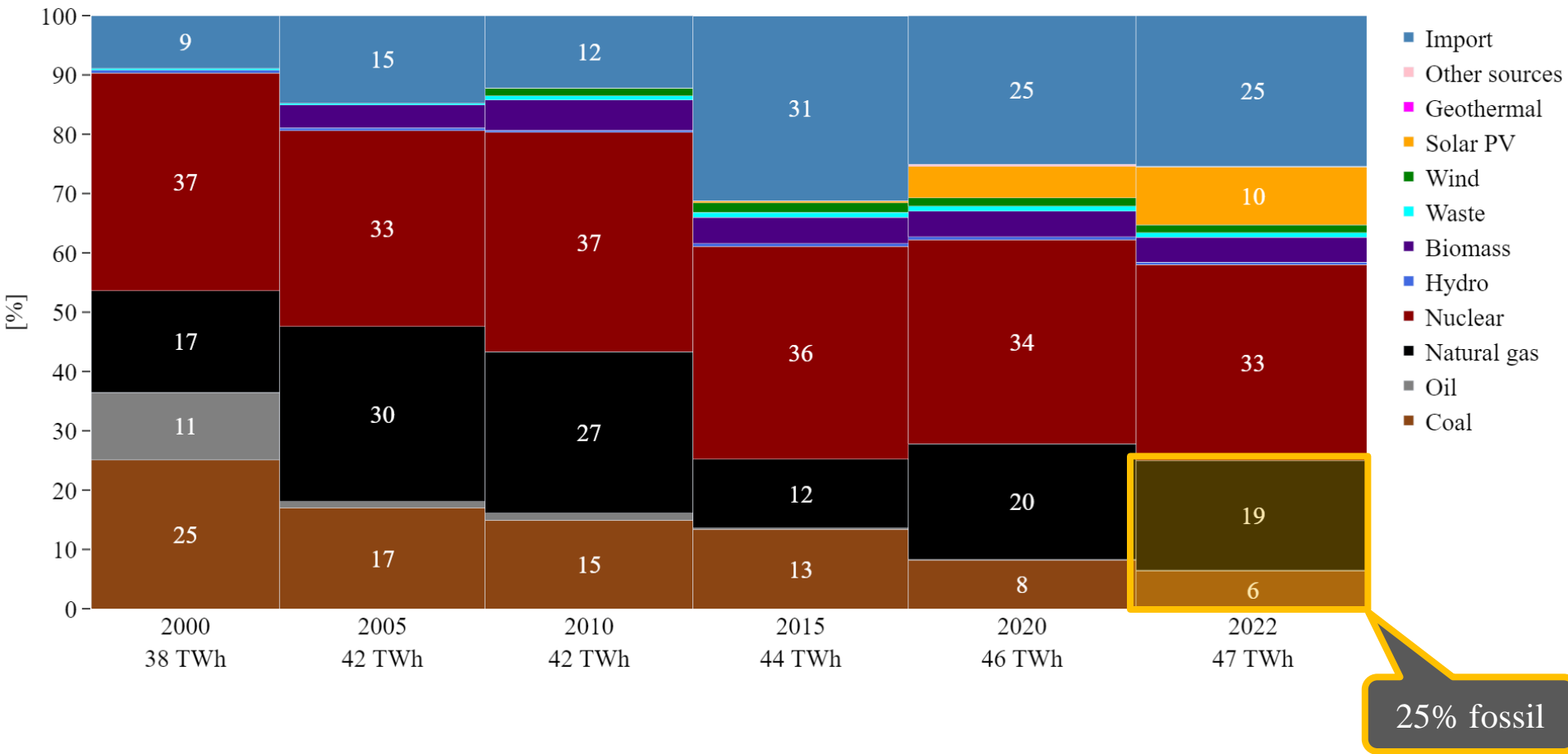
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- Highest point:
  - Kékes 1 014 m
- Lowest point:
  - Tisza River 78 m
- Mean elevation: 143 m
- The Carpathian Basin is surrounded by mountains
  - Limited hydro power,
  - limited wind power resources

Source of picture: <https://mapofeurope.com/physical-map-europe/>

# Final energy consumption in Hungary

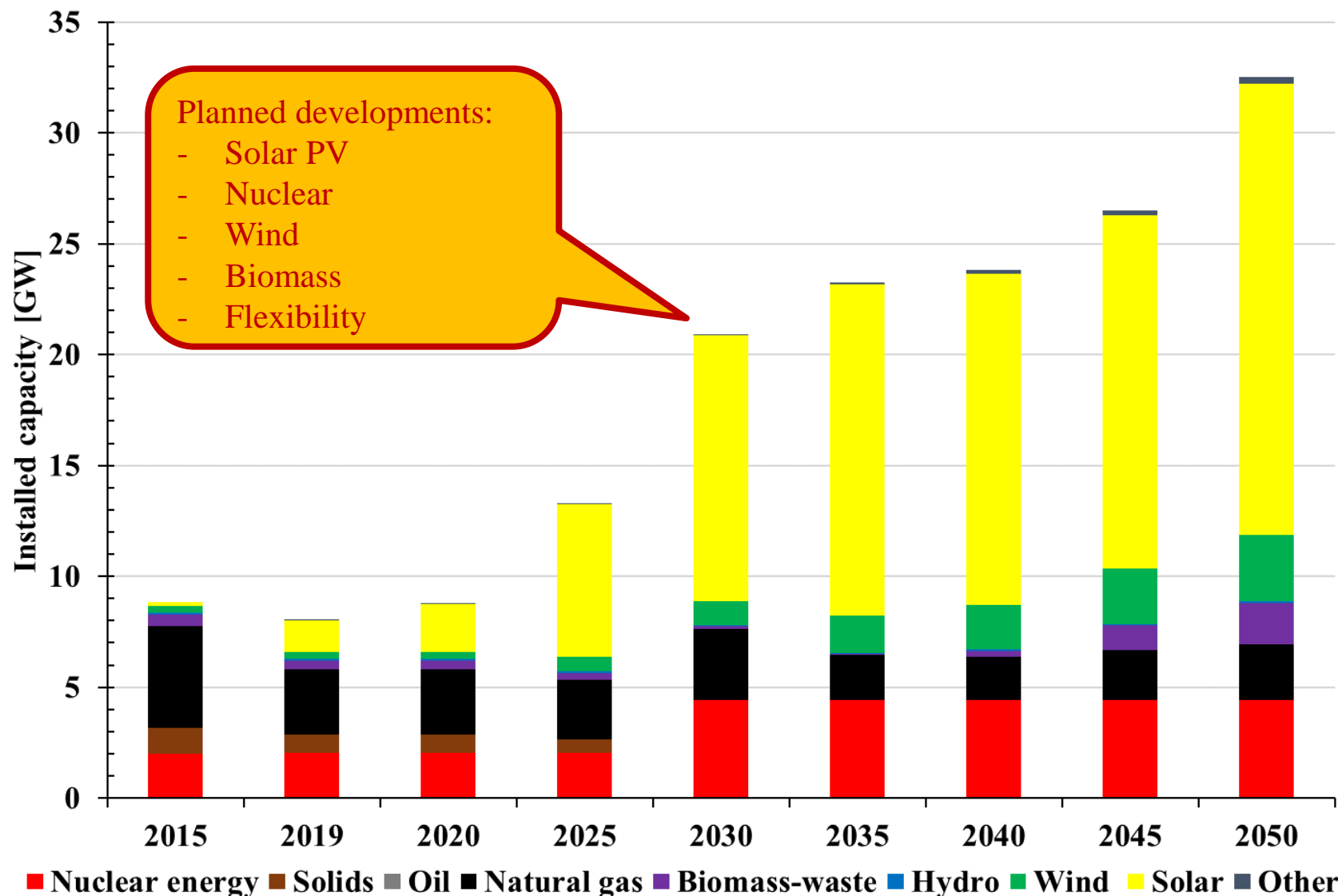


# Electricity mix in Hungary



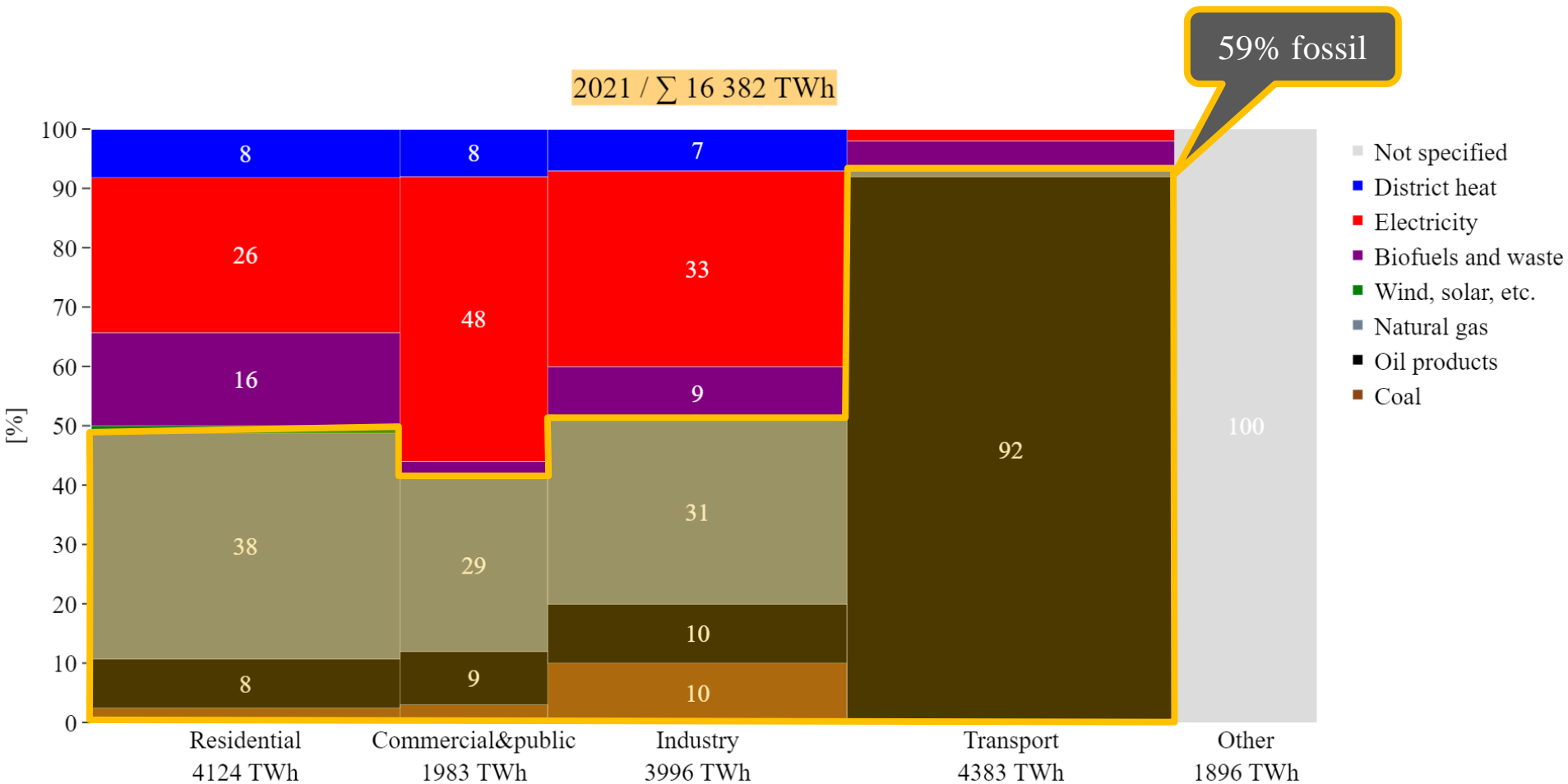
# Future electricity mix in Hungary

## Installed capacity of electricity generating plants in Hungary

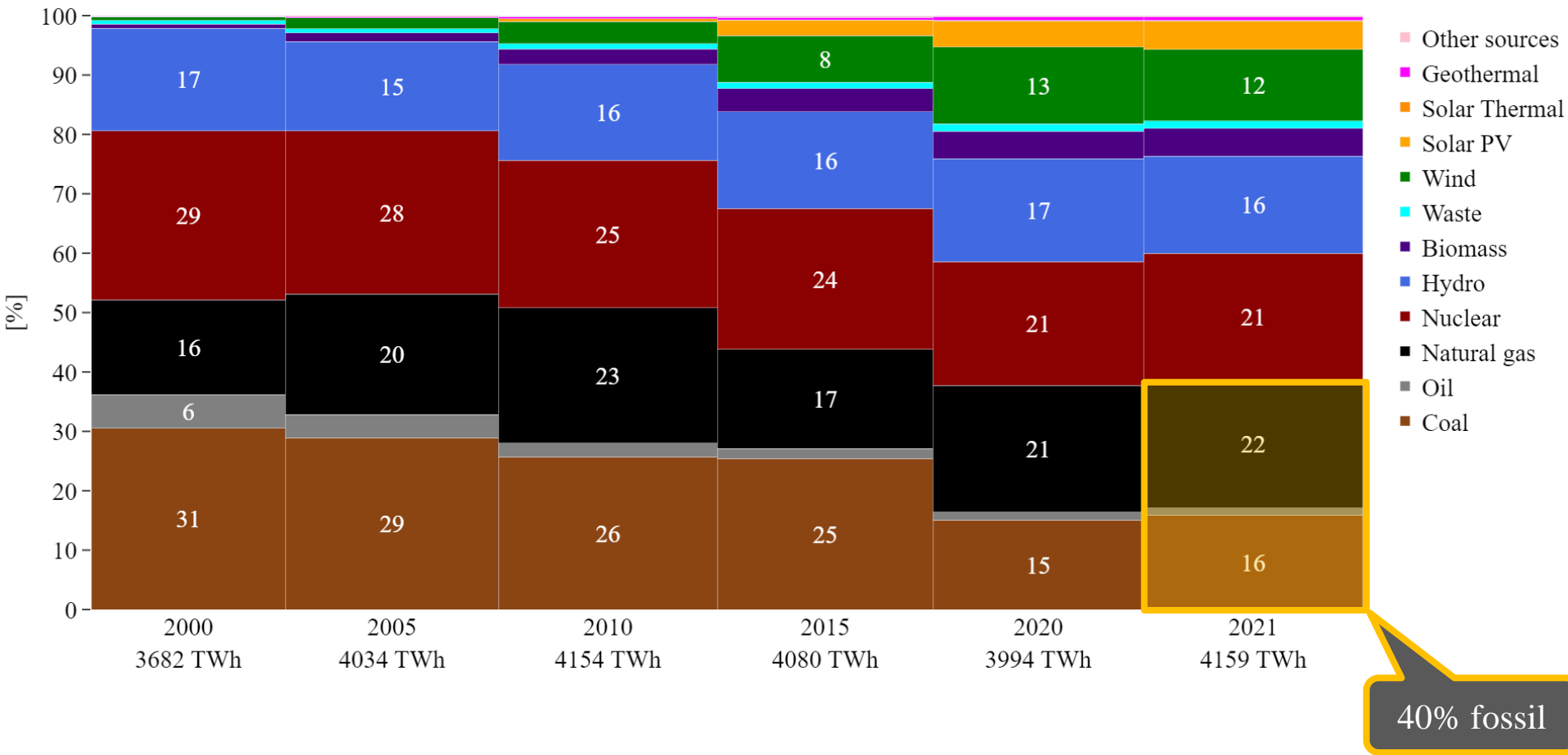


Source of data: [https://commission.europa.eu/document/download/f51a47de-30f0-4176-bab0-89fca0244233\\_en?filename=HUNGARY%20-%20DRAFT%20UPDATED%20NECP%202021-2030%20\\_EN.pdf](https://commission.europa.eu/document/download/f51a47de-30f0-4176-bab0-89fca0244233_en?filename=HUNGARY%20-%20DRAFT%20UPDATED%20NECP%202021-2030%20_EN.pdf); own representation

# Final energy consumption in Europe



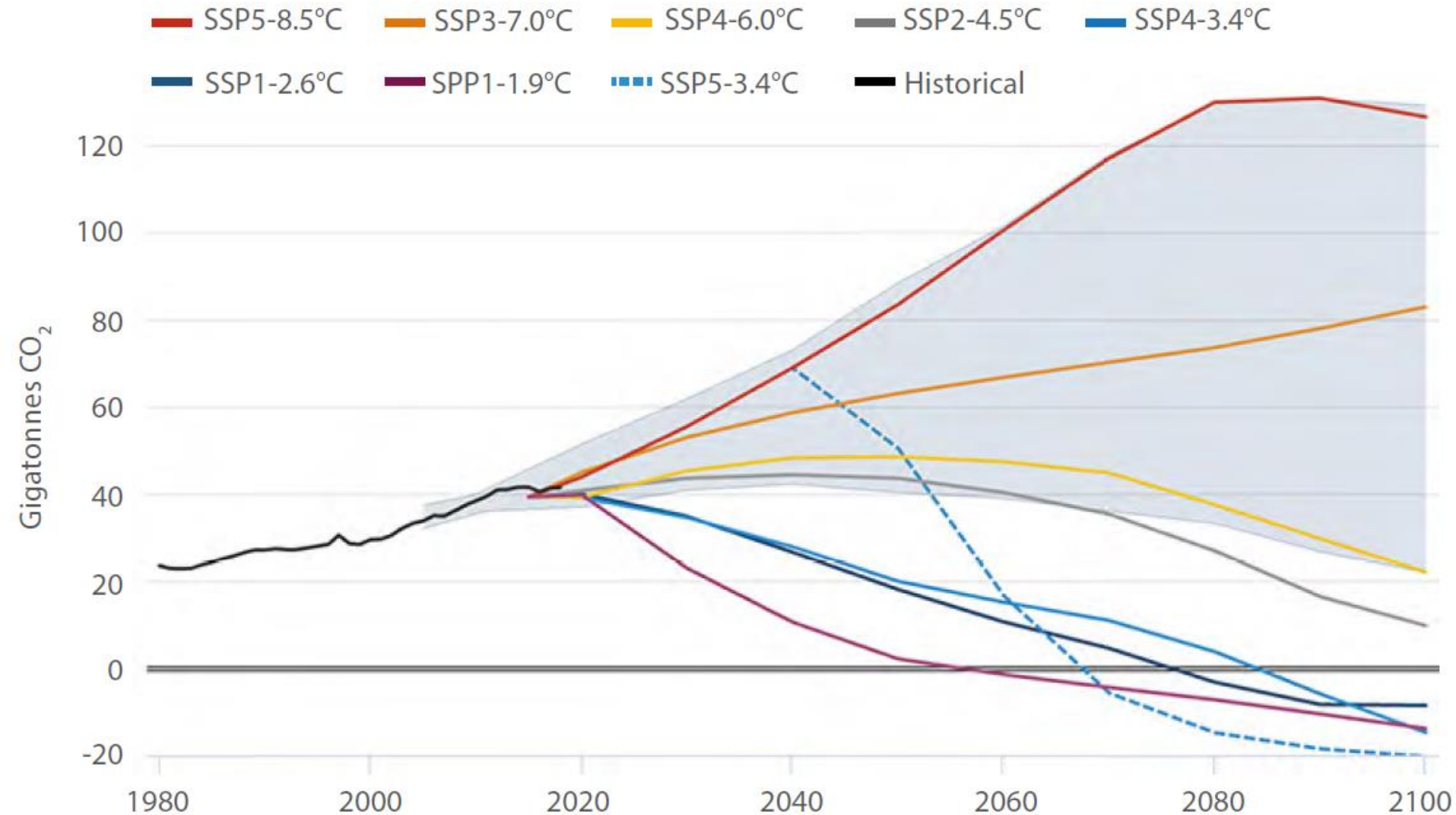
# Electricity mix in Europe





# IPCC scenarios – CO<sub>2</sub> emissions

Figure 1. **Temperature outcomes for various emissions futures**



# Environment is one pillar of **Sustainability**

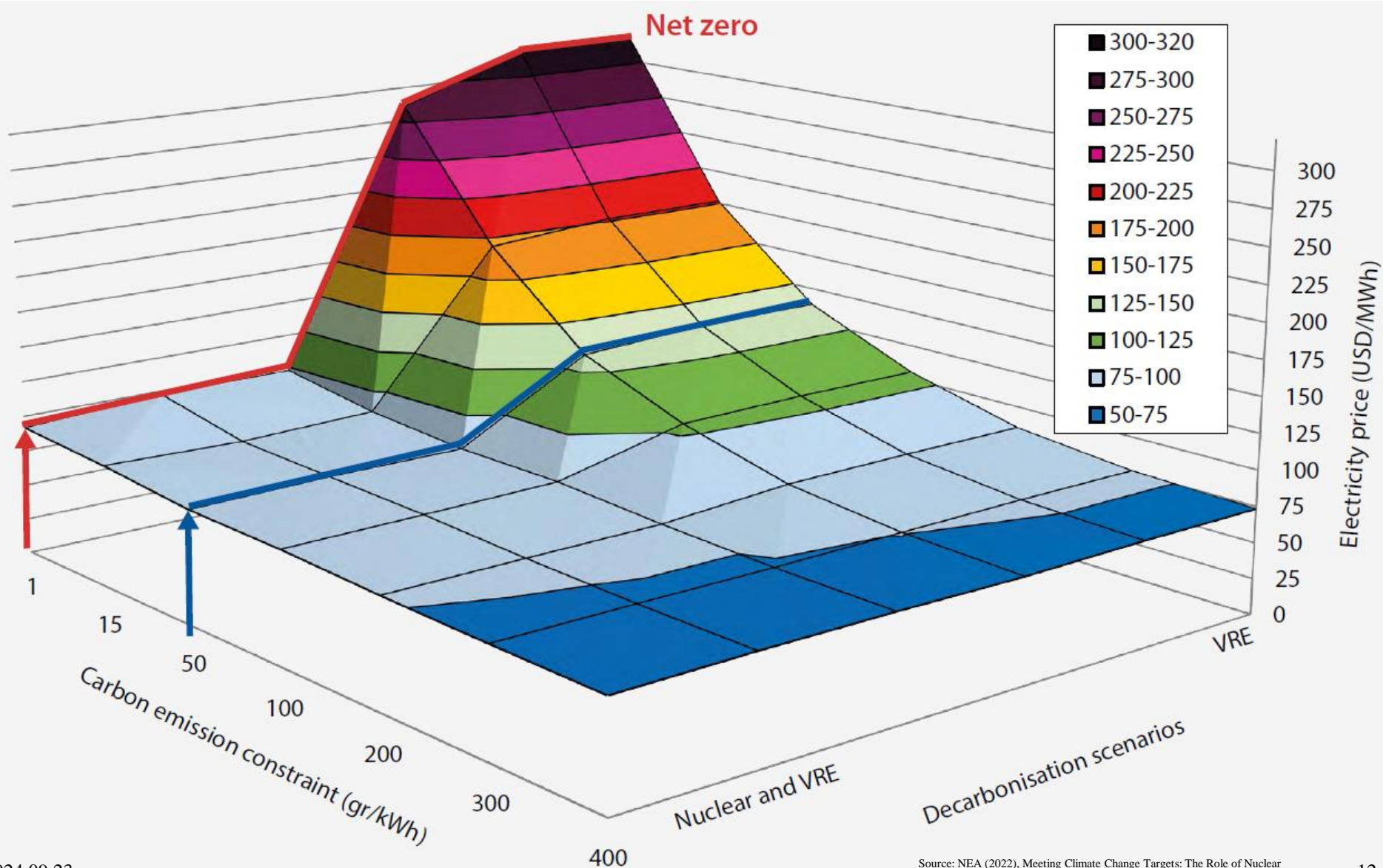


filmfoto / Getty Images

# "Green" does not necessarily mean sustainable!



# Driving to net-zero - costs

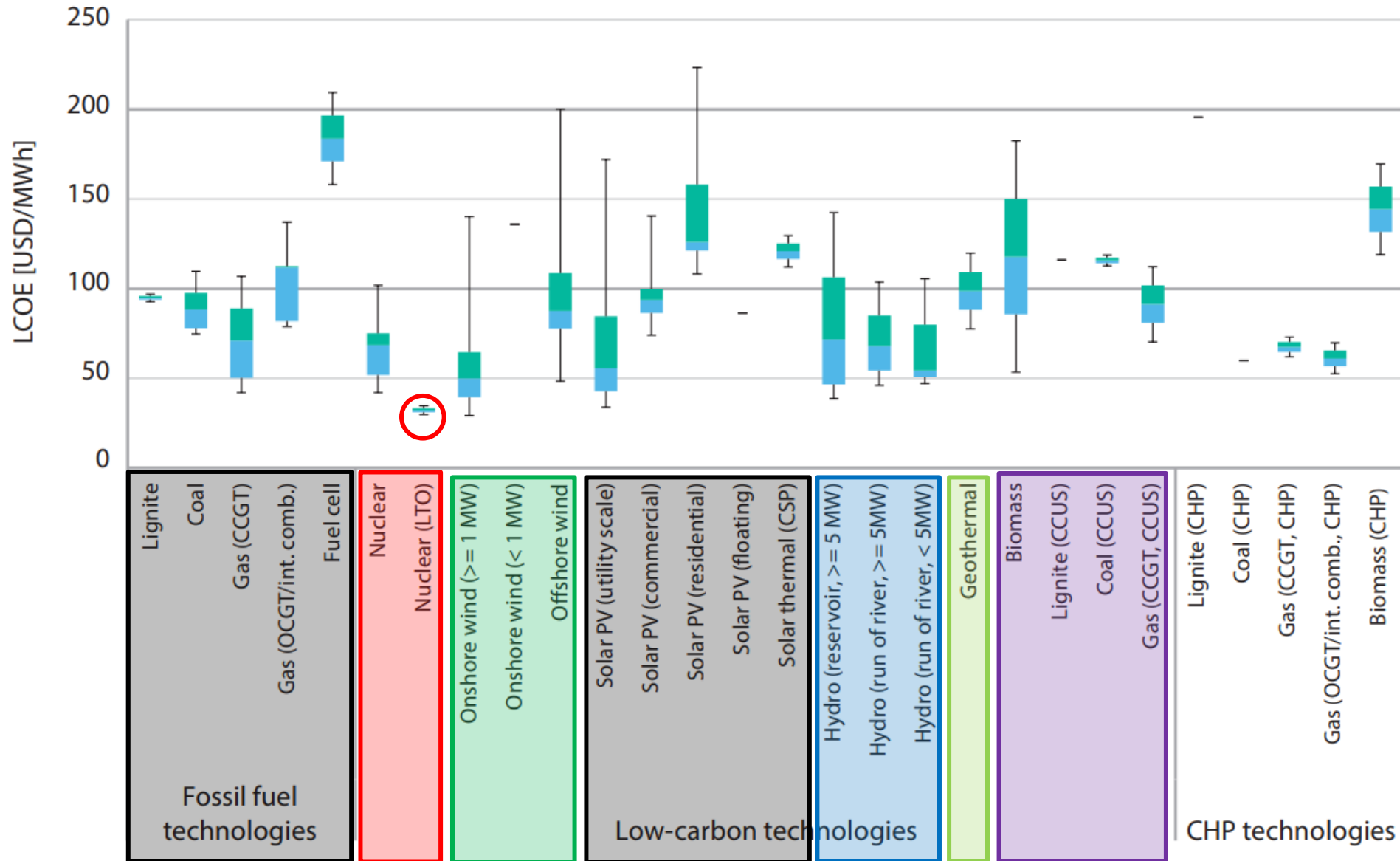


# Carbon neutral solutions

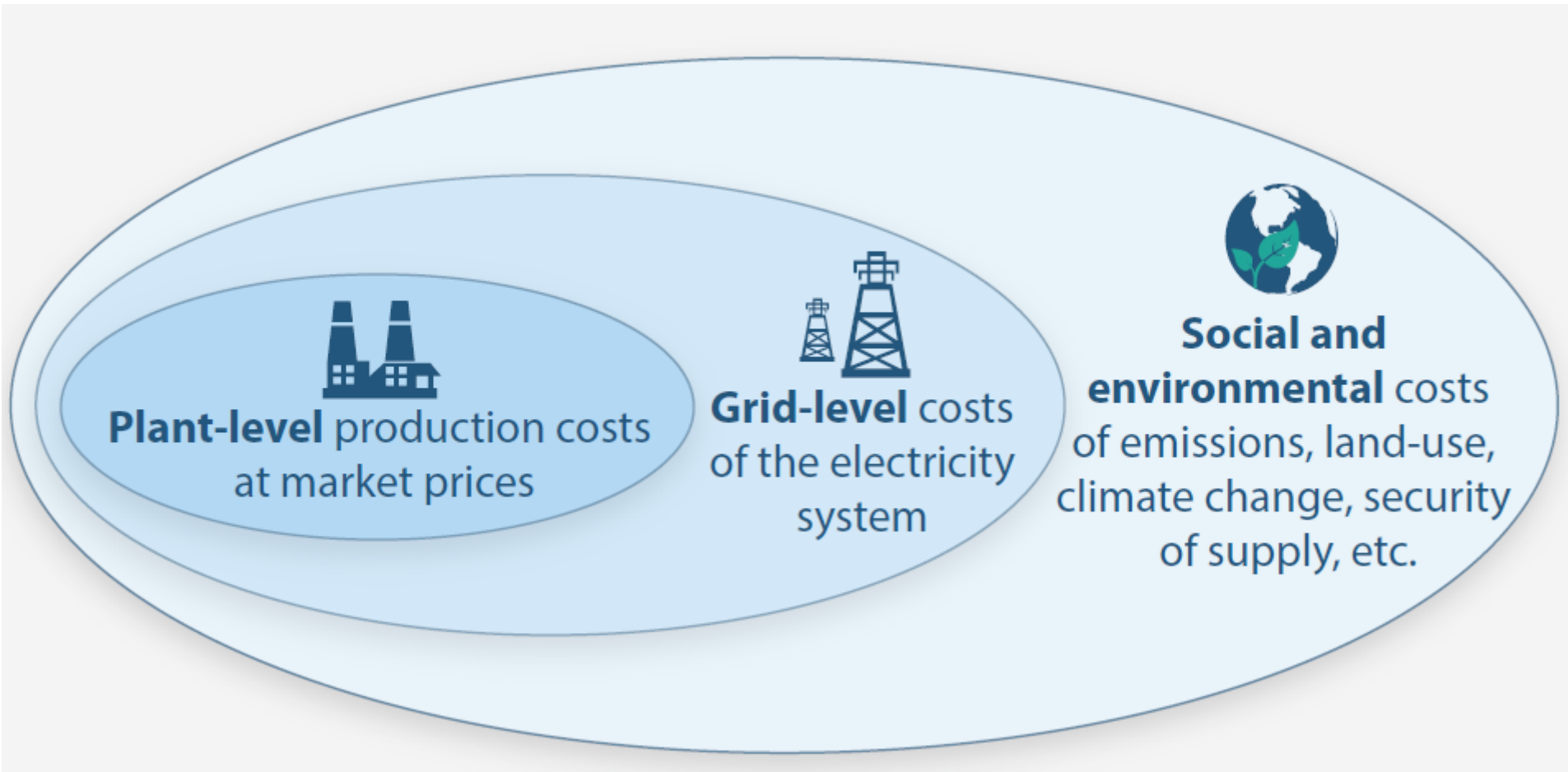
Hydro	Batteries	Long-term storage	Smart grids
Wind	Nuclear long-term operation (LTO)	Hybrid nuclear-energy systems	Demand side management
Solar PV	Large-scale Generation III nuclear	Small modular reactors (SMRs)	Energy efficiency
Biomass	Nuclear hydrogen	Nuclear heat	Behavioural changes
Synthetic fuels	Zero emission transport	Clean heat	Carbon Capture Utilisation and Storage CCUS



# Levelised cost of electricity - LCOE



# System costs of electricity supply



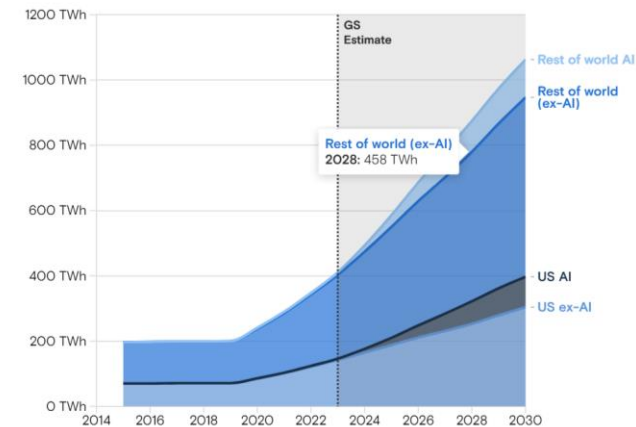
# Summary of energy perspectives

- Only **engineering** and innovative technologies can resolve the problems we face.
- **Stable and secure energy supply** is fundamental prerequisite of developed societies.
- Sustainability  $\neq$  renewable or “green”.
- Pillars of sustainability: environmental, social and economic.
- Sustainable engineering solutions must be **affordable**.
- **Electricity** will dominate energy supply.
- Future: **nuclear + renewables + storage**.
- The new energy system is heavily data-driven.
- At the same time, the **data-driven economy** itself leads to an increase in electricity demand.



Source: <https://www.unssc.org/news-and-insights/blog/sustainable-development-what-there-know-and-why-should-we-care>

Additional electricity demand for data centers



Source: <https://www.goldmansachs.com/pdfs/insights/pages/generational-growth-ai-data-centers-and-the-coming-us-power-surge/report.pdf>

# Acknowledgements

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