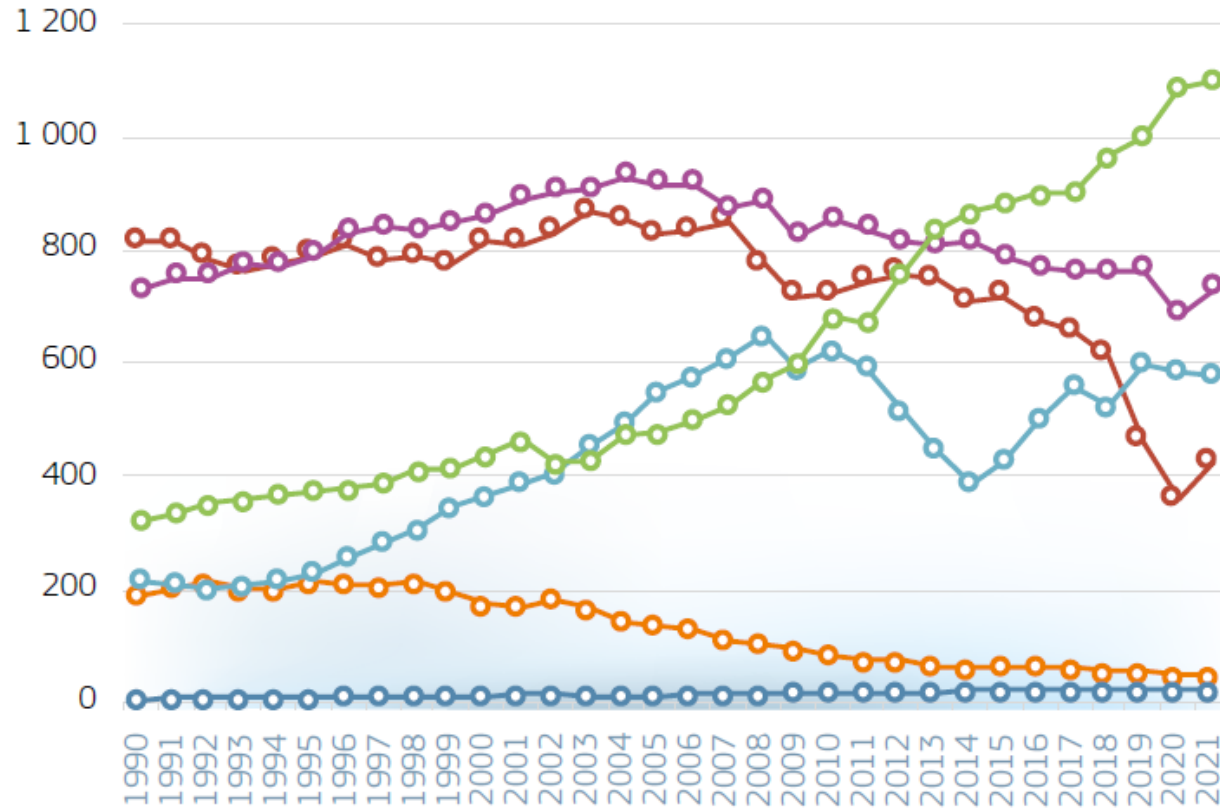


04 Building the IEM in electricity

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2.6.2 Gross Electricity Generation

EU27_2020 – BY FUEL – ALL FUELS – 1990-2021 (TWh)



Solid fossil fuels, peat, oil shale and sands

Renewables and biofuels

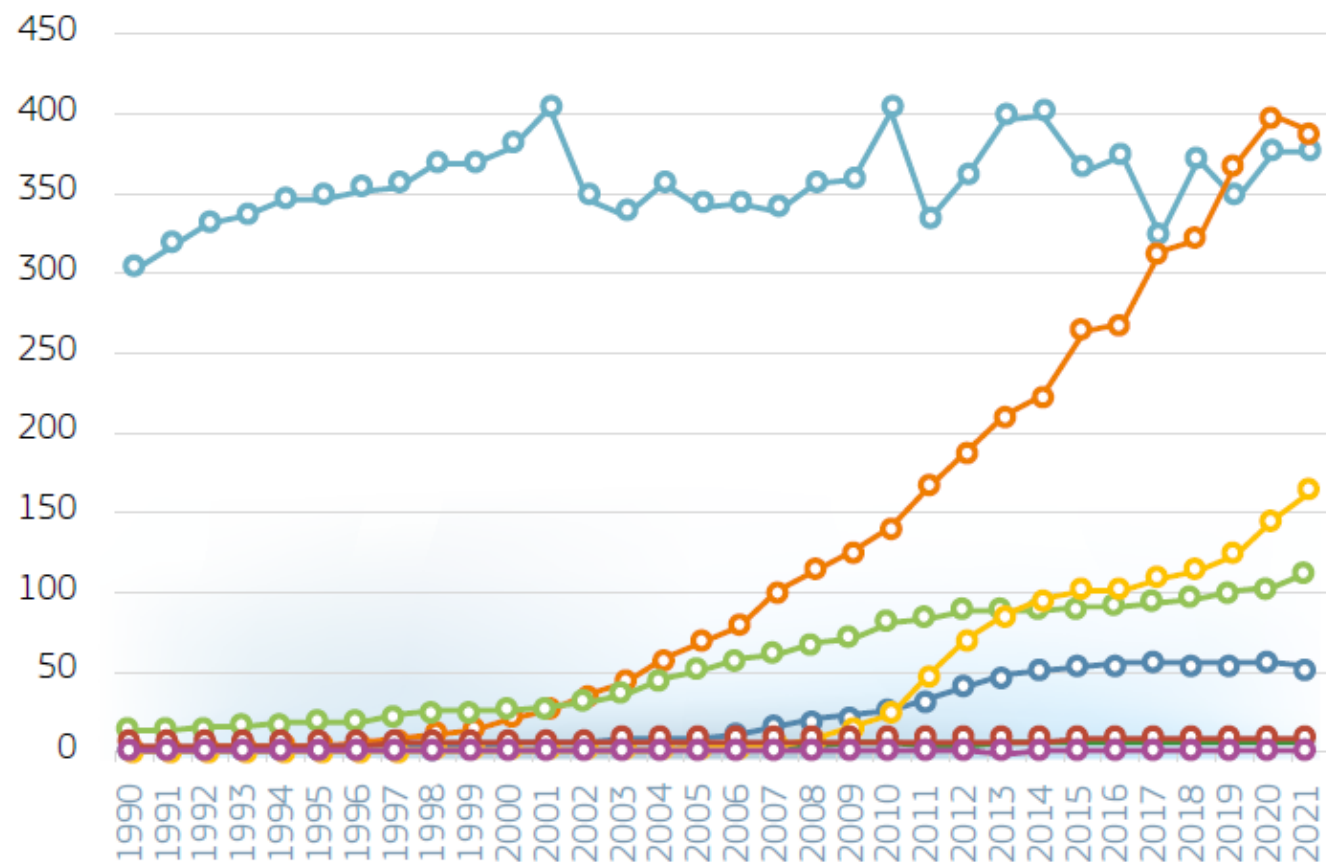
Nuclear

Natural and manufactured gases

Oil and petroleum products

Wastes non-RES

EU27_2020 – BY FUEL – GROSS ELECTRICITY GENERATION, BY FUEL: RENEWABLES – 1990-2021 (TWh)



Hydro

Solid biofuels and renewable wastes

Liquid biofuels

Geothermal

Wind

Biogases

Solar

Tide, Wave and Ocean

Renewable electricity

- In 2023, renewables are the main source of electricity, accounting for 44.7%, compared to 32.5% for fossil fuels.
- The EU aims to achieve 42.5% of energy from renewable sources by 2030.
- This development is primarily driven by a) EU policy objectives, b) national subsidies and regulations, and c) increasing technological competitiveness

Rapid decarbonization of the power sector

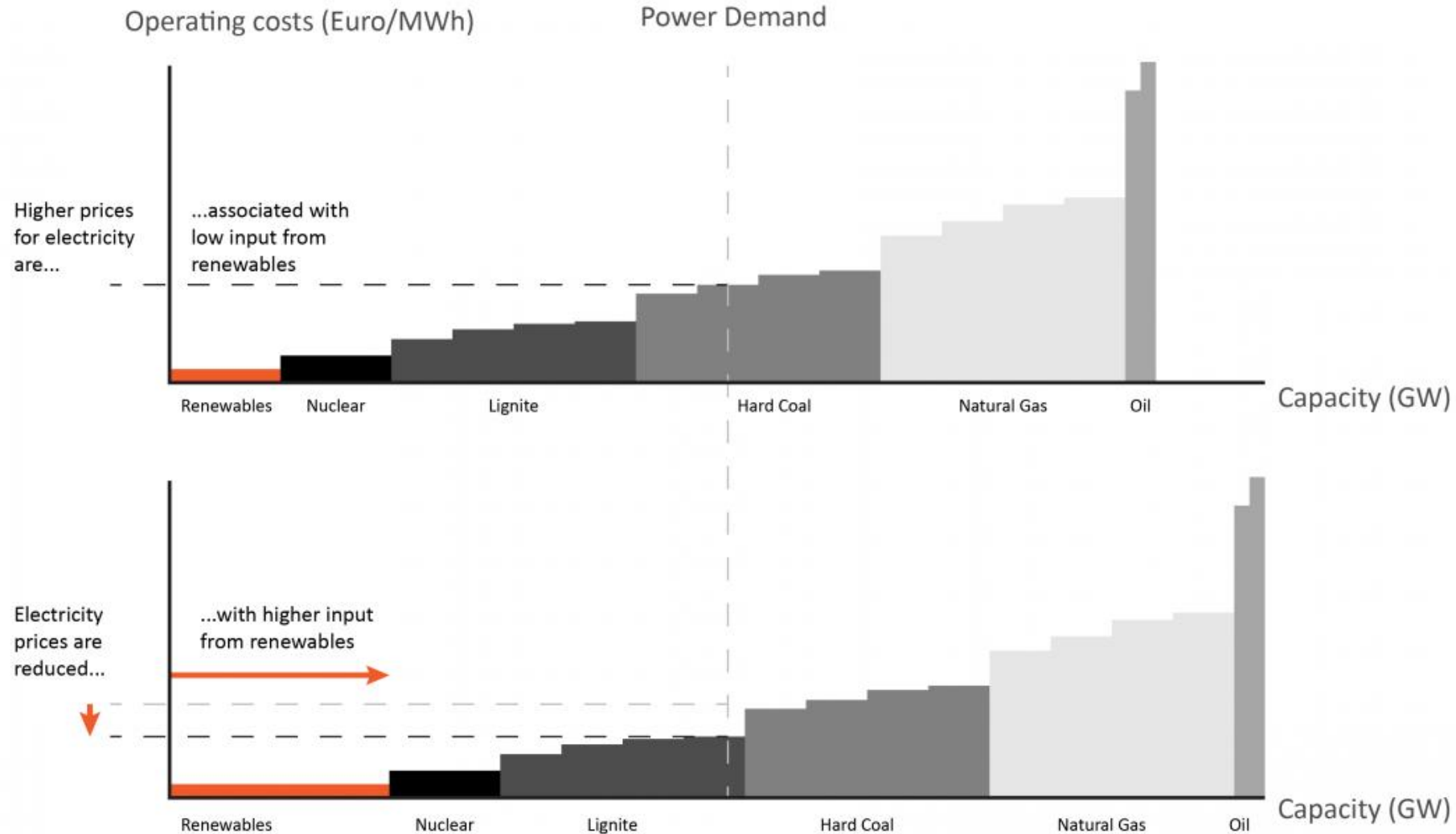
- New sources (RES) integrated into the established electricity system.
- Predictable and dispatchable sources are replaced by less predictable and non-dispatchable (weather-dependent) technologies.
- The existing system is under threat, but we don't have a new one and we don't know what it will look like.

RES impact on electricity price

Simple explanation: Subsidized RES electricity is pushing the price down.

Elaborated explanation: Merit order effect.

Illustrating electricity price fluctuations due to the Merit Order Effect

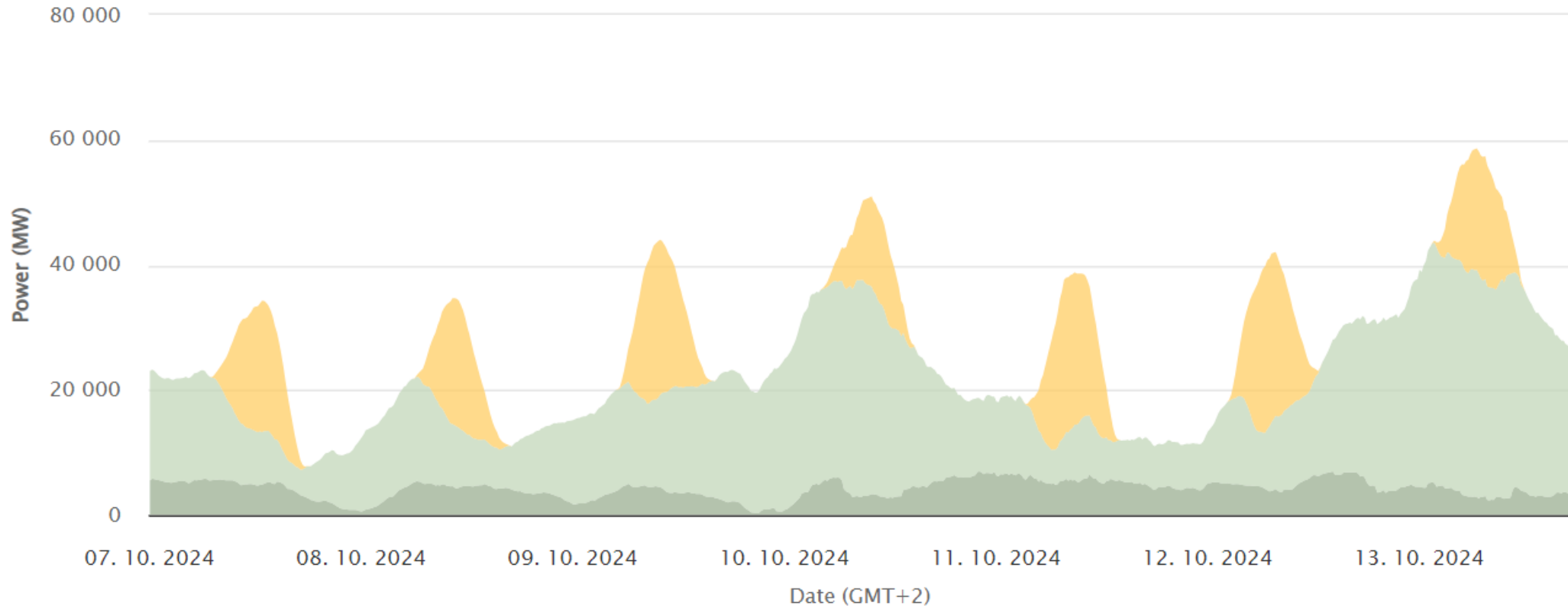


RES impact profitability of traditional sources

- = They drive the prices down.
- = They limit the time when other generators can make money.
- = They force the traditional sources to retire.
- = They prevent new (dispatchable) sources to be built.

Public net electricity generation in Germany in week 41 2024

Energetically corrected values



- Hydro-pumped-storage-consumption
- Biomass
- Fossil-oil
- Hydro-water-reservoir
- Waste
- Solar
- Renewable share of generation
- Cross-border-electricity-trading
- Fossil-brown-coal / lignite
- Fossil-gas
- Hydro-pumped-storage
- Wind offshore
- Load
- Renewable share of load
- Hydro-Run-of-River
- Fossil-hard-coal
- Geothermal
- Others
- Wind onshore
- Residual load
- Day Ahead Auction (DE-LU)

Solution 1. Energy-only market

- Generators are compensated solely based on the quantity of electricity they produce.
- Peak Load Pricing Theory: Ensures capacity adequacy, as prices are expected to increase when market participants foresee potential shortages, prompting new investments.
- In RES context relatively new concept with limited practical experience.
- Political and regulatory constraints can hinder market dynamics.
- Susceptible to boom-and-bust cycles.
- The system's limited electricity storage capability, combined with uncertainties in supply and demand, as well as inelastic demand, results in high price volatility, especially when reserve margins are low.

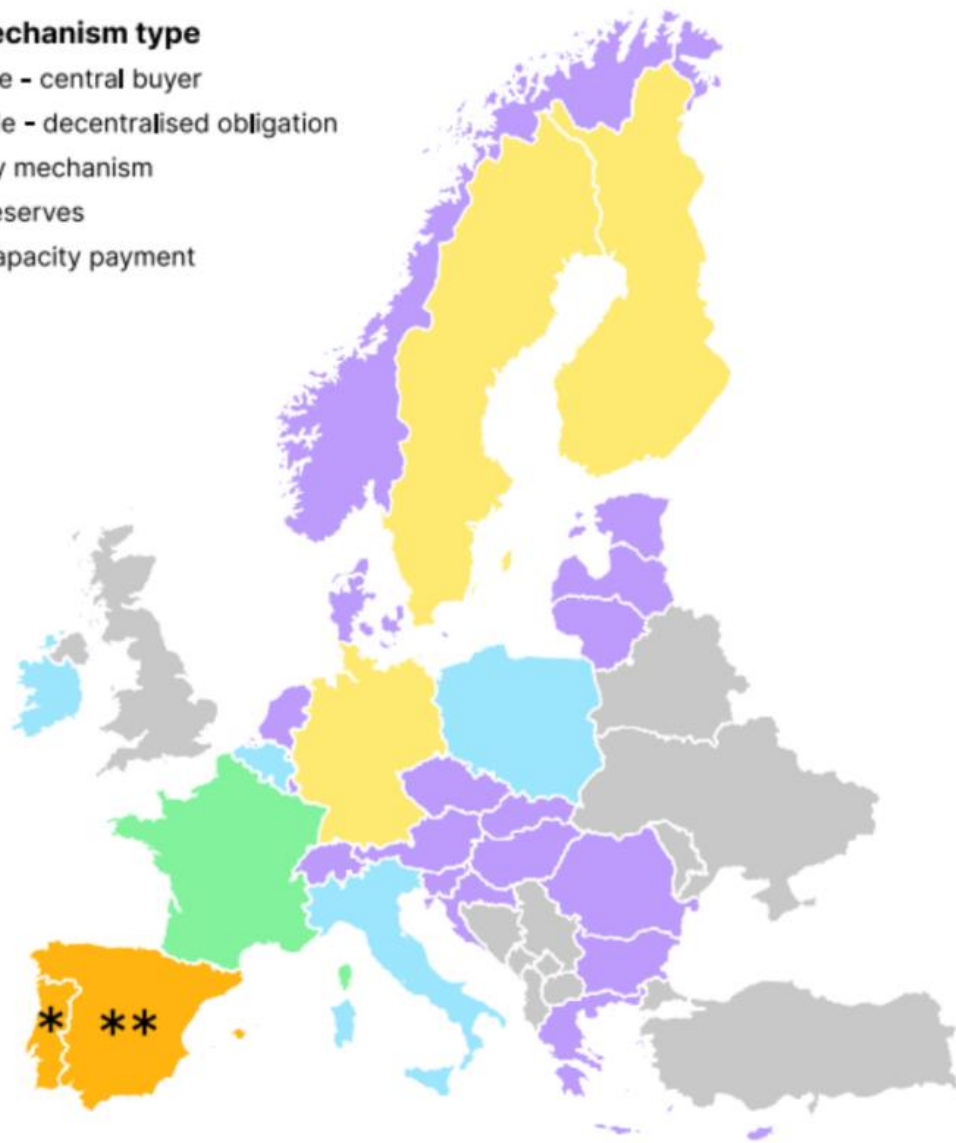
Solution 2. Capacity mechanisms

= capacity remuneration, Designed to address the issue of weak investment incentives by providing payments for maintaining available generation capacity.

- Replaces market-driven investment with "central planning," introducing considerable regulatory risk and costs for investors and consumers.
- Usually not open to cross-border participation.
- Strategic Reserves: Activated only in emergencies, not participating in the market under normal conditions.

Capacity mechanism type

- Market-wide - central buyer
- Market-wide - decentralised obligation
- No capacity mechanism
- Strategic reserves
- Targeted capacity payment



Source: ACER based on NRA data.

Challenges of increasing RES share

- Costs of subsidies
- Financial models/Market design challenges
- Price cannibalisation
- Flexibility needs
- Market liberalization vs. regulation
- Grid stability and infrastructure upgrades
- Social acceptance and land use conflicts
- Cross-border coordination issues
- Declining capacity factors
- Curtailment policies

Sources of flexibility in the EU and other regions

