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ENERGY RESEARCH

The Kraftwerksstrategie and the future of gas power plants in Germany

Short presentation at Strommarkttreffen Workshop in Berlin

April 19, 2024

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- Renewables & PPAs
- Storage
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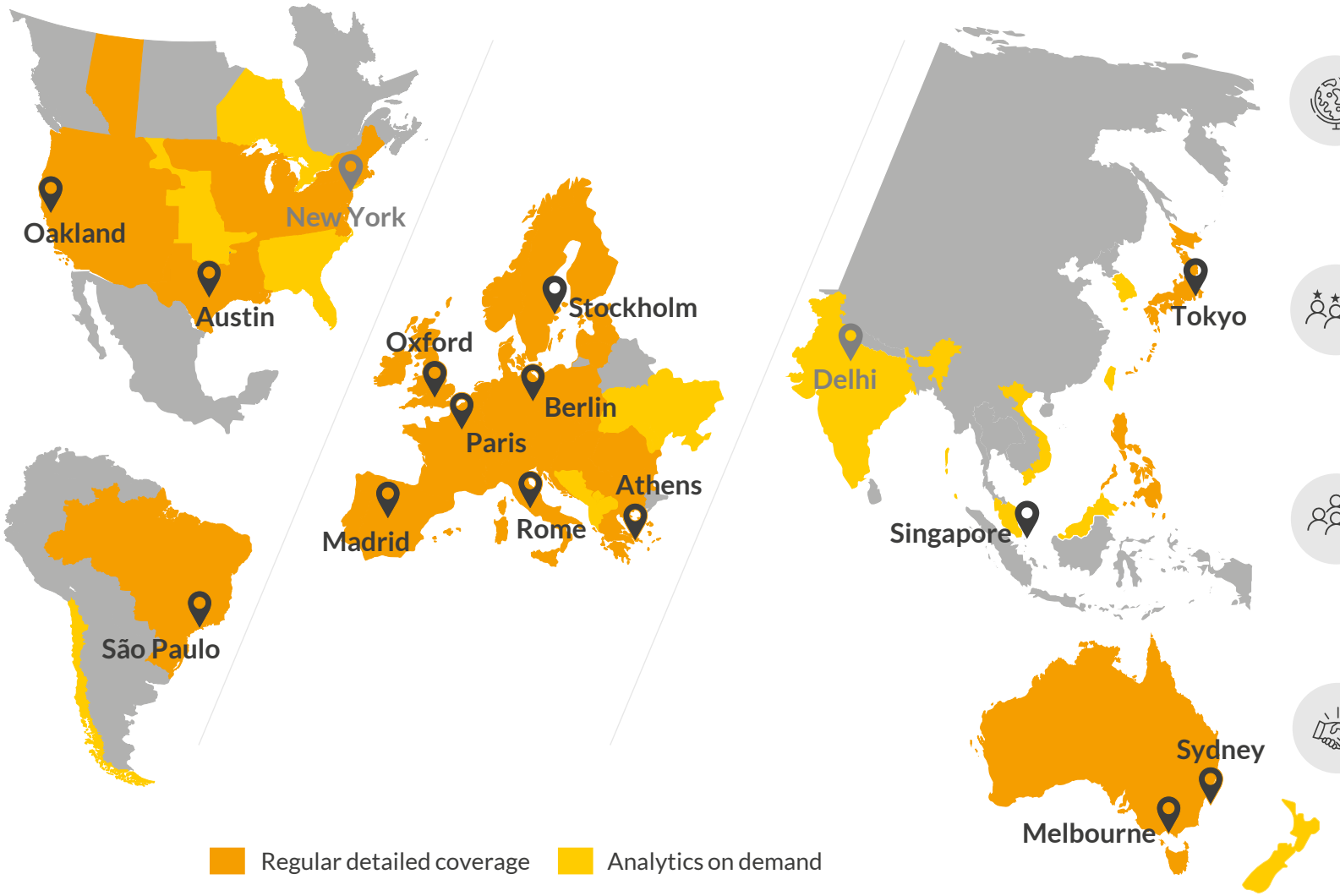
- Electric vehicles
- Hydrogen H_2
- Carbon CO_2
- Natural gas



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Source: Aurora Energy Research

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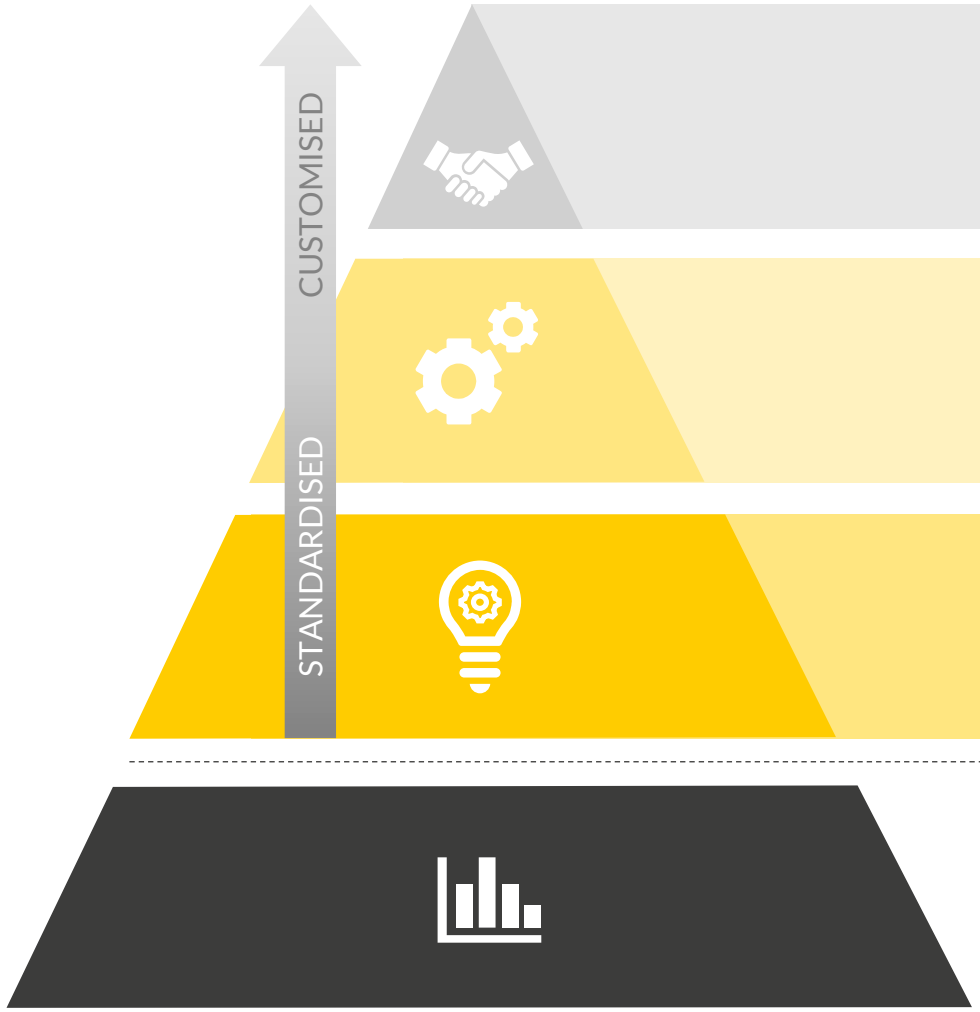

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Source: Aurora Energy Research

Coal plant closures and a growing power demand will create a gap between peak demand and dispatchable thermal capacity

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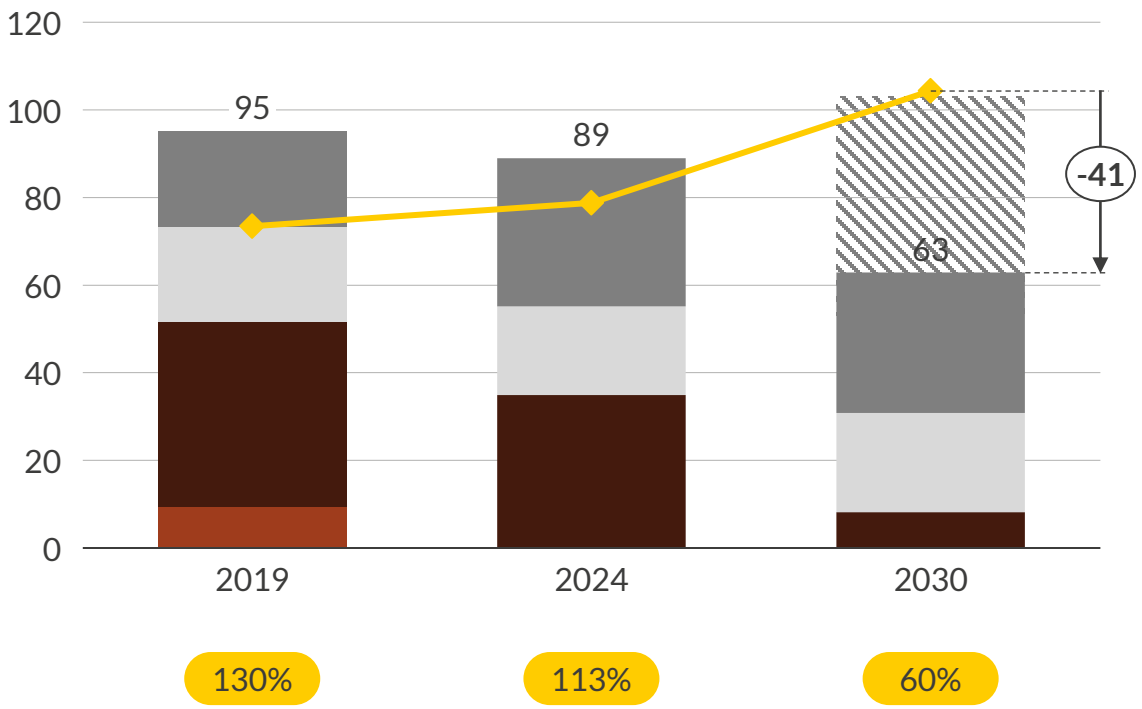
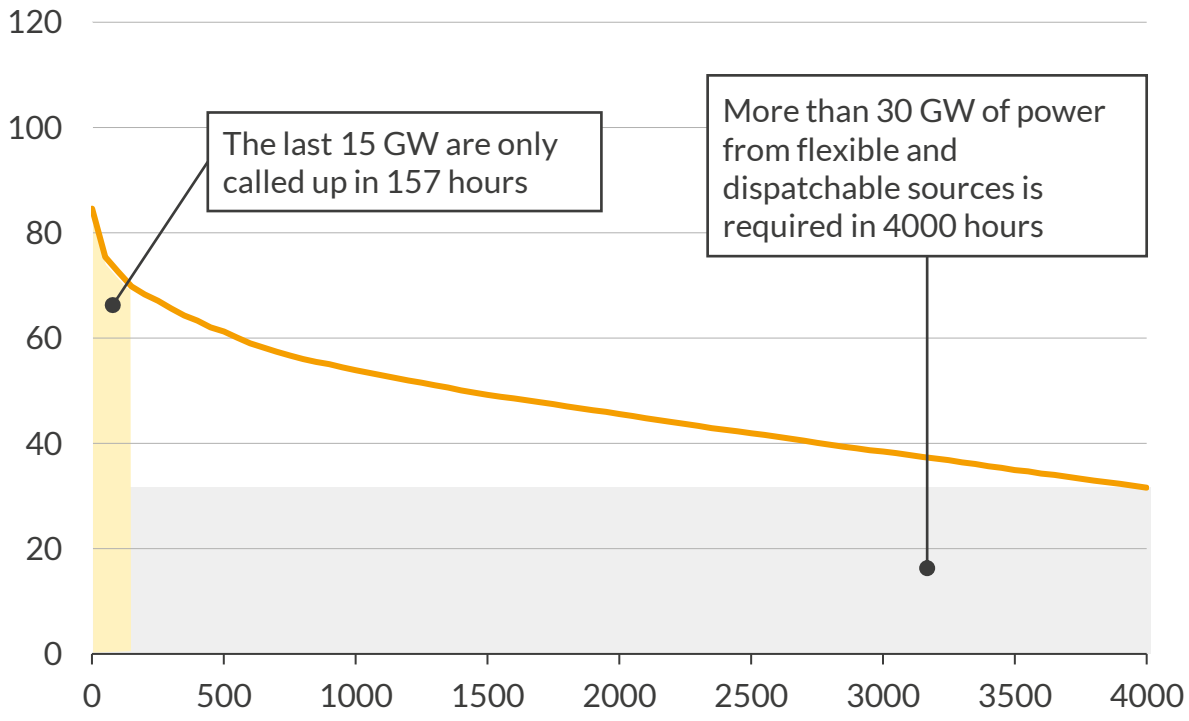
Peak demand and dispatchable capacity without new gas-fired power plants[1]

GW



Residual load duration curve[4] in 2030

GW



Peak demand
Gas[2]
Other dispatchable technologies[3]
Hard coal & lignite
Nuclear
Share of dispatchable capacity of peak demand

1) Based on the Aurora Central scenario, but no further buildout of gas-fired power plants (except for CHPs) is assumed. 2) Includes CCGTs, OCGTs and other thermal peaker. 3) Includes hydro, biomass and other thermal. 4) Residual load is defined as total energy demand, minus the power production of wind & solar.

Source: Aurora Energy Research, BNetzA

There are several technologies available to complement renewable generation; this study focusses on gas and H_2-fired power plants in line with the KWS

A Short-duration flexibility

- Battery storage
  - Lithium-ion
  - Redox-flow
- Compressed air storage
- **Natural gas OCGT & reciprocating engines**
- **Hydrogen OCGT & reciprocating engines**

B Mid- to long-duration flexibility

- Natural gas CCGT + CCS
- Biomass & CCS
- Biogas
- E-methane
- **Natural gas CCGT**
- **Hydrogen CCGT**

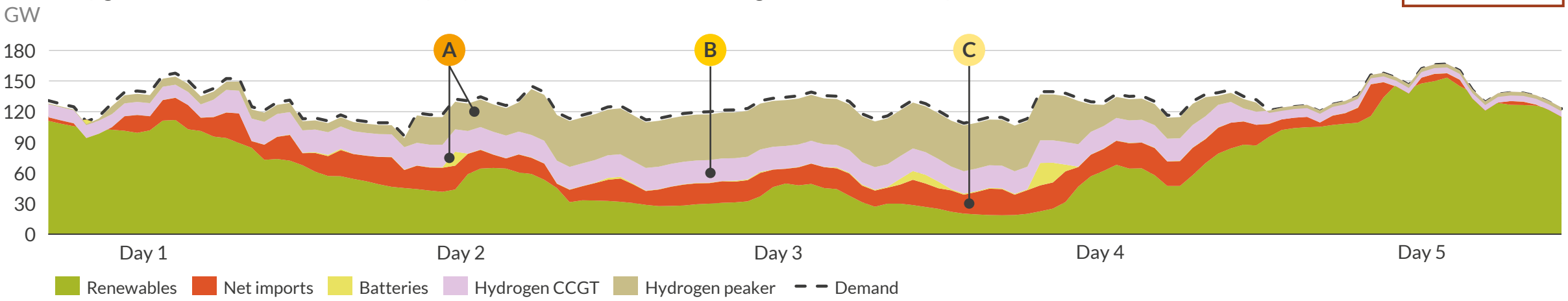
C Alternative flexibility sources

- Interconnection
- Demand side response
  - Smart charging electric vehicles
  - (Hybrid) heat pumps
  - Electric boilers
  - Industrial demand side response
  - Electrolysers

Focus of this study

Electricity generation and demand in an exemplary week with low wind and solar generation in January 2045

Illustrative



Sources: Aurora Energy Research

Germany's *Kraftwerksstrategie* (KWS) is set to deploy 10 GW of H_2-ready power plants as a bridge to a potential capacity mechanism in 2028

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Up to **10 GW of new H_2-ready gas plants** form the core of the KWS

Announcement of a **capacity mechanism**

New H_2-ready natural gas power plants

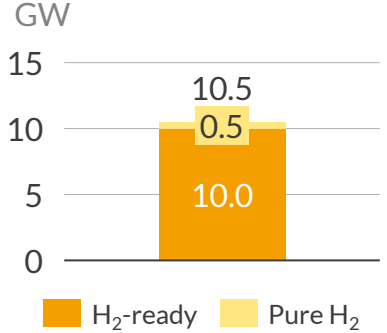
Focus of this study

- 4 auction rounds of 2.5 GW each for CAPEX subsidies
- Full conversion to hydrogen[1] required between 2035 and 2040[2]
- OPEX subsidy to cover the fuel price difference to natural gas[3]
- Funding needs of 15 – 20 bn €, to be financed out of the KTF[4]

H_2 power plants

- 500 MW of pure H_2 plants for research and exploratory purposes

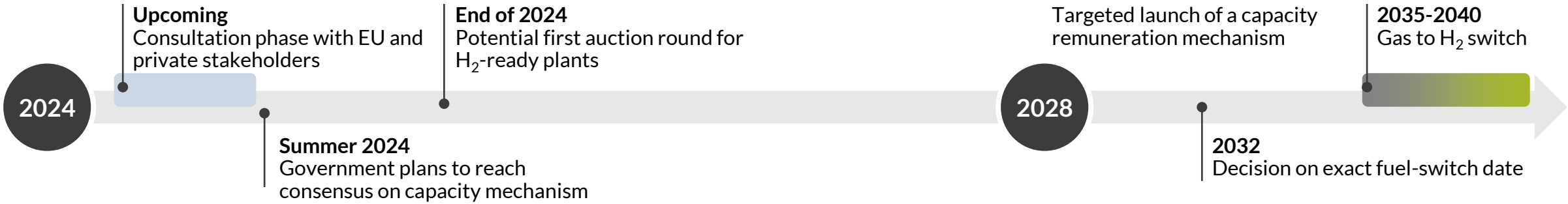
New capacity announced



Auction for long duration energy storage (LDES) technologies

- Technology-neutral tender for LDES technologies, details still under consideration

- The government has committed to developing concepts for a **market-based capacity mechanism** to be **launched by 2028**
- Focus for this mechanisms is on **technology-neutrality**, i.e. allowing different generation technologies, storage, and demand-side response options to participate
- The new gas-fired power plants incentivised via the **KWS** are meant to be **"fully integrated" into the capacity mechanism**
- The **role of CCS** is not yet defined



Introduction of both KWS and capacity mechanism hinge upon **approval under EU state aid law**

1) Not restricted to electrolytic (green) hydrogen, blue hydrogen can also be used as a fuel. 2) Exact conversion date to be defined in 2032. 3) Available until 2040 for max. 800 full-load hours per year. 4) *Klima- und Transofrmationsfonds* (Climate and transition fund).

Source: Aurora Energy Research

For the KWS to successfully incentivise the buildout of new gas plants, key questions need to be answered before start of the auctions

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When will the KWS plants and other newbuilt plants have to convert to hydrogen? Is there a single date for all plants?

The business case is driven by profits in the “natural gas era”, but limited OPEX subsidies during “H2 era” can avoid uncertainty for KWS assets.

How does the KWS interact with the announced capacity mechanism?

After conversion to hydrogen and end of the OPEX support, we expect additional capacity revenues necessary for continued operation.

Which costs are covered by the OPEX subsidy?

Sizeable differences not only exist for the fuel cost (gas versus hydrogen), but also for grid connection costs.

Is there a need for a local incentive?

Especially in the south, coal plants leaving the market put pressure on the system, but regional subsidy elements are not trivial.

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