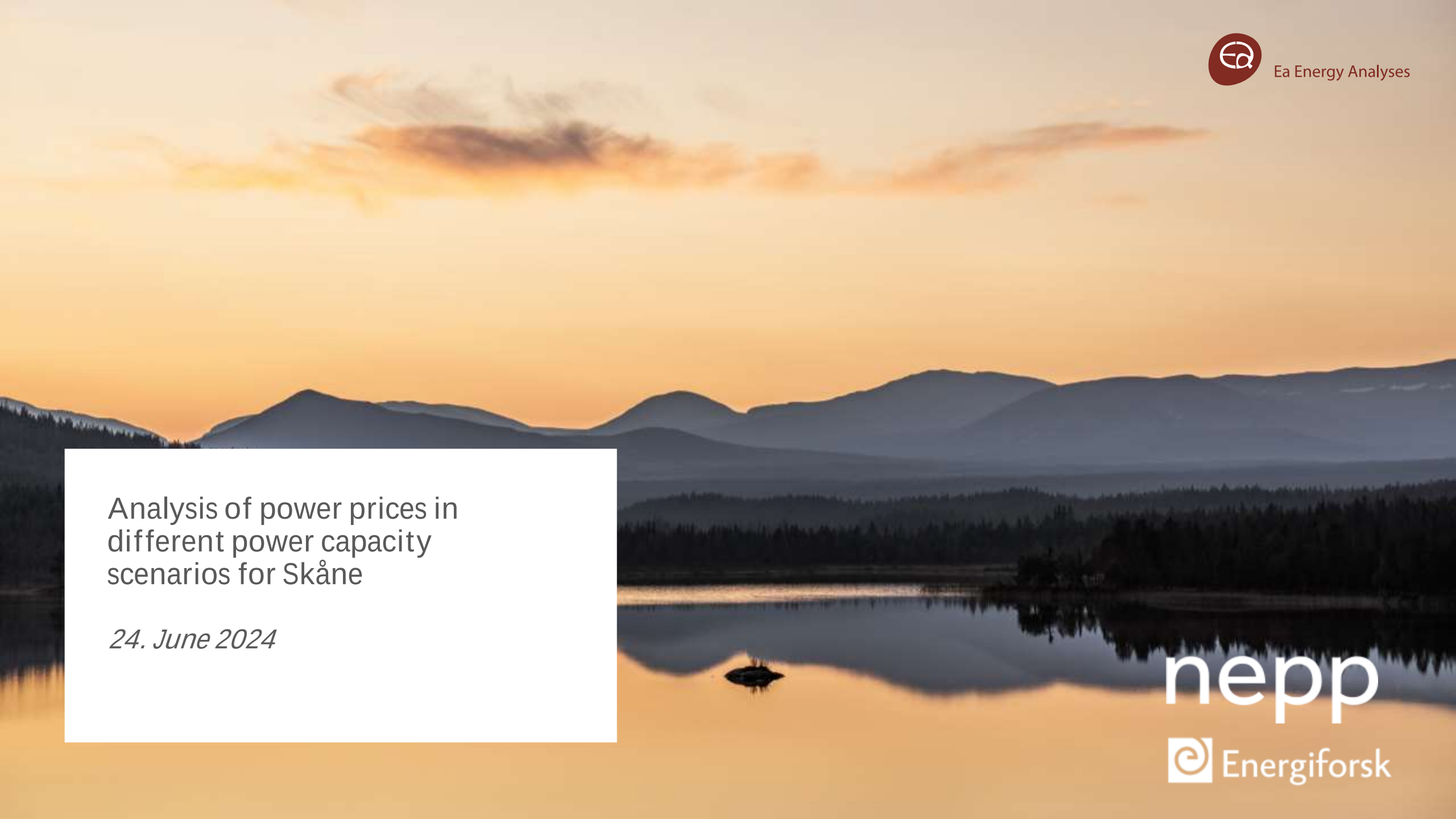

Ea Energy Analyses

Analysis of power prices in different power capacity scenarios for Skåne

24. June 2024

nepp

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Key messages

✓ We analyse two scenarios for the development of the power system in Skåne by 2030.

- A **Reference** with no capacity buildout and a scenario building on the strategy from **Effektkommissionen**
- The Effektkommission strategy includes new thermal and renewable generation capacity, energy efficiency measures and more flexible demand in Skåne

✓The Reference displays average power prices of about 77 EUR24/MWh in SE4 compared to just 38 EUR24/MWh in the Effektkommission scenario.

✓The Reference see unvoluntary load-shedding in about 90 hours, where power prices reach the price ceiling. Load-shedding does not take place in the Effektkommission scenario.

✓If loadshedding is avoided in the Reference, for example through demand response measures, the average SE4 price would drop to 53 EUR24/MWh

✓The price effects displayed reflect short-term effects in the power market from the two scenarios.

✓Over time, large investments in wind and solar power in Skåne may crowd out investments in renewable energy technologies in neighbouring bidding zones or stimulate investments in new demand, for example Power-to-X. This would bring prices back to a market equilibrium displaying higher average prices than observed in the Effektkommission scenario.

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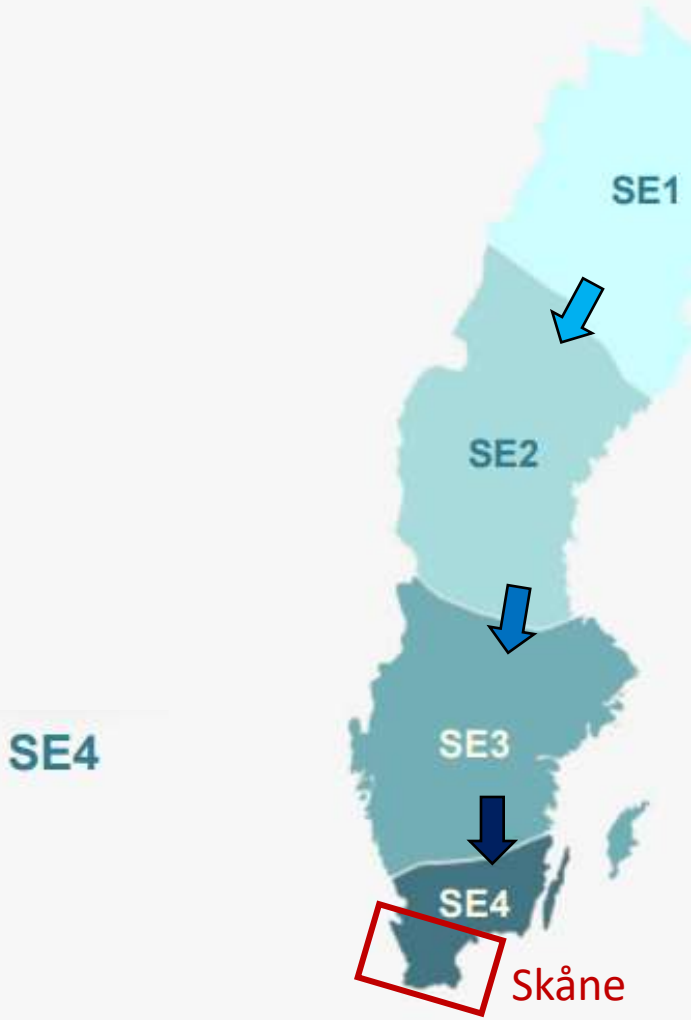
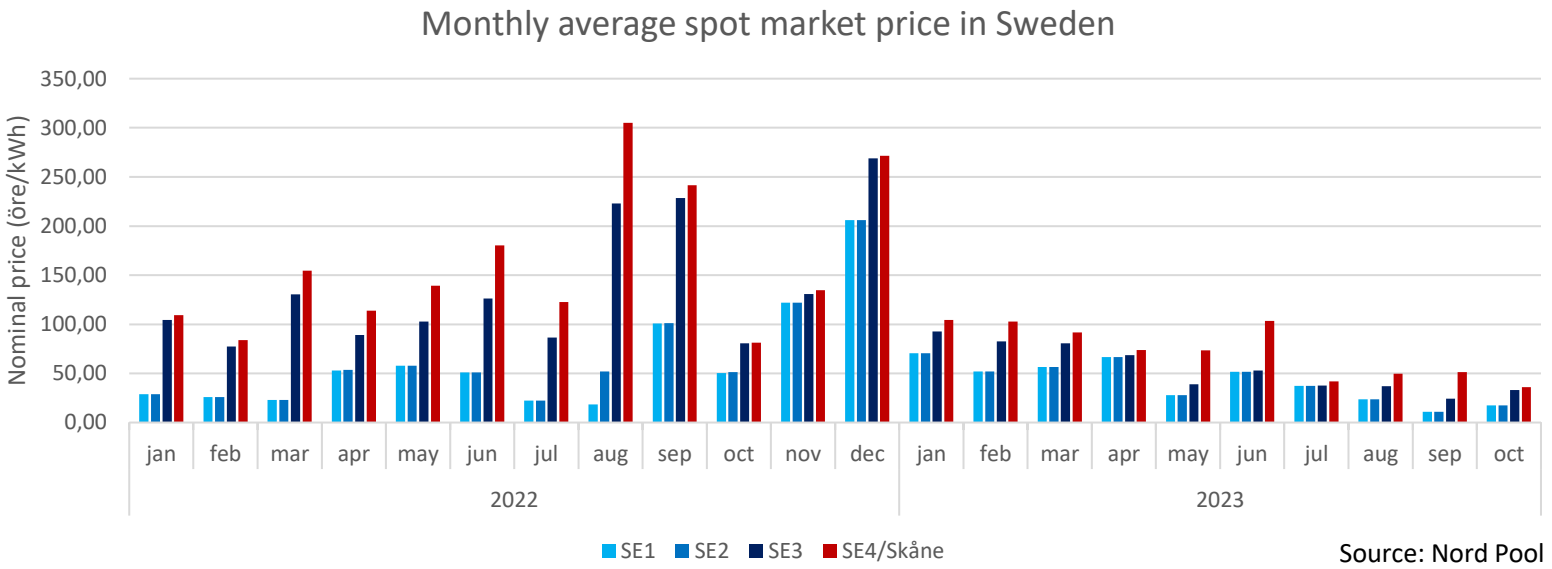
Skåne/SE4 sees higher average electricity prices than the rest of Sweden





Source: Nord Pool

Because of **transmission interconnection** to central European bidding zones with higher marginal cost of electricity generation and higher **net electricity import dependency**, **Skåne**, which is located in the SE4 bidding zone, **is seeing higher average electricity prices** compared to the other Swedish bidding zones.

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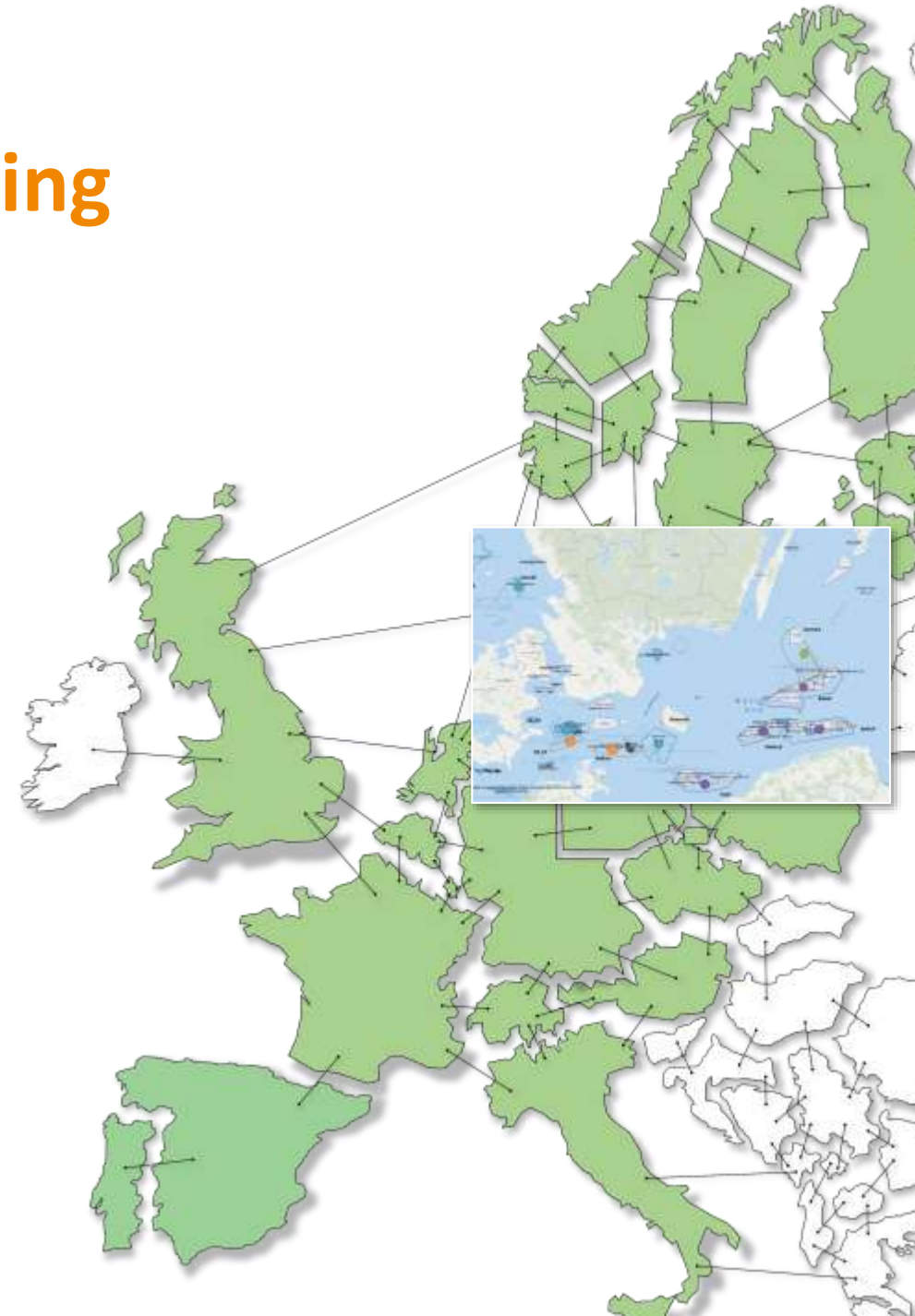
Approach to power market modelling

- Modelling tool: **Balmorel** power market model
  - Simultaneous investment and dispatch optimization.
  - Optimization of power plant dispatch and replication of day-ahead power price formation.
- Modelling year: **2030**
- Geographic scope: Europe (green countries on map)
- Technology scope:
  - Power generation technologies, transmission capacity between bidding zones, district heating, hydrogen production and related infrastructure
  - Offshore wind with close to site level detail
- Sweden and Europe pursue a net zero energy system
  - Electrification, including a large need for green hydrogen
  - EU 2030 hydrogen production expected to lack behind REPowerEU target.
  - Swedish electricity demand increases to 189 TWh by 2030



We are analysing two energy scenarios for SE4 in 2030

1. Reference scenario
   - Existing generation capacity including projects expected to be commissioned before 2025
   - No further buildout of capacity thereafter
   - Demand projection according to ‘Energimyndighetens högelscenario’
2. Effektkommissionen
   - Expansion with **thermal** and **variable** generation capacity in Skåne
   - **Energy efficiency** measures curb the increase in demand in Skåne
   - **Batteries** and **flexible demand**

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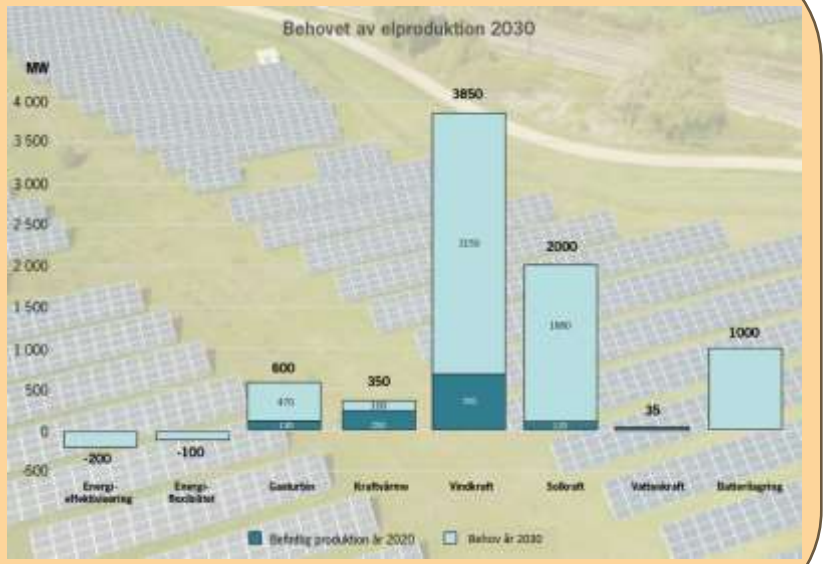
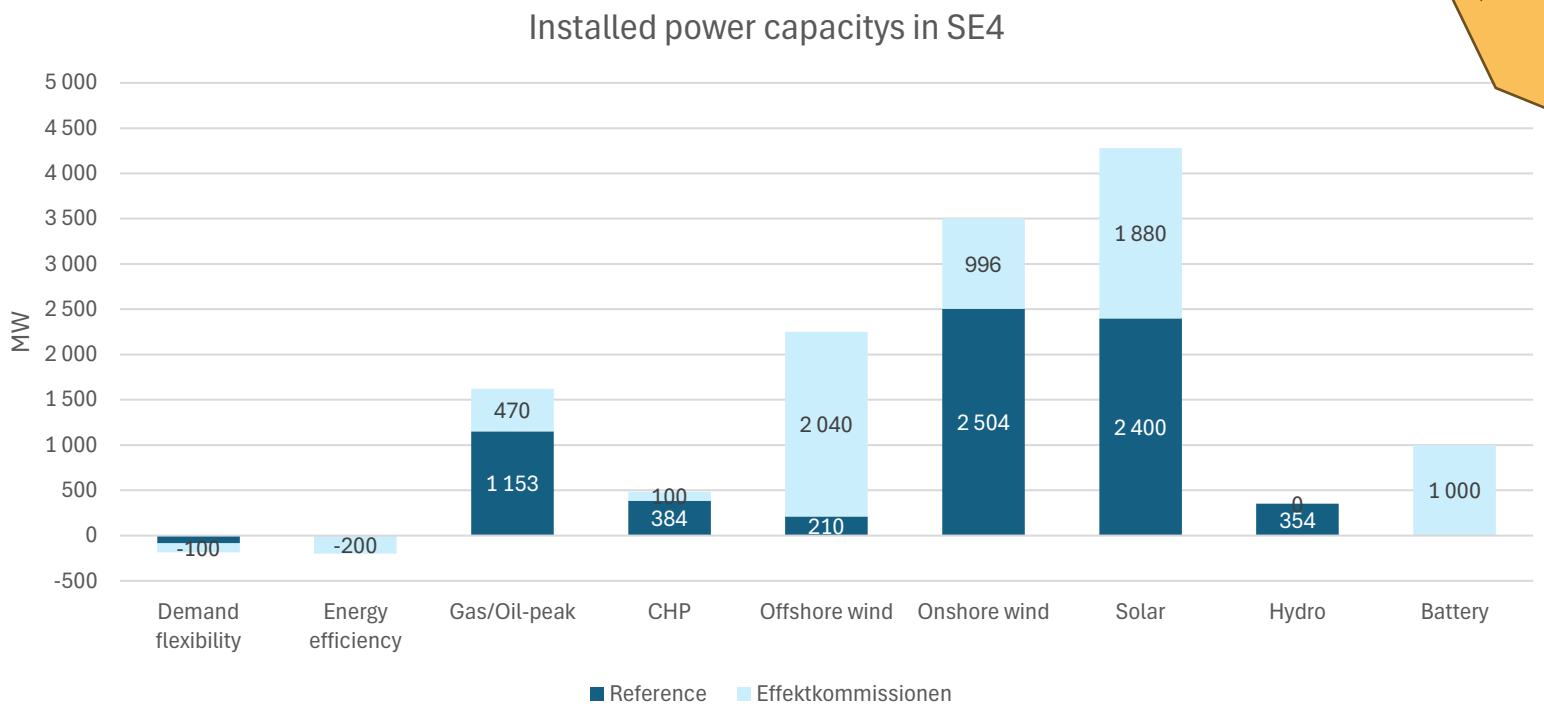
Assumptions

- Effektkommisionens strategy for Skåne is translated to SE4.
  - Skåne represents about 70% of the demand in SE4.

Effektkommissionen's strategy for Skåne





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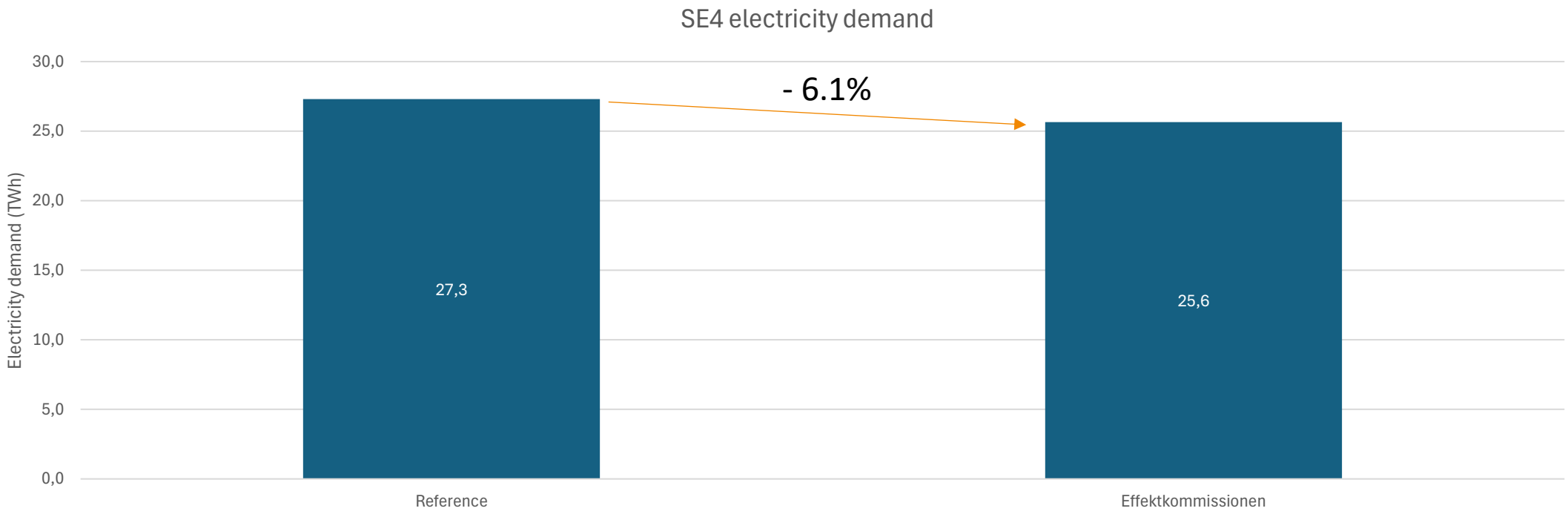
Assumptions

- Energy efficiency measures of the Effektkommissionen are reducing the total electricity demand in SE4 by 6.1% in 2030



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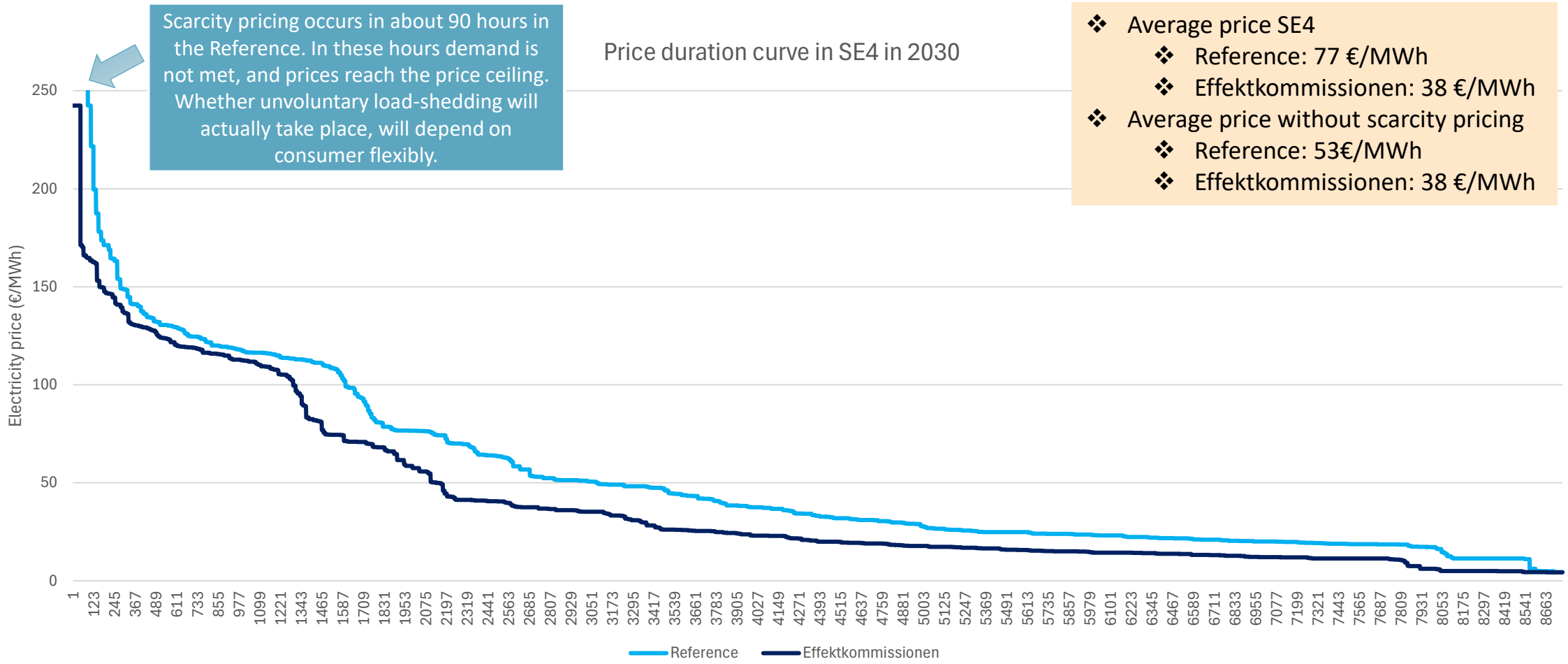
Price effects

Scarcity pricing occurs in about 90 hours in the Reference. In these hours demand is not met, and prices reach the price ceiling. Whether unvoluntary load-shedding will actually take place, will depend on consumer flexibly.



- Average price SE4
  - Reference: 77 €/MWh
  - Effektkommissionen: 38 €/MWh
- Average price without scarcity pricing
  - Reference: 53€/MWh
  - Effektkommissionen: 38 €/MWh

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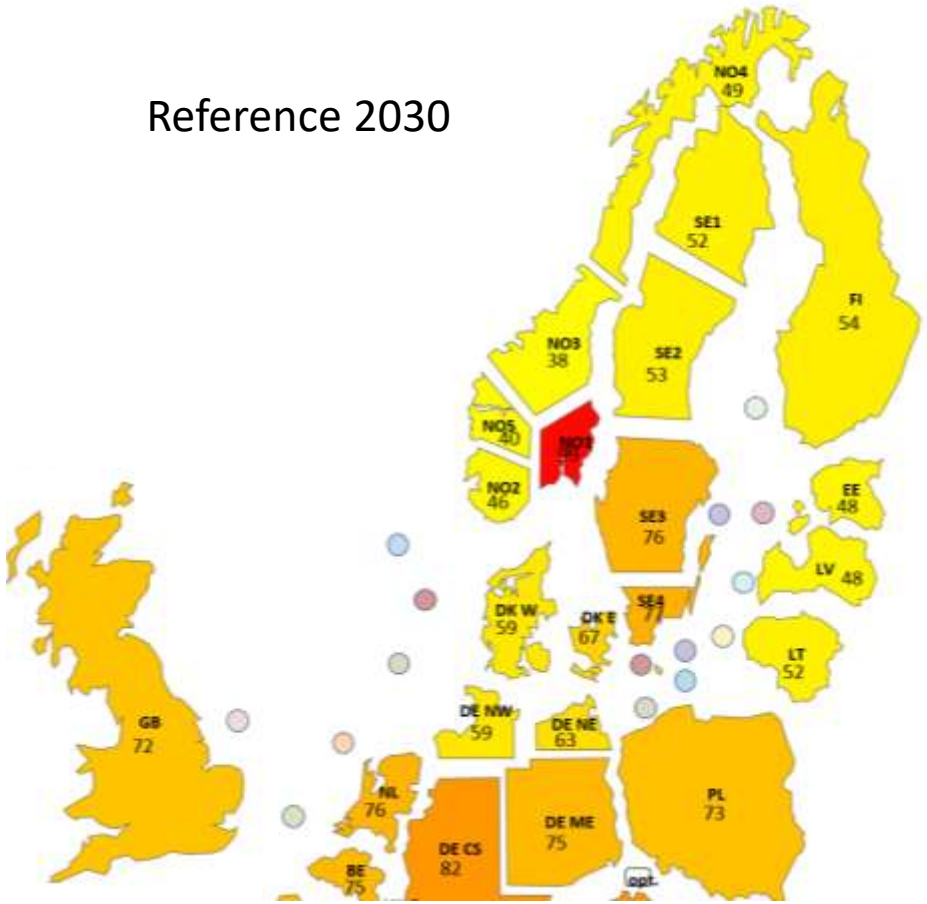
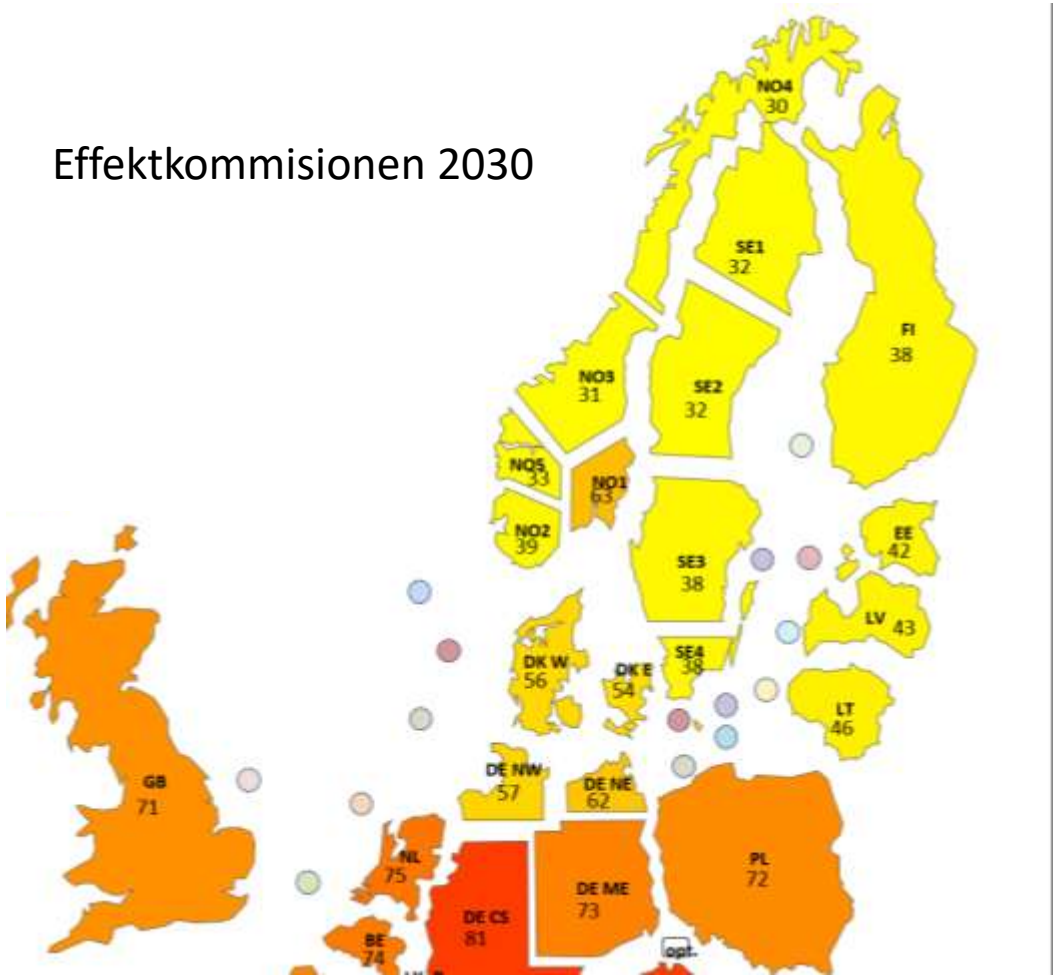
Average price map northern Europe

Reference 2030



Effektkommisionen 2030



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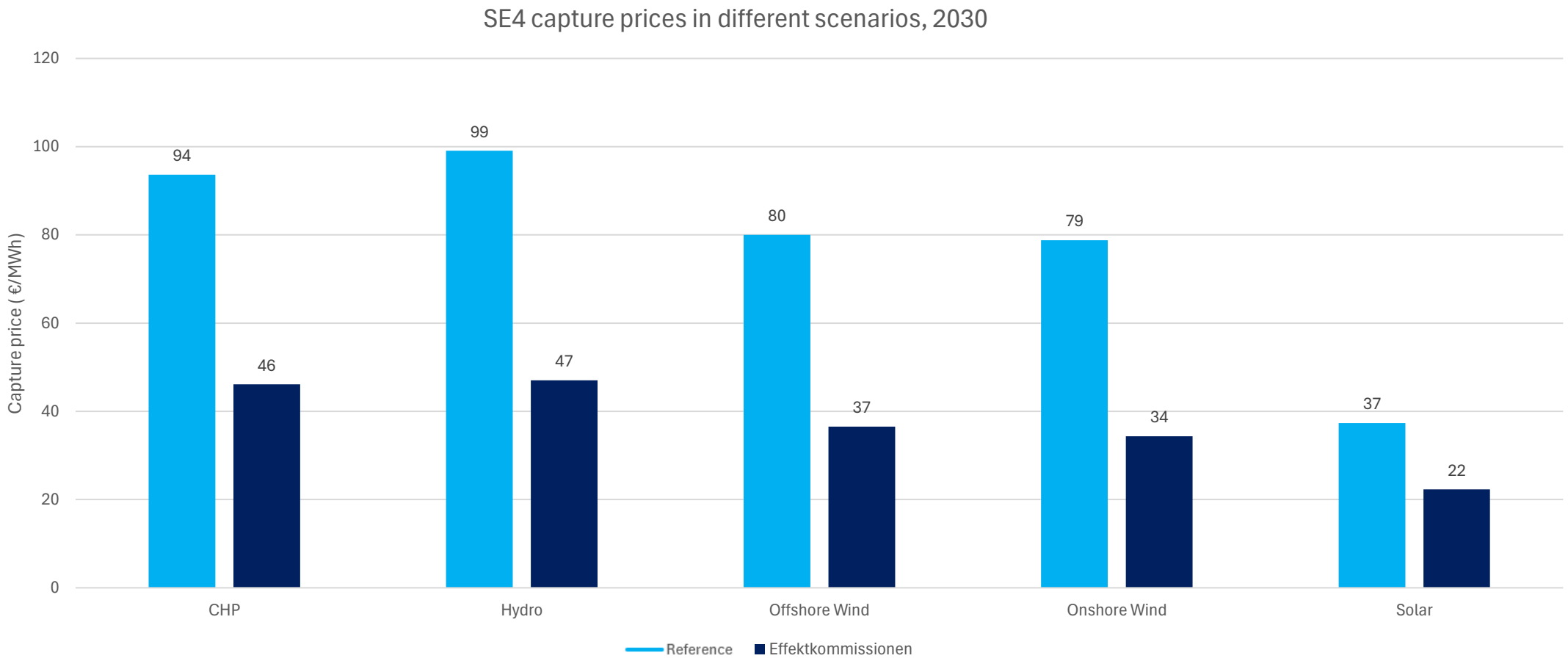
Capture prices in SE4



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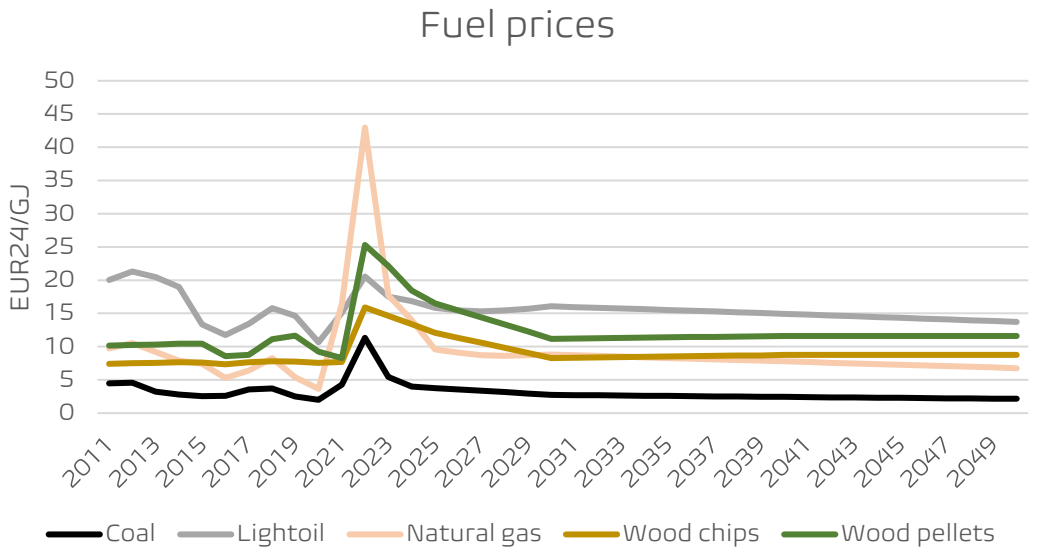
Fuel and CO_2 prices

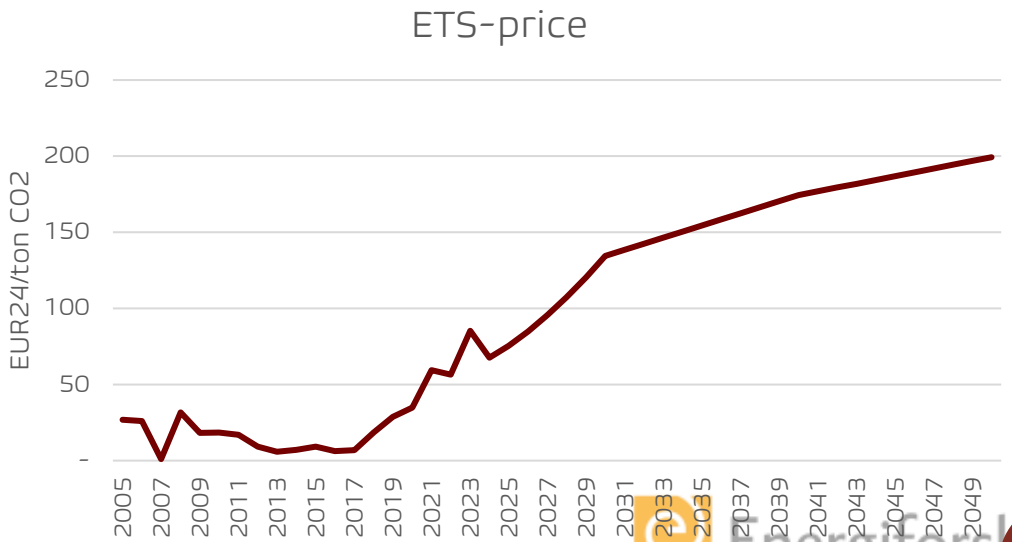
Fuel prices

- Futures (March 2024). Until and including 2026
- Long term. Prices expected to converge to long term equilibrium prices in 2030
  - IEA World Energy Outlook 2023
  - Announced Pledges scenario
  - Natural gas: LNG import price (Japan).
- High gas prices from 2022 have reduced significantly, and towards 2030, reduced dependence on natural gas and high global buildout of renewables further lowers demand for fossil fuels and thus prices.

CO_2-prices

- Forward prices (March 2024). Until and including 2026. Current levels are lower than anticipated in 2022, but expected to increase towards 2030, following expected extension of the EU ETS and EU policy-development.
- Long term. Prices expected to converge to Announced Pledges scenario from WEO2023 in 2030 and onwards.

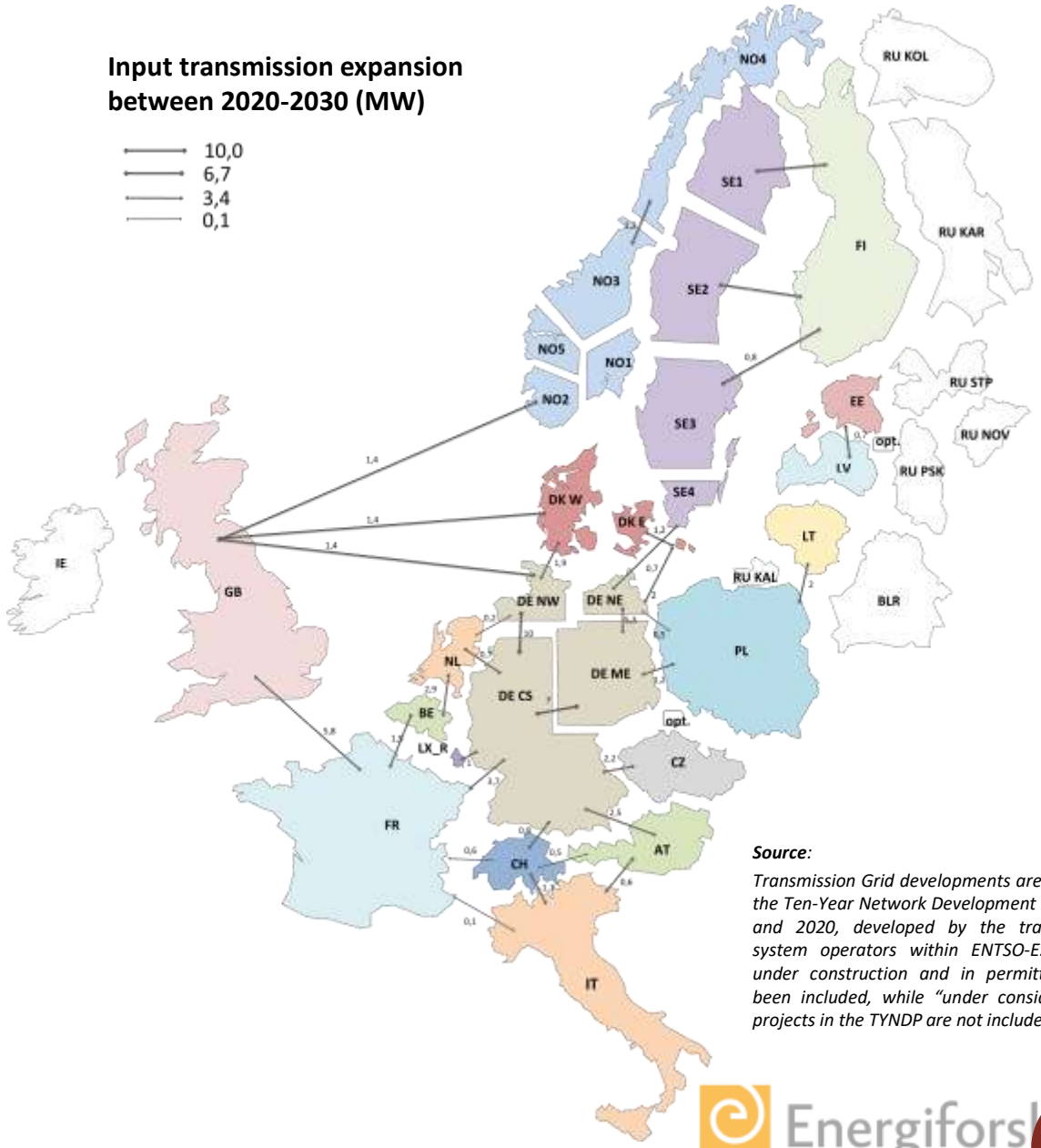




Power transmission capacities

- Transmission grid expansion based on TYNDP 2022 until 2030. After 2030, transmission expansion is subject to model optimization.
- **Overall development**
- Between 2020 and 2030 the transmission system is expanded by 55% according to ENTSO-E's plans. Between 2030 and 2040, further buildout is restricted to 750 MW pr. transmission corridor pr. 5 years.
- **German internal grid:** based on the TSOs' grid development plan (NEP2017), scenario B.
- **Significant changes for Denmark:**
  - **Viking Link:** 1.4 GW (DK-GB) by 2023
  - **Baltic Energy Island (2029):** Adding 1,2 GW to Baltic Energy Island and 2 GW transmission capacity between Baltic Energy Island and Germany
  - **North Sea Energy Island**: Adding 2 GW transmission to Belgium in 2035

- *Note: Hanza Bridge linking SE4 with Germany is included in the map, but the interconnector is NOT included in the simulations.*



***Source**:*

Transmission Grid developments are based on the Ten-Year Network Development Plan 2018 and 2020, developed by the transmission system operators within ENTSO-E. Projects under construction and in permitting have been included, while "under consideration"-projects in the TYNDP are not included

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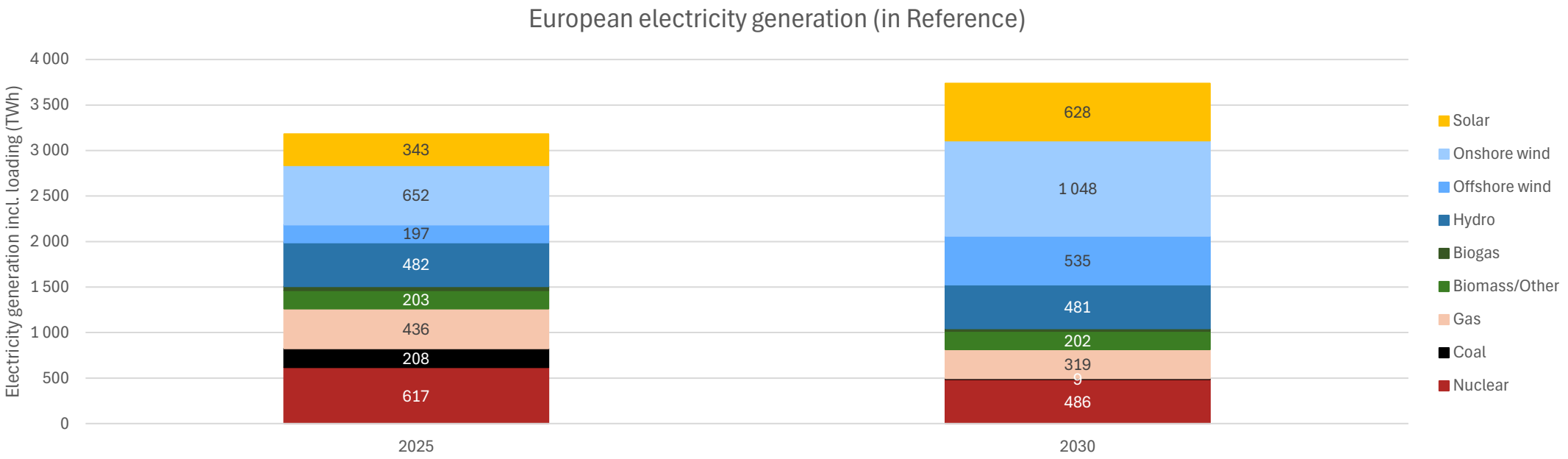
Electricity generation in Europe

- Electrification and Power-to-X causes EU demand to increases by about 17% between 2025 and 2030 as a results of
- Solar and wind replace gas and coal, and supply the electrification



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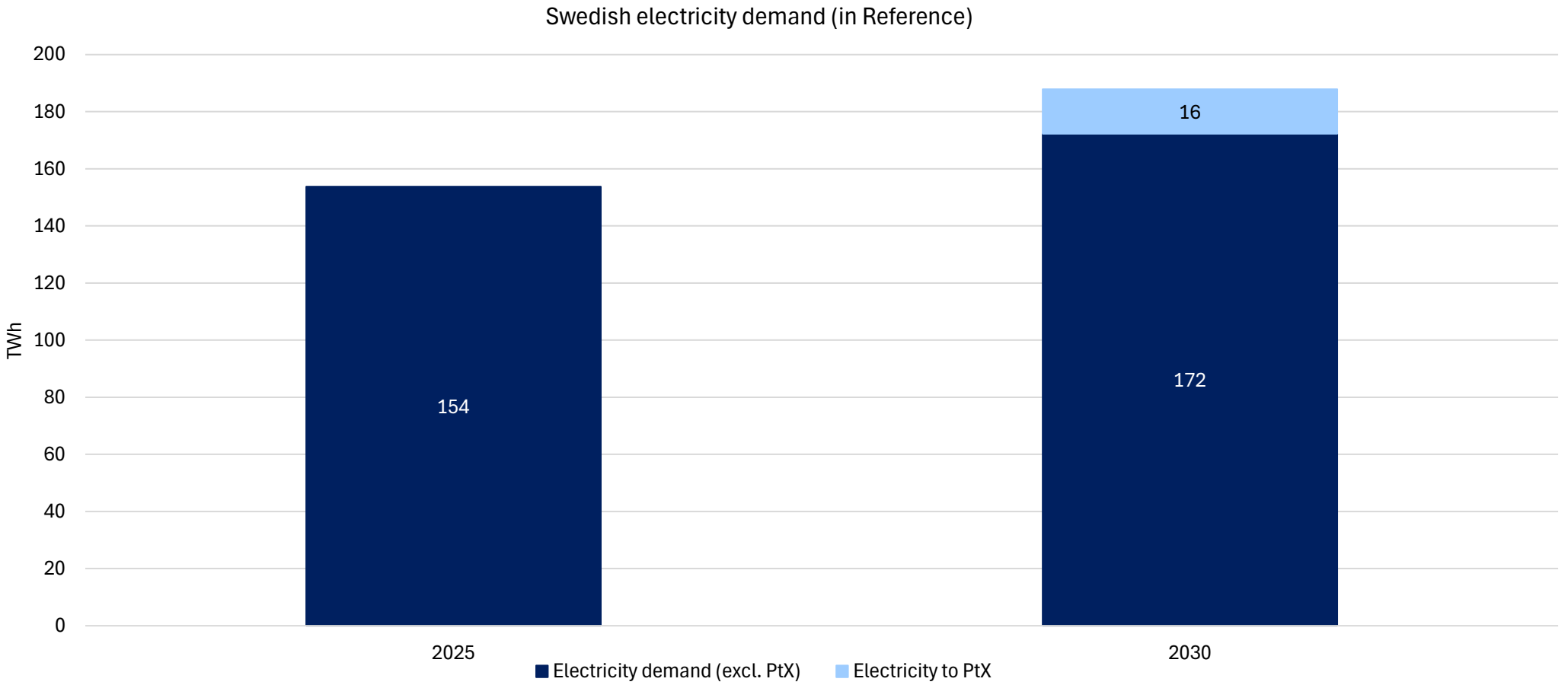
Swedish electricity demand



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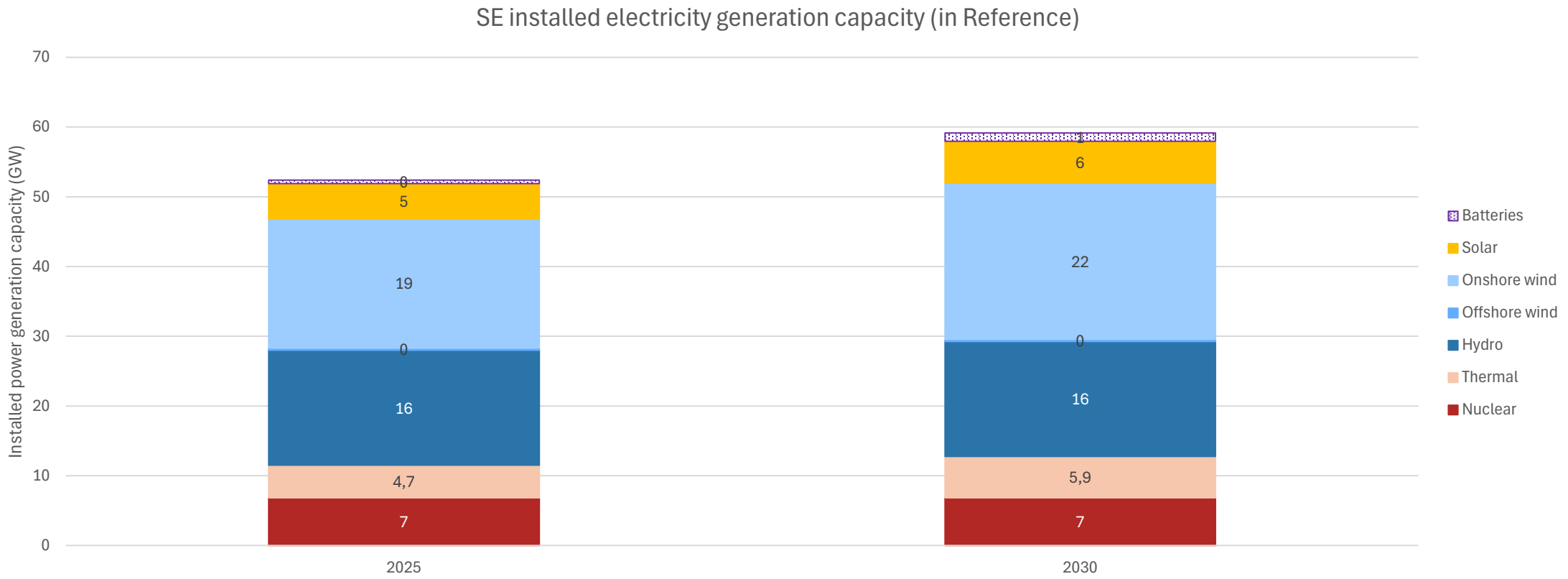
Electricity generation capacity in Sweden

Note: Investments in onshore wind are limited by acceptance



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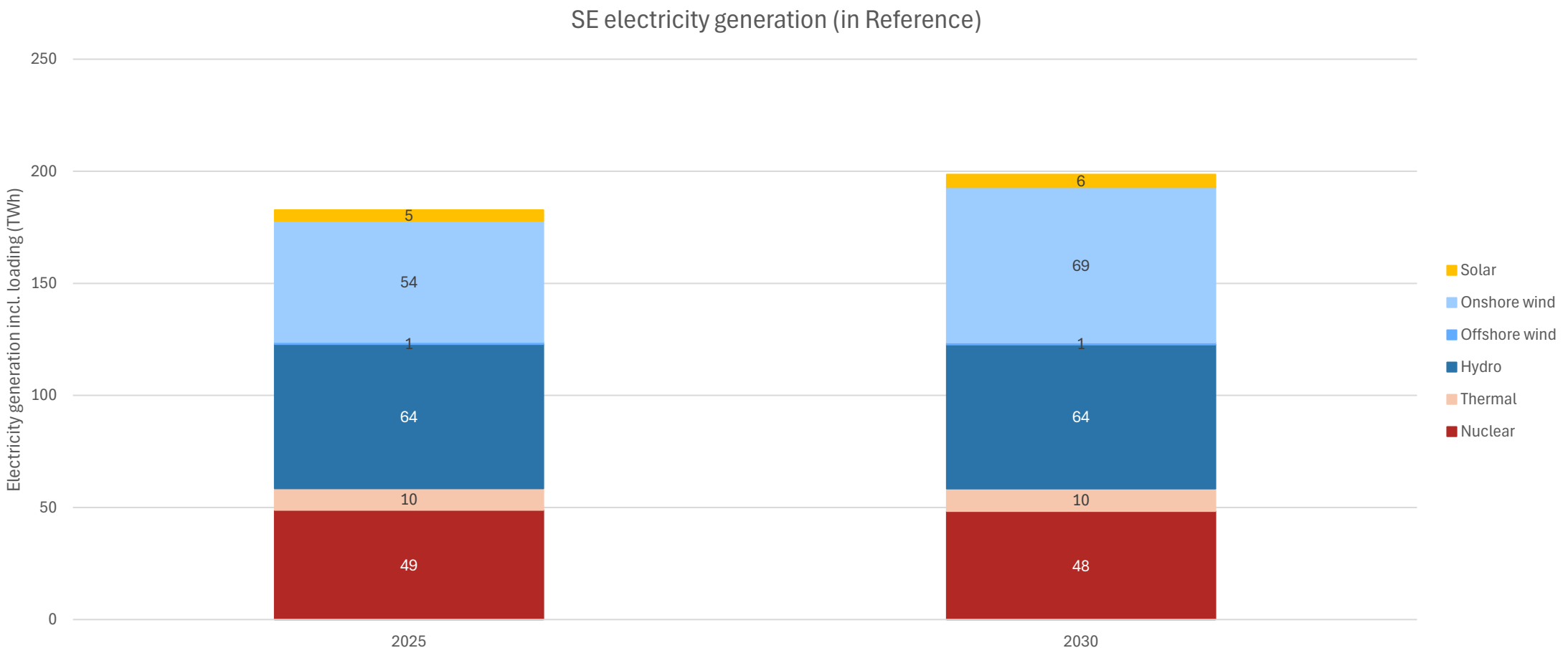
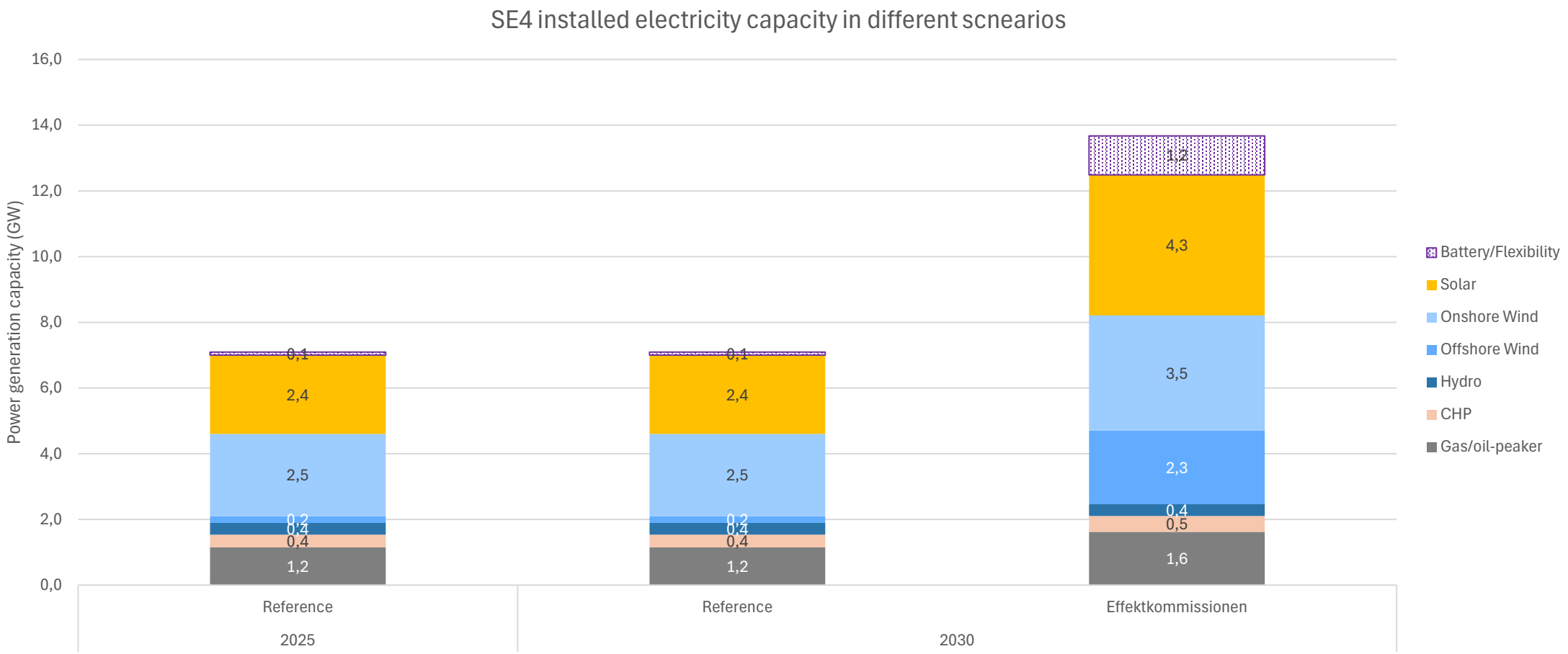
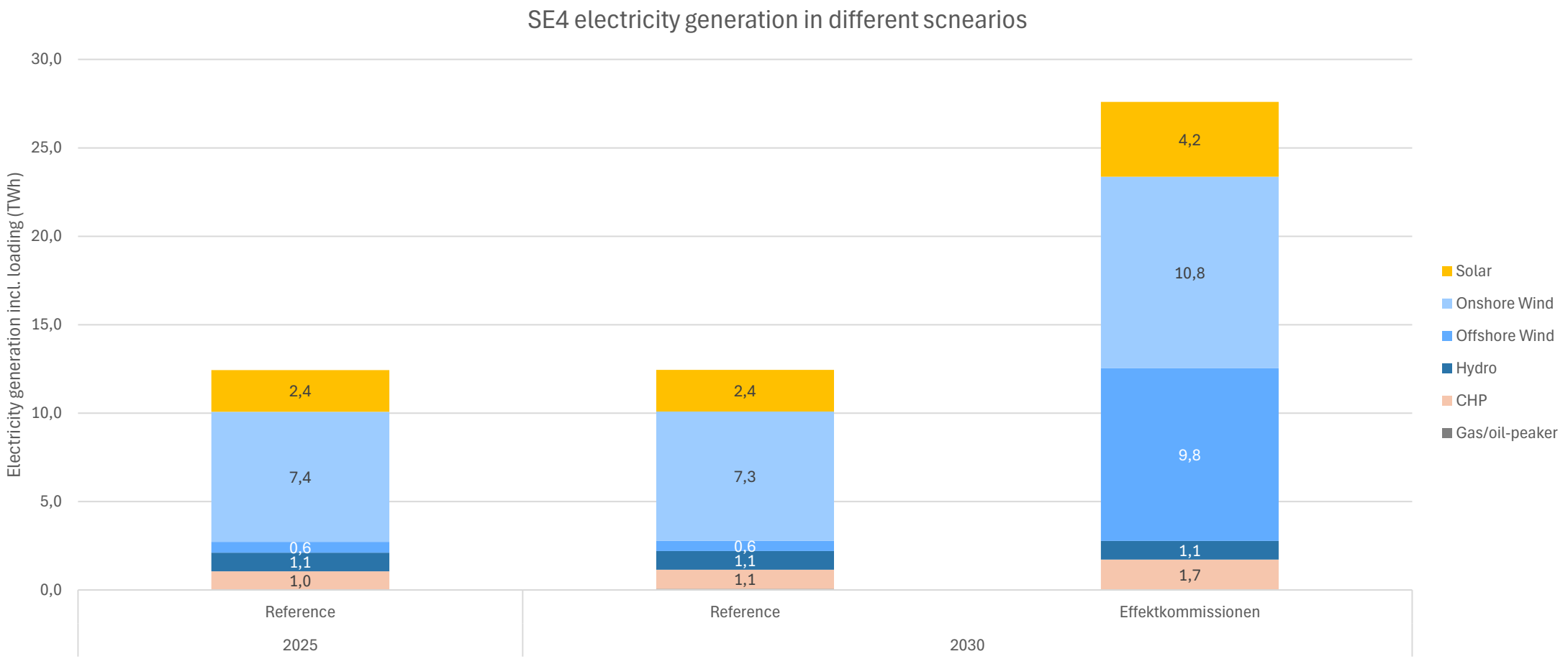
Power generation Sweden



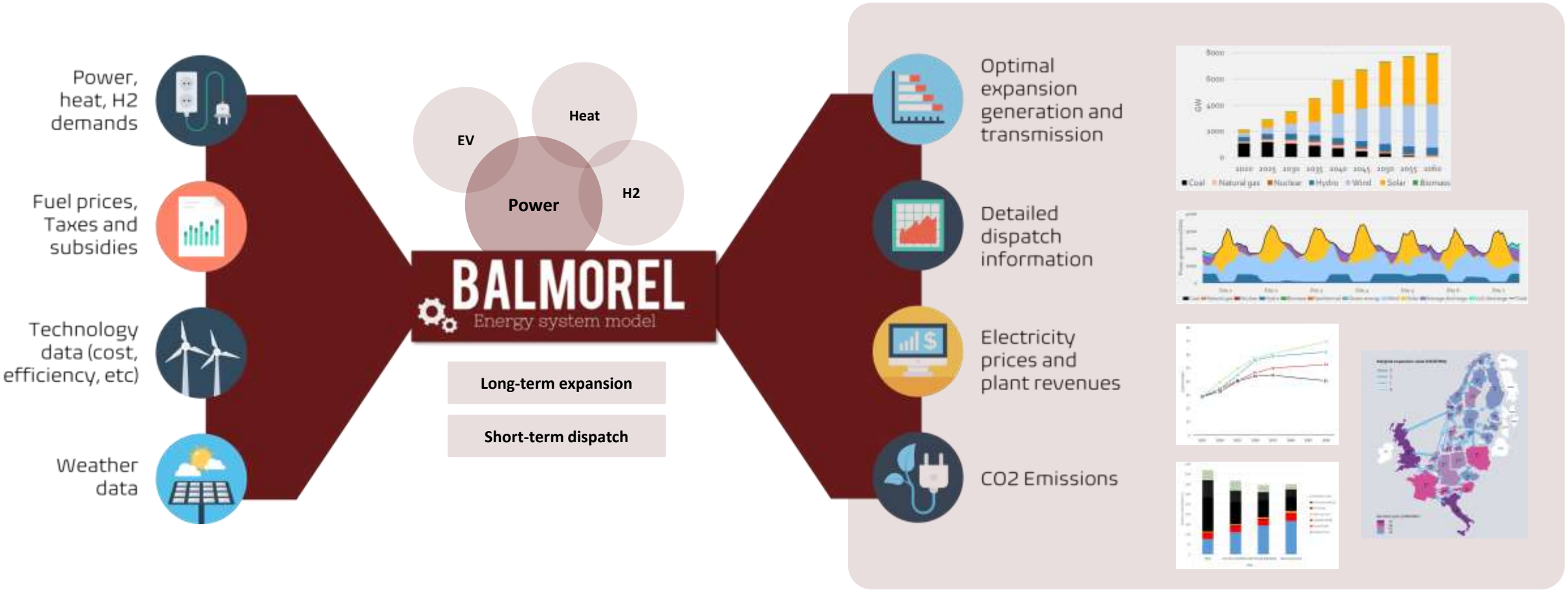
Installed power capacity in SE4



SE4 electricity generation



Balmorel: Energy system model



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