Risks for renewables in the Nordics: negative prices and demand

June 2025

Introducing the speakers

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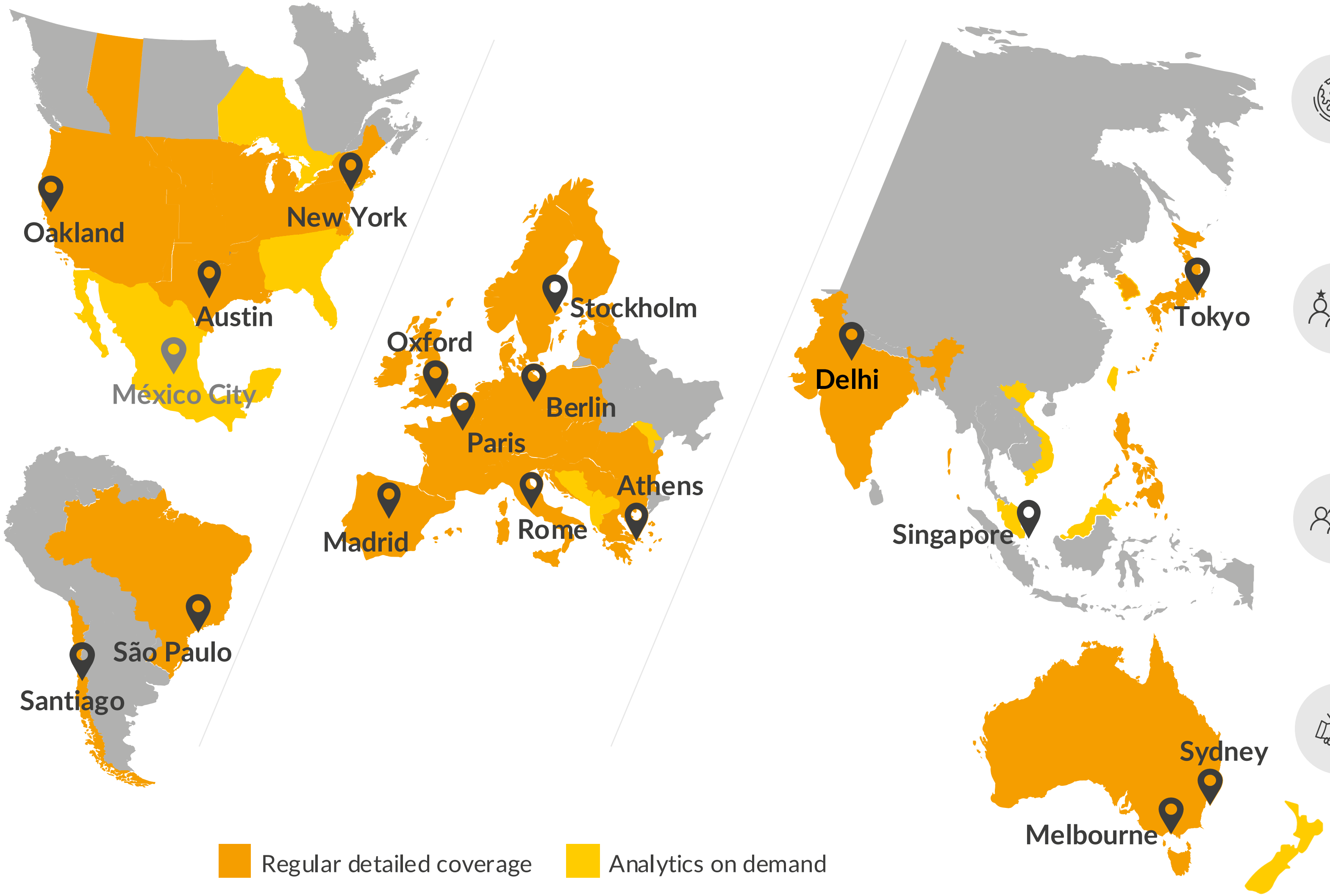

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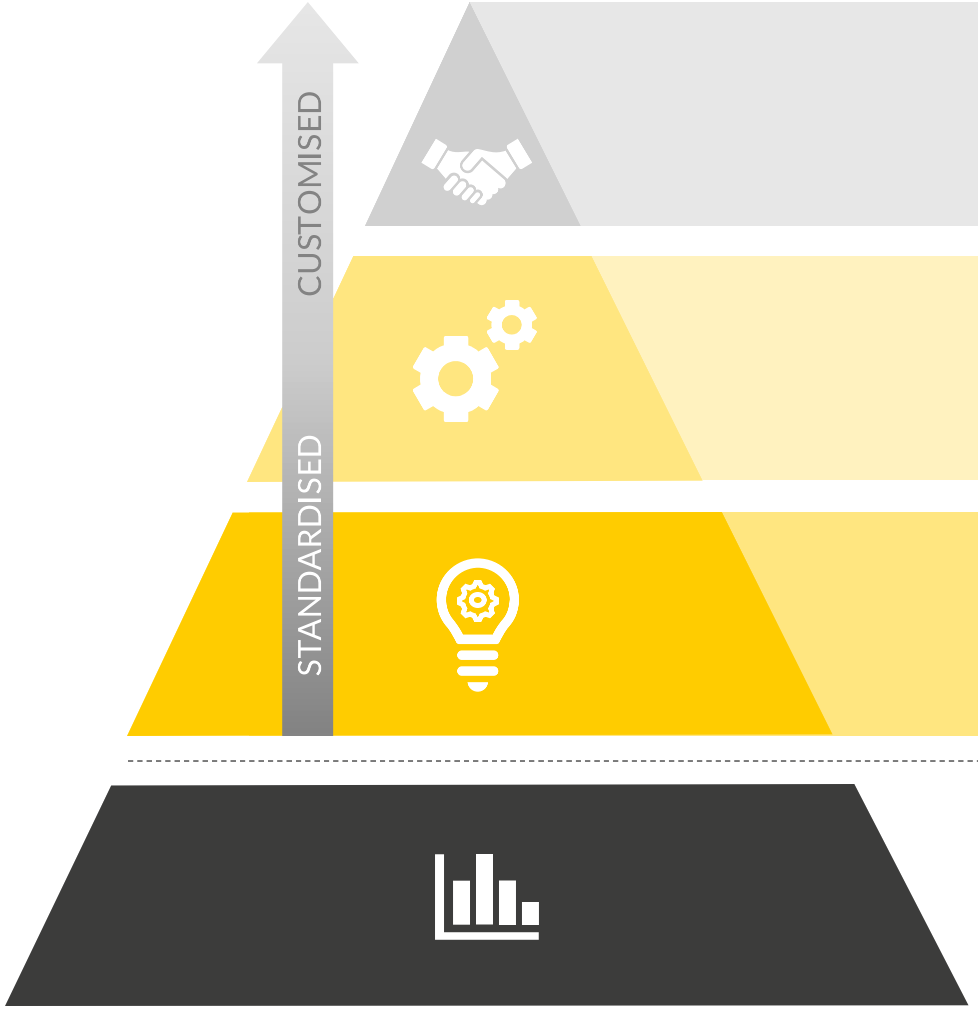

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Source: Aurora Energy Research

Following the energy crisis, Nordic renewable generation grew by 22TWh, while demand remained relatively stable, leading to a drop in power prices

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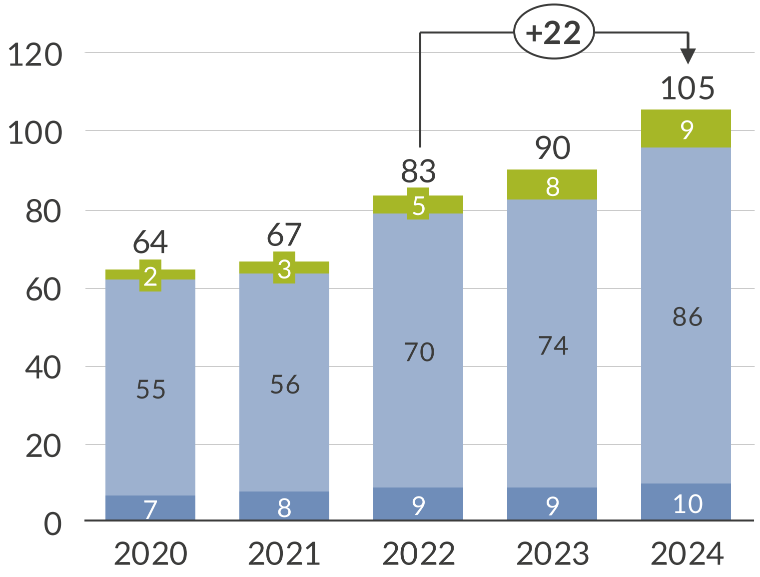
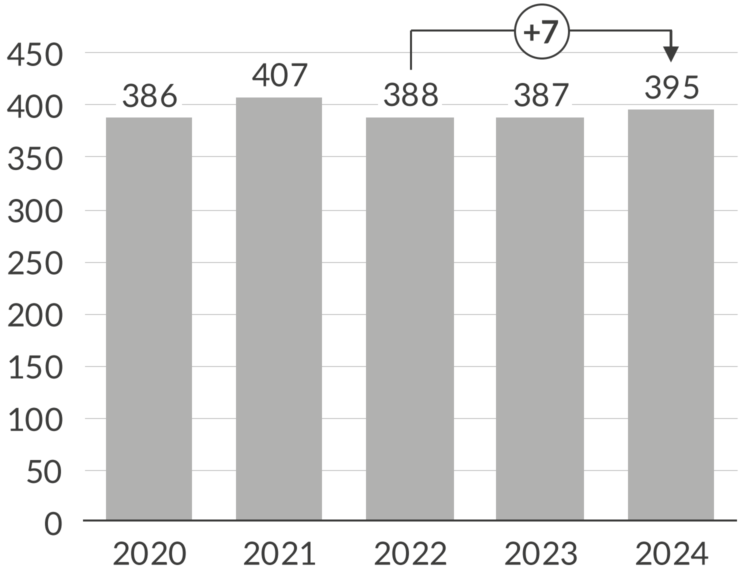
Nordic RES[1] electricity production
TWh



- Over the past two years, renewable generation in the Nordics increased by 22TWh, driven primarily by onshore wind buildout in Finland and Sweden.
- Offshore wind has grown more moderately, led by Danish developments, with the latest being the Vesterhav project in September 2024.
- Solar generation has expanded rapidly, more than tripling in each Nordic country since 2020.

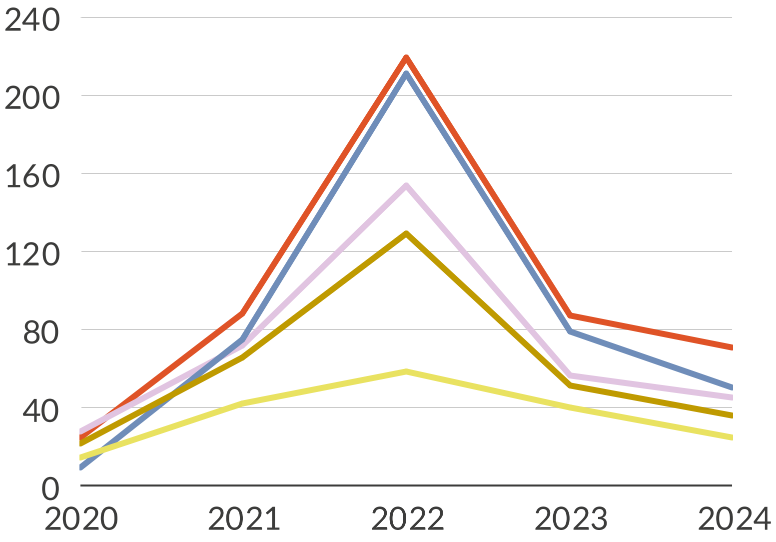
Solar | Onshore wind | Offshore wind

Nordic net annual power demand
TWh



- Despite expectations of rising power demand, total demand across the Nordics has remained constant in recent years.
- Power demand from households and services has continued to rise due to further electrification, matching the deployment of renewables.
- In contrast, power demand from industry has decreased due to weak economic activity.

Nordic wholesale prices
€/MWh (nominal)



- Nordic power prices began to diverge significantly in 2020, driven by the large buildout of onshore wind capacity in northern Sweden.
- After the energy crisis in 2022, gas and power prices have stabilised again.
- The growth of intermittent renewables, coupled with limited demand growth, has driven down baseload and renewable capture prices.

DK1 | FI | NO2 | SE1 | SE3

1) Renewable energy sources, referring to solar and wind.

Sources: Aurora Energy Research, Danish Energy Agency, Statistics Denmark, Statistics Finland, Statistics Sweden, Statistics Norway

Total demand across the Nordics is projected to grow significantly towards 2040, with wind and solar driving the expansion of electricity production

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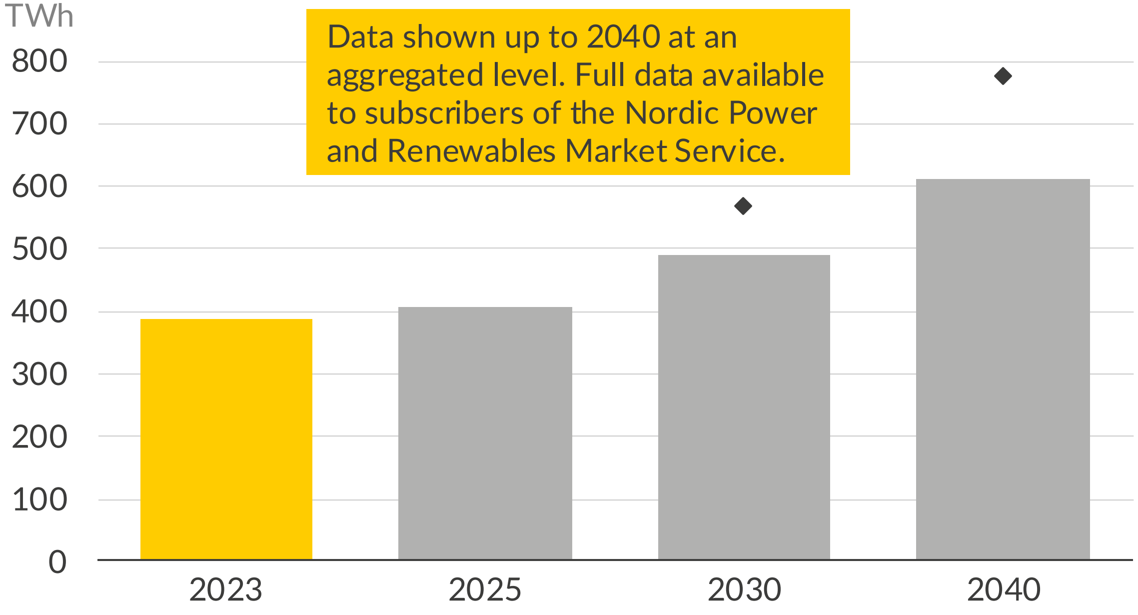
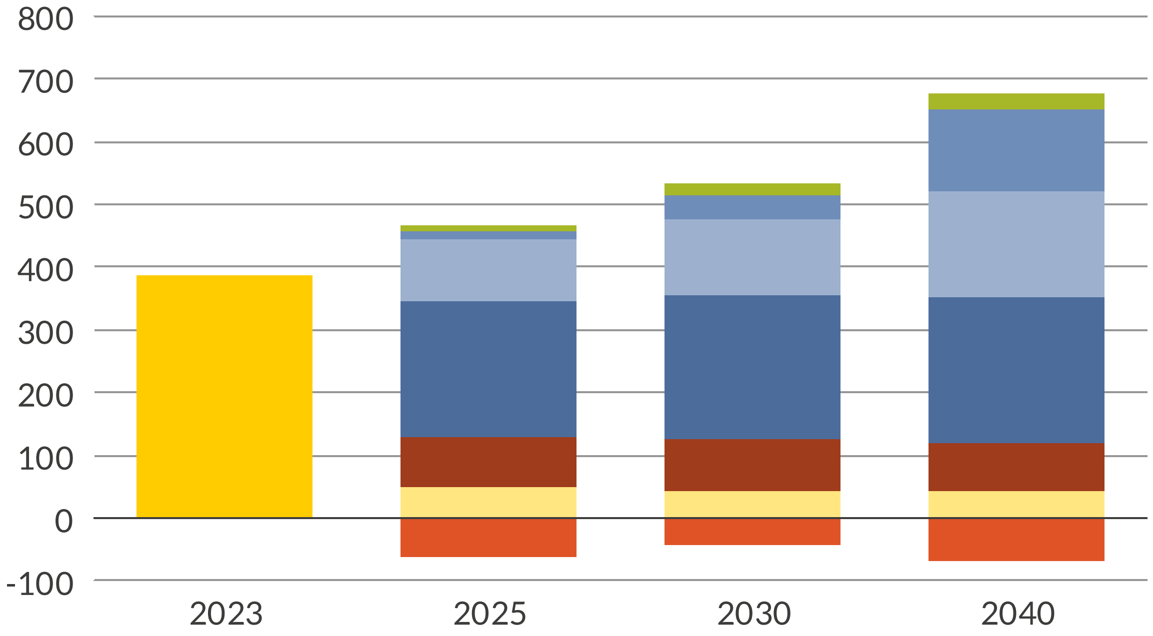
Nordic net annual power demand[1]



Nordic electricity production and net imports



- Base demand grows strongly before 2040, driven primarily by the electrification of gas-fired industrial processes and rising computing demand from data centres.
- Power demand from electrolysis sees the largest uptake between 2030 and 2040, as the Nordics become a significant hydrogen-exporting region.

- Generation from wind, solar, hydropower, waste and biomass grows sharply between 2025 and 2040, increasing from a roughly 80% share of total electricity production in 2025.
- Conversely, conventional thermal technologies such as coal and peat are phased out by 2030, while nuclear continues to hold a significant share in the generation mix.

◆ NGDP[2] | Historical | Aurora Central forecast

Total historical | Offshore wind | Hydro | Other[3] | Solar PV | Onshore wind | Nuclear | Interconnectors

1) Includes sectoral demand as well as transmission losses but excludes power plant self-consumption and demand from efficiency losses of storage; 2) Nordic Grid Development Perspective 2023; 3) Other includes thermal power plants, pumped storage and demand side response.

Sources: Aurora Energy Research

Offshore wind is facing delays and cancellations, but the Nordic countries remain committed to the high ambitions and are adapting their policies

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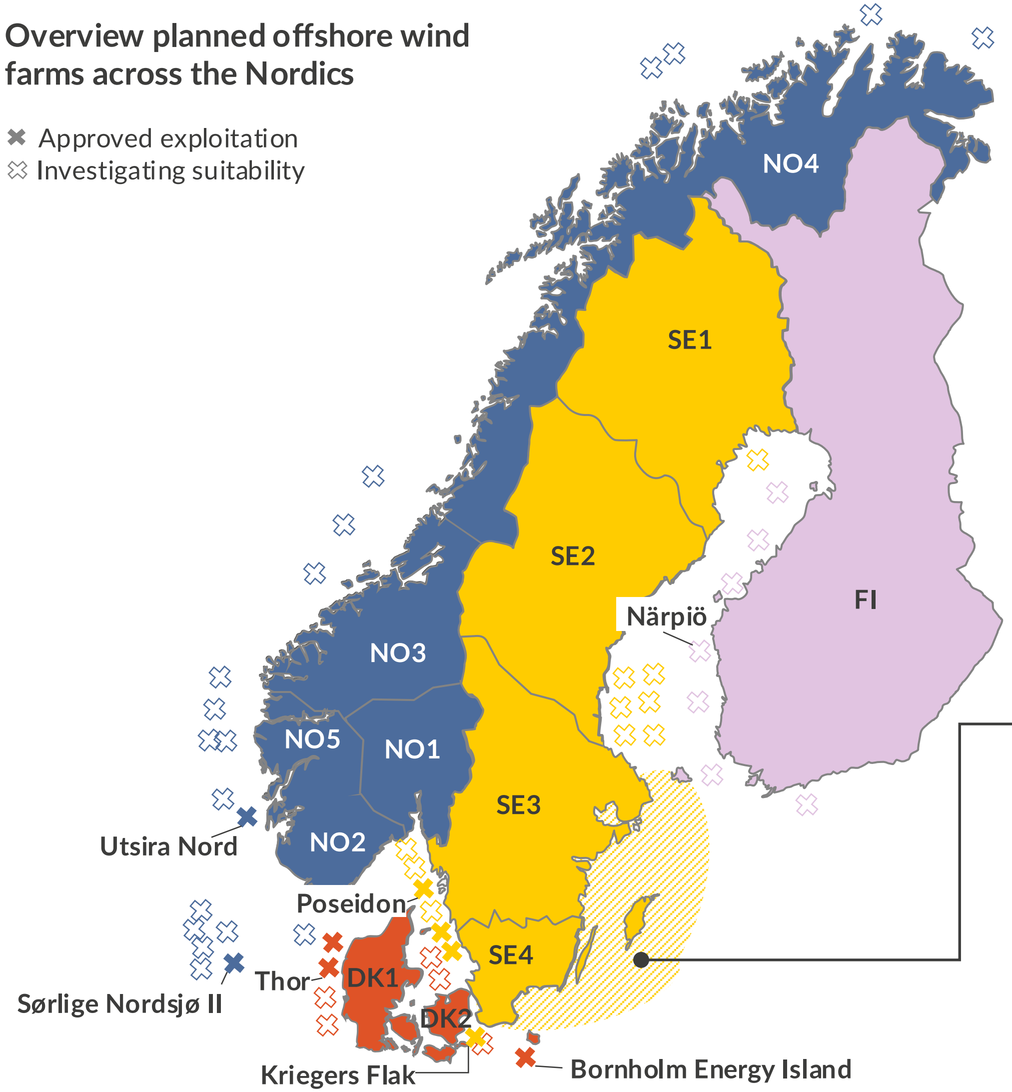
Overview planned offshore wind farms across the Nordics

✖ Approved exploitation
✖ Investigating suitability



Latest policy development

- In February 2025, the Norwegian Government cancelled the plans for a tender for an extension of Sørlige Nordsjø II and declared to prioritise the floating tender of Utsira Nord in view of grid development costs.

- In May 2024, the Finnish Government rejected 16 applications for exploitation permits.
- Under the new legislation, which entered into force in 2025, the specific areas are being tendered, and only thereafter can the winner apply for the exploitation permit.

- In November 2024, the Swedish Government rejected 13 offshore parks in the Baltic Sea due to security concerns.
- The Swedish Government wants to introduce an auction-based system to reduce regulatory risk in an early project stage.

- A 3GW seabed lease tender in late 2024 received no bids, and the planned second round of 3GW in April 2025 was cancelled.
- In response, Denmark is planning to launch a new round of tenders with state support, reinforcing its commitment to offshore wind expansion.

Sources: Aurora Energy Research, Norwegian Government, The Norwegian Water Resources and Energy Directorate (NVE), Metsähallitus, Fingrid , Swedish Government, Danish Government, Danish Energy Agency

Nordic onshore wind capture prices have decreased significantly since the energy crisis, but will benefit of rising system flexibility in the long term

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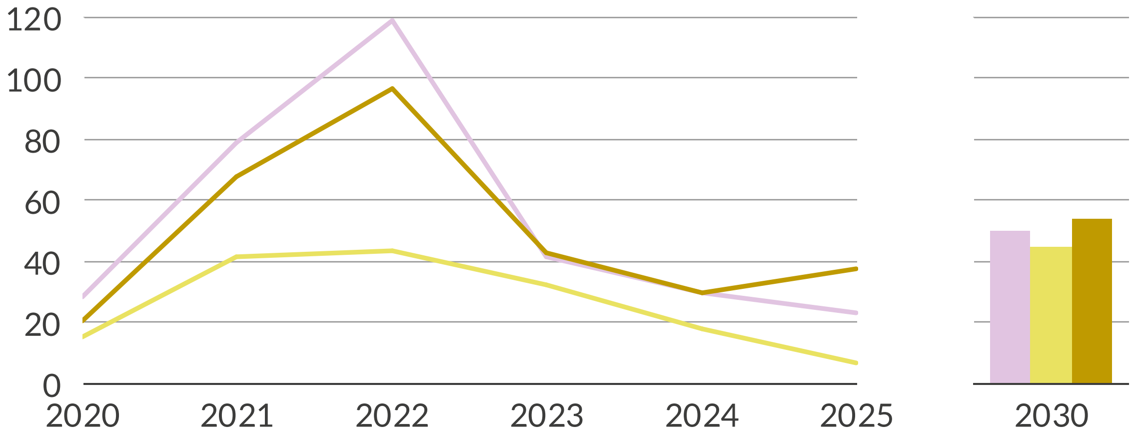
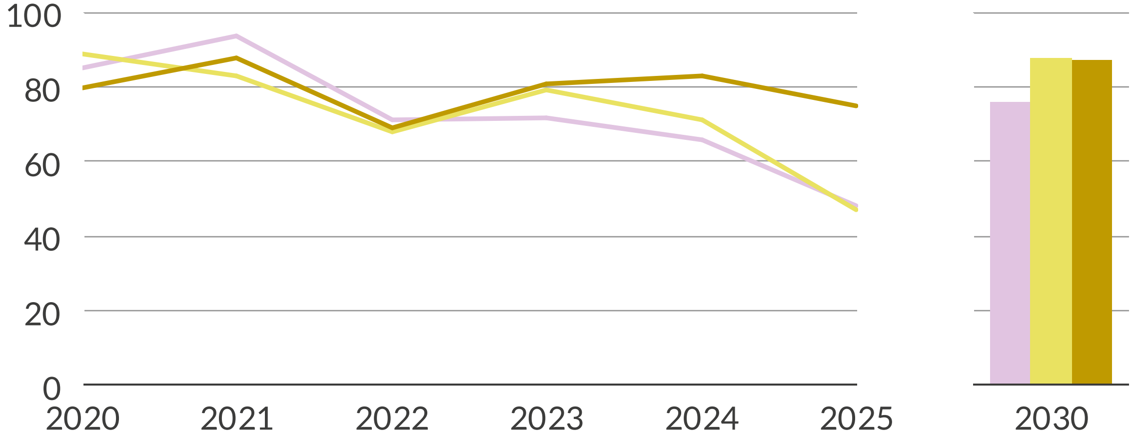
Onshore wind capture price[1,2]

€/MWh (real 2024)



Onshore wind capture rate[1,3]

%



Key drivers for the future of capture prices

Value driver	Description	Probability	Effect
Onshore wind buildout	Significant project pipeline in the short term and lowest cost in the long term.		↓
Offshore wind buildout	High policy ambition, but a challenging market environment.		↓
Demand growth and flexibilisation	High policy ambitions, but expected growth has not yet materialised accross all sectors.		↑
BESS buildout	Significant project pipeline and increased participation in day-ahead market.		↑
More transmission capacity	Several projects aim to enhance interconnection across Nordic zones and to the rest of Europe.		↑

1) Historical data up to but excluding the 1st of May 2025 and Aurora Central scenario, April 2025; 2) Capture prices are uncurtailed generation-weighted fleet average; 3) Capture price relative to baseload price.

Source: Aurora Energy Research

Finland and Sweden saw the highest number of negative price hours in 2024 across Europe, driven by onshore wind buildout and imports during sunny hours

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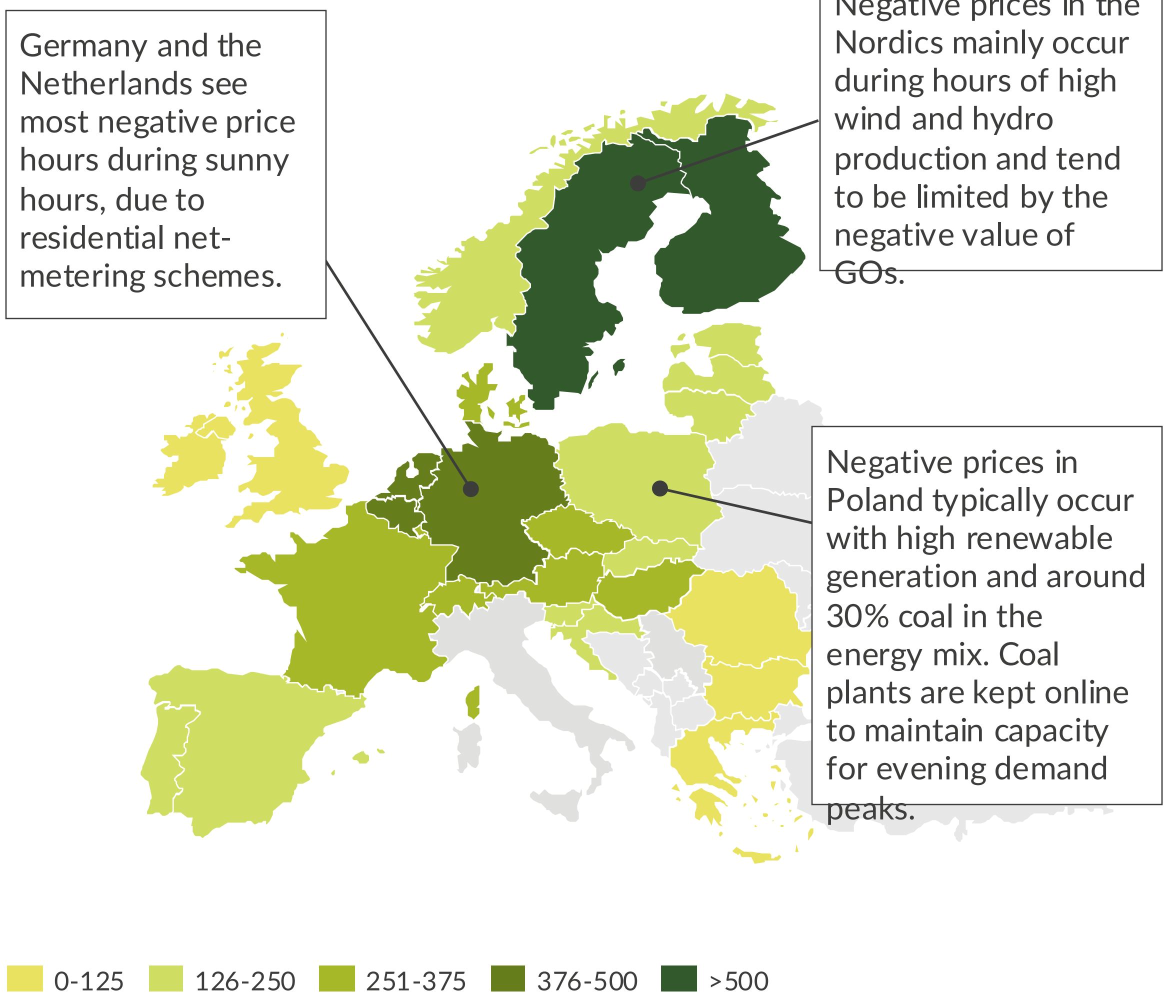
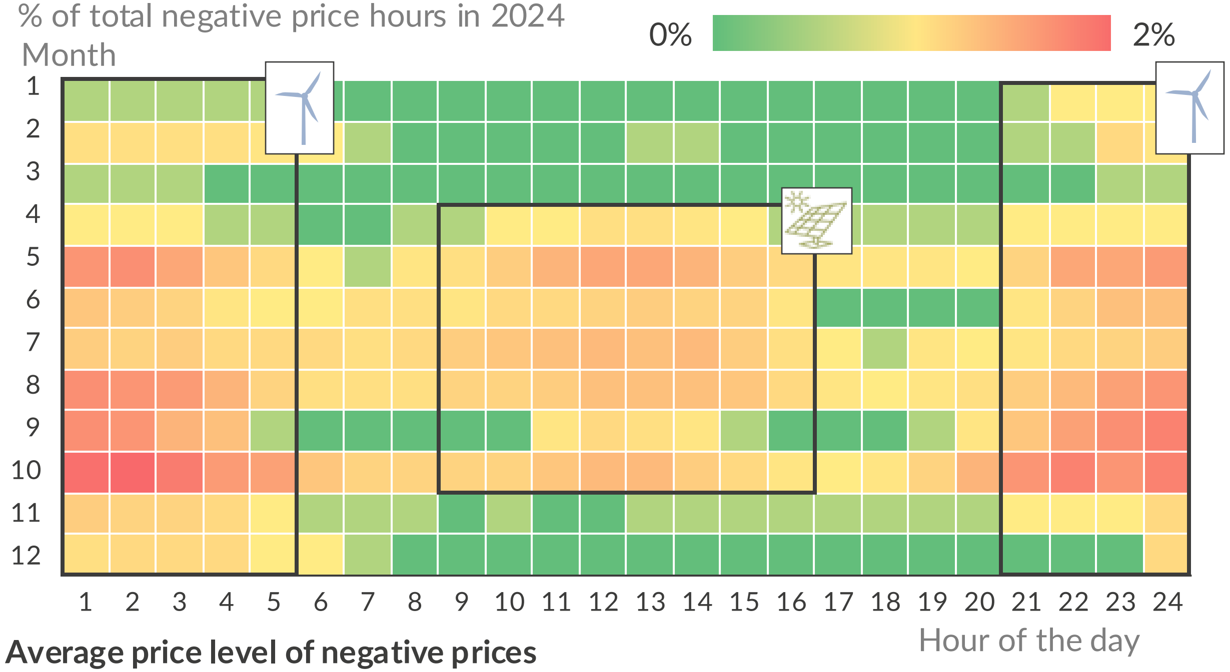
Negative price hours on the Day Ahead market in 2024[1]

Number of hours



Share of negative prices in Finland by hour of the day and month

% of total negative price hours in 2024



Average price level of negative prices

€/MWh (nominal)

-1.3 Close-to-zero negative prices typically occur during nighttime and morning hours. These prices are driven by negative bids from wind and inflexible hydro assets in Finland and Sweden.

-3.0 Negative prices tend to be deeper during sunny hours, driven by imports from Germany and the Netherlands, where a significant share of the solar fleet is inflexible due to subsidy schemes that do not incentivise curtailment.

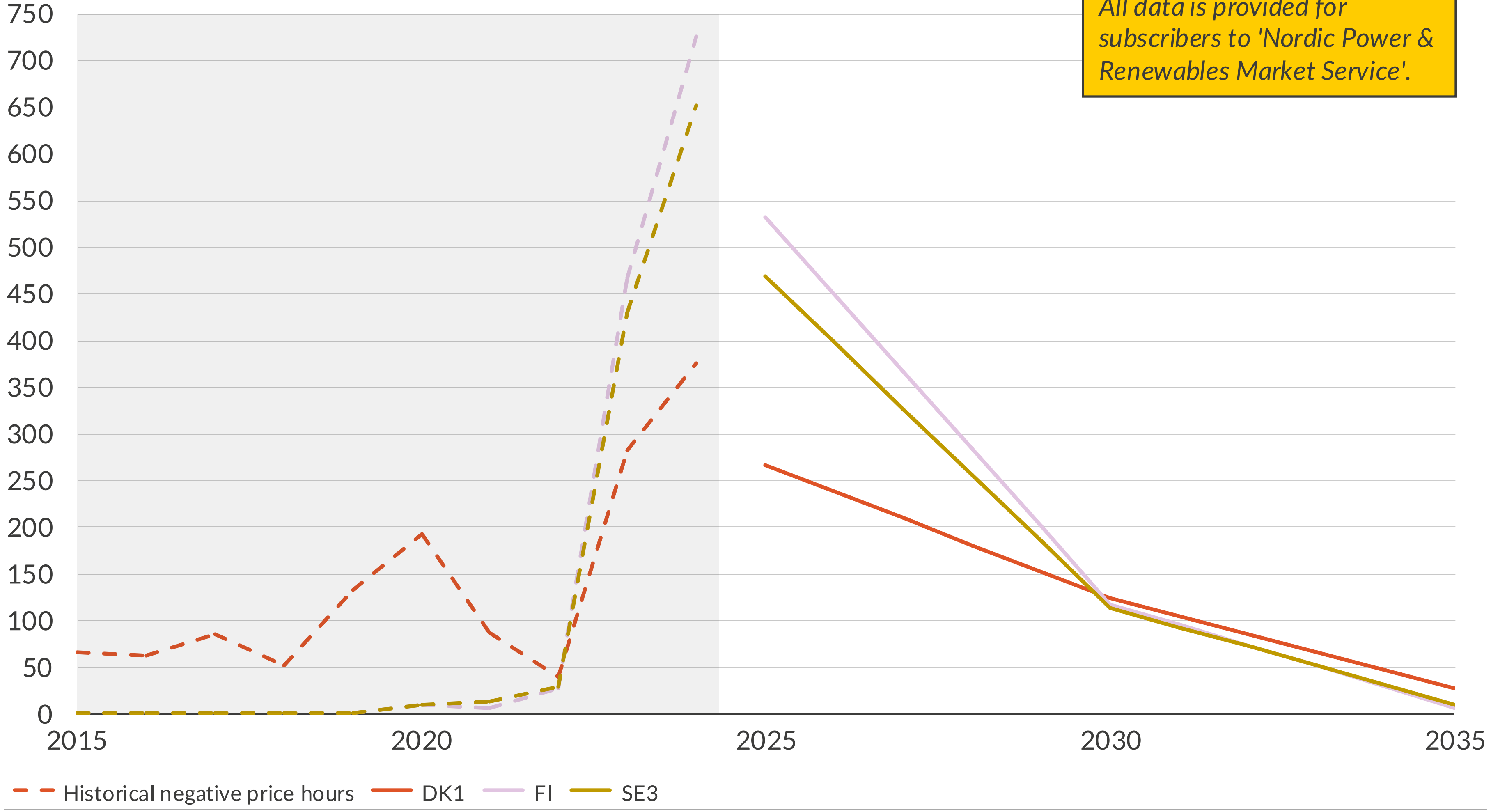
1) According to data from ENTSO-E up to November 2024.

Sources: Aurora Energy Research, ENTSO-E, Nord Pool AS

After the surge in recent years, the number of negative price hours decreases over time towards 2035 due to rising system flexibility

Total number of negative price hours
Hours p.a.

Data only shown for key years and price zones up till 2035. All data is provided for subscribers to 'Nordic Power & Renewables Market Service'.



Sources: Aurora Energy Research, Nord Pool AS

Negative price trends

2025–2027

- Negative price hours will remain high across the Nordics until 2027, as renewable output continues to exceed demand (see page 23).

2028–2035

- We expect negative price hours to decline across the Nordics from 2028 and disappear after 2035.
- Growing flexible demand technologies, like EVs, electric boilers, and electrolysers, reduce the frequency and depth of negative prices.
- At the same time renewables become more responsive to price signals as PPAs align with market conditions, removing incentives to produce during negative prices.

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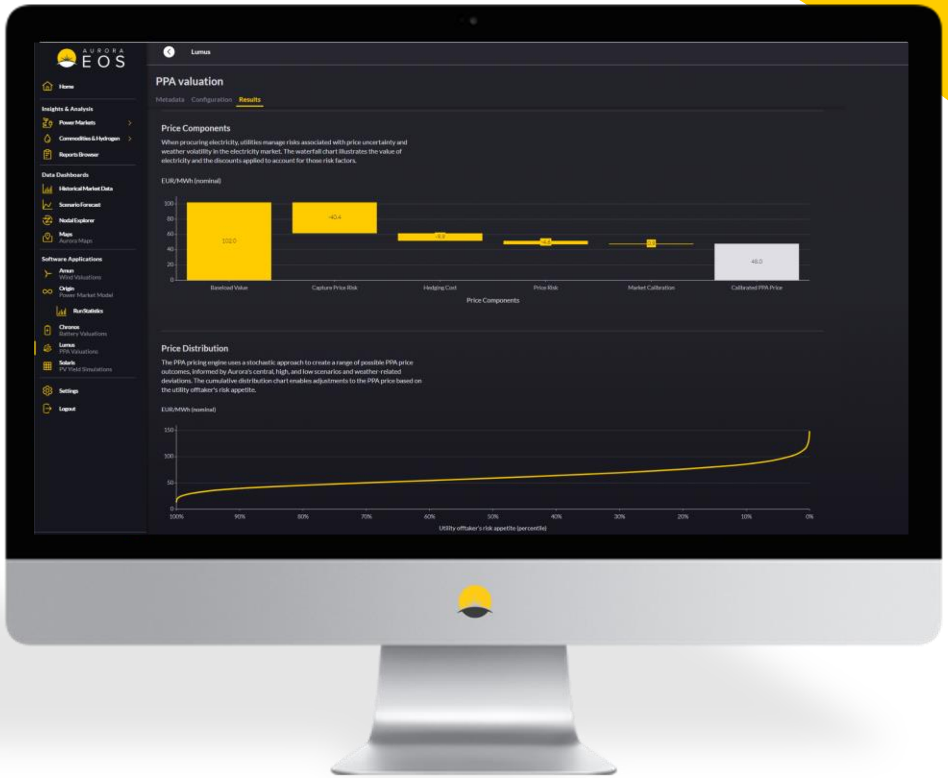

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Publication
Risks for Renewables in the Nordics: Negative Prices & Demand

Date
3 June 2025

Version
1.0

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