The Nordic Market Integration and Cross-Border Experience: Lessons for Emerging Countries

Session III: Cross-border Cooperation; Market Integration

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Nordic Electricity Market

Brief History

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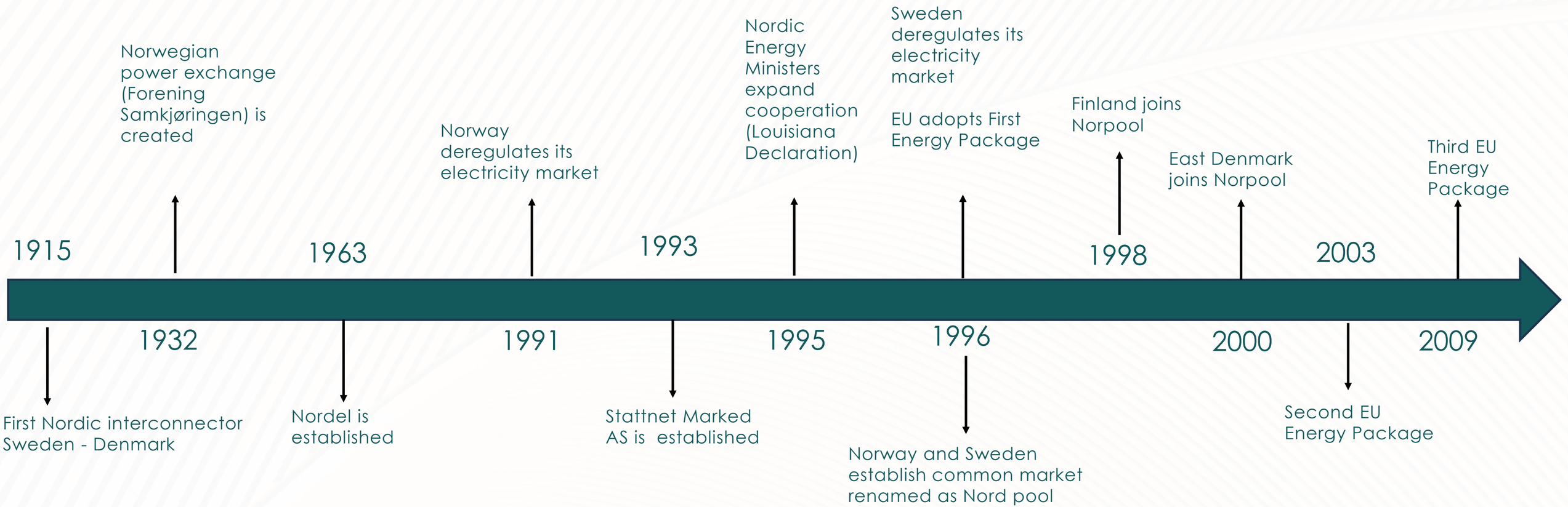

Nordic Electricity Market

Part of the pan-European energy system

Ea Energy Analyses

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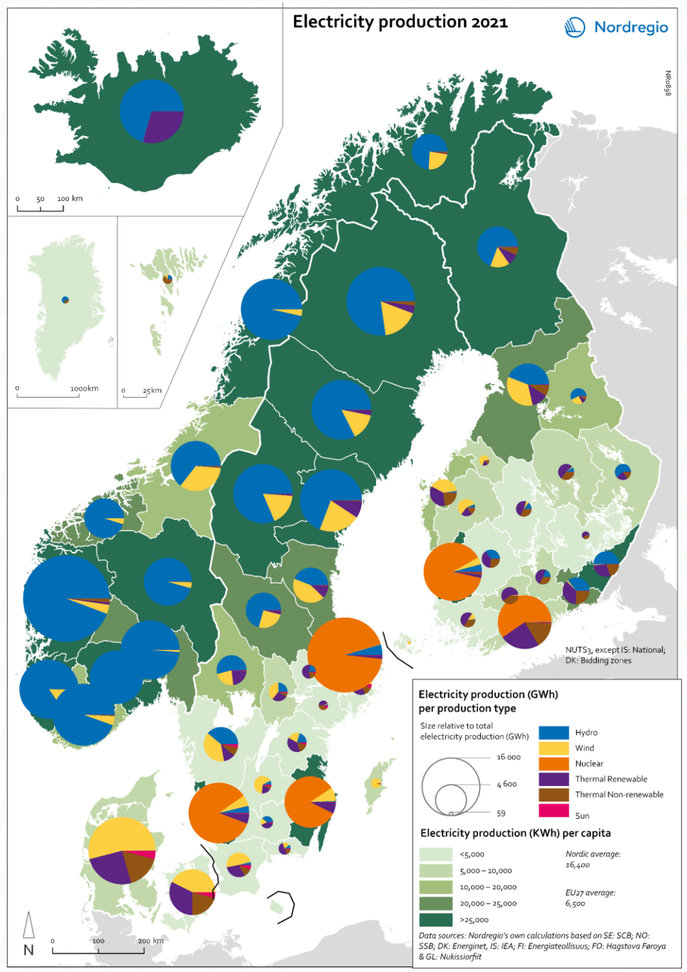
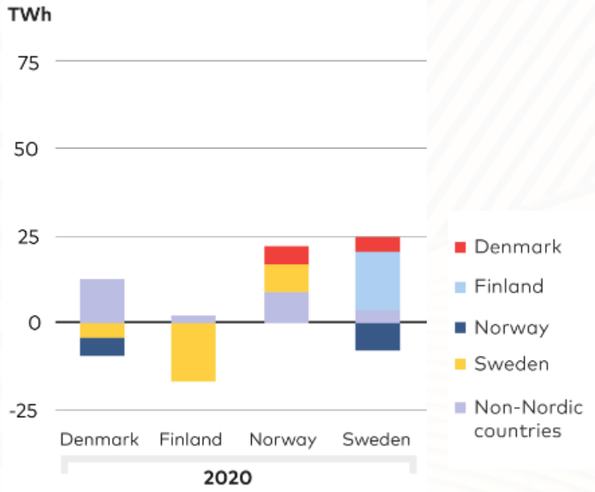


Nordic electricity production per capita

Source: Nordregio

SECURITY OF SUPPLY

Net electricity flows in the Nordics/EU

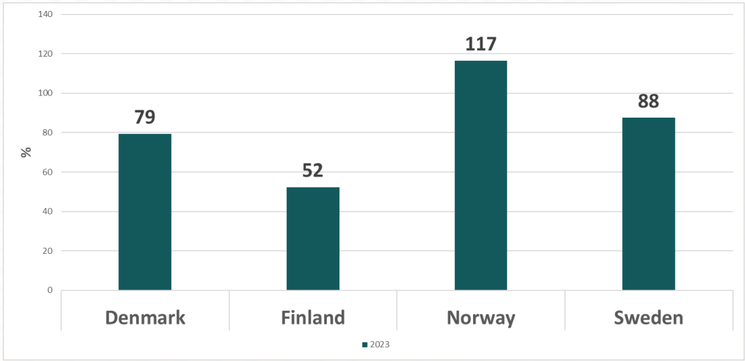


Source: Nordic Clean Energy Scenarios

- 41 TWh in 2024, 49 TWh in 2023
- Sweden and Norway among largest net exporters in EU
- Denmark as transit country
- Largely determined by hydrological conditions
- All countries benefit from net import hours

SUSTAINABILITY

Share (%) of renewables in gross final electricity consumption (2023)



Source: Nordic Statistic Database

AFFORDABILITY

Average day-ahead prices

2023:

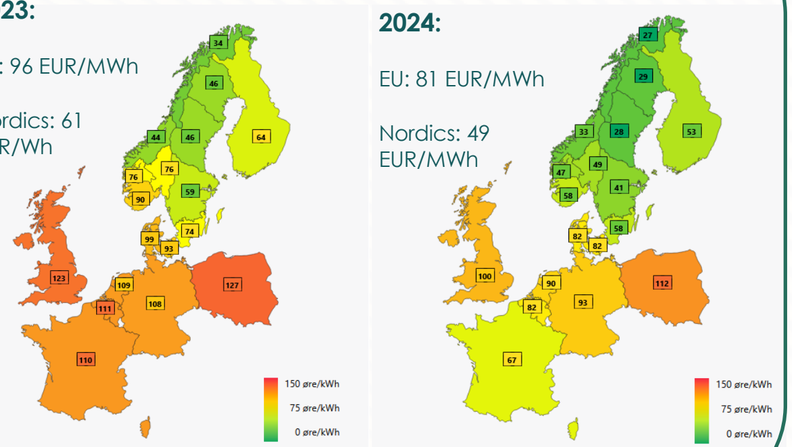
EU: 96 EUR/MWh

Nordics: 61 EUR/Wh

2024:

EU: 81 EUR/MWh

Nordics: 49 EUR/MWh



Source: NVE (originally produced by EXPEX Spot)

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Lessons and how to apply them

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Lessons learned

- Political will, mutual trust and cooperation are crucial
- Relatively simple market design can increase market efficiency and address market power issues
- Market integration can increase security of supply and mitigate market power

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How to apply lessons – a practitioner's perspective

- **Lesson 1:** spend time understanding why is market integration and cross-border trade relevant for the specific country or jurisdiction
- **Lesson 2:** have a vision first, write policies and regulations later
- **Lesson 3:** it is possible to start market integration and cross-border cooperation without full-fledged market reform

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How to apply lessons – a practitioner's perspective

Lesson 1 – spending time on "why":

Motives raised by advised countries:

- End-use prices (tariffs) must be lower, but we're tied to PPAs without any short-term price discovery
- Need to attract investors in generation, transmission and other technologies, e.g., BESS
- Need to address the challenge of variability, e.g., by creating ancillary services compensation mechanisms

Advice: design (simple) markets, let them work, but don't expect them be a silver bullet

Lesson 2 – spending time on a vision:

Motives raised by advised countries:

- Energy Law/Energy Act requires us to have a market

Advice: design a vision that stakeholders believe and understand, create transitional steps and finally write the regulations. Place market reform at the center

Lesson 3 – initiate market integration and cross-border cooperation early

Issues raised by advised countries:

- Regulatory barriers get in the way, internal reform hasn't even started

Advice: initiate dialogue with counterpart, strive to cooperate despite limitations

Financing mechanisms

Available options

Financing mechanisms

Available options

Problem:

- Grid infrastructure may be the main barrier for market integration, cross-border cooperation and RE integration
- Delayed, insufficient grid infrastructure is a barrier to all objectives in energy trilemma
- Problem aggravates when financing entities are cash constrained

Known transmission financing models:

Merchant model: congestion rent finances investment, investor bears risk

Cap-and-floor: risk is shared between consumers and investors, minimum revenue is assured, cap on rent

Regulated investment: consumers bear risk, congestion revenue partially offsets cost to consumers

Which model for emerging countries?

- One that either shares risk and reward (e.g., Cap-and-Floor) or transfers it to the investor (e.g., Merchant)
- Specific design will depend on complexity, urgency and financial availability
- A model that is compatible with Private-Public Partnerships (PPPs)

Advice: create a stable, predictable framework that clearly allocates roles: transmission asset owner, system operator and market operator

Market design and competition

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Market design and competition

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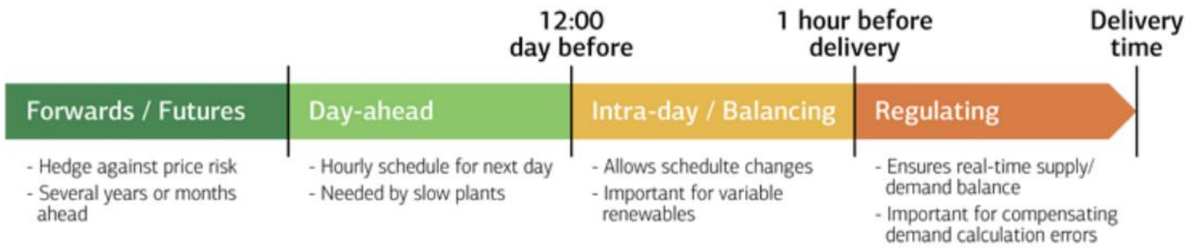
Market design:

- Market with participation from both demand and supply side
- Decentralized dispatch and voluntary trade
- Provides reliable short-term price signal for bilateral contracts



Overview of the Nordic electricity market. Source: Nordic Energy Technology Perspectives

Competition:

- Early years: lower capacity requirements relative to demand brought efficiency gains
- Nordic electricity markets are not perfectly competitive (none is).
- However, competition is in good health. Cournot analysis (Persson): capacity withholding led to 0,2% mark-up before 2020 and 1,6% afterwards (until 2022)
- Ownership concentration: large players have been present since the early stages of the market.
- Market integration as remedy to market power, securing a liquid market

Security of supply

Solidarity and interconnectedness

Security of supply

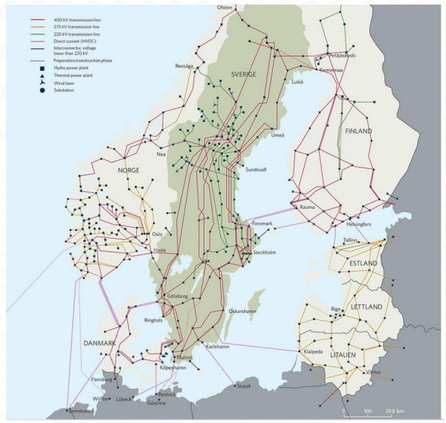
Solidarity and interconnectedness

Ancillary services:

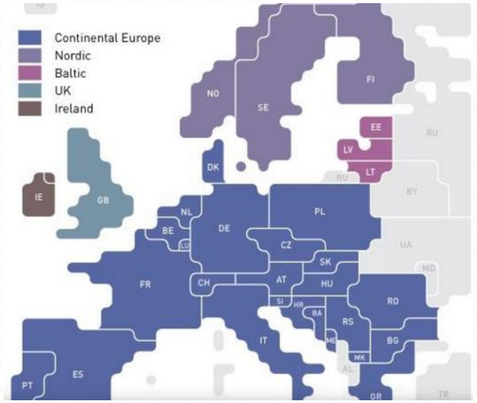
- Technical definitions at pan-EU level: Containment (e.g., FCR), Restoration (e.g., aFRR), Replacement (e.g., mFRR)
- Dimensioning based on a solidarity principle within synchronous areas
- Harmonized technical and trading principles, transition to common balancing reserve and activation markets (MARI and PICASSO platforms)

Recent example:

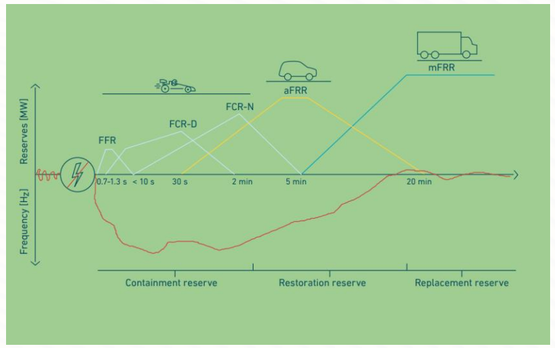
- Blackout in Spain, on Monday 28/04 at 12:30 led to frequency drop also in Western Denmark (synchronous with Continental Europe)
- Swedish reserves were automatically activated over the Konti-Skan interconnector. to restore frequency



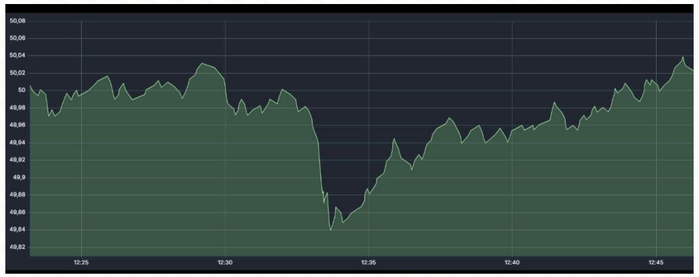
Nordic Transmission infrastructure. Source: Svenska Kräftnatt



Synchronous areas in Europe. Source: ENTSO-E



Ancillary services in Denmark. Source: Energinet



Frequency measured at Fraugde station (DK1) on 28/04 around 12:30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