Cost-efficient, robust and optimized transmission – What does it take?

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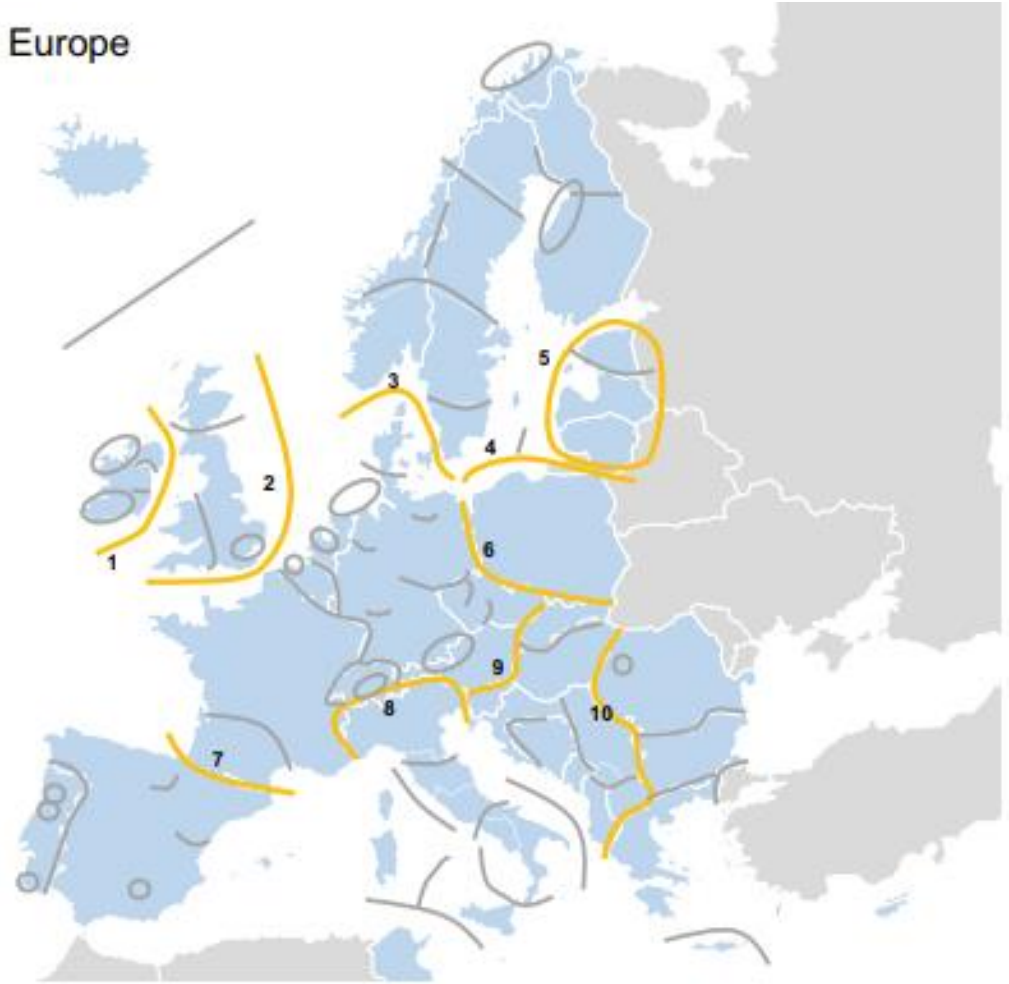
Why there's transmission grid?

- The costs of transforming the system are kept as low as possible (by an appropriate set of investments enabling better market integration and leading to competitive power prices), and
- The continuous secure access to electricity is guaranteed (security of supply)



Source: ENTSO-E TYNDP 2018

NORDENERGI

How does the grid planning and building look like from stakeholders' perspective?

1) Take national grid
2) Consider what is a must within individual TSO's control area without considering transmission grids on other side of border
3) Start late and exceed costs
4) Realize that what has been planned doesn't deliver on time and propose new bidding zones
5) Make regional grid development plan and find that after all the costly action done there's no resources left

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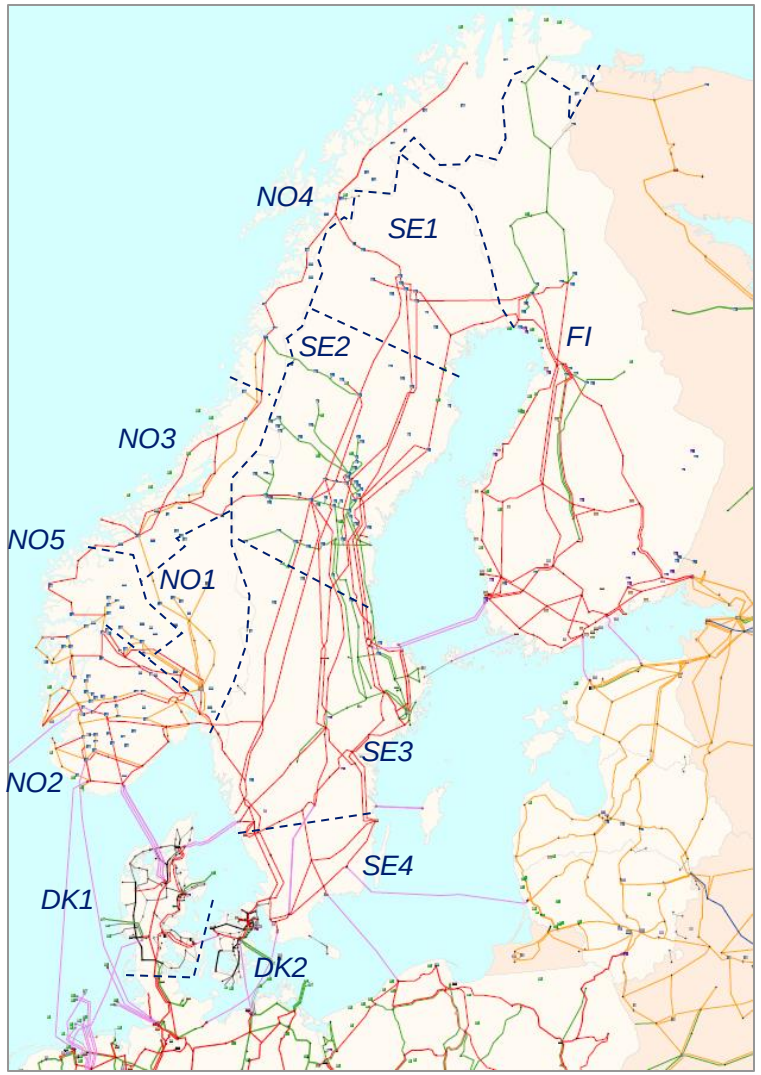
➢ Expensive grid with national borders restricting markets' functioning


Why is it this difficult?

TSOS OPERATE IN DIFFERENT PHYSICAL CONTEXT



Source: ENSTO-e

Transmission

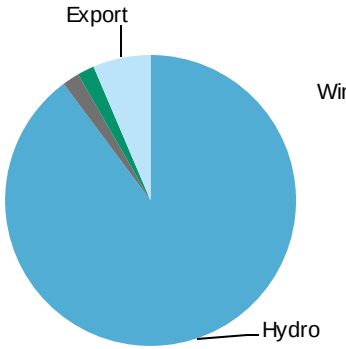
- Reflects that electricity supply has developed through regional development of hydropower
- Five bidding zones

- Main network is old and reaching end of lifetime and requires investment
- Four bidding zones

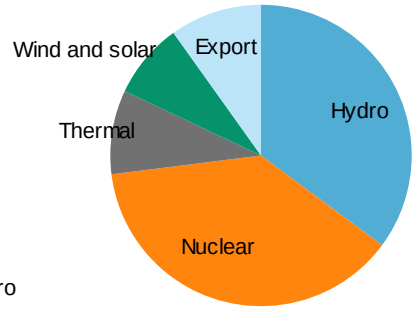
- Strong grid and north-south transmission
- Emphasis on maintaining one bidding zone

- Two synchronous transmission systems and two bidding zones

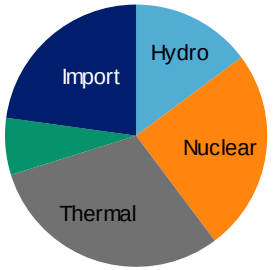
Generation



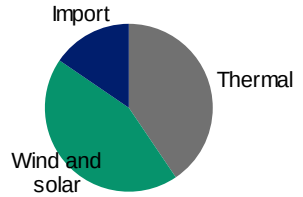
146 TWh



158 TWh



68 TWh



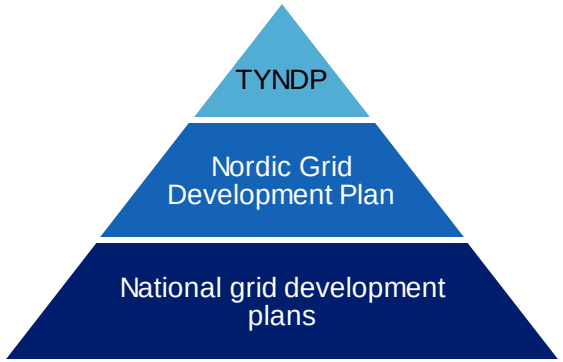
29 TWh

GRID PLANNING AND INVESTMENT IS PROBABLY THE LEAST COORDINATED ACTIVITY BETWEEN THE NORDIC TSOS

Asymmetric costs and benefits between countries complicate cross-border investments and is a new normal

- Simple win-win investment cases have been completed and new projects are more complicated with uneven and uncertain benefits and costs
- Complicating the cost and revenue sharing agreements is the threat from regulators to take retrospective actions on revenue sharing schemes

Grid investments are subject to national interests and prioritisation



- Position of a TSO on investments can change as the process develops
- Investment decisions are ultimately always national and subject to political interests → TSO or NRA or Ministry can stop analysis for non-priority IC
- Prioritisation of Nordic grid investment is a vague subject
- One or several bidding zones – national or TSO objective?

Standard Nordic CBA methodology exists but the scenarios, uncertainties and other inputs cause controversy

- There is a question whose welfare is optimised and how wider Nordic benefits are included in national approval processes
- Different views on economic uncertainties and risks can be used as a means of justifying different prioritisation of grid investments


We can do better
Yes, we can

Enabling efficient power market cost-efficiently

- Nordic grids constitute one synchronous entity – cost-efficient Nordic grid planning should be improved by utilization common resources (national scenarios, common grid models and harmonized measurement of historical congestions) and higher transparency including real involvement of stakeholders
- Consider which bidding zone structure is enabled
- Where are the most distruptive bottlenecks? What could be done for relieving those? Within control areas, cross-border?
- What can be done with relatively cheap and easy measures? Within control areas, cross-border?
- Are there additional musts'? What's the most cost-efficient approach for taking care of them?
- Combine the three previous -> NORDIC grid development plan
- How do the bidding zones possibilities look now? -> NORDIC bidding zone analysis