Transmission challenges (and other challenges) related to balancing power from hydro power in Norway

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Agenda

• Statnett, interconnections today and in 2020

• Profitability of interconnectors

• Challenges related to more ambitious development of interconnectors and hydro flexibility (Big Blue Battery)
  • Two important questions:
    • How much is economically efficient and possible?
    • How can it be achieved?

• R&D perspective. Understand to achieve
Statnett, current situation and plans

- Statnett operates and build the national power grid and interconnectors (TSO)
  - Has promoted interconnectors for more than a decade

- Today: 5000 – 5500 MW transmission capacity out of Norway
  - 2/3 to Sweden, 1000 MW to Denmark and 700 MW to the Netherlands (NorNed)

- Will double the capacity by 2020
  - Denmark + 700 MW
  - Germany 1400 MW
  - UK 1400 MW
  - Sweden 1400 MW

- More connections out of Nordic
Profitability

• Trade saves generation cost and give better utilization of resources. Differences in costs (prices) are the key to the revenue
• Products: Day ahead market. Ancillary services, reserves

• Revenue and benefits in a market context:
  • Congestion rent to grid owner and net economic benefits to market players
  • Security of supply
  • Promotes decarbonisation, more stable prices, more competition

• Market design. (Capacity payments) Regulations. ITC. Ramping restrictions

• **Does the revenue exceed the cost?**
Some interconnectors are profitable even without expansion of renewables

- Hourly price differences 2002-2008. Revenue with 700 MW
Why so profitable?

- 1. Differences in weekly price structure
Why so profitable?

- 2. Variations in average price per week

![Graph showing price variations from 2002 to 2011 for different locations: Oslo, Nederland, Tyskland, and UK. The highest price is 255 EUR/MWh.](image-url)

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Fuel price variation is a part of the explanation
Huge variation in average revenue per week
(average of price difference per hour for every week used as proxy)
The long term perspective

- Challenges related to Big Blue Battery
  - How much is economically efficient and possible?
  - How can it be achieved?
The zero emission target

- Flexibility becomes scarce

⇒ More transmission capacity needed in all directions in Europa

⇒ Need to develop new flexibility where possible
  - Hydro and pumped storage, heat demand and CHP, hydrogen, other energy storage, demand flexibility
  - *We know little about this power system*
    - Technology and regulations, prices and costs, price volatility etc

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Robust, but declining profitability of interconnectors (and new hydro flex)

- Norway's own need covered with the planned expansion
  - Variation of hydro inflow etc

- 10,000 MW will use all the existing flexibility (give or take)

- Further expansion requires new generation capacity and soon also pumping. Low cost projects first
Robust, but declining profitability
+
Many uncertain factors
Challenges to implementation

- All parties must expect to gain
  - Marked design and capacity payment
  - Perception of risk
- Fast expansion – can the market do it?
  - Cable production capacity
  - Investments in transmission and cables may be closely linked to investments in generation and pumping
  - Coordination and packing?
- Government involvement?
Thank you for your attention!