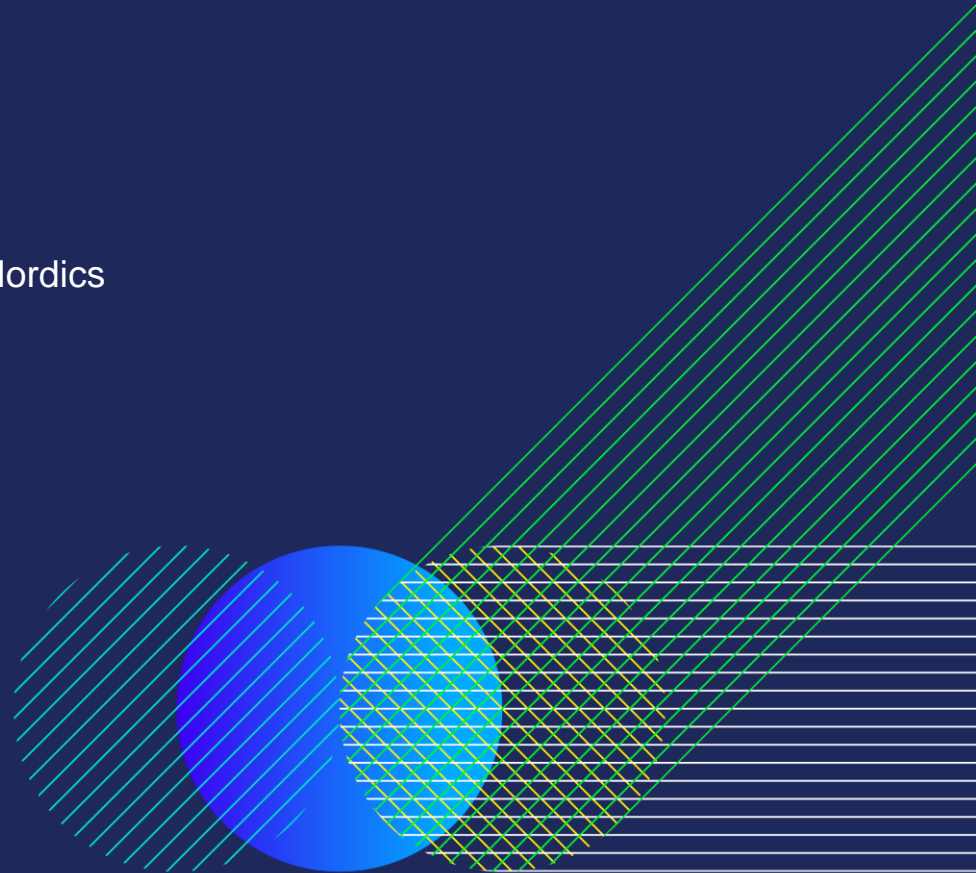


European Power Markets

A glimpse of similarities and differences – The Nordics

2021 03 10



Energy Manager

- Johnny Glærum
- Employee of Bane NOR since September 2018
- Background from power markets since 2000
- Have had positions within trading, portfolio management and origination/industry.
- Responsibilities of the Energy Manager role in Bane NOR
 - Implementation of strategies for hedging and optimization of the power portfolios.
 - Exercise and operation of adopted strategies for both train and internal consumption, which includes hedging of power, FX and certificates
 - Reporting
 - Administrative and ad-hoc energy relevant tasks

Historical development of power markets

AGENDA

- Historical development
- Fundamental contexts - Which technologies and forces balance market prices?
- How does the future look like in the Nordics?

Historical development of power markets

Regulation

- The Norwegian Energy law of 1.1.1991 was the formal start of deregulating the *Norwegian* power market
 - Background for the law was questioning of the economics of the overinvestments in the 70's and 80's.
 - Transition from political to market based price fixing in an oversupplied market
 - Long term goal has been to reach a common european integrated power system for a best possible exploitation of the resources
- I would claim that the nordic power market has been wellfunctioning until now, **why?**

Historical development of power markets

Institutional

- 1992 Statnett established as the Norwegian TSO
 - «Statnett Marked» was the exchange for power trading and settlement
- 1996 Sweden joins Norway and Nordpool ASA is established
- By year 2000 the Nordic powermarket becomes fully integrated as Finland and Denmark joined
- In 2002 Nordpool ASA was split into 2 companies
 - And in 2010 Nasdaq acquired all shares from Nordpool Clearing
- Today Nordpool is the main marketplace for physical power in the Nordics, were Nasdaq OMX is the equivalent for financial clearing
- Both marketspaces is open for competitors to enter into
- Later years national hubs for metering data and eSett for nordic imbalance settlement has been put into operation

Statnett



NORD
POOL



NORD
POOL

Nasdaq

elhub

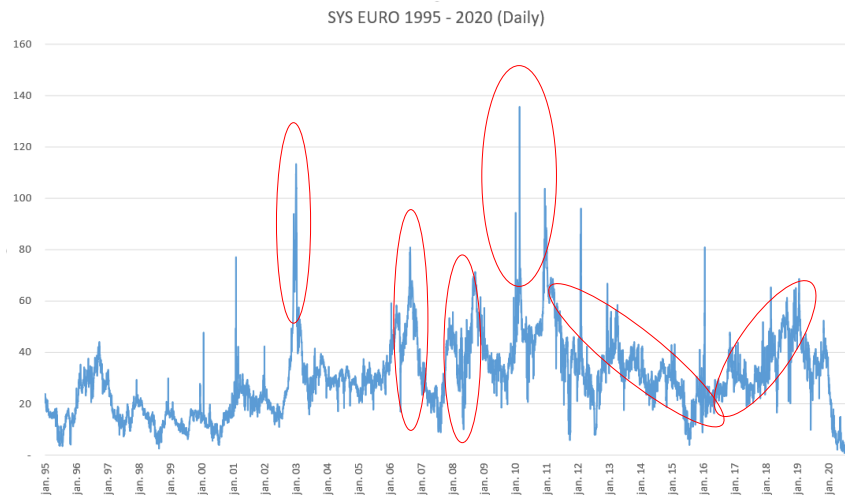
eSett

BANE NOR

Historical development of power markets

Highlights & Market happenings

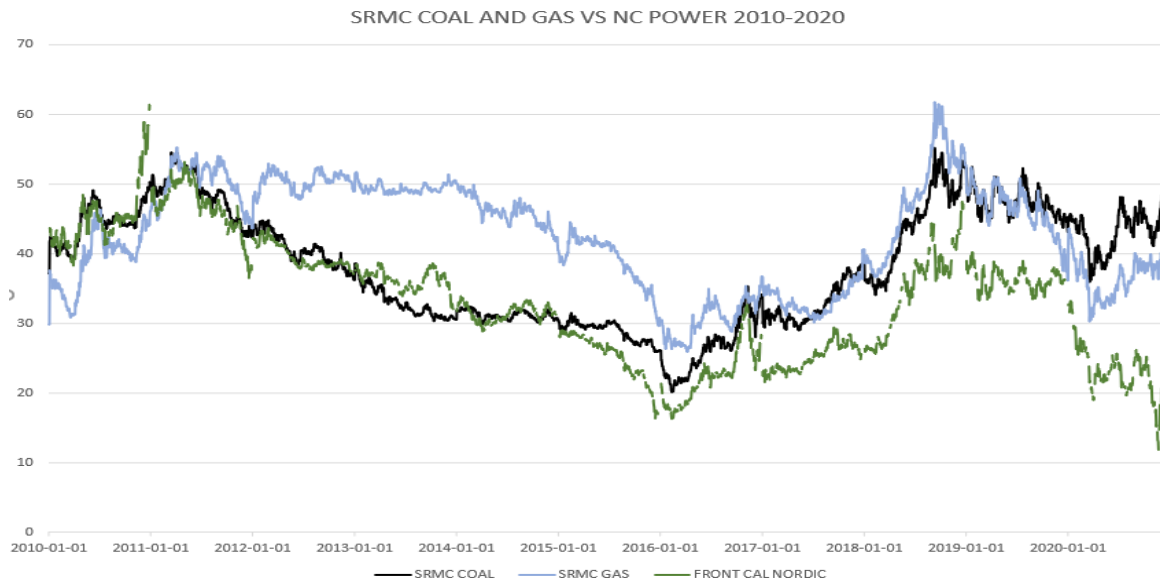
- Market test of winters 02/03, 09/10 and 10/11
- EUA ETS trading startup January 2005
- From NOK to EURO since 2006
- 2006..(Swedish nuclear, weather and EUA crash)
- Financial crisis 2008
- Introduction of the elcert market 2012
- Weather incidents and trends



Which technologies and forces balance market prices?

Price *levels* in the nordics has been determined by SRMC Coal

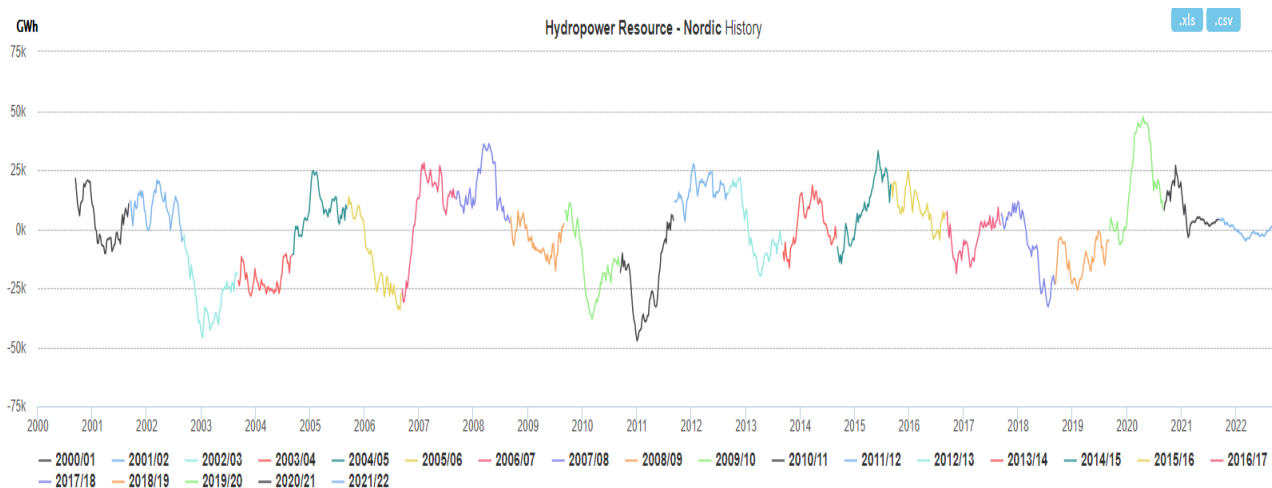
- Nicely correlated until lately..



Which technologies and forces balance market prices?

Price **volatility** in the nordics relates to changes in hydro balance

- Dry periods adds a premium to SRMC Coal, were wet periods subtracts a premium



Which technologies and forces balance market prices?

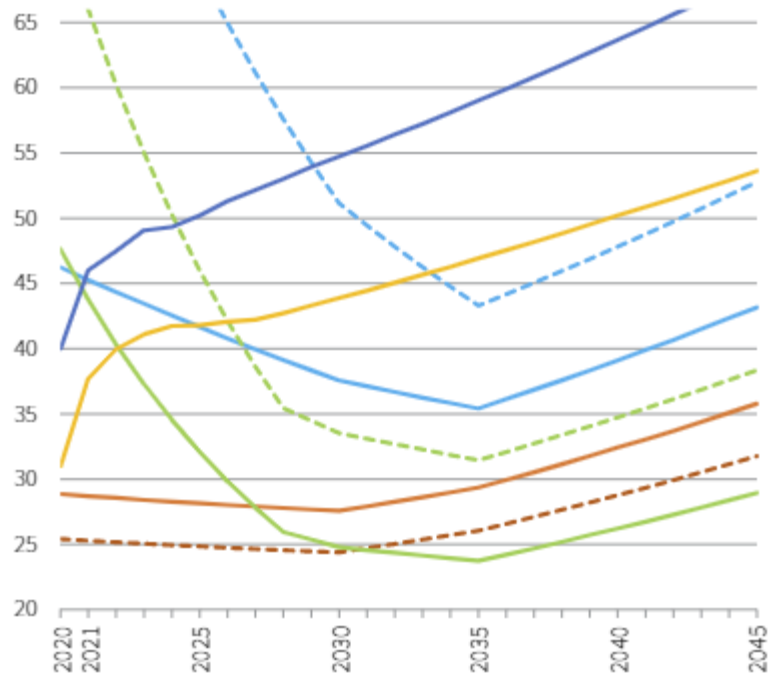
Developments over the years

- From SRMC of fuel(s) to LRMC of new technologies
- Weather has explained volatility before and in delivery – expected to continue and increase
- Tighter coupling to continental prices by extended interconnector capacity

How does the future look like in the Nordics?

LRMCs

€/MWh



- LRMC Onshore wind Nordics (3500 FLH, WACC 4.5%)
- - - LRMC Onshore wind NO4 (4400 FLH, WACC 4.5%)
- LRMC Offshore wind (bottom fixed) Nordics (4500 FLH, WACC 4.5%)
- - - LRMC Offshore wind (floating) Nordics (4500 FLH, WACC 4.5%)
- LRMC PV (Utility scale) Nordics (1000 FLH, WACC 4.5%)
- - - LRMC PV (Roof top) Nordics (900 FLH, WACC 4.5%)
- SRMC Coal
- SRMC CCGT

How does the future look like in the Nordics?

- All time low cost for new renewable power investments, all time high for expected output from renewables
 - Investments in solar to pass wind in about 6-7 years
 - Uncertainties of how much will be built out
 - Carbon market continues to be the switch mechanism
 - Large scale electrification in industry, P2X and transportation
 - Huge investments in storing and balancing of an intermittent power system
 - Increased interconnector capacity
 - Steady nuclear availability as phase out is replaced with Finnish reactors
 - System changes from a production to consumption based balancing
 - Higher consumption at low prices
- Overall target to meet net zero emissions by 2050!

