Nordic CCM Stakeholder Group meeting

11 October

Set Persson

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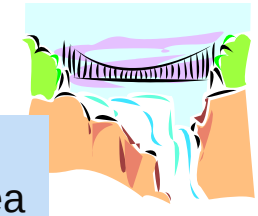
Water value

- **Marginal cost for hydro power is low**
  - If this were used to control utilization, all hydro power would be used at maximum until all reservoirs are empty. After this supplementary generation would be extremely expensive.
- **Instead water value is used**
  - It describes the most expensive other generation that can be replaced by a small portion of additional water.
  - Water value is defined from **price forecasts** and by how long the water can be stored.

Seasonal hydro power planning
Price forecast: The EMPS model from Sintef in Trondheim

800 hydropower Stations in Nordic area



About 50 large thermal power stations in the Nordic area

46 years inflow, wind and temp statistics

Network capacities

Mathematical model

Dynamic programming gives hydro shadow price.

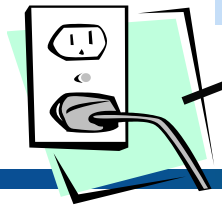
Simulation with thermal power running costs and shadow price on hydro resources.

350 thermal and 50 hydro Power Stations in Germany etc

Fuel price forecast

Result:
Price forecast

Electricity demand



Snow volume forecast

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Seasonal hydro power planning
The Prodrisk model from Sintef in Trondheim

- Different price/inflow scenarios from EMPS model

- Detailed generation schedules
- Reservoir utilization
- **Water values** for large reservoirs

Weekly planning

- Collect various types of public or purchased information:
  - Information from NordPool (UMM) about **grid** and competitors production resources.
  - Weather forecasts: Wind, inflows, temperature
- Own outages and limitations
- Short term price forecast (2 weeks):
  - SPOTNIC
- Water values for medium sized reservoirs:
  - Based on Hot Shot

Principles of current short term price model, Spotnic

Fundamental, deterministic model

A **Load prognosis**

- Load prognosis for all Nordic price areas
- Temperature dependent

-

B **Price independent production**

- Nuclear
- Wind
- must run CHP
- unregulated hydro

+/-

C **Flow between areas**

- **Transmission capacities** set limit of flow between areas and import/export, both to/from the Nordics and within the Nordics
- When optimising, the flow is calculated between the areas

=

D **Volume to be met by flexible production**

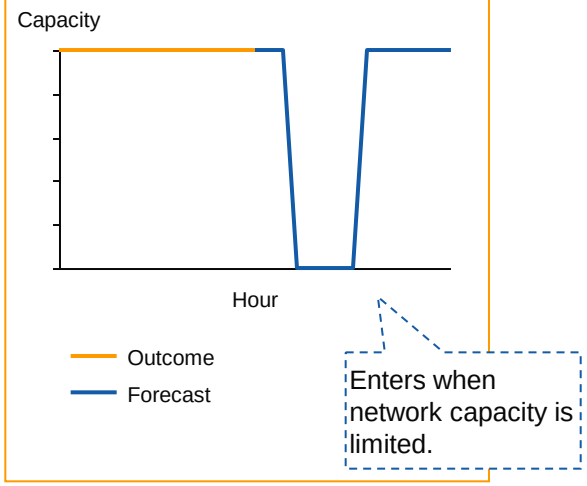
- Remaining must be met by flexible (price dependent production), mainly hydro and condensing/CHP
- Modelled with bid curves

Maximum flow is set by the capacity forecast

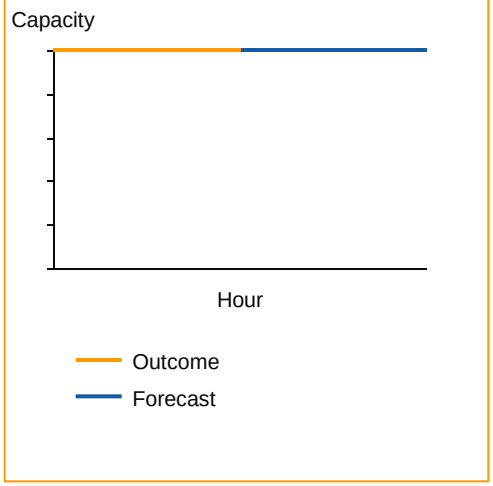
Capacity forecast

- Operator keeps track of all UMMs related to limited transmission capacities

SE1 → FI



SE1 → SE2



Limited transmission capacities

- SE1-SE2
- SE2-SE3
- SE3-SE4
- SE1-FI
- SE3-FI
- FI-EE
- FI-RU
- DK1-SE3
- DK1-NO2
- DK1-DK2
- DK2-SE4
- SE4-DE
- SE4-PL
- NO1-SE3
- NO3-SE2
- NO4-SE2
- NO4-SE1
- NO1-NO2
- NO1-NO5
- NO2-NO5
- NO1-NO3
- NO3-NO4
- NO2-NL
- DK1-DE
- DK2-DE

Vattenfalls need for information when Flow Based is used

Transmission capacities

Period	SE1-SE2	SE2-SE3	SE3-SE4	SE1-FI	SE3-FI	FI-EE	FI-RU	DK1-SE3	DK1-NO2	DK1-DK2	DK2-SE4	.....	.....
D+ 1 hour 1	2500	6500	3000	1000	600	200	600	300	600	500	800	.....	.....
D+ 1 hour 2	2000	6000	3000	1000	600	....	....	.....	.....	.....	.....	.....	.....
D+ 1 hour 3	2000	6000	3000	1000	....	....	....	.....	.....	.....	.....	.....	.....
.....	....	....	.....	....	....	....	....	.....	.....	.....	.....	.....	.....
D +1 hour23	3000	6500	3000	800	....	....	....	.....	.....	.....	.....	.....	.....
D +1 hour24	3000	6500	3000	700	....	....	....	.....	.....	.....	.....	.....	.....
D+ 2 hour 1	2500	6500	3000	500	....	....	....	.....	.....	.....	.....	.....	.....
D+ 2 hour 2	2500	6500	3000	500	....	....	....	.....	.....	.....	.....	.....	.....
.....	....	....	.....	....	....	....	....	.....	.....	.....	.....	.....	.....
.....	....	....	.....	....	....	....	....	.....	.....	.....	.....	.....	.....
D+21 hour23	3000	6400	3000	700	....	....	....	.....	.....	.....	.....	.....	.....
D+21 hour24	3000	6500	3000	700	....	....	....	.....	.....	.....	.....	.....	.....
W+4 00-07	1500	- 800	-1000	1000	....	....	....	.....	.....	.....	.....	.....	.....
W+4 07-18	2500	7000	3000	1000	....	....	....	.....	.....	.....	.....	.....	.....
W+4 18-24	2500	6500	3000	1000	....	....	....	.....	.....	.....	.....	.....	.....
W+5 00-07	2000	3000	500	1000	....	....	....	.....	.....	.....	.....	.....	.....
.....	....	....	.....	....	....	....	....	.....	.....	.....	.....	.....	.....
.....	....	....	.....	....	....	....	....	.....	.....	.....	.....	.....	.....
W+157 07-18	3000	7000	3000	1000	....	....	....	.....	.....	.....	.....	.....	.....
W+157 18-24	3000	7000	3000	1000	....	....	....	.....	.....	.....	.....	.....	.....

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