An aerial photograph of a large, irregularly shaped lake surrounded by a dense forest of green trees. The water in the lake is a deep blue-grey color, and the surrounding land is a mix of green foliage and some bare earth or light-colored soil.

Challenges of FBMC implementation from hydro-scheduling perspective

Olof Nilsson
Rebeca Brenes Brenes
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Agenda

- High level process
- Short term price forecasting
- Daily process
- Different approaches to forecast FB domain
- Challenges we experience



Key Message

- Optimal hydro-scheduling relies (partly) on NTC forecasting.
- TSO information and UMM facilitate NTC forecasting.
- After FBMC go-live, actors will need to forecast the FB domain.
- Forecasting FB domain is challenging due to lack of public data usable for forecasting.
- Information from TSO, such as UMM, will no longer be helpful as it is in the current setup.
- Actors don't have enough information to forecast changes in the domain due to changes in availability of network elements and power plants.
- Losing ability to forecast and resulting in **less optimal use of water resources.**

High Level Process

Current reservoir levels in combination with the price forecasts allows to find optimal water values.

Why do we need optimal water values?

For correct pricing for DA, AS and ID to ensure we:

- Always can maximize the flexibility we are offering.
- Don't waste resources.
- Have space in our reservoirs to meet future increased inflows.
- Save the water for times when the system needs it the most.

We assume other hydropower producers have a **similar set-up**, meaning all have **similar challenges** when implementing FBMC.

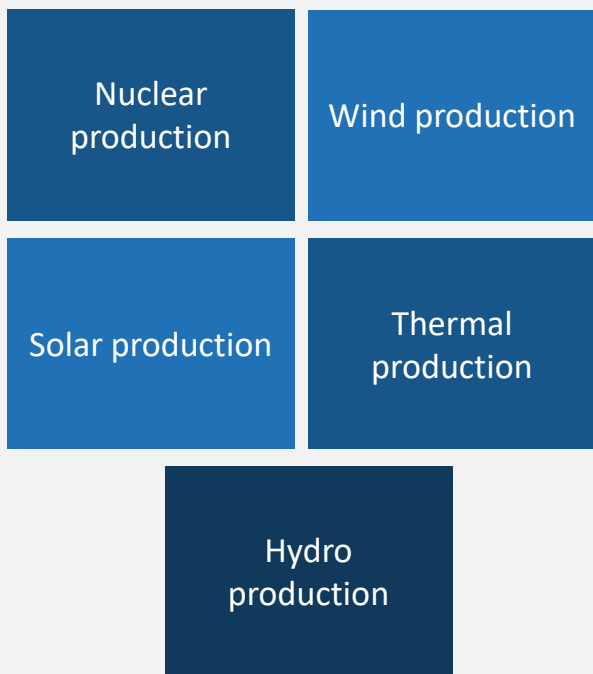
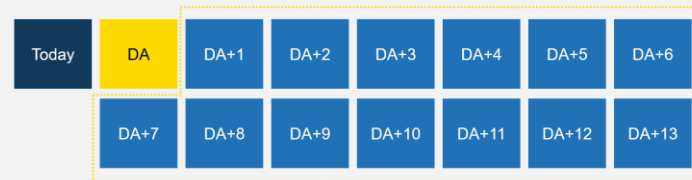
Short Term Price Forecast
Up to two weeks ahead

Reservoir Levels

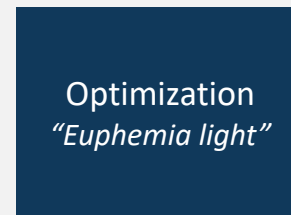
Mid Term Price Forecast
Up to five years ahead

Water Values

Short Term Price Forecast

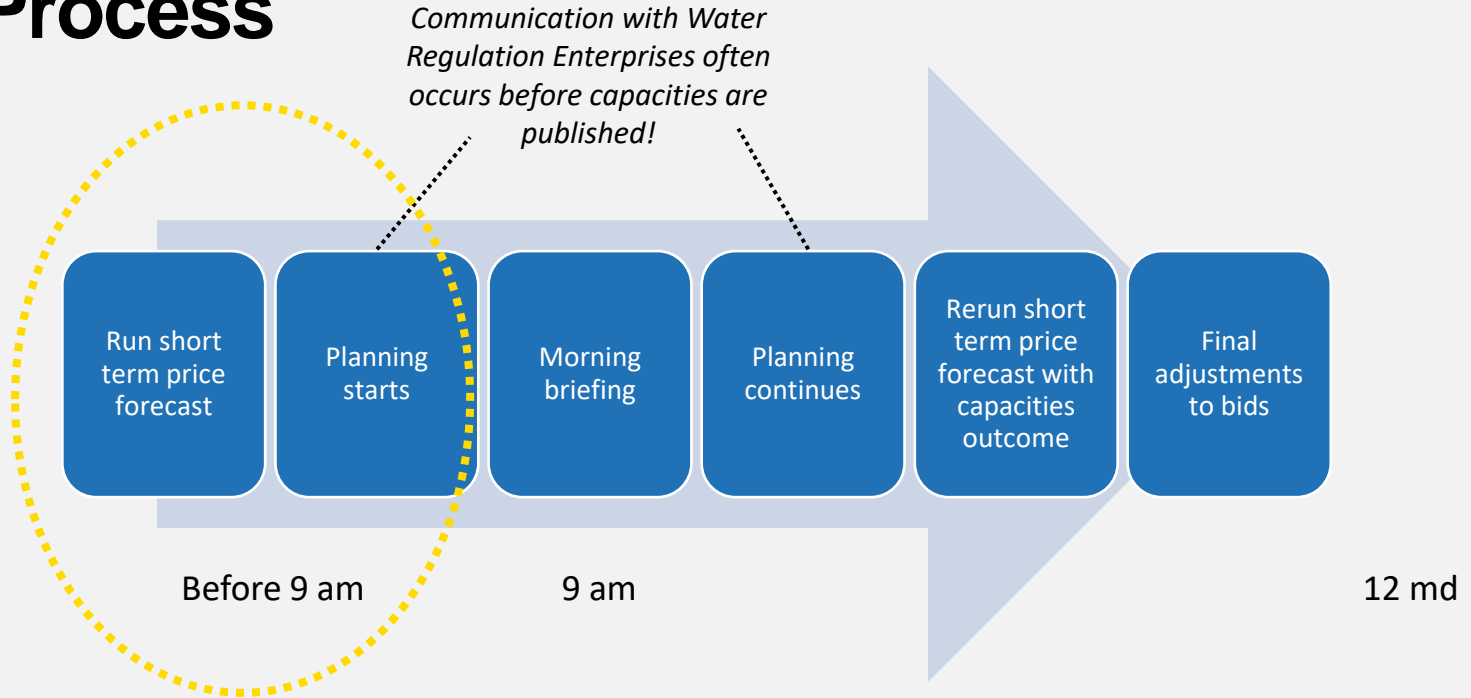


All forecasts are done **per area**, on MTU resolution up to **two weeks ahead**.



For Import/Export we forecast **NTC per border**, including UMM and trends in capacity offered by TSO
→ After **FBMC go-live**, we will need to **forecast the FB domain** up to two weeks ahead for our process to work.

Daily Process



This implies that we need a forecast of the capacities. Once FBMC is implemented, we will need a **forecast** of the FB **domain**.

After capacities are updated (often after 10 am)

Price Area Volatility



Prices are very volatile!

Besides forecasting the domain for the coming day (before the real domain is available), we need to have a domain for every hour, for the coming days.

Without proper capacities/domain, we risk to wrongly plan our water (this could mean "wasting" water and not having enough **when then system needs it**).

Different approaches to forecast FB domain

Use NTC for
DA+2 to 14

Use historical
PTDF

Domain
forecast from
TSO

*PYPSA package for example, but our research shows that general assumptions in these models does not fully allow to replicate the domain.
It requires a lot of **manual changes, verification and testing.**
→ **Requires a lot resources and time.***

Network
Model

Aggregated
network
model

(These are the approaches that we could identify)

Challenges we experience

- Anonymous CNE/CNEC in Sweden.
- No official network data, network model would then be based on assumptions.
- Generation shift keys, limited information on these, which means we can only try to do an educated guess.
- Translating NTC UMM into FB UMM, requires understanding how each UMM affects the FB domain.
- State of serial capacitors, how to model these? They have a big impact!
- Demand and production forecasts we use may differ from TSO forecasts, another error source (net position distribution would then be different).
- Up to this date we still see quite some errors in the domain description (for example substation to/from vs name definition), adds a layer of complexity when processing information.
- No existing list of all CNEC, meaning that from time to time we see new CNECs being added to the domain, which we haven't "processed".
- Forecasting of Fmax without network model and TSO assumptions is too complex.
- ... and the list goes on!

→ We need to simulate what TSO do, without all the TSO data. **Practically an impossible task!**

Most of our challenges are unique to Nordics

- Share of hydro power is much larger in the Nordics than in the Continent, which means a large share of production relies on water valuation. Pricing on the Continent on the other hand depends mainly on fuel and carbon prices, meaning no complex reservoir optimization is required.
- Nordic price areas are much smaller than the price areas in the Continent, meaning our price areas are much more sensitive to network outages. In the Continent, network outages typically have less impact. However, situation during the spring/summer 2024 with French borders shows this could also be an issue for Continent if large outages in the network and certain combinations of production & consumption.
- No anonymous CNE/CNEC in Continent facilitates using historical domain and/or creation of network model based on domain.

How do we get most value out of flow-based?

- Big actors like Vattenfall may have more resources to put into FB modelling and trying to do educated guesses, and even so it proves to be a complex task. But what about smaller actors?
- We would like to see more **openness** from TSO with the data and assumptions to facilitate forecast process.
- More collaboration between Nordic RCC/TSO and stakeholders: understanding each other needs and finding solutions for the Nordic-specific challenges actors face.

An aerial photograph of a large, roughly circular pond with dark blue water, surrounded by a thick forest of green trees. The pond is the central focus, with the text 'Thank you! Q&A' overlaid in white. The surrounding forest is dense and vibrant green, with some lighter patches of grass or bare earth visible near the water's edge.

Thank you!
Q&A