

mFRR CM in our SHOP processes

KARIN ORRE, FREDD KRISTIANSEN, HANS OLE RIDDERVOLD

Fredd Kristiansen





Education:

• Master degree in Electrical Engineering NTNU (2002)

Work experience:

- 2003-2025 Member of the industry steering committee for the research and development of SHOP.
- 2012-2025 STATKRAFT, Senior Specialist Hydropower modelling
- 2008-2012 STATKRAFT, Production planner
- 2007-2008 STATKRAFT Trondheim, Production planner
- 2002-2007 Trondheim Energi, Systems specialist and Production planner

In my free time, I like to :

- I play the card game bridge and just became a regional champion.
- I like hiking



Bacground – market development mFRR capacity market (CM)



- mFRR capacity market: We get paid for reserving capacity for mFRR market
- There has been a increase in volume when mFRR CM was introduced
- «Flow based» and «dynamic procurement» is also affecting the volume in this market.



Our operative processes

Our mFRR CM tasks

- Prepare bids for mFRR CM
- We run SHOP before we send bids to the exchanges
 - Price
 - FCR, aFRR and mFRR contracts
- We run SHOP when we have gotten the prices and contracts from the exchanges
 - Load
 - FCR, aFRR and mFRR contracts
- To maintain a high efficiency in these processes we need to maximize
 automation and minimize manual work

Our SHOP portifolios

NO2: (22 plants)
NO3: (27 plants)
NO4: (19 plants)
NO5/1: (16 plants)
SE1: (1 plant)
SE2: (34 plants)
SE4: (15 plants)



Deadlines for nominating ancillary services



Deadlines for nominating intraday- and dayahead- auctions

What we want SHOP to optimize in our processes

100

90

80

70

60

50

40

30

20

10

6

MΜ

mFRR up

Inrtra day flex up

Intraday flex down

mFRR down

Min prod

 This picture illustrates how we present planned production, FCR, aFRR, and mFRR for each unit.

• When there is spare capacity in the portfolio to cover both the energy market and the CM, we want to utilize the most expensive water for CM and the cheapest water available for intraday markets.

This is now random in SHOP

This is a graph from our new SHOP GUI



The tested solutions

• Test 1: Inverted mFRR costs.

7

- We tried including a negative cost for delivering mFRR, we assumed this would make the CM up contract to be placed on the plants with the highest water value.
 - Efficiency is not taken into account.
 - Short term reservoir constraints is not considered.
- Test 2: A two-step solution with high/low price
 - We tried running SHOP two times, one with a CM up contract and a high market price and one with a CM down contract and a low market price to find the distribution of the CM contract and lock this in the nomination/scheduling process.
 - Sub optimal solution for a «normal» market price.
 - Some plants might deliver both up and down reserves, which is not feasible.
- Test 3: A two-step solution with high/low load.
 - We tried running SHOP two times, one with a CM up contract and a high market load and one with a CM down contract and a low market load to find the distribution of the CM contract and lock this in the nomination/scheduling process.



• Some plants might deliver both up and down reserves, which is not feasible.

The results – missing functionality for a perfect workflow

- We have plants that take longer than 15 minutes to start and Statnetts rulebook on mFRR EAM might lead to high unbalance costs for us if we stop the units.
 - A flag to include or exclude MW below Pmin in mFRR CM down.
 - There might be situations that we have plants that have a "must run" constraint, that can deliver CM up/down
- Units with prohibited operating ranges.
 - The mFRR CM optimization can give a result that if activated the unit will run in prohibited ranges.
- Cross-optimization of ancillary markets
 - We would like SHOP to distribute mFRR CM up and down in the same optimization, taking into account water values.
 - Long term we would like SHOP to distribute all ancillary contracts in a single optimization.
 - Calculation time within reasonable limits.



The results – we need to co-optimize price/load with all ancilliary service contracts to get a good and fast solution

- We are looking for partners to start a project with Sintef on this task.
- In the meantime, we use method 1 from the last slide and manually correct for the weaknesses.





statkraft.com

