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Nordic Balancing Model

Shadow Operation

of the new nordic mFRR energy activation market Nordic balancing model

Webinar, September, 2024

Nordic Balancing Model Program

Welcome

- Welcom to webinar presenting market results from Shadow operation
- Purpose:
  - Prepare all market parties for the upcoming changes in the Nordic mFRR market
  - Share as much insight as possible in a transparent way
- Shadow operation is internal trial operation including all four Nordic TSOs
- Shadow operation simulates the nordic mFRR platform that runs every 15 minutes, with fully automatic processes at each TSO
- Meeting rules:
  - Mute your mic!
  - Questions in the chat are welcome – we will try to answer after each topic
  - We will also answer questions at the end
- Recording will be available after the meeting

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mFRR EAM in brief

- mFRR EAM is a fundamental change in how we manage the Nordic power system
- From an operator-centred model to an algorithm-centred model
- Necessary step for 15 min and MARI
- Requires automation and standardization at TSOs and BSPs
- **Go-live December 3 at 13:00**

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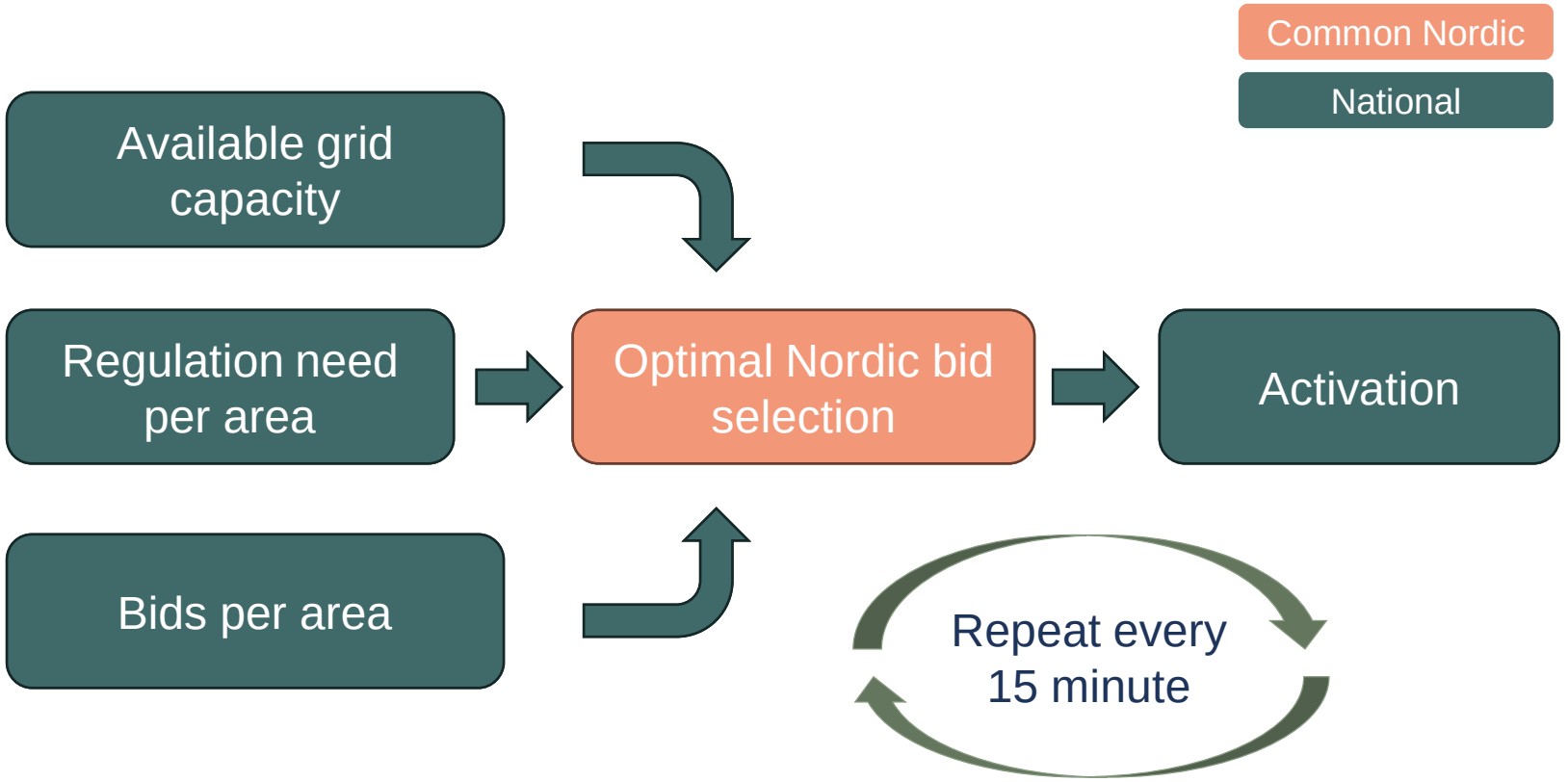
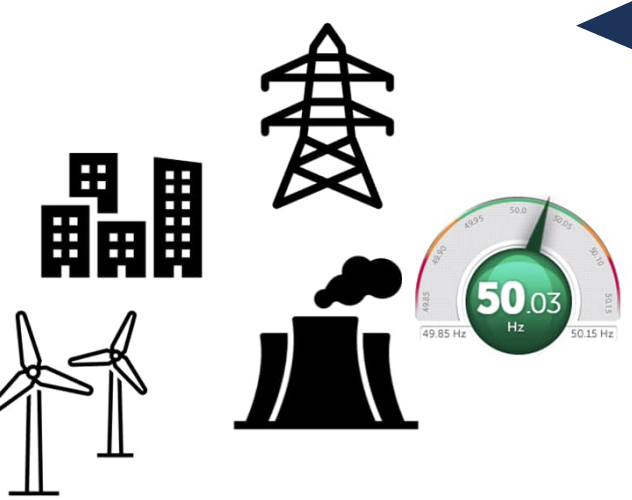
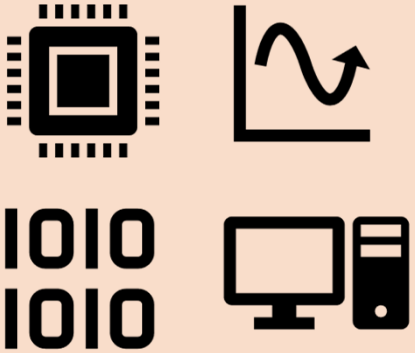




TSO



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ENERGINET

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Disclaimers

- All results are from a test system, and will not reflect the real operation perfectly
  - In the stabilization period errors happen, sometimes they affect the market result
- No operator in the loop
- Exisisting bids are used
- Existing market capacities are used (no flow-based impact)
- Price formation in shadow operation is not always reliable

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How is the automatic balancing working?

Eivind Lindeberg, Statnett

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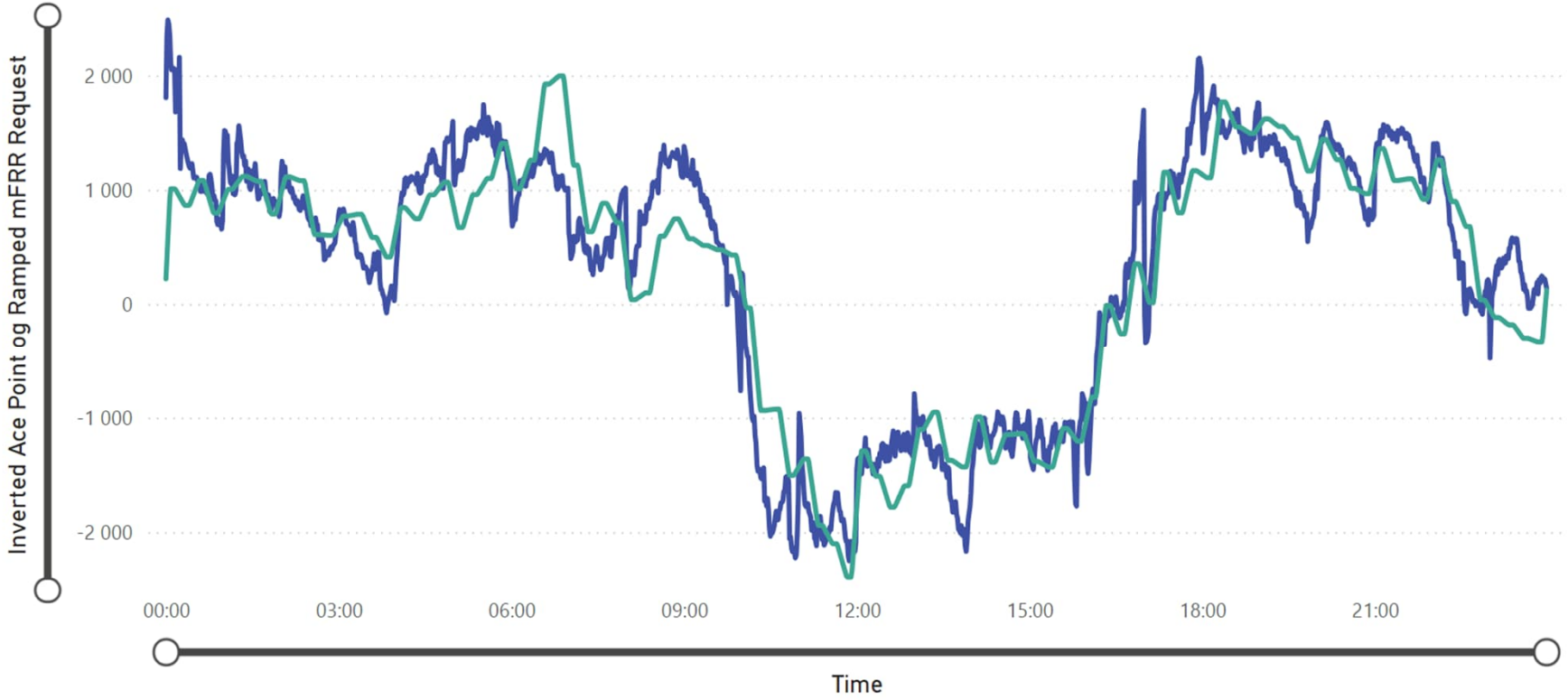
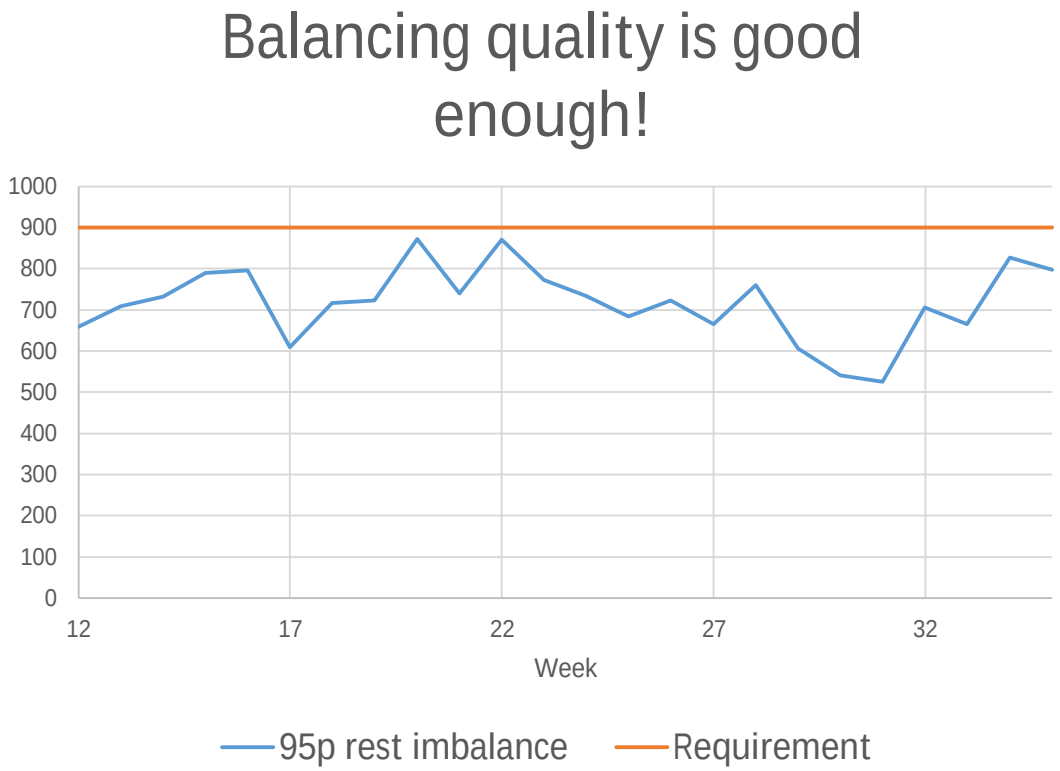
How is the automatic balancing working?



How is the automatic balancing working?

- All TSOs forcast the imbalances per bidding zone
- "mFRR Request" made based on the imbalance forecast
- If the mFRR request does not match the imbalance we must use aFRR and FCR
- Goal:
  "Rest imbalance" < aFRR + FCR-N
- Shadow operation indicate similar frequency quality as today



Automation will lead to more frequent activations.

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- Computers don't hesitate
- Bid selection is done in an algorithm, based on input from 4 TSOs, not the manual assesment of an operator
  - mFRR need change every 15 min
  - Bid list change every 15 minutes
  - ATCs
- Imbalances will change more frequently.
- "Quarter shifts" and production smoothing included in mFRR

VV0

VV0 ?

Valli Väinö; 2024-10-07T07:08:52.888

EL0 0 Removed

Eivind Lindeberg; 2024-10-07T07:58:04.992

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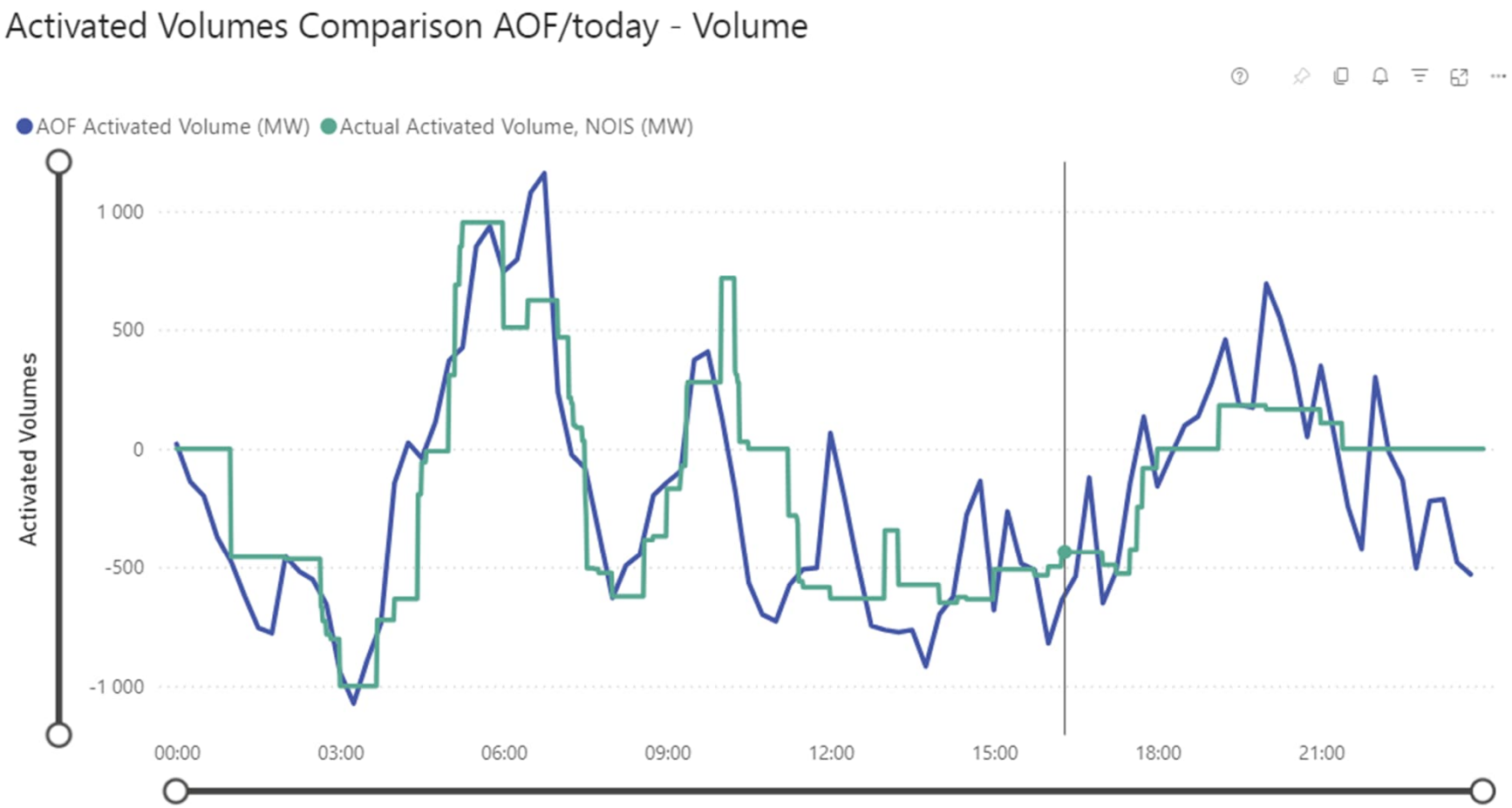
More changes in total activation



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Example from one day for one regulated object

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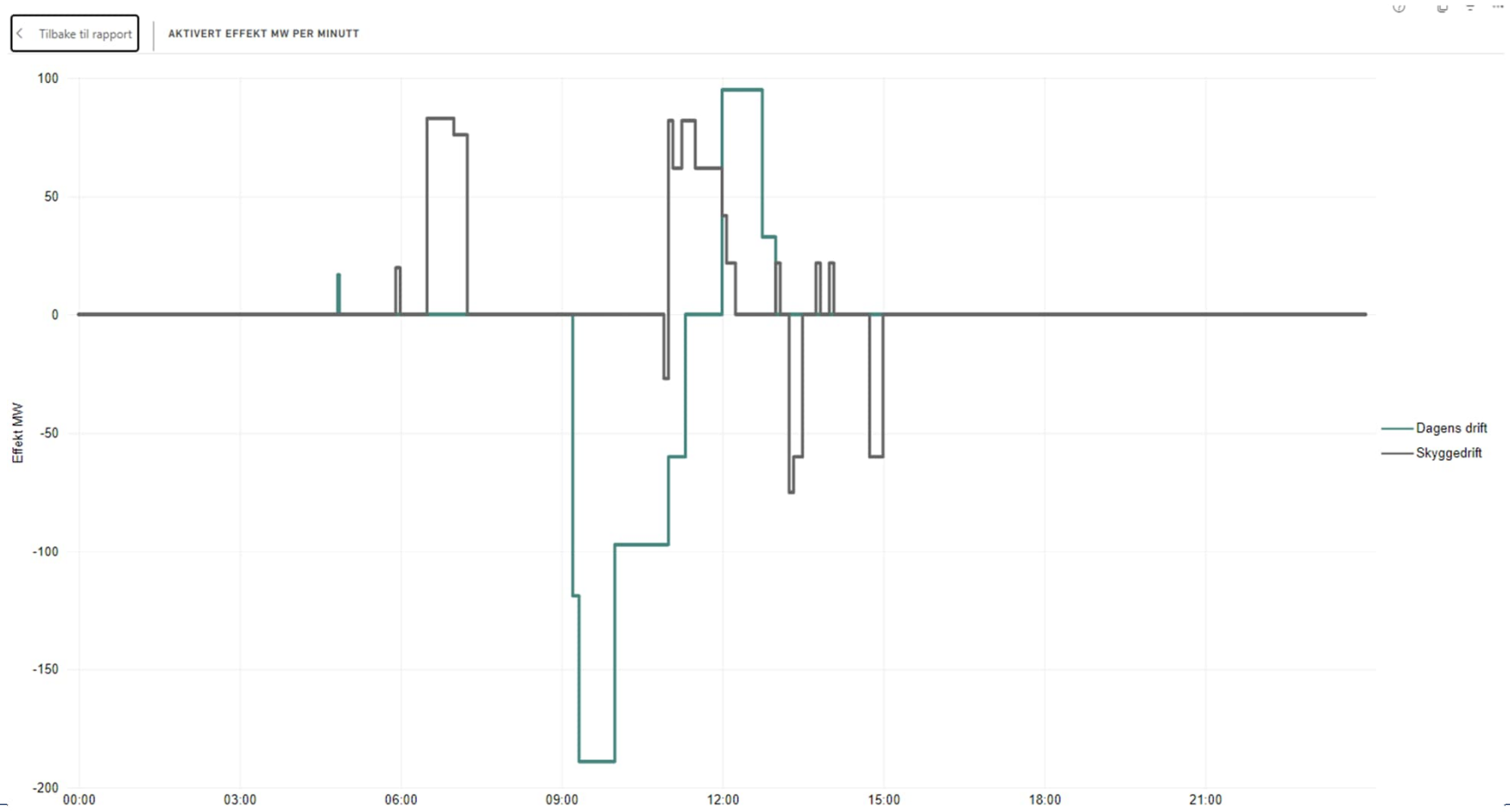
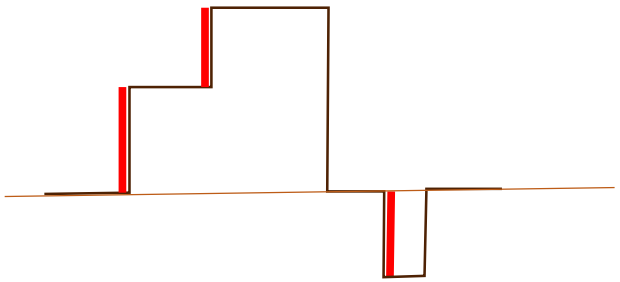


More frequent regulation

>100%

more changes in activated power

- Per regulated object/station group
- Including quarter shifts (today) and Period shift (shadow)
- Data for Norway



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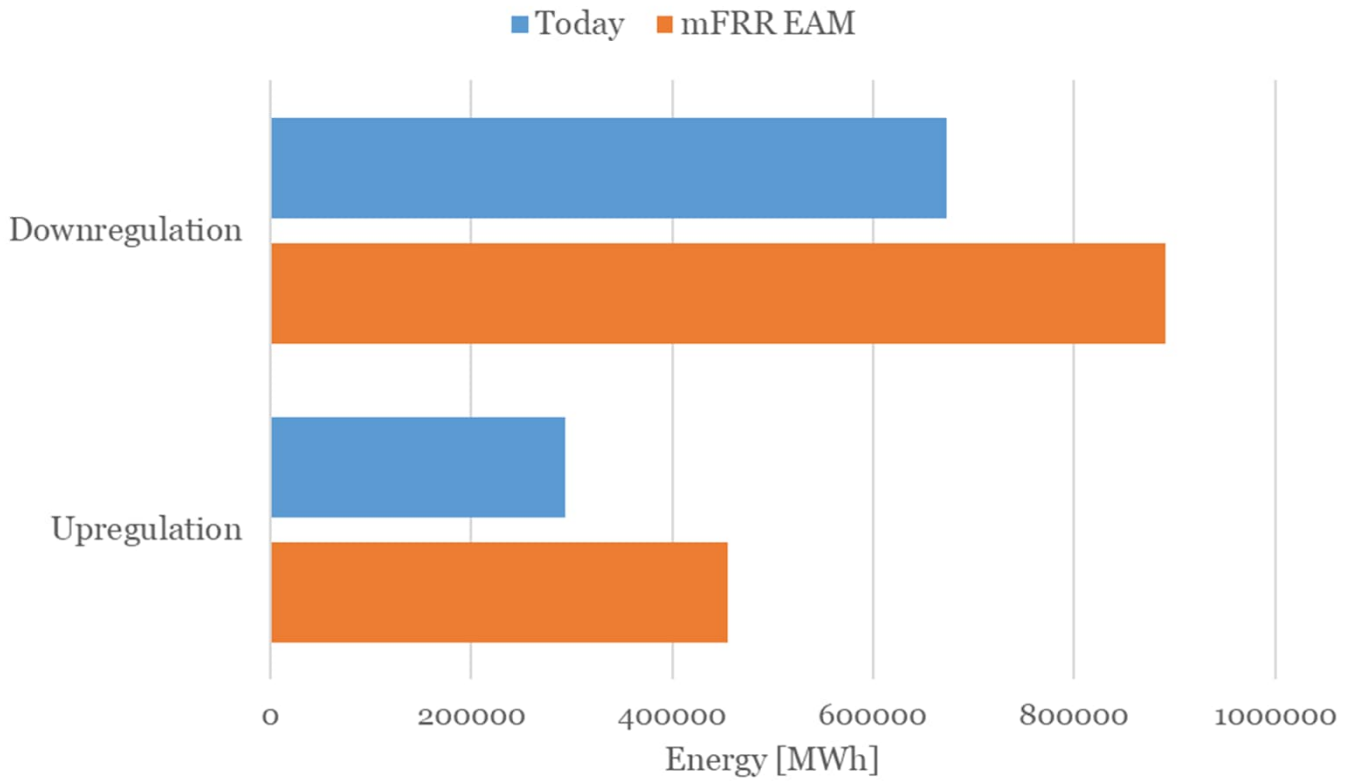
Activated volumes are higher than today

Ellika Wik, Svk

Activated volumes are higher than today

- Increase in counteractivation, decrease in netting
- The AOF does not hesitate to activate on the forecasted imbalance
  - The time no mFRR is activated in the Nordics goes from 13 % today to 0.1 % with mFRR EAM
  - Even if all mFRR needs could be netted like today there would still be an increase in activated energy

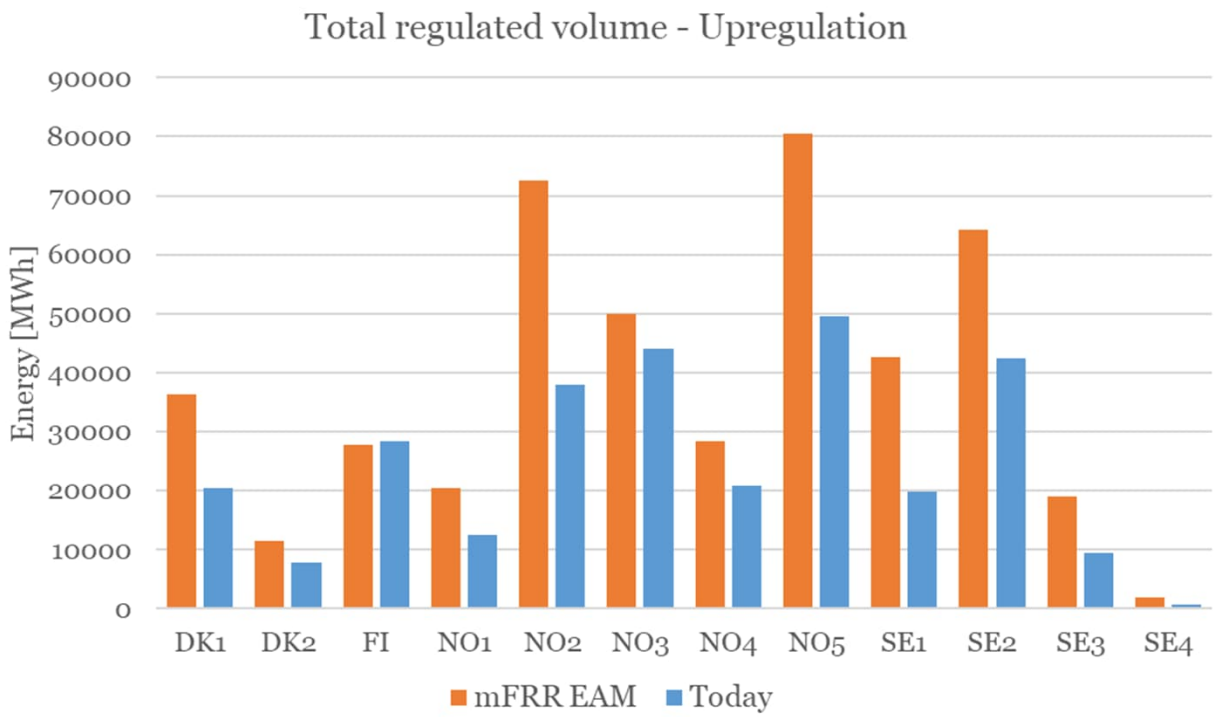


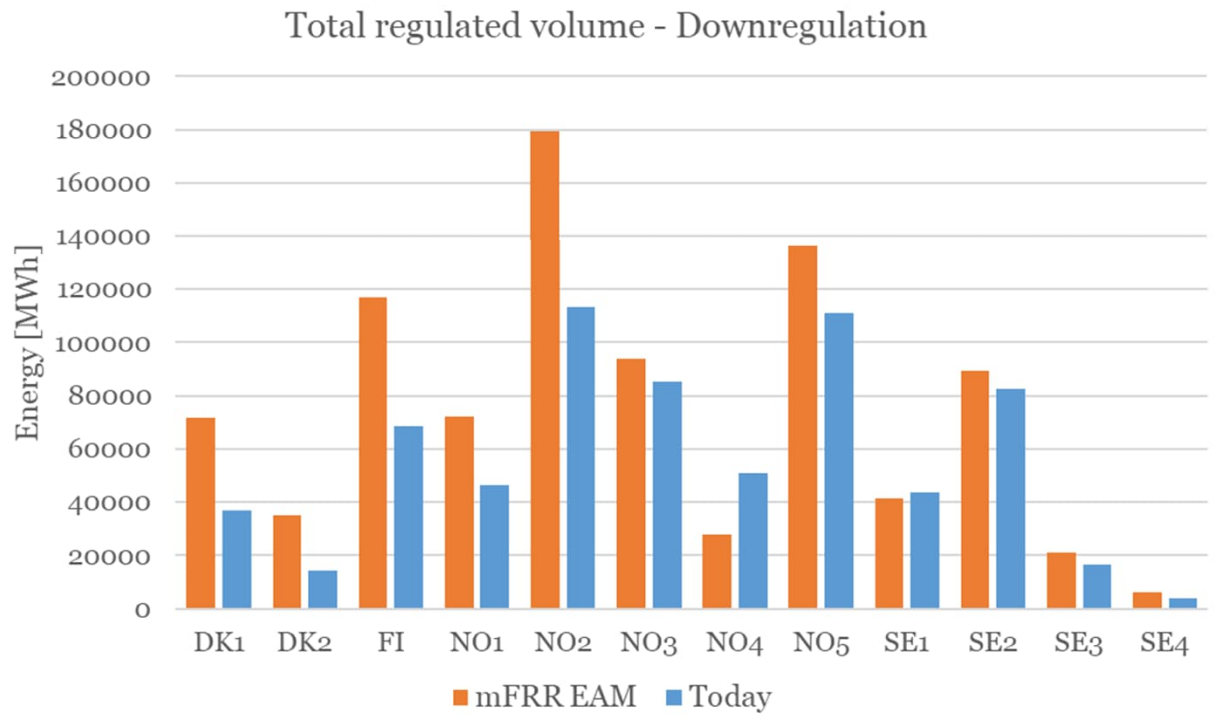
Activated volume increases in most areas

The increase in activated energy is visible in most bidding zones

The exceptions are:

- Upregulation: FI
- Downregulation: NO4, SE1

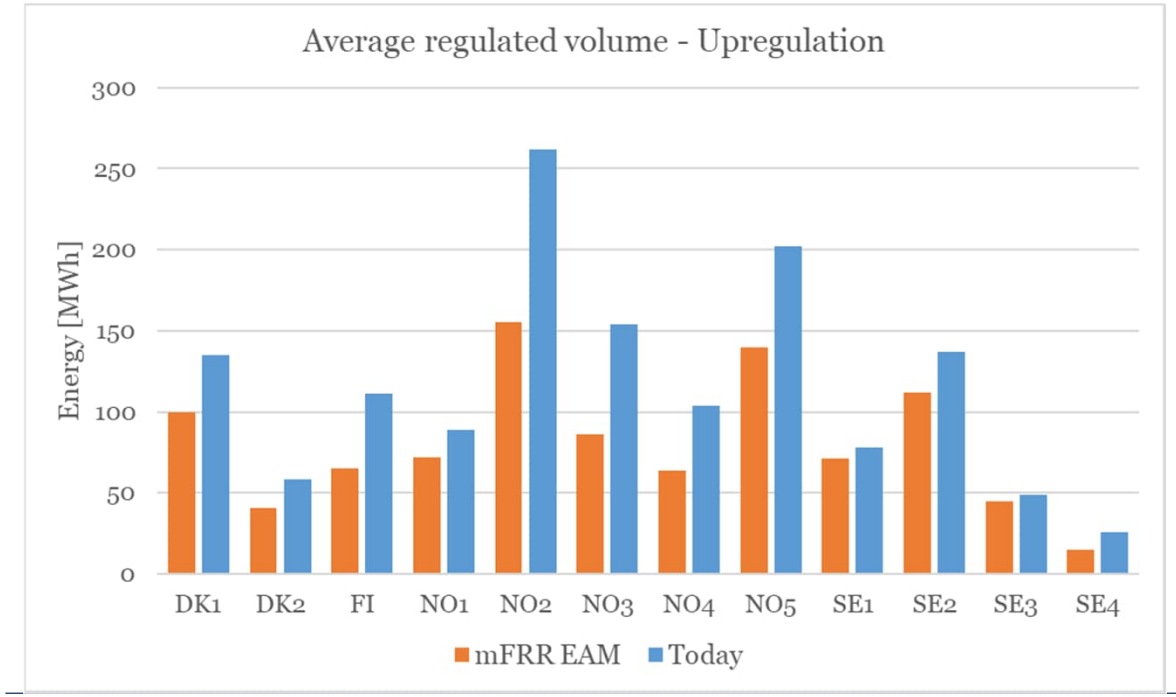


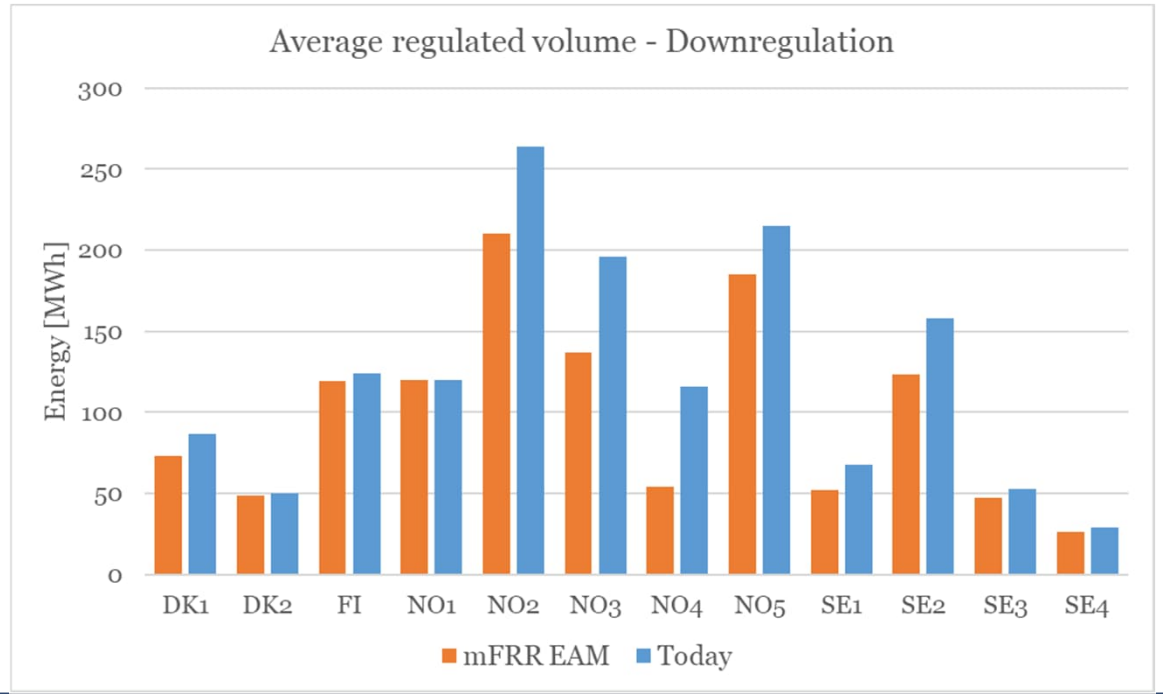


Average activated volume decreases

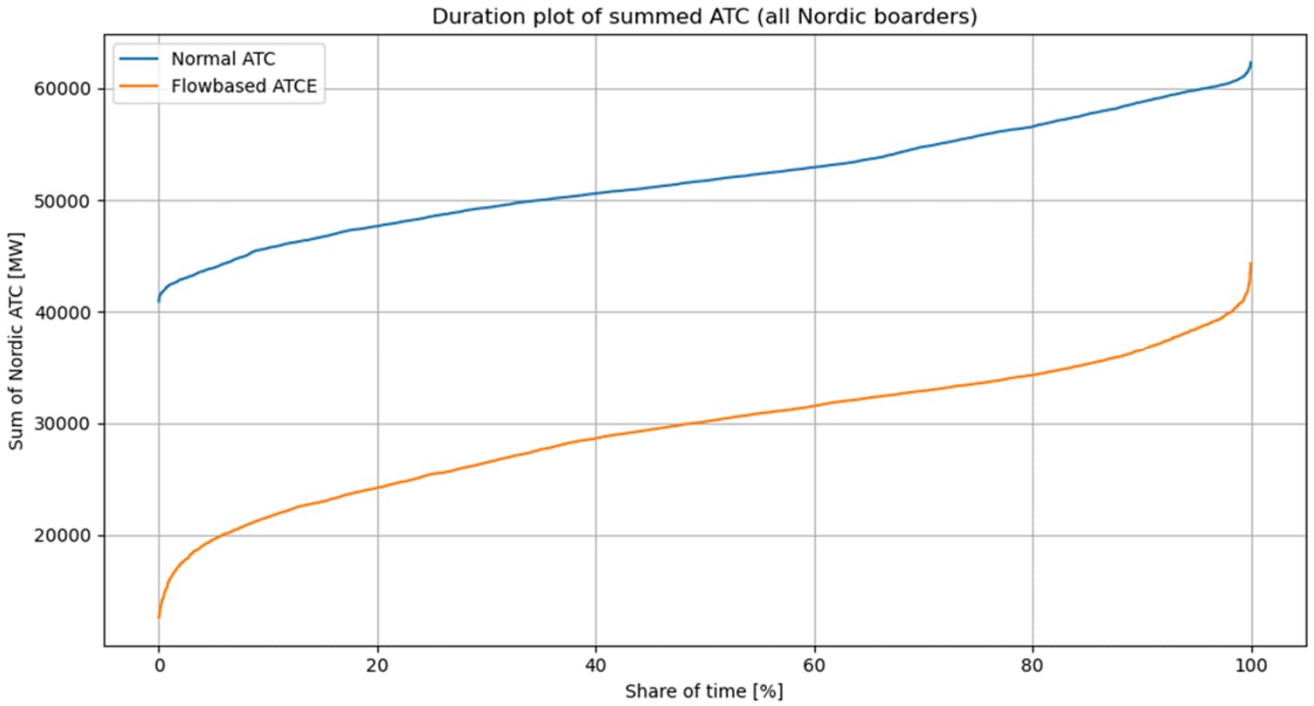
This indicates an increase in small activations in mFRR EAM

The AOF does not hesitate to activate on big or small mFRR needs





Flow-based affects the available cross-border capacity (ATC)



- The results in previous slides are based on the ATC today
- ATCs will be lower after Flowbased go-live
  - Even less netting possibility meaning further increase in activated volume
  - More activations in areas that see few activations today
- To deal with this the TSOs will use mFRR capacity market and transmission capacity reservations more

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Counteractivation

Lasse Diness Borup, Energinet

We see much more *counteractivation* in Shadow operation than today

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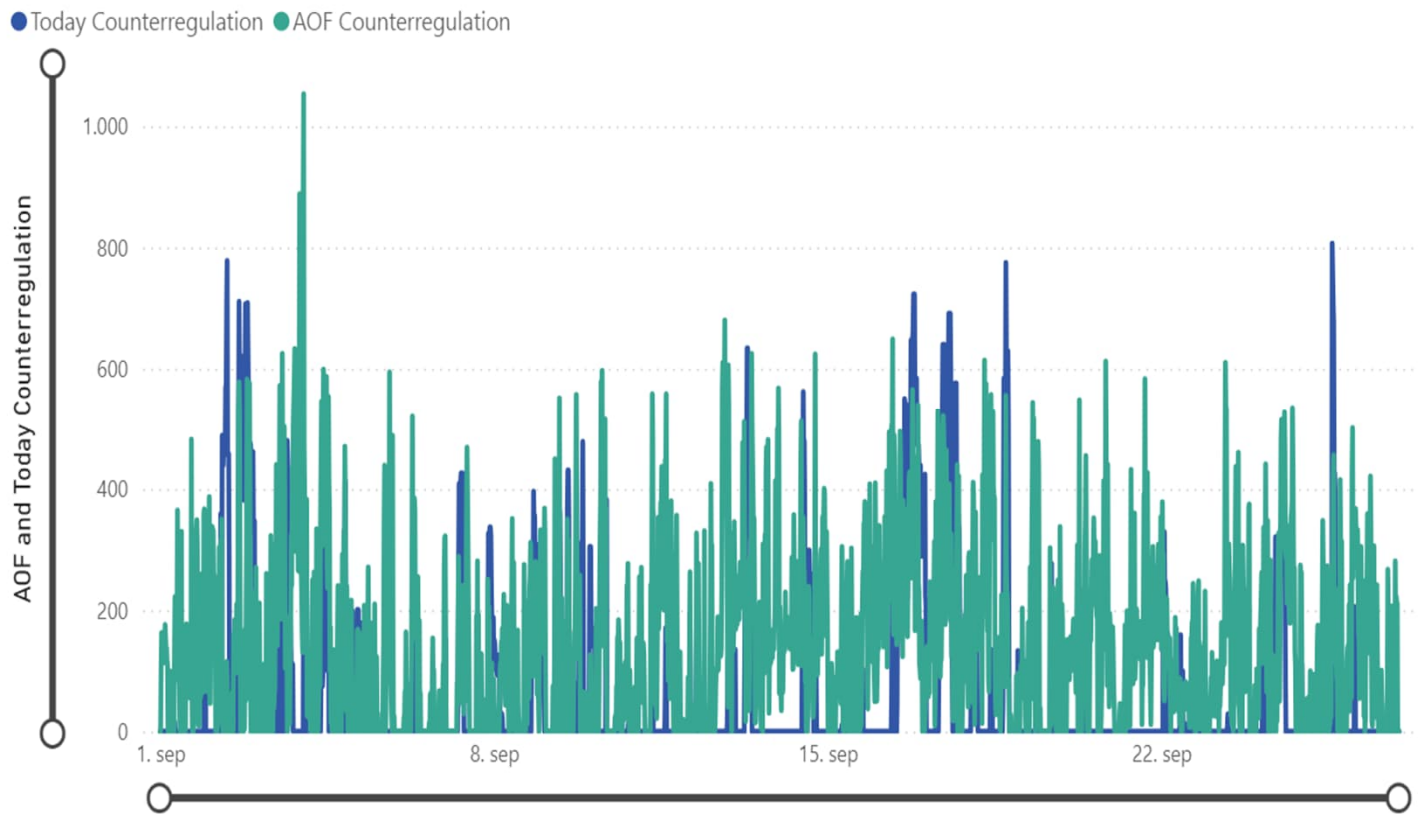

Area
- Denmark
  - DK1
  - DK2
- Finland
- Norway
  - NO1
  - NO2
  - NO3
  - NO4
  - NO5
- Sweden

	Today	AOF
Average MW	61	144
No. of QH	519	1910
Max MW	807	1053
% of QH	21 %	77 %

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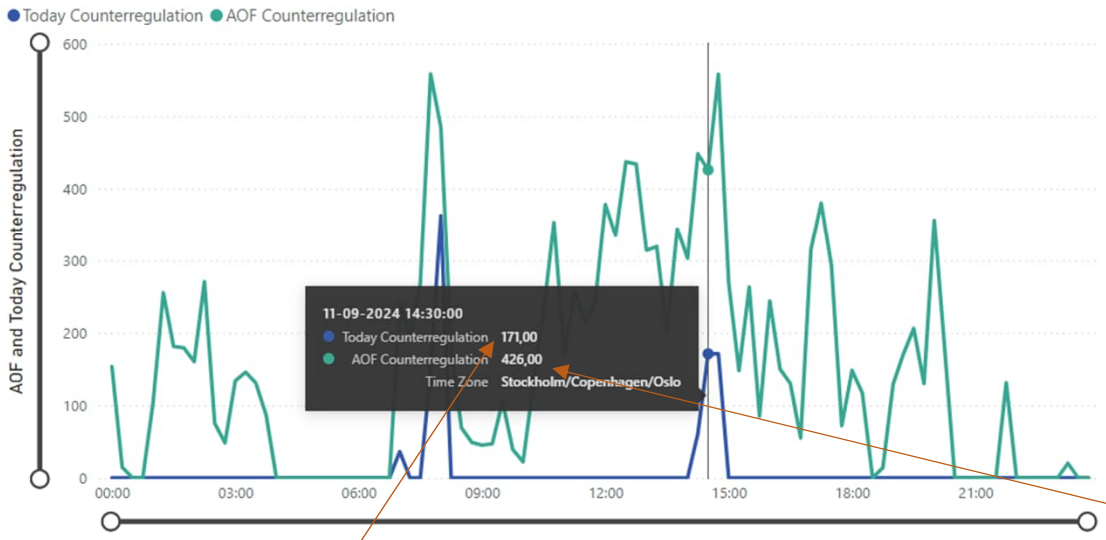
Example



AOF data

14:30 - 14:45

Areas

CtrlA		SchA	Offers [MW] Up	Offers [MW] Down	Needs [MW] Up	Needs [MW] Down	Activated Offers [MW] Up	Activated Offers [MW] Down
CtrlA|DK		DK1	564.0	2,201.0	0.0	483.0	0.0	146.0
		DK2	246.0	267.0	0.0	491.0	0.0	10.0
CtrlA|FI		FI	785.0	1,111.0	342.0	0.0	342.0	0.0
CtrlA|NO		NO1	0.0	321.0	0.0	54.0	0.0	30.0
		NO2	2,737.0	2,167.0	0.0	228.0	0.0	468.0
		NO3	1,072.0	1,619.0	11.0	0.0	25.0	0.0
		NO4	1,826.0	246.0	0.0	164.0	0.0	0.0
		NO5	833.0	1,178.0	0.0	34.0	0.0	60.0
CtrlA|SE		SE1	1,845.0	836.0	23.0	0.0	10.0	0.0
		SE2	632.0	1,324.0	726.0	0.0	49.0	0.0
		SE3	230.0	270.0	307.0	0.0	0.0	0.0
		SE4	32.0	7.0	0.0	243.0	0.0	0.0
Regional Aggregation			**10,802.0**	**11,547.0**	**1,409.0**	**1,697.0**	**426.0**	**714.0**

Actual data

Bid Detail | Activations | Balance Detail

	Balance MW	Balance Deactivation
Up	775.00	0.00
Down	-171.00	0.00
Sum	604.00	0.00

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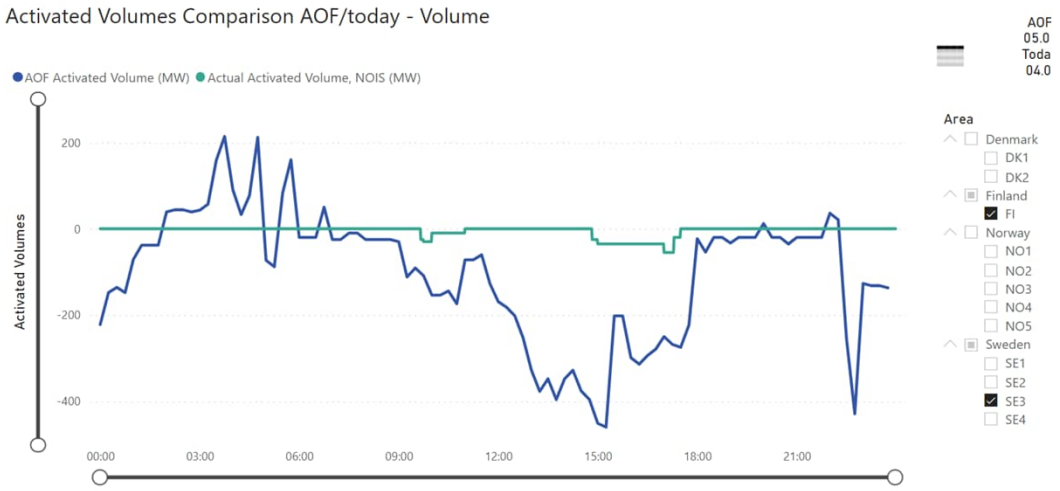
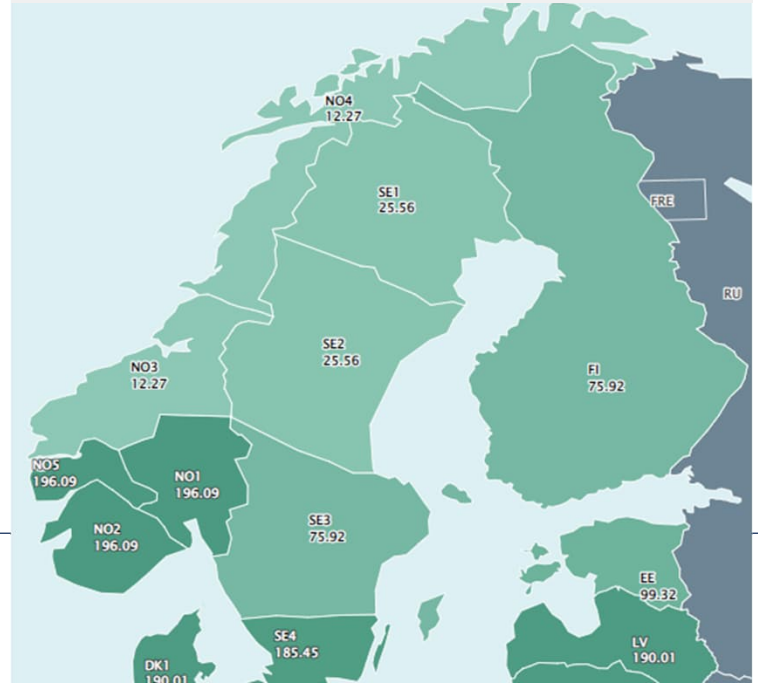
Why more counterregulation?

- Today the operators balance starting with the total Nordic *NETTED* demand.
- In AOF netting is done when it is economically efficient.
- This can lead to more down-regulation in relatively expensive areas.



Example:
FI&SE3 have the same spot price, while neighbouring areas have a lower price. Downregulation bids in FI/SE3 are available with **higher price, than the upregulation** bids in the neighboring areas.



Why is regulation less expensive than netting

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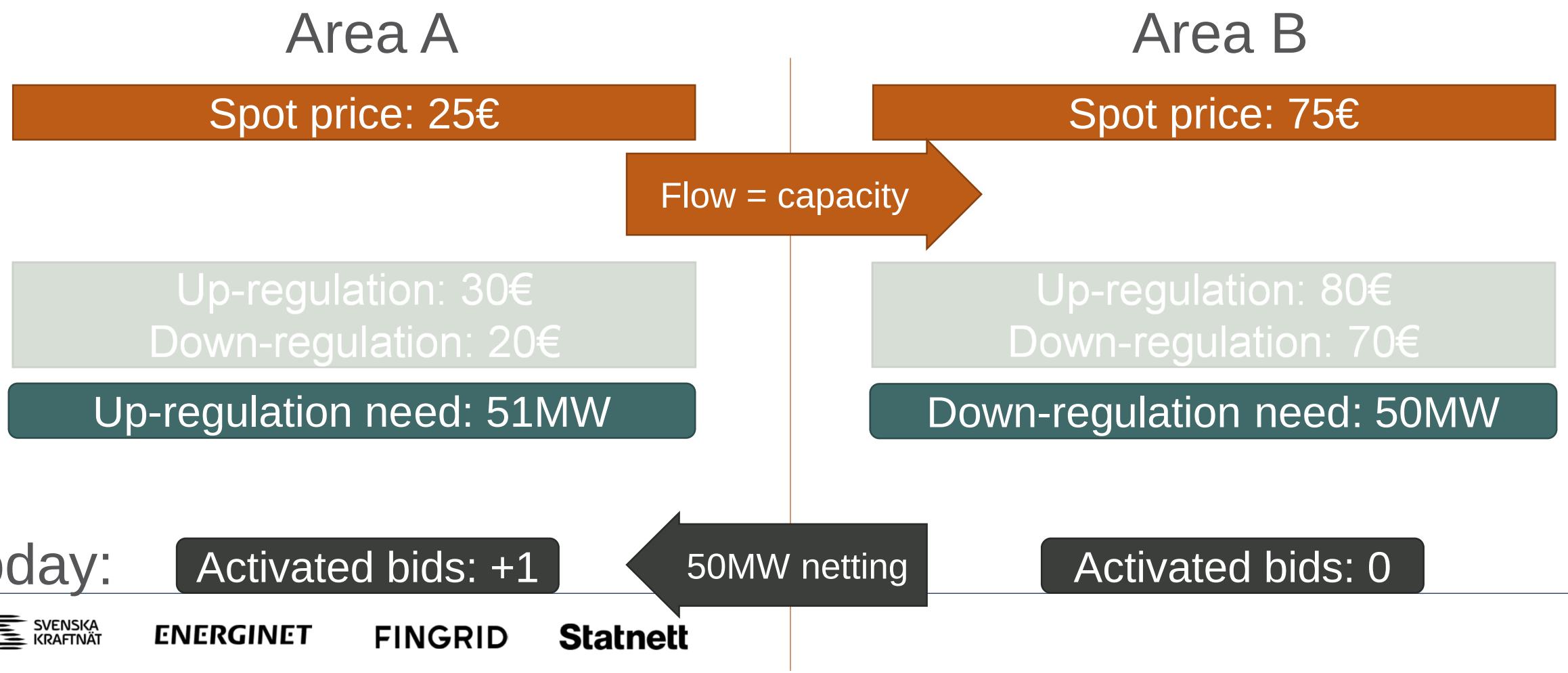
- How can it be "cheaper" to do *something* rather than nothing?



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Why is regulation less expensive than netting

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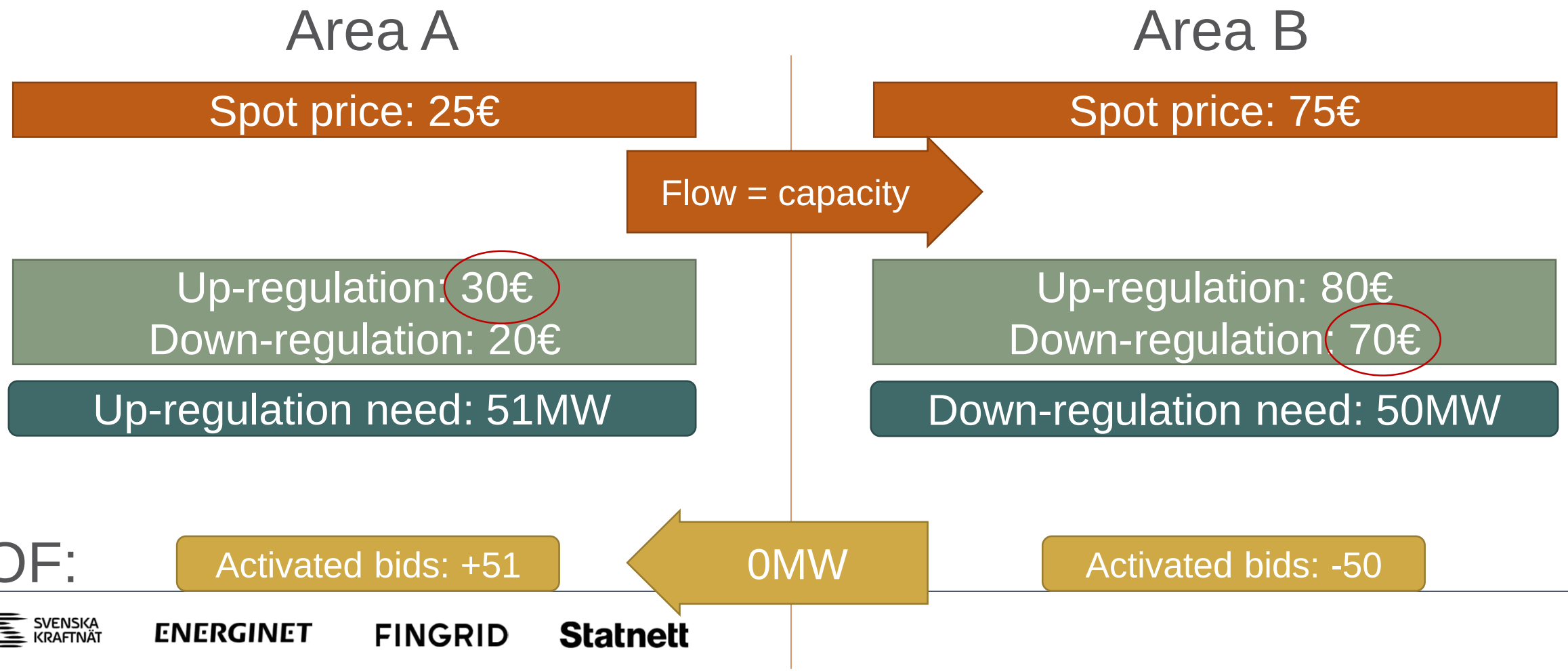

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Why is regulation less expensive than netting

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Activated bids: +51

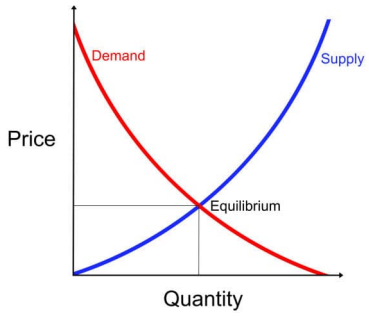
0 MW

Activated bids: -50

TSO pays 51*30€

TSO *receives* 50*70€

- ✓ In both cases the TSOs solve the balancing problem
- ✓ In the AOF the TSOs of the two areas combined also gains/saves 50MW*(70€-30€) = 2000€



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Prices

Väinö Valli, Fingrid

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Pricing in mFRR EAM

- In final stage mFRR and imbalance price will be set for every quarter hour*
- **before common Nordic 15 min ISP (March 2025)* mFRR and imbalance price will be set for 60 minutes based on the price of the most expensive QH -in the dominant direction, per uncongested area
- In Finland and Denmark also aFRR price can set the imbalance price

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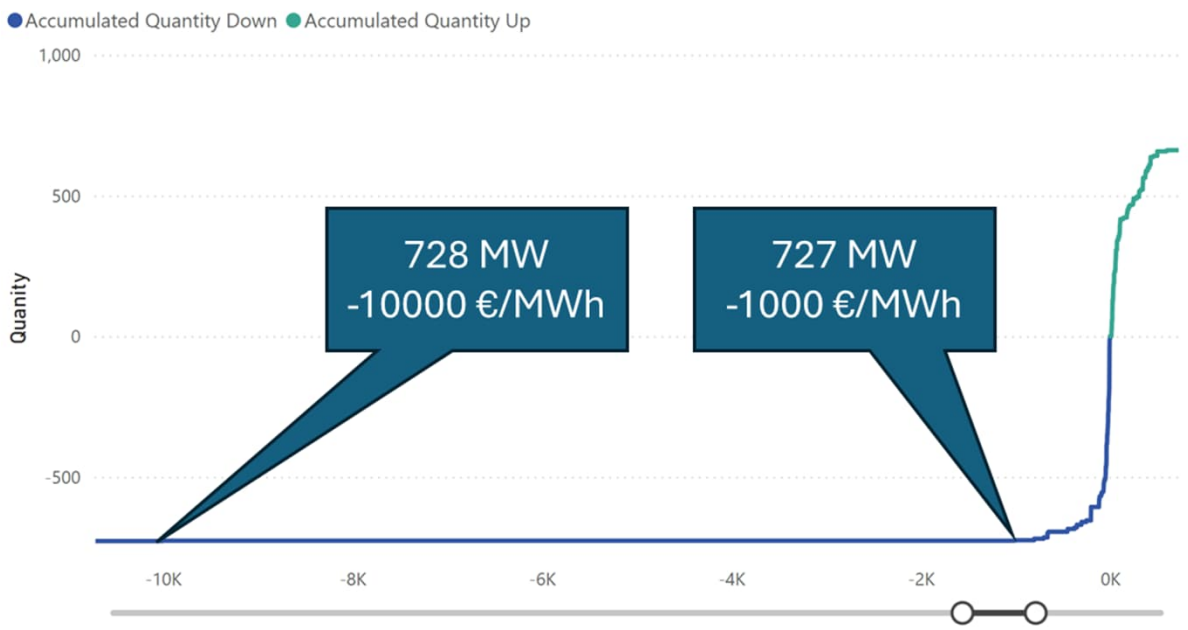
Prices will be more volatile than today

- AOF always aims to satisfy all demand regardless of the mFRR price
- AOF can only use the available transfer capacity for mFRR exchange

--> If no ATC left, small changes in demand can lead to high prices



Bid curve FI, 9 August 22:15

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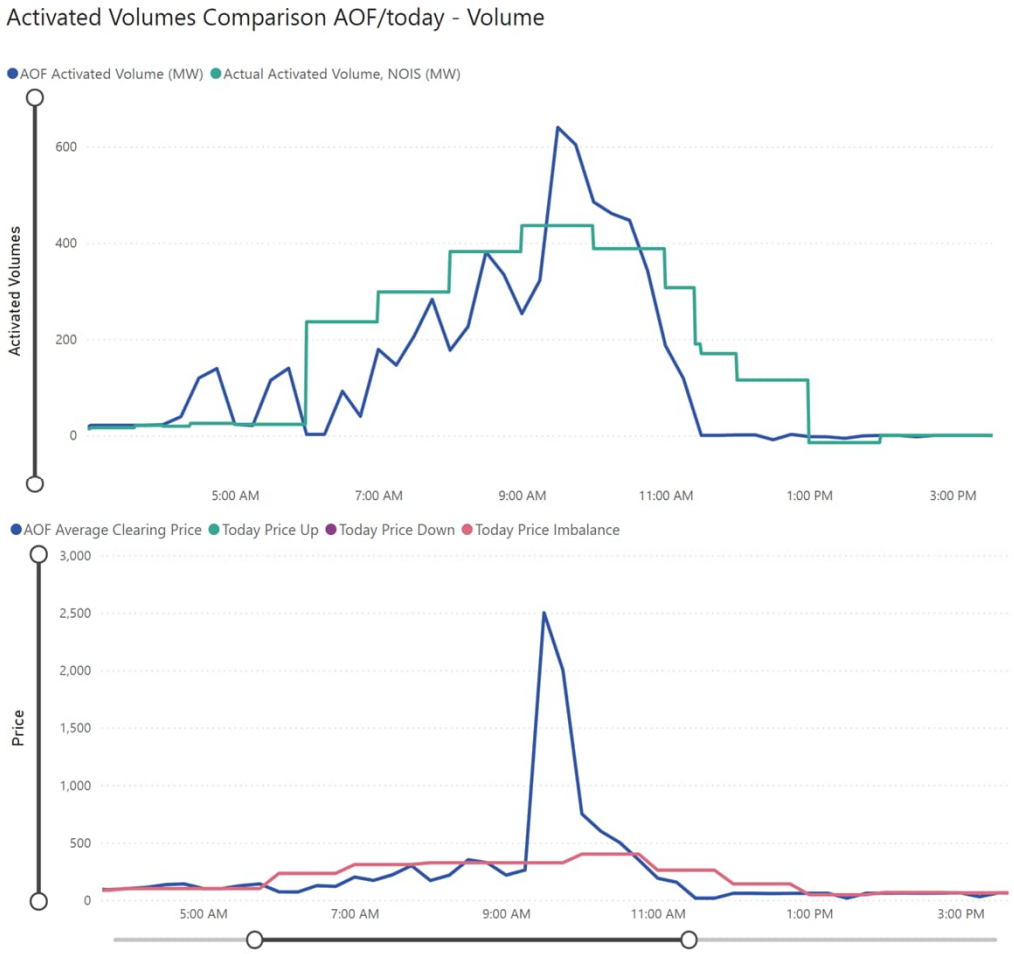
Prices will be more volatile than today

- mFRR exchange between price areas can be more restricted than today due to (ramping) restrictions in the HVDC links --> this can affect the mFRR price
- Case: Finland 5.4.2024 9:30
  - 2500 €/MWh price spike
  - No ATC on shadow operation
  - Possibly more capacity on Fennoskan in real operation



Instead of netting, more mFRR is activated

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- In today's operation the market parties often try to avoid up-regulation and high imbalance cost by procuring excess (should not do this)
  - These surplus imbalances get often netted --> imbalance price is the same as DA price --> no price incentive to be in balance
- Instead of netting AOF activates more down regulation --> imbalance price is lower than DA price --> *be in balance to avoid imbalance cost*

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Bid attributes

Eivind Lindeberg, Statnett

Use of bid attributes

- Available for scheduled or scheduled and direct
- Minimum bid volume
- Complex bids
  - Conditional linking
  - Exclusive groups

- Direct activation is used in local systems when there is a large imbalance that needs to be balanced immediately
- Bids that are sold in capacity markets **must** be availble for direct activation
- DA is used when demand is large → when DA is used prices are high

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Use of bid attributes

- Available for scheduled or scheduled and direct
- Minimum bid volume/indivisible
- Complex bids
  - Conditional linking
  - Exclusive groups

- Minimum volumes can be used to avoid too small activations
- (large) minimum volumes og indivisible bids can be skipped when they are on the margin
- Minmum volume is better for the system than indivisible bids

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Use of bid attributes

- Available for scheduled or scheduled and direct
- Minimum bid volume
- Complex bids
  - Conditional linking
  - Exclusive groups

- More avanced bidding strategies can be implemented with the use of complex bid attributes
- Conditional linking: "This bid is avaiable only if…"
- Exclusive groups: "You can activate only one of these bids"
- Can be used to model start-up costs, avoid undesireable activation patterns etc.

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Stability of electronic activation process

Filippa Pyk, Svk

Stability of the automatic activation

- Essential that we have well functioning IT-system at both parties
- Process for Statnett and Svenska kraftnät:
  - Bids must be available for bid selector minimum 15 min before delivery period, **ensure BSP availability with heartbeat functionality**
    - Heartbeat is empty activation messages sent to BSP every 5 min
    - Bids not answering heartbeat will not be available for activation coming 2 quarters
      - Bids considered available again when answer to hearbeat, also if within the two quarters

Stability of the automatic activation

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- What happens if a big BSP falls out?
  - Bid list with remaining bids will be used as long as possible
  - If not enough bids in bidlist --> operators will evaluate best action given the circumstances.
    - One alternative is to call BSPs and ask for activations, volume and price will be agreed, price will not impact mFRR-price

Stability – electronic order is stable

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- **For SVK, few quarters that some BSP does not answer heartbeat,**
- **For SN, heartbeat is considered stable**
- **Price impact depends on:**
  - Where in bidlist the BSP is,
  - how large bid volume the BSP has,
  - At what time the heartbeat is missed
    - For Svk, heartbeat sent 18 min before is essential

Aktør	Antall aktiveringer	Aktivering bekreftet (%)	Aktivering avvist (%)	Timeout (%)
	5 180	45,5 %	0,0 %	54,5 %
	5 180	72,0 %	0,0 %	28,0 %
	5 180	80,0 %	0,0 %	20,0 %
	5 180	95,4 %	0,0 %	4,6 %
	5 180	98,5 %	0,0 %	1,5 %
	5 180	98,7 %	0,0 %	1,3 %
	5 180	99,4 %	0,0 %	0,6 %
	5 180	99,5 %	0,0 %	0,5 %
	5 180	99,7 %	0,0 %	0,3 %
	5 180	99,8 %	0,0 %	0,2 %
	5 180	99,8 %	0,0 %	0,2 %
	5 180	99,9 %	0,0 %	0,1 %
	5 180	99,9 %	0,0 %	0,1 %
	5 180	99,9 %	0,0 %	0,1 %
	5 180	100,0 %	0,0 %	0,0 %
	5 180	100,0 %	0,0 %	0,0 %
	5 216	100,0 %	0,0 %	0,0 %
	5 180	100,0 %	0,0 %	0,0 %
	5 180	100,0 %	0,0 %	0,0 %
	5 180	100,0 %	0,0 %	0,0 %
	5 180	100,0 %	0,0 %	0,0 %
	108 816	94,7 %	0,0 %	5,3 %

Wrap-up

Eivind Lindeberg, Statnett

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Summary

- The power system will be balanced also after Dec. 3
- Change in activations will be more frequent than today
- Activation spikes and price spikes are expected to be more pronounced
- XB capacity will play a new role – flow-based important
- Economically optimal activation can mean more activation, also counteractivation
- All areas will se more activations – bids everywhere will be used

Further information

www.nordicBalancingModel.net

- Implementation guide
- Memo: Process for activating products
- Algorithm description (new version one month before go-live)

- Downloadable files

Downloadable files

- mFRR request per area (7.9 – 6.10)
- Activation per area (7.9 – 6.10)
  - Today and in shadow operation
- mFRR prices (7.9 – 6.10)
  - Today and in shadow operation

What to think about when looking at the data

- No ATC NO1A (7.9-20.9)
- Energinet IT trouble 27.9
- Price spikes – high prices spread to all areas.
- IT systems are not in full operation

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Contact for further details

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- Statnett: BSP@statnett.no
- Fingrid: Marina Nordström marina.nordstrom@fingrid.fi
- Energinet: Caroline Strøh Potter, cnp@energinet.dk

Final questions?


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Thanks for listening
Good luck with your preperations for December 3!