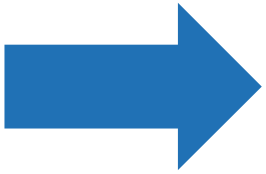
Concerns Vattenfall

1 July 2020

What's is it about?

Our questions

1. How is the intraday market supposed to work and still deliver flexibility to the Nordic TSOs and market participants?
2. What would be the socioeconomic cost of lower transparency and lost confidence in the market price?
3. In light of the presumed minor gains, is this the right priority given the enormous change our sector is currently going through?



- Even though Flow-based with non-intutive flows is theoretical superior in the day ahead socio economic welfare, we believe there are other costs not accounted for in the calculations presented by the TSOs.
- This costs must be analysed to give a fair comparison for Flow Based solutions vs alternatives.

1 Lost flexibility for the Intraday market

Intraday market with Flow Based

- Traditional ATC capacities will be given ID for an undefined time, basically until Flow Based is ready for the intraday market.
- As confirmed by TSO: No arbitrage should be possible with a non-intuitive flow → 0 MW in ATC capacity will be given counter a non-intuitive direction.
- From simulations result, many hours are expected with non-intuitive flows.

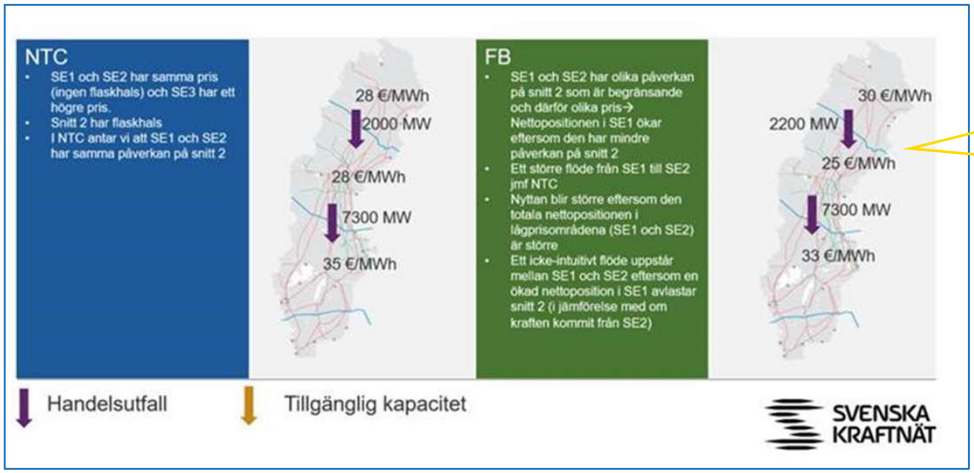
Why is this a problem?

- The Nordic market consists of several bidding zones to address congestions and needs a well functioning intraday market for transfer of power.
- With zero capacity, Market participants are locked-in intraday:
  - More and more intermittent power creates a need to trade over borders closer to delivery
  - Imbalance to be covered by regulation in same bidding zone – restrict the free market's ability to actively offer flexibility, and rely more heavily on a reactive system operation
  - Market participants will adapt to the day ahead bid knowing the risk for being locked-in ID

➡ This effect has not been included in the assessment up to date and it is our believe that the TSOs underestimate the negative consequences.

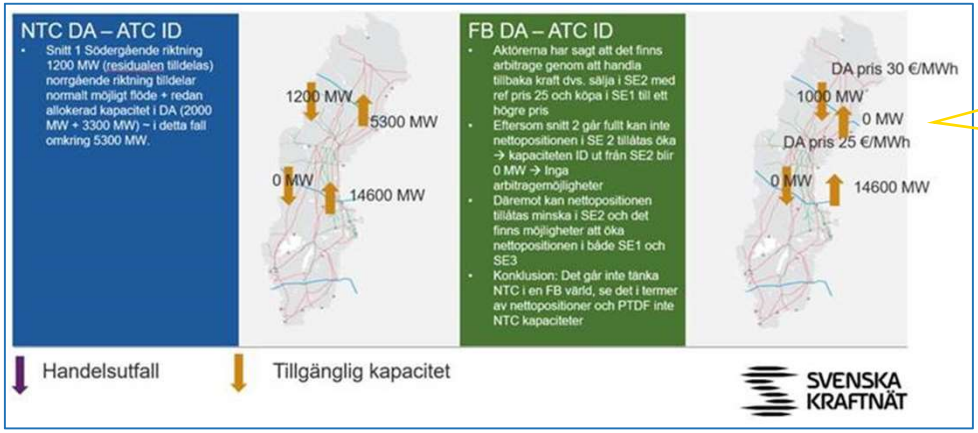
1 Example by Svenska Kraftnät

DAY AHEAD
Price and Flow



Non intuitive flow
SE1→SE2

INTRADAY
ATC



Intraday ATC 0 MW
SE2→SE1

1 Consequences for a wind producer:

Assume delivery hour PH16. Non-intuitive flow SE1→SE2. Intraday SE2→SE1 0 MW.

SPOT for PH16 - 27 hours before delivery

SE1	PH16
Wind production (estimate at 12.00 day before)	100 MW
Sold at spot	-100 MW
Balance	0 MW

SE2	PH16
Wind production (estimate at 12.00 day before)	200 MW
Sold at spot	-200 MW
Balance	0 MW

INTRADAY – Wind forecast increase SE2 and decrease in SE1

SE1	PH16
Wind production (estimate at 13.00, 1h before PH16 close)	50 MW
Sold at spot	-100 MW
Balance	-50 MW

SE2	PH16
Wind production (estimate at 13.00, 1h before PH16 close)	250 MW
Sold at spot	-200 MW
Balance	+50 MW

No capacity to transfer power from SE2→SE1. Not possible to sell excess wind power in SE2.

1 Consequences for a wind producer, cont'd:

Assume delivery hour PH16. Non-intuitive flow SE1→SE2. Intraday SE2→SE1 0 MW.

SPOT for PH16 - 27 hours before delivery

SE1	PH16
Wind production (estimate at 12.00 day before)	100 MW
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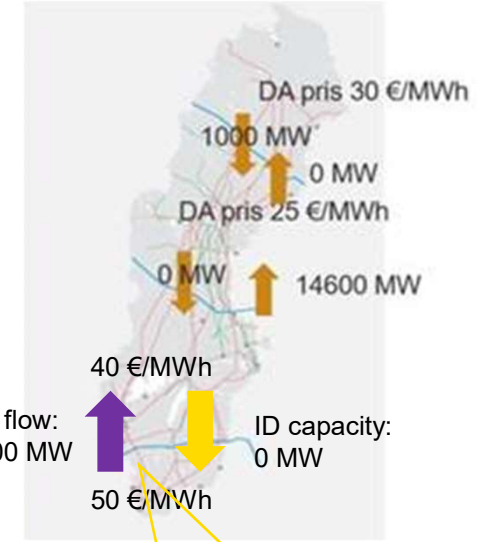
Balance	+50 MW

DELIVERY HOUR – Regulation needed in both areas

- More and more flexible resources must be used within each bidding zone for regulation
- There is a cost associate with:
  - Market participants cannot trade over bidding zone borders
  - TSOs need to procure more ancillary services within specific bidding zones

1 But what if non-intuitive flow SE4→SE3

Assumed spot price, spot flow and intraday capacity



Non intuitive flow SE4→SE3

There are limited available regulation resources in SE4

- Not possible to sell from SE3 and buy in SE4 intraday
- Baltic Cable is already restricted in capacity DE→SE4. Tennet is sending an UMM almost everyday, stating that the 70% requirement on the border cannot be met due to *no up regulation resources* in SE4

Remarks
DE can guarantee capacities according to Regulation (EU) 2019/943 only with countertrade. However, there is no guaranteed volume in the intra Day in SE4 to counter trade in the direction DE>>SE4 for the next day (i.e. no potential for upward regulation in SE4). In order not to endanger system security in SE4 limitation are needed.

- With flow based non-intuitive flow – Why would Svenska Kraftnät increase the need for regulation resources in SE4?

1 Consequences for nuclear and hydro producer:

Non-intuitive flow SE3→SE2. Intraday SE2→SE3 0 MW. Unexpected nuclear failure.

SPOT for PH16 - 27 hours before delivery

SE2	PH16
Hydro production (estimate at 12.00 day before)	3000 MW
Sold at spot	-3000 MW
Balance	0 MW

SE3	PH16
Nuclear production (estimate at 12.00 day before)	6000 MW
Sold at spot	-6000 MW
Balance	0 MW

INTRADAY – Nuclear failure

SE2	PH16
Hydro production (estimate at 13.00, 1h before PH16 close)	3000 MW
Sold at spot	-3000 MW
Balance	0 MW

SE3	PH16
Nuclear production (estimate at 13.00, 1h before PH16 close)	5000 MW
Sold at spot	-6000 MW
Balance	-1000 MW

Flexible, could be adjusted up – but power cannot be transferred

Need for up regulation

Simulations 2017 (w1-w12, except w7):

- 57% of hours with non-intuitive flow SE2-SE3
- Only 3% of hours had price different SE2 vs SE3 (w1-w12, except w7 2017)

1 Consequences for nuclear and hydro producer:

Non-intuitive flow SE2→SE3. Intraday SE3→SE2 0 MW. Nuclear is expected back from revision tomorrow.

SPOT for PH16 - 27 hours before delivery

SE2	PH16
Hydro production (estimate at 12.00 day before)	3000 MW
Sold at spot	-3000 MW
Balance	0 MW

SE3	PH16
Nuclear production (estimate at 12.00 day before)	6000 MW
Sold at spot	-6000 MW
Balance	0 MW

INTRADAY – Nuclear back from revision

SE2	PH16
Hydro production (estimate at 13.00, 1h before PH16 close)	3000 MW
Sold at spot	-3000 MW
Balance	0 MW

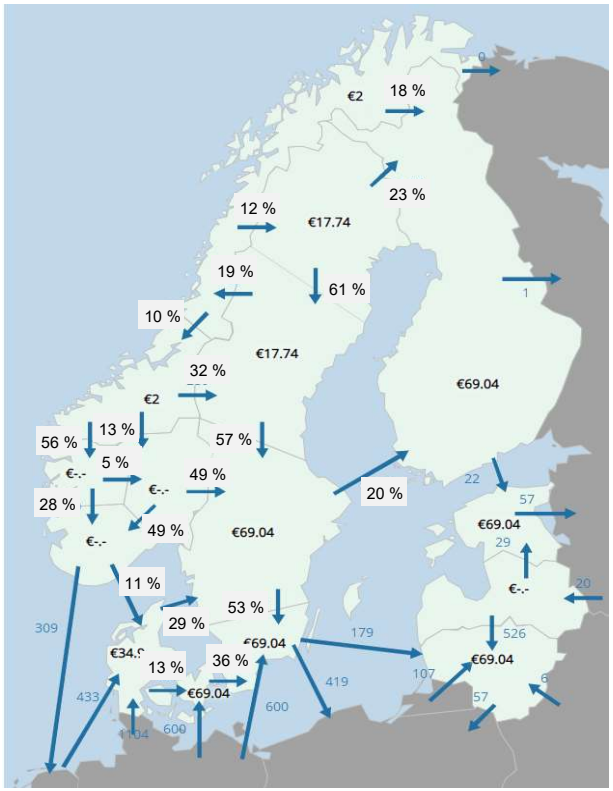
SE3	PH16
Nuclear production (estimate at 13.00, 1h before PH16 close)	7000 MW
Sold at spot	-6000 MW
Balance	+1000 MW

Flexible, could be adjusted down

Not sure that extra nuclear can be balanced with hydro – what can down regulate 1000 MW in SE3?

1 Impact on Nordic Intraday market

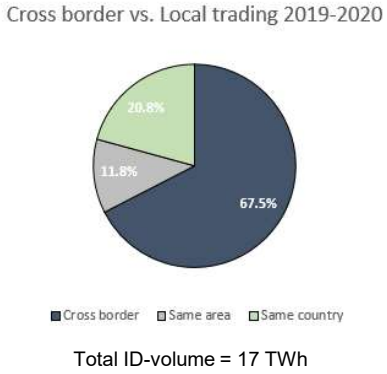
Result from FB-simulations (% of hours with NI-flows)[1]

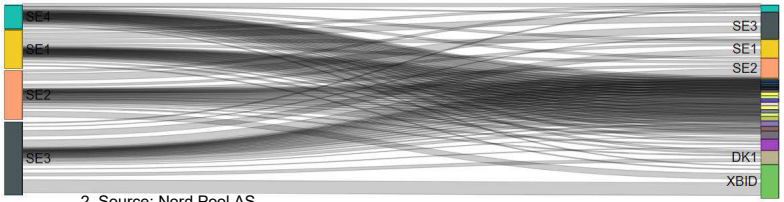


1. Source: Nordic RSC simulations for w1-w12 2017 (except week 7)

Dependency of Cross border trading

- Nordic ID-market is heavily dependant on cross border trading. 2019-20 cross border trading represented 88% of total volume traded om Nordic ID-market.[2]
- FB-simulations indicates substantial impact on ID-capacities for some of the most important cables in the Nordic ID-market:
  - SE3-DK1 (-29%)
  - NO1-SE3 (-49%)
  - SE1-SE2 (-61%)
  - SE2-SE3 (-57%)
  - SE3-SE4 (-53%)
  - SE1-FIN (-23%)
  - SE3-FIN (-20%)
  - …





2. Source: Nord Pool AS

2A Transparency is expected to decrease

Transparency with Flow Based

- Transparency is expected to decrease, especially the critical network elements within Statnett's and Svenska Kraftnät's grid.
- The transparency is expected below the transparency in the CWE region.

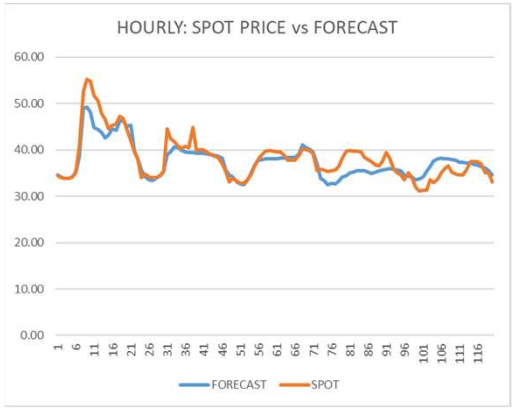
Why is this a problem?

- Market participants need to be able to make proper forecasts – the better forecasts the better use of flexibility, especially for hydro assets.
- Information is key for forecasting. Lack of transparency implies harder to predict prices

➡ The costs associated with predicting the market prices/understanding the market outcome is not properly taken into account.

2A Transparency to affect flexible production

Short term optimisation of hydro assets requires a price forecast



Downstream of mountain reservoirs, typically for a Swedish river:

- Weekly flexibility – only enough water to run 4 of 7 days
- Daily flexibility – only enough water to cover either the morning peak or the evening peak

Reduced transparency will make it harder

- Today, Nordic is a transparent market and we are able to model supply, demand and transmission capacities fairly well.
- Even though TSO will help providing market participants with information in the industrial tool, it will be more difficult to forecast prices simple because some information is not given.
- Market participants cannot figure out how the CNEs at Svenska Kraftnät and Statnett will affect the PTDF etc
- In addition, it will be more difficult for humans to understand the of market outcome when the input parameters are not visible

2B Trust in market outcome impacts risk mitigation

Trust in market outcome with Flow Based

- Transparency is expected to decrease putting the first question mark for market participants to truly understand the market outcome.
- The few weeks of provided simulations exemplified individual cases with non-intuitive price differences in the range of 100€/MWh.
- It has be said that this is a “communication problem”, but is it more?

Why is this a problem?

- Market participants – both consumers and producers – will have less intuitive understanding of price formation.
- For some larger consumer, cost of electricity consists of a signifiant share of its cost. If something gets more complicated, then the risk appetite should decrease. This will create an increased need for hedging.
- In addition, a more complicated market should drive out the few remaining speculators – who will risk money on something they do not understand?
- Risk premiums are expected to increase in the EPAD market.

➡ The financial market and hedging possibilities for price ares risk (EPADs) are not covered in the studies

3 The enormous change in our sector right now

Ongoing market changes…

- Fundamental changes with more intermittent power
- 1-price settlement
- 15-min balance settlement
- Introduction of Balancing Service Provider role
- MARI (European platform mFRR)
- PICASSO (European platform aFRR)
- National data hubs
- Energy market aFRR
- Capacity market mFRR
- FCR-D down
- Established FRR market

We believe that more and more value move from day ahead to closer to delivery

3 What will be the consequences for Flow Based given the changes?

What is the consequence of the ongoing changes?	• How is Flow Based fitting together with the ongoing changes? • Flow Based is theoretical superior in maximising socio economic welfare in the Day Ahead market, but: • If more and more value moves from day ahead to intraday/delivery hour, then the future SEW day ahead will be of less importance compared to SEW intraday.
Why is Nordic Intraday different from CWE?	• The Nordic market is fundamentally different consisting of many tiny areas with limited internal liquidity and flexibility • Nordic ID market is heavily dependant on cross boarder trading since the local liquidity in each area is very limited (many areas with only a few (or single) active players)
Let's create conditions for a functioning market	• The market should be enabled for better utilise flexibility closer to delivery. • Market participants will always adapt to the market, trying to maximise profit, which could lead to changed bidding behaviour.

Proposed way forward

- Transparent evidence of the benefits of FB and a guarantee from regulators that method will not go live, unless it brings reals benefits. The TSOs' request to removing that condition must be rejected.
- A simulation period of 12 months should proceed the parallel runs. It should at the minimum compare a plain and an intuitive patch of FB. ID capacities should be presented for the full 2-year period.
- As the fair comparison between FB and CNTC is still missing, efficiency improvements should be significantly better compared, if compared to the NTC method.
- The socio-economics must be complemented with: value possibilities to trade into balance using the ID market, benefits from using the financial market. Thus impact on ID market, transparency and explicability of the market results must be taken into account.
- The minimum level for transparency (related to both input and output data) should be the same as in CWE region today.

- If TSOs are not able to show that FB will contribute to increasing transparency and efficiency, the implementation process must be stopped.
- At that stage, if not earlier, TSOs should restart investigating the CNTC alternative.