



# DA results from the external parallel run (EPR) of Nordic flow-based

SH Monthly meeting  
11 April 2024

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# Agenda

1. Upcoming events and news
2. Follow-up from last SH event
3. Background information on the EPR
4. EPR results week 7-10
  - Impacts on SEW, prices, flows, net positions, constraining CNECs
5. Specific hours



# Upcoming events and news

- **Next monthly meeting:**
  - Monthly meeting on **Wednesday 8/5**, 9-11 CET covering the results for week 11-14.
  - Note: Moved from original time slot due to Christ's Ascension day.
- **Recording from the FB for beginners event (March 13) will soon be available at the N-RCC webpage**
- **Reminder: In order to continue to receive news and updates from Nordic CCM, renewal of consent is needed**
  - Check email inbox for information about consent, or sign up by sending an email to [ccm@nordic-rcc.net](mailto:ccm@nordic-rcc.net) to get added to the mailing list for the newsletters
  - If consent is not renewed by May 2nd, the email address will be removed from the mailing list
- **ID ATCE- The TSOs received a new version of the ID ATCE software module and are testing it.**
  - In week 17 the TSOs will come back to stakeholders on the ID ATCE topic.



# Upcoming events and news

- **Updated version of the Operational Learning Points scheduled for publication tomorrow, April 12, 2024**

## **New topics added:**

- The introduction of ramping on Fennoskan in EPR, 600 MW/h from w. 10
- Changed ramping on SwePol link in EPR, 300 MW/h from w. 10
- Removed ramping limit on SWL (SE3-SE4), from w. 10
- Introduced limitation on the northbound flow on SWL, 0 MW SE4-> SE3 from March 2, 2024
- Modelling of FI-NO4 in EPR; a CNEC including both SE1-FI and NO4-FI included from December 2023 in order to maintain flows NO4-FI within operation security limits
- Update on the publication error regarding scheduled exchanges on NO1A-NO2, error rectified from March 14

Link: [Simulation Results - Nordic Regional Coordination Centre \(nordic-rcc.net\)](https://nordic-rcc.net)



# Follow-up from the last SH meeting

- **Is the overview with shadow prices per CNEC representative for what SH can see?**
  - TSO feedback after the SH event: The results shown in the limiting CNEC table are summarized for the same CNEC for the period, so stakeholders will not see the same if they aggregate the shadow price in the GC-matrix.
- **Regarding allocated flow for NTC. If we take an example for 2024-01-15 MTU 22, the flow in SE2>SE3 says 7814, how is this possible?**
  - The AAF flow is calculated by multiplying the net positions from the NTC results by the PTDFs used in FB. Remedial actions, such as countertrade, would have been considered if such a result was received. The scheduled exchange in NTC for the hour was 7300 MW. See MoM for more details.



# Follow-up from the last SH meeting

- **The Scheduled Exchange, for NTC, seems like there is wrong values for NO1- NO2, for example 2024-02-08 MTU 17, the NTC values says up to 6500 MW.**
  - There was a mistake in the published data for border NO2-NO1. The data published was the flow between NO1A-NO1 instead of NO1A-NO2. This has been corrected on 14/3 2023 on the website. Thank you for letting us know!
- **About missing ATCE results for NO1A-NO1, NO1A-NO2, NO1A-NO5, etc.**
  - These borders are missing from the ATCE results. We will make sure these borders are added going forwards. Furthermore, we will ensure that these borders are included in the re-calculation that we have anyway planned for the previous weeks, due to changes to the relaxation parameters used in EPR.



# External parallel run (EPR)

- In EPR, the capacity calculation process for both FB and NTC is performed in parallel. Market results are available for:
  - NTC = actual day-ahead market coupling results, “production”
  - FB = simulated market coupling results with flow-based constraints
- Simulations are done on a weekly basis after a 2-week grace period, and the market report is published ~4 weeks after production.
- Goals of the EPR:
  - 1) Ensure that the capacity calculation process works
  - 2) Show the differences between FB and NTC capacity calculation methods
  - 3) Intended for market participants to become familiar with FB capacity calculation and the impacts FB may have on the market outcome
  - 4) “Learning by doing” for TSOs



# The role of TSOs and EPR

- **Flow-based capacity calculation aims to enhance the use of current transmission capacities.**
  - The role of TSOs is to provide as much transmission capacity to the markets, as operationally secure, to ensure efficiency.
  - Other market participants are responsible for other segments of the day-ahead market; TSOs should not intervene or speculate in these.
- **EPR compares different capacity calculation methods but uses the same market coupling algorithm and same order books as in NTC.**
  - This enables a fair comparison of the two capacity calculation methods. It isolates the impacts solely from FB without further assumptions.
  - EPR is not a forecast of future prices and flows.
    - With higher capacity available, there may be other changes in the market after go-live, but these are not considered.
    - EPR is intended to show the impact if we would have used FB for any single day-ahead coupling instead of NTC.
- **Why we measure the SEW impact of FB?**
  - EPR is done the way NRAs and CACM require TSOs to perform it.\*
  - Higher SEW **per MTU** indicates **higher or economically more efficient flows**
  - Higher SEW **over a long time** indicates **a trend of the above**

The report shall include at least the following, based on a per MTU level of granularity:

- A calculation of DA socio-economic effects (as measured by delta in consumers' surplus, producers' surplus and congestion income) from flow-based capacity calculation compared to the current capacity calculation method in use. The geographical area for this calculation shall be the Nordic market area plus neighboring countries if possible.
- If the accumulated DA socio-economic effect of flow-based is negative over any two-week period, the TSOs shall provide analysis and explain why this occurred.

\* <https://www.fingrid.fi/globalassets/dokumentit/fi/tiedotteet/sahkomarkkinat/2020/paatos-cacm-suuntaviivojen-202-artiklan-mukaisen-nordic-kapasiteetin-laskenta-alueen-yhteisen-kapasiteetin-laskentamenetelman-muuttamisesta.pdf>





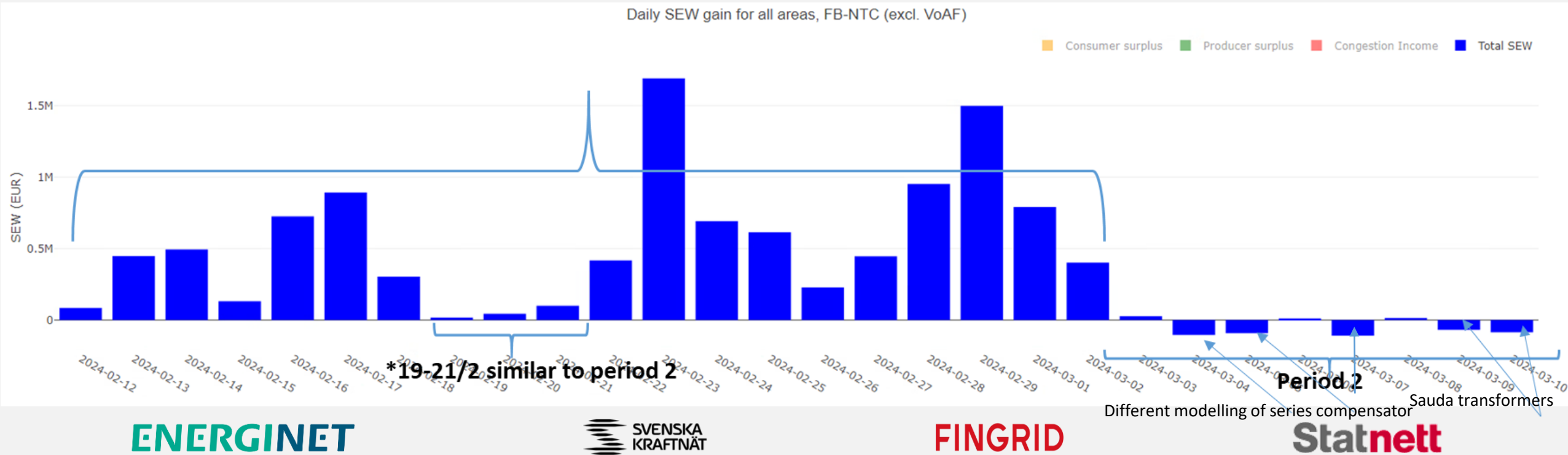
# Summary of week 7-10, 2024

## 12 Feb – 10 Mar



# Social welfare change W 7-10

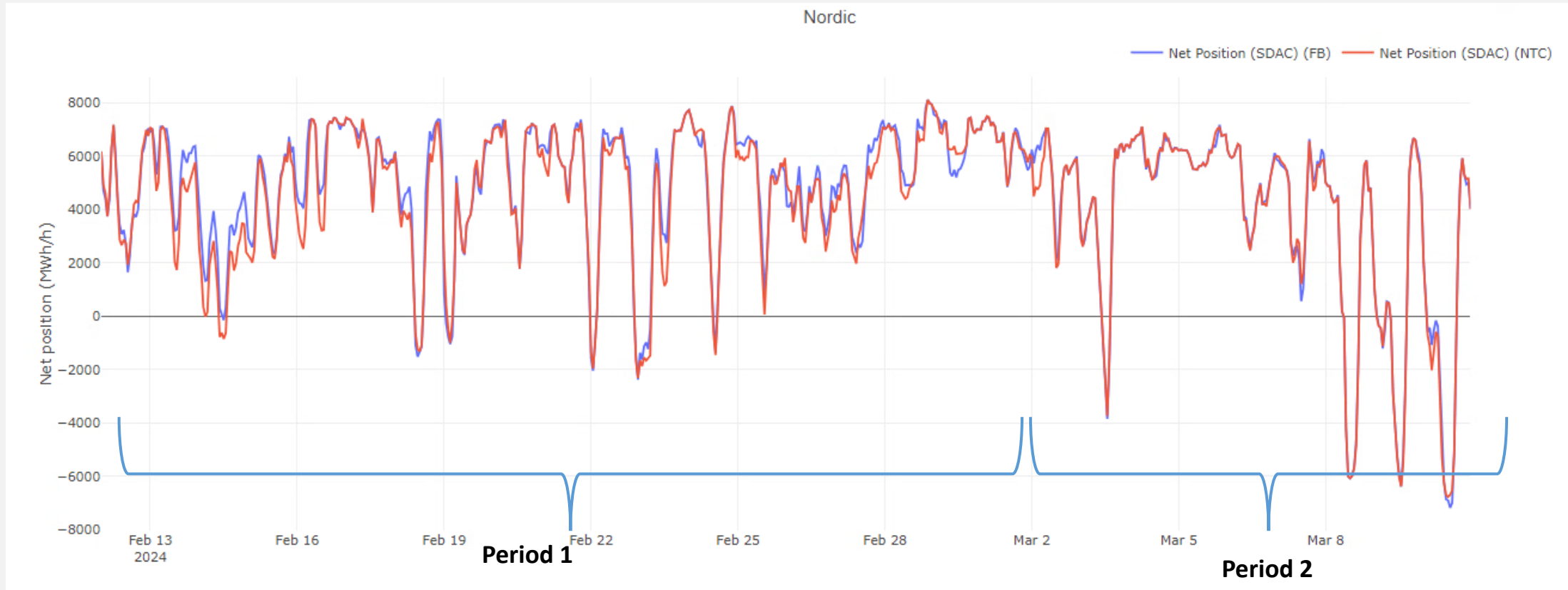
- These 4 weeks are split into two periods:
  - Period 1, 12/2-2/3. Large positive welfare changes except for 19-21/2
  - Period 2, 3/3-10-3. Slightly negative welfare changes
- Over the full period, flow-based results in a higher SEW compared to NTC for the Nordic region, and also for the whole market coupling region (SDAC).
  - Total Nordic SEW change +11.8 M€
  - Total SEW change in the SDAC region +10.6 M€





# Nordic Net Position W7-10

- The total Nordic Net Position change is +134 GWh in FB.
  - Period 1: NP increases with 130 GWh from NTC to FB
  - Period 2: NP increases with 3,7 GWh from NTC to FB
- Export from the Nordics for most hours. Import during some hours in the end of week 10









# Average prices and flows in the Nordic region Period 1

For these weeks, there are Constraints between:

- Northern Nordics -> Southern Nordics
  - The flow over these constraining elements was increased with 410 GWh.
- Southern Sweden > Southern Norway & Denmark
  - The flow over these constraining elements was increased with 404 GWh.
- Finland & Southern Sweden > Poland & Baltic
  - Decreased flow (-27 GWh, -4 %)

The price decreases with ~1-2 EUR/MWh in NO1, NO2, NO5 and Denmark

The price increases in Sweden, Finland, NO3 & NO4 with ~3-7 EUR/MWh

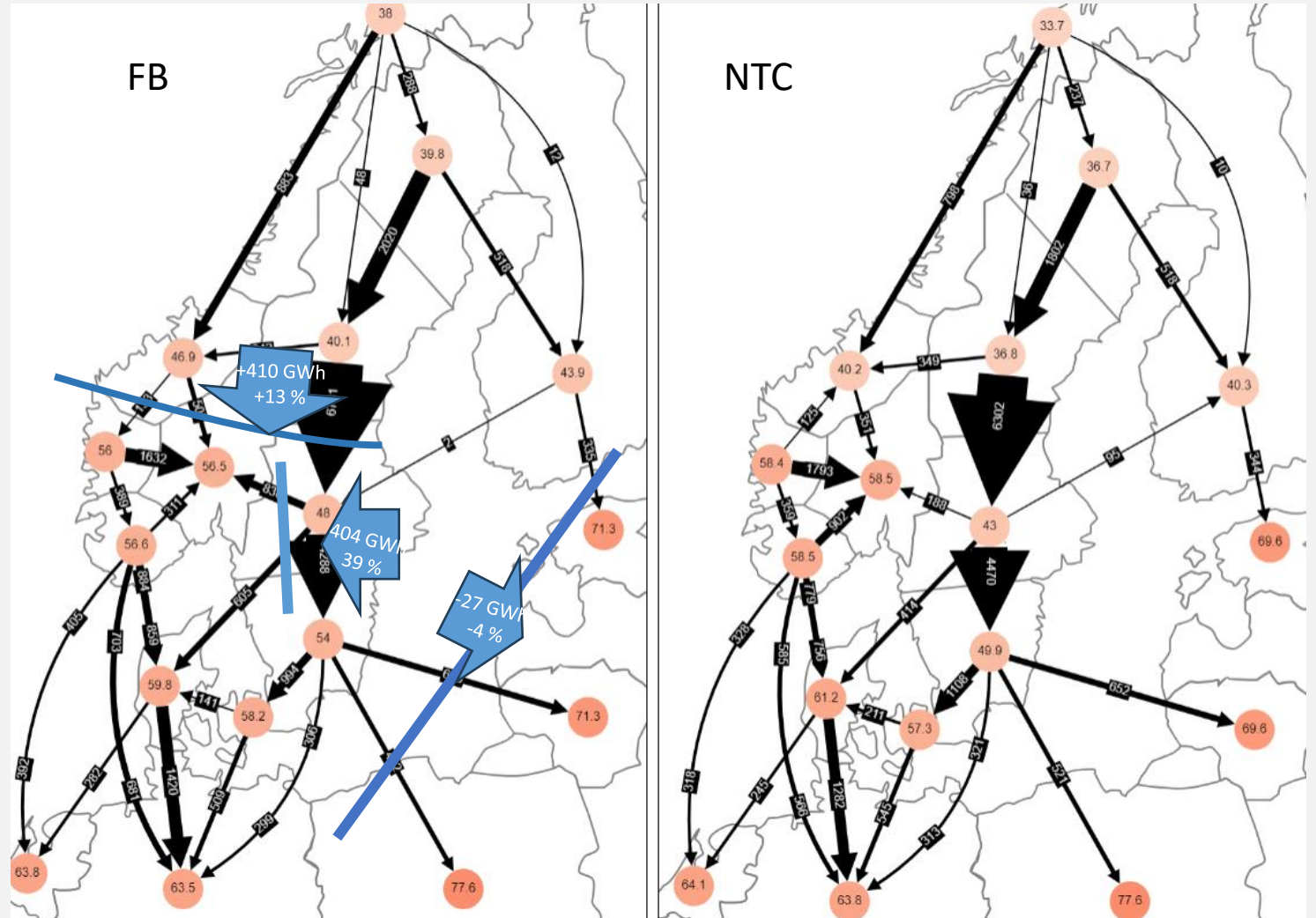


Figure: Average price in each BZ in FB and NTC. Arrows show the increased flow over constraining elements.





# Impact on buy and sell volumes (FB-NTC) Period 1

- Largest net position decrease are observed in NO2 and NO5.
- Largest net position increase observed in NO3
- Mostly the change in supply volumes that are impacting the changing net positions in the bidding zones

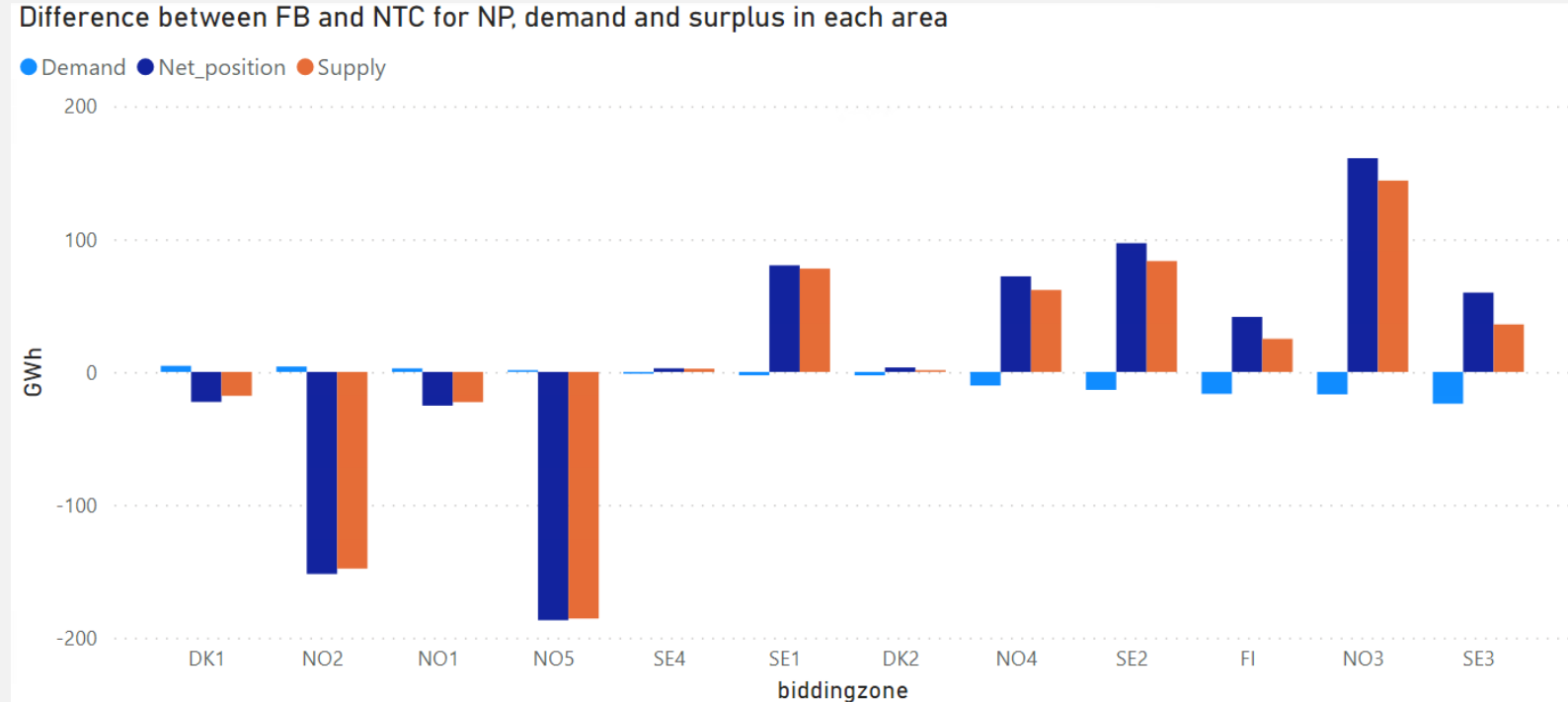


Figure: Demand and supply volumes difference (FB-NTC) and the corresponding net position change



# Prices Period 1 12 Feb – 2 Mar

- Average prices in DK1, NO1, NO2, NO5 are decreased, and increased in the other bidding zones.
  - The bidding zones with decreased prices are the ones with the highest average price
  - Average price difference between FB-NTC is a few €/MWh for all BZs
- The maximum prices decreased for all bidding zones except for FI, NO4, and SE3.

## Market prices

Rounded to nearest integer. Thousands separated by comma. Example: 1,234,567

Bidding zone	Min. price		Max. price		Avg. price		
	FB	NTC	FB	NTC	FB	NTC	FB-NTC
DK1	0	0	110	112	60	61	-1
DK2	0	0	110	112	58	57	1
FI	0	-1	122	111	44	40	4
NO1	28	33	100	102	57	59	-2
NO2	23	33	102	102	57	59	-2
NO3	26	14	82	84	47	40	7
NO4	12	14	82	76	38	34	4
NO5	32	38	95	102	56	58	-2
SE1	2	-1	82	84	40	37	3
SE2	1	-1	82	84	40	37	3
SE3	-2	-1	103	101	48	43	5
SE4	-3	-1	108	112	54	50	4

Table: Min, max and mean prices for all bidding zones in FB and NTC





# Constraining CNECs in FB

## Period 1, 12 Feb – 2 Mar

- Finnish PTC CNEC is the most constraining this period
- Mainly HVDC are the most limiting elements
- High shadow prices indicate that more flow would have increased the total SDAC welfare.

### Counts of hours with shadowprice (FB)

Thousands separated by comma and decimal separated by dot. Example: 1,234.56

↕CNEC	↕Count of hours	↕Average shadowprice	↕Total shadowprice
FI_PTC_FI_EL_EXPORT	328	31.98	10,488.16
1ff8828f593c437fb8d76690007012c8	284	20.67	5,871.32
48a525f33fed42a1ab5c2ef1028f2a79	182	24.35	4,431.97
13792_325 65% 420 Namsos-Ogndal + 30% 420 Namsos-Hofstad + 300 Tunnsjødal-Verdal	146	27.81	4,060.54
578d324f848b43598a1eba028979d56b	239	16.93	4,046.91
AC_Minimum_SE4_BC	247	15.50	3,828.82
1609c8869df3483abf2d473000e19788	25	136.33	3,408.17
AC_Minimum_SE4_SP	184	17.79	3,273.06
15291_10 40% 420 Moskog-Høyanger + 300 Øvre Vinstra-Fåberg	154	18.89	2,908.67
AC_Minimum_NO2_NK	317	9.13	2,895.46
AC_Minimum_NO2_ND	275	10.20	2,805.90
AC_Minimum_FI_EL	101	26.34	2,660.78
AC_Minimum_DK2_KO	200	12.69	2,538.07
AC_Minimum_SE4_NB	106	22.96	2,433.88
4593595ac10540ba835436e1bc97f00a	39	61.91	2,414.59
ACLLineSegment ENDK DK1 E_KAE-LYK_3 1 N Terminal : N	8	259.17	2,073.34
DK2_SV_IMP	241	8.36	2,013.92
9be30bb3afc4437dbf39b5ab37d868f6	79	23.19	1,831.88
AC_Minimum_SE3_KS	217	6.24	1,354.38
DK1_NL_EXP	147	8.86	1,302.77

Table: The 20 CNECs with highest aggregated shadow prices during the period



# SEW Impact on bidding zone level

## Period 1, 12 Feb – 2 Mar

- The impact on the different parts of the SEW from FB differs between the Nordic bidding zones.
- Positive total SEW change with FB compared to NTC in SE2, NO1, NO4, SE1 and SE3
- FB results in a gain for consumers in DK1, NO1, NO2 and NO5.

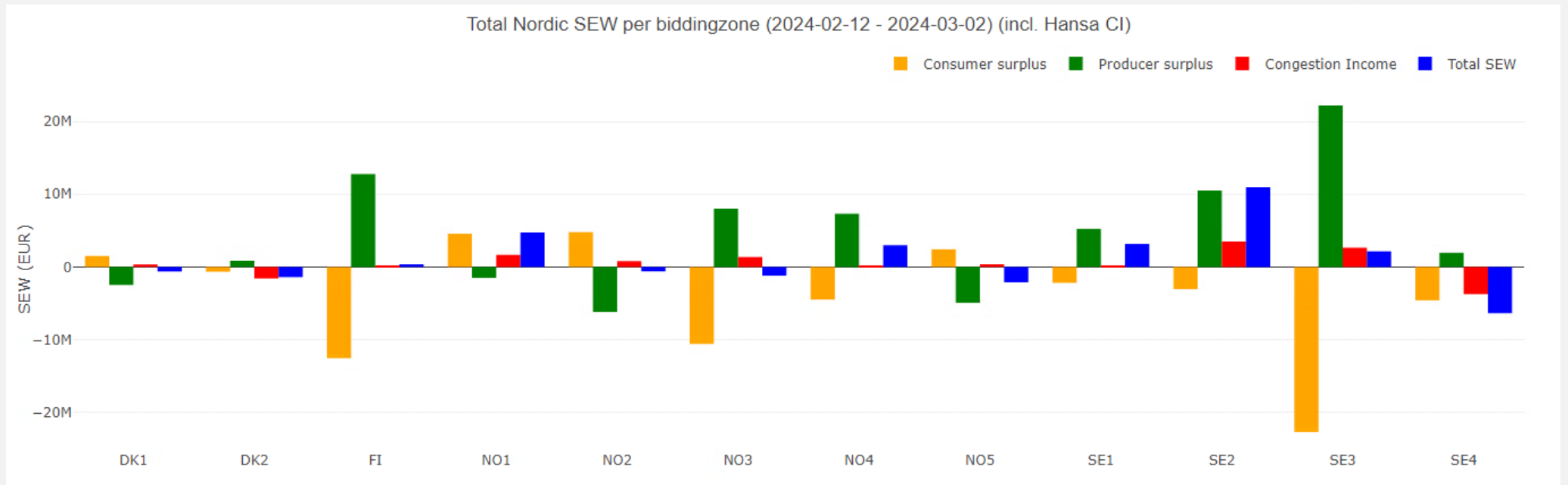
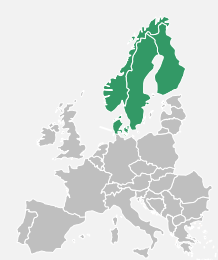


Figure: SEW change per stakeholder group in CCR Nordic, per bidding zone



# Average prices and flows in the Nordic region Period 2

For these weeks, there are constraints between:

- the Baltics and the Nordics
- Imports to Finland

Very small price changes:

- The price decreases with around 1 EUR/MWh in SE1 and NO5
- The prices increases the most in FI, NO3 SE3 and SE4 around 1 EUR/MWh

Change in flows has small impact due to small price differences except for flow towards Finland.

Negative SEW this week partly due to different modelling of series capacitors in FB and NTC resulting in the capacity on SE2-SE3 and SE3-FI being overly restricted in FB.

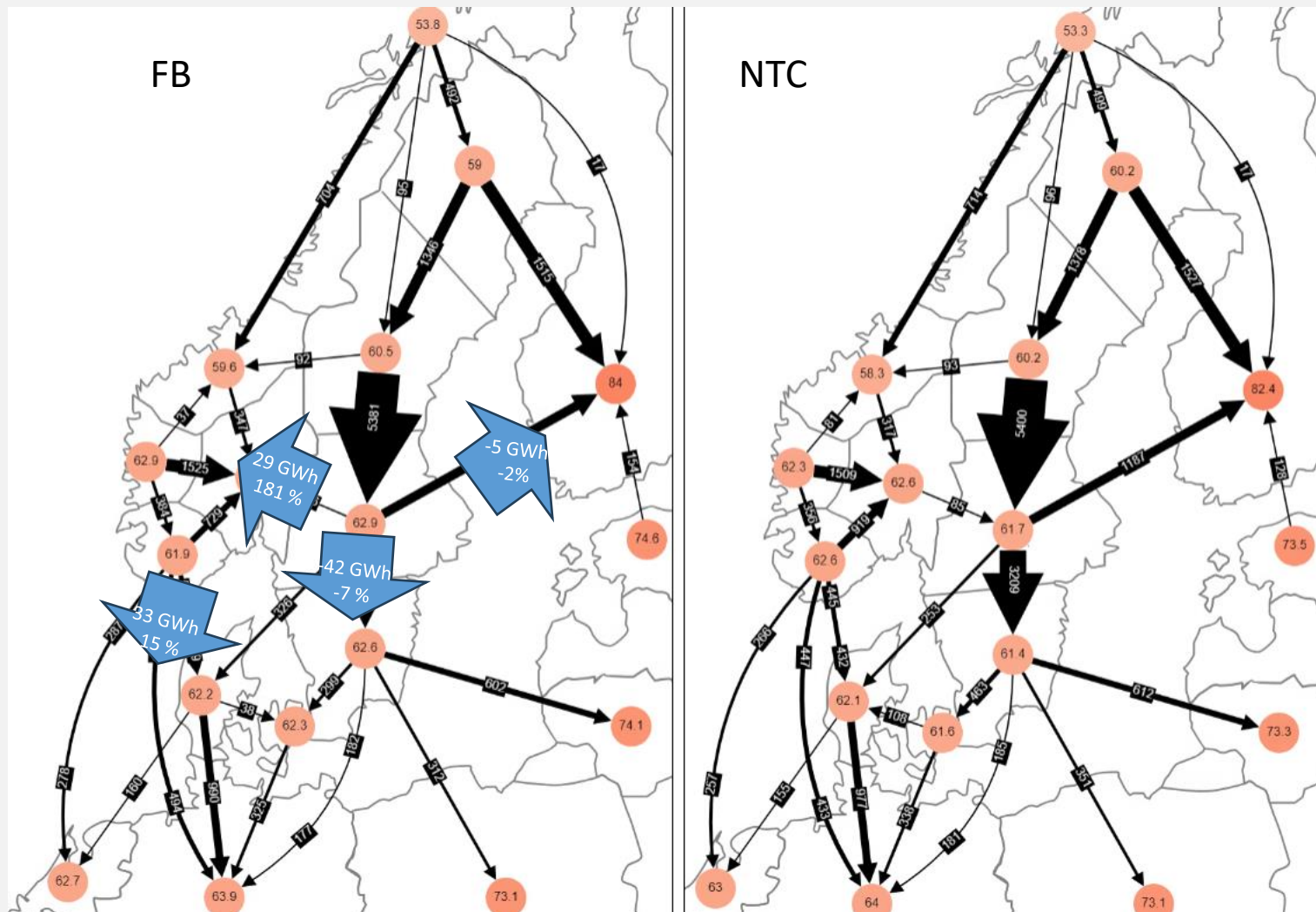


Figure: Average price in each BZ in FB and NTC. Arrows show the increased flow over constraining elements.



# Impact on buy and sell volumes (FB-NTC) Period 2

- Biggest difference of demand is noted in SE2 and NO2, largest overall difference in NP is in NO2, NO3 and SE1
- Multiple bidding zones have very small change both on the demand and supply side
- Mostly the change in supply volumes that are impacting the changing net positions in the bidding zones

Difference between FB and NTC for NP, demand and surplus in each area

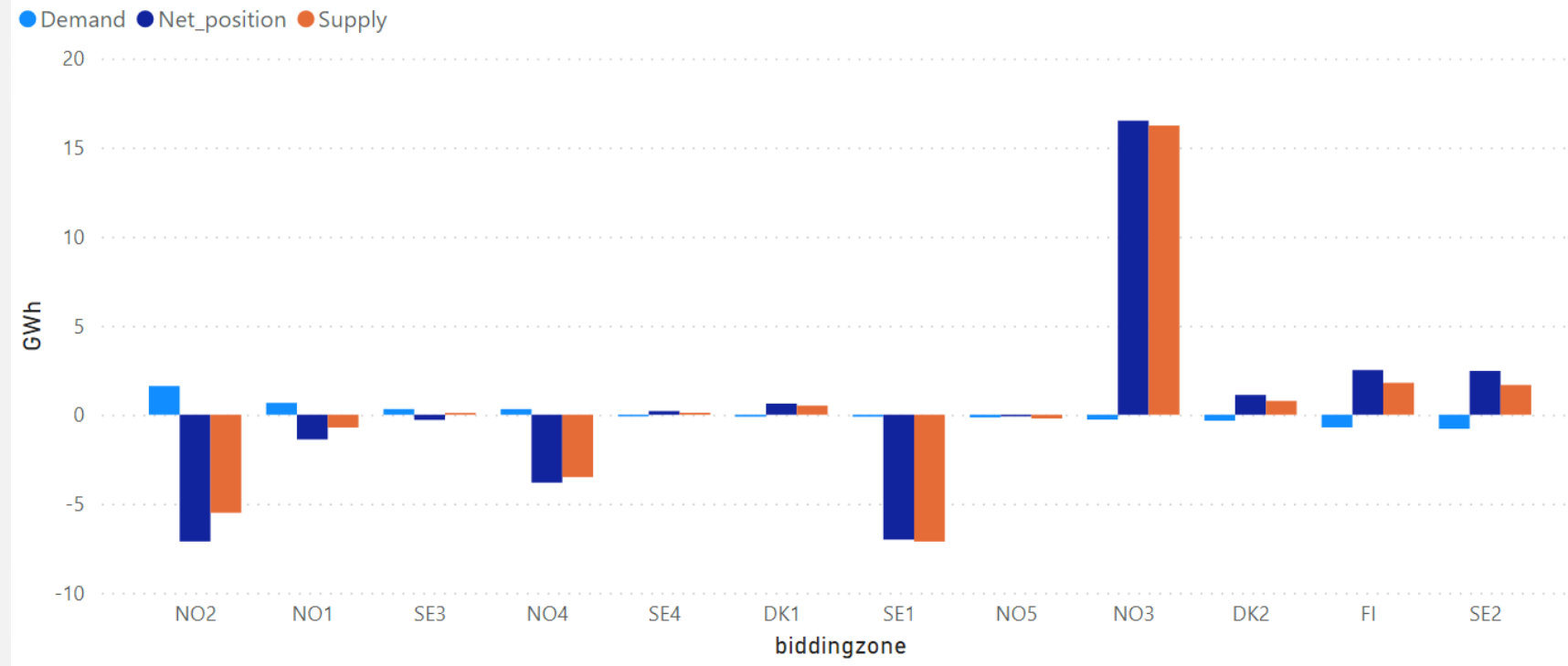


Figure: Demand and supply volumes difference (FB-NTC) and the corresponding net position change



# Prices

## Period 2, 3-10 Mar

- In general, the average prices are very similar in FB and NTC for all Nordic bidding zones
  - 1 € decrease in NO2 and SE1. The rest are unchanged or increased with 1 or 2 €/MWh
- Very small changes in maximum price as well (except for Finland)
- Import to the Nordics (negative Net position) for some hours in the end of this period, still prices are kept at a relatively low level

### Market prices

Rounded to nearest integer. Thousands separated by comma. Example: 1,234,567

Bidding zone	Min. price		Max. price		Avg. price		
	FB	NTC	FB	NTC	FB	NTC	FB-NTC
DK1	-2	-2	119	120	62	62	0
DK2	0	0	119	120	62	62	1
FI	50	49	169	200	84	82	2
NO1	41	33	115	116	62	63	0
NO2	36	33	115	116	62	63	-1
NO3	40	32	114	116	60	58	1
NO4	29	31	111	100	54	53	1
NO5	45	47	115	116	63	62	1
SE1	29	31	112	116	59	60	-1
SE2	29	31	114	116	60	60	0
SE3	27	31	121	119	63	62	1
SE4	26	2	120	119	63	61	1

Table: Min, max and average prices for all bidding zones in FB and NTC



# Constraining CNECs in FB Period 2, 3-10 Mar

- The CNECs with the highest shadow prices are mainly HVDCs, few internal CNECs in Sweden and the Norwegian Sauda transformers
- Also, the finnish PTC is the second most limiting CNE

Counts of hours with shadowprice (FB)

Thousands separated by comma and decimal separated by dot. Example: 1,234.56

CNEC	Count of hours	Average shadowprice	Total shadowprice
4593595ac10540ba835436e1bc97f00a	41	99.68	4,087.04
FI_PTC_RAC_SE1-FI	140	26.94	3,772.06
AC_Minimum_SE3_FS	100	23.45	2,344.62
3fcc339f45484f03946ae218eb540c85	28	77.66	2,174.62
15351_334 95% Sauda T2 Transformator P + Sauda T3 Transformator P	20	87.48	1,749.61
1ff8828f593c437fb8d76690007012c8	107	16.29	1,743.48
8362274212fb4e15924a093ef99f8623	17	82.42	1,401.15
10417244ef394430b61457d857ef3433	52	24.43	1,270.19
AC_Maximum_FI_EL	53	22.29	1,181.16
2cd6e201f82943bab9d9bab3b2d82076	20	45.31	906.28
AC_Minimum_NO2_ND	96	8.58	823.85
FI_PTC_FI_EL_IMPORT	31	25.15	779.71
AC_Minimum_NO2_NK	91	8.04	731.86
578d324f848b43598a1eba028979d56b	74	9.56	707.71
AC_Maximum_NO2_ND	15	45.77	686.62
AC_Minimum_SE4_SP	54	12.30	664.21
AC_Minimum_SE4_BC	97	6.10	591.28
AC_Maximum_SE4_BC	25	20.49	512.18
DK1_NL_EXP	56	9.12	510.81
AC_Minimum_DK2_KO	60	8.48	508.98



# SEW Impact on bidding zone level

## Period 2, 3-10 Mar

- The change on the different parts of the SEW from FB differs between the Nordic bidding zones
- Largest magnitude of the changes in FI, SE2 and SE3 when looking at all the welfare components
- Small changes in total welfare in most bidding zones, FI, SE2 and SE4 have the largest change in total SEW
  - Small price changes in general, for all bidding zones

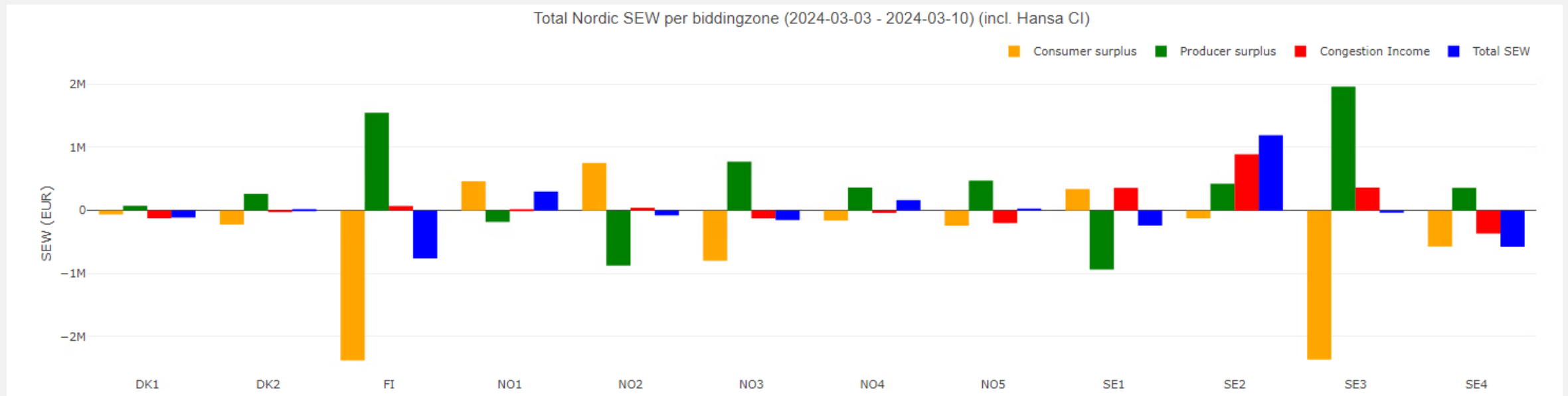


Figure: SEW change per stakeholder in CCR Nordic per BZ

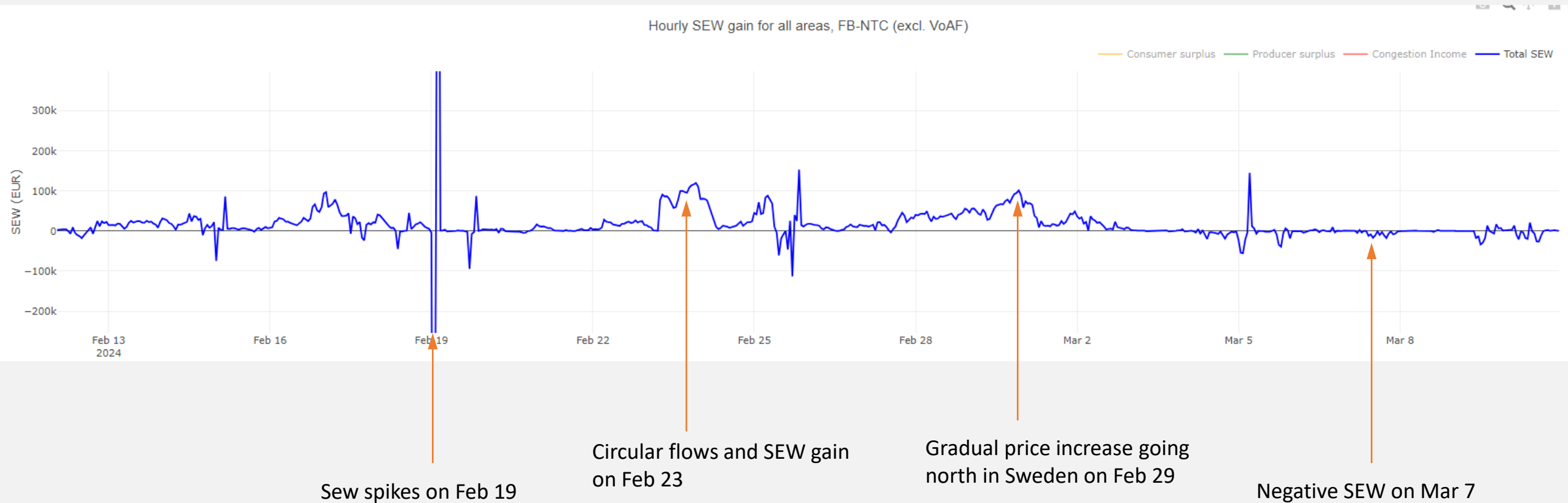


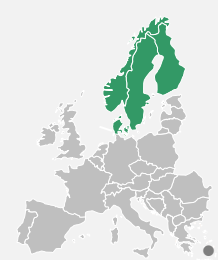
# Specific hour walkthrough





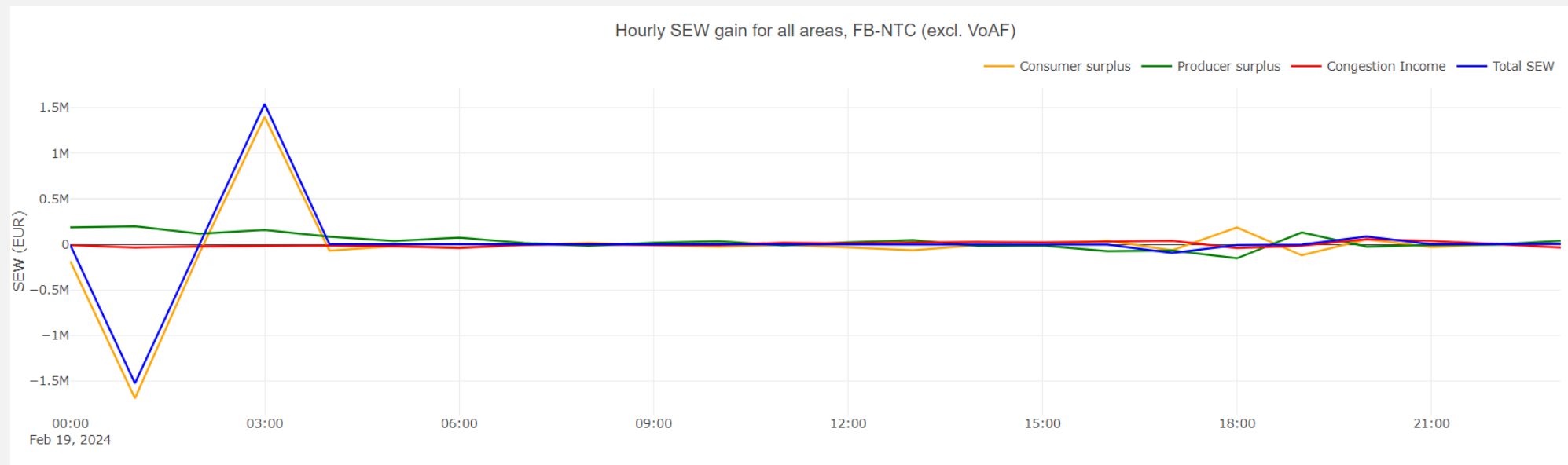
# Hours we go through today

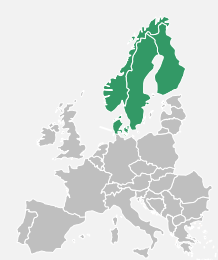




# SEW spikes on February 19th, MTU 2 & 4

- SEW spikes of  $\pm 1.5$  M€ for the entire SDAC area on February 19th in MTU 2 and 4
- Caused by later activation of a block bid in DE/LU
- With very similar results between FB and NTC, there might be some randomness that determines when the block bids are activated.
- The total results in around zero SEW change, so no real market effect in total.





# Circular flows increasing capacity and SEW

## 23 February, 18:00 – 19:00

- Nordic SEW gain of 2.13 M€, which makes it the day with the highest gain in W7-8
  - Hourly gain is 190 k€ (excl. Hansa)
- NTC: Same price in FI and SE1-SE4, higher prices in the South Norway, Denmark and the continent
- Constraints in NTC between:
  - Nordics → Baltic + Continent
  - SE/FI → NO + DK
  - NO3 → South Norway & Denmark
- FB solution increases flow from SE2→SE3 & SE3→NO1
- FB decreases prices in South Norway, but increases in SE3 & SE4
- Circular flows SE3-FI relieves cut 2, allowing for more flow

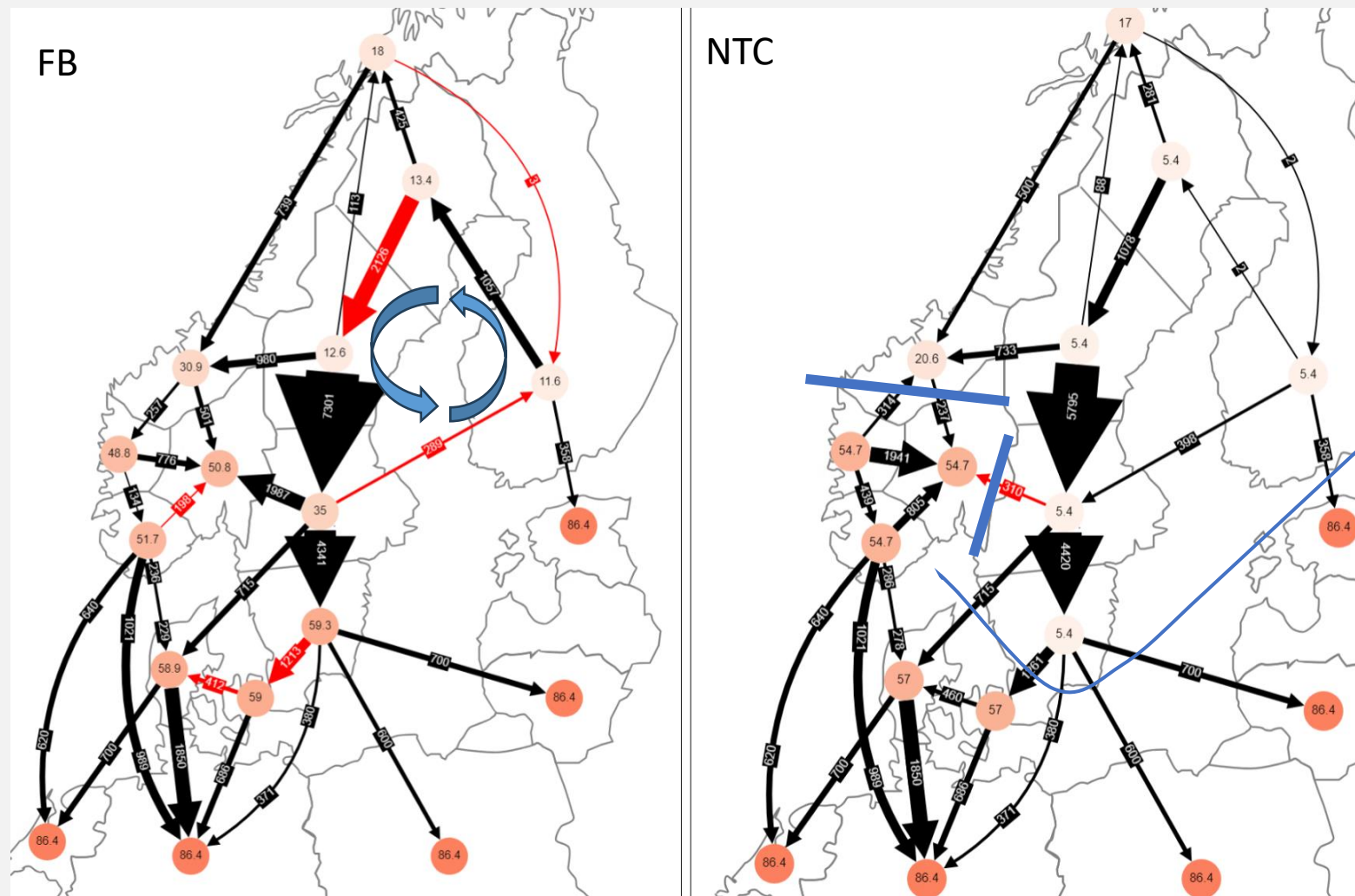


Figure: FB vs NTC simulated flows and prices for 23 February, 18:00 – 19:00. FB increases the price convergence.



# Increased Net Position and SEW gain in FB

## 23 February, 18:00 – 19:00

- FB increases Net Position in South Sweden
- SEW gains in SE2 & SE3 due to increased Producer Surplus & Congestion Income
- Caused by increased flows & price differences

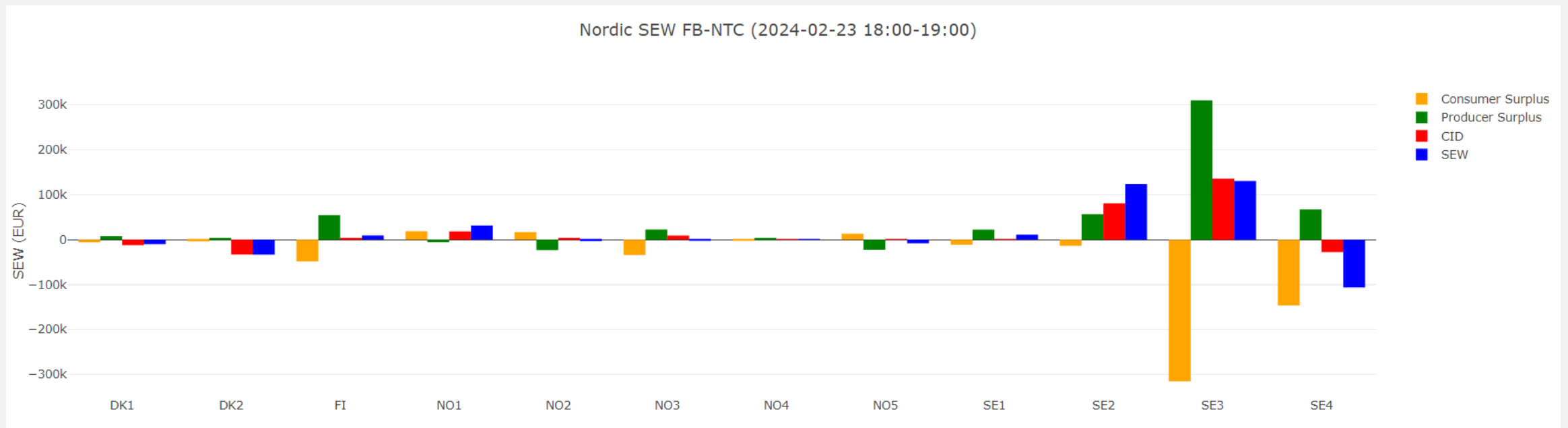


Figure: Nordic socio-economic welfare differences (FB-NTC) for all Nordic bidding zones



# Price gradually increases north in Sweden February 29th 22:00-23:00

- Zero prices in Finland and Sweden in NTC.
- Prices increase as you move north in Sweden resulting in non-intuitive flow from SE1 to SE4 in FB.
- High demand in southern Norway causes CNEC at SE3-NO1 to be fully loaded. By increasing net position in northern Sweden rather than southern Sweden more power is flowing to Norway further north, avoiding overload on SE3-NO1.

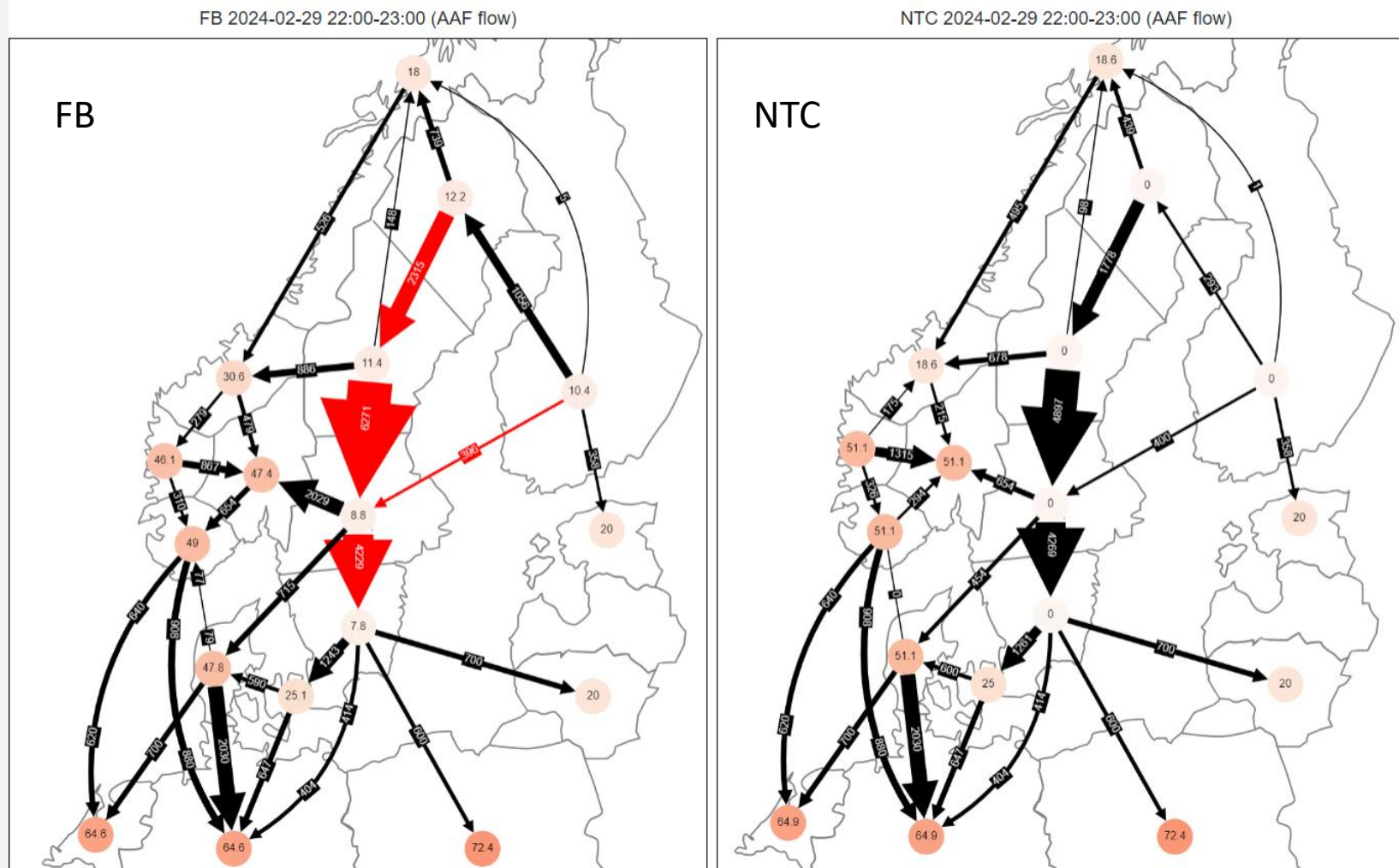


Figure: FB vs NTC simulated flows and prices for 29 February, 22:00 – 23:00. Prices increases north in Sweden



# Negative SEW on 7 March, 18:00-19:00



- Hour with the most negative SEW in the Nordics of -65k €
- Prices in Finland and the Baltics are already high, but gets higher in FB due to lower flow on Fennoskan
  - SE2-SE3 is the limiting CNEC, and more flow on Fennoskan would overload SE2-SE3
  - A suboptimal configuration of the series compensators on SE2-SE3 limited the flow too much in FB
  - Svk is working on improving this for the future

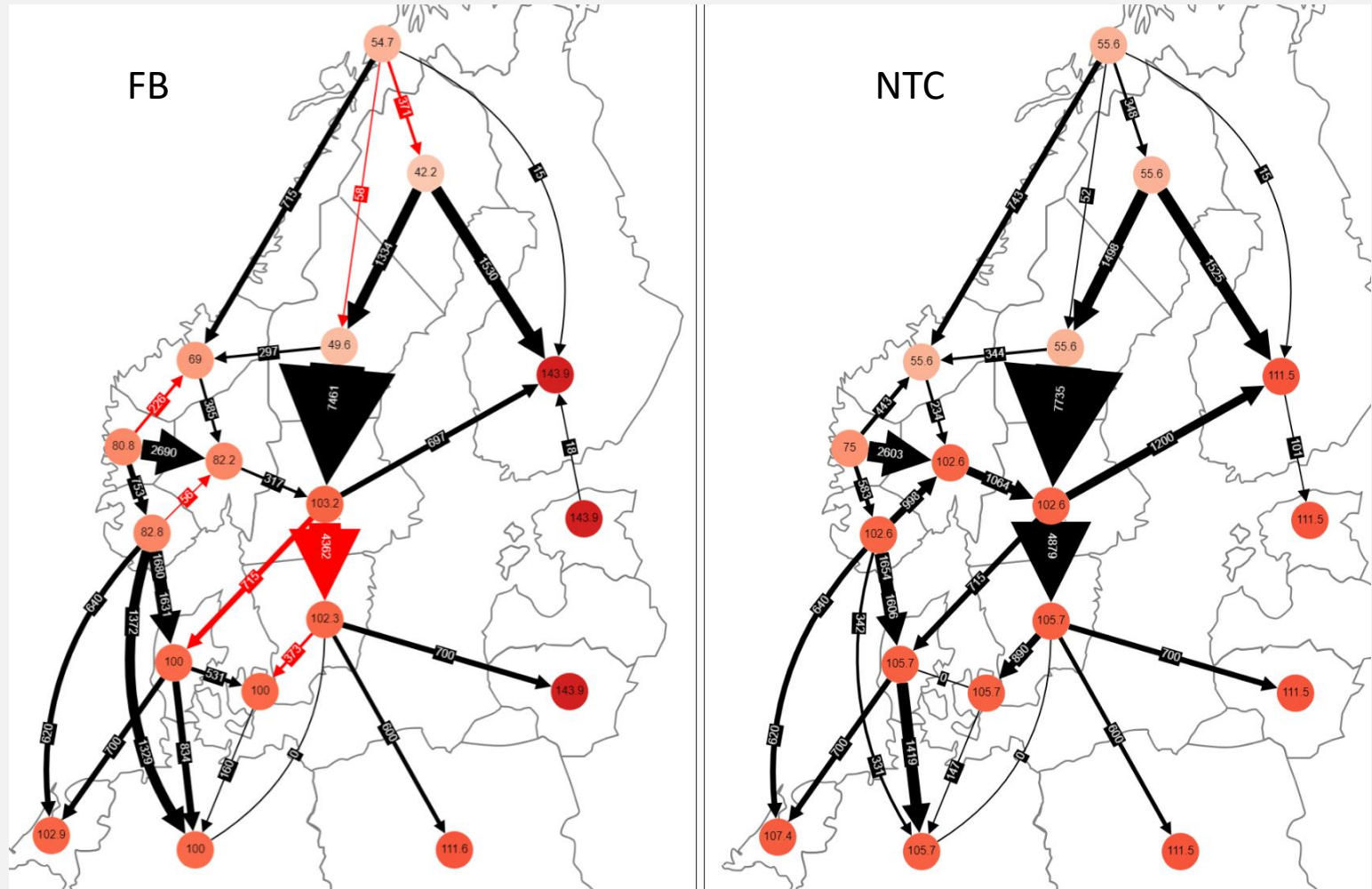


Figure: FB vs NTC simulated flows and prices for 7. March.



Questions?

**ENERGINET**

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**FINGRID**

**Statnett**



**Thank you!**

Contact: [ccm@nordic-rcc.net](mailto:ccm@nordic-rcc.net)

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