Nordic Capacity Calculation Methodology Project (Nordic CCM)

Nordic CCM

External Parallel Run Market Report for Week 5

03.03.2023

ENERGINET SVENSKA KRAFTNÄT FINGRID Statnett

Abbreviations

CCM - Capacity Calculation Methodology

CGM – Common Grid Model

ENDK – Energinet

EPR – External Parallel Run

FB – Flow-based

FG – Fingrid

IGM – Individual Grid Model

IVA – Individual Validation Adjustment

JAO – Joint Allocation Office

LHF – Last Hour Flow

MTU – Market Time Unit

MAS – Modelling Authority Set

NP – Net Position

NTC – Net Transfer Capacity

PTC – Power Transfer Corridor

RCC – Nordic Regional Coordination Centre

SA WG – Simulation & Analysis Working Group

SEW – Socio-economic Welfare

SF – Simulation Facility

SN – Statnett

Svk – Svenska kraftnät

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Introduction

This market report presents the comparison of the market results between the current Net Transfer Capacity (NTC) calculation method and the simulated Flow-Based (FB) capacity calculation method of the day-ahead market timeframe. NEMO Simulations has produced the simulated FB market results by using Euphemia test environment.

The analysis presented in the market reports focuses on the socio-economic welfare (SEW) outcome of the Nordic power systems. During the external parallel run (EPR) weekly reports are published along with supplementary data and additional documents.

Chapter 1 gives an overview of the input data and TSO remarks regarding the FB domains.

Chapter 2 elaborates on the overall comparison of NTC vs. simulated FB market results of week 5.

The capacity calculation tool and the data used for the capacity calculation are under development and continuously being improved by the Nordic TSOs. The outcome of the FB calculations is considered valid for comparison with NTC even with some known disclaimers that are being continuously evaluated and improved by the TSOs.

Please refer to the phenomena report found on the RCC website for in-depth descriptions of known issues with input data, modelling, and methodology that could potentially influence the simulation results.

In the Appendix detailed market results of each Nordic country are presented.

The Nordic TSOs welcome comments and questions from the stakeholders. Please send an email to CCM@nordic-rcc.net.

Data quality

The following table provides information about the data quality during the TSO operator domain validation process, such as substituted domains and IVA provision. More details regarding the quality of the FB domains for this report are presented in the Appendix.

Energy Delivery Day:	Mon. 30.1	Tue. 31.1	Wed. 1.2	Thu. 2.2	Fri. 3.2	Sat. 4.2	Sun. 5.2
Substituted IGMs	0	0	0	0	0	0	0
IVA provision	0	0	0	0	0	0	0
Final domain acceptance (1 TSO =25%)	100%	100%	100%	100%	100%	100%	100%

Table 1. Data from Norcap reporting. Note: IGM refer to hourly national power system models, and the IVA refer to manual adjustments of the domain capacities. The final domain acceptance must be 100% for the data to be published.

Data quality remarks

As seen in Table 1, there were no remarks to the data quality of the FB process under week 5. There were no substituted IGMs or IVA provided, and the final FB domain was accepted by all TSOs for 7 out of 7 days for this week.

Disclaimer

The TSOs are looking into the high surplus in NO4 in FB compared to NTC and can see that the modelling in FB is not fully comparable with NTC. The TSOs are working on improving this.

Market outcome NTC vs. simulated FB for week 5

This chapter presents a comparison of the market results for week 5 (January 30-February 5 2023) between NTC and simulated FB with regards to changes in socio-economic welfare along with individual bidding zone price changes.

Aggregated price results

Bidding zone	Price FB [€/MWh]	Price NTC [€/MWh]	Price FB-NTC [€/MWh]	Price diff (FB-NTC)*100/NTC [%]
DK1	107.14	107.95	-0.81	-0.75
DK2	104.63	97.09	7.54	7.77
FI	100.11	98.94	1.17	1.18
NO1	102.84	107.36	-4.52	-4.21
NO2	103.8	107.36	-3.56	-3.32
NO3	77.0	64.16	12.84	20.01
NO4	62.21	42.54	19.67	46.24
NO5	100.33	103.52	-3.19	-3.08
SE1	68.46	67.8	0.66	0.97
SE2	63.95	67.8	-3.85	-5.68
SE3	98.19	90.08	8.11	9.0
SE4	101.8	94.59	7.21	7.62

Table 2. Average price per bidding zone with NTC and flow based, week 5.

As shown in Table 2 above, a large price difference can be noted for NO3 and NO4 when comparing FB and NTC. FB allows for a larger net position to be reached in NO3 and NO4, which in turn results in higher prices in these areas. For example, the net position for NO4 is shown in Figure 1 below.

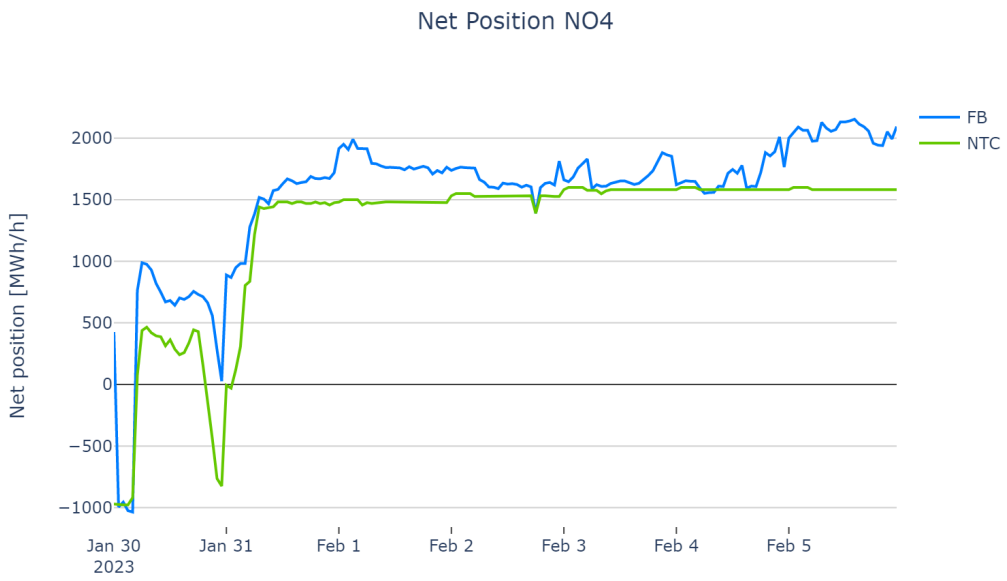

Figure 1 - Day-ahead net position in NO4 on hourly level for both FB and NTC.

As noted for week 4, SE2 stands out with a lower price in FB compared to NTC (Figure 2), this is caused by a lower NP with FB than NTC. The market coupling algorithm optimizes the NP in FB to get more power from cheap areas in the north to the consumers in the south than is being done in NTC. Because SE2 has the highest PTDF on the most limiting CNEC on the flow from north to south, the FB algorithm decreases NP in SE2. In NTC, Svenska kraftnät sometimes uses countertrade and redispatch to increase capacities in NTC and these measures are not fully modelled in FB. Additionally the FB-domain is dependent on the topology provided in the CGM. The optimized topology of the eight lines with series capacitors between SE2 and SE3 is not always captured in the FB-process but is in the live NTC process. This along with countertrade and redispatch may cause the SE2 prices to decrease in FB compared to NTC.

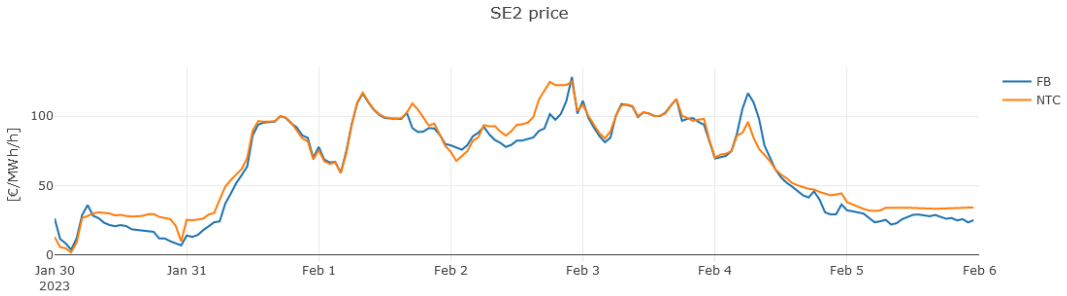

Figure 2. Day-ahead price in SE2 on hourly level for both FB and NTC

Socio-economic welfare results

	Denmark	Norway	Sweden	Finland	Sum
Congestion income	0.02 M€	-3.30 M€	8.69 M€	0.06 M€	5.48 M€
Consumer surplus	-1.74 M€	-5.43 M€	-14.85 M€	-1.42 M€	-23.44 M€
Producer surplus	1.22 M€	11.48 M€	8.79 M€	1.18 M€	22.66 M€
Sum	-0.50 M€	2.75 M€	2.63 M€	-0.18 M€	4.70 M€

Table 3. SEW gain per country. The values represent the difference in SEW between FB and NTC for CCR Nordic. Positive numbers indicate higher SEW in FB than NTC.

In Table 3 the Nordic CCRs SEW difference between FB and NTC for week 6 can be seen. The table shows the change per stakeholder type and country. The overall SEW change in FB compared to NTC for week 5 is 4,7 M€, which is in large part due to a high gain of producer surplus in Norway and Sweden. In all countries the welfare moves from the consumer to the producers. The SEW is positive for Norway and Sweden and slightly negative for Denmark and Finland.

If the congestion income on the HANSA and Baltic borders are included in the SEW calculation, the overall SEW changes. The congestion income diminishes with -0,6 M€, where only half of that loss is attributed to the Nordic area. The resulting total SEW for the SDAC area is 3,4 M€ for week 5.

In Figure 3, the difference in consumer surplus, producer surplus and congestion income in NTC and FB for each day of the week can be seen. The SEW for the Nordics CCR is positive for each day except on the 2nd of February and 4th of February, where it is slightly negative instead. The SEW for the SDAC area is positive for each day of the week.

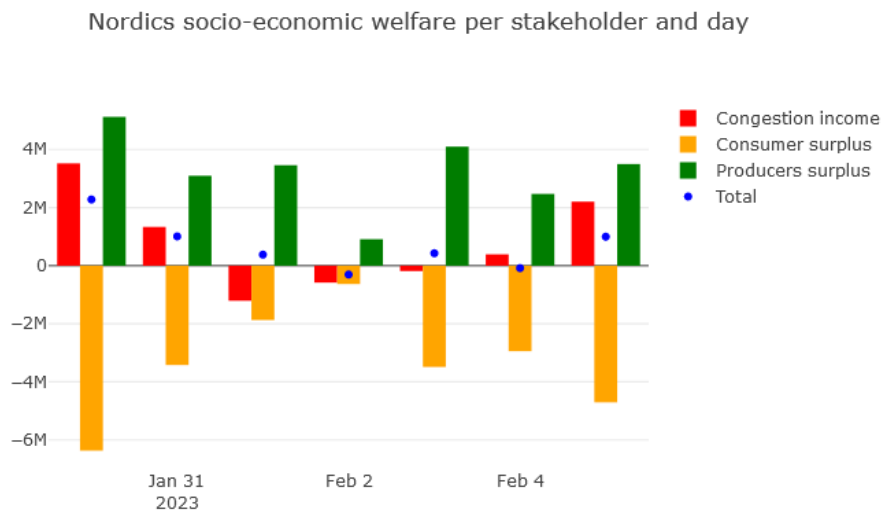

Figure 3. Nordics consumer surplus, producer surplus and congestion income change per day for CCR Nordic.

From Figure 4, the largest increase in welfare is seen in NO4 driven by high producer surplus, and in SE2 driven by high congestion income due to larger price differences between SE2 and SE3 in FB. Even SE3 shows an increase in welfare, mainly driven by producer surplus.

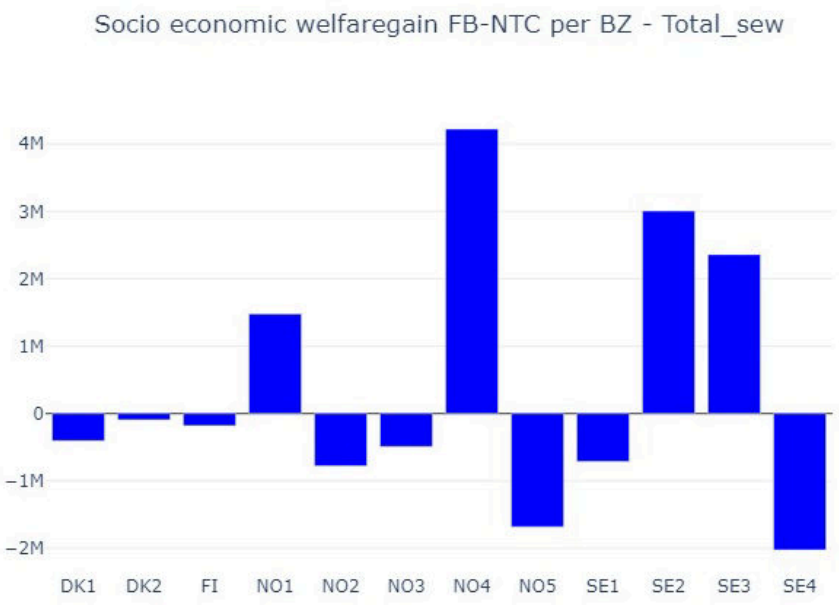

Figure 4. Change in Nordic socio-economic welfare per bidding zone.

Price difference duration curve

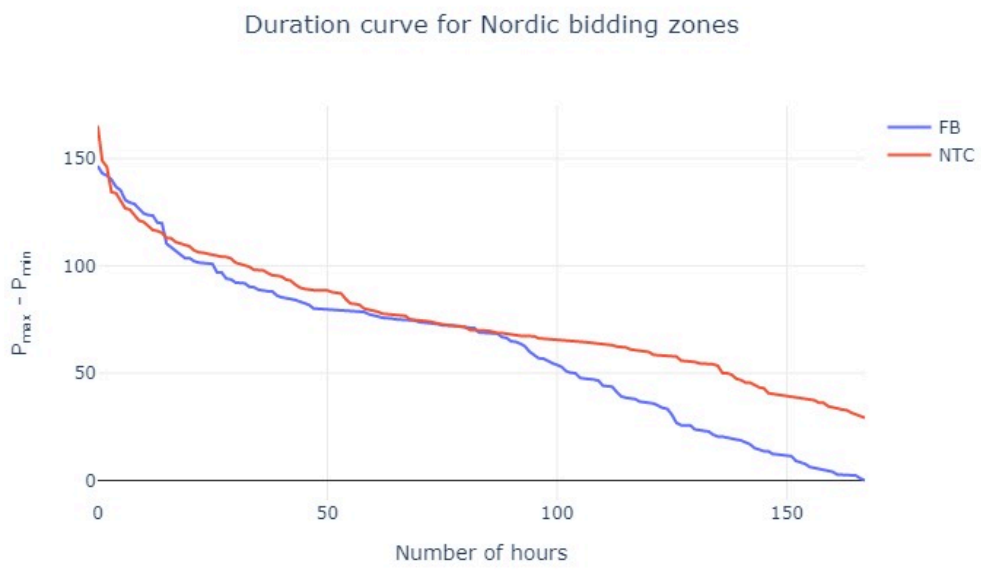

Figure 5. Duration curve showing the difference in area price between the area with the highest and lowest price within the Nordic area.

In Figure 5, the duration curve for the difference in price between the bidding zone with the highest and the lowest price is shown. The difference between min and max price among the Nordic bidding zones is in general lower in FB compared to NTC. This trend has been observed in most previous weeks.

Nordic net position

Figure 7 shows that on the 4th of February, the net position in the Nordics is lower with FB than with NTC which leads to that the accumulated net position for week 5 is lower with FB than with NTC. This is a deviation from the regularly observed pattern that FB enables larger net position for the Nordics than NTC. On the 4th of February, the flow on SE4-LT turned, and SE4 had import from LT, which contributed to the decrease in net position for this day.

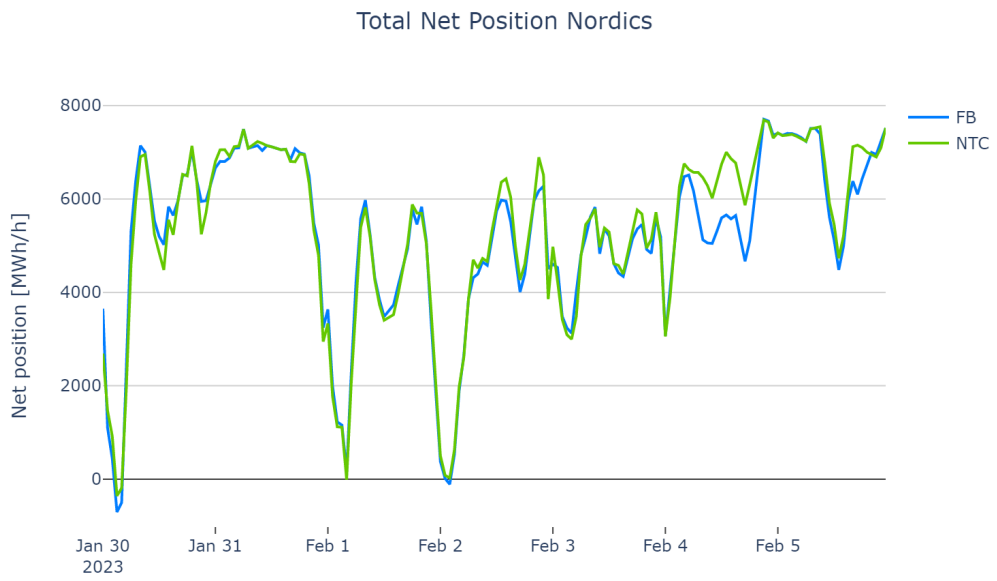

Figure 6. Net position in the Nordics in FB and NTC for week 5.

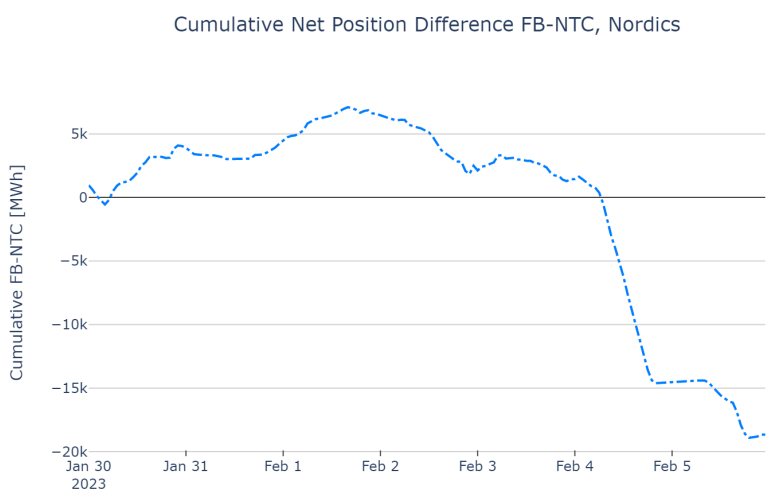

Figure 7. Overall net position for the Nordic area, showcases either import or export.