



Nordic Capacity Calculation Methodology Project (Nordic CCM)

Nordic CCM

External Parallel Run Market Report for
Week 3

14.02.2023





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

RRC – 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 3.

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. 16.01.	Tue. 17.01.	Wed. 18.01.	Thu. 19.01.	Fri. 20.01.	Sat. 21.01.	Sun. 22.01.
Substituted IGMs	0	0	0	0	0	0	0
IVA provision	0	0	1	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

(Added on the 22/2-2023) 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.

As seen in Table 1. after adjustments the final FB domain was accepted by all TSOs for 7 out of 7 days for week 3. For the 18.01 SVK had an incorrect Fmax value on a CNE due to an outage, hence the applied IVA.



Market outcome NTC vs. simulated FB for week 3

This chapter presents a comparison of the market results for week 3 (January 16- January 23 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	143.52	143.9	-0.38	-0.26
DK2	134.75	121.22	13.53	11.16
FI	96.92	93.34	3.58	3.84
NO1	130.91	136.62	-5.71	-4.18
NO2	132.83	136.62	-3.79	-2.77
NO3	93.21	80.09	13.12	16.38
NO4	71.27	49.34	21.93	44.45
NO5	127.12	136.64	-9.52	-6.97
SE1	78.77	79.45	-0.68	-0.86
SE2	69.7	79.45	-9.75	-12.27
SE3	117.23	102.19	15.04	14.72
SE4	127.36	113.21	14.15	12.5

Table 2. Average price per bidding zone with NTC and flow based, week 3.

From Table 2 the average prices and differences between the different bidding areas can be seen. As is expected many of the Northern areas see an increase in their electricity price whilst some of the more southern areas see a decrease in their price, thus indicating that FB is better able to flow power from areas with cheap production to areas with high production.

One area that stands out which is DK2. As evident in Figure 1 there are hours mainly during the 17th, 18th, and 22nd where FB sees a higher price than NTC.



Figure 1. Day-ahead price in DK2 on hourly level for both FB and NTC.



The lower area price is due to a lower import from SE4 in FB, thereby activating more expensive production within DK2. Though the area price is higher for DK2 in these hours is more expensive the overall system sees a positive SEW, meaning a higher welfare is gained elsewhere in the system compensating for the decrease in DK2 welfare.

Likewise SE2 also sees decrease in the area price which is opposite to the expected for a low price area. This week SE2 sees a lower NP this week in FB compared to NTC of about 100 GWh. This comes in the form of more import from cheaper more northern areas while the export southward is lower. As the overall electricity mix in the area stemming from cheap production.



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	-1.84 M€	-0.10 M€	20.70 M€	1.13 M€	19.90 M€
Consumer surplus	-3.24 M€	-2.33 M€	-25.84 M€	-4.14 M€	-35.54 M€
Producer surplus	3.69 M€	5.28 M€	10.48 M€	4.36 M€	23.82 M€
Sum	-1.38 M€	2.85 M€	5.35 M€	1.36 M€	8.17 M€

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

Over the course of the week the congestion income on the Hansa and Baltic borders is equal to: -2.24 M€, while the SEW in the rest of SDAC is: -1.77 M€. The total change in SEW is thereby 4.16 M€.



From table 3 it can be seen that overall NO, SE, and FI come out with a positive SEW while DK has a negative SEW. Furthermore in all countries the welfare changes from the consumer to the producers. Nonetheless using FB sees is an overall positive SEW change at 8.17 M€ from the Nordic CCR, though not all days have a positive SEW. From Figure 2 it can be seen that the 20th has a negative SEW.

During the 20th there is a rather large difference in the NPs that are obtained from NTC and FB, which can be seen on Figure . This difference in NP lies mostly within SE2 where the domain in NTC allows a higher flow on some CNEs which are not allowed in the FB domain. The FB results are thus forced to lower the NP in order to accommodate these constraints. The overall reduction correlates with the time in which wind production for the week was at its lowest point, meaning cheap production capacity was scarce.

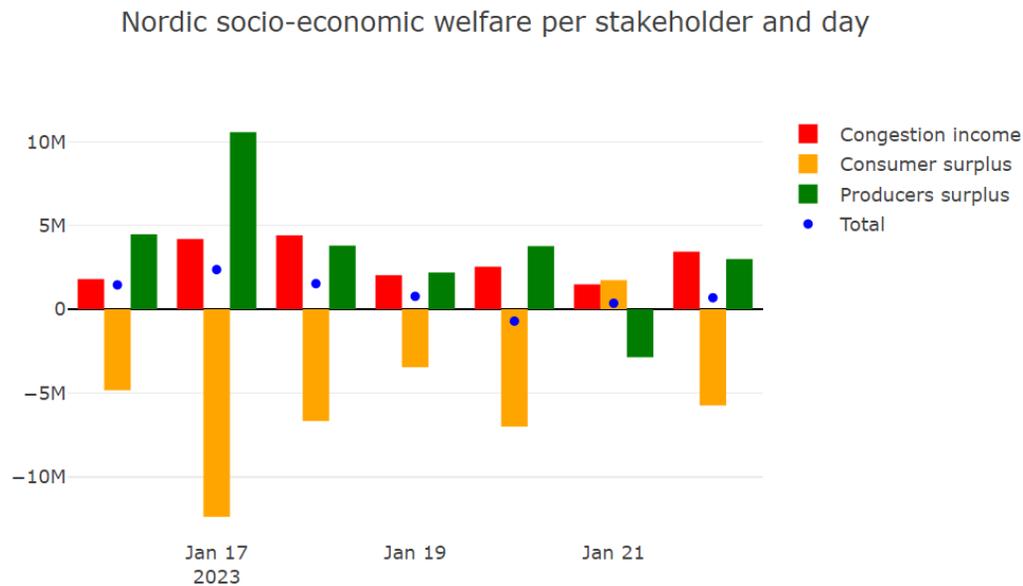


Figure 3. Daily SEW change for the Nordic CCR.

Like what was seen in Table 3, the producer and consumer surplus on a daily level is also opposite each other as evident from Figure 3. This is the case for the majority of days which in part comes from an increased export of electricity from the Nordic area to the higher priced external regions. This increased export can be seen in the cumulative net position in Figure 6.



From Figure 4 it can be seen that the largest increase welfare is seen in NO1, NO4, SE2 and SE3, while NO4 and SE4 see the largest decrease.

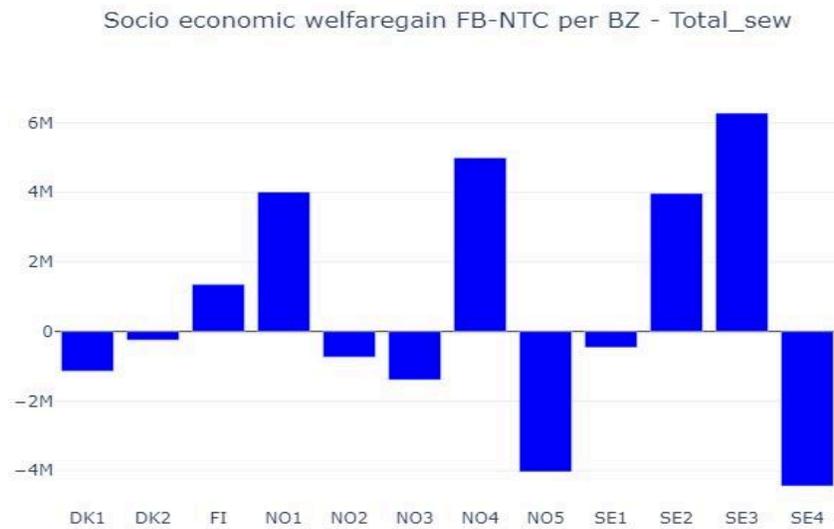


Figure 4. Change in Nordic socio-economic welfare per bidding zone.



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.

The duration curve in Figure 5 shows that for week 3 the price difference between the lowest and highest area was overall lower in FB than in NTC when sorted. A lower price difference between areas indicates that the grid is better utilized. A price difference of zero means that congestions are not limiting the system and prices have converged. Though no hours in week 3 have a price difference of zero, being closer to a price convergence gives an indication that the grid has been used in such a way that fewer constraints have been present.



Nordic net position

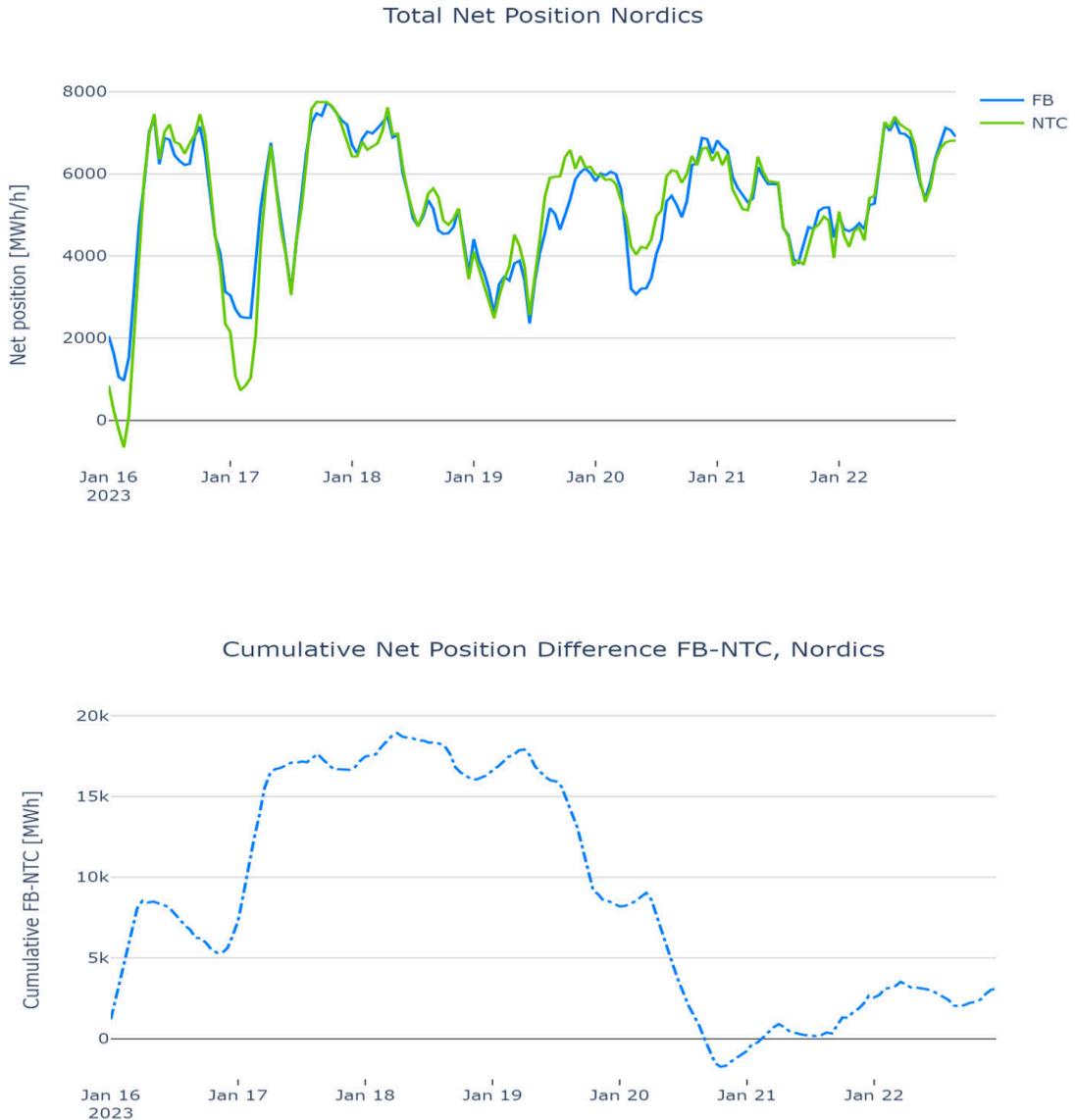


Figure 6. Overall and cumulative net position for the Nordic area, showcases either import or export.

In Figure 6 the NP and cumulative NP can be seen. Here it can be seen that during the 19th and 20th, the overall NP in the Nordics is lowered meaning the export to the Hansa and Baltic regions has been lowered. As mentioned previously these days see



the lowest wind production during the week which explains why the export is lowered.