Nordic Capacity Calculation Methodology Project (Nordic CCM)

Nordic CCM

External Parallel Run Market Report for Week 6

02.03.2023

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

RRC –Regional Coordination Centre

SA WG – Simulation & Analysis Working Group

SEW – Socio-economic Welfare

SF – Simulation Facility

SN – Statnett

Svk – Svenska kraftnät

Contents

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 6.

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. 06.03	Tue. 07.03	Wed. 08.03	Thu. 09.03	Fri. 10.03	Sat. 11.03	Sun. 12.03
Substituted IGMs	0	0	0	24	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.

Remarks

As seen in Table 1. after adjustments the final FB domain was accepted by all TSOs for 7 out of 7 days for week 6.

For the 9th 24 IGMs for DKW were substituted with IGMs from the previous day. The CGM was also substituted due to large imbalances. No IVAs were needed as the topology was the same.

During the EPR, the Nordic CCM will ensure necessary improvements of our input data, modelling and processes in general. Please use the EPR as a learning by doing experience. After go-live, the Nordic TSOs and Nordic RCC will continue to improve the flow-based process as and when needed.

Market outcome NTC vs. simulated FB for week 6

This chapter presents a comparison of the market results for week 6 (February 6-February 13 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	118.87	123.7	-4.83	-3.9
DK2	111.01	98.85	12.16	12.3
FI	60.53	60.87	-0.34	-0.56
NO1	99.47	106.09	-6.62	-6.24
NO2	101.32	106.1	-4.78	-4.51
NO3	51.31	30.03	21.28	70.86
NO4	26.81	22.81	4.0	17.54
NO5	94.81	104.52	-9.71	-9.29
SE1	31.77	29.84	1.93	6.47
SE2	21.5	29.84	-8.34	-27.95
SE3	81.82	58.97	22.85	38.75
SE4	94.62	83.59	11.03	13.2

Table 2. Average price per bidding zone with NTC and FB, week 6.

When looking at the average prices it is expected that high price areas see an decrease in their average price while low price areas see a increase in price when going from NTC to FB. This expectation holds true for the high price areas DK1, NO1, NO2, and NO5 which see an average price decrease, and the low price areas NO3, NO4, and SE1 which have had a price increase. Only SE2 are divagating from this this expectation.

By looking at the price curves during week 6 for SE2 and SE3 (Figure 1) the price change in these areas can be seen. The price in SE3, SE4 and DK2 have a closer convergence than with SE2 and this is due to grid limitations that are found on the border between SE2 and SE3. The power coming from the northern Nordics is consumed within SE2 rather than being transported further down south. This can be seen from the NPs in Figure 2 where SE2 is importing power and SE3 is exporting power.

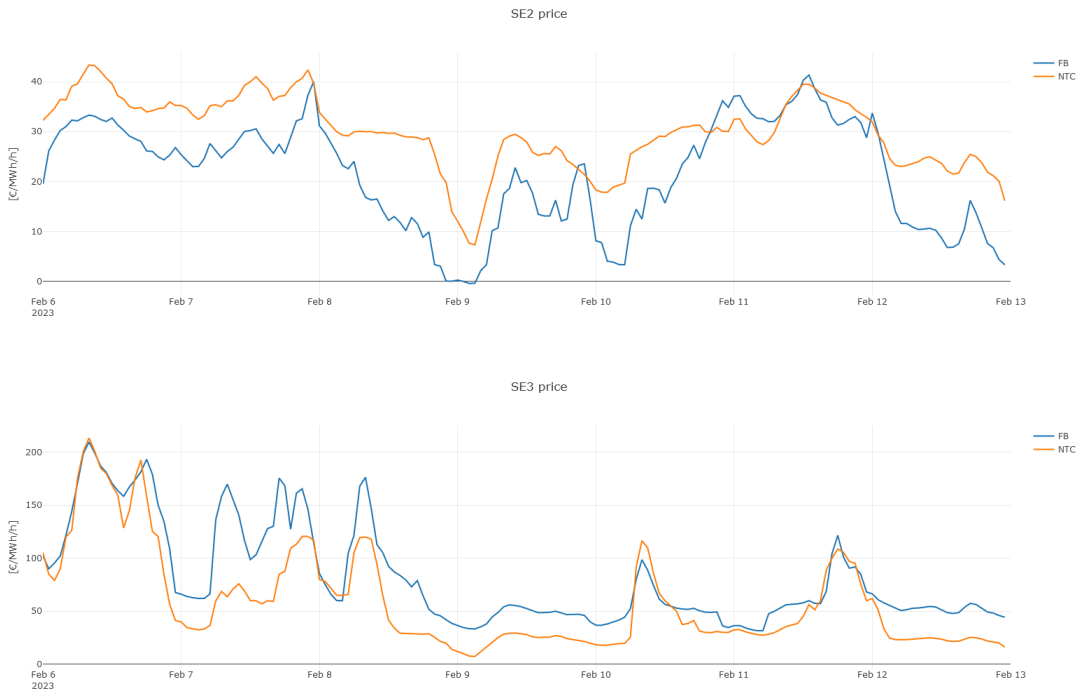


Figure 1 - Price for SE2 and SE3

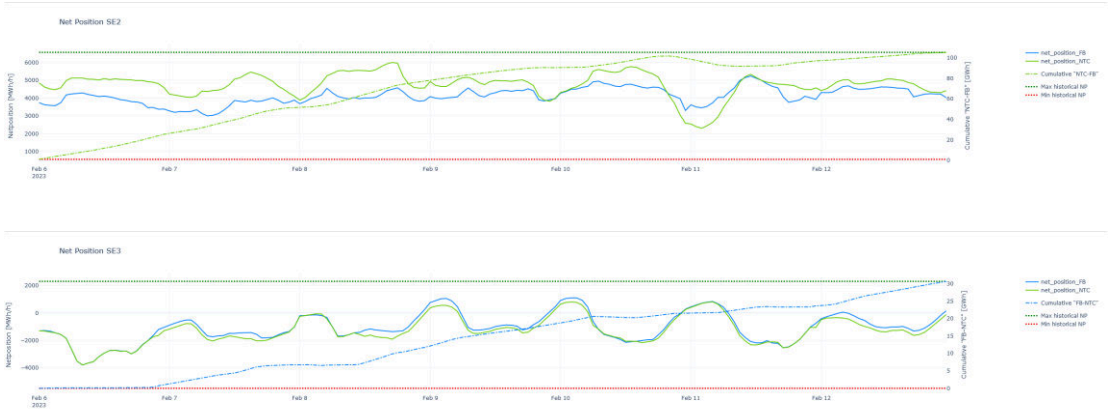


Figure 2 - NP for SE2 and SE3

This observation has also been noted for week 4 and 5 where the same limitations are at play. With FB, the limitations in the grid are better represented in order to achieve an optimal flow from cheap areas in the North to consumers in the South. 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 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 with FB compared to NTC.

Socio-economic welfare results

From Table 3 it can be seen that all countries except Denmark see a positive change SEW over the week. For the Nordic CCR consumers see a loss, but producers see a surplus. A large gain comes from the CI which will to some degree be shared with the consumers in the form of reduced tariffs lessening the loss in surplus.

	Denmark	Norway	Sweden	Finland	Sum
Congestion income	-1.00 M€	5.94 M€	17.89 M€	-0.04 M€	22.79 M€
Consumer surplus	-2.31 M€	1.90 M€	-39.06 M€	0.47 M€	-39.01 M€
Producer surplus	-0.36 M€	-4.90 M€	27.84 M€	-0.18 M€	22.41 M€
Sum	-3.67 M€	2.94 M€	6.67 M€	0.24 M€	6.18 M€

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

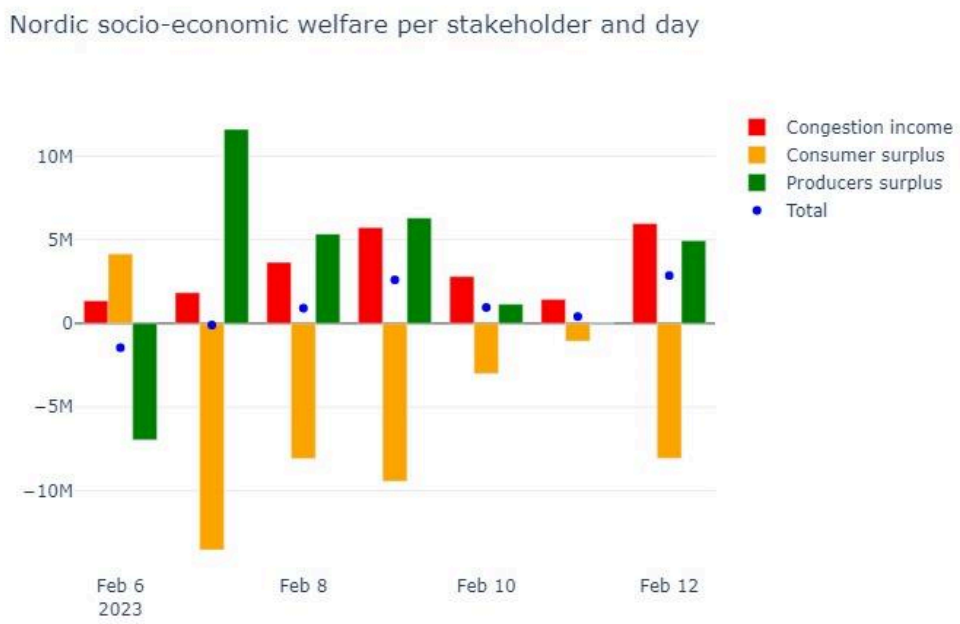


Figure 3 – Daily SEW change for the Nordic CCR.

Over the course of the week the change in congestion income on the Hansa and Baltic borders is equal to: -0,62 M€. The SEW change in the rest of SDAC is -0,026 M€ giving a weekly total of 5.52 M€.

From Figure 3 it can be seen that the Nordic CCR has a positive SEW all days except the 6th of February. This day also sees a negative SEW for the whole SDAC area of approximately -186 kEUR. The negative SEW this day is to a large degree a result of the limitation that occurs on the SE2-SE3 border. As previously mentioned NTC has an easier time capturing more dynamic changes in the topology. For this day it leads to a larger southward flow that gives a higher SEW.

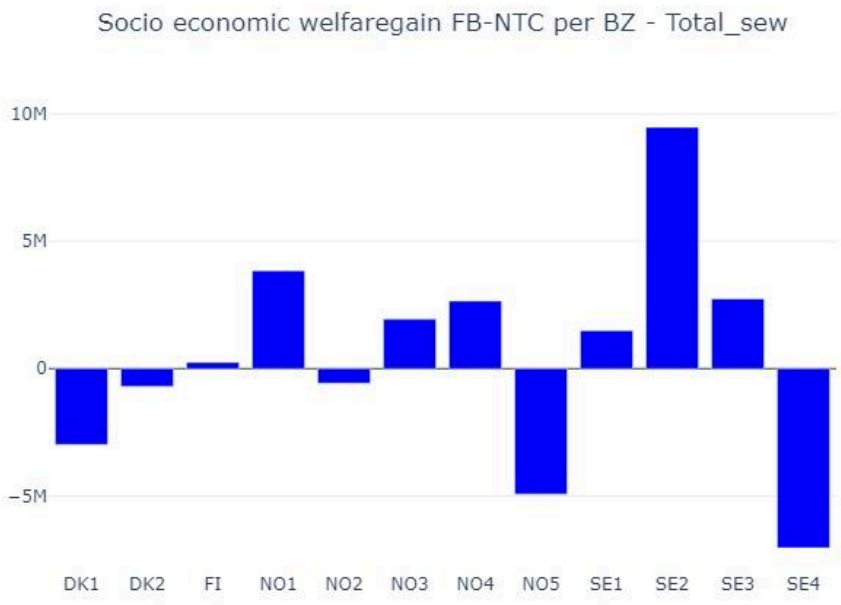


Figure 4. Change in Nordic socio-economic welfare per bidding zone. CI from the Hansa/Baltic region is included in this graph.

Looking at the change on a bidding zone level then only five of the twelve bidding zones see a SEW loss, as can be seen in Figure 4. The zones that experience a loss in FB compared to NTC are the most southern bidding zones. This can be seen as one of the consequences of the limitation on SE2-SE3 as less cheap power has been transported to the southern bidding zones.

Price difference duration curve

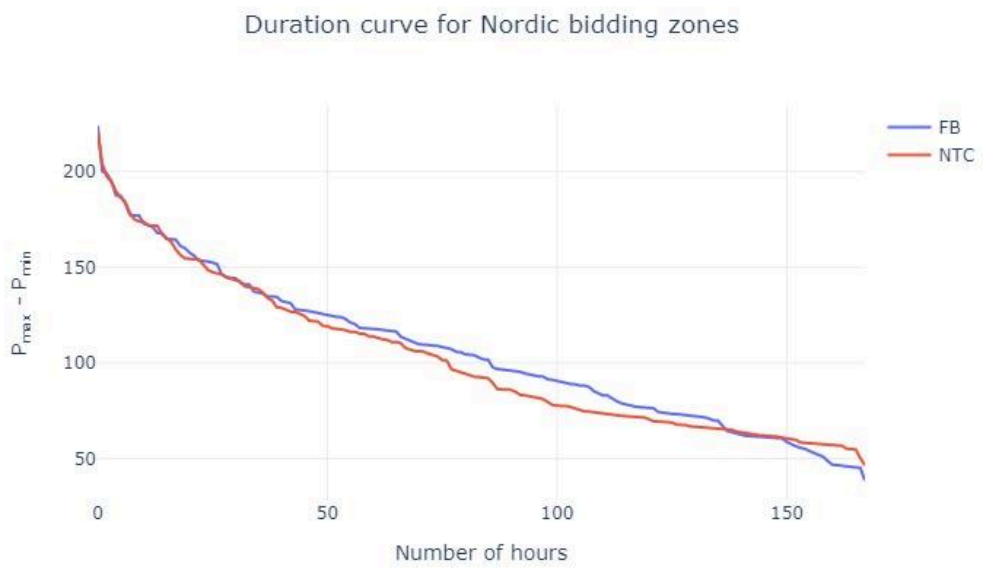
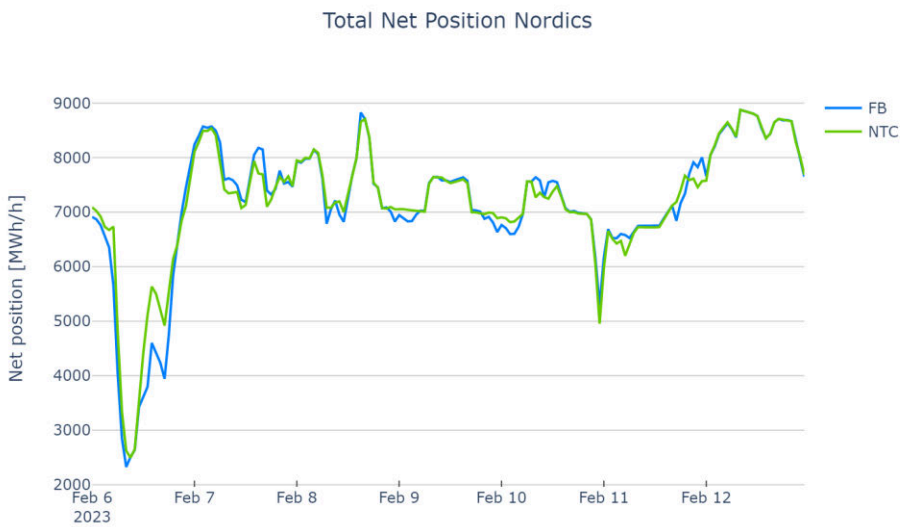


Figure 5. Duration curve showing the difference in area price between the area with the highest and lowest price within the Nordic CCR.

During week 6 the price difference between the highest and lowest bidding zone has been lower in NTC for the majority of the week as evident from Figure 5. In total there are 69 hours where FB outperforms NTC in regards to the price difference this week. The price convergence is closer for FB in the hours when there is either a high or low price. Many of the hours where FB performs worse than are centered around the first day where the negative SEW for FB is observed.

Nordic net position



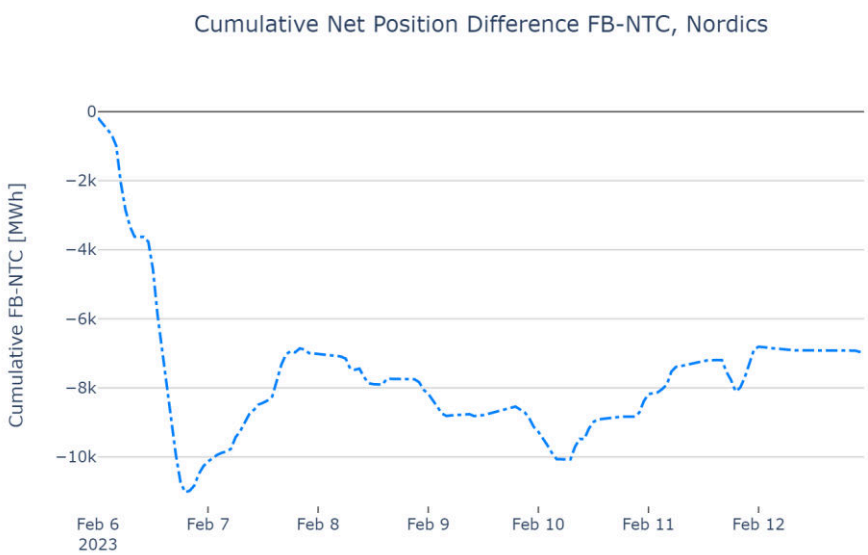


Figure 6. Overall net position for the Nordic CCR, showcases either import or export.

From Figure 6 the biggest thing to note is the very low NP the first day of the week and the high difference between FB and NTC. This low NP comes in large part from very low wind production during the 6th of February. The large difference between the NP in FB and NTC comes mainly from SE due to the limitation on the SE2-SE3 border. This enables SE2 to reduce its NP significantly as much of the cheap

northern power cannot be transported fully southward, but can in turn be used within SE2, leading to a low NP. This NP contributes to the negative SEW change this day and the high prices in the beginning of the week which can also be seen on Figure 6.