

Nordic Capacity Calculation Methodology Project (Nordic CCM)

Nordic CCM

External Parallel Run Market Report for Week 10

06.04.2023





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
- RCC Nordic Regional Coordination Centre
- SA WG Simulation & Analysis Working Group

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- 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, "Data quality", gives an overview of the input data and TSO remarks regarding the FB domains.

Chapter 2, "Market outcome NTC vs. simulated FB for week", elaborates on the overall comparison of NTC vs. simulated FB market results of week 10.

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 <u>CCM@nordic-rcc.net</u>.







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. 6.3.	Tue. 7·3·	Wed. 8.3.	Thu. 9.3.	Fri. 10.3.	Sat. 11.3.	Sun. 12.3.
Substituted IGMs	1	13	10	3	4	0	0
IVA provision	0	1	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 systemmodels, and the IVA refer to manual adjustments of the domain capacities. Thefinal domain acceptance must be 100% for the data to be published.

Data quality 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 10.

Adjustments:

- Monday: one substituted Norwegian IGM. Non-convenging powerflow.
- Tuesday: 13 substituted Norwegian IGMs. Non-convenging powerflow. Also, one IVA provision due to wrong Fmax value in Finnish CNEC.
- Wednesday: 10 substituted Norwegian IGMs.
- Thursday: 10 substituted Swedish IGMs.
- Friday: 3 substituted Swedish IGMs.

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.







Disclaimer

The revised management of series capacitors on lines between SE2 and SE3 that was introduced during week 9 was continued in week 10. Correct prognosis helps to provide more transmission capacity for SE2-SE3 border. More detailed description of management of series capacitors is provided in External Parallel Run report Week 9. During week 10 no additional IVA was provided on the lines in question.

Reoccurring disclaimers can be found in the phenomena report.

Market outcome NTC vs. simulated FB for week 10

This chapter presents a comparison of the market results for week 10 (March 6-March 12 2023) between NTC and simulated FB with regards to changes in socioeconomic welfare along with individual bidding zone price changes.

Bidding zone	Price FB [€/MWh]	Price NTC [€/MWh]	Price FB-NTC [€/MWh]	Price diff (FB- NTC)*100/NTC [%]
DK1	116.74	116.89	-0.15	-0.13
DK2	117.9	113.6	4.3	3.79
FI	118.48	117.7	0.78	0.66
NO1	110.21	115.11	-4.9	-4.26
NO2	110.68	115.11	-4.43	-3.85
NO3	96.66	77.88	18.78	24.11
NO4	59.07	74.5	-15.43	-20.71
NO5	109.19	114.8	-5.61	-4.89
SE1	91.93	77.88	14.05	18.04
SE2	91.11	77.88	13.23	16.99
SE3	117.7	113.08	4.62	4.09
SE4	118.95	113.29	5.66	5.0

Aggregated price results

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Table 2. Average price per bidding zone with NTC and flow based, week 10.

Table 2 shows the weekly average prices from the FB simulations and with NTC per bidding zone, and the price difference between FB and NTC.

Highest price changes occurs in NO3, NO4, SE1 and SE2 areas. In the last weeks NO4 Flow-based price have been increased compared to NTC, however, this week represent lower Flow-based price than NTC price in NO4 area. Opposite impact

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occurred in SE2 area where Flow-based price have increased in week 10 compared to NTC.

Price changes suggest that effects of NO4 area modelling and updated modelling of series capacitors can be seen from price results. Modelling improvements of NO4 and management of series capacitors on lines between SE2 and SE3 will be continued for upcoming weeks. It has been estimated that some changes could have been too restrictive in NO4, meaning that more production is used from the SE1 and SE2 areas. Clear indications of the changes in NO4 can be validated in upcoming weeks since NO4 prices are affected by planned outage of a large hydropower plant in week 10.



Figur 1. Day-ahead price in SE2 on hourly level for both FB and NTC.

Systematically higher price in Figure 1 confirms that more production can be used from SE2 area, cumulatively 30.7 GWh more by Flow-based. Also, improved modelling have reduced CNEC congestions in SE2, which earlier affected to lower SE2 net position.



Socio-economic welfare results



Nordic socio-economic welfare per stakeholder and day



Over the course of the week total SEW change in the Nordics is 1,68 M€, while total SEW in pan-European market coupling area is 1,69 M€. Change in congestion incomes in the Nordics is -5,0 M€

Highest changes of consumer and producer surplus occurred on Monday when generally prices decreased in the bidding zones where producers are majority.

Total SEW gain is positive as seen from table 3. Highest market impacts are in Sweden, namely in SE1, SE2 and SE3. Congestion incomes have been reduced, indicating that there are less congestions in the transmission network.

	Denmark	Norway	Sweden	Finland	Sum
Congestion income	0.32 M€	6.68 M€	-11.18 M€	-1.82 M€	-6.00 M€
Consumer surplus	-1.02 M€	5.43 M€	-17.63 M€	-0.77 M€	-14.00 M€
Producer surplus	1.04 M€	-12.85 M€	32.34 M€	0.50 M€	21.04 M€
Sum	0.34 M€	-0.74 M€	3.52 M€	-2.09 M€	1.04 M€

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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.









Socio economic welfaregain FB-NTC per BZ - Total_sew

Figur 2. Change in Nordic socio-economic welfare per bidding zone. CI from the Hansa/Baltic region is included in this graph.

High SEW change in Sweden are mainly driven by high price changes compared to NTC. While highest percentage price changes in Sweden occurs in SE1 and SE2 areas, SE3 negative SEW change is caused by lower congestion incomes compared to NTC.

Producer surplus increases in SE1 and SE2 while consumer and congestion incomes reduces in SE3.





Price difference duration curve

Duration curve for Nordic bidding zones



Figur 3. Duration curve showing the difference in area price between the area with the highest and lowest price within the Nordic CCR.

As seen in the figure 3, Flow-based introduce more extreme prices in the Nordic area if taking into account only lowest and highest prices from each hour. However, congestion incomes have been reduced in week 10 which generally indicates less congestions in the transmission network. Still, changes in congestion incomes are mainly occurring in SE2-SE3 border in the Nordics.







Nordic net position

Total Net Position Nordics



Cumulative Net Position Difference FB-NTC, Nordics



Figur 4. Overall net position for the Nordic CCR, showcases either import or export.

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In figure 4, High deviation of Nordic net position change is due to different market situations (upper graph), but also how Flow-based allocates flows differently (graph



below). Net position deviates more during week 10 if compared to previous four weeks.

Cumulative flow-based net position change have been stabilized during the weeks 9 and 10, suggesting improvements to the NO4 modelling and management of series capacitors in SE3. Conclusions require more data to confirm stabilization.



