



Nordic Capacity Calculation Methodology Project (Nordic CCM)

Operational learning points during the external parallel run of the Nordic flow-based methodology

10 July 2024



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Introduction

External parallel run (EPR) is conducted to ensure a proper implementation of the Nordic flow-based methodology (FB) and an adequate comparison to the current capacity calculation method (NTC). During the EPR, Nordic CCM has ensured and will ensure necessary improvements of our input data, modelling and processes in general. Hence, the EPR should be used as a learning-by-doing experience. This means that during the EPR, the comparison between NTC and FB has at times been affected by issues in either one of the approaches. This should not disqualify the NTC capacities or FB domains, or the market coupling results computed with them. Neither of the processes are able to capture perfectly all possible aspects at all times, and the varying levels of contribution (e.g., primary focus being on the operational issues instead of simulations), differences in process timings, or other mistakes may have affected the comparability of the NTC and FB results. It should be noted that also after go-live, the Nordic TSOs and Nordic RCC will continue to improve the flow-based process as and when needed.

This document aims to collect and explain the operational learning points that the TSOs have encountered during the EPR. The document covers both the KPI reporting period of the NRA report (12 December 2022-12 March 2023) but also new findings that have been encountered after publishing the 3-month NRA report. It should be noted that the SEW impacts of the operational learning points may be either positive or negative, when comparing FB to NTC, and depend on the specific case.

From week 17 in 2024, the TSOs have also published ATCE (ATC extraction) results with the parameters that will be used to provide intraday capacities to the market after Nordic flow-based go-live. Operational learning points for Intraday capacities are therefore also a part of the operational learning points document to provide experiences and potential issues in the intraday market both in NTC and FB for the last six months of the EPR before go-live.



Day-ahead operational learning points

Overview and affected time periods

This section lists the most significant identified operational learning points during the last six months that are further clarified later in the document. The items are further categorized in Figure 1 into solved and ongoing ones (indicated with an arrow at the right end of the time interval) and in Figure 2 into other implemented changes. A more detailed timeline for all items that are presented in this document can be found in the Appendix.

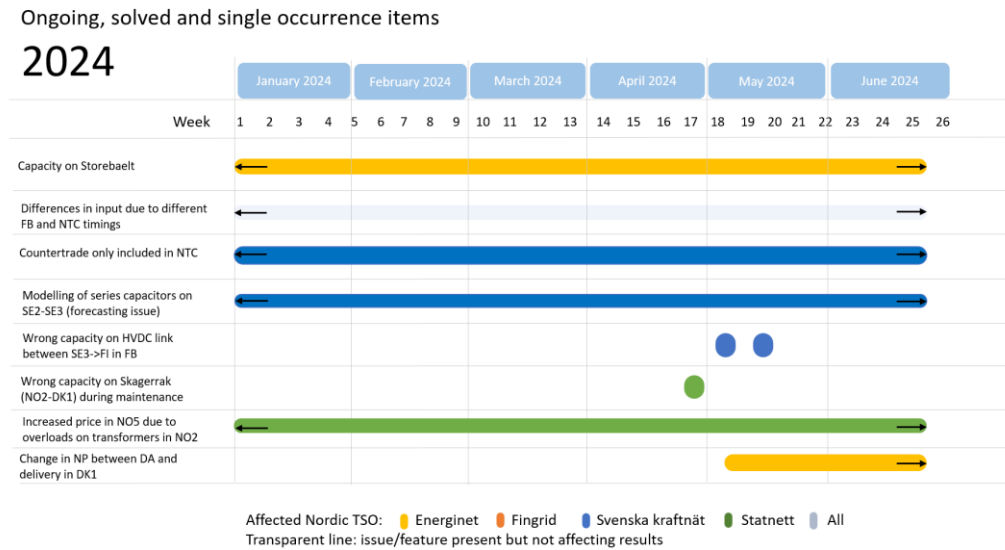


Figure 1: Timeline of the most significant “ongoing and solved” operational learning points during the last 6 months of the external parallel run.



Implemented changes

2023-2024

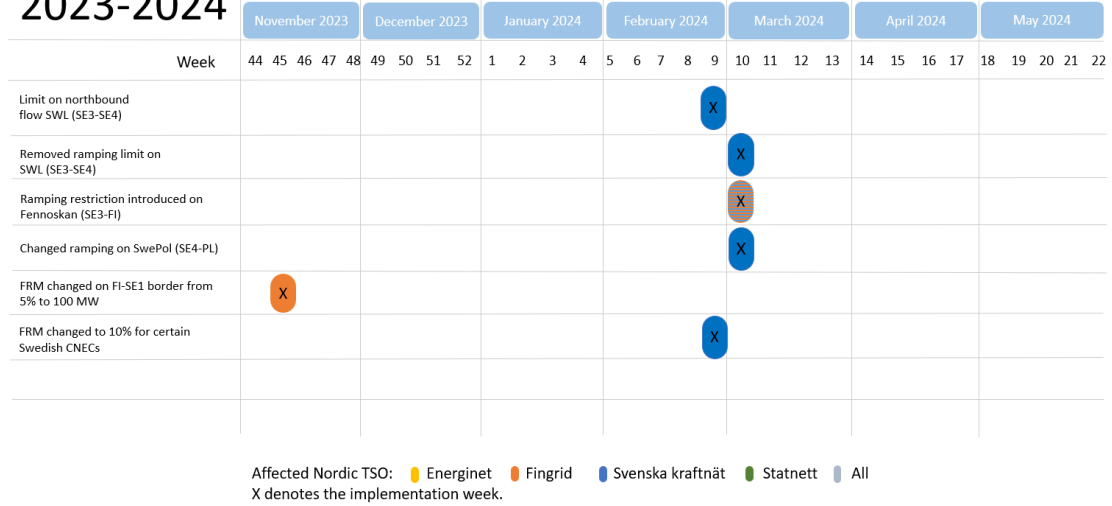


Figure 2: Timeline of the most significant “implemented changes” operational learning points since November 2023 until May 2024. X denotes the implementation week to the input data of the external parallel run.

Implemented changes

This section covers operational learning points that are considered as changes that are implemented to the input parameters during the EPR due to, for example, operational reasons.

Ramping restriction on Fennoskan (FI-SE3)

Published: 30.6.2023

Please note! This text has been updated on April 5th, 2024. The previous version of the Operational learning points stated that ramping restrictions are investigated and could be applied by FB go-live.

Ramping refers to active power flow change of HVDCs between one market time unit (MTU) to another. Analysis during EPR shows that FB allocated flows on FI-SE3 have had a higher variation compared to NTC allocated flows. Occasionally, ramping has been higher than what is technically possible in the operation of Fennoskan. Similar outcome is not observed from the NTC results. In order to ensure secure operation of Fennoskan at FB go-live, Svenska kraftnät and Fingrid have agreed to introduce a ramping limit on the cable. At FB go-live 600 MW/h ramping constraint



will be introduced on Fennoskan, and the 600 MW/h ramping limit is also included in the EPR from week 10, 2024, and onwards.

FRM changed on FI-SE1 border from 5% to 100 MW

Published: 14.12.2023

The method of percentage based FRM (5% of F_{max}), which has been used on all bidding zone borders in the Nordic flow-based EPR until November 2023 (cf. the item “RM calculated differently in FB and NTC”), has been assessed not to be sufficient for the FI-SE1 bidding zone border due to physical limitations. Currently in the NTC capacity calculation a fixed TRM (Transmission Reliability Margin) of 100 MW is used. The same value of 100 MW will be applied for FRM on the FI-SE1 bidding zone border. This fixed FRM is required due to the physical limitations and the inherent linear relationship between net position and border flow when the Finnish grid effectively has only one AC bidding zone border (FI-SE1). The physical limitations are based on frequency containment reserves, high variability of loads close to the FI-SE1 bidding zone border, and limitations of AC border lines. In effect, this change reduces the PTC (Power Transfer Corridor) capacity on FI-SE1 by 100 MW from F_{max} instead of the 5% from 10 November 2023 (W45) onwards in the EPR simulations. The impact of this change is that the maximum flows on SE1-FI border are expected to slightly reduce from what has been observed in the EPR so far, and thus, the maximum flow will be close to NTC maximum flow.

FRM changed to 10% for certain Swedish CNECs

Published: 8.3.2024

Svenska kraftnät has identified the FRM (Flow Reliability Margin) of 5% on all Swedish CNECs not to be a sufficient marginal to manage all market outcomes. In order to ensure operational security, Svenska kraftnät increases the FRM on 13 certain CNECs to 10%, starting from the 26th of February 2024. The increased FRM means an increased marginal to cover for uncertainties, and the increase of the FRM means that the RAM of the CNEC is reduced proportionally to the size of the FRM. The change gives a better opportunity to validate the market outcome and reduces the risk of overloads. The Nordic CCM explains that the reliability marginal should be regularly evaluated, and this change of the FRM is a result of such an evaluation.

Changed allocation constraints in South West Link (SE3-SE4)

Limited northbound flow



Published: 12.4.2024

During the EPR, FB has frequently allocated a northbound flow on South West Link, a HVDC located on the SE3-SE4 border. The northbound flow is considered to be operationally unfeasible by Svk, which is why Svk has decided to limit northbound flow on the South West link to 0 MW. The measure will increase voltage stability in SE3 and therefore secure higher dynamic limits on the rest of the SE3 borders. This value might change during specific outage conditions. The change is implemented from March 2, 2024.

Removed ramping limit in EPR

Published: 12.4.2024

The South West Link has had a ramping limit of 600 MW/h during the EPR. Svk foresees that there will be no ramping limit on the South West Link by the FB go-live and has therefore removed the ramping limit, starting from week 10, 2024.

Changed ramping on SwePol

Published: 12.4.2024

For some HVDC, including SwePol Link, the analysis during EPR shows that changes of the flow between market time units (ramping) will increase to a level that would be technically impossible. Therefore, Svenska kraftnät and the Polish TSO, PSE, have agreed to change the ramping on SwePol Link from 600 MW/h to 300 MW/h at go-live of flow-based capacity calculation in the Nordics. In order to reflect the constraints at FB go-live during the EPR, the ramping is changed from week 10 2024 and onwards.

Modeling of FI-NO4 border

Published: 12.4.2024

From the go-live date of the Nordic flow-based capacity calculation the FI-NO4 bidding zone border will be part of the European day-ahead market coupling (cf. [Fingrid news from 2023](#)). The change will be made due to the ACER decision to include Norwegian bidding zone borders to the Nordic capacity calculation region.

It has been observed that the PTDF values of FI_PTC_FI-NO4 CNEC were often below the significance threshold (difference between smallest and largest zone-to-slack PTDF is at least 0.05, i.e., maximum zone-to-zone PTDF is not higher than



0.05) which is needed for the CNEC to be significant in market allocation. A non-significant CNEC will not constrain the FB domain. Therefore, it has been decided to have a sum CNEC for FI-SE1 and FI-NO4 flows (FI_PTC_SE1-FI_NO4-FI) to maintain the NO4-FI flows in operationally secure limits. This CNEC replaced the old one since EDD 13 December 2023 and is foreseen to be used also after go-live.

Ongoing items

This section covers operational learning points that are considered by the TSOs as ongoing items that may affect the results of the external parallel run.

Countertrade only included in NTC

Published: 30.6.2023

Please note! This text has been updated on February 27th, 2024. The relevant period has been updated and the previous version of the Operational learning points also stated that the inclusion of countertrade would be ready before Go-live.

Svenska kraftnät had procured production resources in the south of Sweden during the period December 2022 – September 2023 and from December 2023 and onward production resources have been procured again. These acquired resources, when activated, have bolstered capacity in the Net Transfer Capacity (NTC), enabling a more substantial flow between SE2 and SE3. The procured production resources are currently not included in the FB domain. Consequently, the ‘missing’ production resources in FB contribute to a larger flow being allowed between SE2-SE3 in NTC than in FB. The procured production resources resulted frequently in an increased NTC-capacity on the border SE2->SE3 during the period December 2022 until mid-March 2023 and June 2023 until mid-September 2023. During the periods mid-March 2023 until the start of June 2023 and December 2023 until the publishing day of this document the NTC-capacity on the same border has only been increased for a few days.

It has not been possible to prioritize the inclusion of the countertrade in the FB domain and it is foreseen to be implemented when such implementation has reached a satisfactory level of development quality but is not expected to be ready before FB go-live. The border between SE2 and SE3 is the largest corridor in the Nordic CCR for transporting electricity from North to South. When the grid topology (see also the Section about Series compensator modelling) and countertrade modelling in FB does not match the one in NTC, this has an impact on the cross-border capacity and



henceforth on the comparison of prices, congestion income, and welfare distribution between flow-based and NTC.

Capacity on Storebælt

Published: 30.6.2023

For the entire EPR period the capacity on DK1->DK2 has in flow-based been set to 600 MW instead of the correct 590 MW that is the case in NTC. The issue stems from internal IT programs which complicate the process of setting the correct capacity.

Number of polarity reversals

Published: 30.6.2023

Polarity reversals on HVDCs have been observed to occur quite frequently in FB which is not consistent with the current usage of HVDC equipment in NTC. Further analysis is ongoing.

Differences in input due to different timings in FB and NTC

Published: 30.6.2023

There are two different deadlines for providing NTC and flow-based capacities to the market, and this can result in different transmission capacities if e.g. an interconnector trips between those deadlines. Both capacities are correct, but the different timings led to different transmission capacities and results. An example of this was observed on 8 January 2023 on the LT-SE4 border.

Another example was observed on the 29th of October. From MTU 1 to MTU 18, the capacity provided on Nordbalt was different in FB and NTC. A scheduled outage on the HVDC link was terminated earlier than anticipated, which was not captured in FB due to different deadlines. The capacity was in FB set to 0 but was 700 MW in NTC for that period. This impacted the resulting FB prices for the period and the FB flows in the grid. Additionally, the AAF flows in NTC were also incorrect for that period due to this issue.

A third example was observed on the 24th & 25th of December 2023 on Kontiskan (DK1-SE3). On the 24th between 9-10, ENDK needs to disconnect KontiSkan2, which is right after the NRCC published the capacity to the NEMOs. ENDK adjusts the capacity to 345 MW and the NRCC published the reduced capacity at 09.50. The FB-



domain was already cleared at 08.50, shortly before KS2 needed to be disconnected. Due to the short timeline, the focus was on updating the NTC-capacity. This resulted in higher flows on DK1-SE3 in the FB-domain than available in NTC.

RM calculated differently in FB and NTC

Published: 30.6.2023

In the current implementation of the flow-based approach, the default Reliability Margin (RM) is a fixed number (5% of Fmax) and not yet defined with statistical approach in accordance with approved CCM. In NTC, each TSO defines Transmission Reliability Margin (TRM) as a certain set value in MW for the relevant border. The RM in FB serves the same purpose as TRM in NTC, which is to account for uncertainties in the system.

AC load flow not included in contingency scenarios

Published: 30.6.2023

The AC load flow is not applied when assessing contingency scenarios, as it has been agreed to be implemented after the flow-based go-live. Instead, DC load flow is used in current implementation. This affects the RAM calculation accuracy as DC assumes voltages on grid nodes to be 1.0 p.u. when contingencies are calculated. In AC load flow the real grid node voltages are defined and applied in contingency calculation.

Increased price in NO5 due to overloads on transformers in NO2

Published: 2.2.2024

At the end of December and the beginning of January, there were many hours where transformers (Sauda) in a substation in NO2 were fully loaded in FB and had a high shadow price. In NTC, the flows were much higher, providing a higher SEW than in FB. However, the operators had to use countertrading and grid splitting in the operational hour to avoid overloads, as the flows from the market result are too high. The issue occurs when there is high import from the continent to the Nordics, and there is a deficit in parts of NO5 and NO2. In FB, production is increased in NO5 to avoid flow from NO2 to NO5, thus relieving the transformers. The prices in NO5 increase but provides a more secure operational domain without the need for countertrade or grid splitting. The situation and the FB solution is still being



analysed, but the operators are more convinced with the FB solution rather than how they handle these situations in NTC.

Forecasting issues in FB compared to NTC

Published: 8.3.2024

After the management of the series capacitors in FB was improved in March 2023, there is a risk remaining that the forecast of the situation in operation differ from the real outcome. This means that recurrently, for some hours or days there can be differences in the series capacitor setup in FB compared to NTC which affect the flow on the SE2-SE3 border. The forecasting issue is expected to decrease after FB go live as the timings of IGM creation and receipt of the market outcome will be changed compared to the timings during EPR.

Changes in NP between DA and delivery in DK1

Published: 19.6.2024

Updated: 9.7.2024

In Weeks 19-25, high shadow prices on two Danish CNECs were observed. These CNECs are located on the Danish West Coast and were constrained during this period due to planned maintenance in the area and high renewable production.

During this period, the NTC day-ahead capacity was not reduced, and counter trade was planned to be used if the marked outcome would result in overload on the west coast 150 kV lines. This means that the NTC marked clearing resulted in overloads and downregulation of renewable was activated.

However, when providing the FB domain, the capacities are based on the expected topology and renewable production without counter trade.

ENDK is developing a function in an internal IT-tool that will enable the use of Remedial Actions on Danish CNECs. This is planned to be used in cases where Remedial Actions are anticipated to be needed to relieve internal congestions.

The implementation is expected to be ready before September.



Solved items

This section covers operational learning points that are considered by the TSOs as solved items that may have affected the results of the external parallel run, but are no longer considered open.

Series capacitors in FB modelled with even distribution of flows

Published: 30.6.2023

Solved: from week 9/2023 onwards (with a few exceptions)

Between 12 December 2022 and 28 February 2023, the series compensators on the SE2-SE3 border had different setups in FB and NTC. The practice in FB was to have an even distribution of expected flows on the capacitors. In NTC, the operational status is instead adjusted to the expected situation in operation. This resulted in the maximum permissible flow in NTC being higher than in FB, which led to some network elements situated on the SE2-SE3 border being the most constraining elements in the Nordic CCR. Since 1st of March 2023, the management of the series capacitors has been improved in FB to fit the expected operational status. This has resulted in a better alignment of the maximum allowed flow between NTC and FB. Note: For a few instances since March 1, 2023, the modelling of series capacitors has again not matched the setup in NTC. This occurred on 21 March, and 3-6 April 2023.

NO4 export is too high in FB

Published: 30.6.2023

Part of the explanation of why the net position in NO4 is higher in FB than in NTC is more varying, and sometimes higher capacity between NO4-SE1 in FB than in NTC. The current GSK strategy is not optimal for some production units near the NO4-SE1 border. Svenska kraftnät is assessing how these can be revised and improved.

Earlier, there was too high export in NO4 in FB due to wind production in northern Norway that the capacities in FB did not consider. Estimation from RES has been added to the IGMs as of September, so this is no longer a significant issue.

NO4 export too low in FB

Published: 30.6.2023

Solved: from week 14/2023 onwards



In week 11, there was a software update of the tool creating Statnett's IGMs, to improve the RES modelling. However, there was a bug affecting the first weeks (end of week 11 to mid-week 13), by setting all the RES units to their maximum production levels. This limited the net position in NO4 too much in this period, resulting in lower prices in FB than NTC.

Error in visualization of flow in NTC on SE3-SE4 border

Published: 30.6.2023

Solved: from week 20/2023 onwards

Since the start of the EPR (December 2022), the flow in NTC on the SE3-SE4 border has been calculated incorrectly in the post-market scripts that are used to visualize the data and create the reports. This calculation flaw stems from an error in how the flow on the South West Link is represented on the border, resulting in a too large flow on the SE3-SE4 border for the NTC data. As this error comes from the visualization of data rather than the market optimization, it does not have an impact on the SEW figures. However, it affects the values of flow on the border for NTC in the Appendices of the weekly market reports. This error was rectified starting from week 20 publication.

Small discrepancies due to PTDF rounding

Published: 4.9.2023

Solved: from week 29/2023 onwards

For the external parallel run, the NRCC has published and weekly updates an Excel file with the market simulation results. The file includes data from week 50 of 2022 and adds a new week each week when new simulation results are available. NRCC also weekly publishes a Grid Constraint Matrix. In theory, multiplying the PTDFs in the Excel sheet or the GC-matrix (or the values in JAO) with the net positions found in the Excel sheet should yield the values for already allocated capacity, given by F_AAC in the Excel sheet. However, the PTDF values used for calculating F_AAC have been rounded to three decimals, but the calculation of F_AAC have five decimals. Thus, there becomes a small difference between the two values. This might be the reason why there are sometimes small overloads in FB. This has been corrected as of week 34 but will not be recalculated for the previous weeks.



Lower flows on NO5-NO2 in flow-based

Published: 4.9.2023

Solved: from week 43/2023 onwards

Please note! This text has been updated. The previous version of the Operational learning points stated that the flows on NO1-NO2 flows were unrealistically high due to the high capacity on NO5-NO2.

After deeper analyses, Statnett has found that the flows indicated by the flow-based simulation results are realistic and does not create overloads in the situations analyzed. The domains from the flow-based simulations are outside the NTC domains, which is why the solution seemed over-optimistic. The flow-based capacity on NO5-NO2 was reduced from week 34 2023 as an attempt to reduce the flow on NO1-NO2. As the NO1-NO2 flows are now deemed realistic, the capacity on NO5-NO2 has from week 43 2023 been increased back to its normal capacity.

Lower flows on NO5-NO1 in flow-based

Published: 8.11.2023

Solved: from week 43/2023 onwards

Statnett operates with temperature dependent thermal capacities. In NTC, these capacities are updated automatically based on measured temperatures or weather forecasts. For flow-based, these thermal capacities are set manually. During the later parts of summer 2023, the thermal capacities were set to 20°C for flow-based. However, during the fall when air temperature dropped, there was no change made to the thermal capacities for flow-based. This resulted in lower capacities and flows on all lines, but it is most noticeable on the lines between NO5 and NO1. Since week 43 2023, thermal capacities with a lower temperature have been added.

Incorrect FAAC NTC flows

Published: 8.11.2023

Solved: from week 36/2023 onwards

The FAAC NTC flow ($PTDF * NP_NTC$) from the SE3-SE4 that travels on the South West Link is determined by a set of rules. These rules were incorrectly configured from the start of the EPR until week 31 2023 in the scripts that create the grid constraint matrix. In these scripts, the direction of the NTC flow on the South West Link was set in the opposite direction to what it should have been. This affected the



market report appendices and the market results file that were published at the time. The scripts were altered by the RCC to fix the error mentioned above during week 31. The fix did not completely solve the problem and another error occurred which most notably impacted the flow on the SE4-DK2 border. This error was fixed for the publication of week 36 2023. The appendices and GC-files for week 31-35 have been re-uploaded with the correct FAAC NTC flows. Please note that in the market results file the whole EPR data is recalculated each week, so during this time the issue affected also historical data. Both issues have been corrected as of week 36.

Violation of Kontiskan constraints

Published: 14.12.2023

Solved: from week 43/2023 onwards

A non-redundant Konti-Skan constraint has been mathematically neglected on several occasions by Euphemia due to the wrong input file from the NRCC to the NEMOs. The violations have occurred when IVAs were applied on this constraint by Svenska Kraftnät. Violations have occurred in the following weeks during 2023.

- Week 36: 9 instances of constraint violations. The constraint was at most exceeded by 715 MW
- Week 38: 12 instances of constraint violations. The constraint was at most exceeded by 245 MW
- Week 42: 17 instances of constraint violations. The constraint was at most exceeded by 350 MW

The violations have occurred when IVAs have been applied on this constraint by Svenska Kraftnät. The error causing the violations has been rectified in week 46 and no further violations are expected.

Outage in Finland on cut P1 handled differently in NTC than in FB

Published: 8.3.2024

Solved: from week 4/2024 onwards

On week 2 (8-9th January) and week 3 (17-18th January) a CNEC located on cut P1, mid-Finland, is constraining the market results, leading to high shadow prices on the P1 CNEC towards south. This situation is related to an outage that was handled differently in FB than it was in NTC, leading to negative SEW impacts compared to



NTC. In FB, the outage causes a limitation on the concerning CNEC, which also affects cross-border flows from SE1 to FI. In NTC, the limitation is not visible to the markets in the transmission capacity that is given to SE1-FI border. This is due to a change in switching that can change the topology of the grid, enabling higher flows on cut P1 and on the SE1-FI border. The correct way to handle this would have been to give the PTC limits on P1 assuming the switching change (topology change) can be used in real time. Fingrid is looking into how to handle such situation in the future to avoid unnecessary market limitations in the FB setup.

Error in pre-processed scheduled exchange values for NO1A-NO2 border

Published: 12.4.2024

Solved: from week 12/2024 onwards

At the RCC website, there is a document titled Market Simulation Results week 50 (2022) - week [latest available week]. Here, there was an error since the document was first published, where the pre-processed scheduled exchange values in NTC for border NO1A-NO2 showed values for NO1A-NO1 instead. This has been fixed as of 14 March 2024, so all values regarding this border should now be correct.

Single occurrence or recurring items

This section covers operational learning points that are considered by the TSOs as single occurrence or recurring, meaning that they have only affected the external parallel run during short or limited periods of time, and are not considered ongoing.

IT issues affecting allocation constraint

Published: 30.6.2023

In the process of creating the IGM for 3 April 2023, an allocation constraint on the DK1↔DK2 border was incorrectly submitted. When the error was discovered, it was too late to submit a new allocation constraint through an internal IT system that handles this, and manual editing was not possible. In total this limited the transfer capacity for eight MTUs for both FB and NTC.

Incorrect IVAs for an out-of-service CNE

Published: 30.6.2023



For five hours on 20 March 2023, a CNE which was supposed to be out-of-service due to maintenance was still part of the IGM and market coupling, although it should not have been. In order to avoid this CNE having an impact on the system operation, operators applied IVAs to set the RAM to zero. As the CNE had been part of the optimization it had a PTFD value $\neq 0$, and with a RAM of zero the CNE limited the system very much since the NP could not be increased in certain places without violating the limits of this CNE.

Normally, CNEs on lines with maintenance are not part of the IGM, and cannot be constraining (get shadow prices, for example). Instead, the IVAs on the RAM should have been set to a very large number in order not to have this CNE constraining the system. Also, IVAs should have been applied on related CNECs that would have been affected if the CNE had not been part of the IGM.

aFRR and/or mFRR capacities not included in FB domain

Published: 30.6.2023

aFRR capacities were not included in the flow-based domain but were included in NTC due to data processing errors on the following days: 25-27 December 2022 and 14 January 2023. This resulted in slightly larger flow-based domains.

A similar issue occurred on 21 October 2023, when the FB domain does not include already allocated capacity for aFRR and mFRR, resulting in slightly larger flow-based domains.

Missing IVA on Fennoskan

Published: 4.9.2023

Fennoskan capacity (FI-SE3) was reduced -1200MW by IVA on Saturday July 15th due to an outage in the Swedish grid. The IVA should have been applied also during Sunday 16th – Thursday 20th July (weeks 28-29) to set RAM=0 for the whole period of the outage but this was not done. However, this had no impact on the EPR market results because there was no market flow from FI to SE3.

Wrong hours for outage on Baltic Cable

Published: 8.11.2023

The RAM on Baltic Cable was incorrectly set to be zero for MTU 1-7 on the 6th of September and for MTU 17-23 on the 15th of September 2023. The RAM should have



been 615 MW for these hours, which is the NTC capacity that was submitted to the market, meaning that the FB domain was smaller than it should have been for the hours mentioned above. The error stems from an error in an internal system at Svenska kraftnät.

IVA missing on DK1 borders

Published: 14.12.2023

On October 2nd and 3rd 2023, the capacity from DK1 was reduced on multiple borders in NTC due to maintenance on an internal grid element. The related NUCS message can be found [here](#). This type of maintenance cannot be handled in the current version of the capacity calculation. Consequently, for FB the full capacity was provided, whereas an IVA should have been applied. The allocated flow with FB was 215 MWh higher on Kontiskan and 490 MWh higher on Skagerrak than NTC. This exceeds the secure domain allowed and would have resulted in countertrading in production.

A similar issue occurred for DK1-NO2 and DK1-SE3 on October 23rd 2023, from 0:00 – October 25th 15:00. An IVA was missing, which caused at max. 167 MW higher flows in FB than NTC from NO2 to DK1, and at max. 75 MW higher flows in FB than NTC from SE3 to DK1.

Mismatch between the CNEC and PTC capacity for the SE1-FI border

Published: 2.2.2024

The flow on the SE1-FI PTC (flow towards Finland) is limited to 1200 MW when the nuclear power plant Olkiluoto 3 in Finland is producing over 1300 MW. On 21.11.2023 the production forecast for Olkiluoto 3 was over 1300 MW but during the day the plant operator notified that they have to continue their outage that had started a few days before. This caused a mismatch within flow-based parameters between the Olkiluoto 3 production that is used in the IGM and the one used to determine SE1-FI capacity. Due to timing differences, power transfer corridor (PTC) capacities were given as if Olkiluoto 3 was not producing over 1300 MW (which indeed was the case and corresponds to NTC) but in IGM the production was over 1300 MW (based on the outdated forecast) which affects CNECs. The limit imposed by the CNEC near the SE1-FI border was ~1300 MW, so above what should have been allowed in the situation the IGM described (Olkiluoto production over 1300



MW). This could have been solved by a more recent production forecast and possibly a new IGM, or with an IVA which was not used.

North Sea Link forecast causes limitations on NO1→SE3

Published: 2.2.2024

In FB, a forecast for North Sea Link (NSL – HVDC line between NO2 and UK) is included in the IGM, and when the flow is high, the RAM on some CNECs is limited. An example of this is 4 and 5 December, where the capacity on NO1→SE3 was limited in FB. In NTC, the forecast on NSL is not a standard part of the capacity calculation. Thus, the FB capacity calculation is theoretically better, but may be too limiting or not limiting enough if the forecast is wrong. However, this is still a better way of handling the NO1→SE3 capacity than how it is done in NTC, even if in some cases the SEW is lower in FB than in NTC.

Wrong capacity on Skagerrak (NO2-DK1) during maintenance

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In week 17 from 22 April to 23 April, the maintenance on some of the poles on Skagerrak (NO2-DK1) took longer than expected. Thus, the capacity had to be reduced to 330 MW longer than initially planned. This was not added to the FB domain, but only in NTC capacities, so FB allowed for a much higher flow. This would not have been possible to handle in real-time operations and would have resulted in the need for countertrading if FB had been in production. This was a mistake from the operators but was most likely because they focused on NTC capacities in the operation. Therefore, we don't expect this issue to occur again after go-live.

Wrong PTC-capacity on HVDC link between SE3→FI in FB

Published: 19.6.2024

For two different time periods, the capacity on the PTC on Fenno-Skan was incorrect in the input data files sent from SVK to the RCC. Both of these errors have had an impact on the resulting flows and prices from the FB simulations.

For the first occasion, which took place between the 3rd and 6th of May 2024, except for MTU 20-24 on the 5th, the capacity was too restrictive. The capacity should have been set to 900 MW from SE3 to FI but was instead restricted to 700 MW. This



restriction limited further electricity export from SE3 to FI for several hours during those days.

For the second occasion, which occurred on the 17th of May for MTU 20-24, the capacity from FI to SE3 was set to 800 MW when it should have been limited to 0 MW due to an outage in SE3. Due to higher prices in SE3 compared to FI, all of this incorrect capacity was used by the market coupling for the 5 MTUs in question.

Intraday (ATCE) operational learning points

Identified operational learning points

Non-zero ATC on border in outage – 2024, week 16

Published: 19.6.2024

For some EDDs of week 16 ATCE returned non-zero capacity for the border NO4-SE1, although this border was out of service.

NO4-SE1

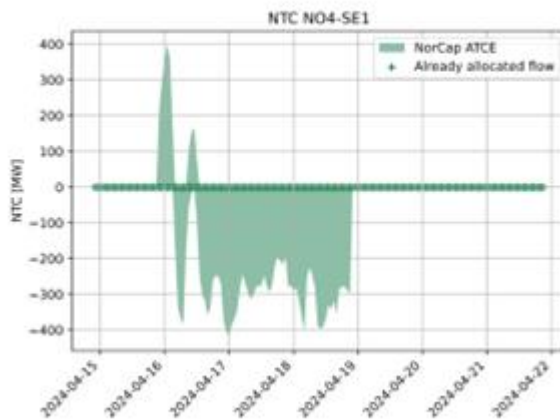


Figure 3: Non-zero capacity on border in outage

The ATCE methodology does allow non-zero capacity to be assigned to borders where all interconnectors are out of service. This can happen e.g. in cases where a trade can be realized by a flow that is pushed to other borders in the meshed AC grid.

However, assigning non-zero capacity to such a border is counter intuitive and may be problematic for operators in case they need to provide manual adjustments to adapt to unplanned outages.



Therefore, the ATC extraction process includes a process of restricting ATC to zero on borders where all interconnectors are out of service. This process usually works well and can be seen to function for 4 of the EDDs in week 16 2024. Yet, the detection that the border is in outage failed for 3 EDDs; 16th, 17th and 18th of April 2024. This is due to an error in the definitions used in the outage detection where some very simple cases are not currently considered.

The issue will be corrected in a future version of ATCE. The TSOs are discussing the proper way of handling the outaged borders for go-live.

Modelling of non-ID borders

Published: 19.6.2024

The non-ID borders refer to the borders that are subject to DA market allocation but not in ID market allocation.

- The Baltic cable between Germany and SE4: This border is subject to the DA allocation but not to the ID allocation.
- Finland – NO4 border: as of now, this border is not commercially operational in the DA allocation or in the ID allocation. At the FB DA go-live, this border will be commercially operational in the DA market, but not the ID market. At the FB ID go-live, this border will be commercially operational in both DA and ID markets.

During the EPR, the TSOs modelled these two borders by applying the ATCE methodology the same way as other ID borders. These two borders currently do not have the possibility to utilize that capacity computed to them.

For the period after go-live, an update on the industrial tool will be implemented, such that ID capacity of these two borders will not be considered by the ATCE methodology, reflecting their commercial arrangement of not participating the ID market allocation.

Appendix: Day-ahead learning point timelines

Table 1: All identified learning points with their respective timelines during weeks 50/2022 – 52/2023.

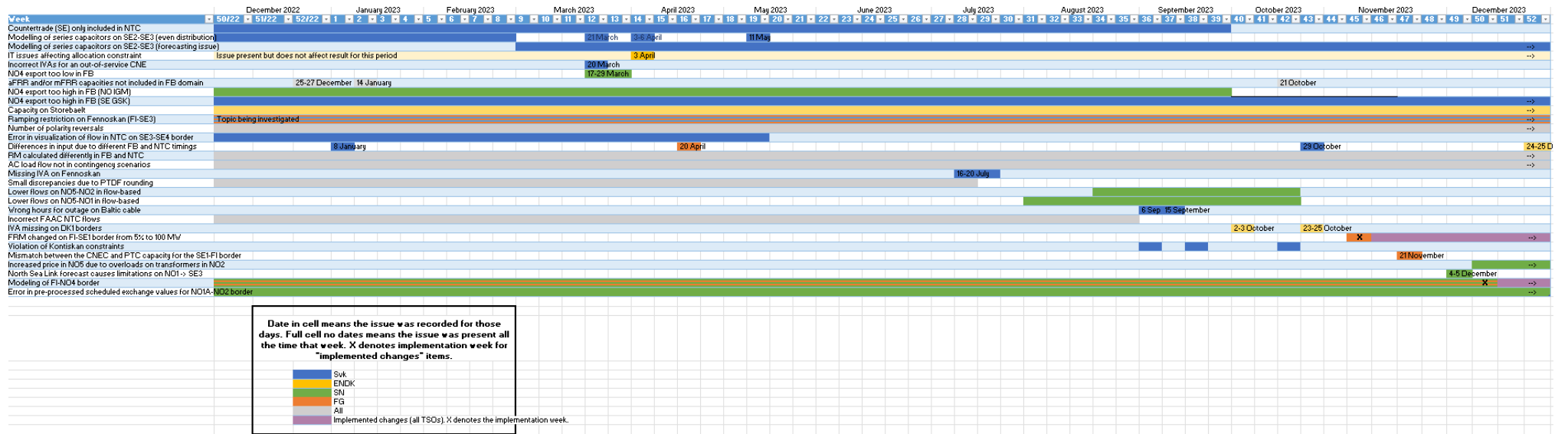




Table 2: All identified learning points with their respective timelines during weeks 1-19/2024.

Week	January 2024				February 2024				March 2024				April 2024				May 2024				June 2024					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Modelling of series capacitors on SE2-SE3 (forecasting issue)	←																									
IT issues affecting allocation constraint	←																									
NO4 export too high in FB (SE GSK)	←																									
Capacity on Storebaelt	←																									
Ramping restriction on Fennoskan (FI-SE3)	←																									
Number of polarity reversals	←																									
RM calculated differently in FB and NTC	←																									
AC load flow not in contingency scenarios	←																									
FRM changed on FI-SE1 border from 5% to 100 MW	←																									
Increased price in NO5 due to overloads on transformers in NO2	←																									
Outage in Finland on cut P1 handled differently in NTC than in FB	8-9 17-18																									
FRM changed to 10% for certain Swedish CNECs	X																									
Modeling of FI-NO4 border	←																									
Error in pre-processed scheduled exchange values for NO1A-NO2 border	←																									
Limit on northbound flow SWL (SE3-SE4)	X																									
Removed ramping limit on SWL (SE3-SE4)	X																									
Changed ramping on SwePol (SE4-PL)	X																									
Wrong capacity on HVDC link between SE3->FI in FB	3-6 May 17 May																									
Wrong capacity on Skagerrak (NO2-DK1) during maintenance	24-26 April																									
Change in NP between DA and delivery in DK1	→																									

Date in cell means the issue was recorded for those days. Full cell

- Svk
- ENDK
- SN
- FG
- All
- Implemented changes (all TSOs). X denotes the implementation week.

Latest update with W(X) data W24