

Nordic CCM – External
Parallel Run Market Report
for Week 14

2022/07/15

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

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 simulated market results between the current NTC capacity calculation method and the FB capacity calculation method of the day-ahead market timeframe. 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 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 FB vs. NTC for the simulated period of week 14.

Chapter 3 addresses the known data issues and methodology disclaimers that could potentially influence the simulation results.

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.

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

1 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 Appendix.

Energy Delivery Day:	Mon. 4.4.	Tue. 5.4.	Wed. 6.4.	Thu. 7.4.	Fri. 8.4.	Sat. 9.4.	Sun. 10.4.
Substituted IGMs	-	-	-	-	-	-	-
IVA provision	2	2	2	1	1	1	1
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, after adjustments the final FB domain was accepted by all TSOs for 7 out of 7 days for week 14.

2 Simulated Market outcome FB vs. NTC for week 14

This chapter presents a comparison of the market simulation for the week 14 (4th –10th of April 2022) between FB and NTC with regards to changes in socio-economic welfare along with individual bidding zone price changes.

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

Aggregated price results

Week 14 was challenged by a series of outages which limited the flow of electricity from the northern to southern bidding zones.

The comparison of the NTC and FB simulation for week 14 shows that FB reduced the average prices in 8 out of 12 bidding zones. The price differences between FB and NTC are relatively small and lies between -5 and 5 EUR/MWh with the exception of the bidding zones NO3, NO4 and SE3.

Bidding zone	Price FB [€/MWh]	Price NTC [€/MWh]	Price FB-NTC [€/MWh]	Price diff (FB-NTC)*100/NTC [%]
DK1	88,13	85,75	2,38	2,78
DK2	82,85	77,50	5,35	6,90
FI	53,10	57,12	-4,02	-7,04
NO1	169,07	170,20	-1,13	-0,66
NO2	167,50	170,20	-2,70	-1,59
NO3	105,57	37,89	67,68	178,62
NO4	21,25	26,16	-4,91	-18,77
NO5	172,34	170,24	2,10	1,23
SE1	39,96	40,68	-0,72	-1,77
SE2	39,72	40,70	-0,98	-2,41
SE3	67,97	77,63	-9,66	-12,44
SE4	77,49	77,72	-0,23	-0,30

Table 2. Average price pr. bidding zone with NTC and flow based, week 14

The highest change in price occurred in the bidding zone NO3 with the average price being 179% higher compared to NTC. In FB the net position increased in NO3 especially due to one CNE that allowed more flow if production occurred in NO3 instead of NO4. The highest prices in NO3 was in the hours where RAM was reduced on this CNE due to internal flow. Besides NO3, price increases in FB happened in the southern areas DK1 and DK2.

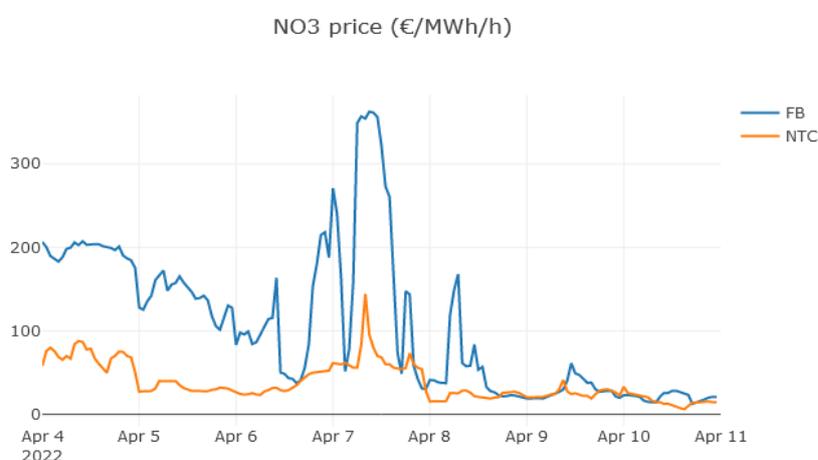


Figure 1. Day-ahead price in NO3 on hourly level for both FB and NTC

The highest reduction in prices was seen in NO4 and SE3. NO4 did not reach the same price spikes in the beginning of the week compared to NTC.

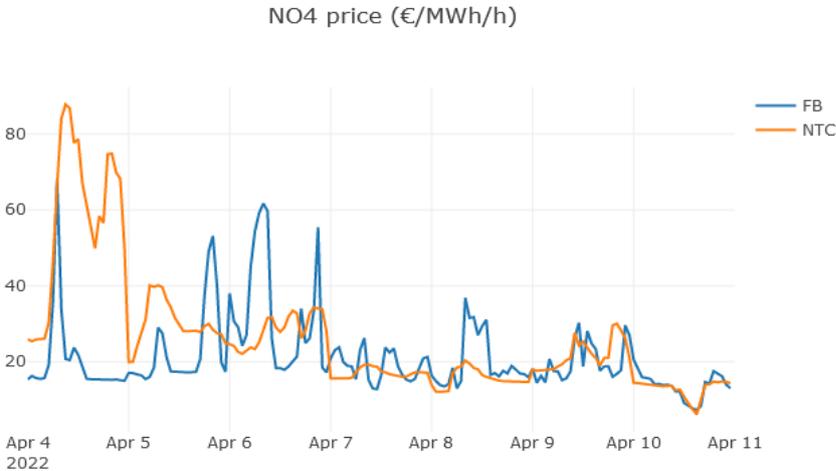


Figure 2. Day-ahead price in NO4 on hourly level for both FB and NTC

During the week, FB contributed to less fluctuating prices in SE3, SE4 and DK2 mainly driven by lower prices during peak load periods, cf. figure 3.



Figure 3. Day-ahead price in SE4 on hourly level for both FB and NTC

Socio-economic welfare results

In week 14, the Nordic SEW in FB is in total **1.5 M€** lower than in NTC, cf. figure 3. The difference in the consumer and producer surplus of 2M€ did not outweigh the 3.5M€ loss in congestion income. Negative congestion income is expected as FB allocates the flows between different price areas more efficiently and therefore enables lower price spreads. Overall, NTC allowed higher flows in the simulated period resulting in a significantly higher number of overloads. The potential associated cost of the overloads in NTC is not accounted for in the SEW results comparison.

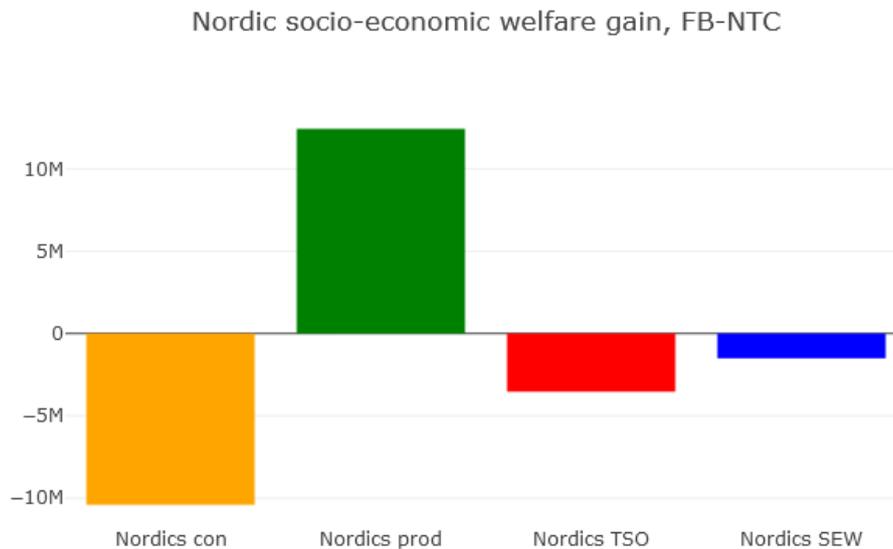


Figure 4. Nordics consumer, producer and congestion income change. Total Nordic socio-economic welfare gain over the simulation period is the sum of the previous three.

Country level data shows that the most noticeable change in total SEW occurred in Sweden and Norway due to a large move in congestion income from Sweden to Norway as seen in figure 5.

Swedish SEW loss of 25.2M€ mainly comes from lower congestion income driven primarily by SE2 and SE3 where the total loss in SEW was 8.1M€ and 19.1M€, respectively. SE4 contributed to a total SEW gain of 3.4M€, cf. figure 5.

In contrast, the SEW gain of 25.6M€ in Norway stems from the increase in congestion income on 28M€ primarily driven by NO3 where the total SEW gain rounded 21M€.

Taking a look at the combined consumer and producer welfare change in each country, Norway has a loss of 2.4M€ with FB compared to NTC. In contrast, the other Nordic countries experienced a gain where the largest was in Sweden with 2.36M€.

Total Nordic socio-economic welfare per country

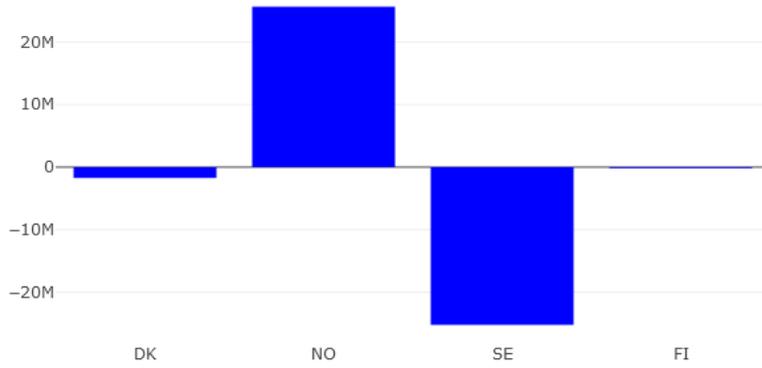


Figure 5. Nordic socioeconomic welfare pr. country – (FB –NTC) (€), week 14

Socio economic welfaregain FB-NTC per BZ - Total_sew

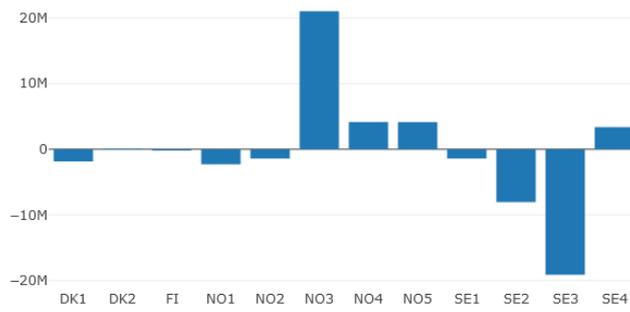
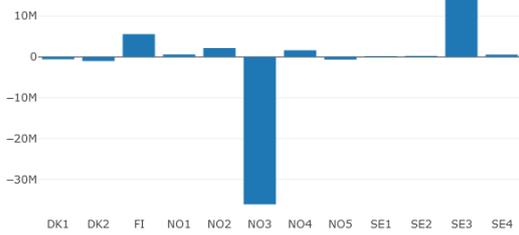


Figure 6. Change in Nordic socio-economic welfare per bidding zone

Socio economic welfare gain FB-NTC per BZ - consumer_surplus



Socio economic welfare gain FB-NTC per BZ - producer_surplus

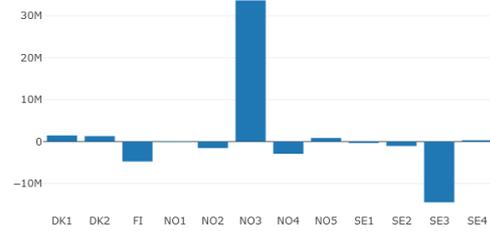


Figure 7. Consumer and producer socio-economic welfare change per bidding zone in the Nordics

The changes in total SEW between FB and NTC has been on a relatively lower level compared to previous weeks as seen in figure 8. The highest negative SEW was generated on the 5th of April and derives from large price differences in favor of NTC.

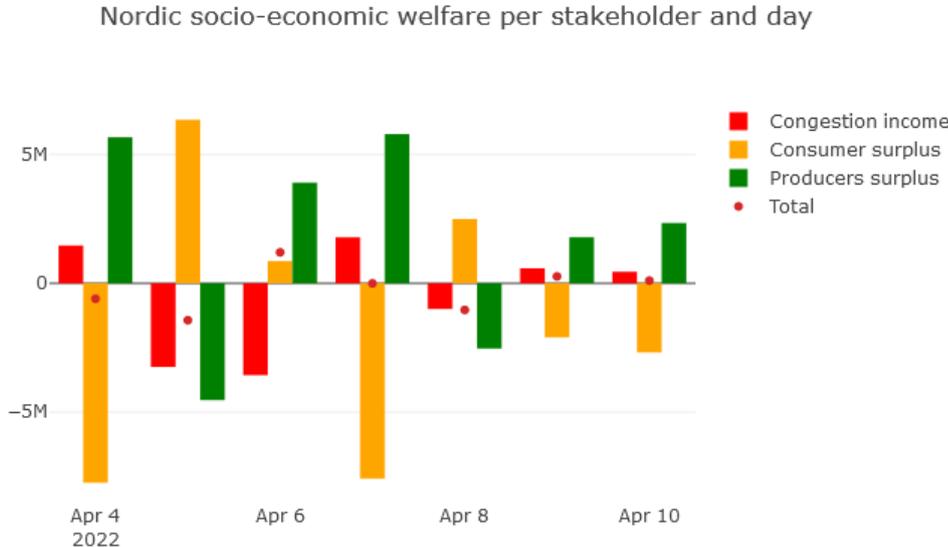


Figure 8. Nordics consumer, producer and congestion income change per day.

3 Disclaimers

This chapter describes known issues with input data, modelling and methodology.

Disclaimers related to data in the EPR process

Data quality

The capacity calculation tool and the data used for the capacity calculation is continuously being improved, and TSO operators are improving their processes by using the Domain validation tool in daily operations. The outcome of the FB calculations are considered valid for comparison with NTC even with some known disclaimers that are being continuously evaluated and improved by the TSOs.

Domain validation process

The TSO operators are in the 'learning-by-doing' phase in the parallel run process. The validation tool that is supporting the domain validation activities is still under active development.

SE1-FI border

The capacity calculation for FB calculates the wrong border capacity between SE1-FI, 1390 MW in FB vs. 1520 MW in NTC.

NO3-NO5 border

A significant CNE was discovered missing in the FB domains for EDD 4-6th April.

Simulation set up – Lineset ramping

A new FB topology had to be created in order to incorporate the previously missing South-West link and the newly formed bidding zone NO2A. NO2A was created in order to limit the total ramping on Norned and Nordlink. In the new topology, this is managed by introducing a lineset ramping – a ramping limitation for multiple line segments.

When performing the initial simulations with the new topology, an error occurred. The simulations failed applying both the individual line ramping and the lineset ramping. The reason why the simulations fails when applying both individual line ramping and lineset ramping is still under investigation. In the meantime, in order to produce any simulation results, the lineset ramping was removed from both FB and NTC. This means that the total ramping for Norned and Nordlink can exceed 900 MW as long as the individual ramping restrictions are respected.

Disclaimers related to market analysis report (Nordic CCM)

Market results are calculated by Simulation Facility

The market coupling is calculated by Simulation Facility (SF). SF uses the same market coupling algorithm that is used for day-ahead market coupling. However, SF is a testing environment and therefore the availability of SF (e.g. impacted by content-wise and/or IT-wise changes in the SF) is not guaranteed. This may increase the necessary time to produce market analysis reports. Also, the simulation facility imposes a grace period, currently set to 2 weeks after the energy delivery date. The production of the market report will need to comply with the grace period.

NTC order books being used in the FB market simulations

The market simulations of the FB methodology use the NTC order books, due to the unavailable dedicated FB order books. This means that the bids (and also final market solution) of the FB calculations are based on the order books of the actual NTC-based electricity market.

Typically, a FB simulation results in a less-constrained power market and more production in areas with cheaper power production. This often means more hydro power production in the northern bidding zones in the FB simulations compared to the NTC simulations. The use of the NTC order books however, implies that a greater release of hydro power under FB is not reflected in the following order books and FB market simulations, potentially leading to a sustained greater production of “cheap” hydro power in FB compared to NTC.

If this effect is sustained over a longer period of time, and the cumulative difference in production is significant, this may lead to a biased cumulative SEW comparison between FB and NTC, benefitting the FB simulation with “cheaper bids” in relation to the underlying hydro reservoir situation.

Simulation set up in Simulation Facility - Last hour flow

The last hour flow is relevant for the ramping restrictions from one day to the next. When starting the SF simulations, as an input requirement, the market flows of the last hour of the previous day is needed from the SF as a starting point of simulating the first hour of the simulation batch. For consistency purposes, the last hour setting for Flow-based simulation as well as for the NTC simulations is set to zero. This is done because there are no historical data available in the production system of Euphemia for the Nordic Flowbased topology.

Additionally, when there is a (few) missing day(s) in the simulations, the LHF of FB and NTC are set to zero as default. Consequently, the simulated market results may not be strictly comparable to the market results from the production environment.

Congestion income computation as post-processing of the market data

Market results require post-processing to create a readable format of the results and to calculate and share generated congestion incomes. Currently, congestion incomes are calculated by Nordic TSOs in accordance with the congestion income distribution methodology. Later this will be calculated by JAO with production-grade tools. FB and NTC congestion income methodologies are the same but the distribution of negative congestion incomes is different¹.

SEW comparison in the operational security perspective

Fair comparison between FB and NTC market results requires the same level of operational security as a basis for the two methodologies. In other words, it is not fair to compare SEWs if FB respects the operational security and yields smaller SEW outcome, whereas NTC breaches the operational security and yields larger SEW outcome. Additionally, the remedial actions and the associated costs to solve the operational security issues in ‘real-time’ are not known to make a fair comparison.

Checks have been made comparing the NTC market outcome and the security domain. The TSOs recommend viewing the SEW comparison outcome both from a socio-economic and an operational security perspective.

¹ Annex I - Congestion income distribution methodology

Appendix:

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- Domain validation
- Social economic welfare
- (Bidding zone) Prices
- Net positions
- Border flow

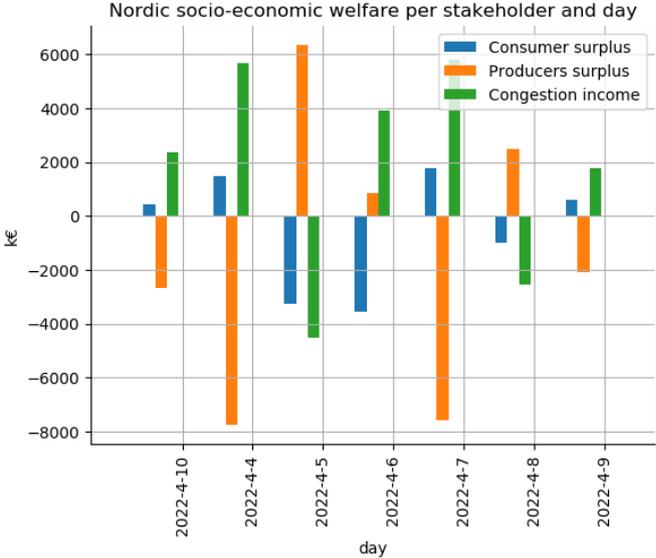
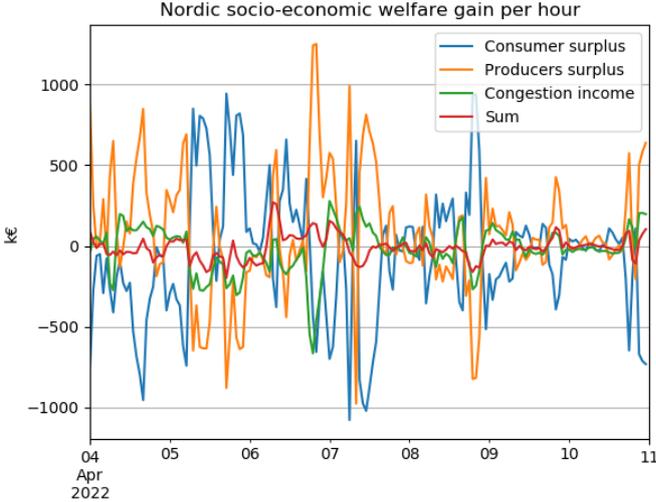
Domain validation

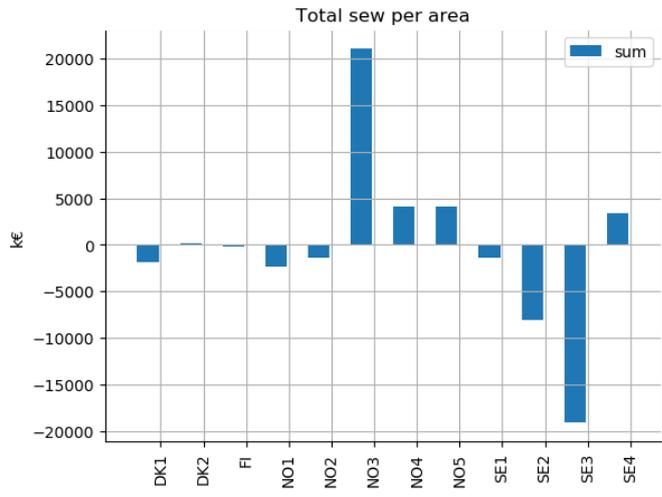
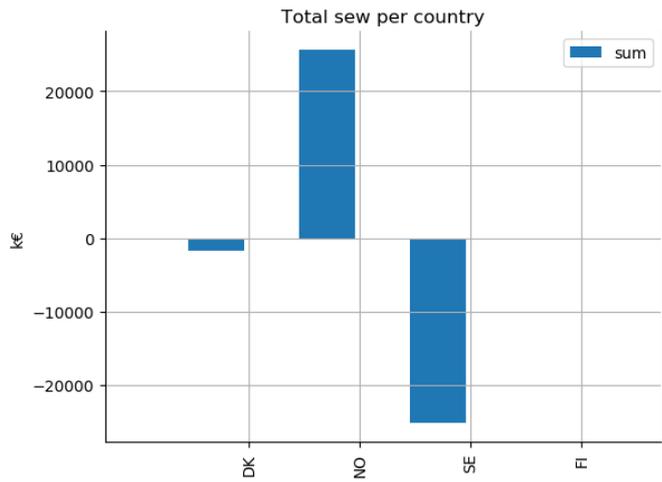
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Invalid/missing IGMs	0	0	0	0	0	0	0
Substituted IGMs	0	0	0	0	0	0	0
Invalid CGMs	0	0	0	0	0	0	0
FB domain back-up	0	0	0	0	0	0	0
FAV provision	2	2	2	1	1	1	1
Final domain acceptance (1 TSO =25%)	100%	100%	100%	100%	100%	100%	100%
FB-domains sent to SA WG/SF	Yes						

Social economic welfare

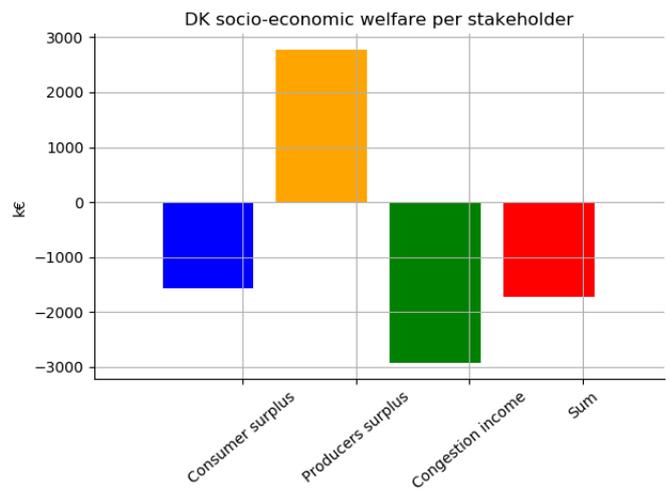
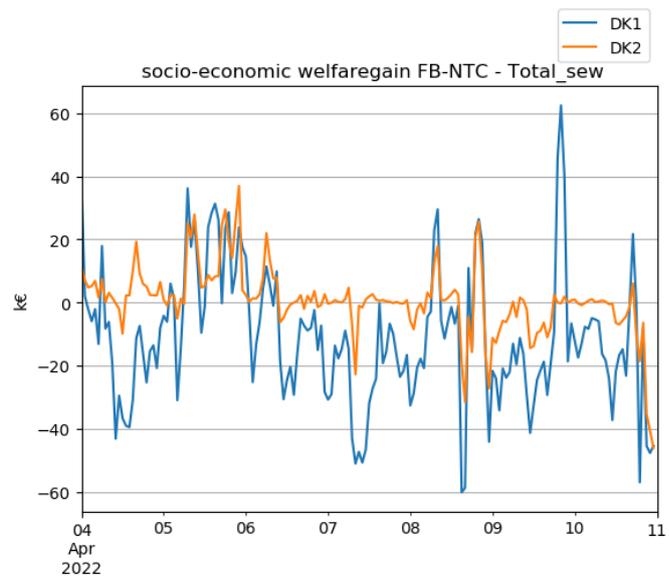
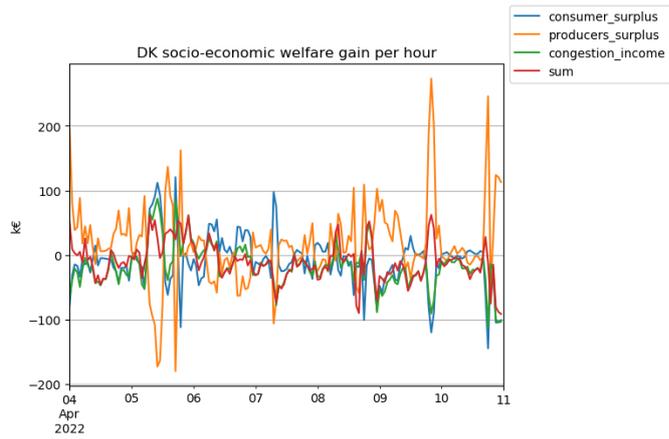
3.1.1.1 Nordics

Nordic welfare gains.

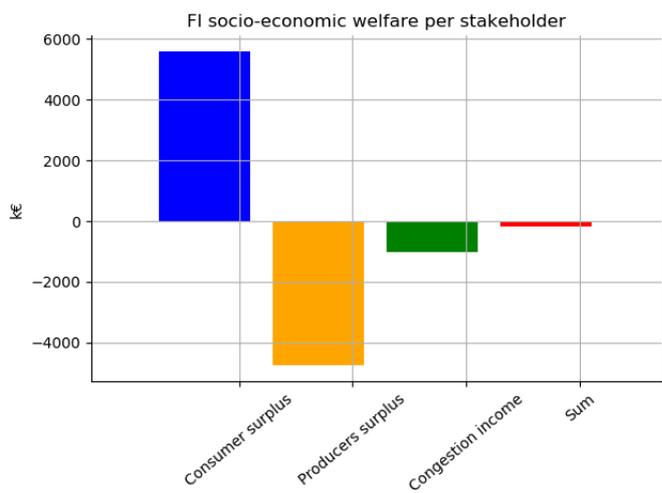
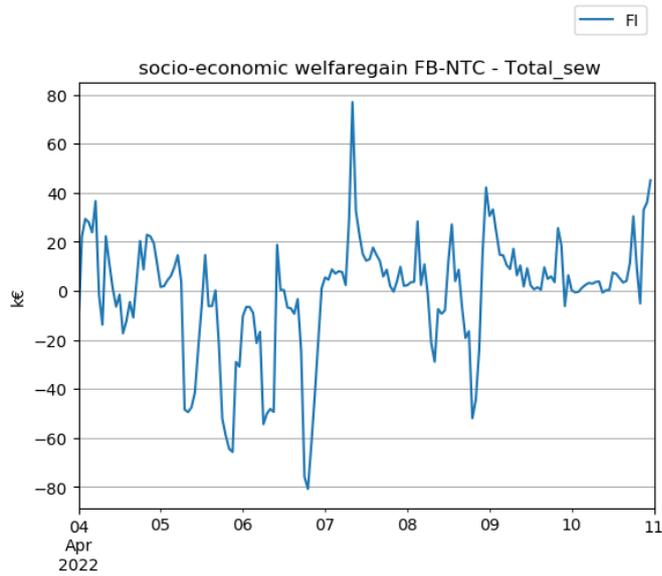
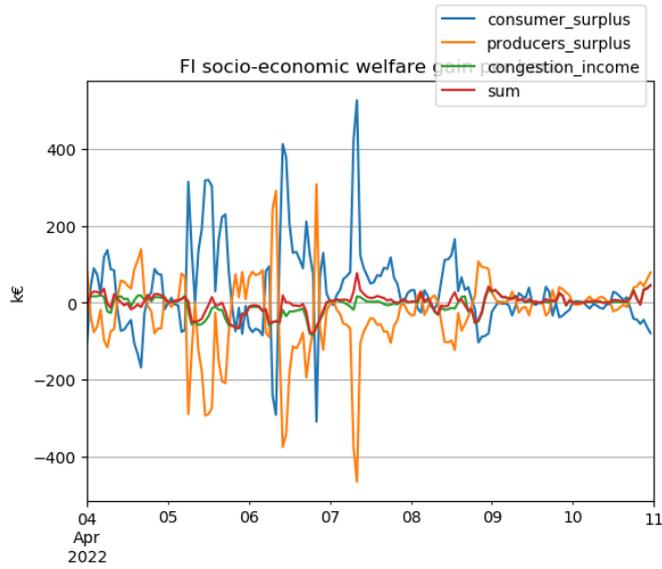




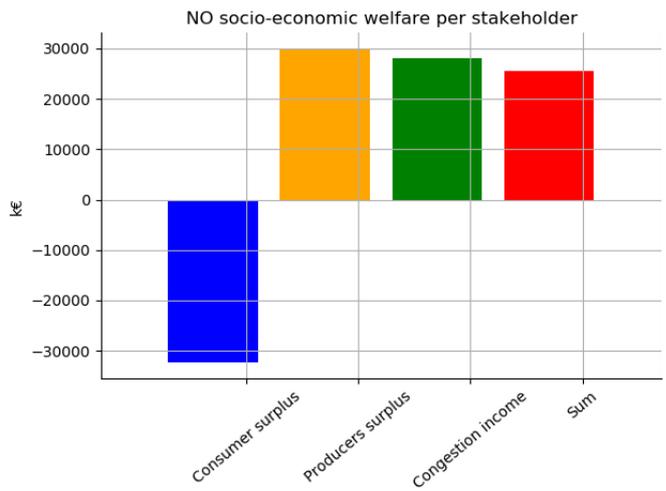
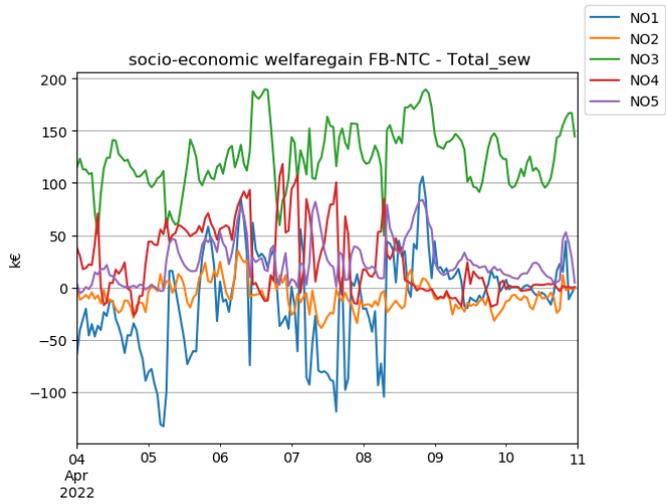
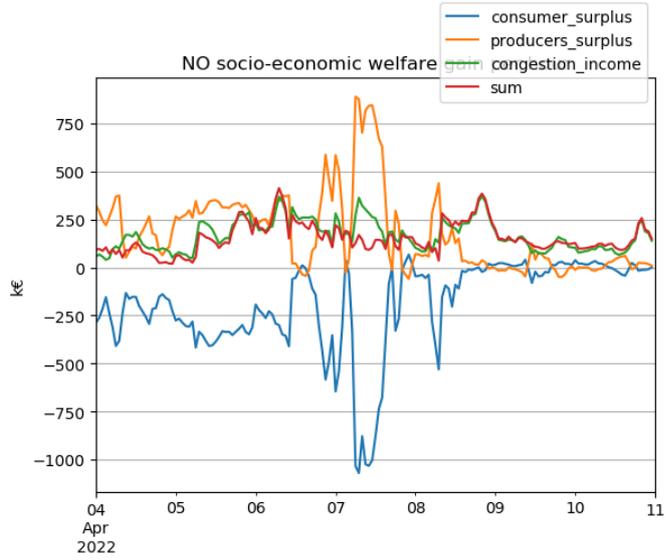
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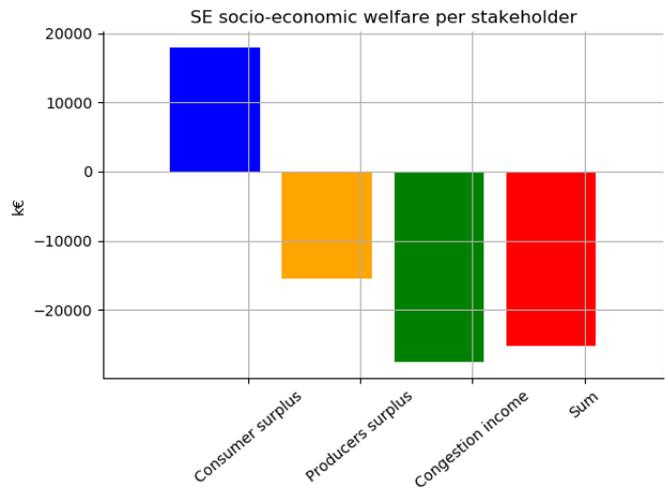
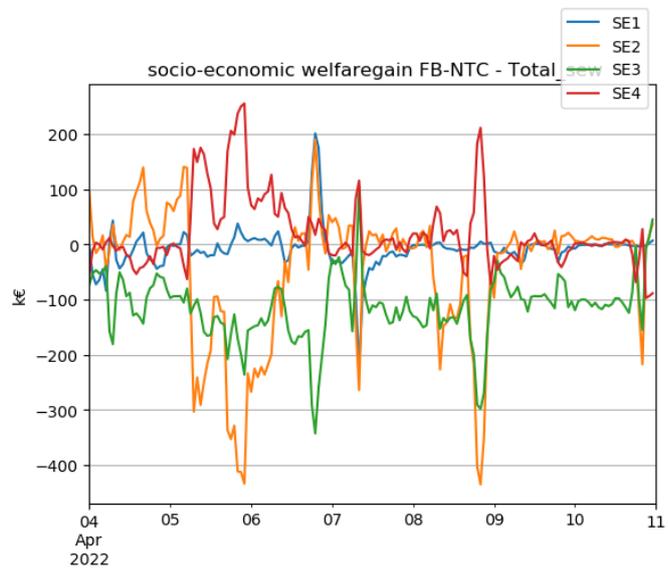
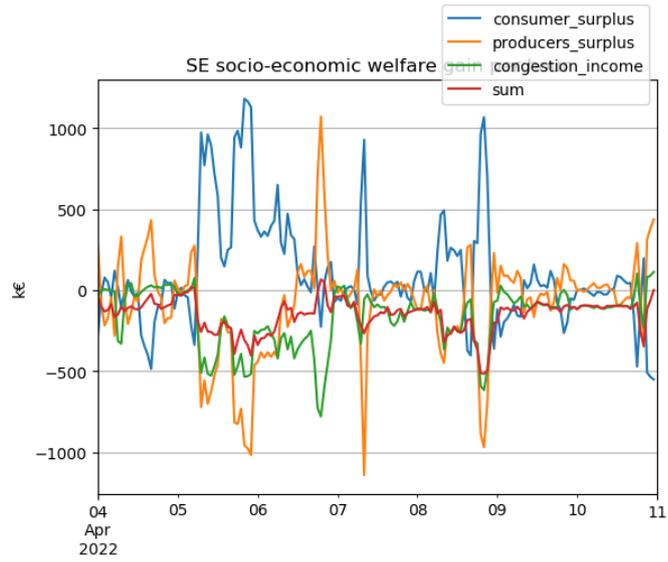
3.1.1.3 Finland



3.1.1.4 Norway
 Statnett welfare gains. Add comments

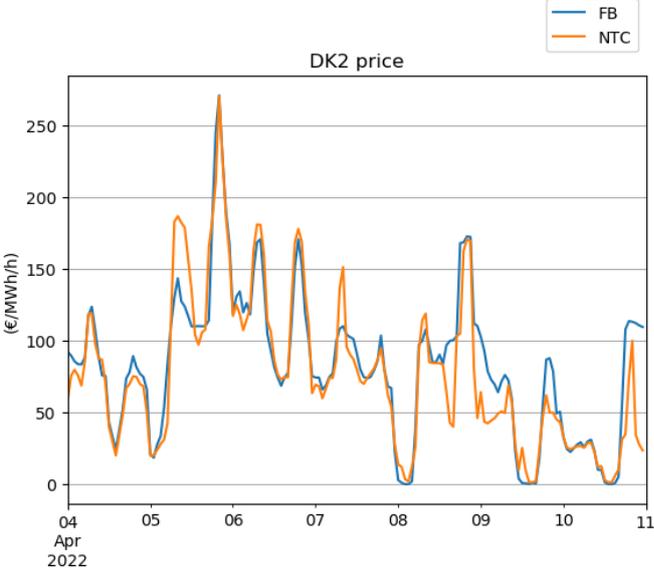
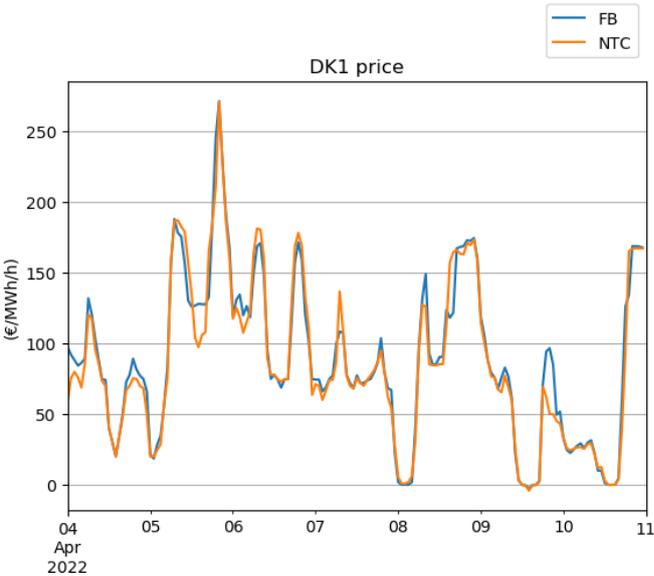


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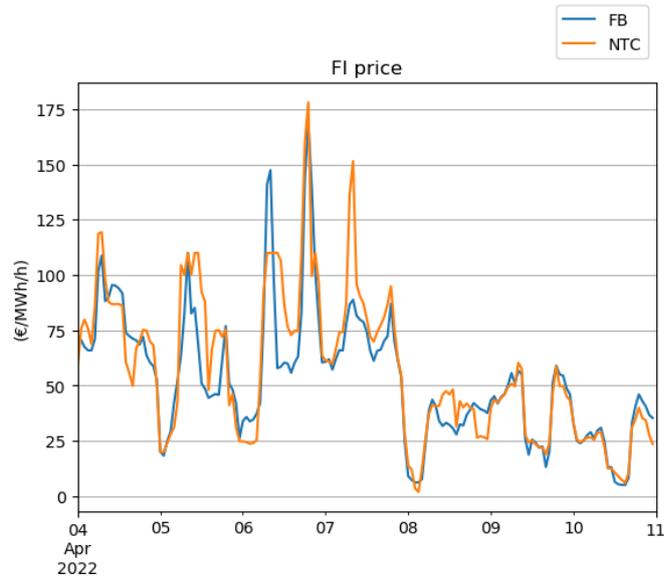


Price

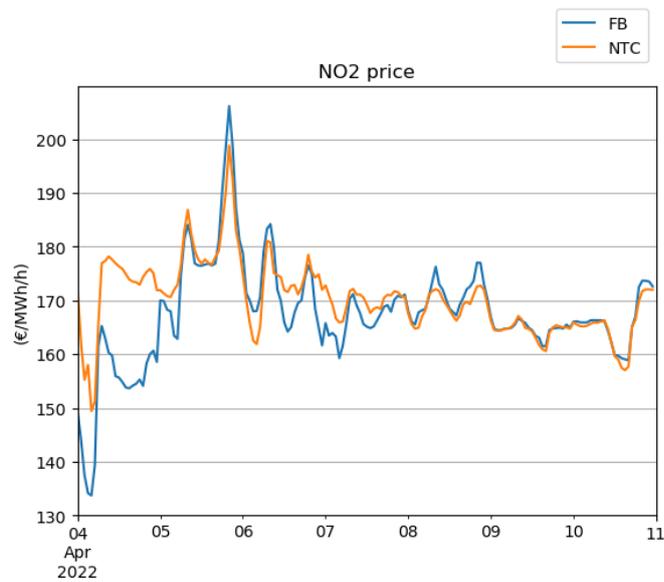
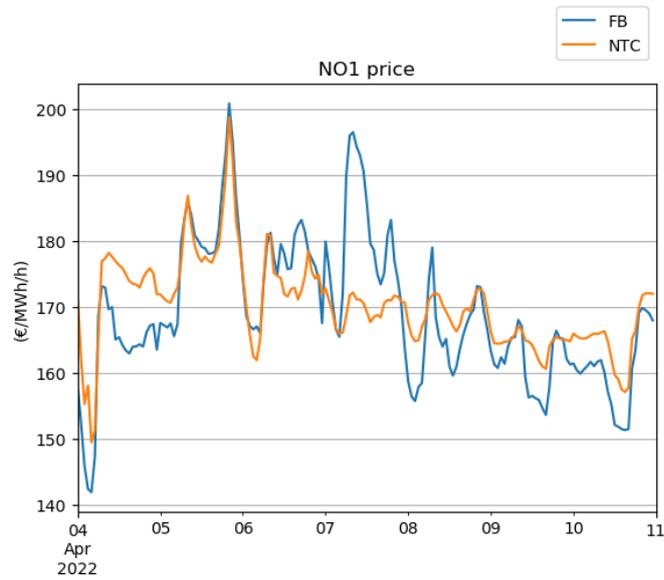
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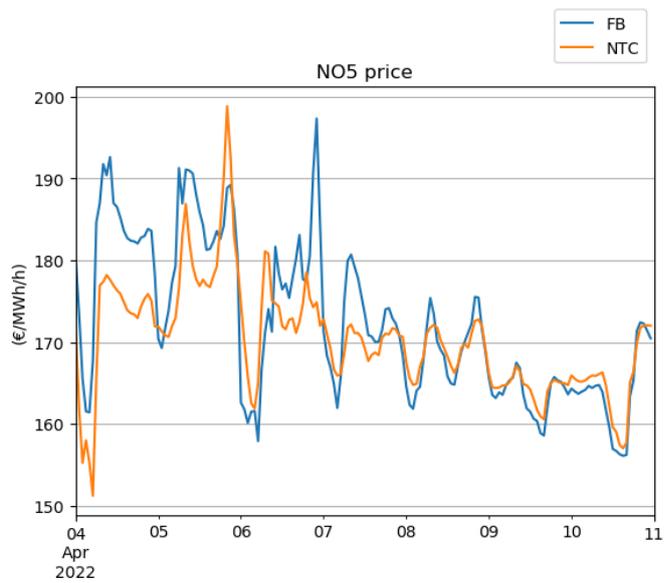
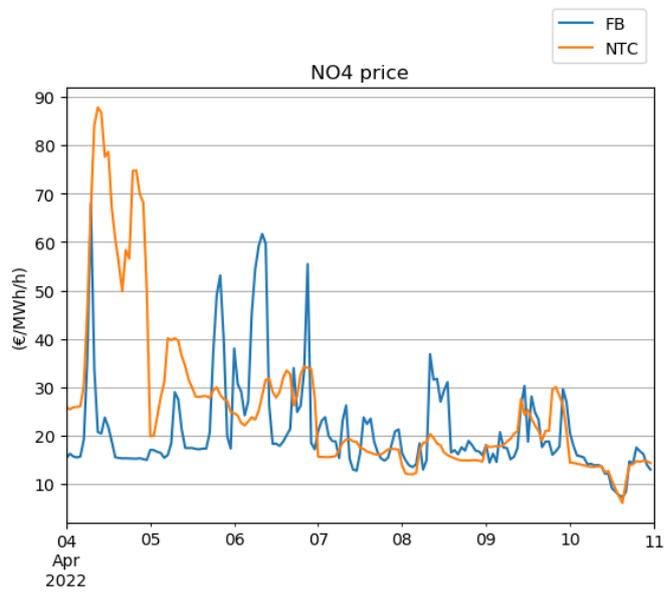
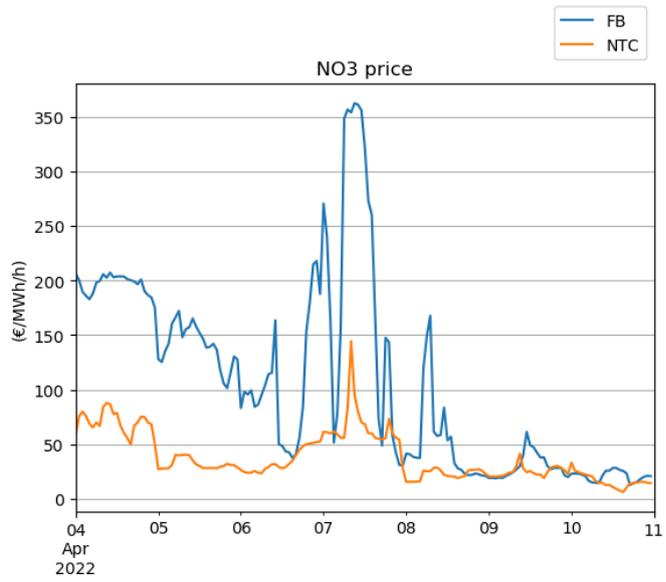


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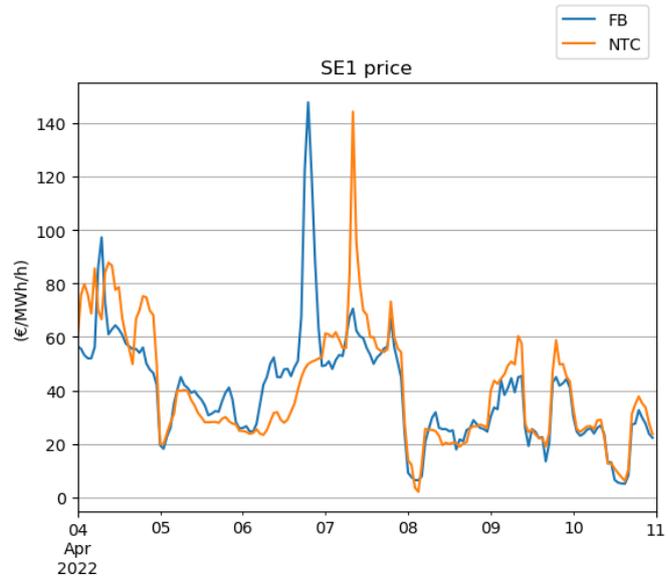


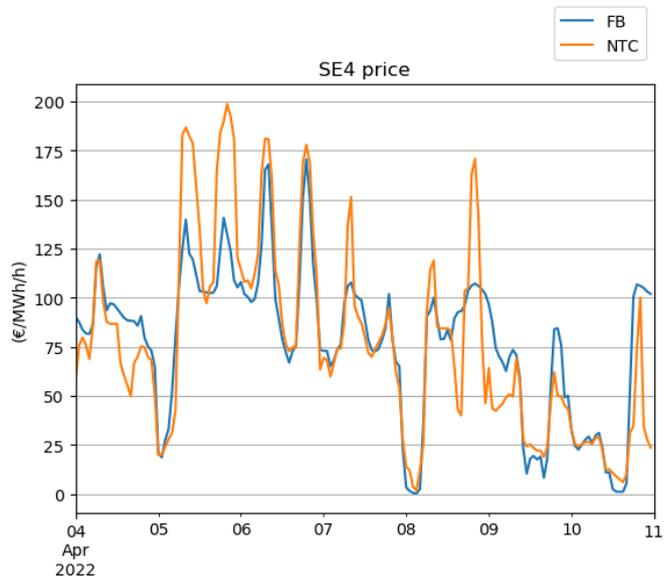
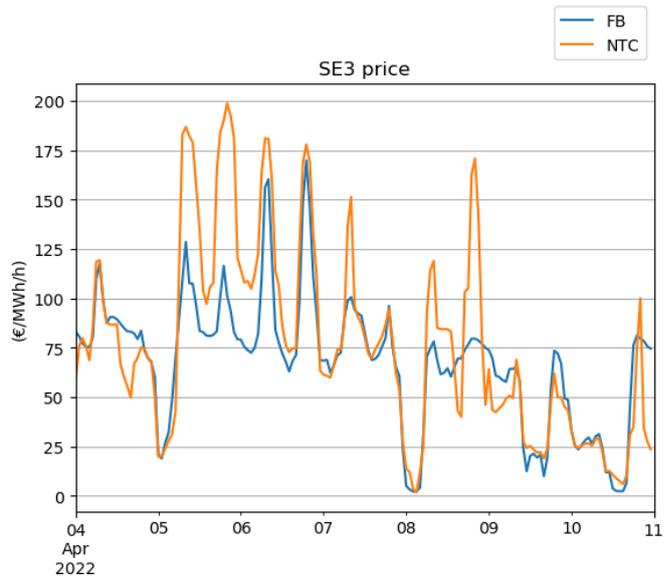
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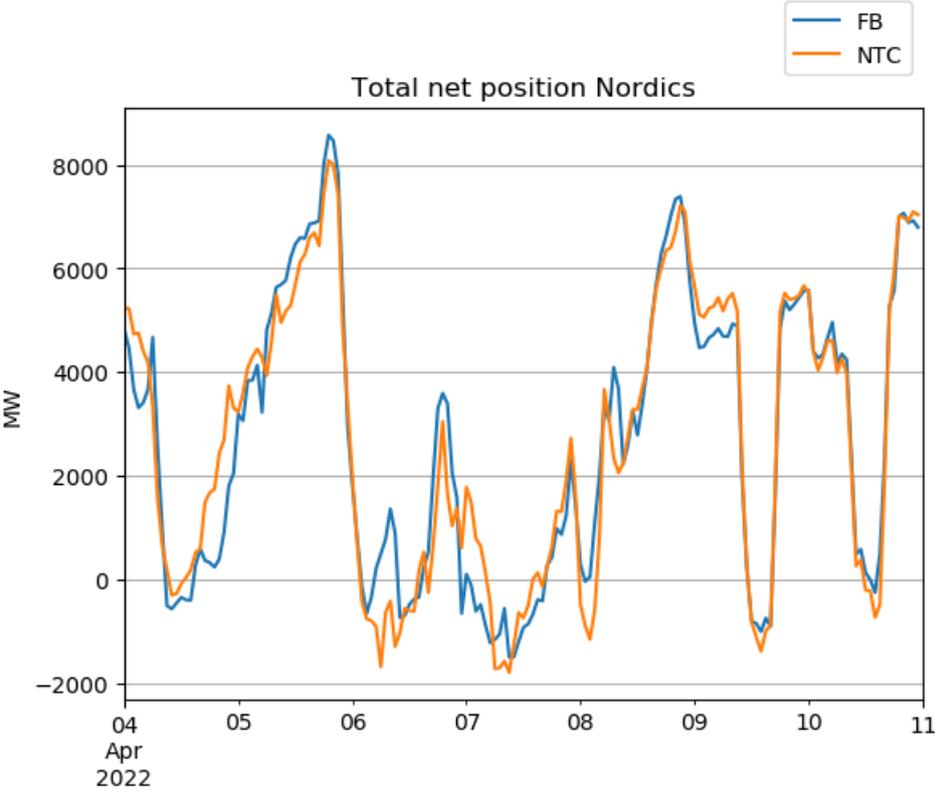
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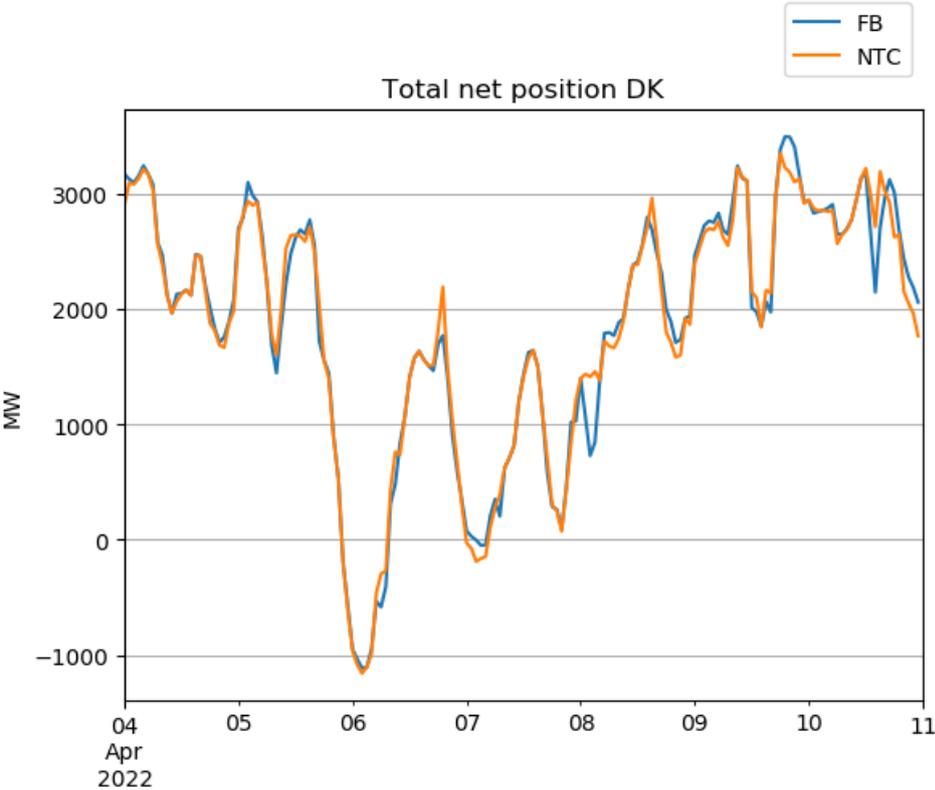


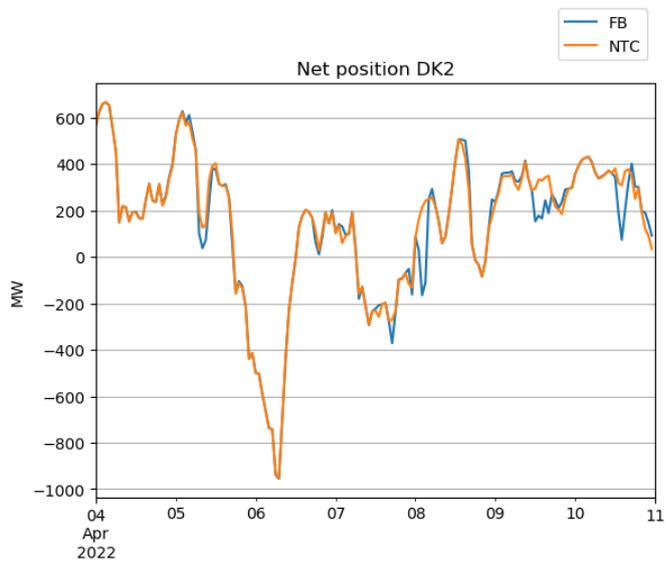
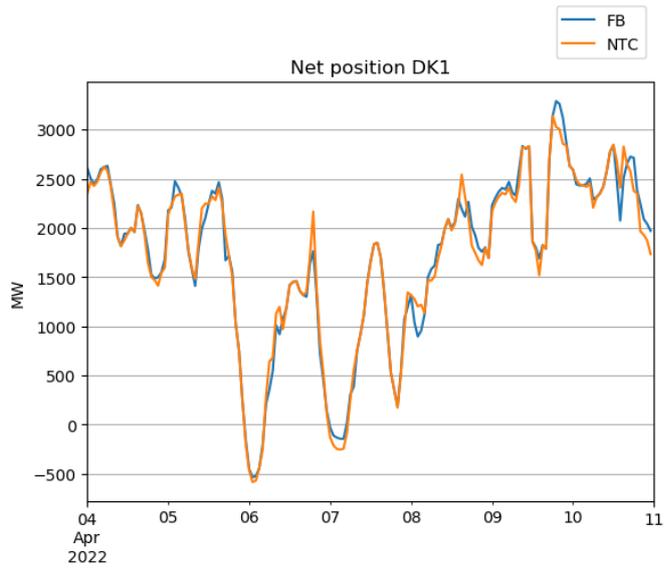
Netposition

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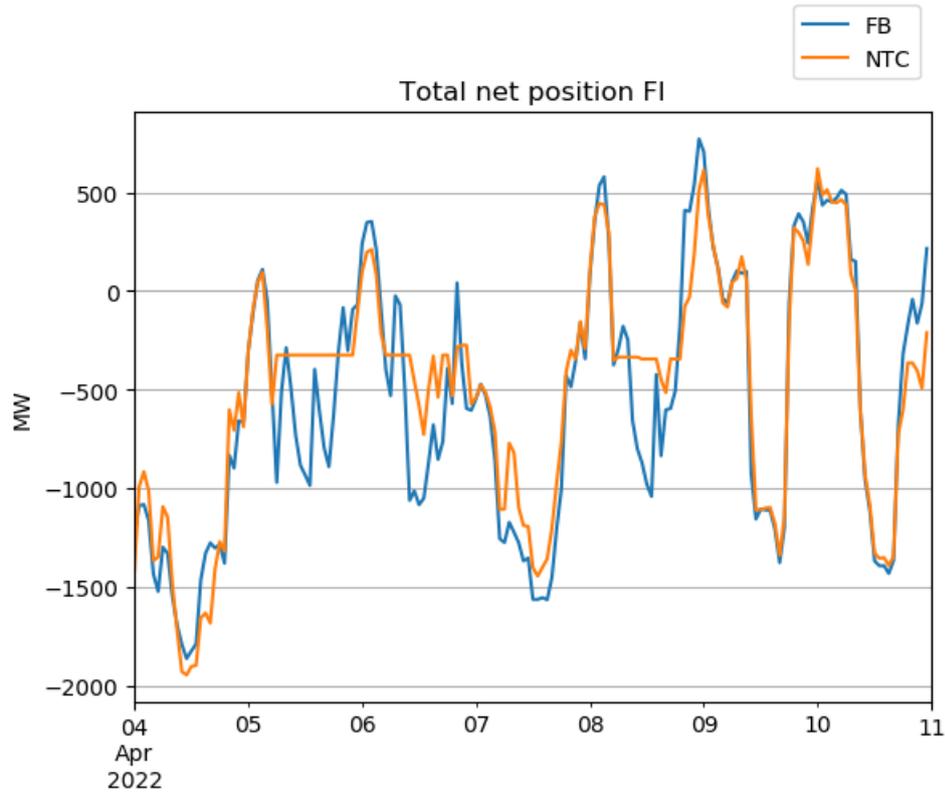
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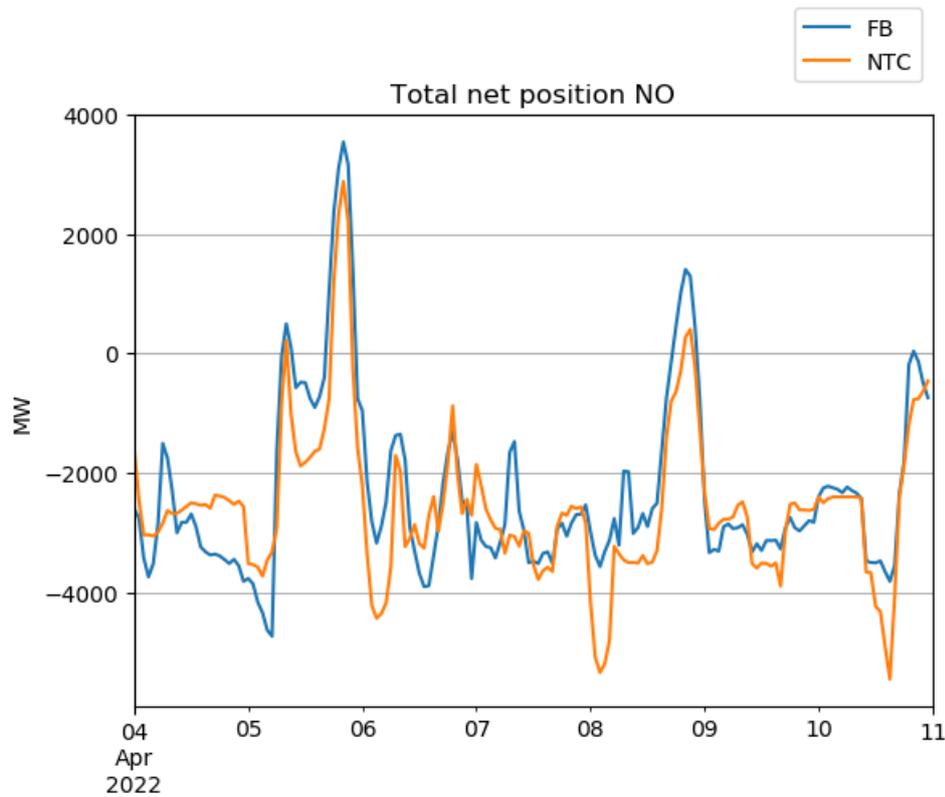


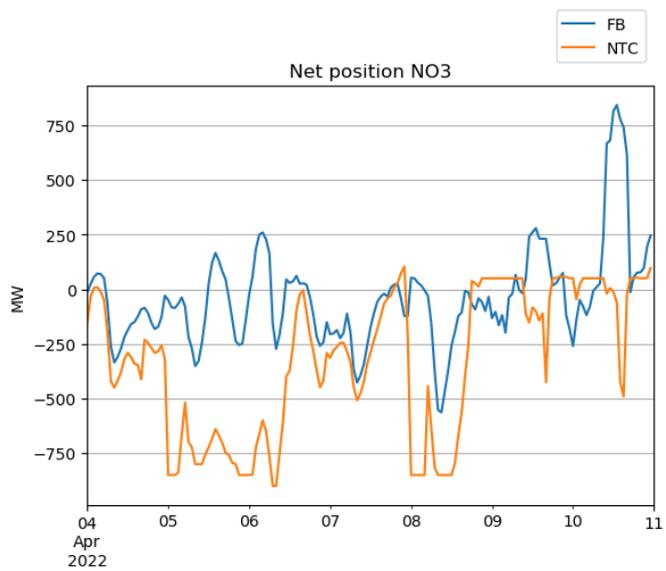
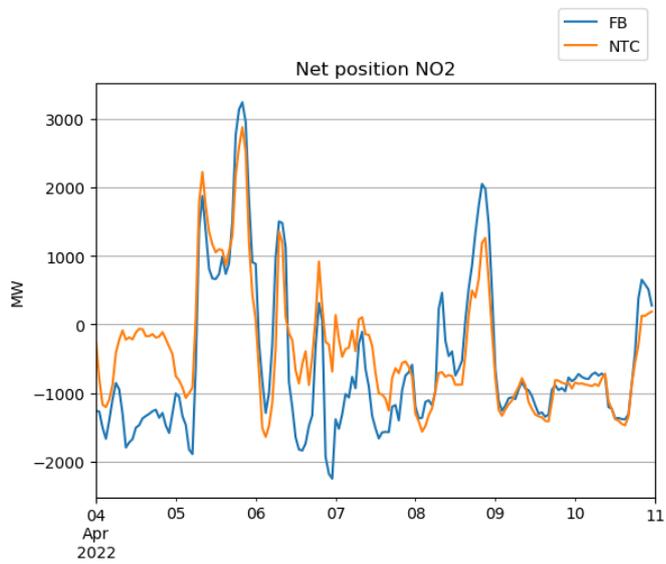
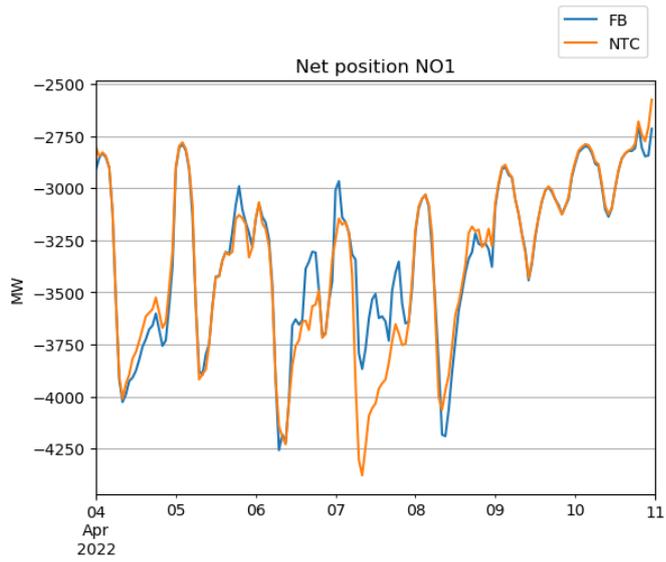
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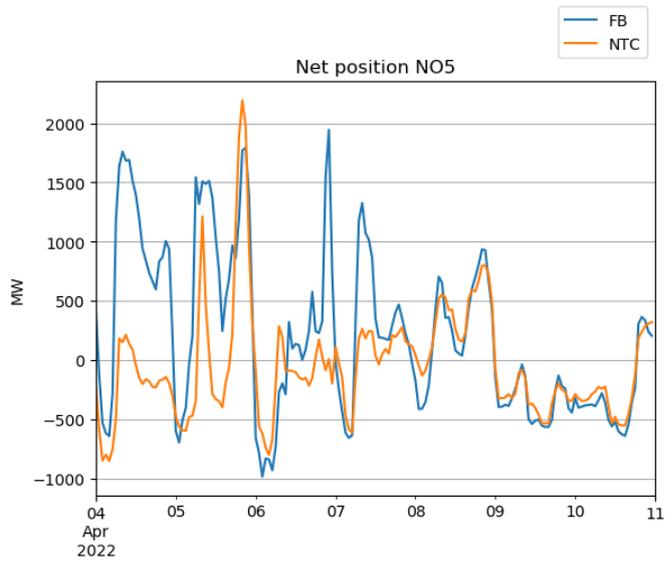
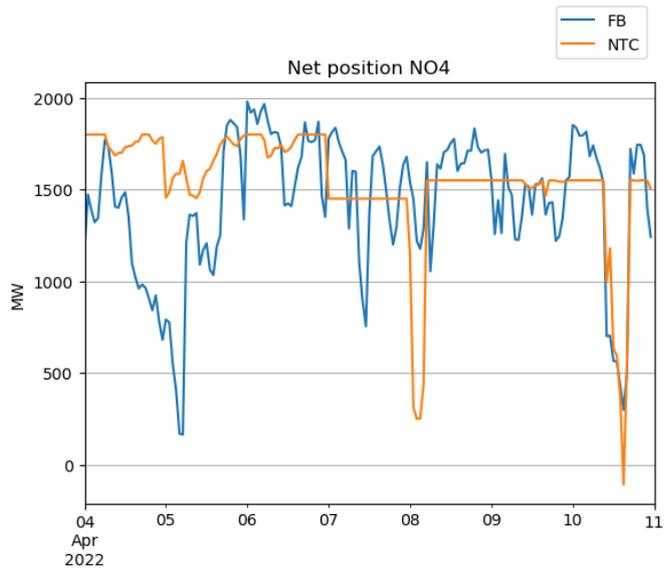
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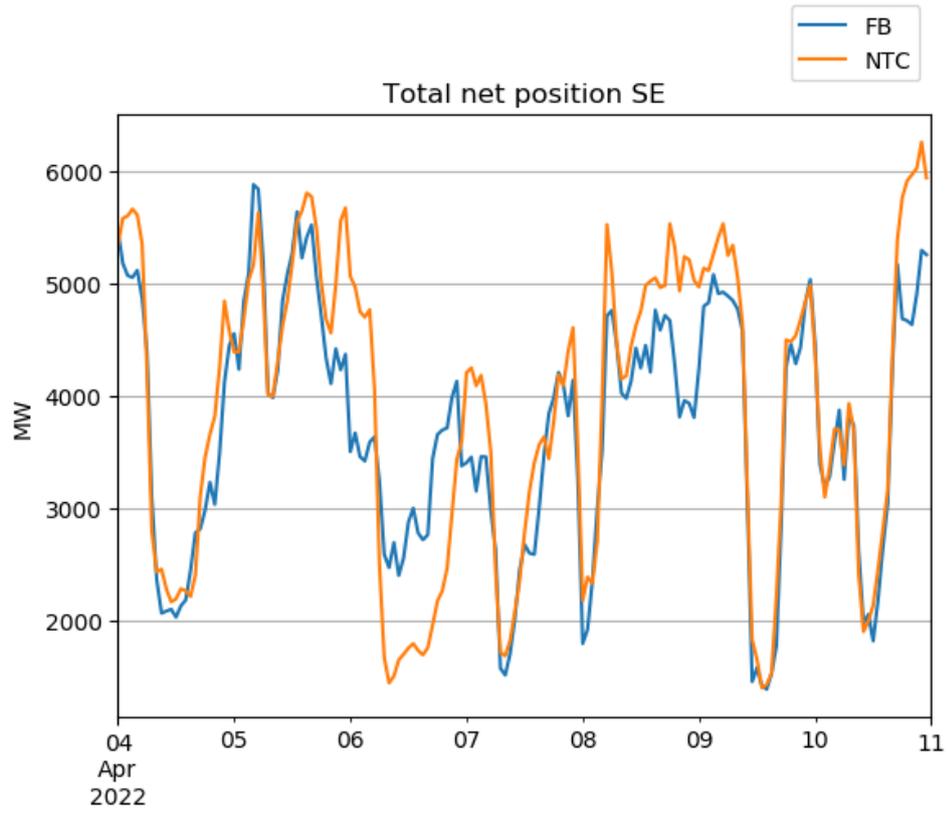
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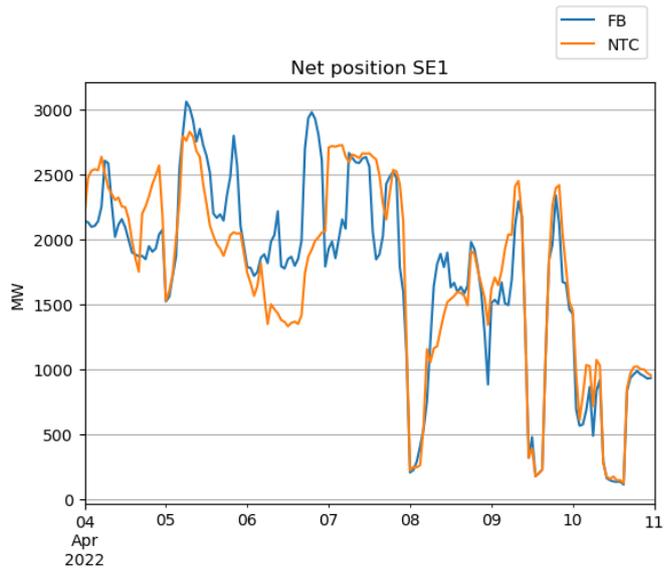


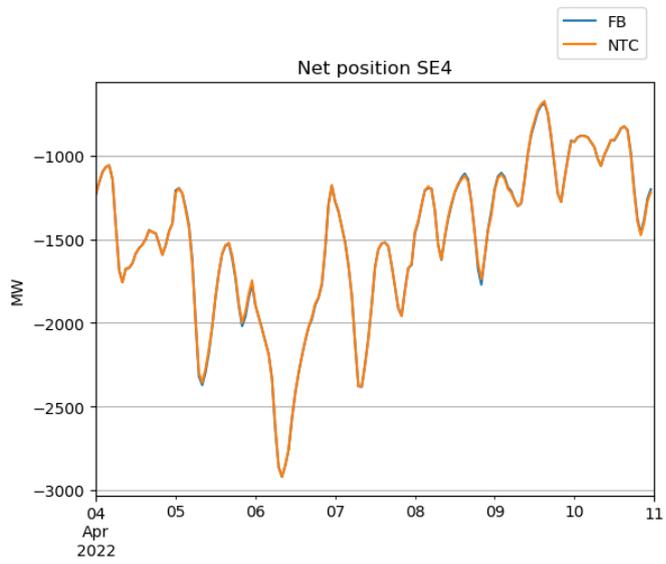
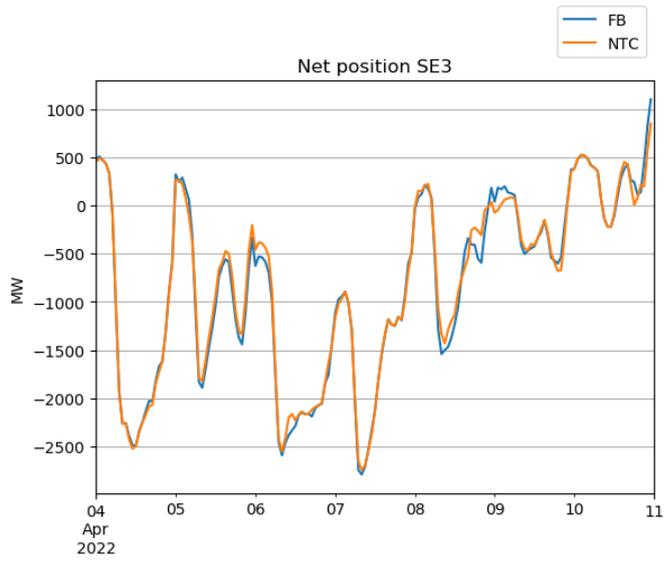




3.1.1.14 Sweden







Border Flows

