

Nordic CCM – External Parallel Run Market Report for Week 15

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 15.

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. 11.4.	Tue. 12.4.	Wed. 13.4.	Thu. 14.4.	Fri. 15.4.	Sat. 16.4.	Sun. 17.4.
Substituted IGMs	0	0	0	0	0	0	0
IVA provision	1	1	1	3	1	1	2
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 IVA provisions the final FB domain was accepted by all TSOs for all days for week 15.

Back-up domains were used for 14th of April for 24 MTUs due to missing CCC data from Energinet.

2 Simulated Market outcome FB vs. NTC for week 15

This chapter presents a comparison of the market simulation for the week 15 (11–17 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

Below is presented Nordic bidding zone prices in Table 2.

In the report, week 15 is compared against 12 earlier analyzed weeks. Meaning weeks from 51 to 6 and weeks from 10 to 14.

FB and NTC price level have been higher and having more fluctuation during week 15 than compared to earlier analyzed weeks before April. Percentage price difference between FB and NTC are at a different level compared to previously studied weeks. Swedish bidding zone FB prices are lower compared to NTC while earlier this have been the other way around. Similarly, FB prices were also lower in NO3 compared to earlier weeks though, the price is still higher than in NTC.

FB prices were slightly higher in FI, NO1, NO2, NO5 and much higher in NO4. Higher price in NO4 is the result of a CNEC definition in NO3 area.

Bidding zone	Price FB [€/MWh]	Price NTC [€/MWh]	Price FB-NTC [€/MWh]	Price diff (FB-NTC)*100/NTC [%]
DK1	179,21	179,36	-0,15	-0,08
DK2	175,32	172,8	2,52	1,46
FI	92,31	89,98	2,33	2,59
NO1	177,91	173,79	4,12	2,37
NO2	177,46	173,79	3,67	2,11
NO3	72,03	69,24	2,79	4,03
NO4	46,77	18,84	27,93	148,25
NO5	177,74	175,33	2,41	1,37
SE1	71,99	79,84	-7,85	-9,83
SE2	69,69	79,84	-10,15	-12,71
SE3	114,49	131,69	-17,2	-13,06
SE4	129,25	132,94	-3,69	-2,78

Table 2, Average price pr, bidding zone with NTC and flow based, week 15

Highest absolute price change was in NO4 and SE3. Below is presented prices in both bidding zones. High price fluctuation have been seen earlier in NO3 area but can now also be seen in NO4. The price level suggests that NO4 prices correlate better with the changes in SE1 and SE2. Earlier, especially NO3, have been correlating more with the neighboring Swedish bidding zones.

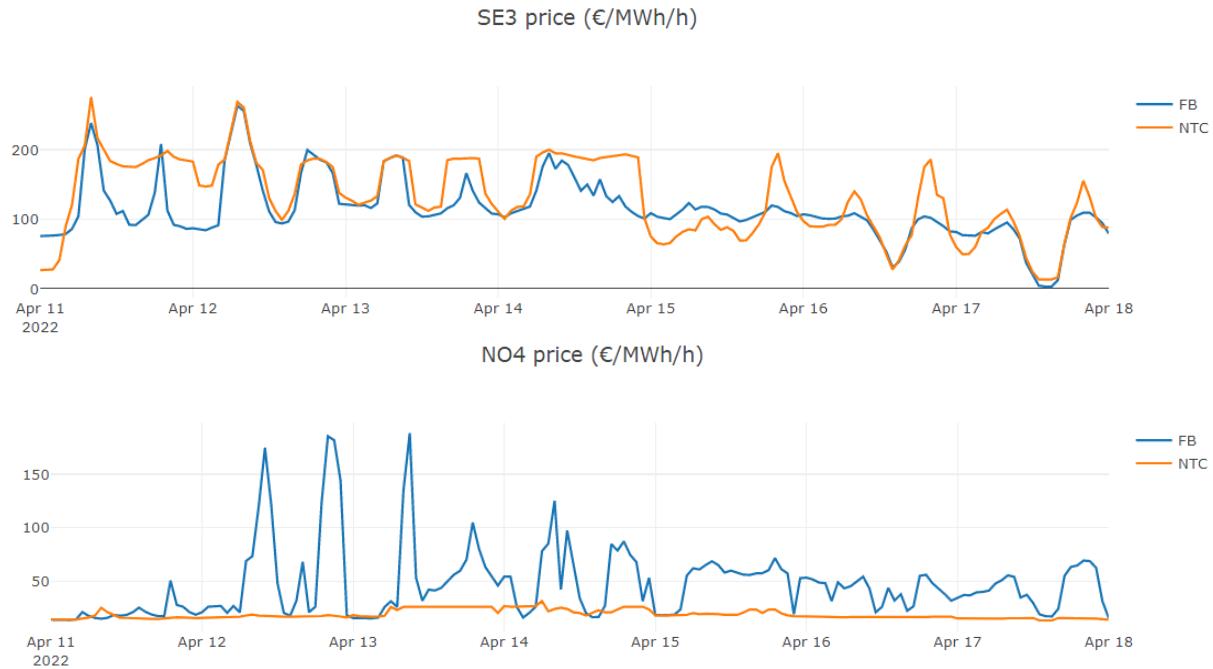


Figure 1, Day-ahead price in NO4 and SE3 on hourly level for both FB and NTC

There are couple of reasons why Swedish bidding zones prices are lower in FB compared to NTC which have not been typical in earlier weeks. In overall, higher prices and more price fluctuation can be handled better by FB which results lower price divergence. During the week, also FI area was not as dependent of SE1 and SE3 exports as typically seen in the results.

FB price reduction compared to NTC in SE3 can be partially explained by the FB market coupling itself. Below is the price duration curves for SE3 for week 15 and also with all earlier analyzed weeks (12 weeks in total). Figures 2 and 3 suggest that the highest reductions in FB prices compared to NTC occur within 100-200€/MWh. This especially is true during week 15 when spread between the NTC and FB is high. It is possible that during unusual market situation, FB may allocate lower prices in consumer dominated bidding zones. This however, is depending on absolute price levels. Similar behavior have been observed in other bidding zones where consumers are majority.

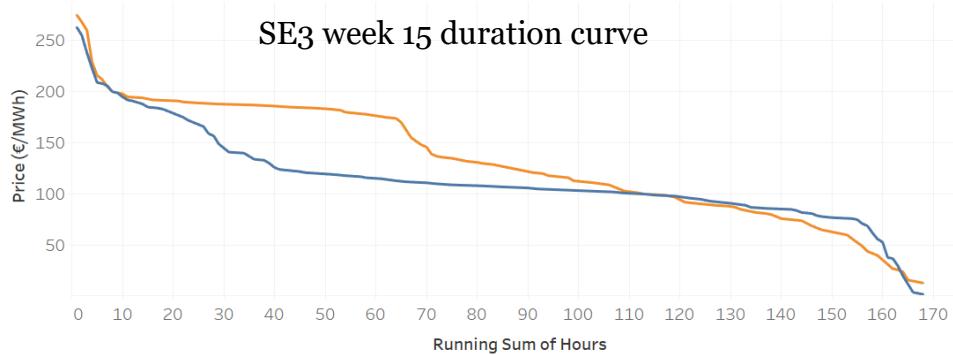


Figure 2, Duration curves of day-ahead prices of SE3 on hourly level for both FB and NTC for week 15.

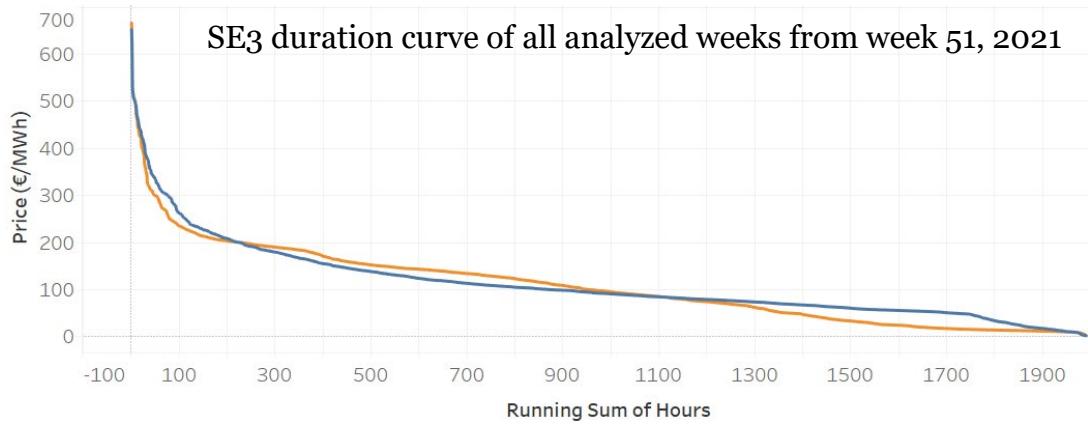


Figure 3, Duration curves of day-ahead prices of SE3 on hourly level for both FB and NTC for all analyzed weeks until week 15.

Socio-economic welfare results

Below is shown socio-economic welfare change between FB and NTC in the Nordic CCR area. During the week, negative Nordic SEW is due to lower price divergence and resulting in lower congestion income from the Nordic borders. Also, price levels were generally lower in SE which have an impact on the results.

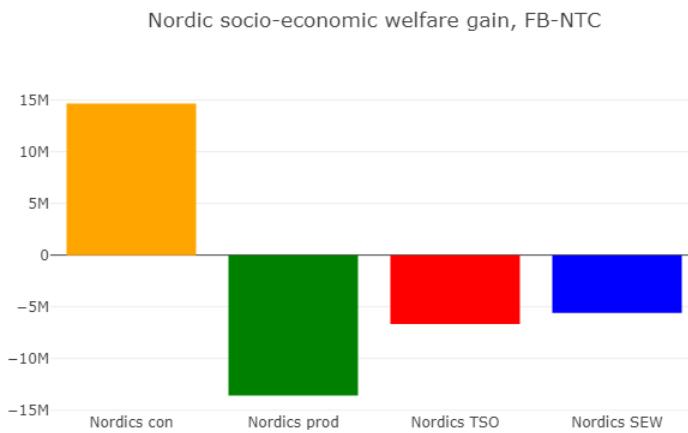


Figure 4, Nordics consumer, producer and congestion income change, Total Nordic socio-economic welfare gain over the simulation period is the sum of the previous three

Total socio-economic change occurred especially in Sweden and Norway (Figure 5). Swedish negative SEW was effected by the lower congestion incomes while Norway positive SEW was due to higher congestion incomes compared to NTC. Change in DK area was -1,6M€ resulted mainly by negative congestion incomes. Change in FI area was -0,2k€.

Total Nordic socio-economic welfare per country

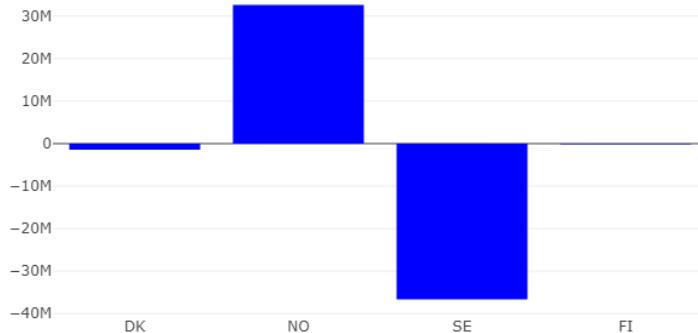


Figure 5, Nordic socioeconomic welfare pr, country – (FB – NTC) (€), week 15

Weekly SEW change was high if we compare the changes in earlier 12 studied weeks. Majority of the change is contributed by the change in congestion income. Also, higher price difference between FB and NTC typically have an impact to consumer and producer surplus depending on the country.

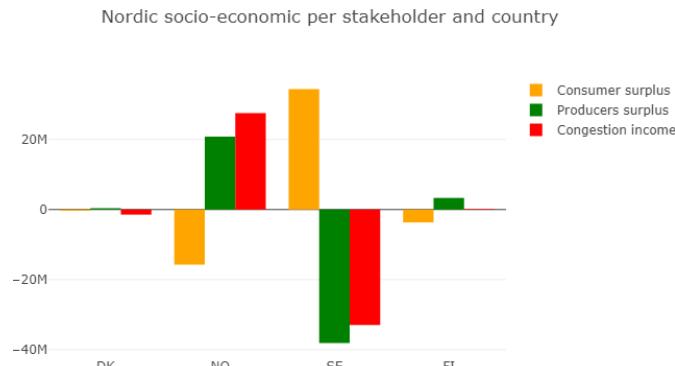


Figure 6, Nordics consumer, producer and congestion income change per day

High total SEW changes between bidding zones are generally originated from the congestion income (Figure 6) and this variates depending on bidding zone. When comparing Figures 7 and 8, some bidding area SEW change is driven by the change of congestion incomes while in the other areas the changes is driven by the change between consumer and producer surplus. Most changes for consumer and producer surplus occurred in SE3 and NO4 areas (Figure 8).

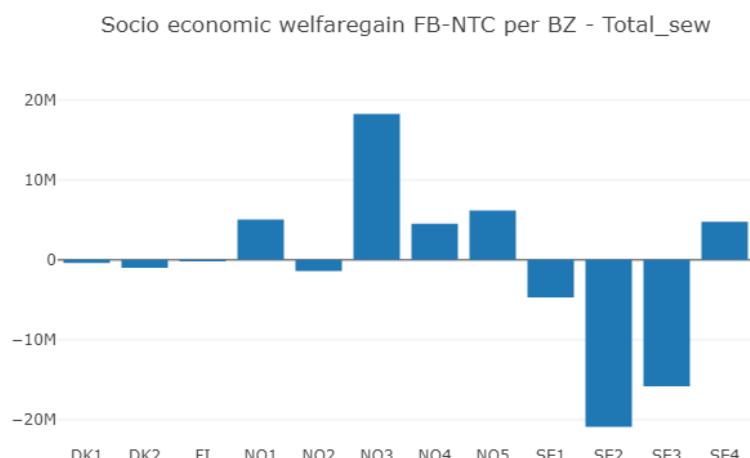


Figure 7, Consumer and producer socio-economic welfare change per bidding zone in the Nordics

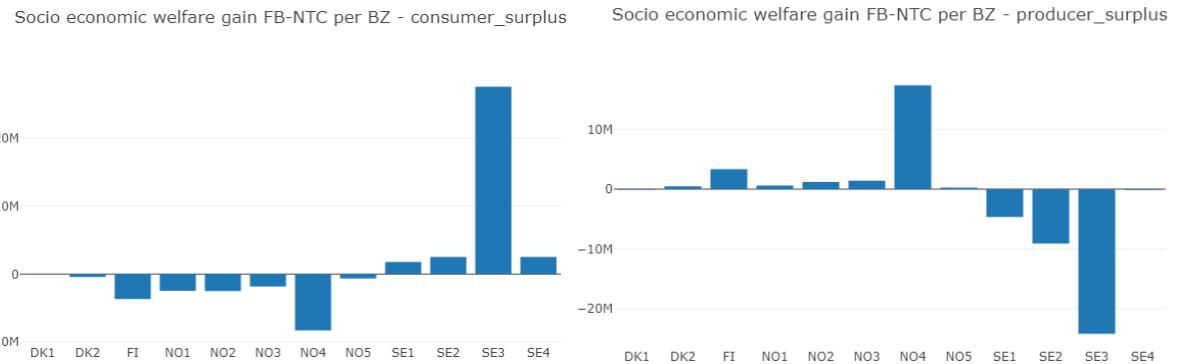


Figure 8, Consumer and producer socio-economic welfare change per bidding zone in the Nordics

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,

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 flows

Domain validation

Below is additional information of the domains used in the FB market coupling.

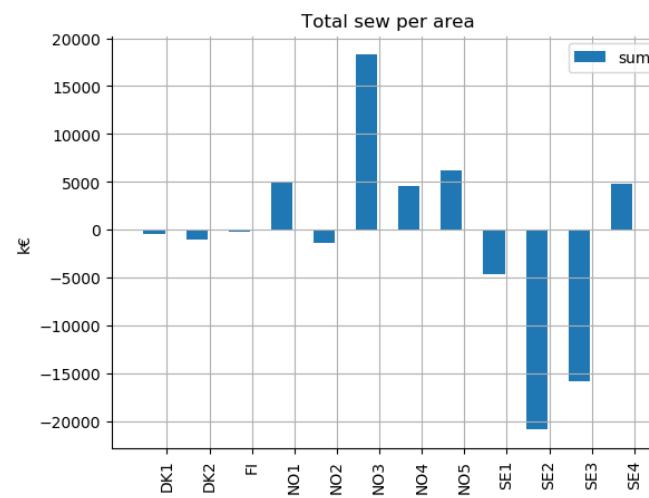
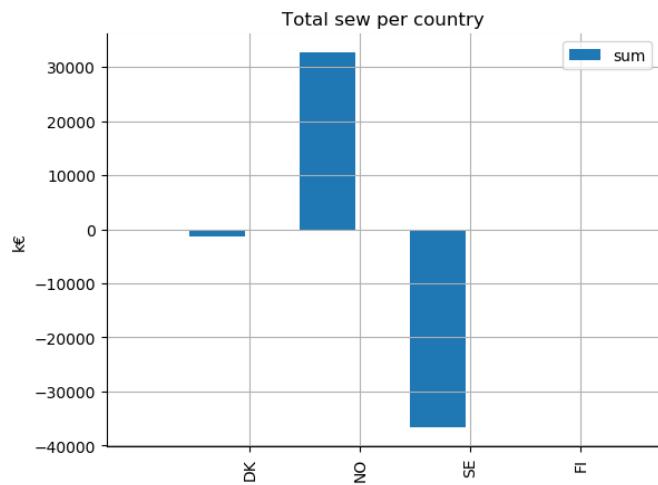
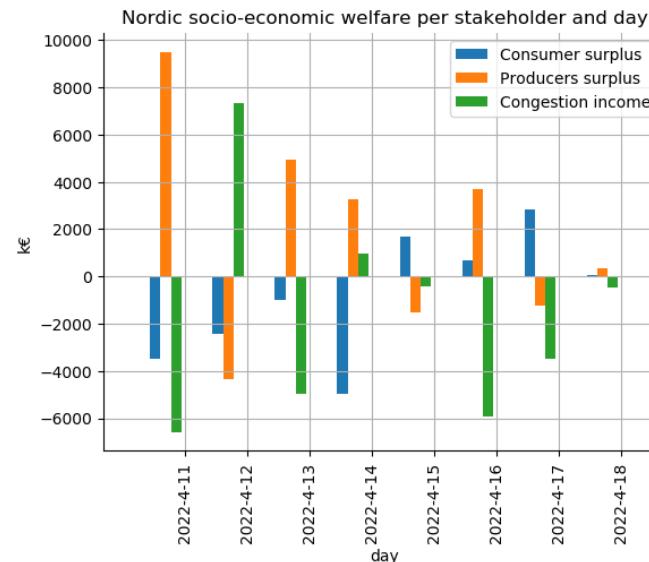
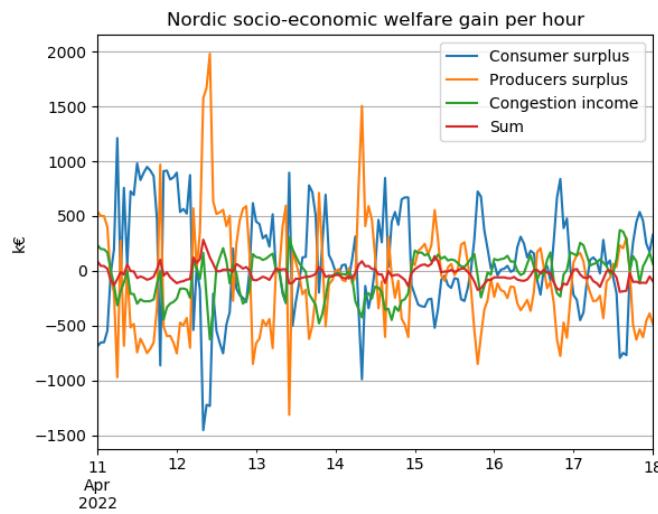
Energy Delivery Day:	Mon. 11.4.	Tue. 12.7.	Wed. 13.4.	Thu. 14.4.	Fri. 15.4.	Sat. 16.4.	Sun. 17.4.
Invalid/missing IGMs	-	-	-	-	-	-	-
Substituted IGMs	-	-	-	-	-	-	-
Invalid CGMs	-	-	-	-	-	-	-
FB domain back-up	-	-	-	24	-	-	-
FAV provision	1	1	1	3	1	1	2
Final domain acceptance (1 TSO =25%)	100	100	100	100	100	100	100
FB-domains sent to SA WG/SF	Yes						

Seven domains were published in week 15. Thursday 14th of May was used FB back-up domains. Back-up domains were due to missing CCC data from Energinet. Because of this, three TSOs provided IVAs.

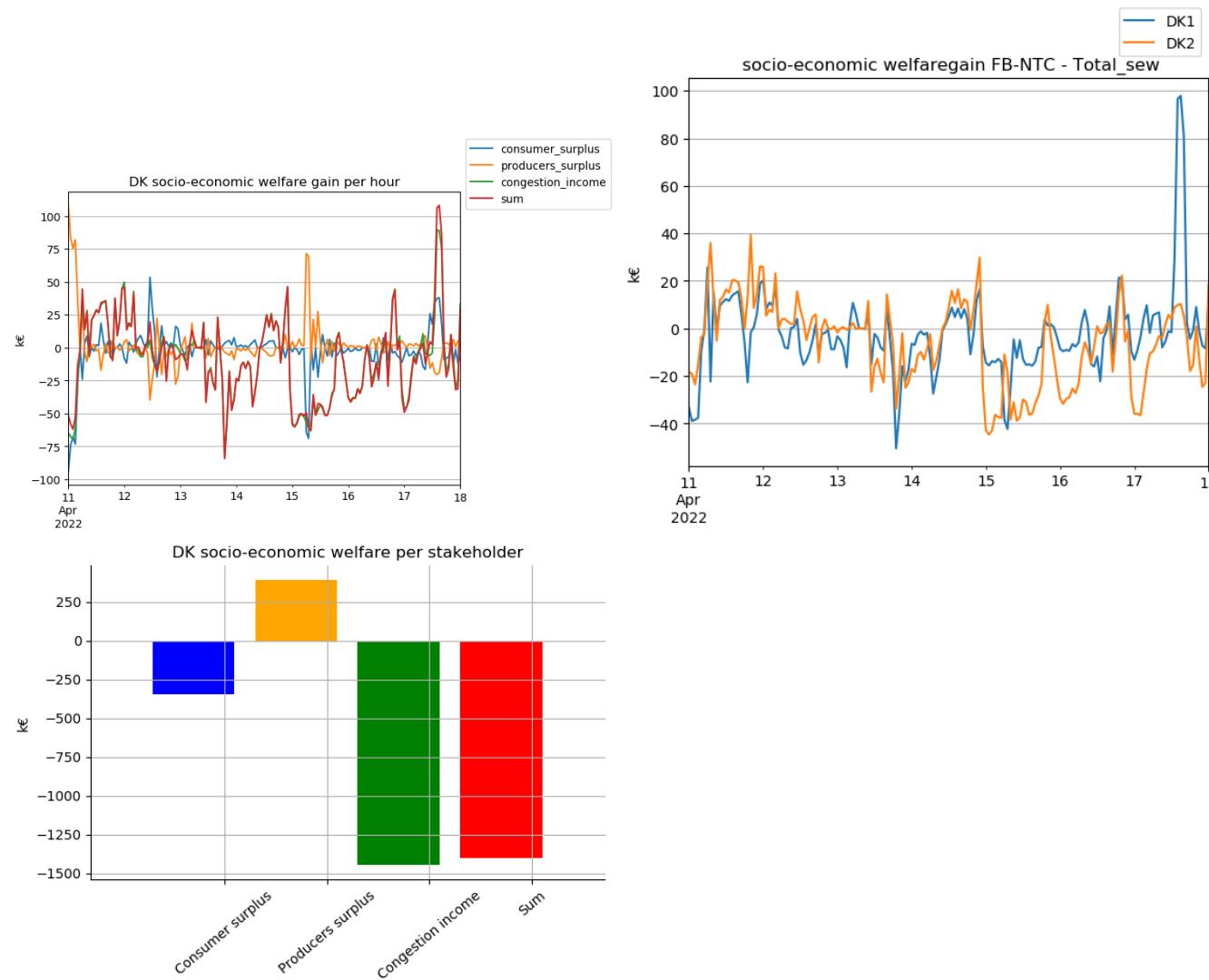
Social economic welfare

3.1.1.1 Nordics

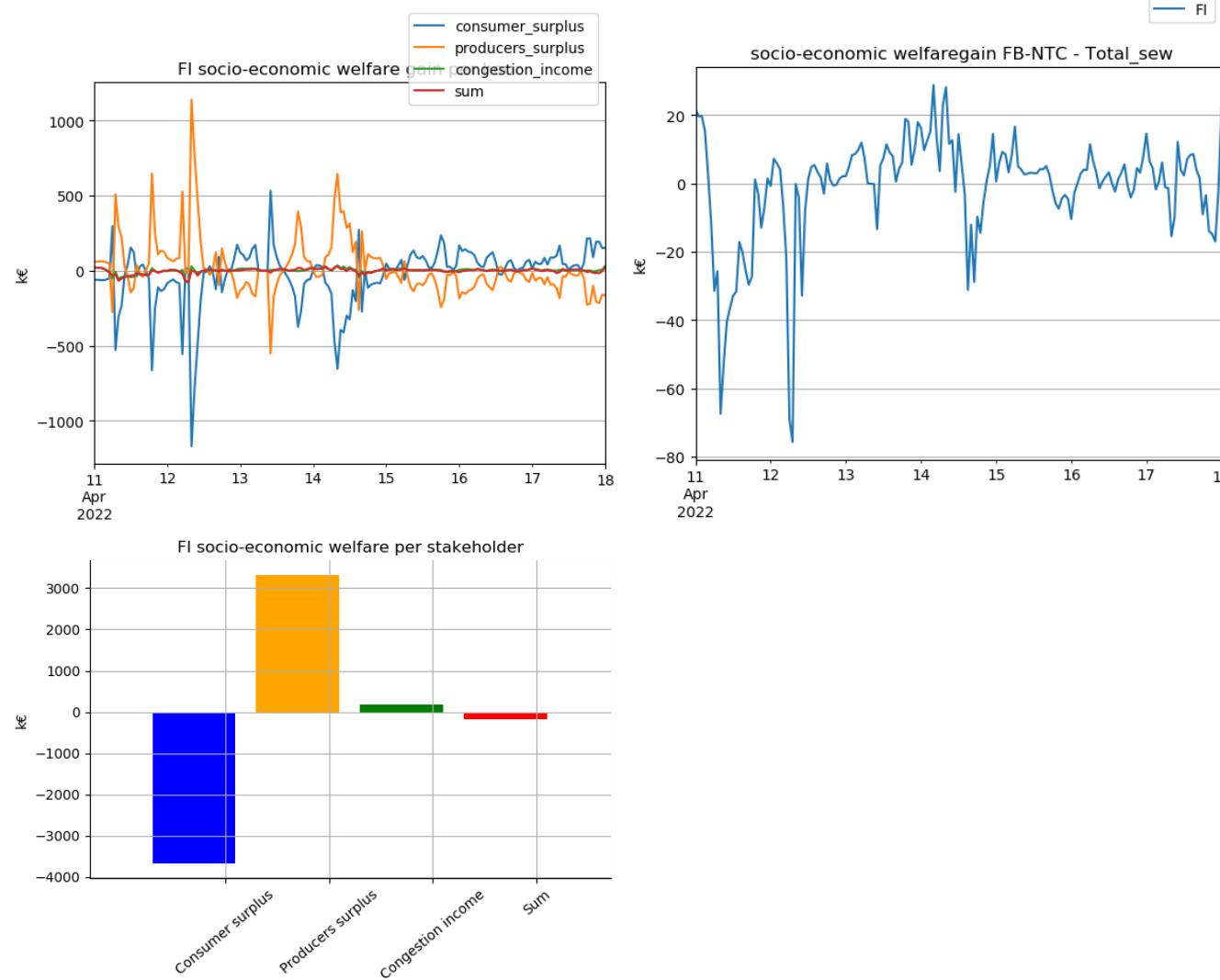
3.1.1.2 Nordic welfare gains.



3.1.1.3 Denmark

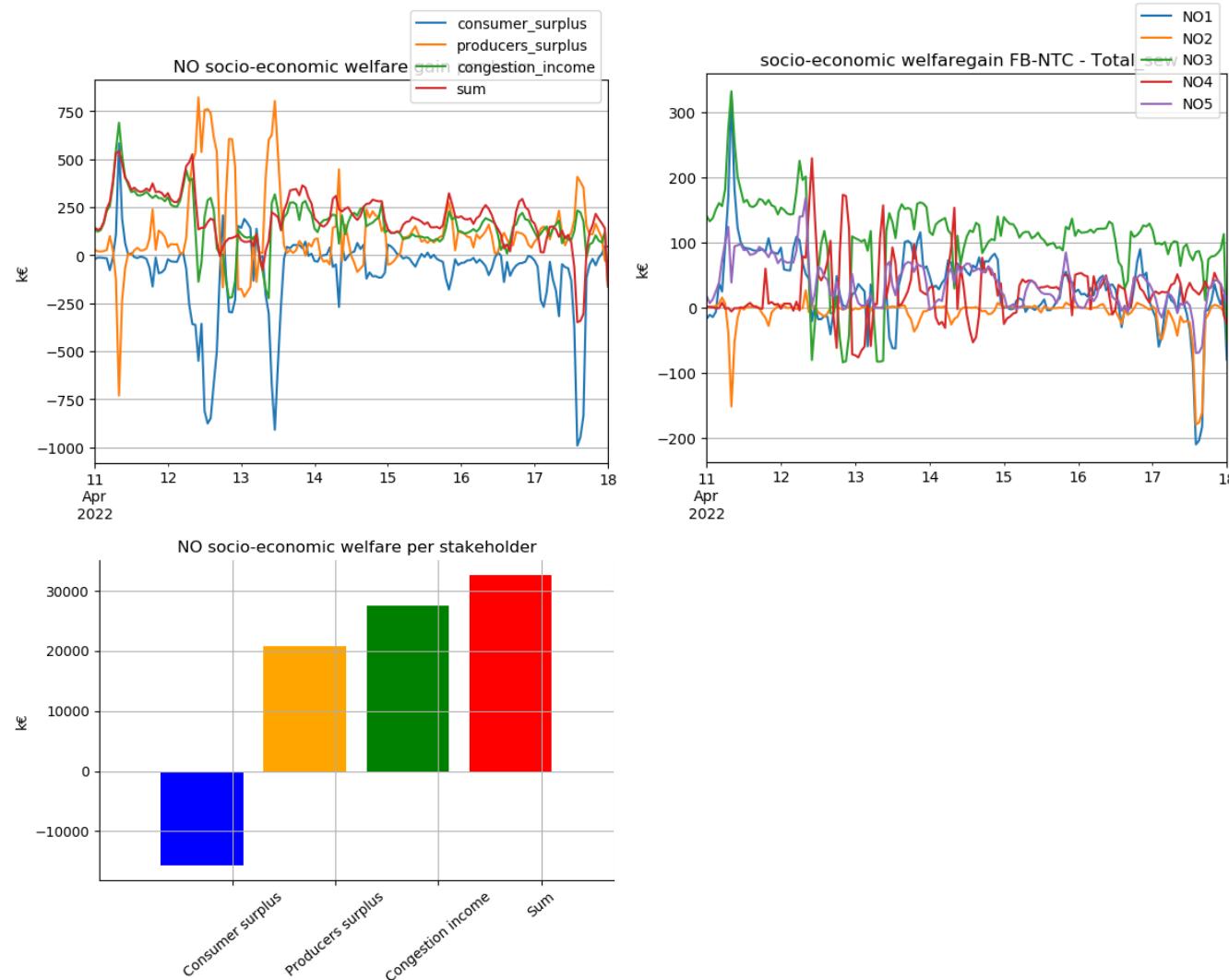


3.1.1.4 Finland

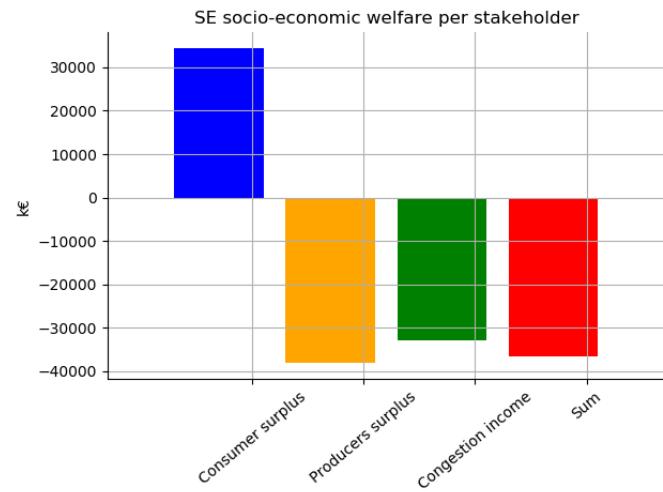
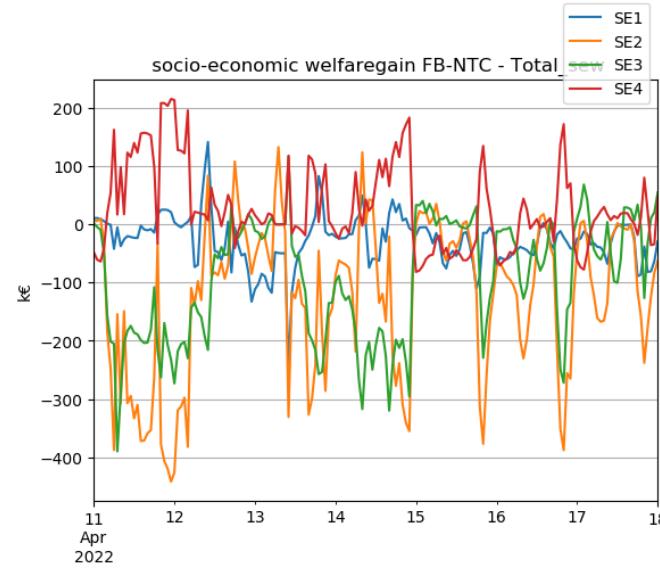
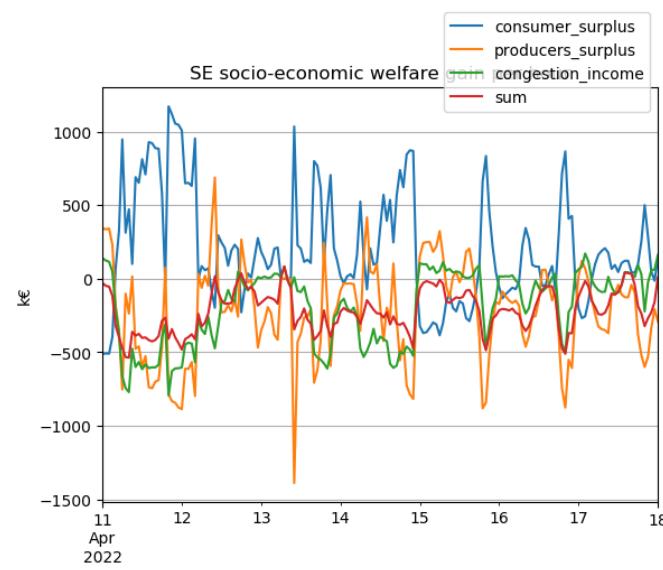


3.1.1.5 Norway

Statnett welfare gains. Add comments

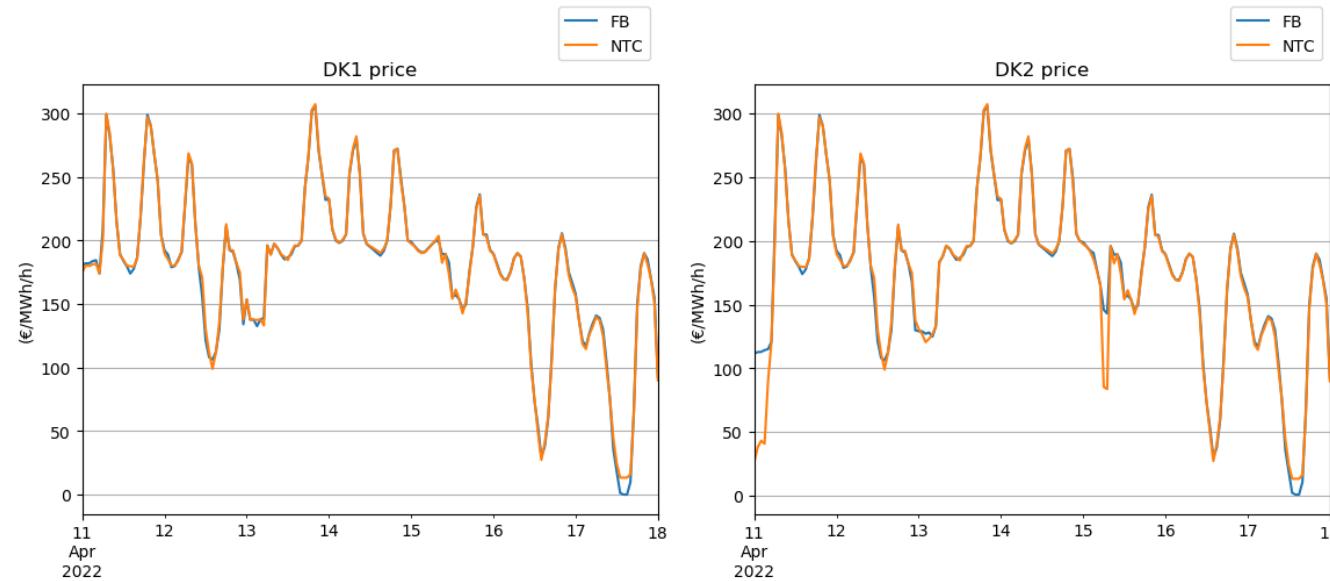


3.1.1.6 Sweden

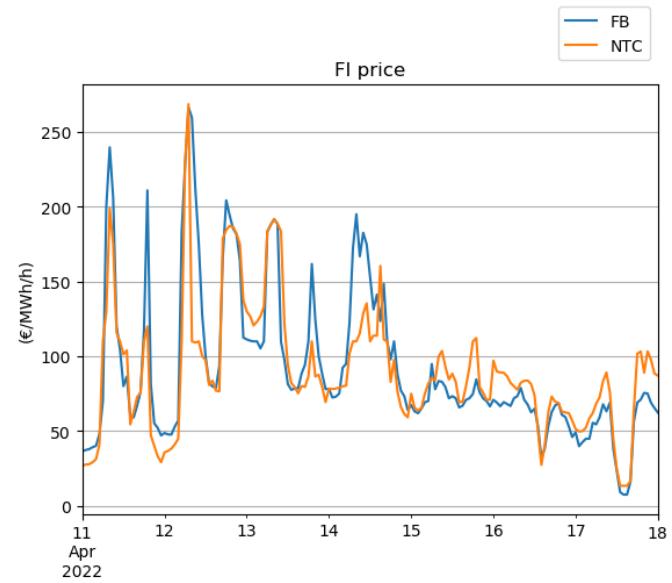


Price

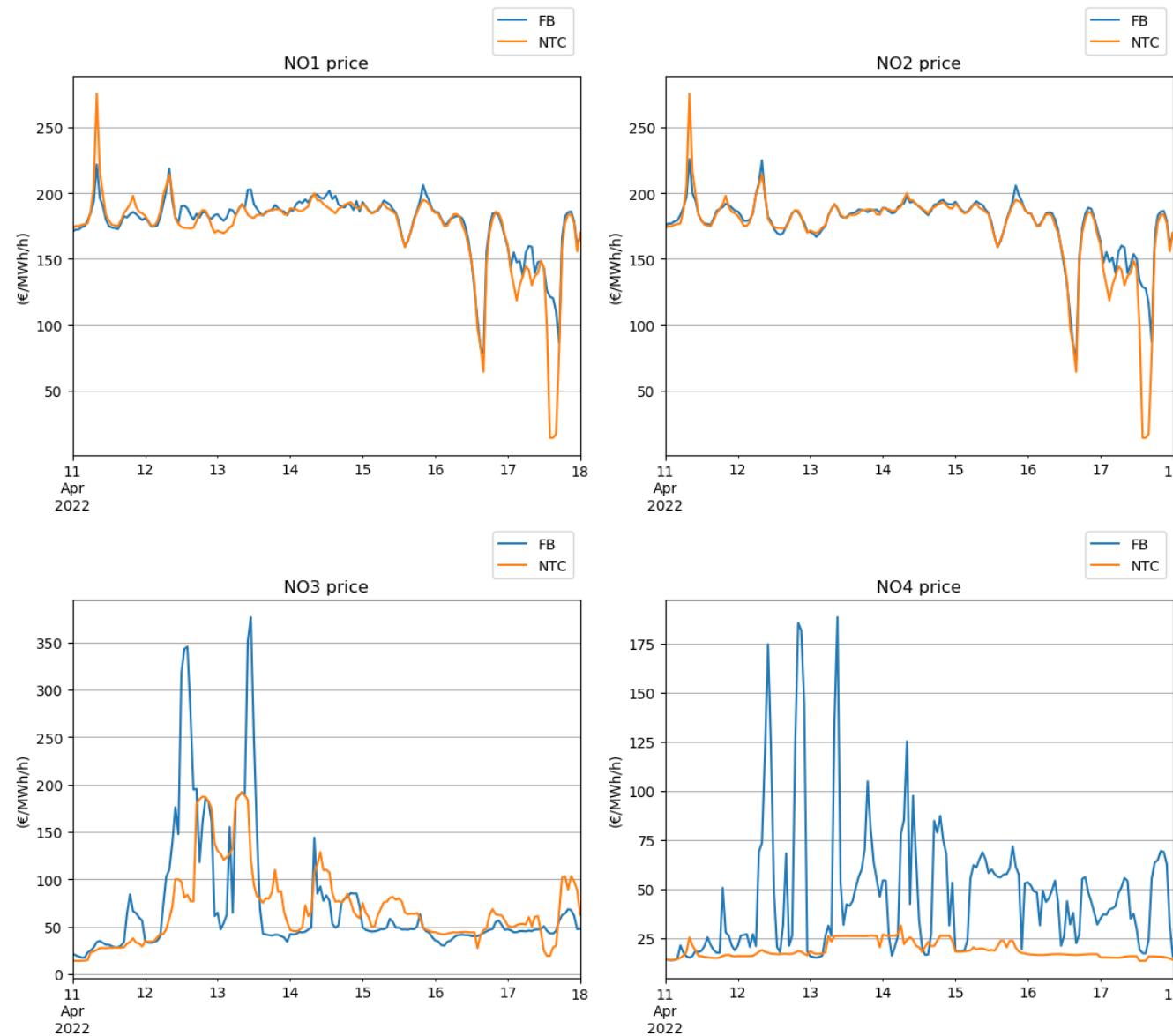
3.1.1.7 Denmark

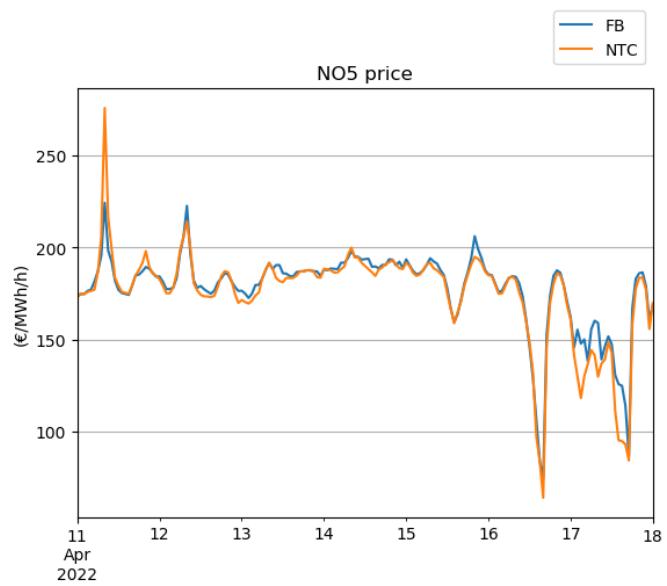


3.1.1.8 Finland

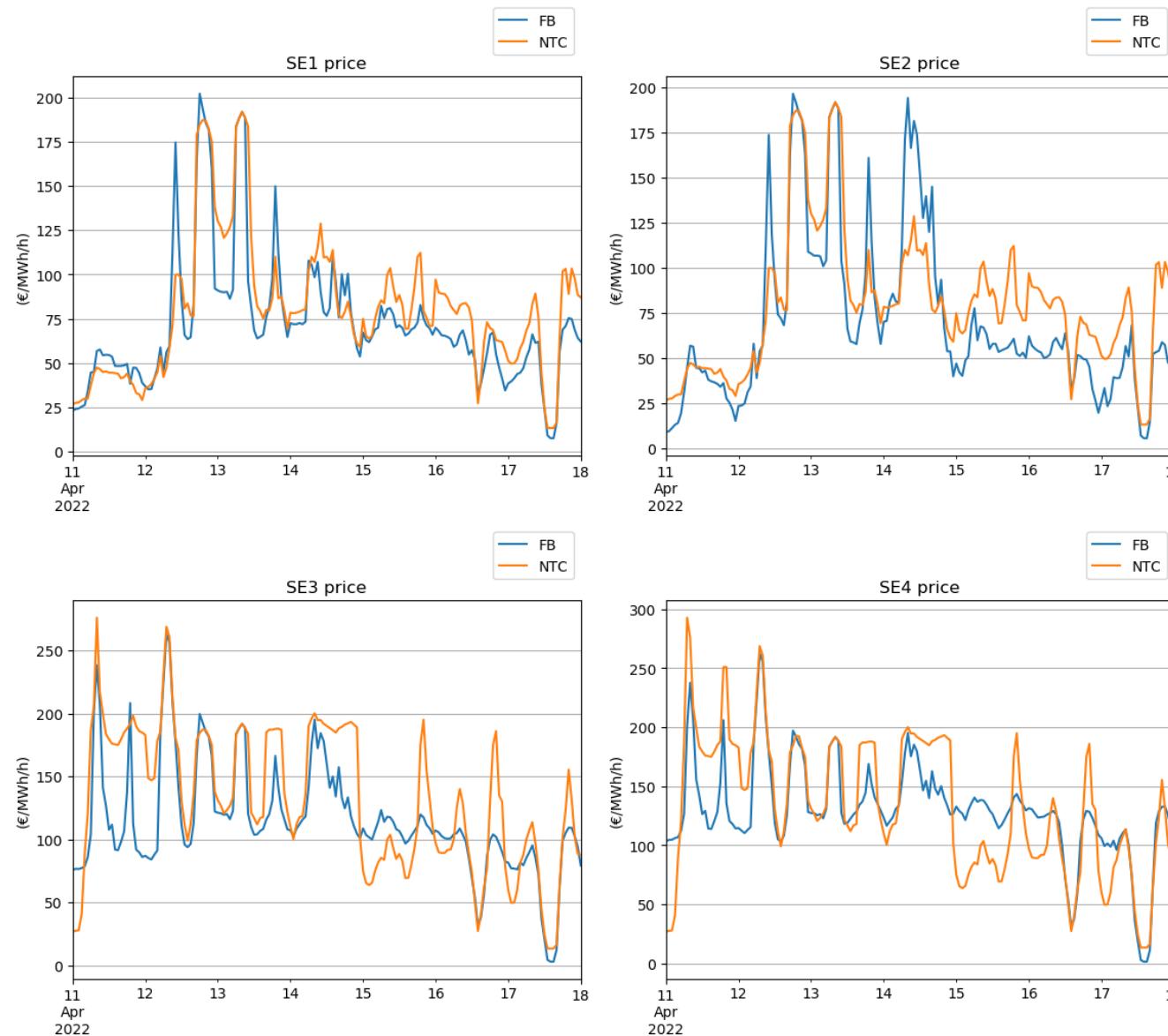


3.1.1.9 Norway



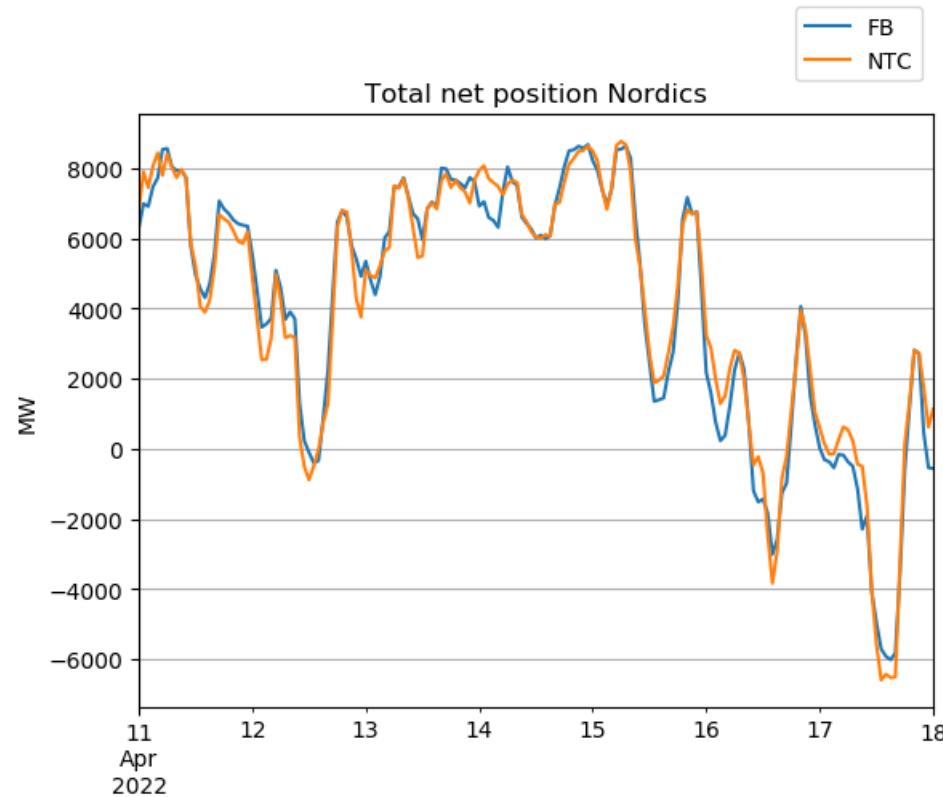


3.1.1.10 Sweden

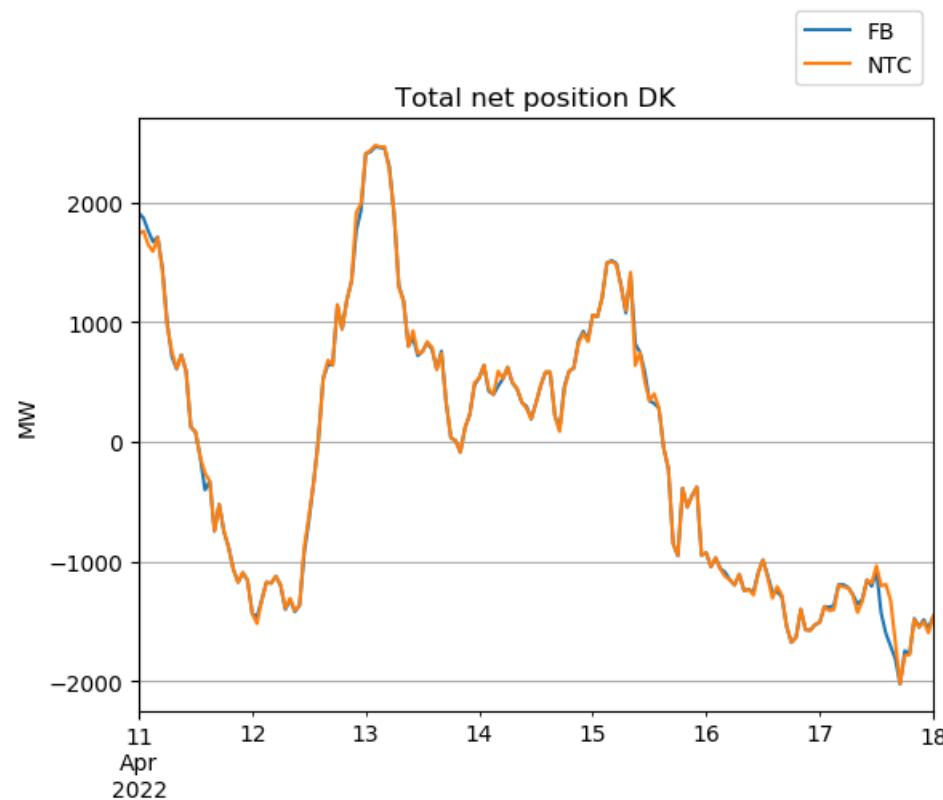


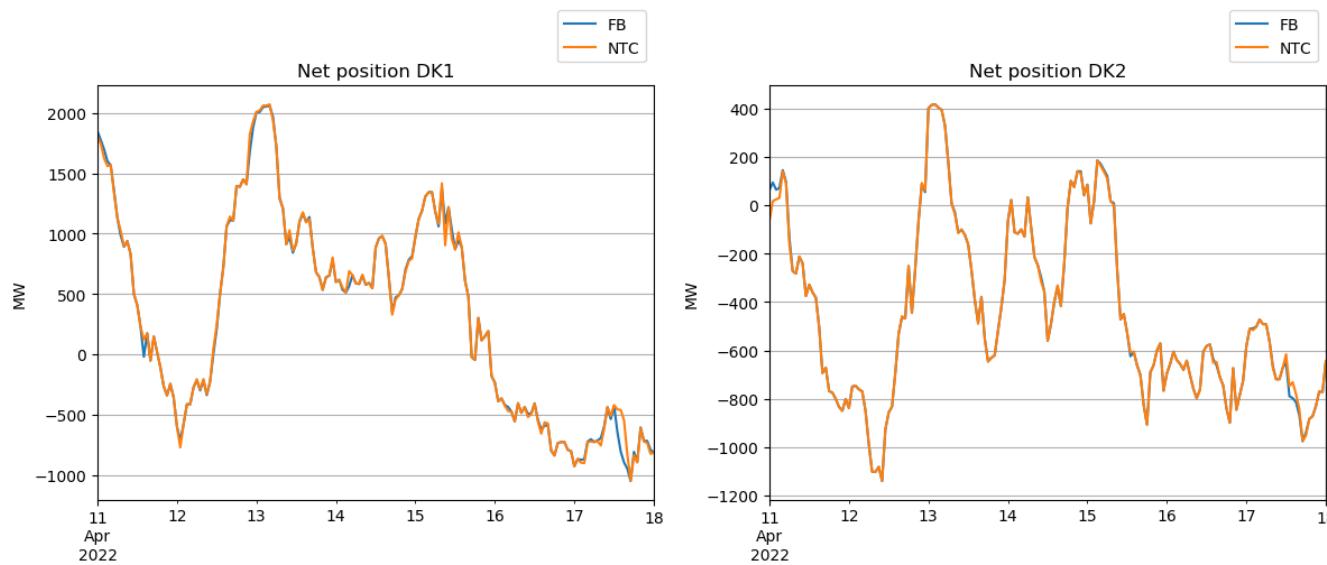
Net position

3.1.1.11 Nordics



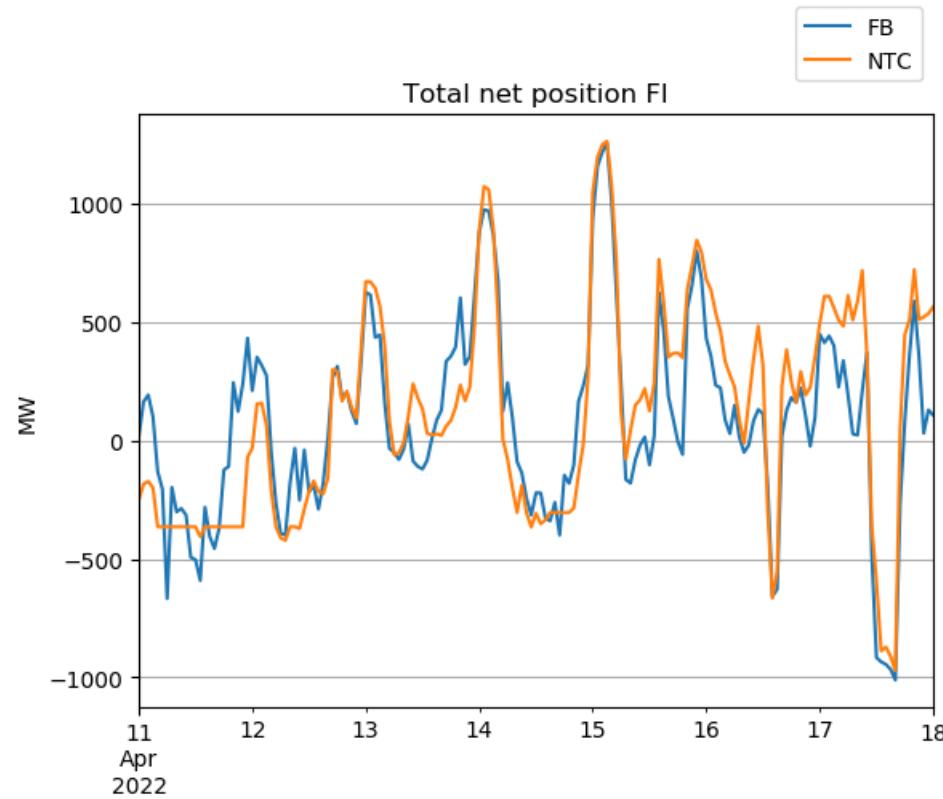
3.1.1.12 Denmark



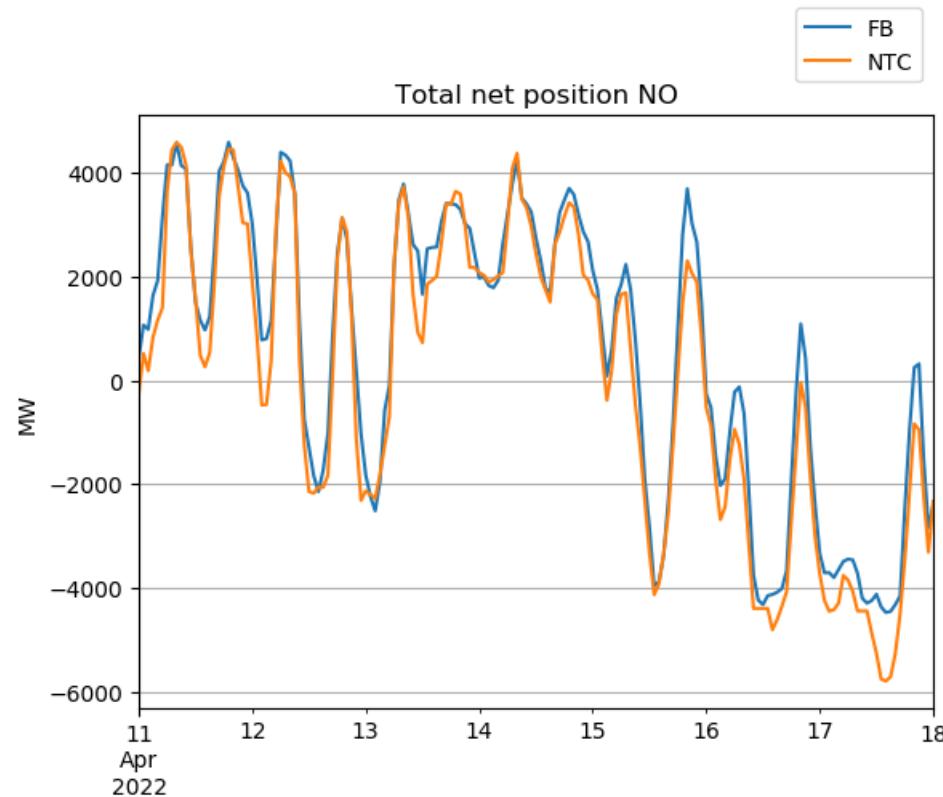


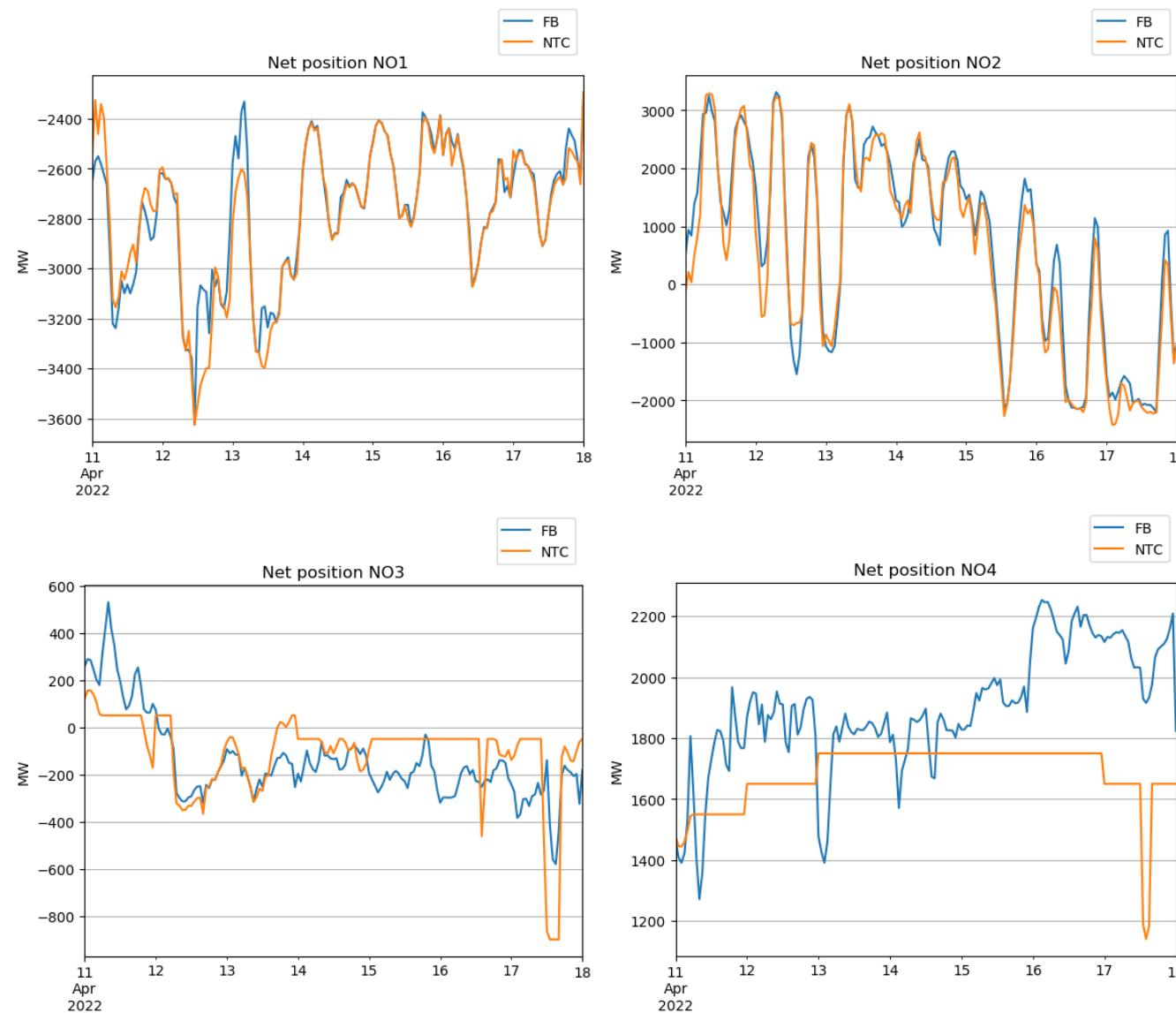
3.1.1.13 Finland

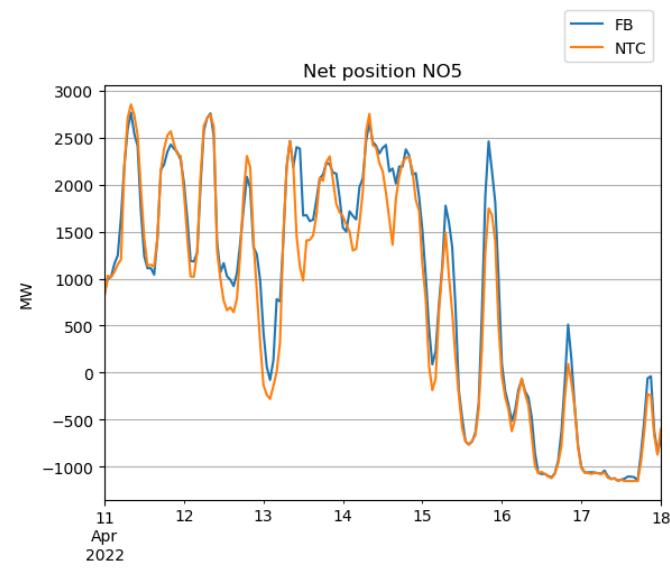
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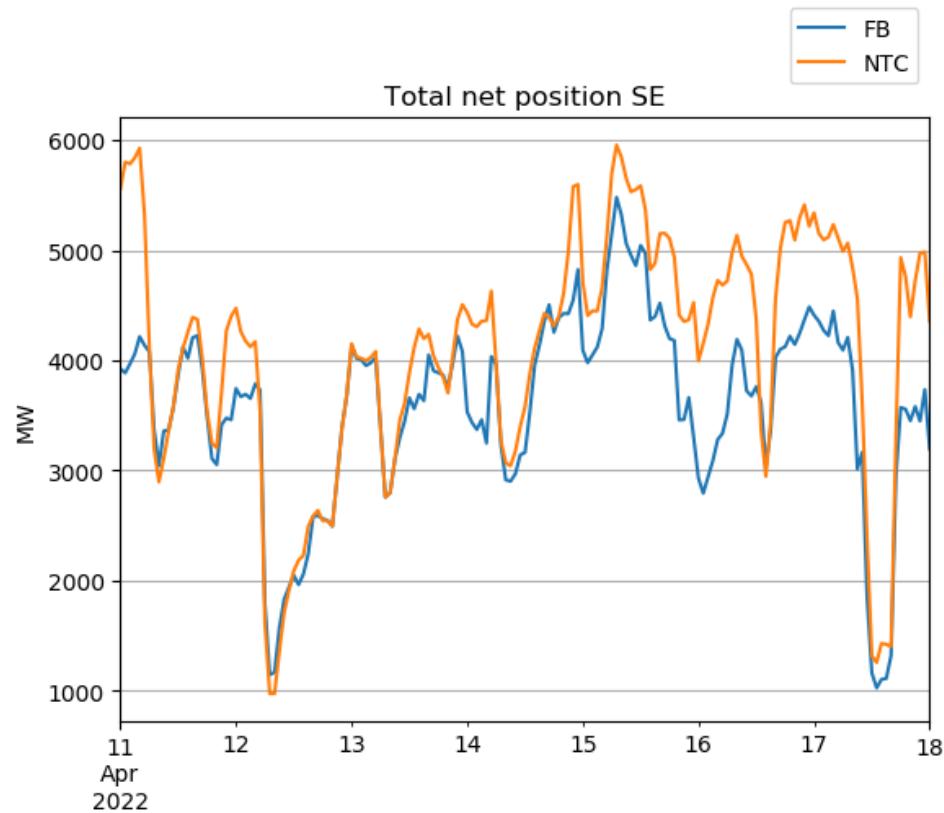
3.1.1.14 Norway

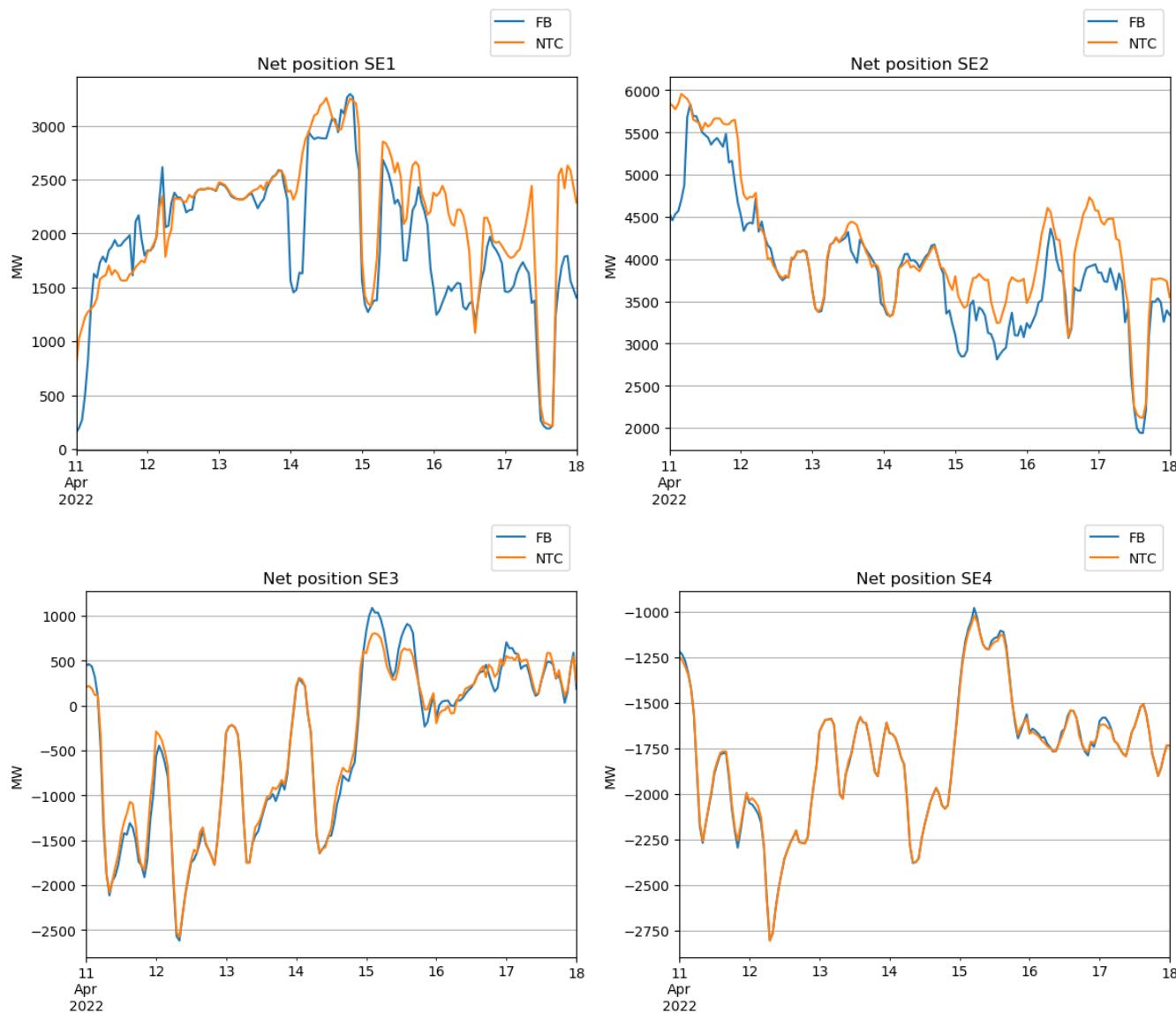




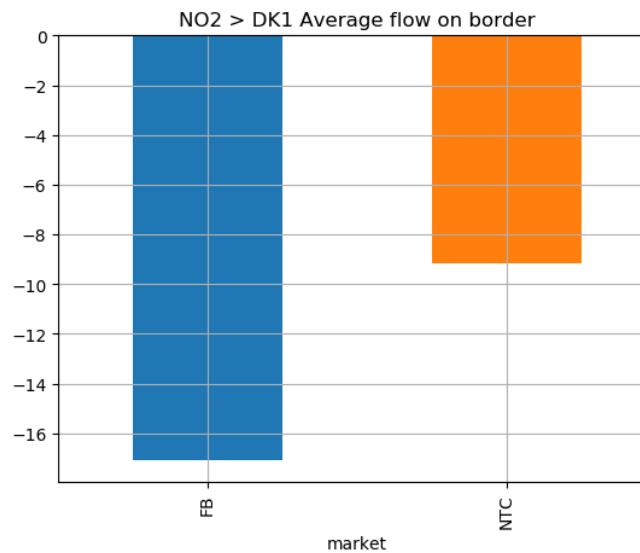
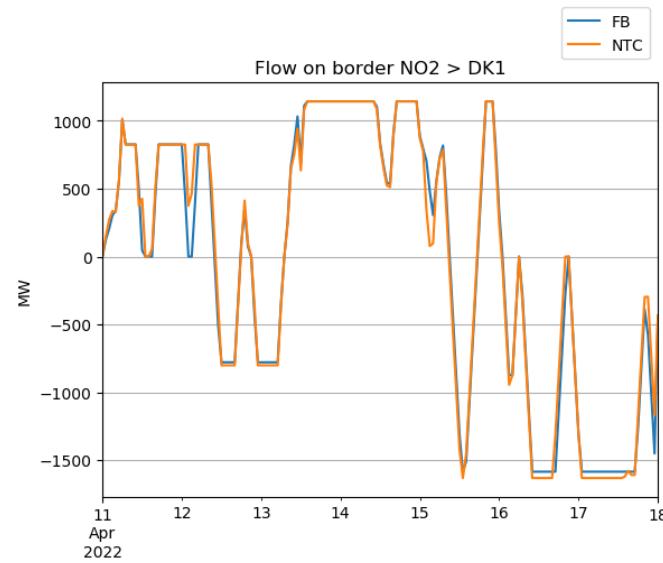
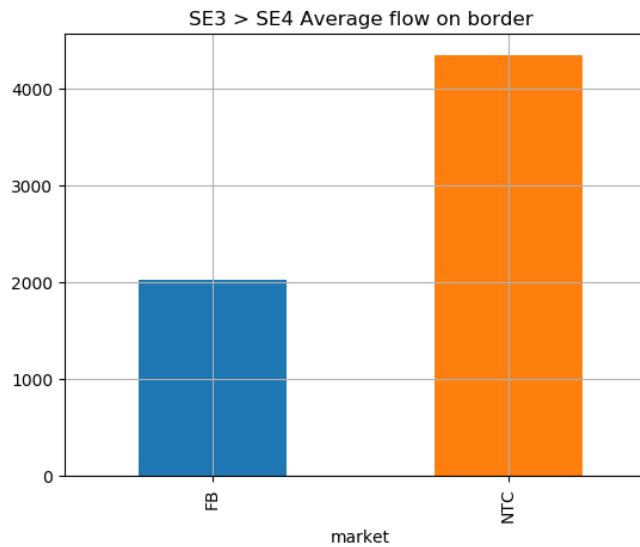
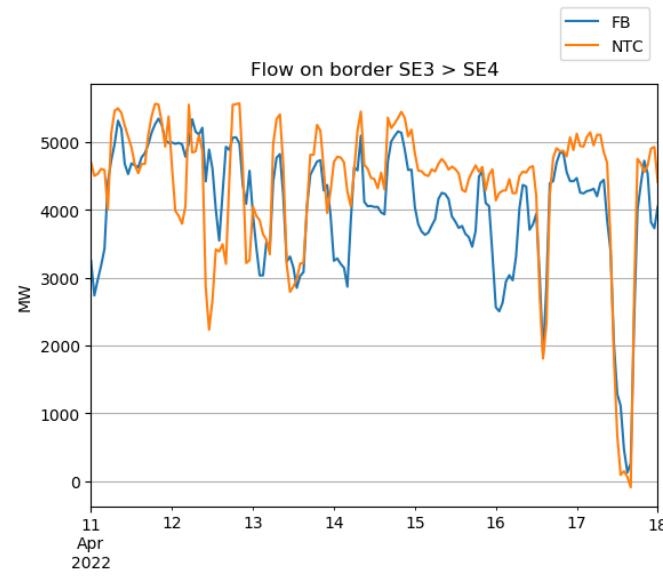


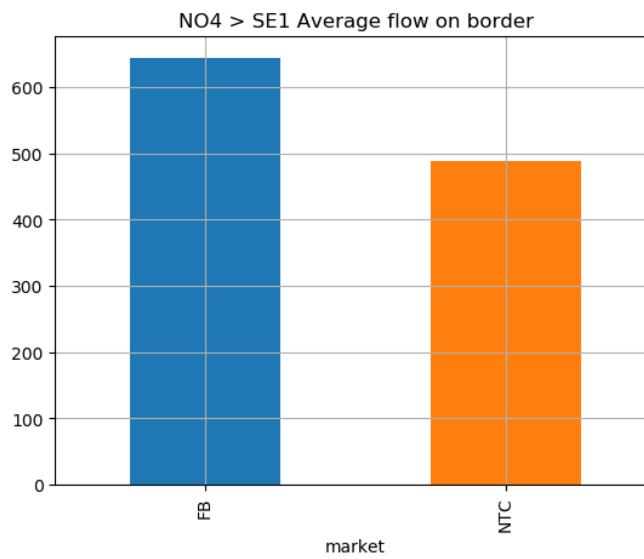
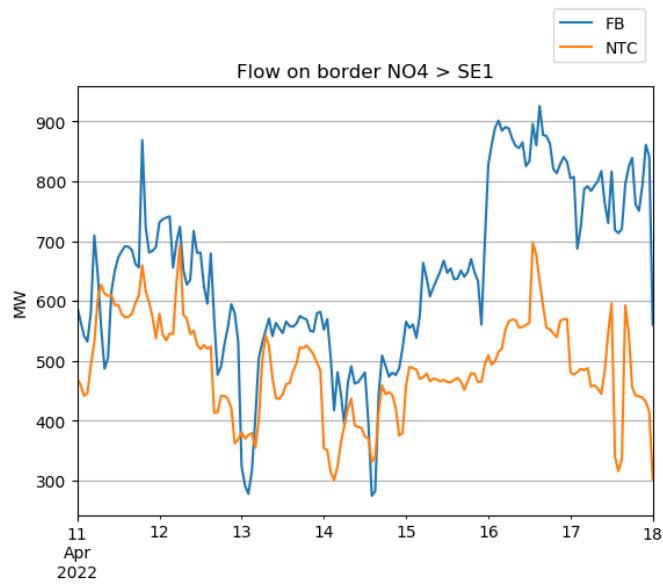
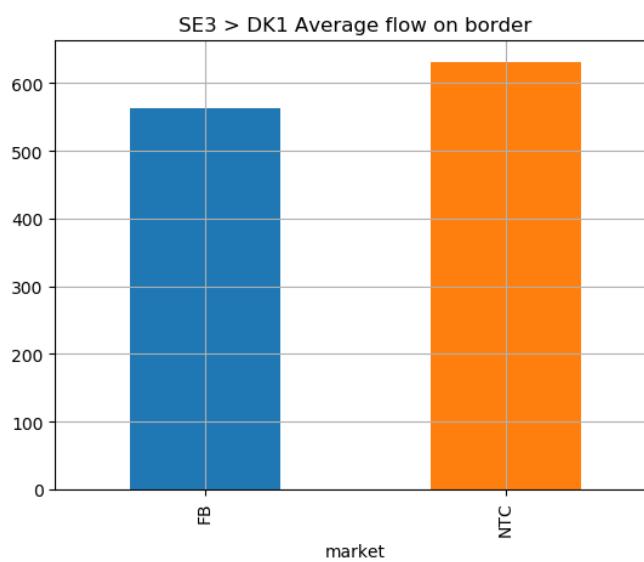
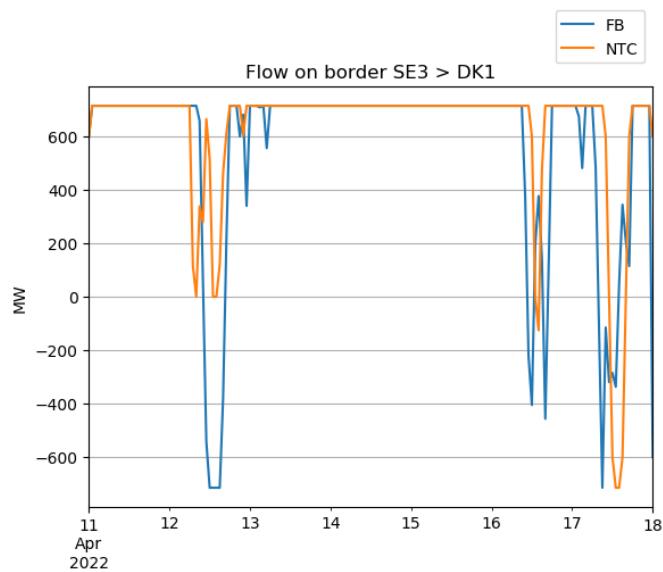
3.1.1.15 Sweden

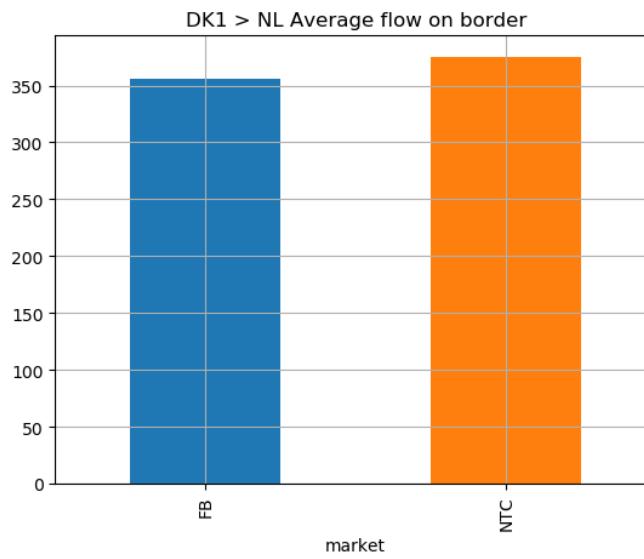
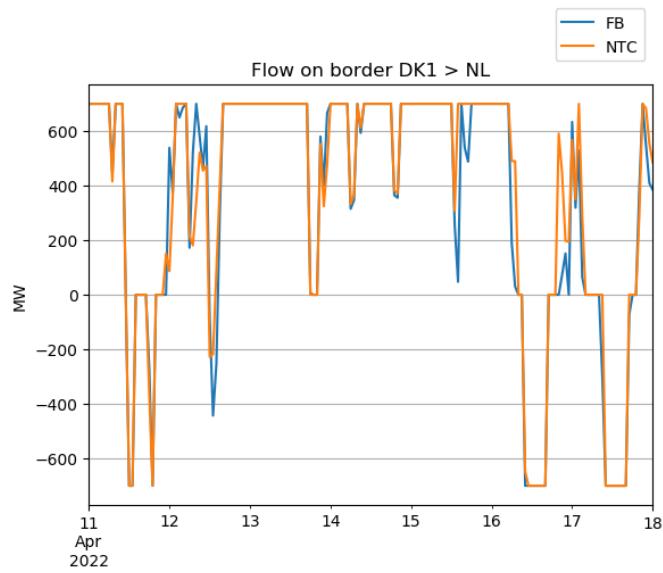
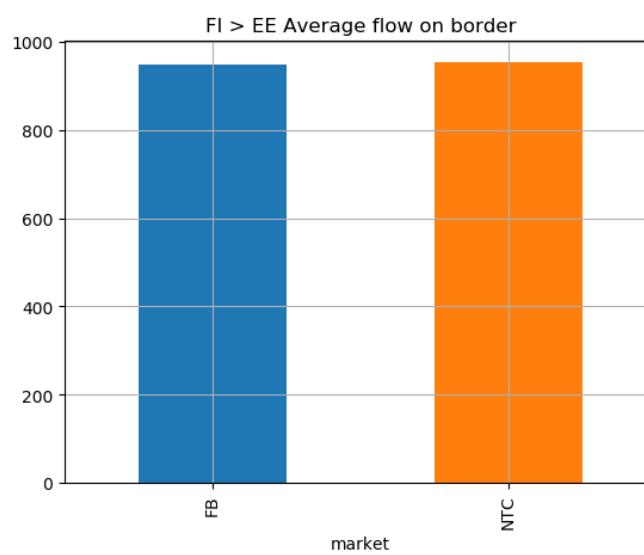
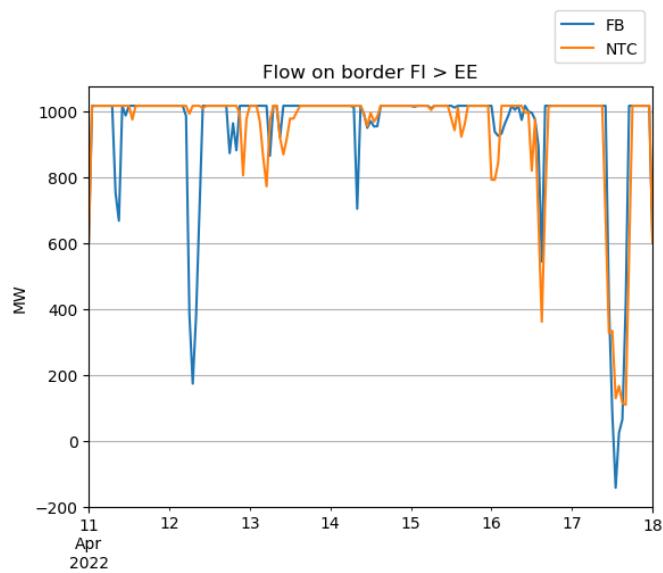


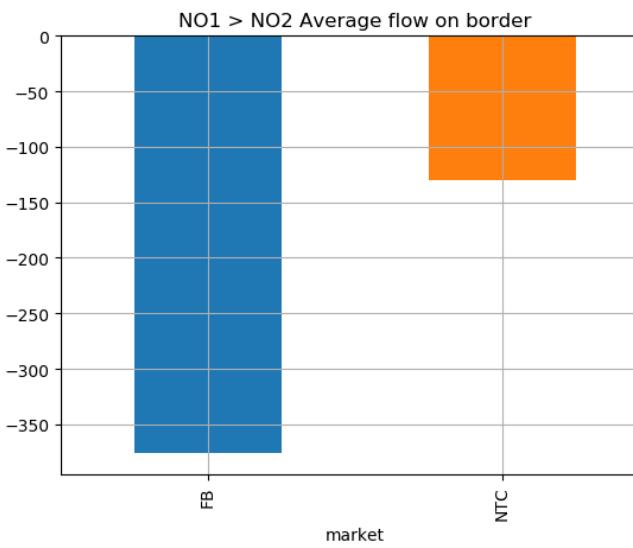
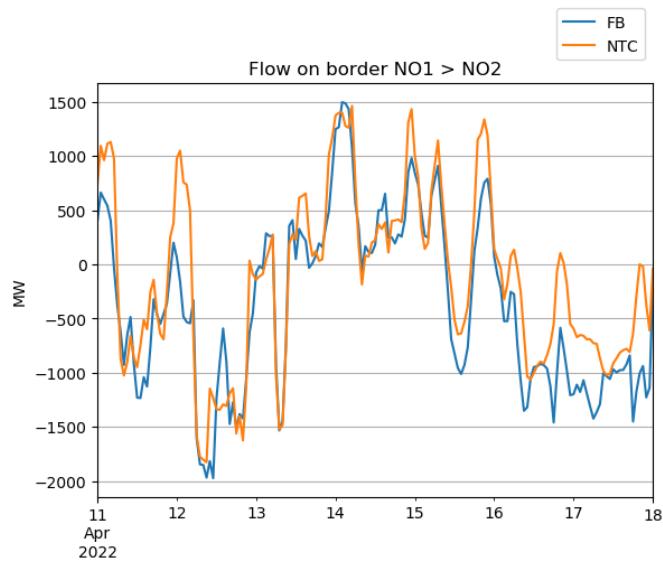
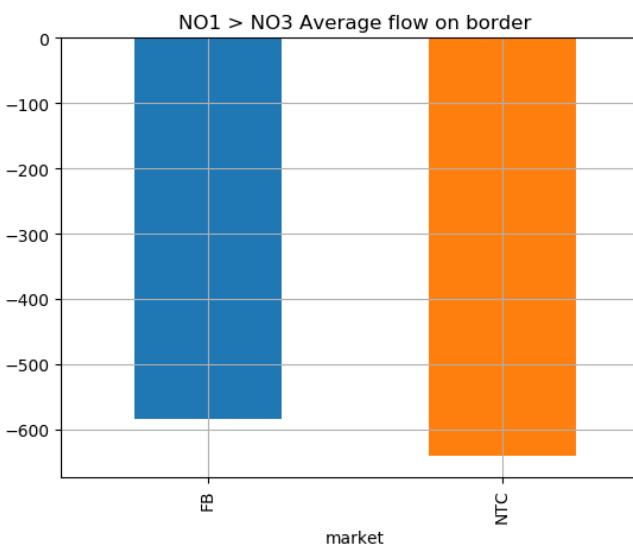
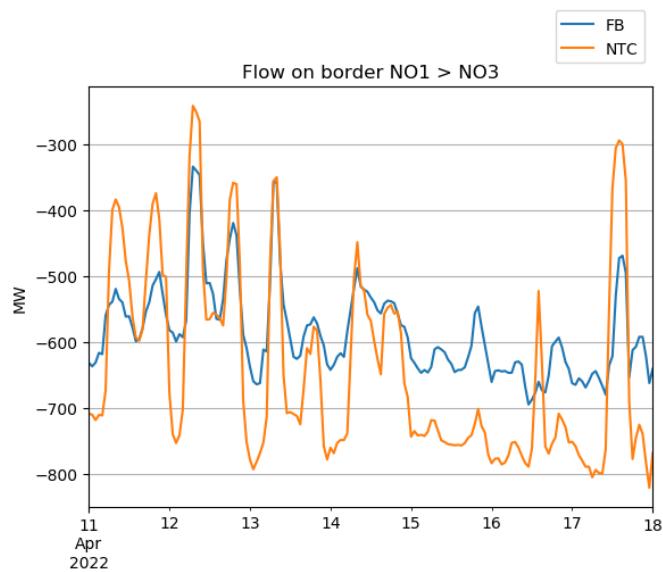


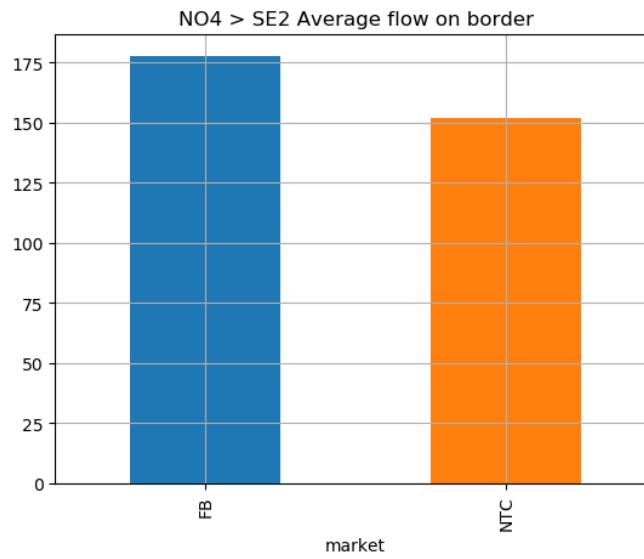
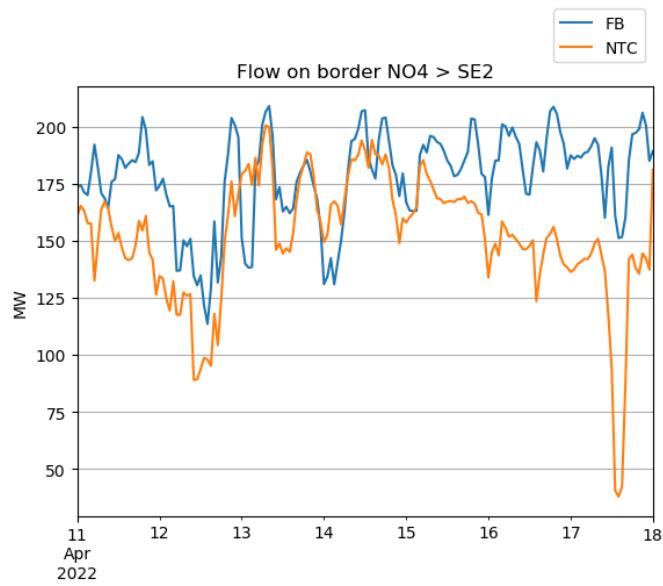
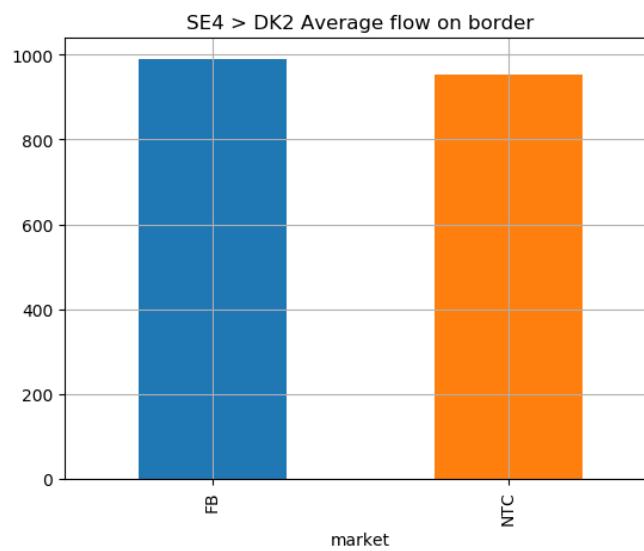
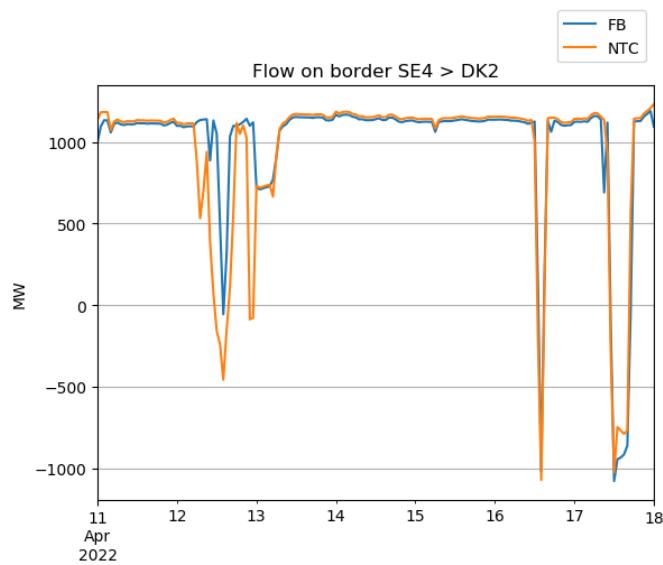
Border Flows

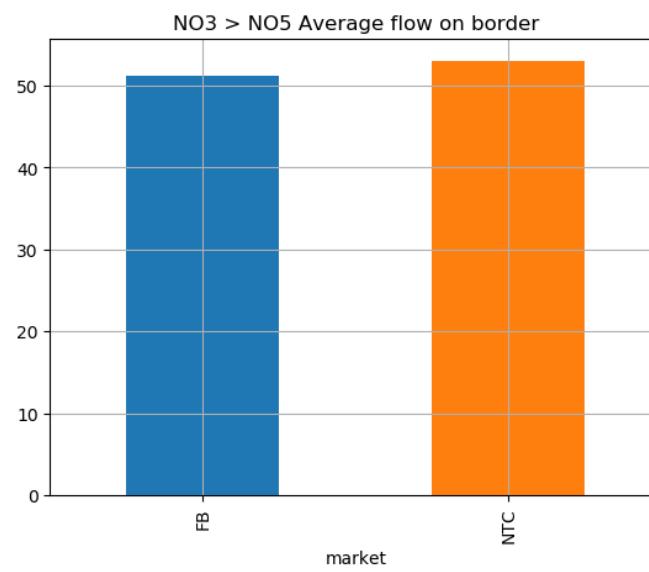
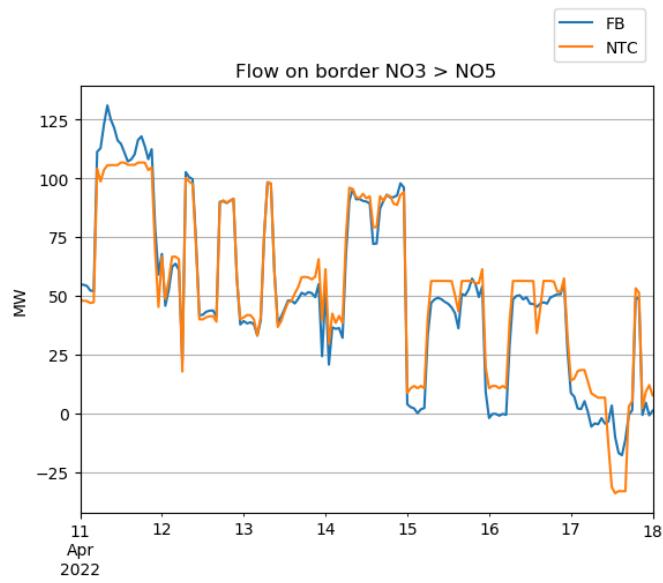
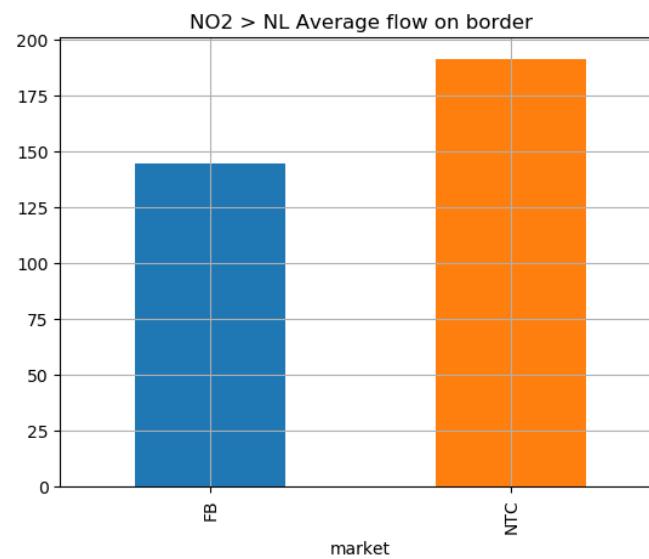
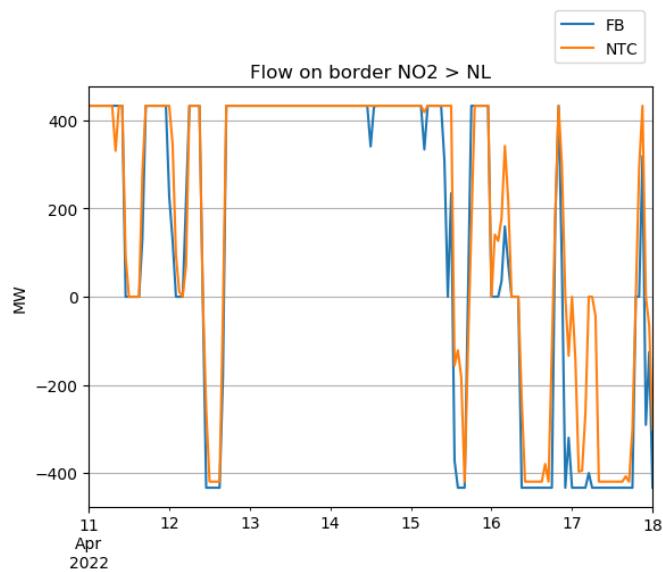


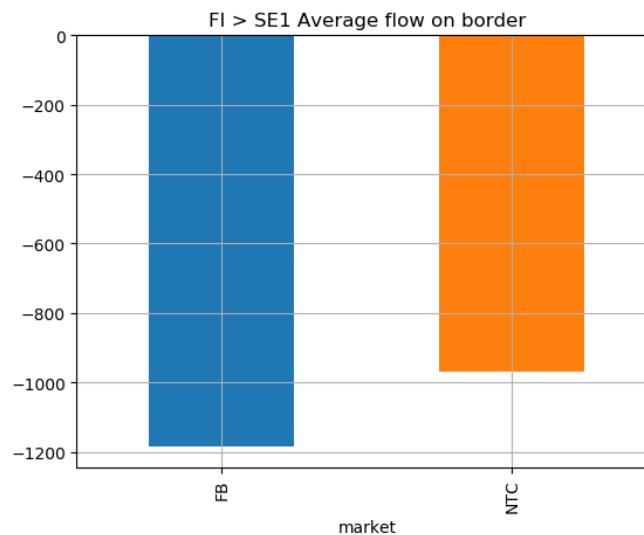
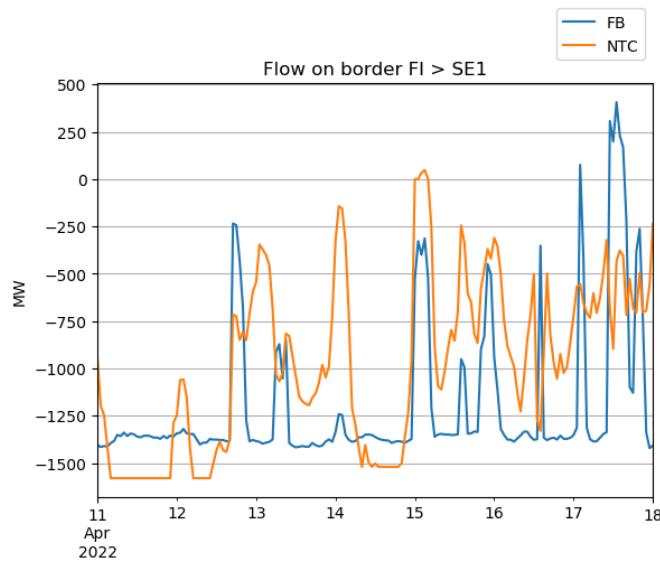
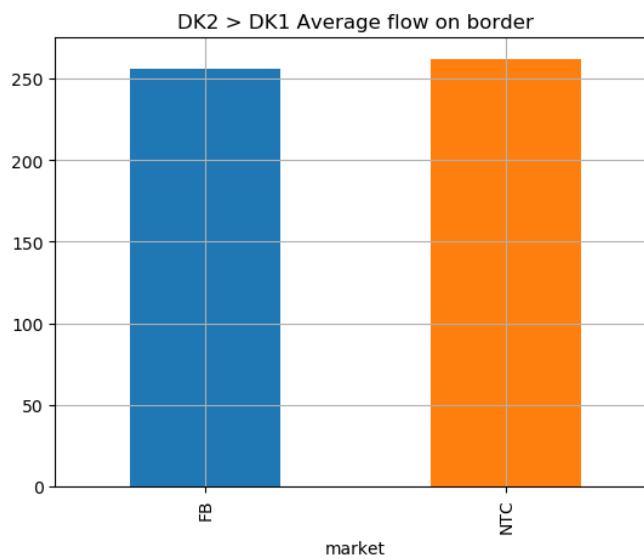
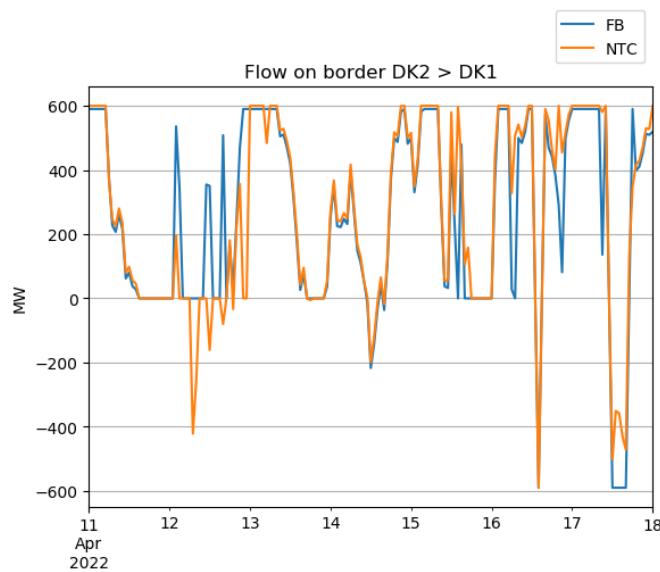


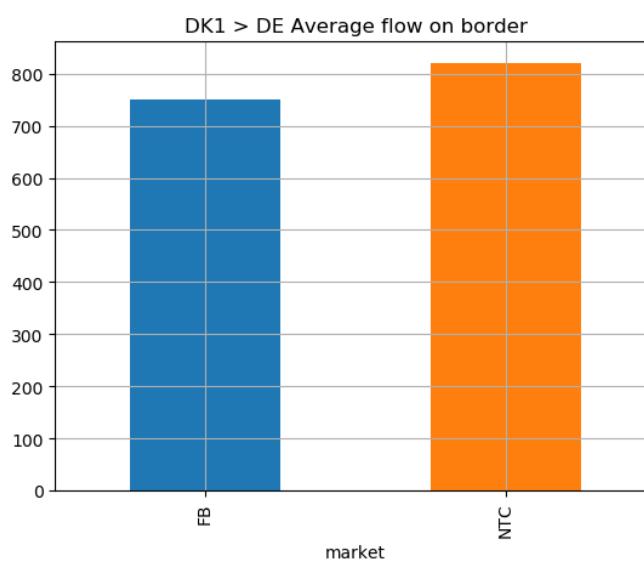
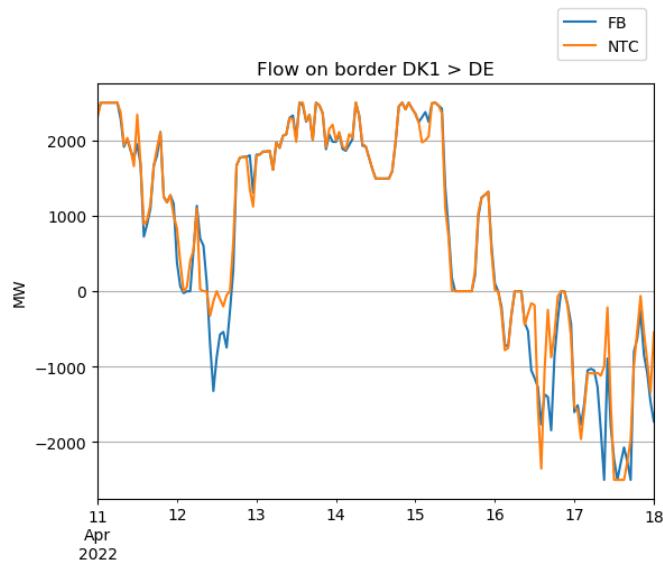
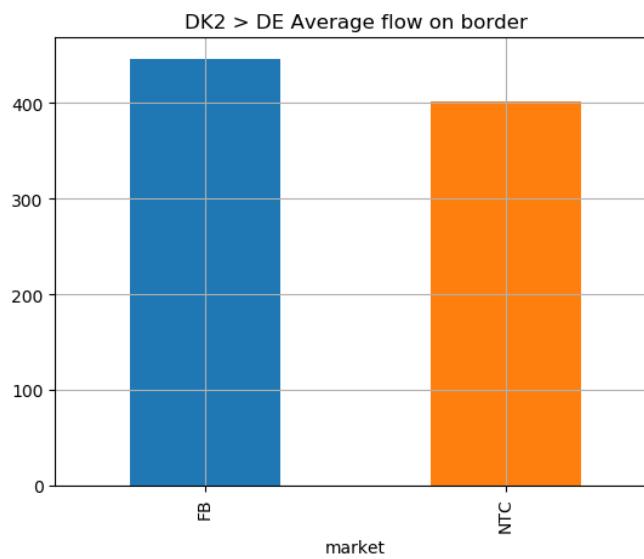
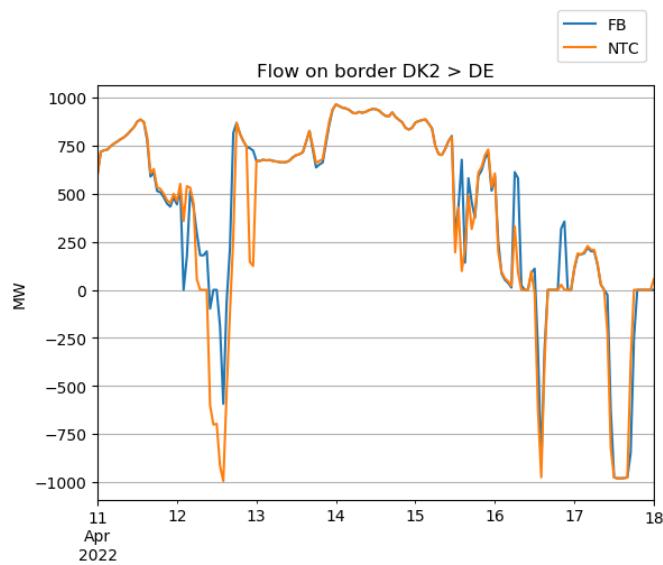


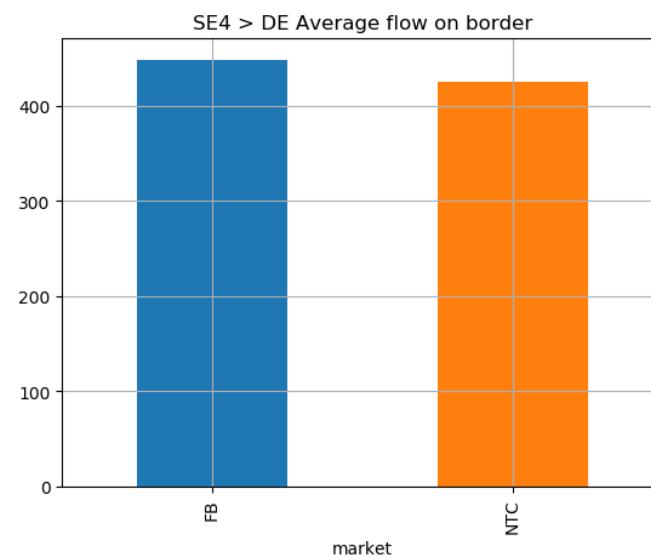
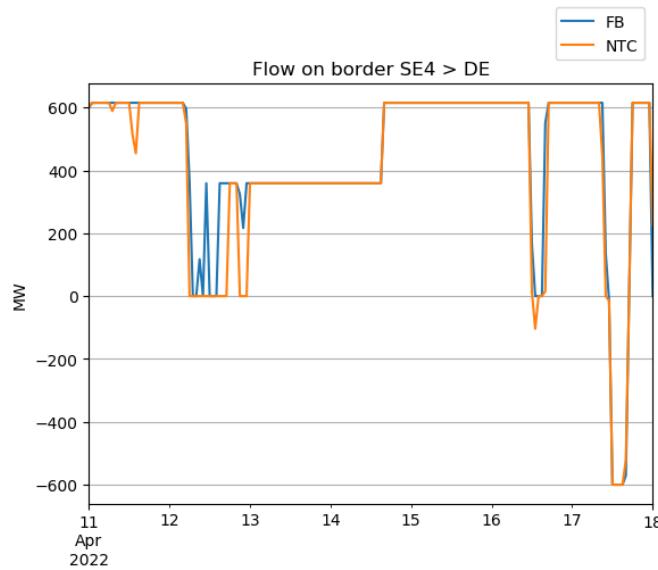
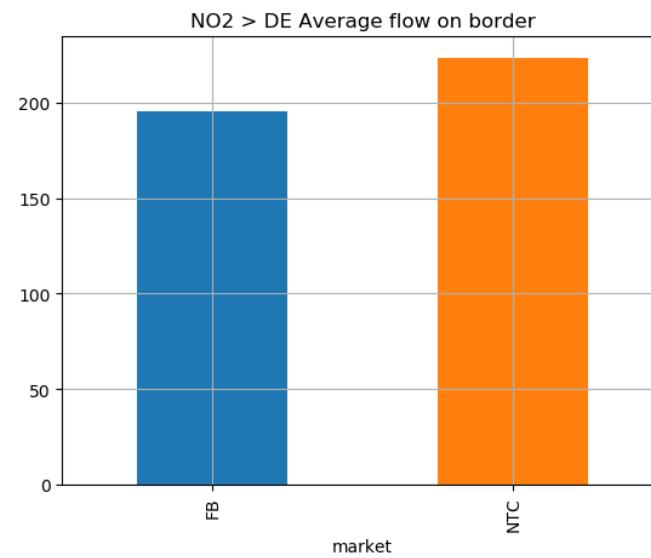
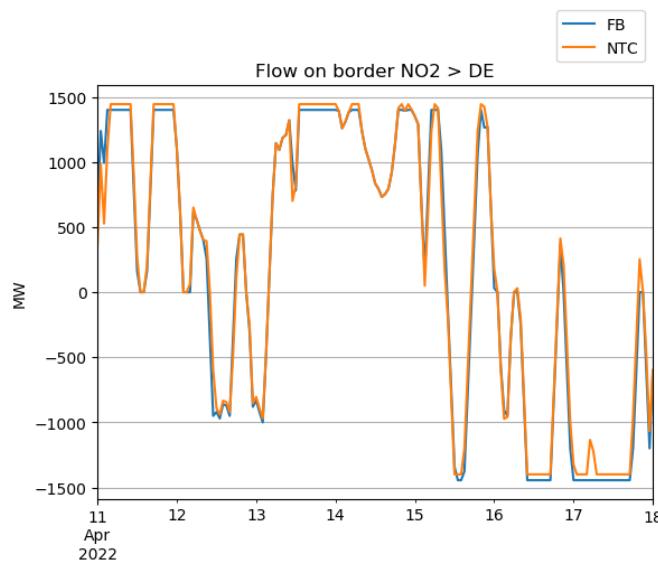


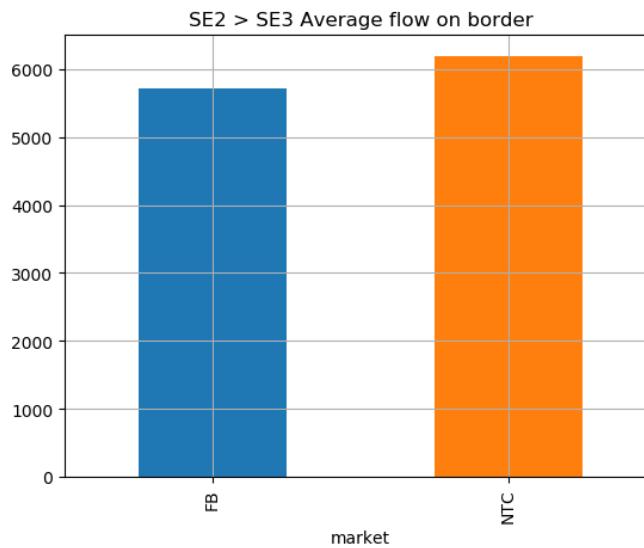
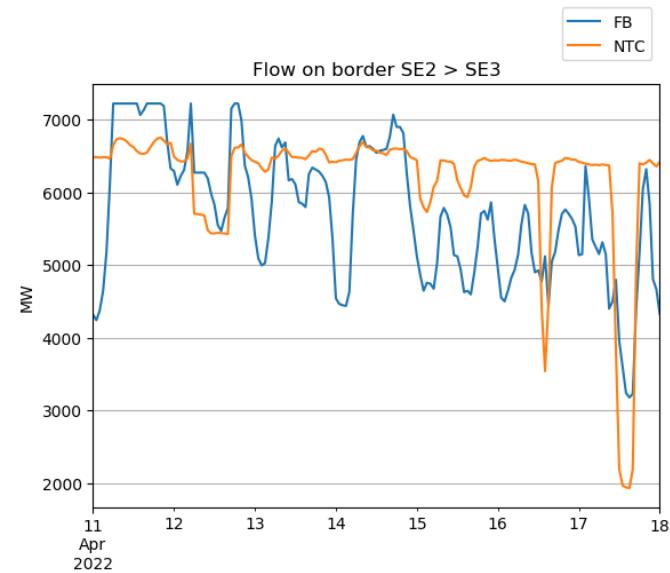
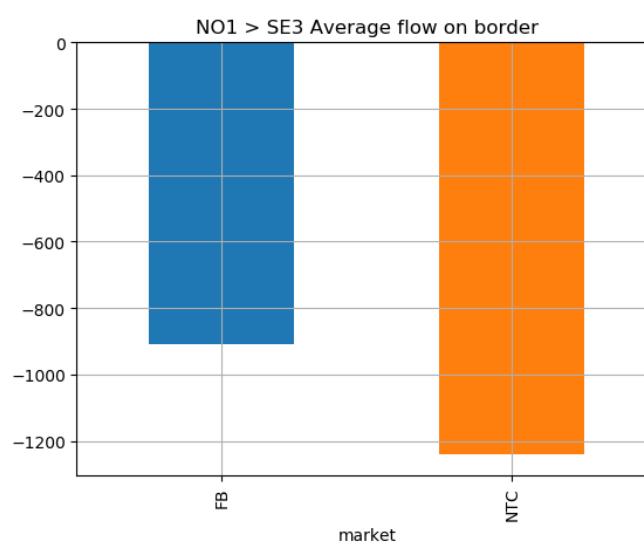
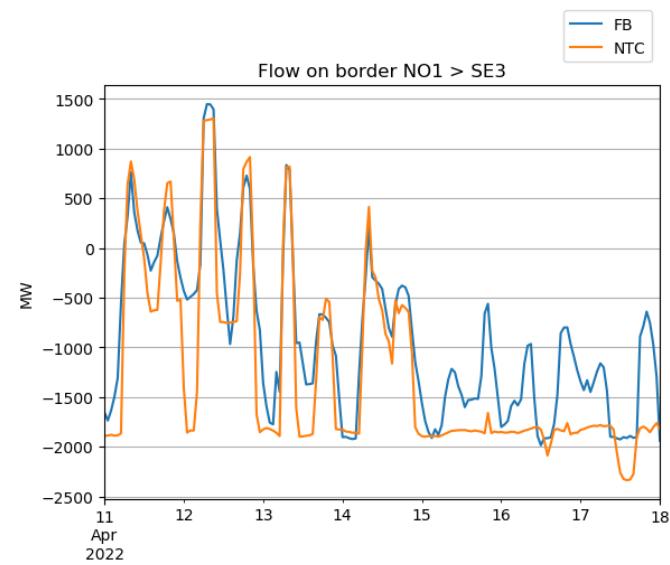


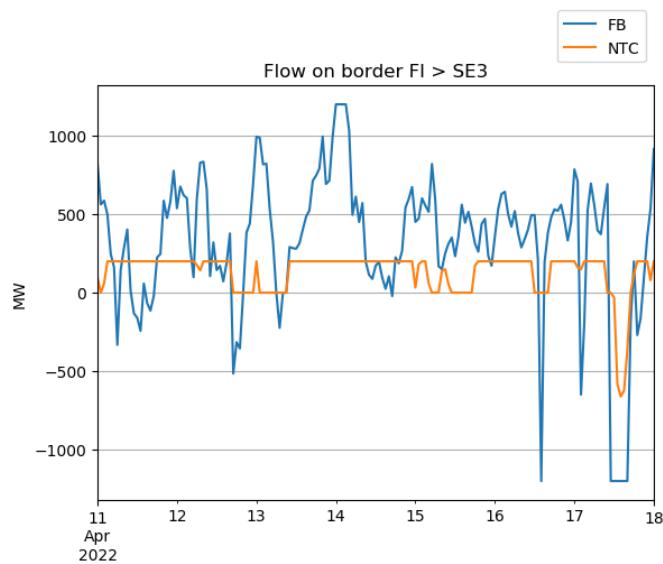




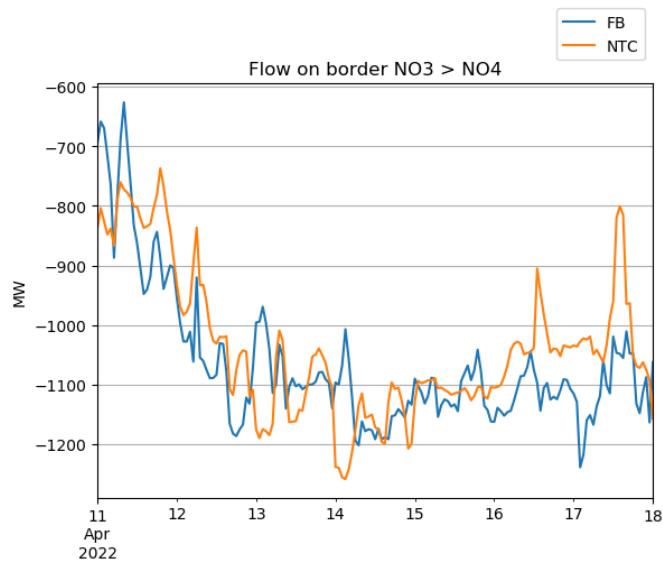
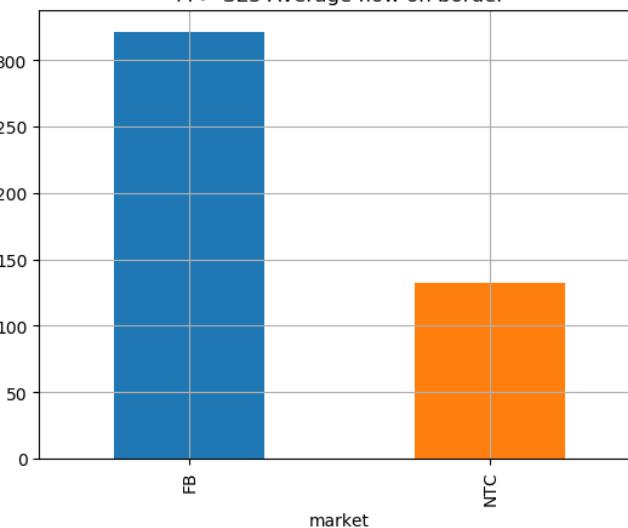








FI > SE3 Average flow on border



NO3 > NO4 Average flow on border

