

Nordic TSOs quarterly cross zonal capacity report

Quarter 4, 2019 - TSO version

Background and Purpose

Quarter 4, 2019

This quarterly report on cross-zonal transmission capacity is produced by the Nordic TSOs by the request of NordREG, an organization for the Nordic energy regulators.

The Nordic TSOs determine the capacity on each cross-zonal corridor every hour of the day. The purpose of this report is to provide the reader with information about

- the available cross-zonal capacity on corridors between the Nordic countries and between the Nordics and continental Europe, and
- the reasons why the cross-zonal capacity has been reduced in the cases where capacity has been reduced below a threshold of 75 % of max NTC as an average over the quarter

The report consists of

- an overview over all corridors,
- detailed information on each corridor with hourly values and
- description of reoccurring and/or significant capacity reductions

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Summary

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For all corridors (34 in total) the available capacity provided by the TSOs was 83% of max NTC as a weighted average, compared to the threshold of 75%.

For AC corridors (14 in total) the available capacity provided by the TSOs was 79% of max NTC as a weighted average, compared to the threshold of 75%.

For DC corridors (20 in total) the available capacity provided by the TSOs was 86% of max NTC as a weighted average, compared to the threshold of 75%.

The number of corridors under 75% was 9. The corridor(s) with the lowest average available capacity compared to Max NTC was NO2-DK1, with 40%.

Weekly day ahead capacities for all corridors – as a percentage of max NTC

Quarter 4, 2019

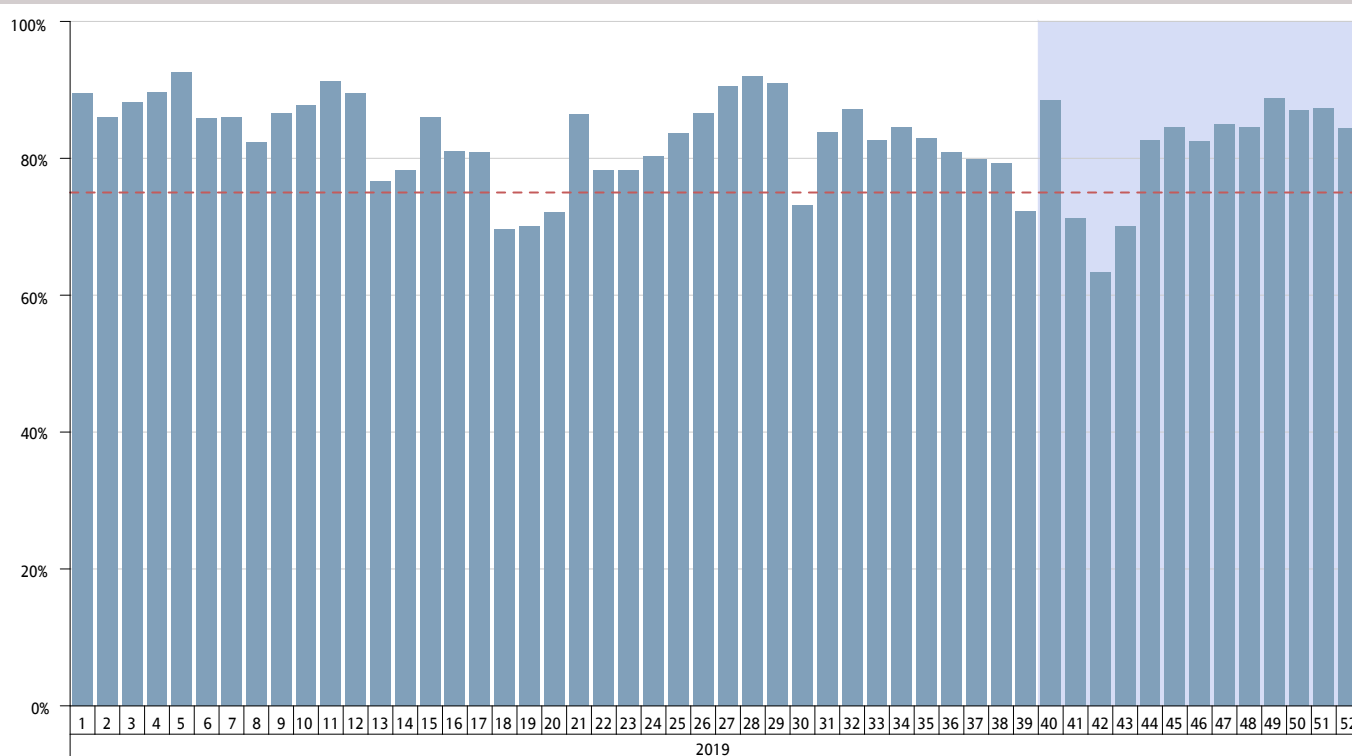


Figure 1: Cross-zonal day-ahead capacity result for all corridors, showing average weekly capacity given as a percentage of max NTC. The capacity is summed independent of direction.

Overall quarterly day ahead capacities and flows – percent of max NTC - AC

Quarter 4, 2019

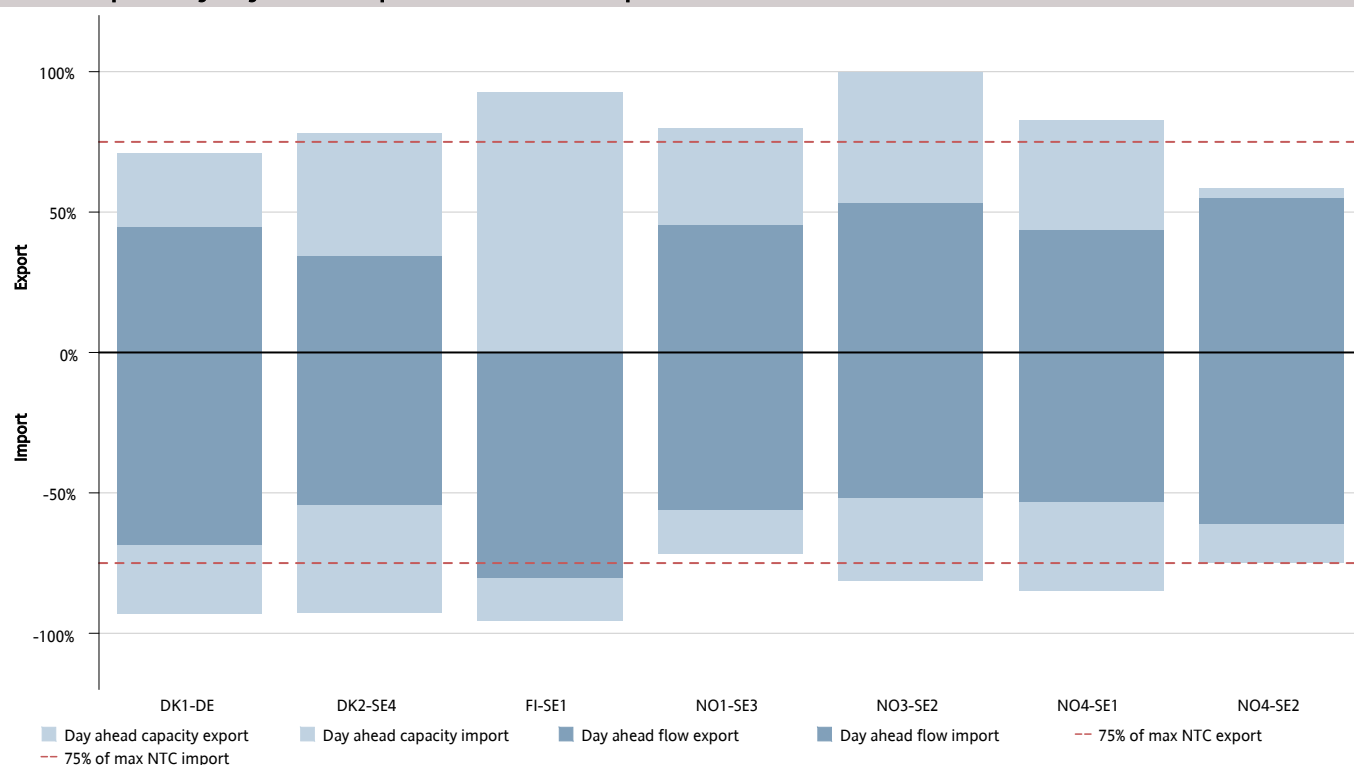


Figure 2: Cross-zonal day-ahead capacity result for AC corridors, showing average capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. For a corridor A-B, export means flow from A to B and import means flow from B to A.

Overall quarterly day ahead capacities and flows – percent of max NTC - DC

Quarter 4, 2019

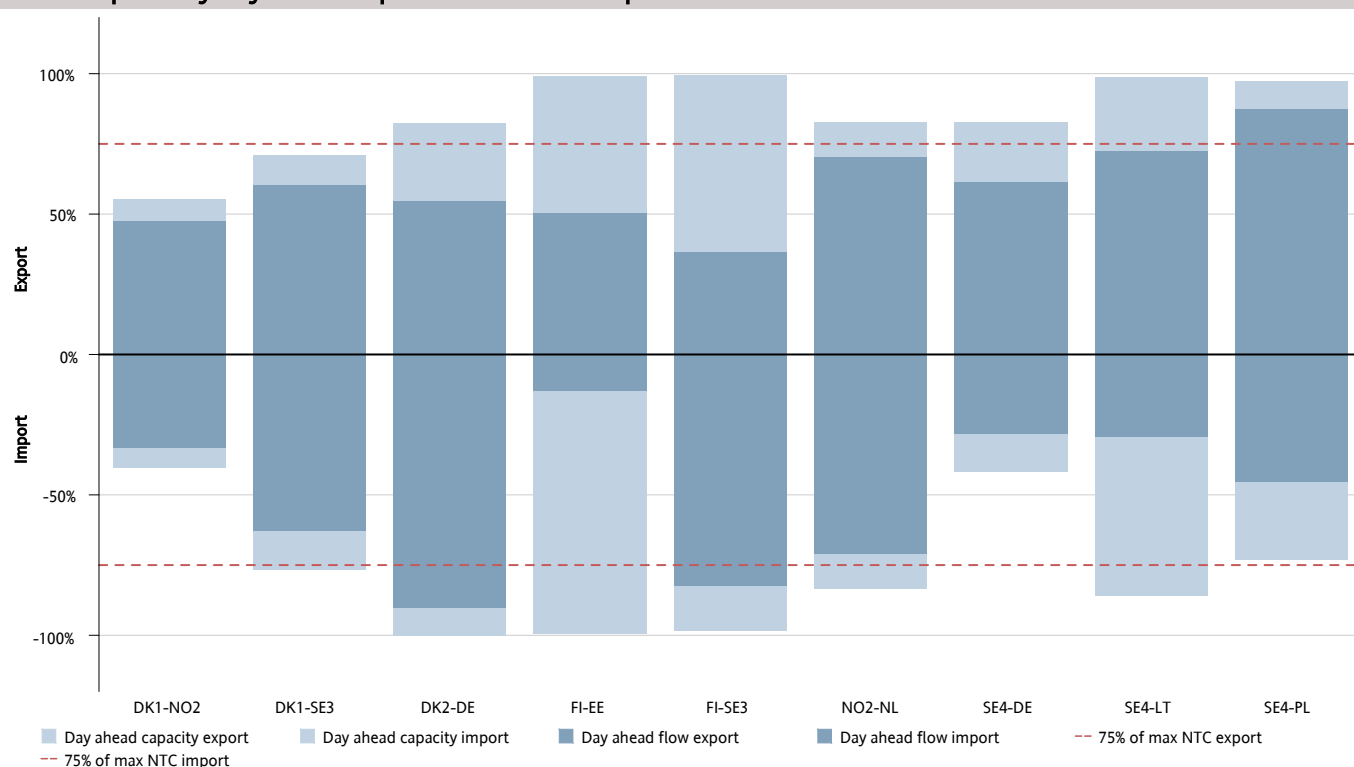


Figure 3: Cross-zonal day-ahead capacity result for DC corridors, showing average capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. For a corridor A-B, export means flow from A to B and import means flow from B to A.

Overall quarterly day ahead capacities and flows - MW - AC

Quarter 4, 2019

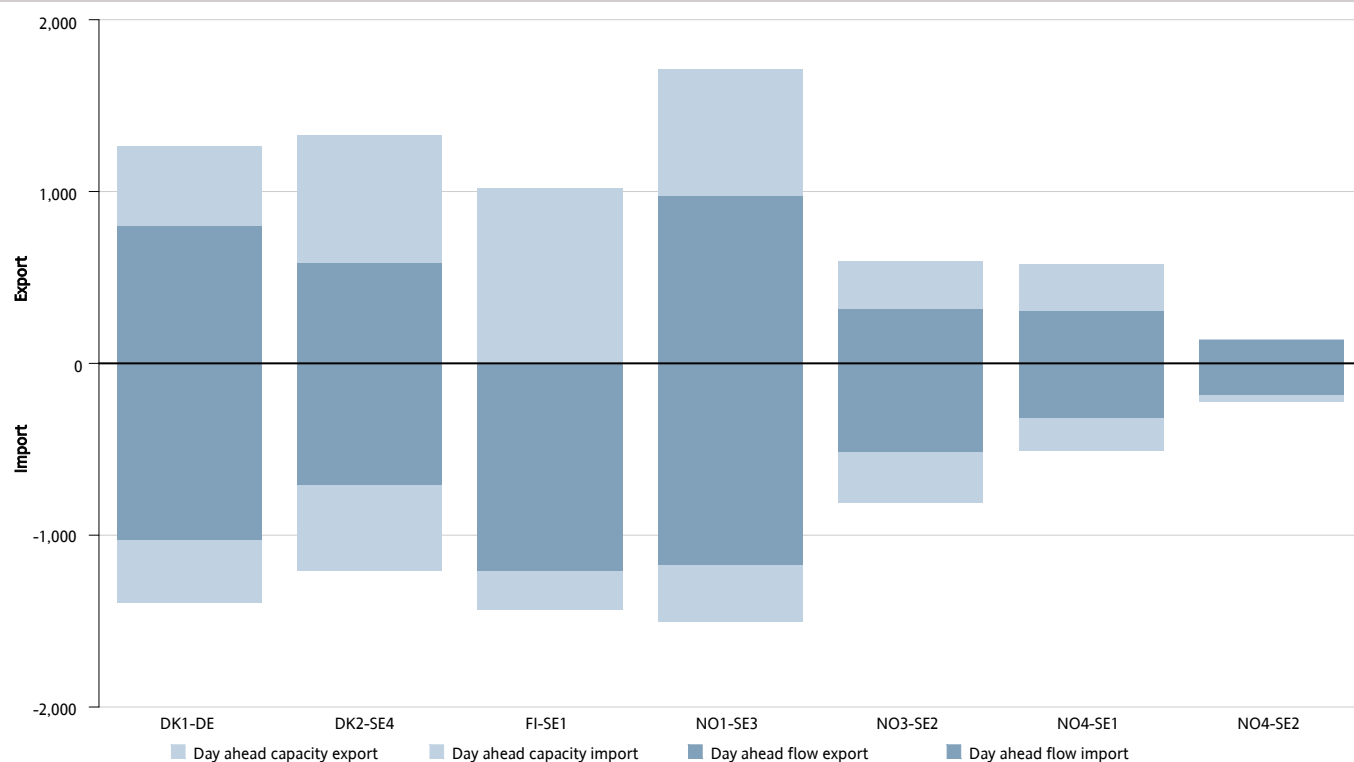


Figure 4: Cross-zonal day-ahead capacity result for AC corridors, showing average capacity given and flow in MW. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. For a corridor A-B, export means flow from A to B and import means flow from B to A.

Overall quarterly day ahead capacities and flows - MW - DC

Quarter 4, 2019

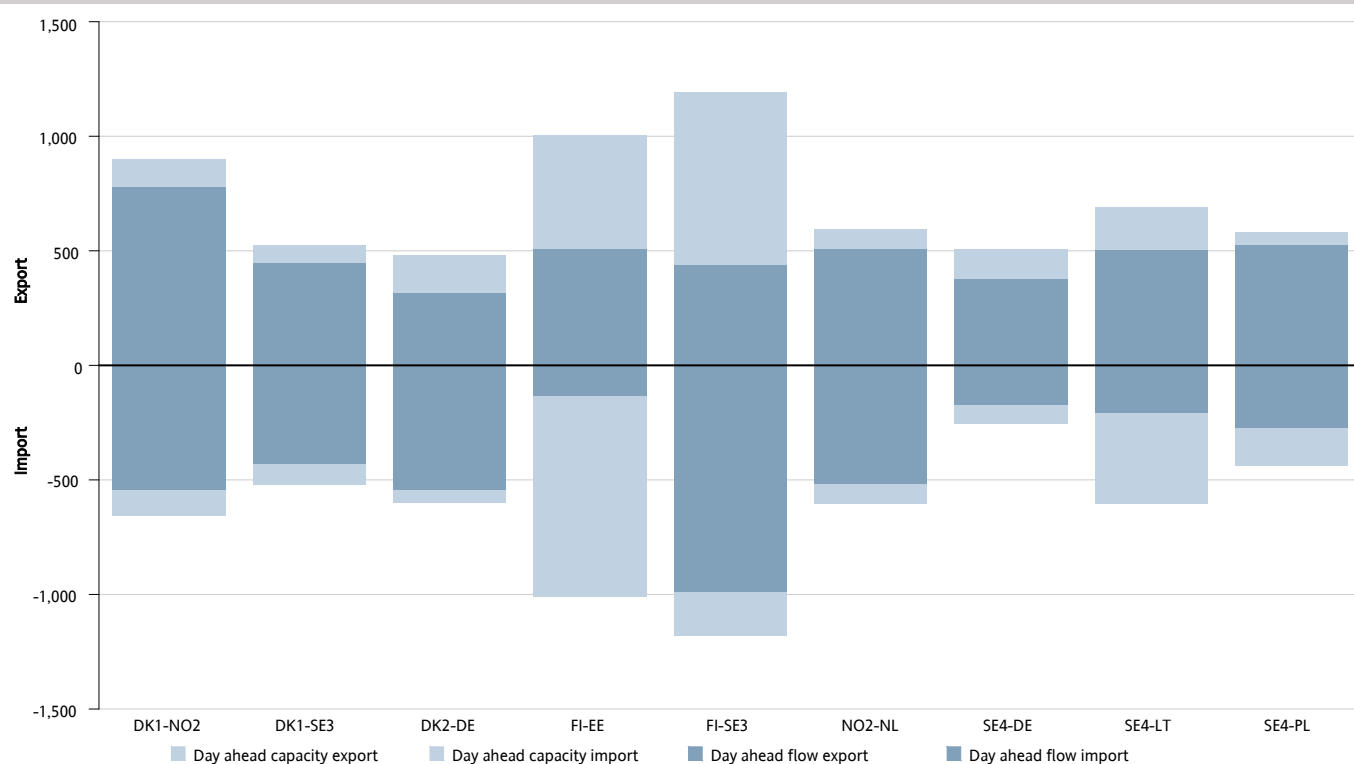


Figure 5: Cross-zonal day-ahead capacity result for DC corridors, showing average capacity given and flow in MW. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. For a corridor A-B, export means flow from A to B and import means flow from B to A.

Percentage of time where capacity is larger than 75% of max NTC - AC

Quarter 4, 2019

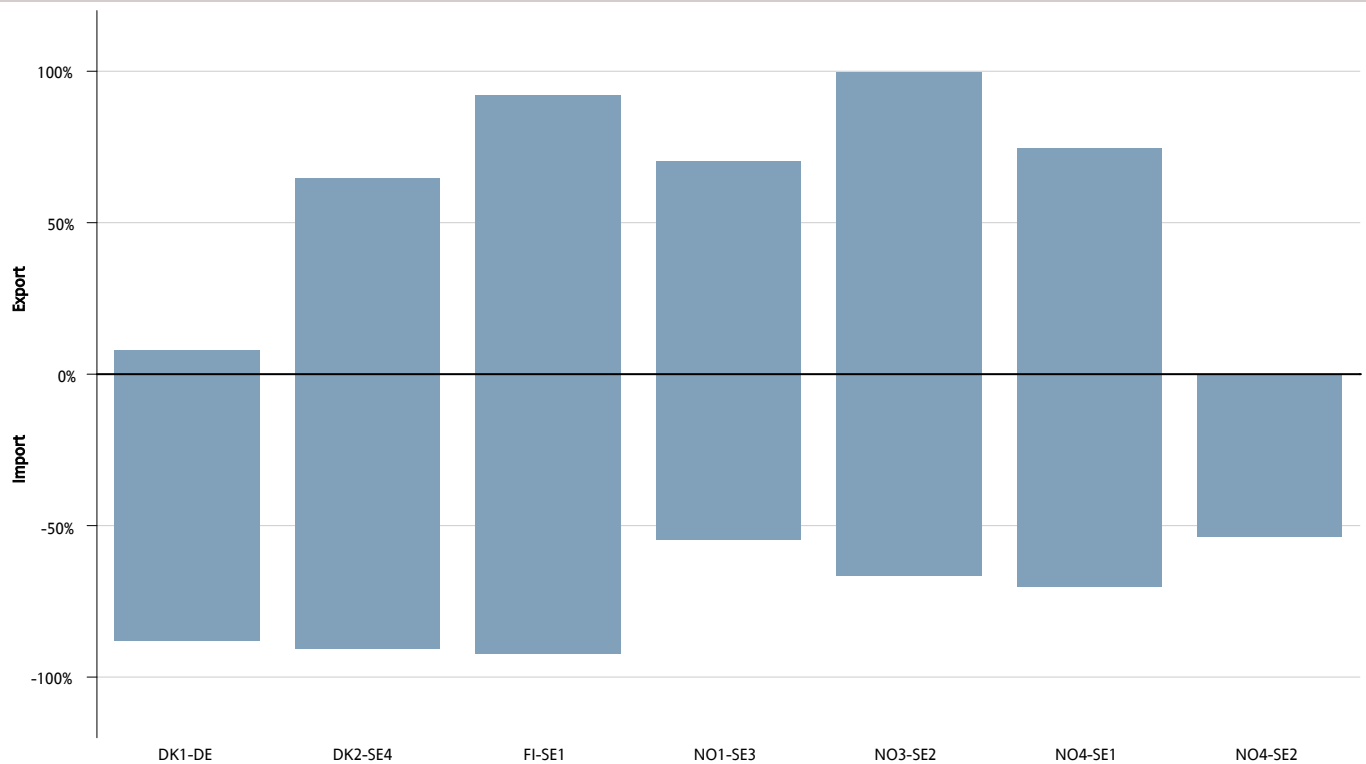


Figure 6: Shows the percentage of hours when the day-ahead capacity for AC corridors given to the energy marked is above 75% of the max NTC. For a corridor A-B, export means flow from A to B and import means flow from B to A.

Percentage of time where capacity is larger than 75% of max NTC - DC

Quarter 4, 2019

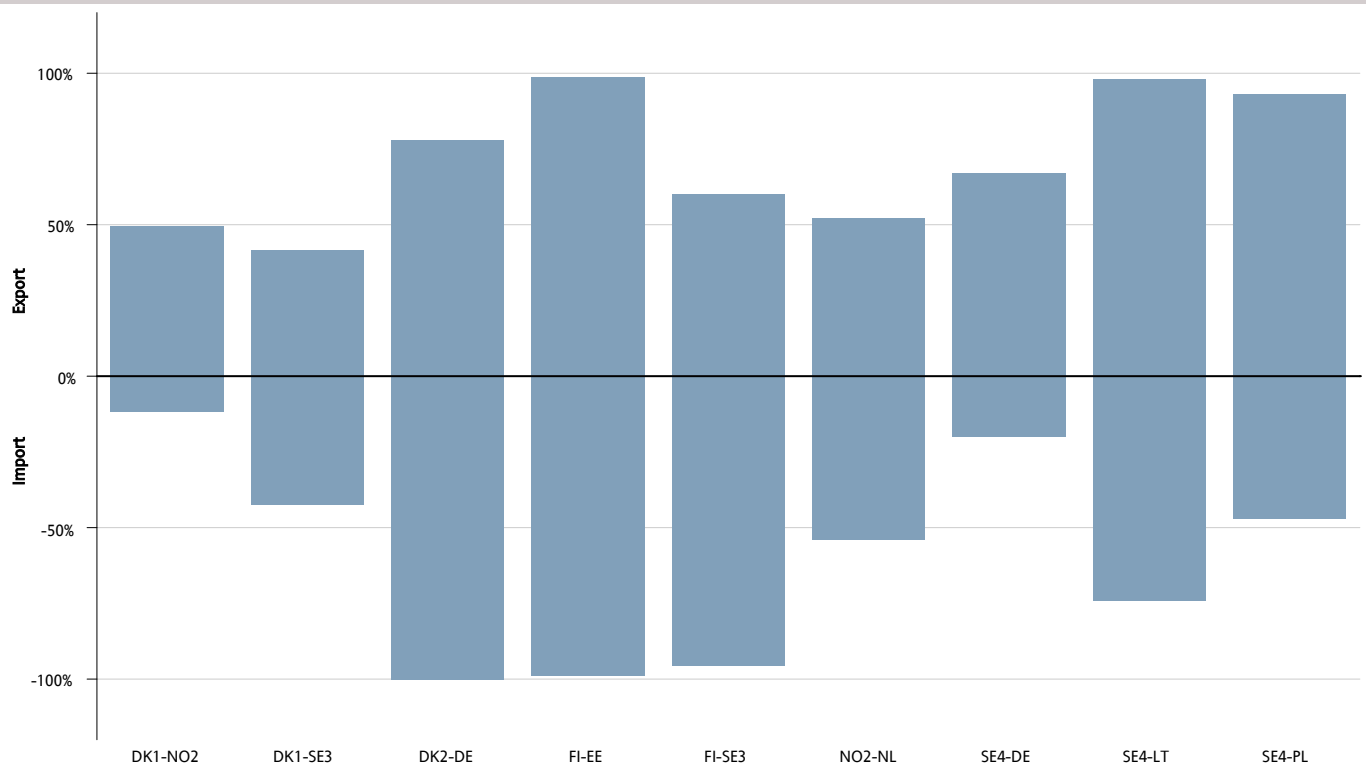


Figure 7: Shows the percentage of hours when the day-ahead capacity for DC corridors given to the energy marked is above 75% of the max NTC. For a corridor A-B, export means flow from A to B and import means flow from B to A.

DK1-DE: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

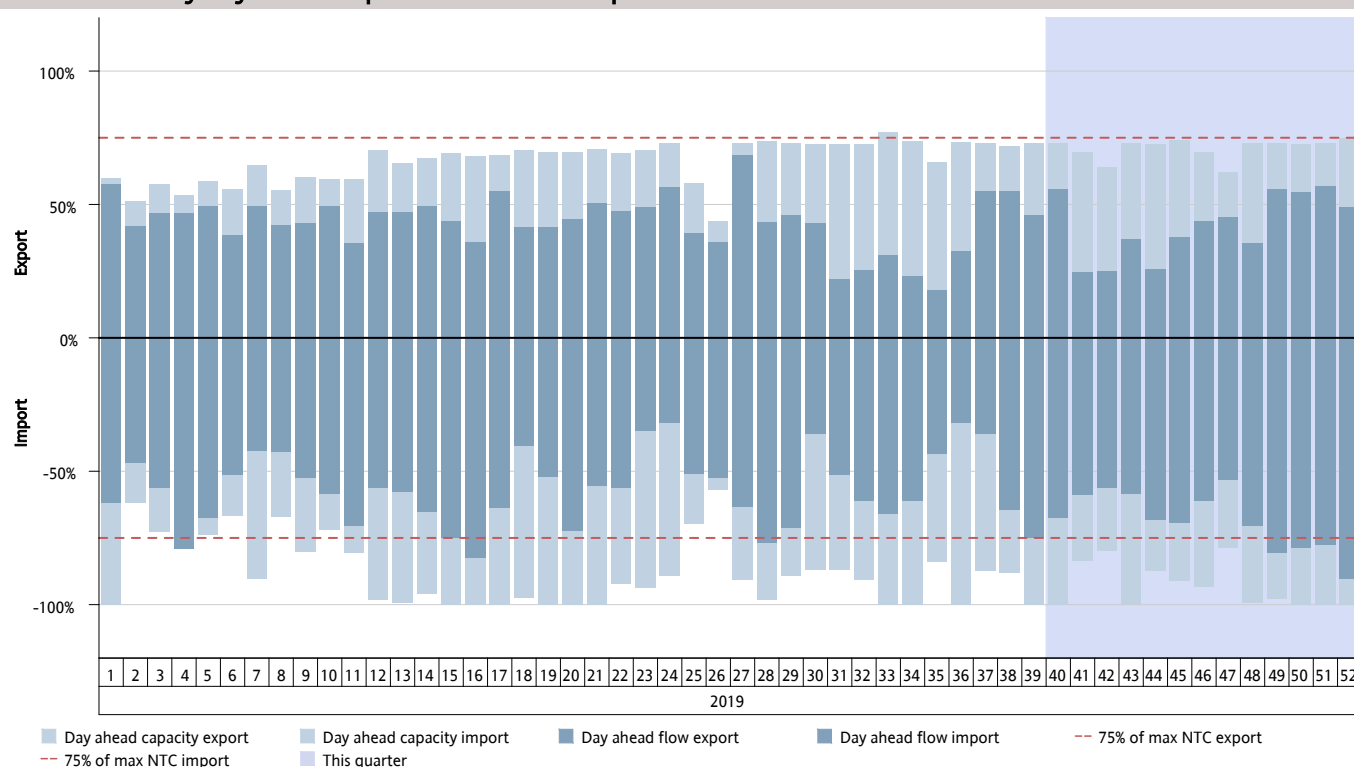


Figure 8: Shows cross-zonal day-ahead capacity result for the AC corridor DK1-DE, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK1 to DE, while import indicates flow from DE to DK1.

DK1-DE: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

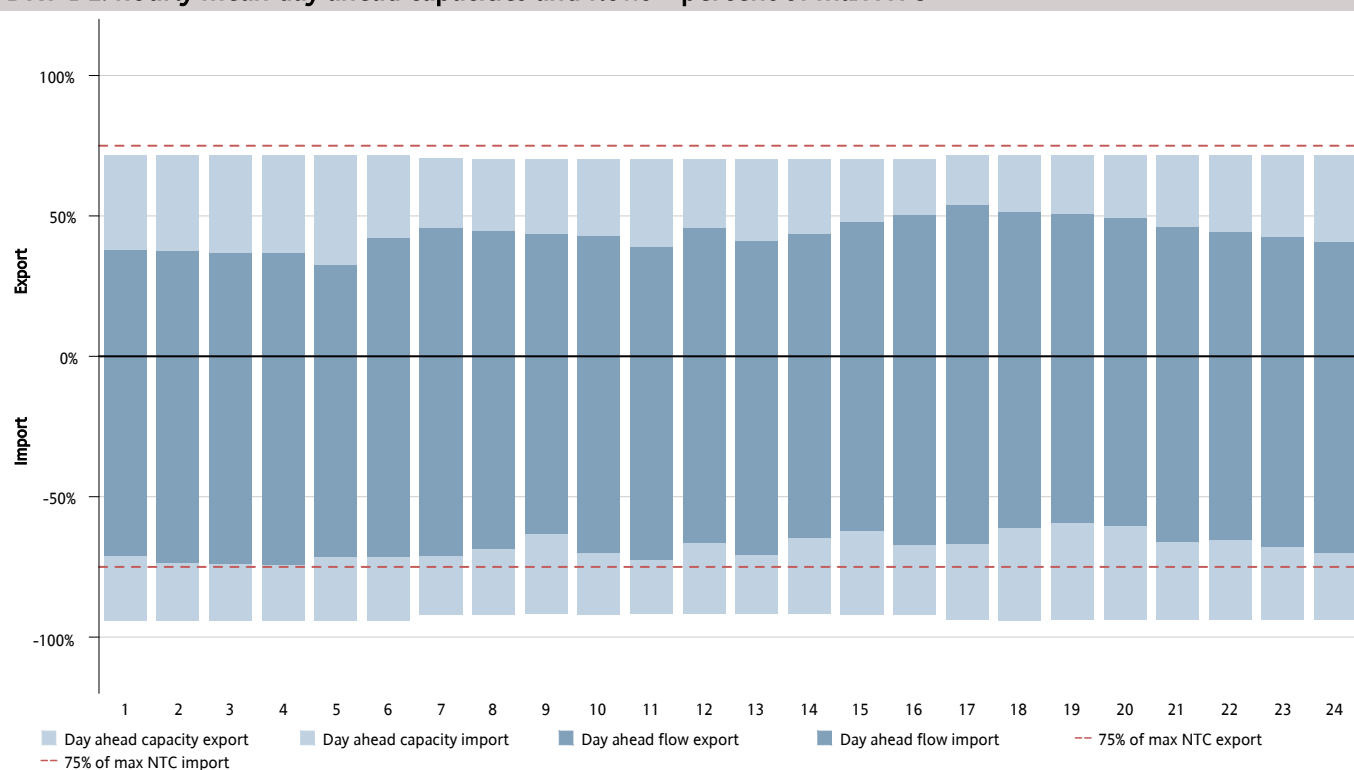


Figure 9: Shows cross-zonal day-ahead capacity result for the AC corridor DK1-DE, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK1 to DE, while import indicates flow from DE to DK1.

DK1-DE: hourly day ahead capacities and flows – MW

Quarter 4, 2019

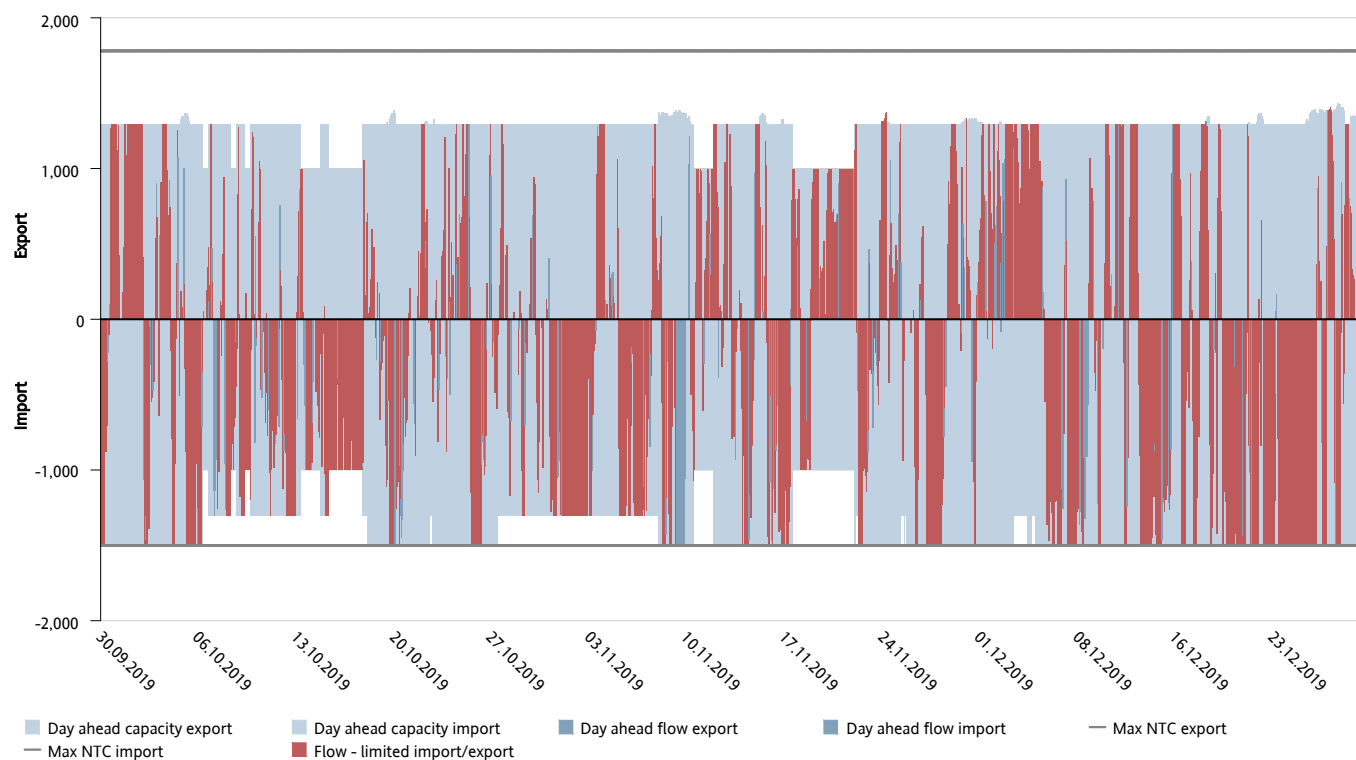


Figure 10: Shows cross-zonal day-ahead capacity result for the AC corridor DK1-DE, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK1 to DE, while import indicates flow from DE to DK1.

DK1-DE: price comparison in EUR

Quarter 4, 2019

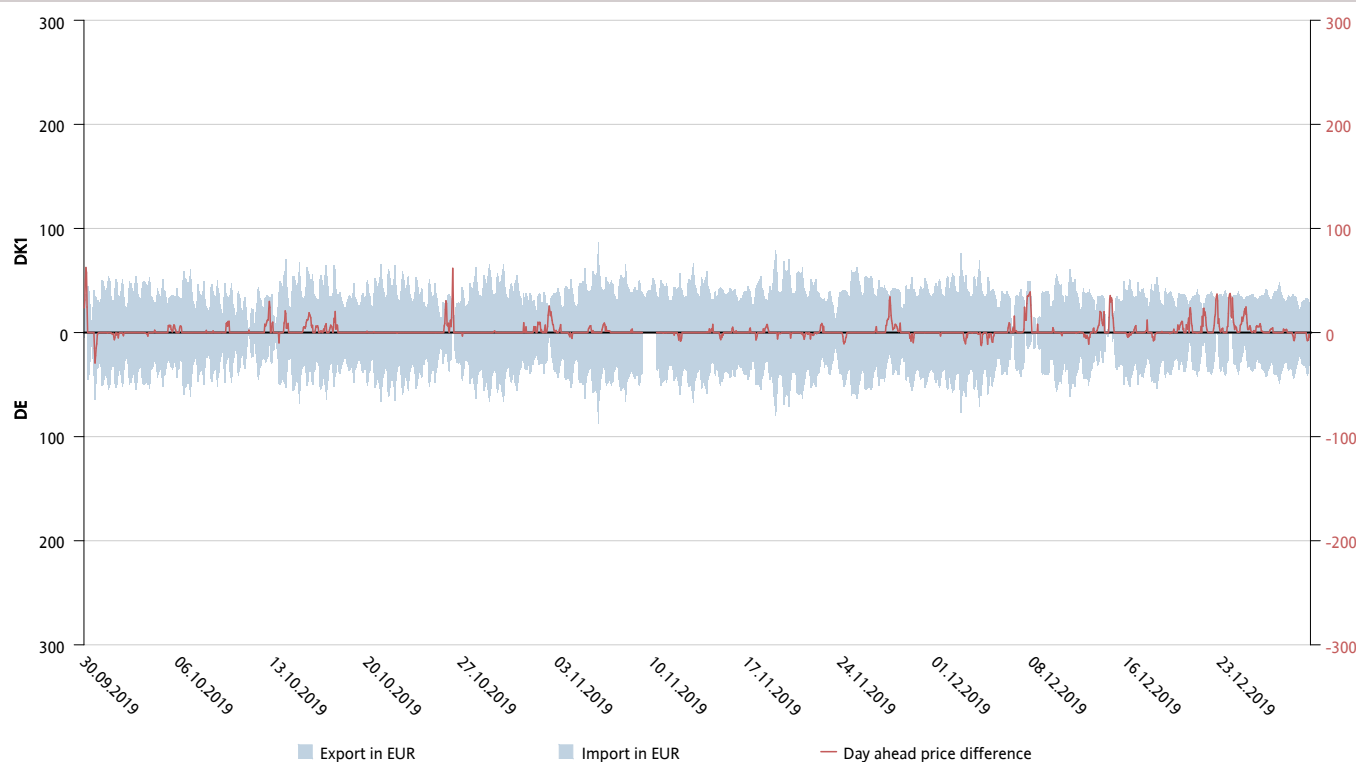


Figure 11: Shows day-ahead prices for the AC corridor DK1-DE, all prices are in EUR. The red line shows the price difference between the two areas.

DK1-NO2: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

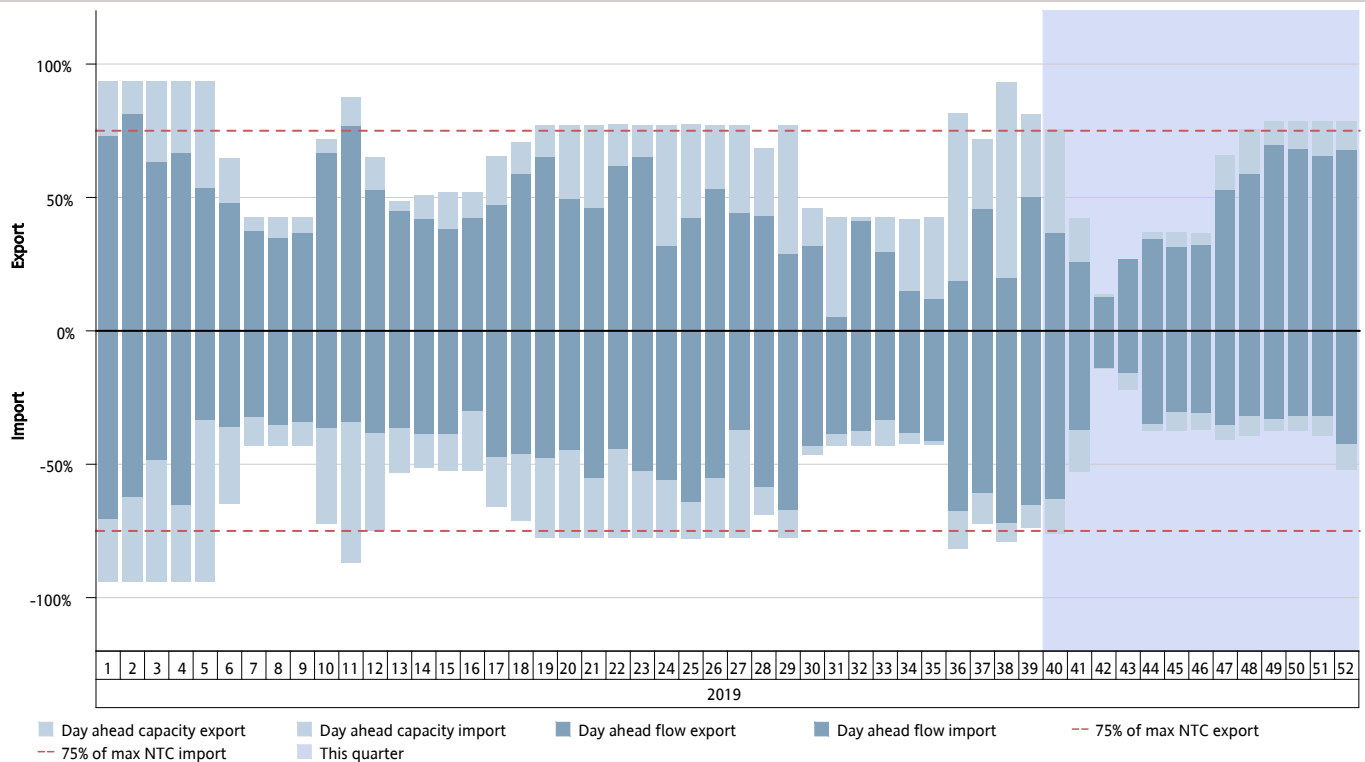


Figure 12: Shows cross-zonal day-ahead capacity result for the HVDC corridor DK1-NO2, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK1 to NO2, while import indicates flow from NO2 to DK1.

DK1-NO2: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

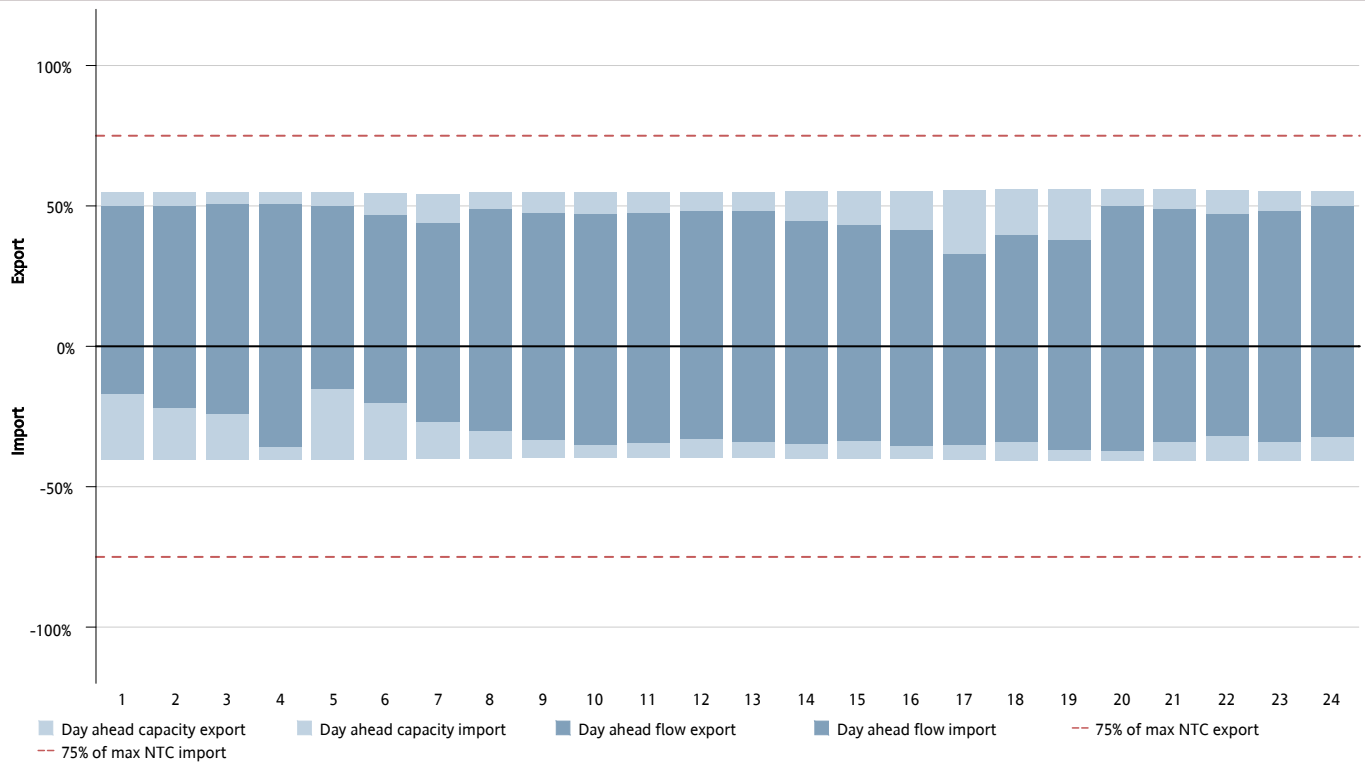


Figure 13: Shows cross-zonal day-ahead capacity result for the HVDC corridor DK1-NO2, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK1 to NO2, while import indicates flow from NO2 to DK1.

DK1-NO2: hourly day ahead capacities and flows – MW

Quarter 4, 2019

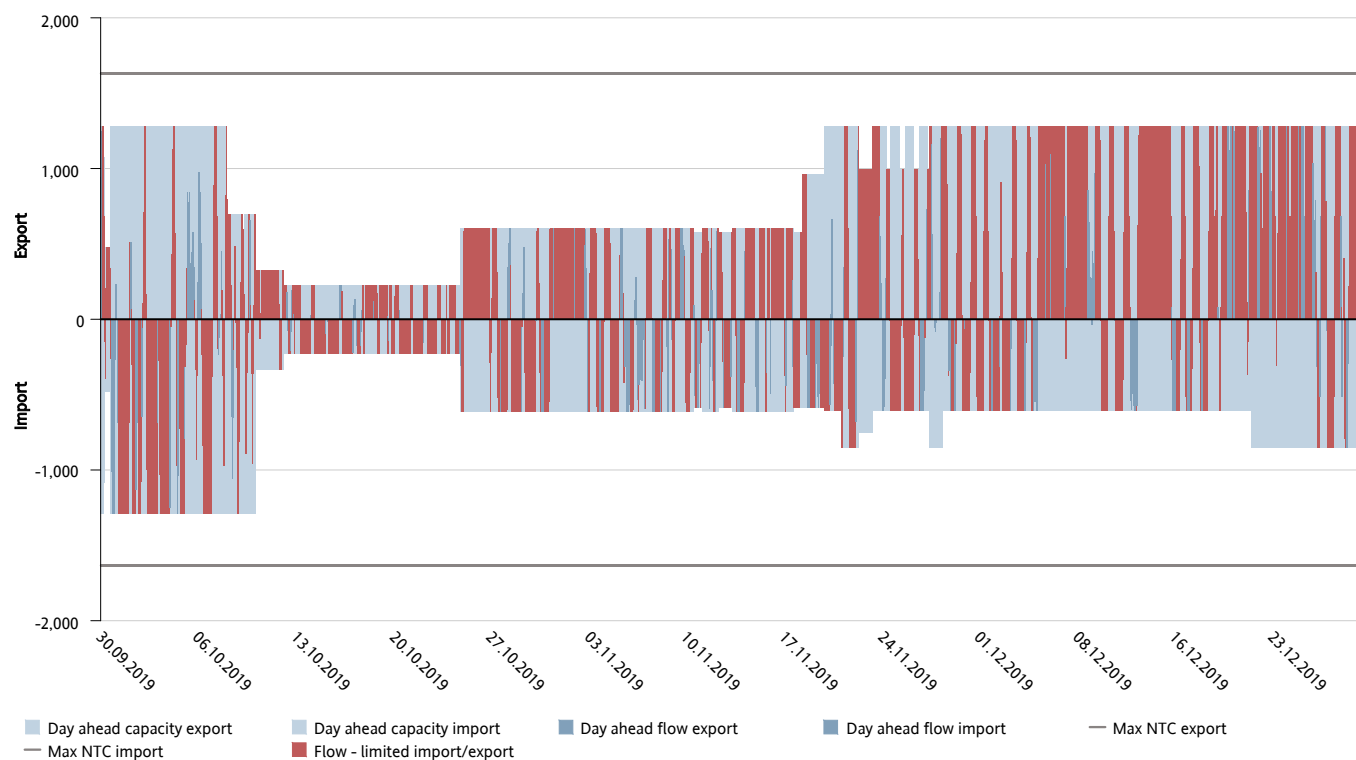


Figure 14: Shows cross-zonal day-ahead capacity result for the HVDC corridor DK1-NO2, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK1 to NO2, while import indicates flow from NO2 to DK1.

DK1-NO2: price comparison in EUR

Quarter 4, 2019

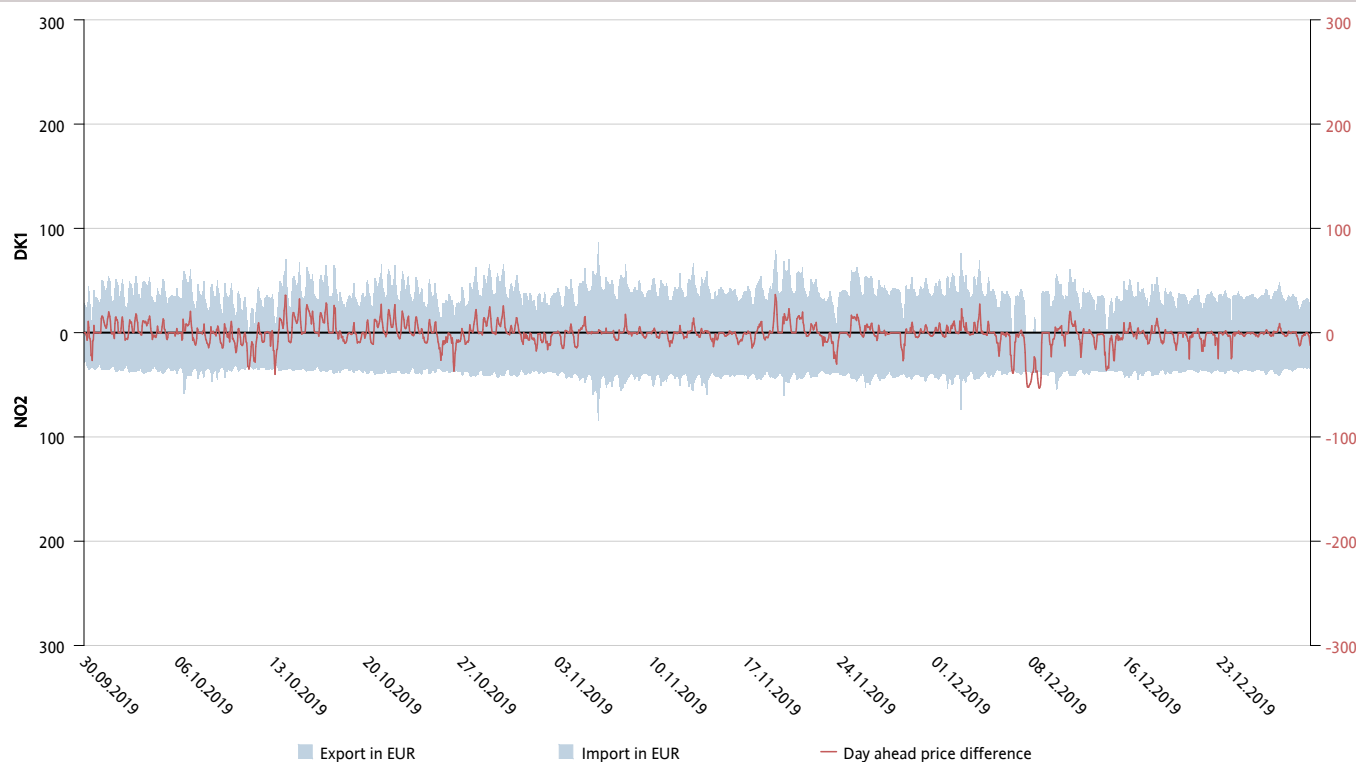


Figure 15: Shows day-ahead prices for the HVDC corridor DK1-NO2, all prices are in EUR. The red line shows the price difference between the two areas.

DK1-SE3: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

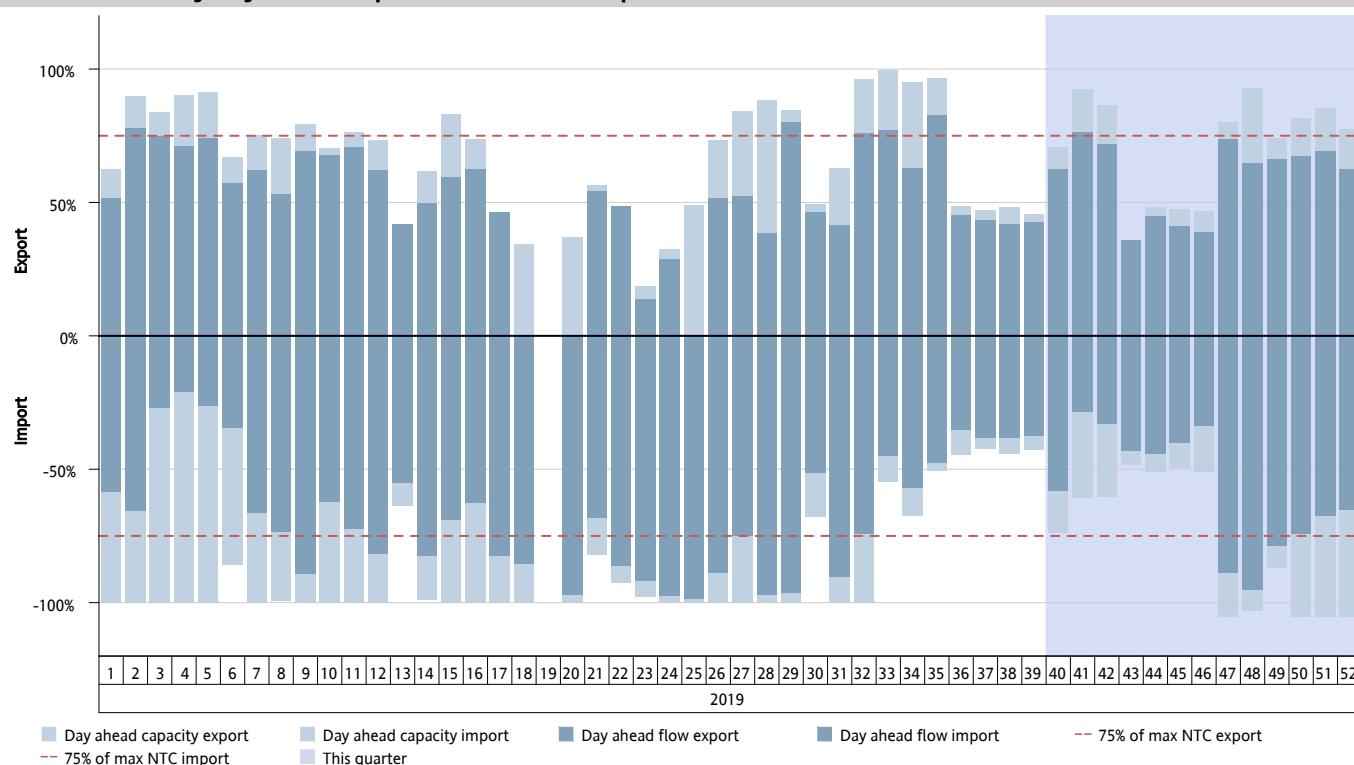


Figure 16: Shows cross-zonal day-ahead capacity result for the HVDC corridor DK1-SE3, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK1 to SE3, while import indicates flow from SE3 to DK1.

DK1-SE3: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

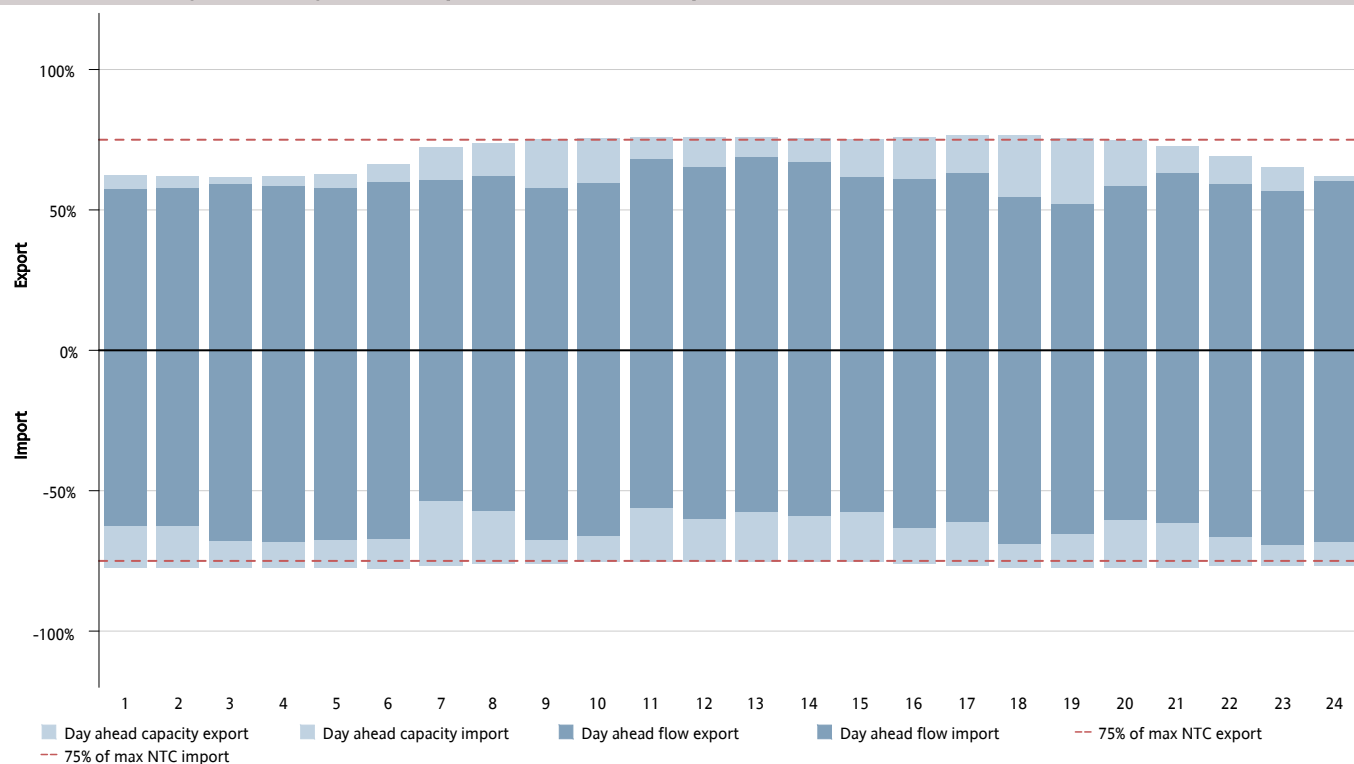


Figure 17: Shows cross-zonal day-ahead capacity result for the HVDC corridor DK1-SE3, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK1 to SE3, while import indicates flow from SE3 to DK1.

DK1-SE3: hourly day ahead capacities and flows – MW

Quarter 4, 2019

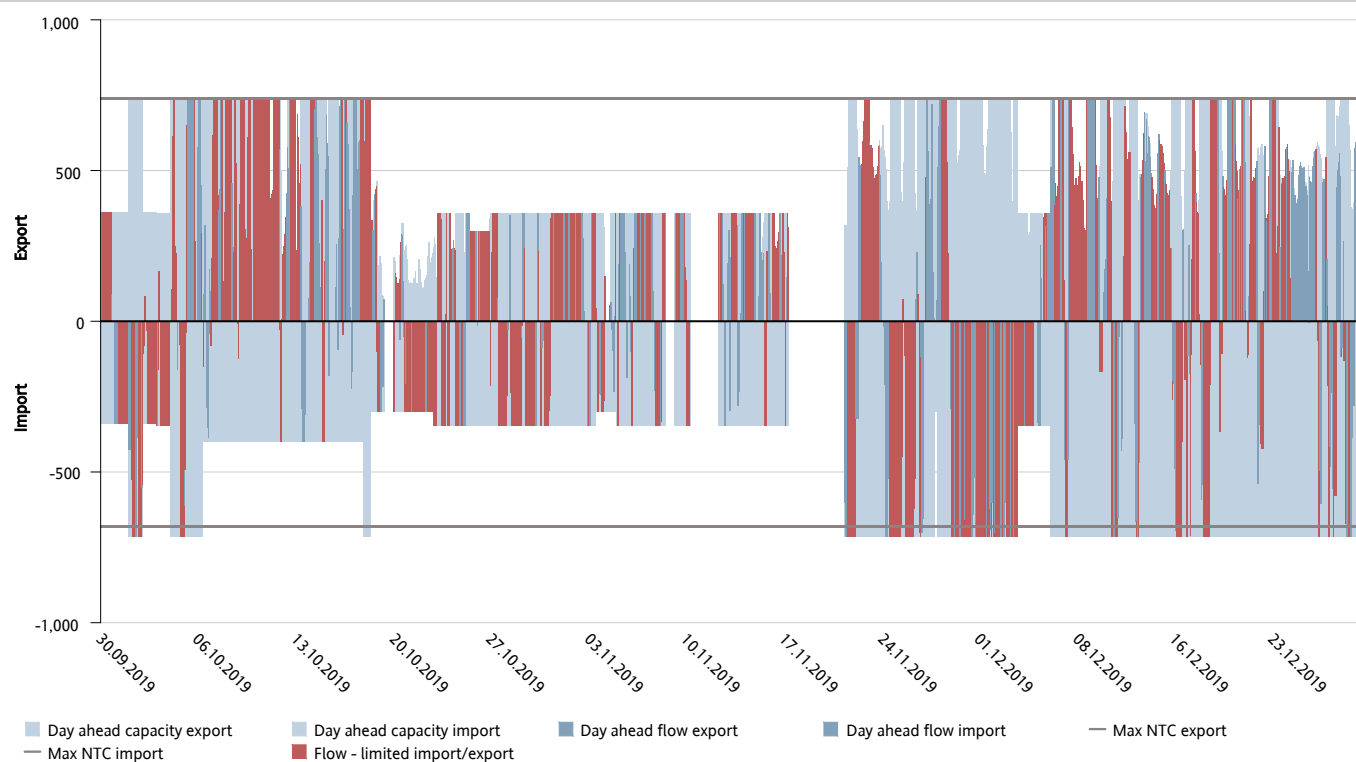


Figure 18: Shows cross-zonal day-ahead capacity result for the HVDC corridor DK1-SE3, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK1 to SE3, while import indicates flow from SE3 to DK1.

DK1-SE3: price comparison in EUR

Quarter 4, 2019

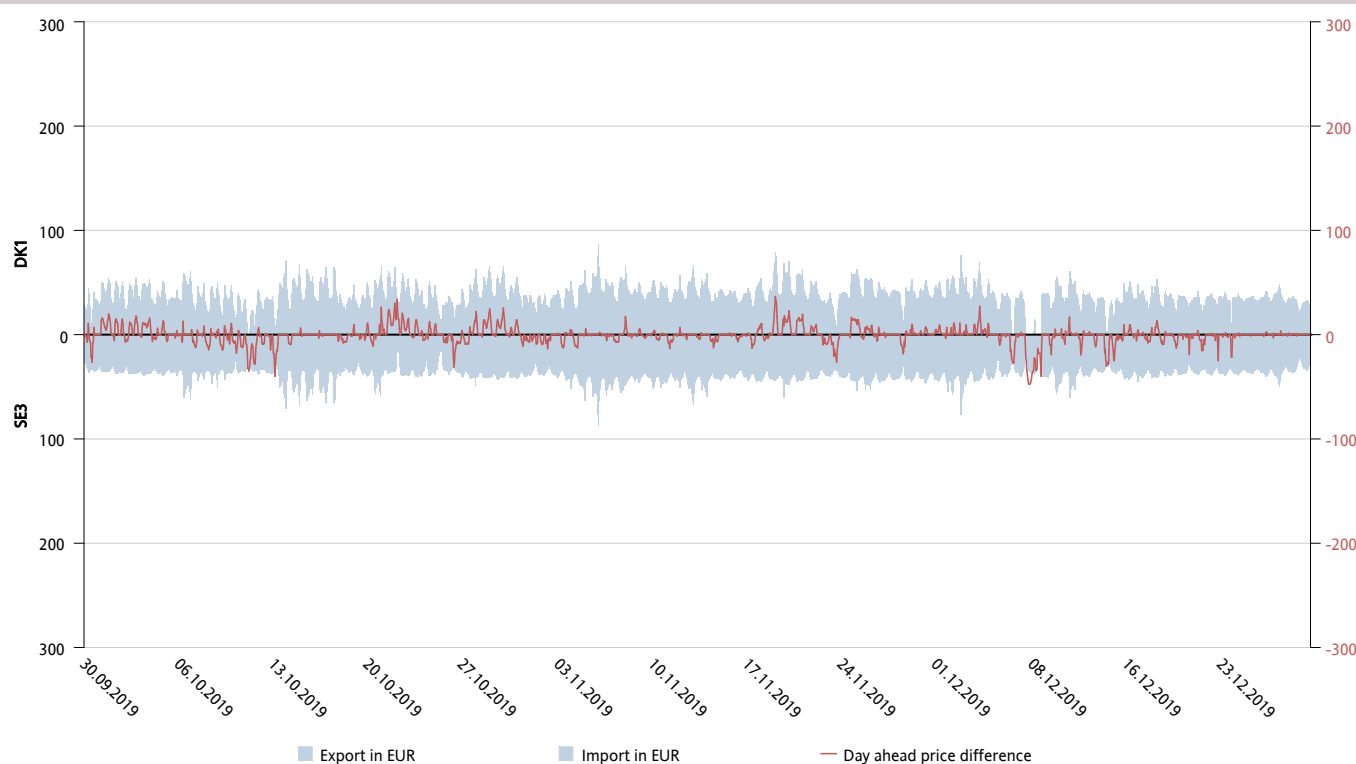


Figure 19: Shows day-ahead prices for the HVDC corridor DK1-SE3, all prices are in EUR. The red line shows the price difference between the two areas.

DK2-DE: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

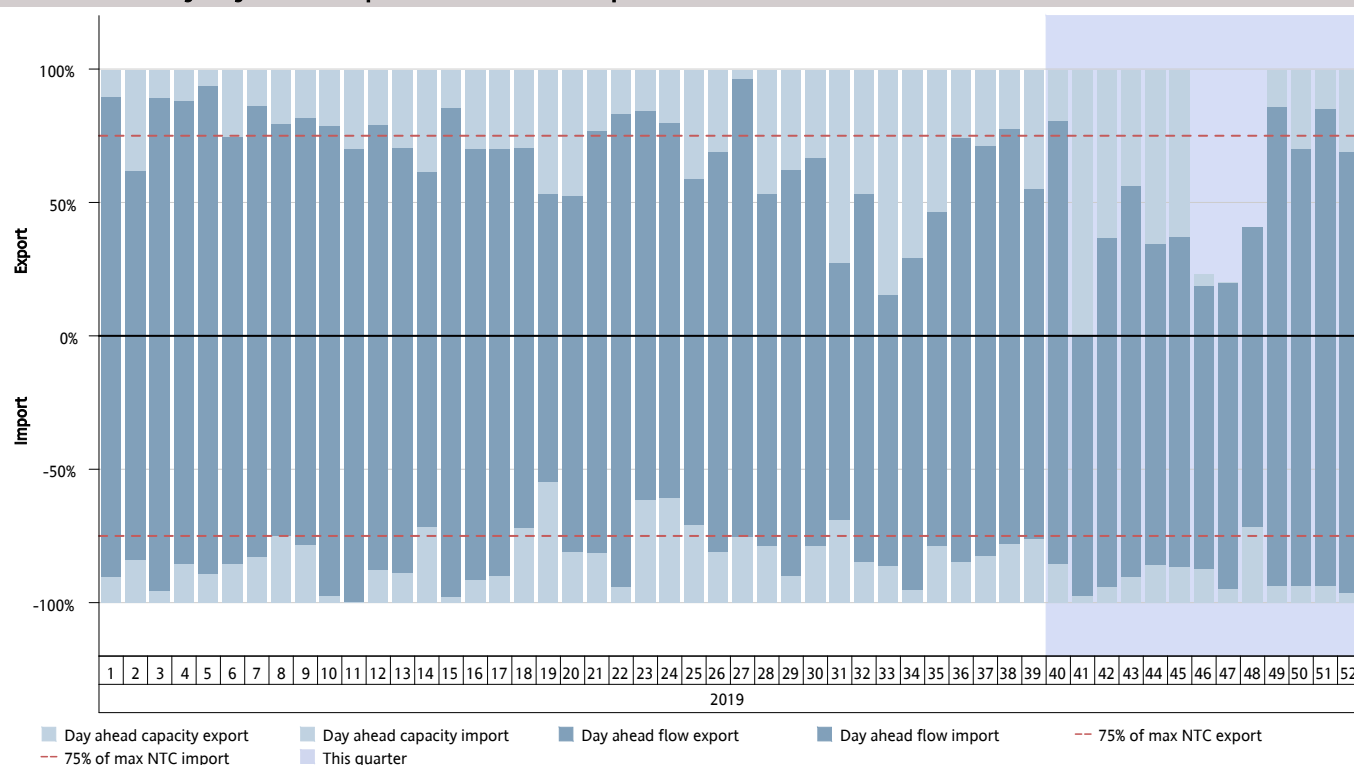


Figure 20: Shows cross-zonal day-ahead capacity result for the HVDC corridor DK2-DE, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK2 to DE, while import indicates flow from DE to DK2.

DK2-DE: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

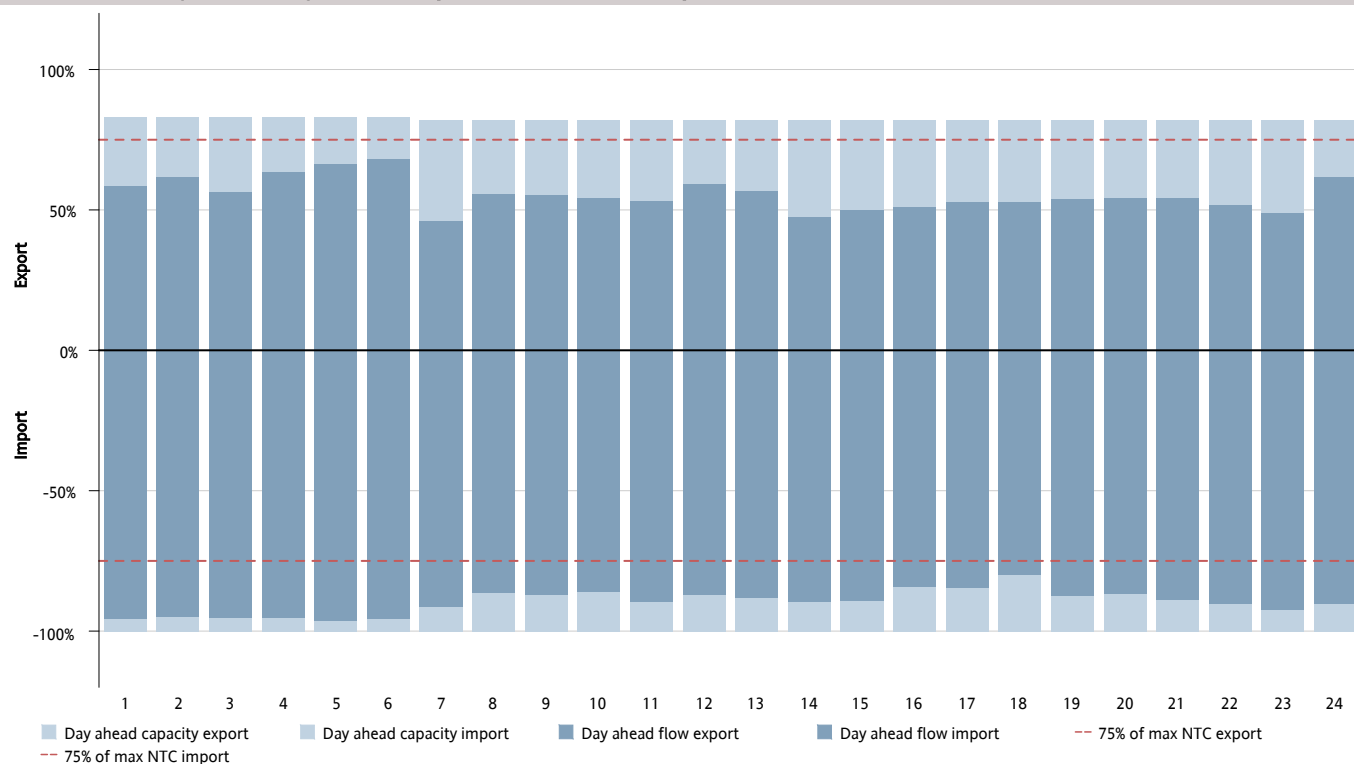


Figure 21: Shows cross-zonal day-ahead capacity result for the HVDC corridor DK2-DE, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK2 to DE, while import indicates flow from DE to DK2.

DK2-DE: hourly day ahead capacities and flows – MW

Quarter 4, 2019

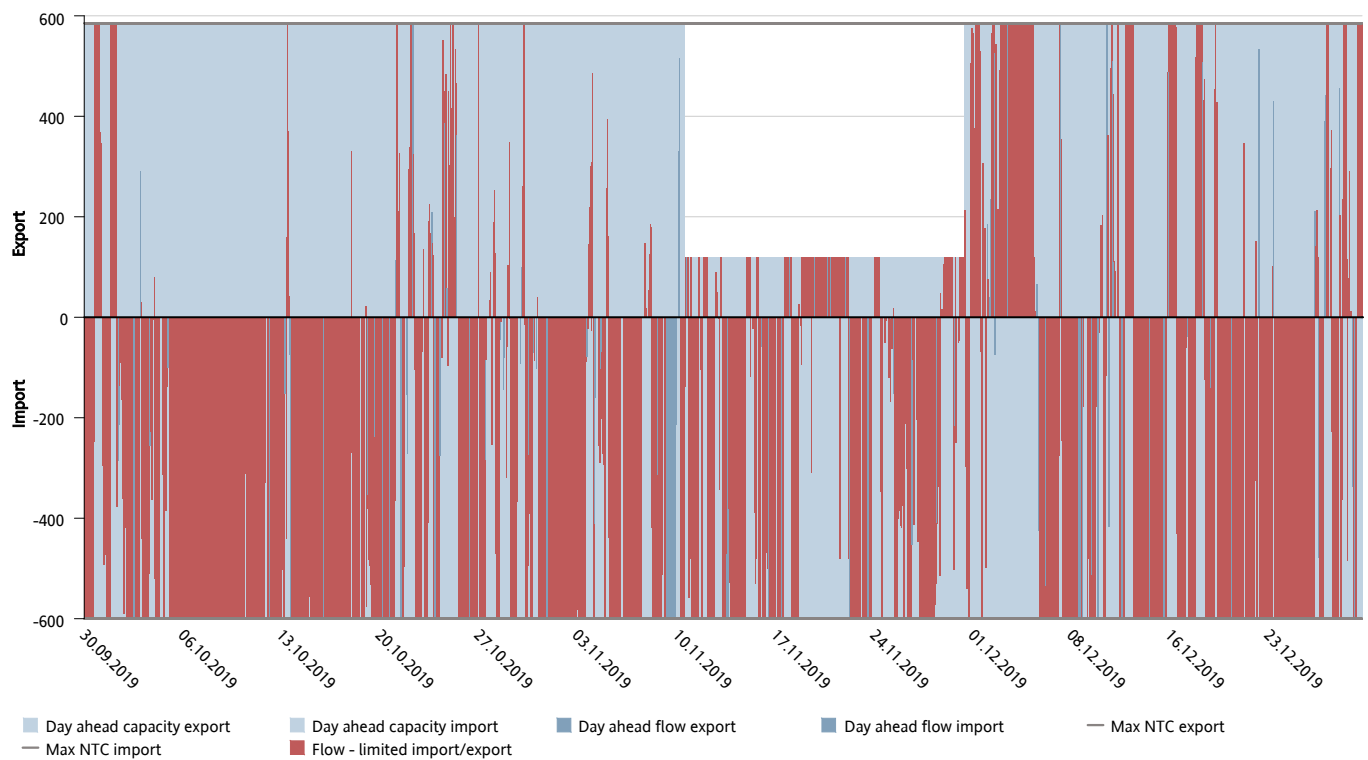


Figure 22: Shows cross-zonal day-ahead capacity result for the HVDC corridor DK2-DE, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK2 to DE, while import indicates flow from DE to DK2.

DK2-DE: price comparison in EUR

Quarter 4, 2019

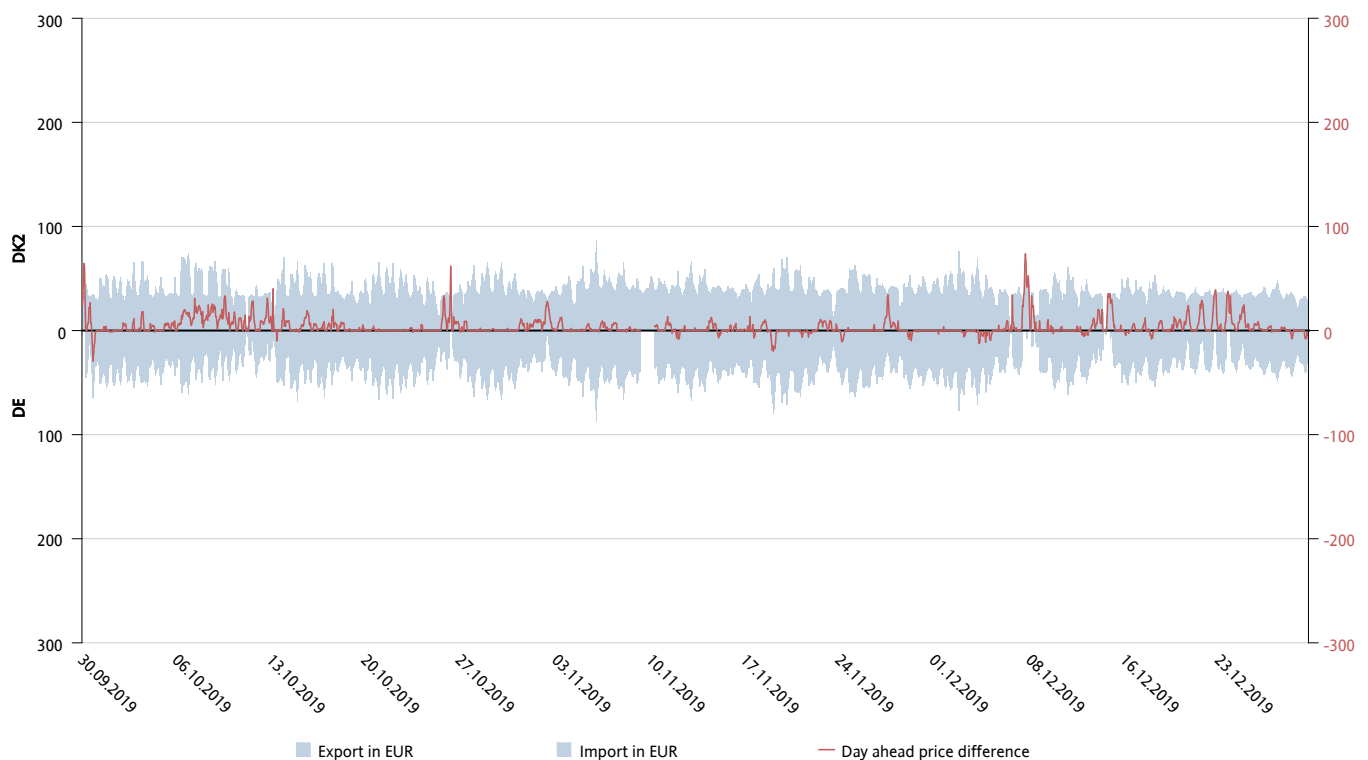


Figure 23: Shows day-ahead prices for the HVDC corridor DK2-DE, all prices are in EUR. The red line shows the price difference between the two areas.

DK2-SE4: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

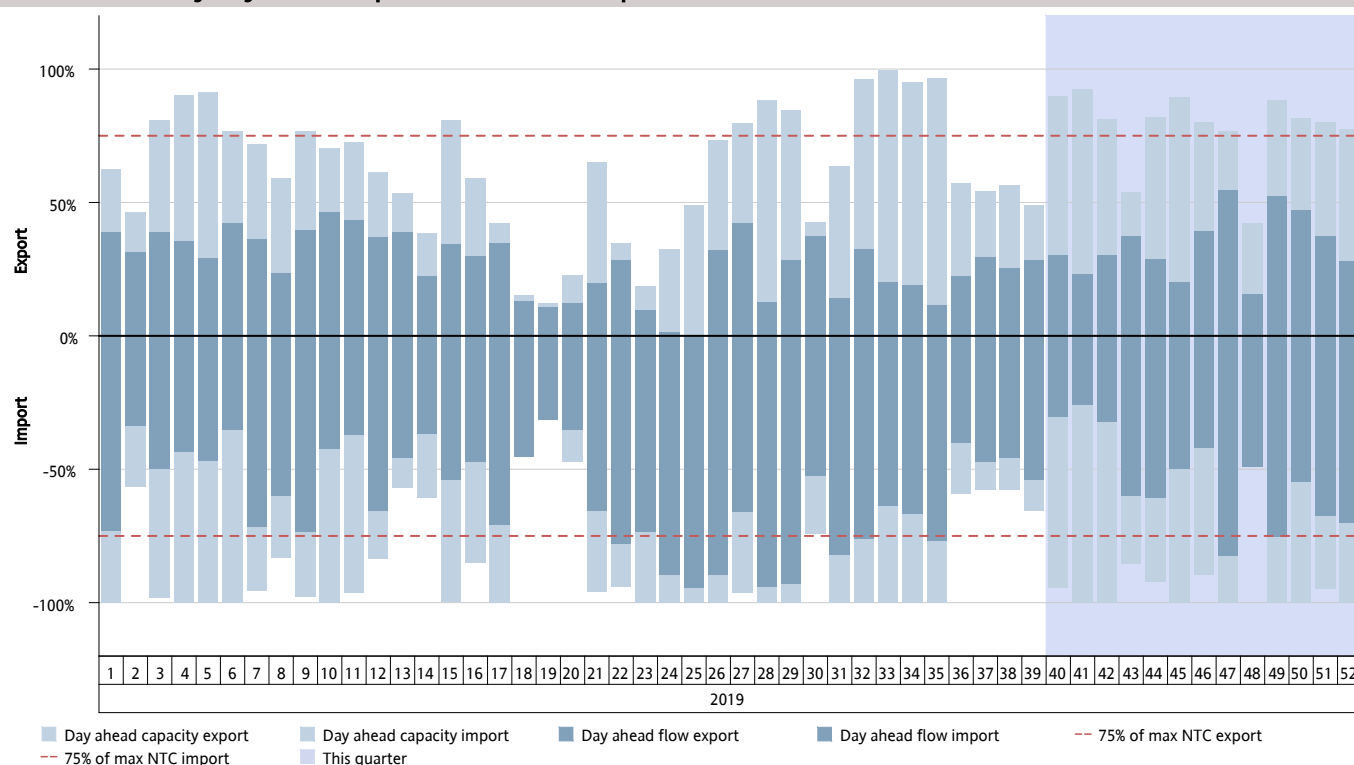


Figure 24: Shows cross-zonal day-ahead capacity result for the AC corridor DK2-SE4, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK2 to SE4, while import indicates flow from SE4 to DK2.

DK2-SE4: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

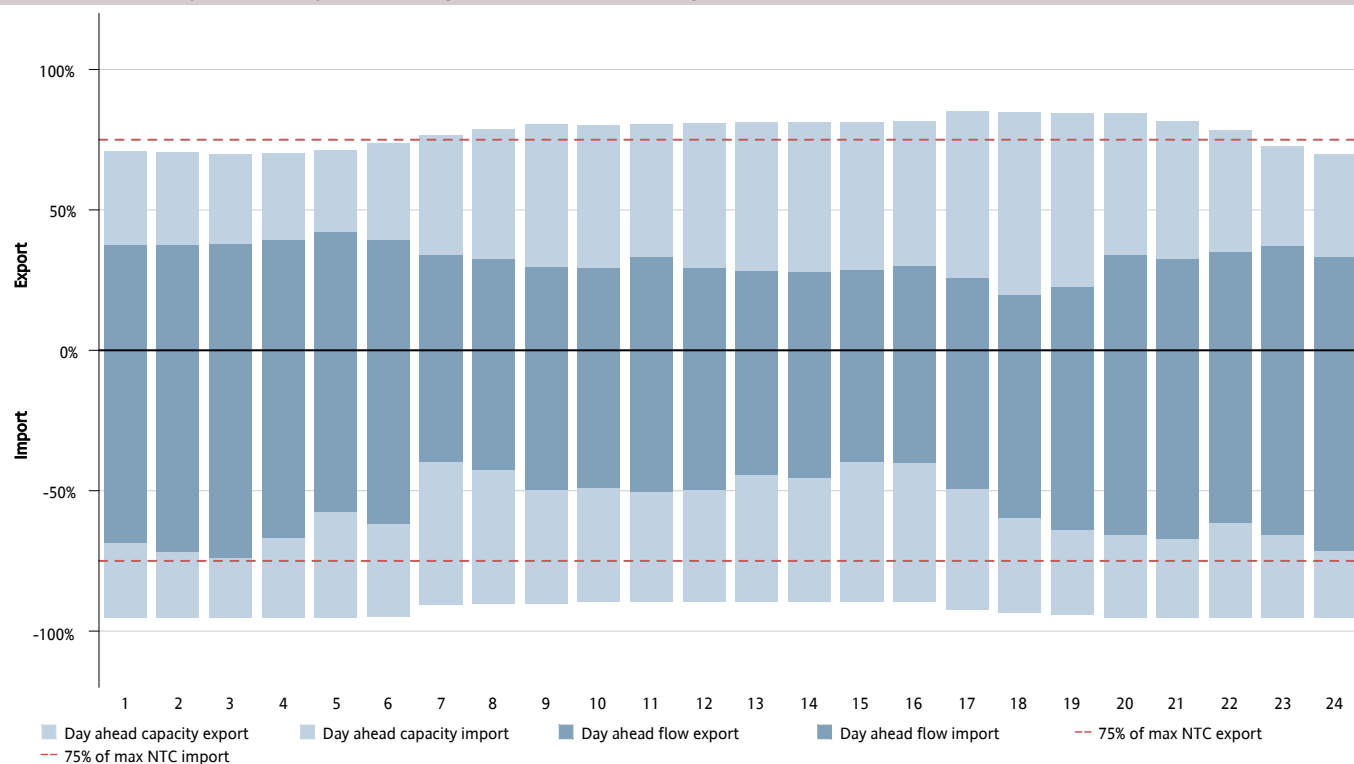


Figure 25: Shows cross-zonal day-ahead capacity result for the AC corridor DK2-SE4, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK2 to SE4, while import indicates flow from SE4 to DK2.

DK2-SE4: hourly day ahead capacities and flows – MW

Quarter 4, 2019

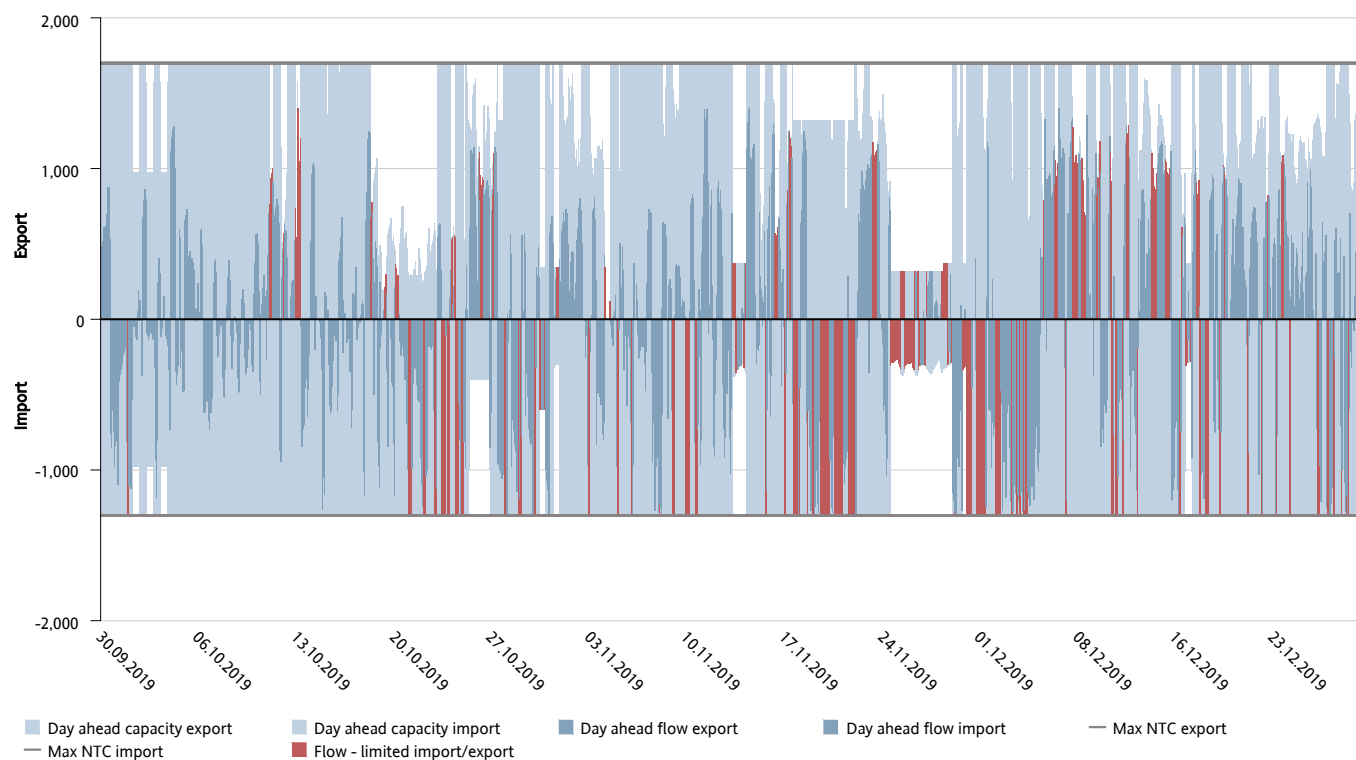


Figure 26: Shows cross-zonal day-ahead capacity result for the AC corridor DK2-SE4, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from DK2 to SE4, while import indicates flow from SE4 to DK2.

DK2-SE4: price comparison in EUR

Quarter 4, 2019

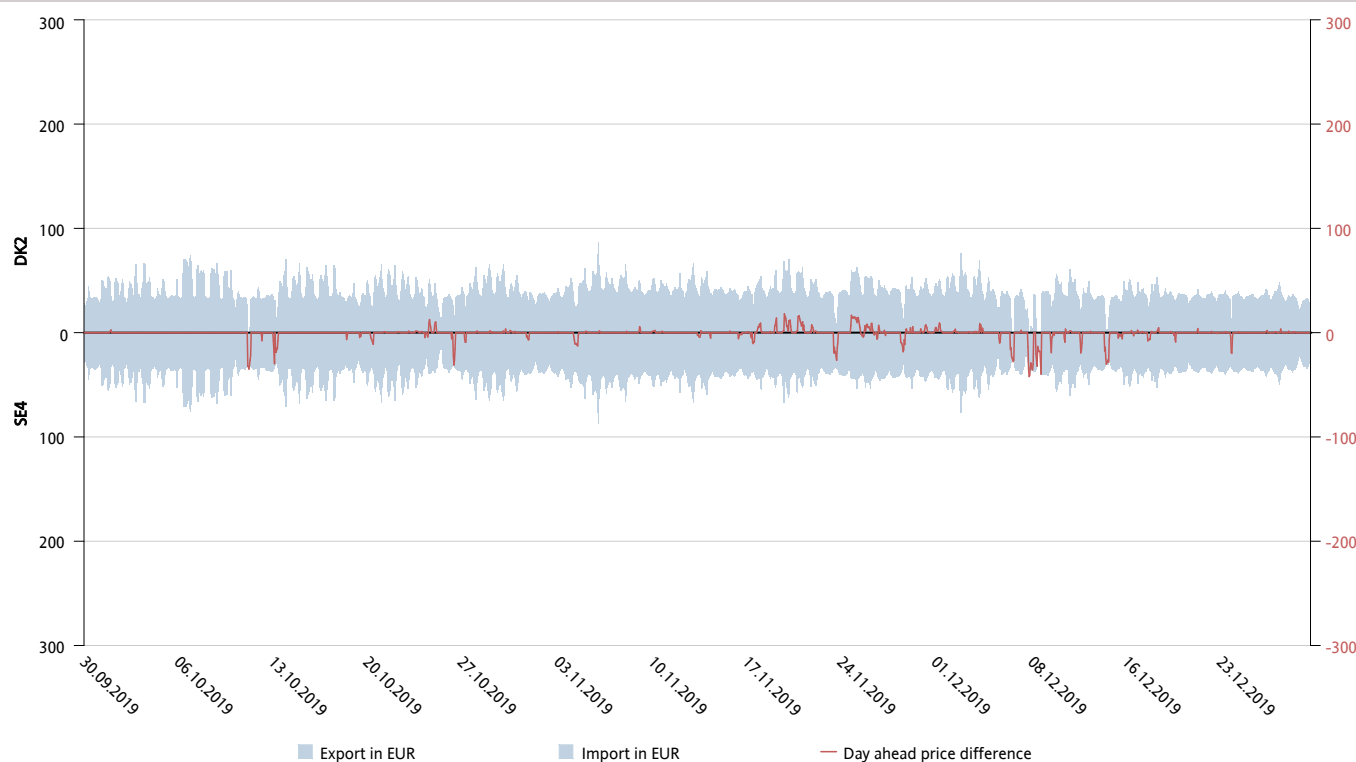


Figure 27: Shows day-ahead prices for the AC corridor DK2-SE4, all prices are in EUR. The red line shows the price difference between the two areas.

FI-EE: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

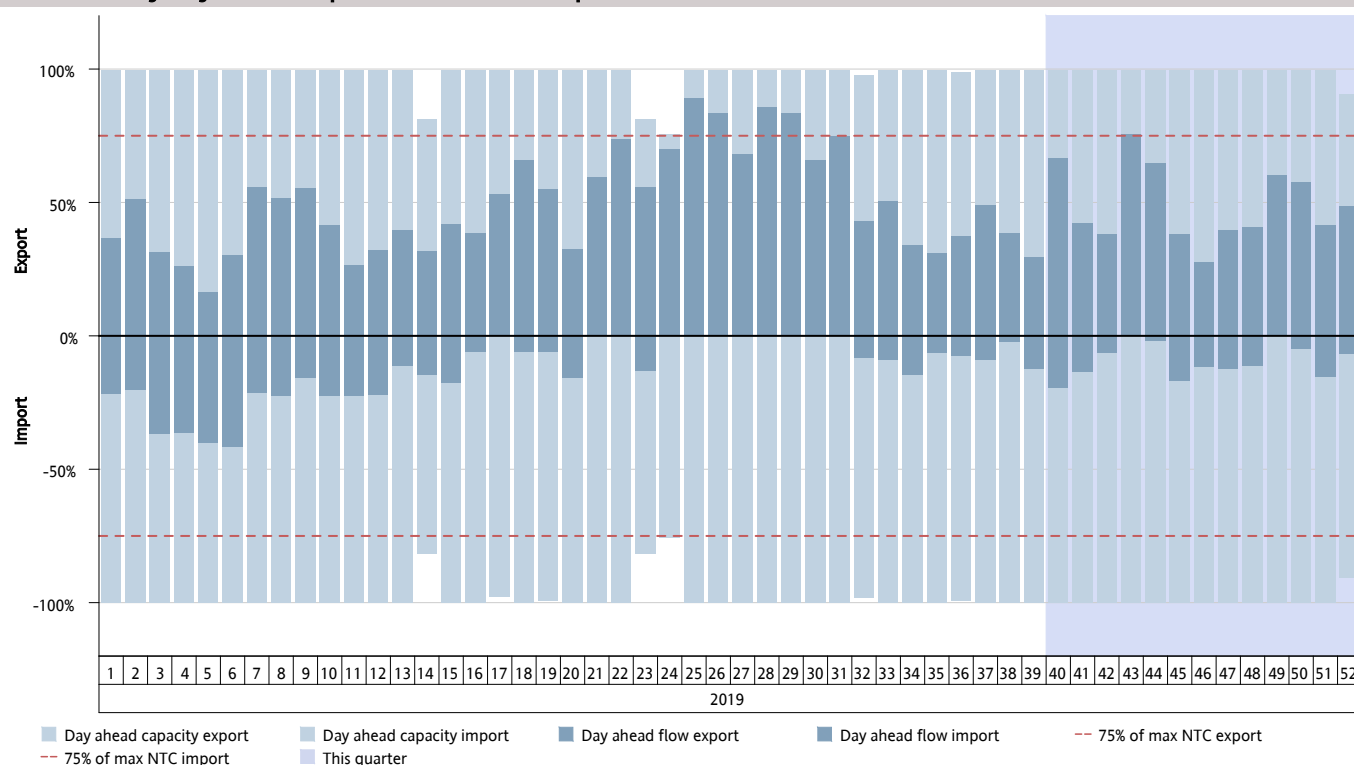


Figure 28: Shows cross-zonal day-ahead capacity result for the HVDC corridor FI-EE, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from FI to EE, while import indicates flow from EE to FI.

FI-EE: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

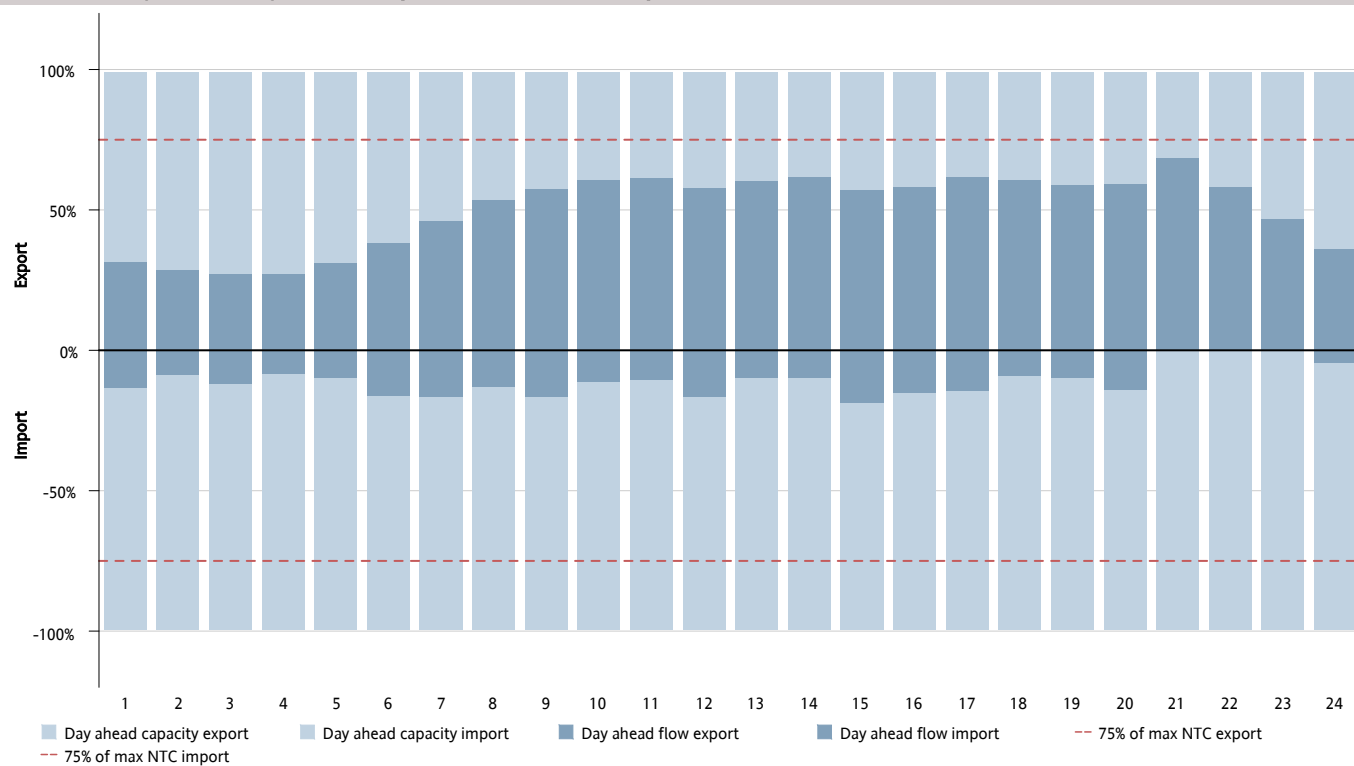


Figure 29: Shows cross-zonal day-ahead capacity result for the HVDC corridor FI-EE, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from FI to EE, while import indicates flow from EE to FI.

FI-EE: hourly day ahead capacities and flows – MW

Quarter 4, 2019

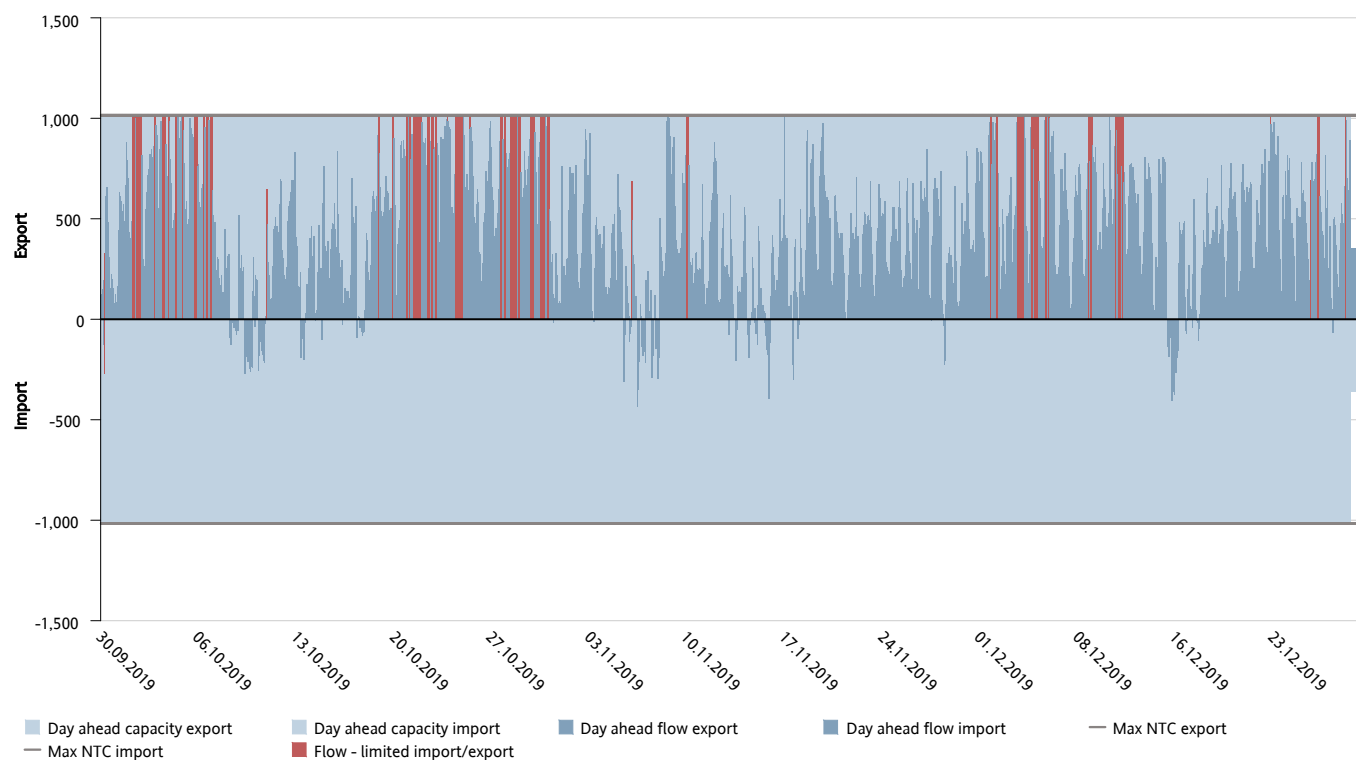


Figure 30: Shows cross-zonal day-ahead capacity result for the HVDC corridor FI-EE, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from FI to EE, while import indicates flow from EE to FI.

FI-EE: price comparison in EUR

Quarter 4, 2019

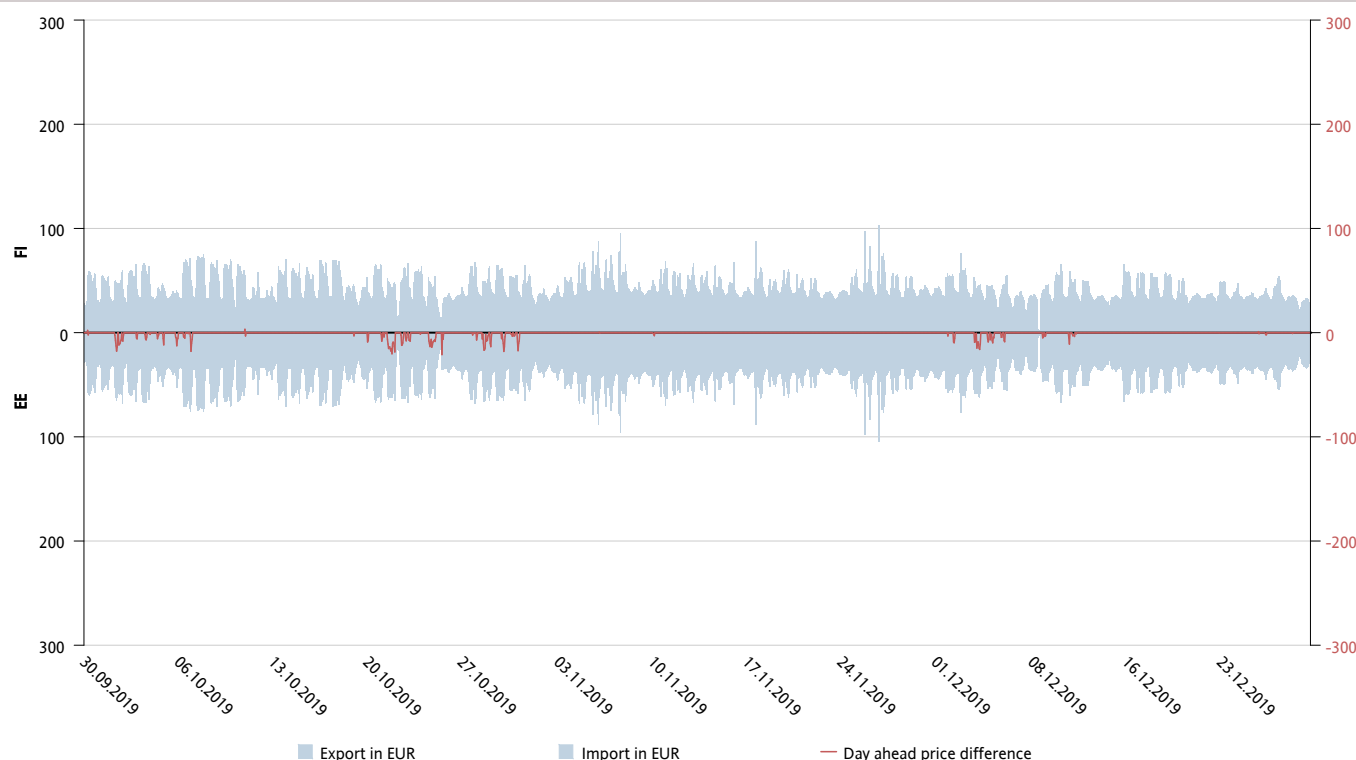


Figure 31: Shows day-ahead prices for the HVDC corridor FI-EE, all prices are in EUR. The red line shows the price difference between the two areas.

FI-SE1: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

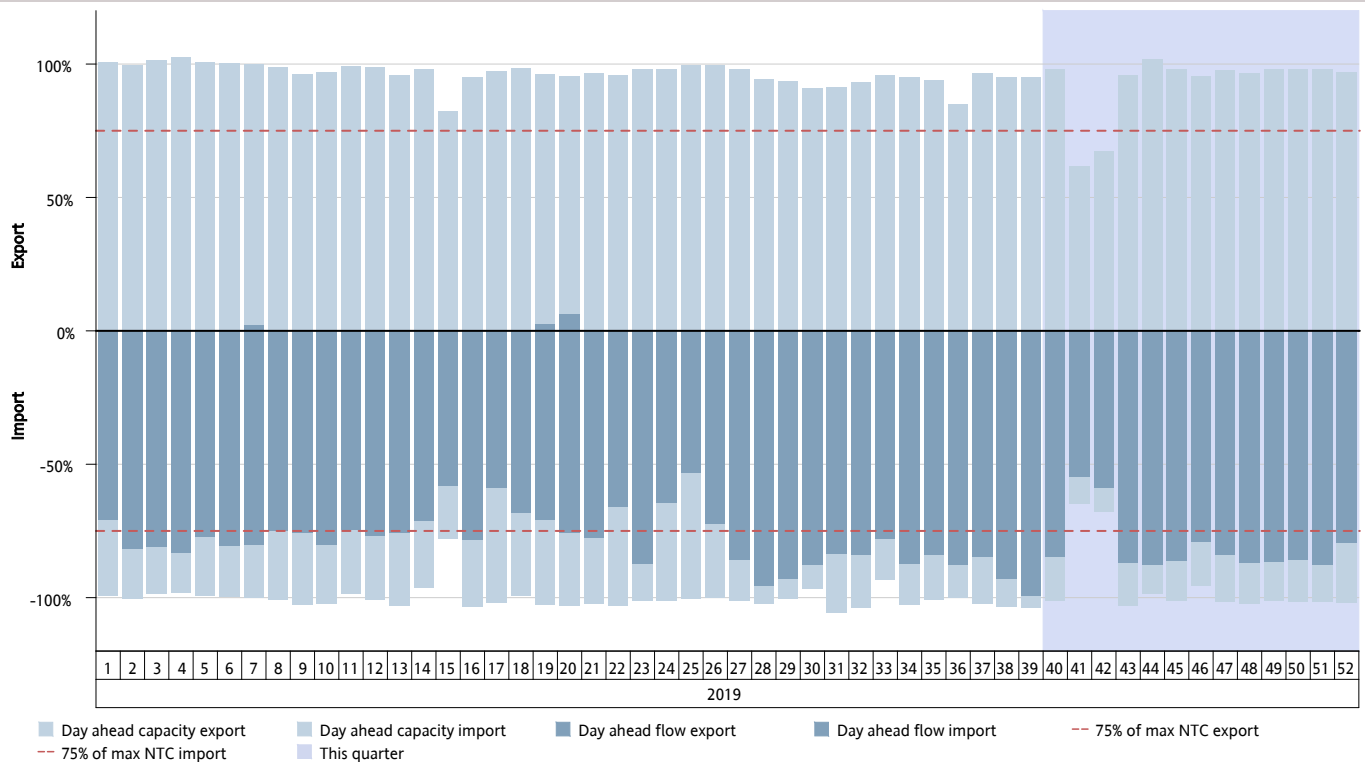


Figure 32: Shows cross-zonal day-ahead capacity result for the AC corridor FI-SE1, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from FI to SE1, while import indicates flow from SE1 to FI.

FI-SE1: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

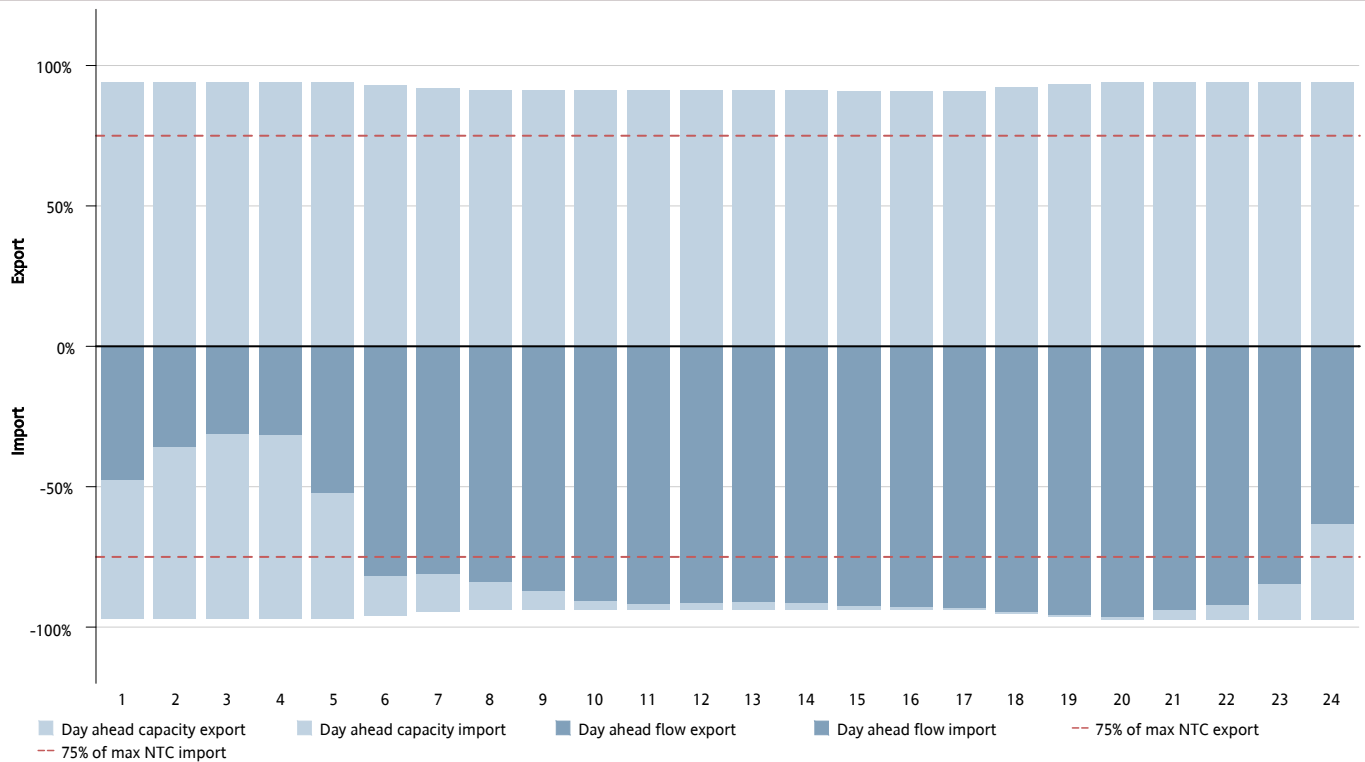


Figure 33: Shows cross-zonal day-ahead capacity result for the AC corridor FI-SE1, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from FI to SE1, while import indicates flow from SE1 to FI.

FI-SE1: hourly day ahead capacities and flows – MW

Quarter 4, 2019

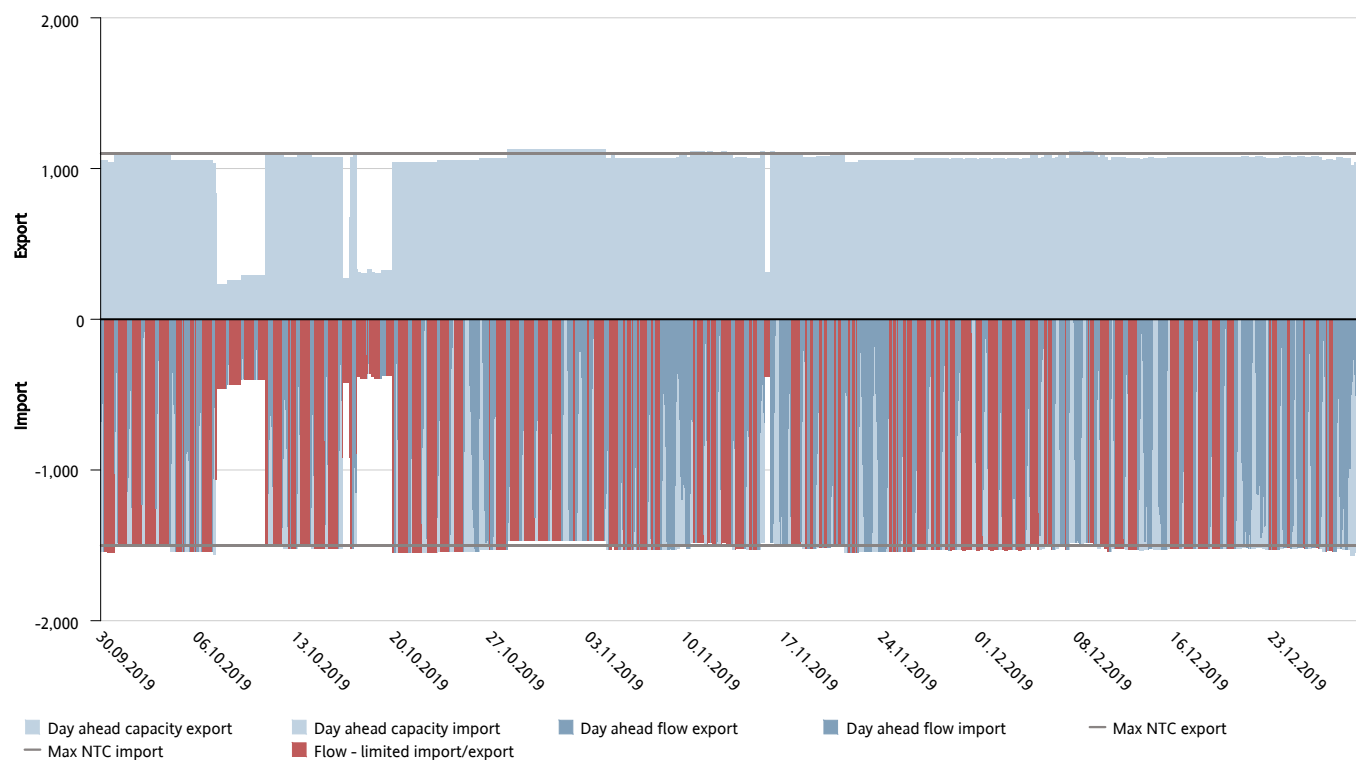


Figure 34: Shows cross-zonal day-ahead capacity result for the AC corridor FI-SE1, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from FI to SE1, while import indicates flow from SE1 to FI.

FI-SE1: price comparison in EUR

Quarter 4, 2019

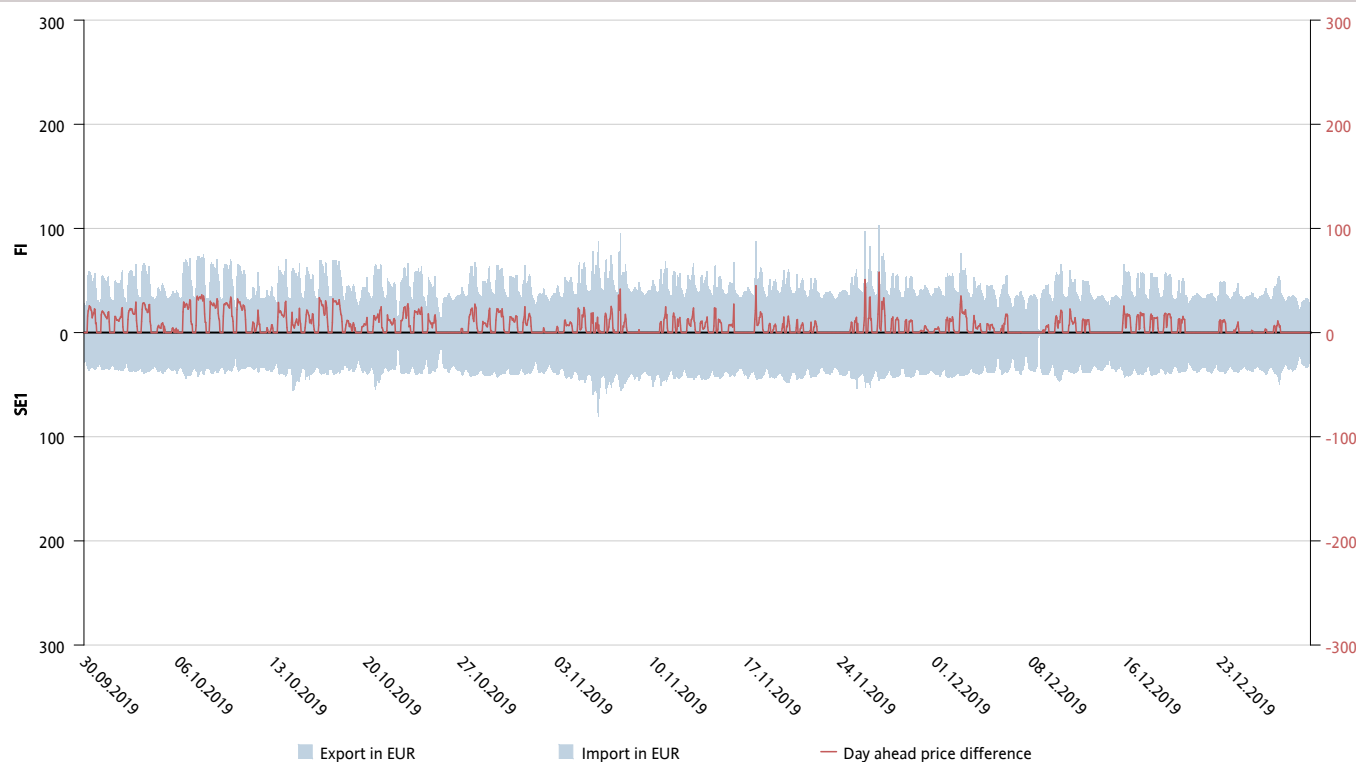


Figure 35: Shows day-ahead prices for the AC corridor FI-SE1, all prices are in EUR. The red line shows the price difference between the two areas.

FI-SE3: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

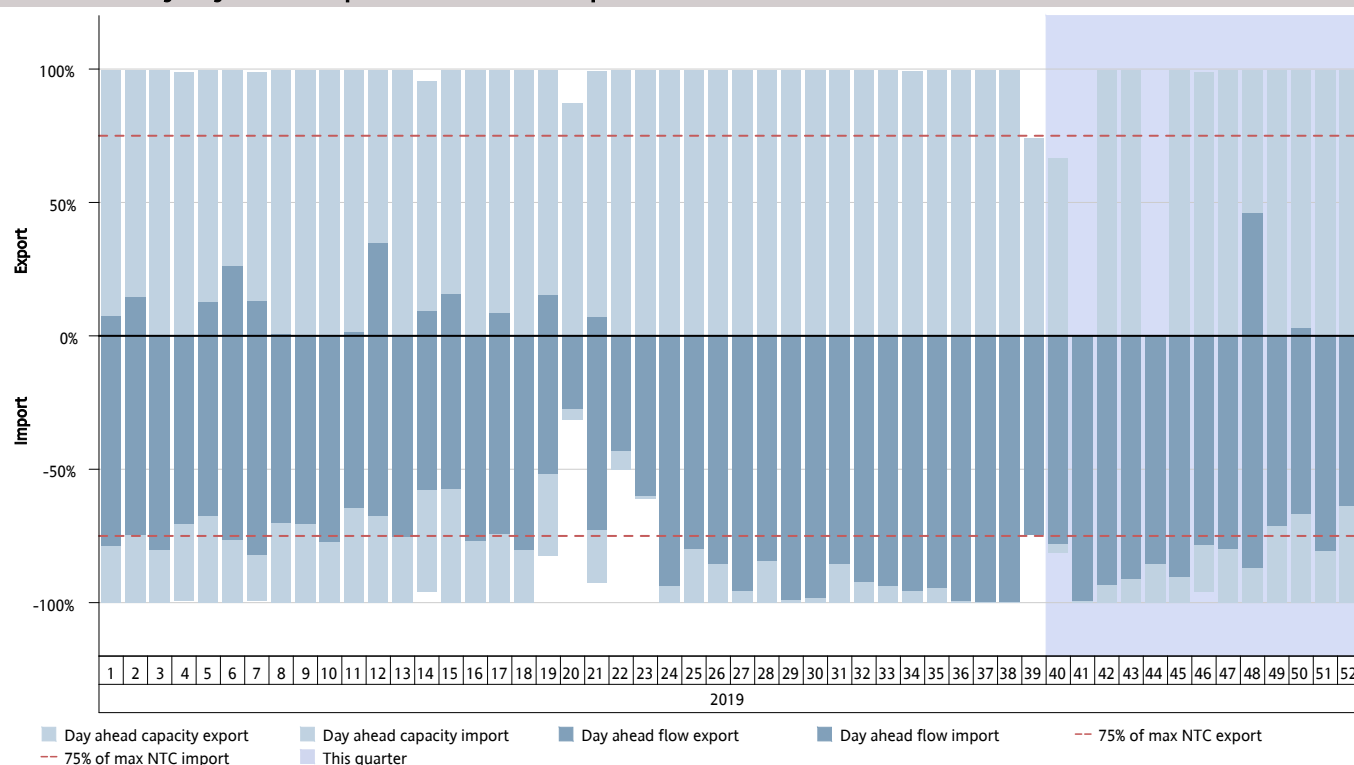


Figure 36: Shows cross-zonal day-ahead capacity result for the HVDC corridor FI-SE3, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from FI to SE3, while import indicates flow from SE3 to FI.

FI-SE3: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

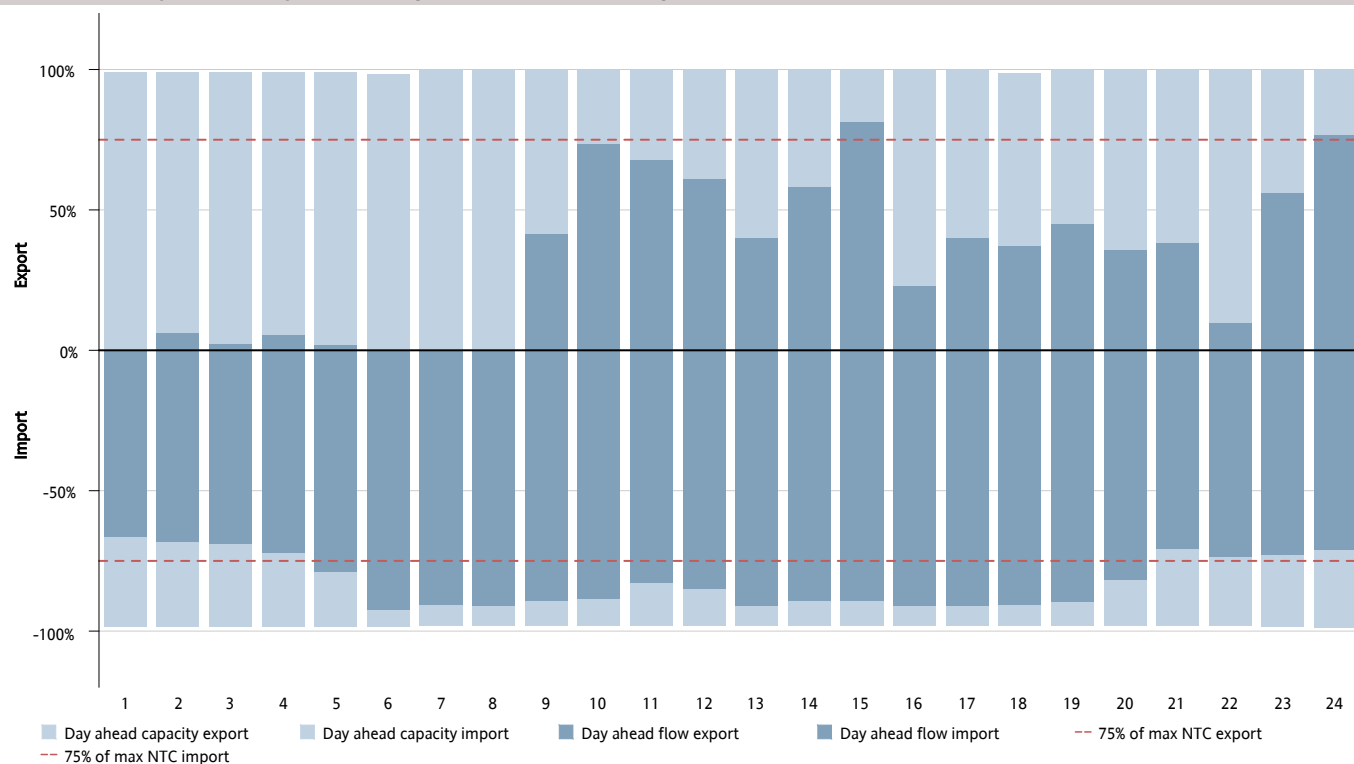


Figure 37: Shows cross-zonal day-ahead capacity result for the HVDC corridor FI-SE3, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from FI to SE3, while import indicates flow from SE3 to FI.

FI-SE3: hourly day ahead capacities and flows – MW

Quarter 4, 2019

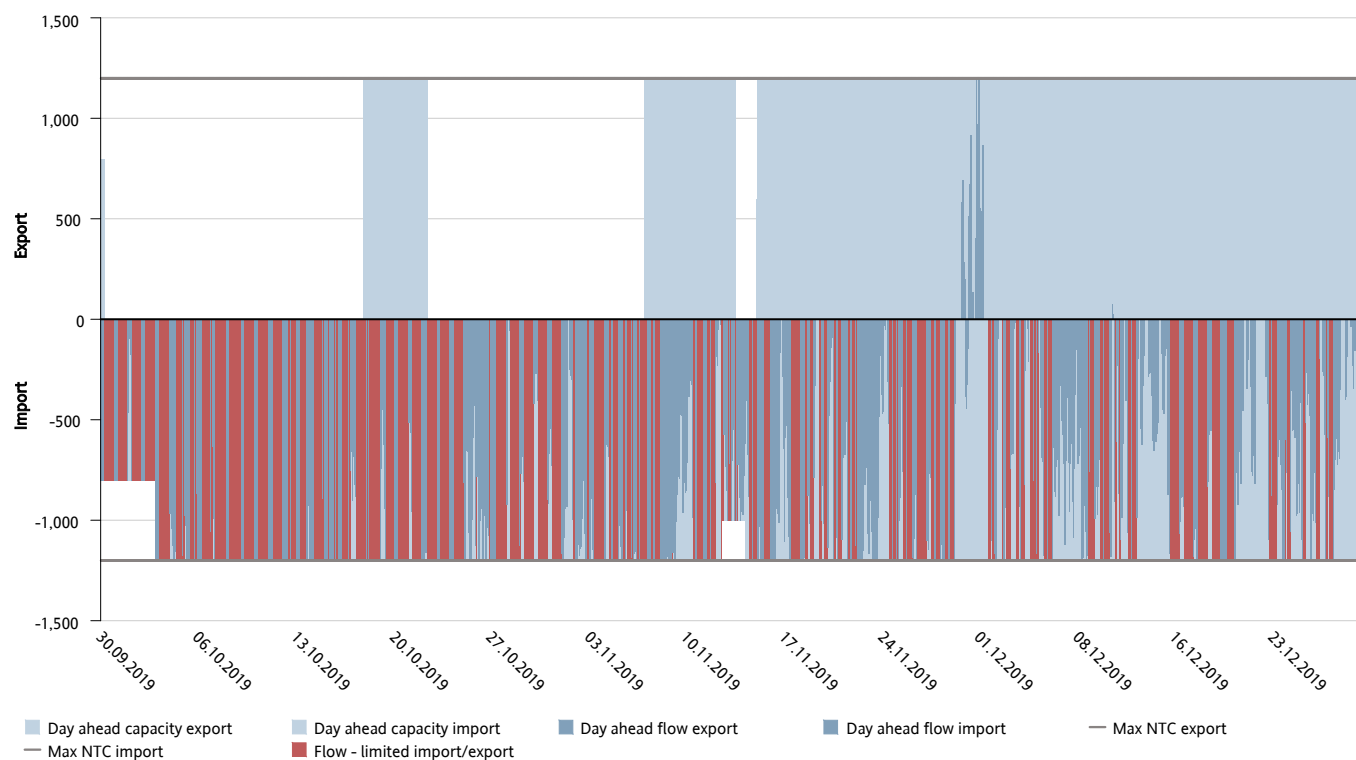


Figure 38: Shows cross-zonal day-ahead capacity result for the HVDC corridor FI-SE3, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from FI to SE3, while import indicates flow from SE3 to FI.

FI-SE3: price comparison in EUR

Quarter 4, 2019

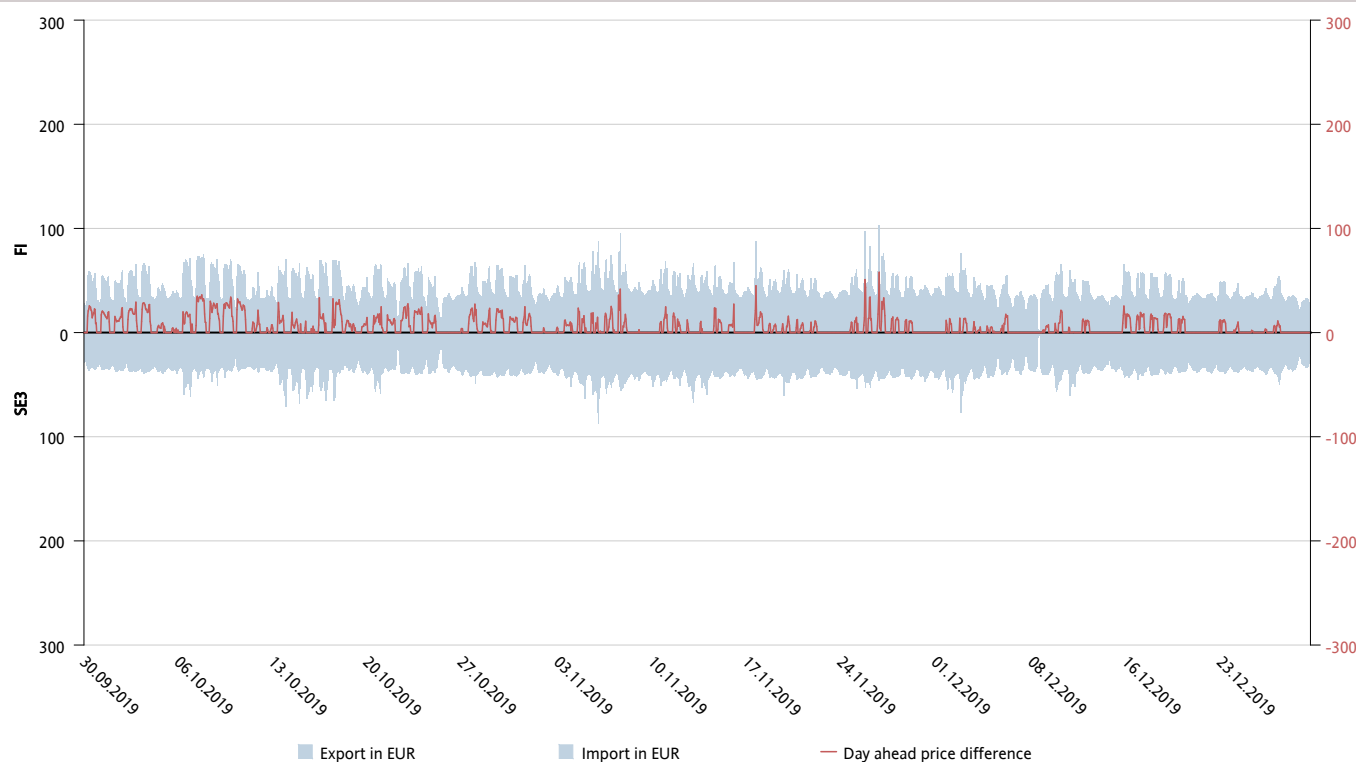


Figure 39: Shows day-ahead prices for the HVDC corridor FI-SE3, all prices are in EUR. The red line shows the price difference between the two areas.

NO1-SE3: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

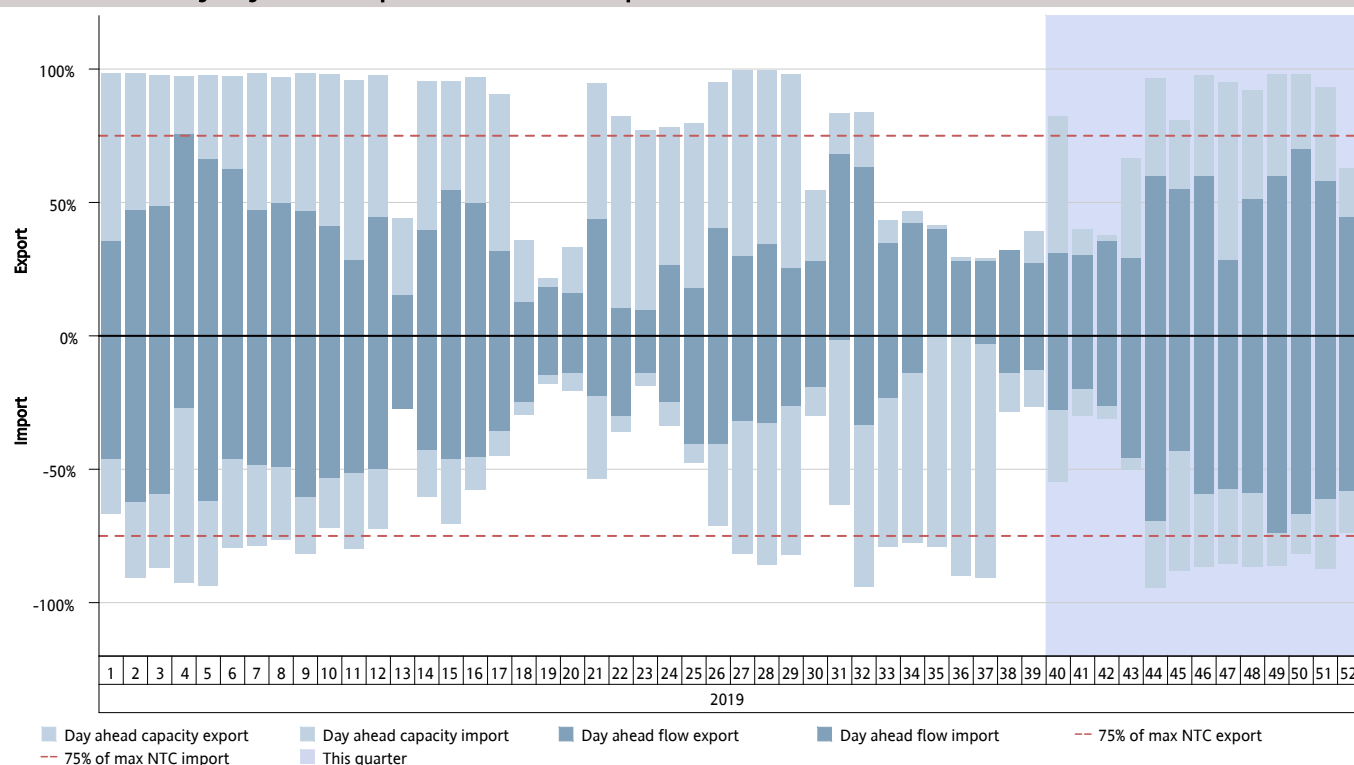


Figure 40: Shows cross-zonal day-ahead capacity result for the AC corridor NO1-SE3, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO1 to SE3, while import indicates flow from SE3 to NO1.

NO1-SE3: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

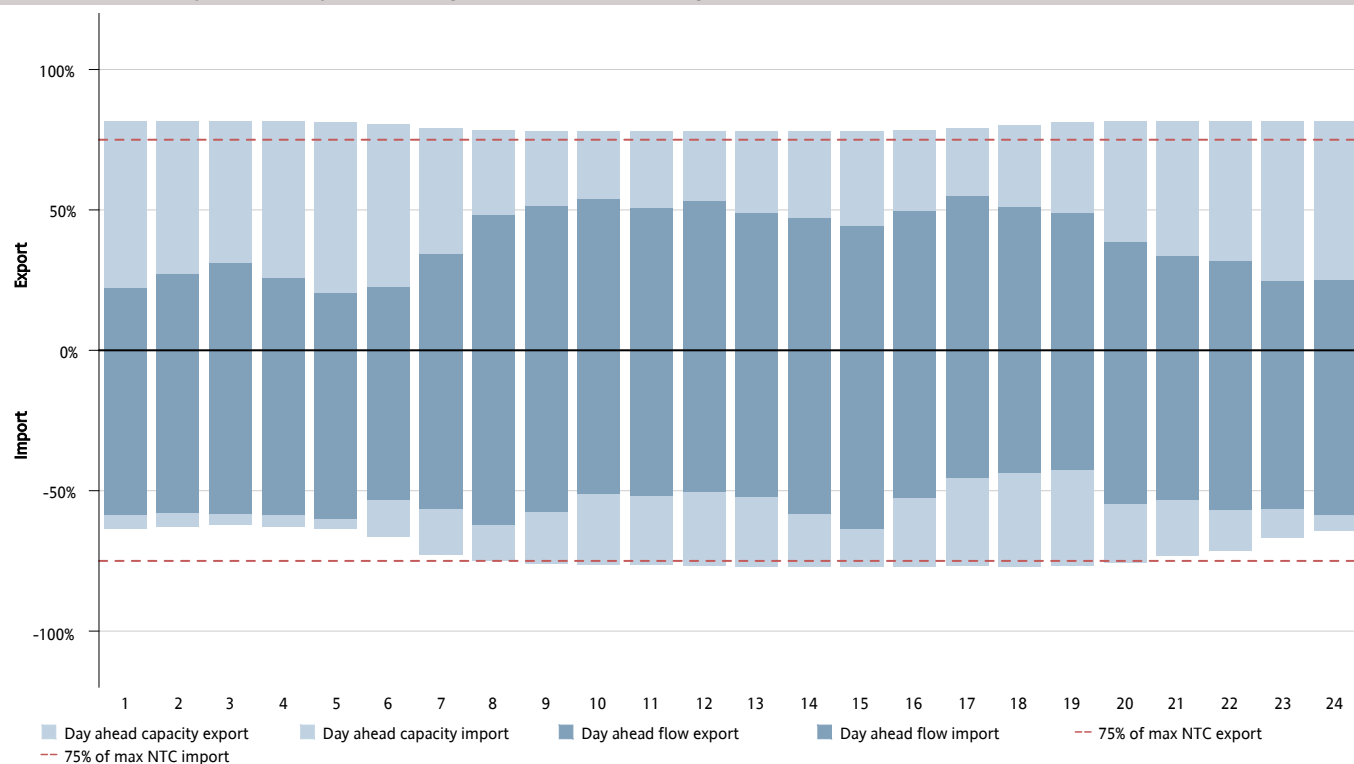


Figure 41: Shows cross-zonal day-ahead capacity result for the AC corridor NO1-SE3, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO1 to SE3, while import indicates flow from SE3 to NO1.

NO1-SE3: hourly day ahead capacities and flows – MW

Quarter 4, 2019

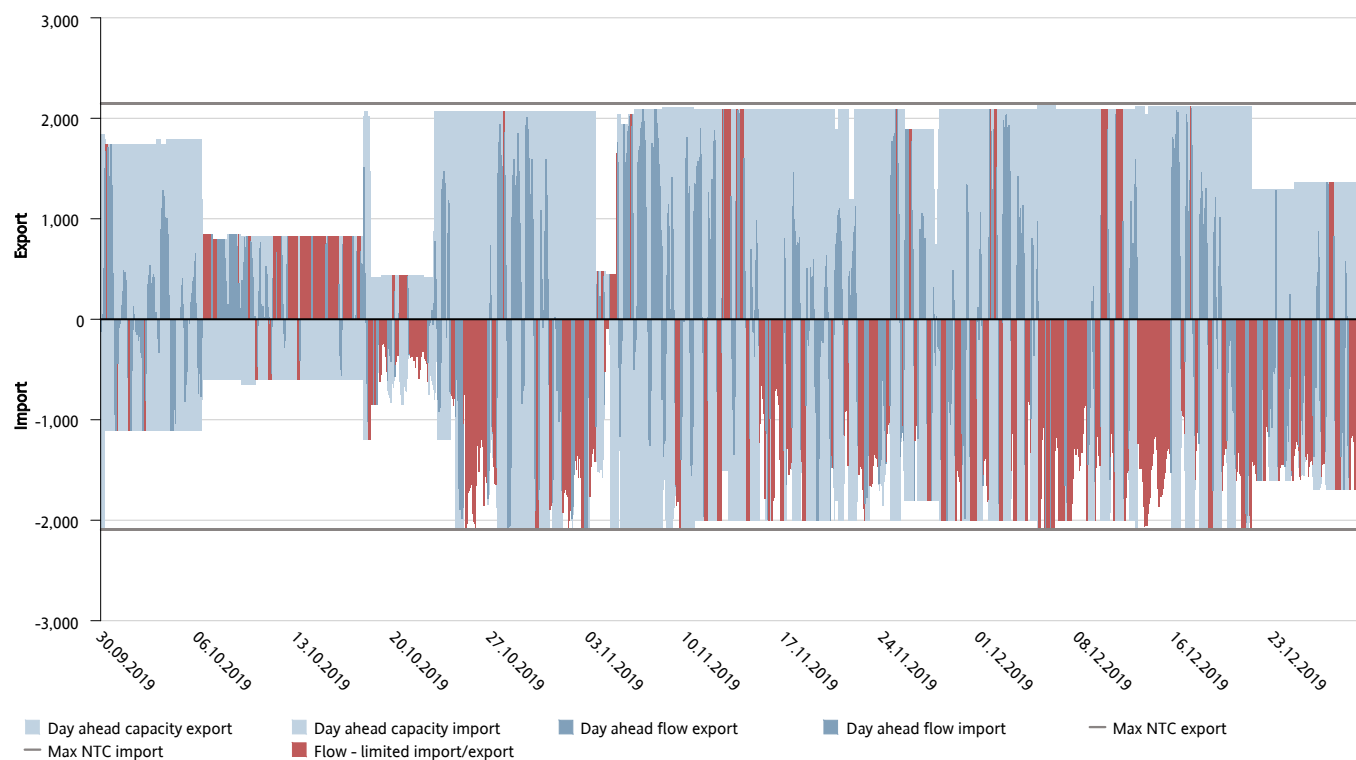


Figure 42: Shows cross-zonal day-ahead capacity result for the AC corridor NO1-SE3, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO1 to SE3, while import indicates flow from SE3 to NO1.

NO1-SE3: price comparison in EUR

Quarter 4, 2019

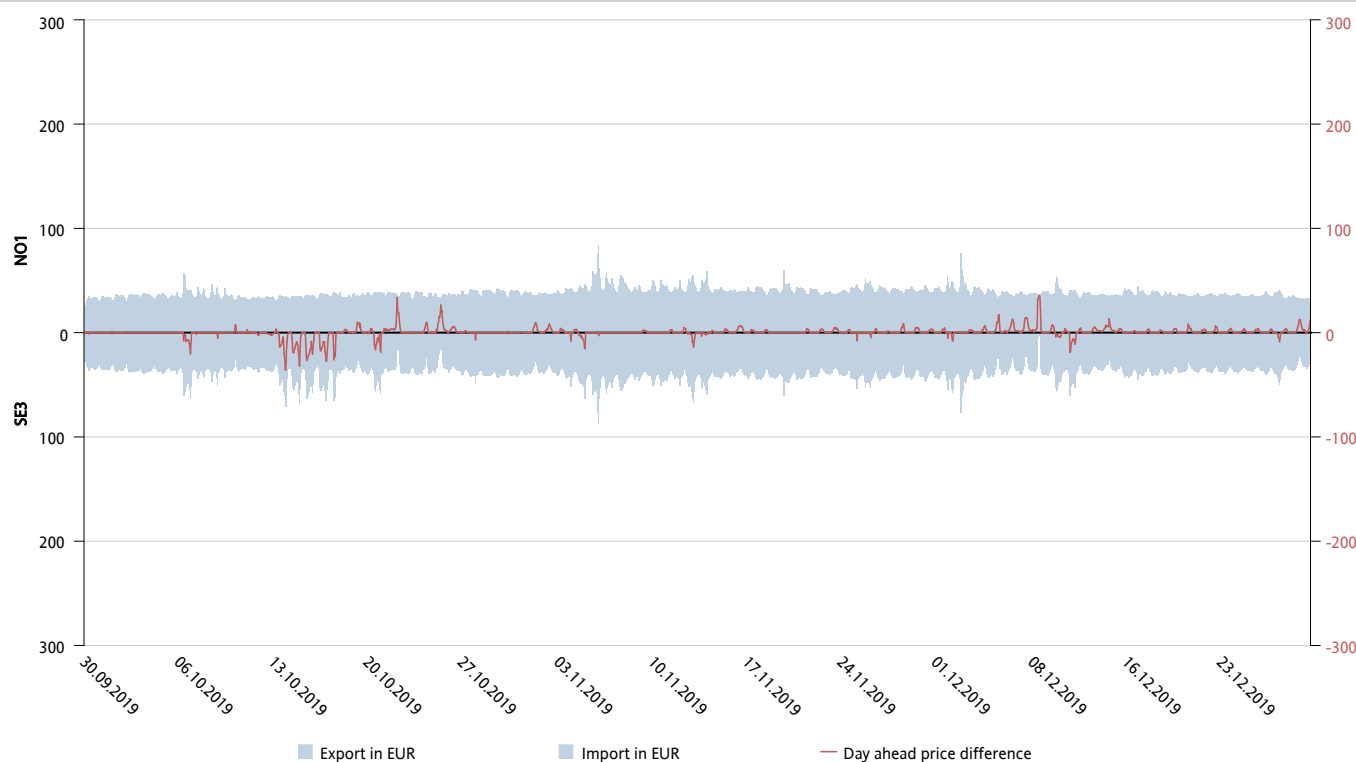


Figure 43: Shows day-ahead prices for the AC corridor NO1-SE3, all prices are in EUR. The red line shows the price difference between the two areas.

NO2-NL: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

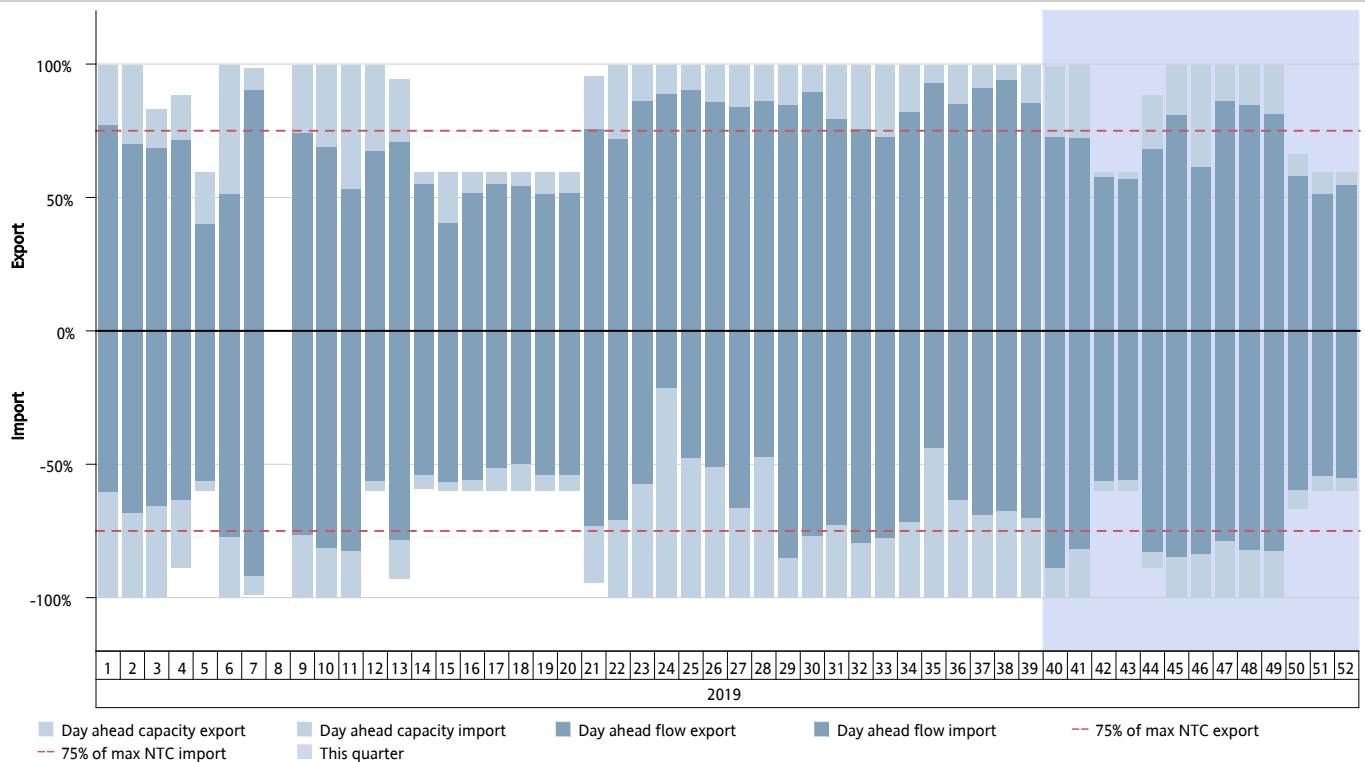


Figure 44: Shows cross-zonal day-ahead capacity result for the HVDC corridor NO2-NL, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO2 to NL, while import indicates flow from NL to NO2.

NO2-NL: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

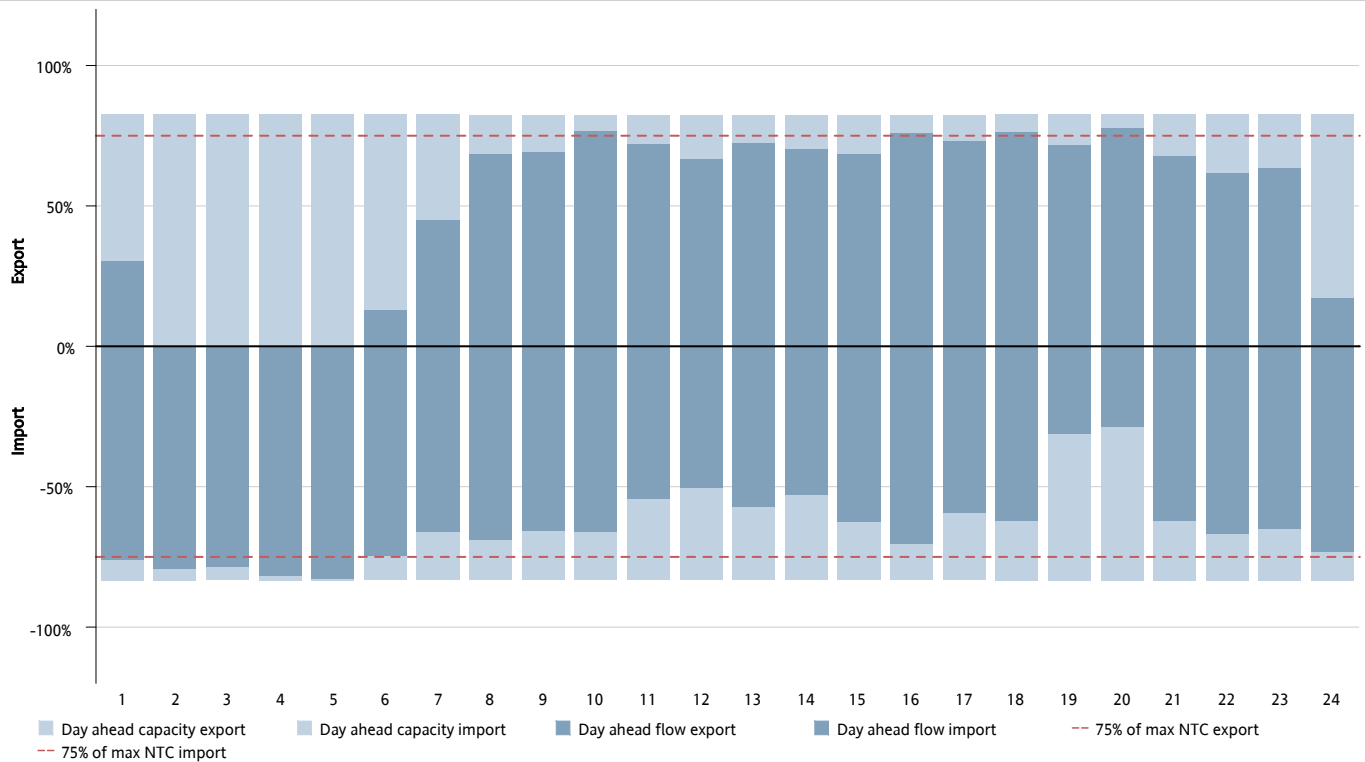


Figure 45: Shows cross-zonal day-ahead capacity result for the HVDC corridor NO2-NL, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO2 to NL, while import indicates flow from NL to NO2.

NO2-NL: hourly day ahead capacities and flows – MW

Quarter 4, 2019

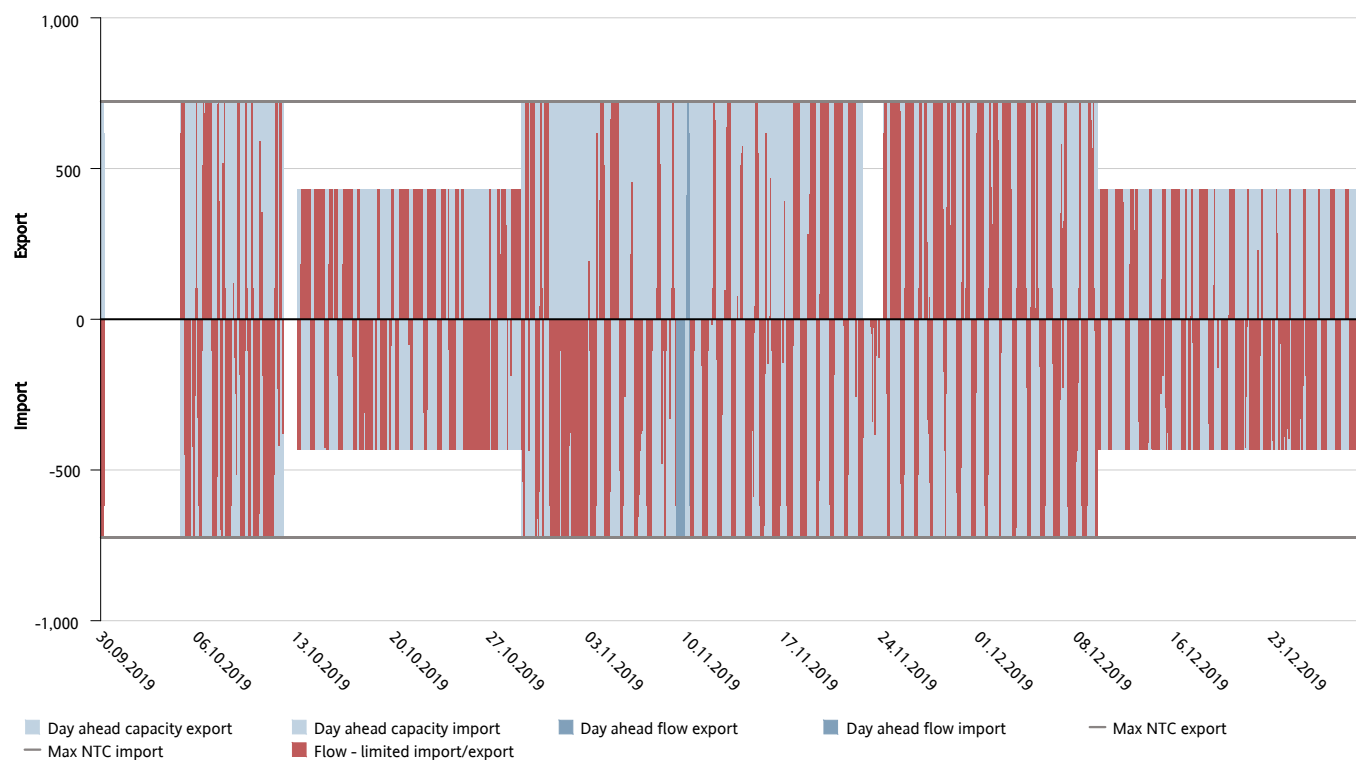


Figure 46: Shows cross-zonal day-ahead capacity result for the HVDC corridor NO2-NL, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO2 to NL, while import indicates flow from NL to NO2.

NO2-NL: price comparison in EUR

Quarter 4, 2019

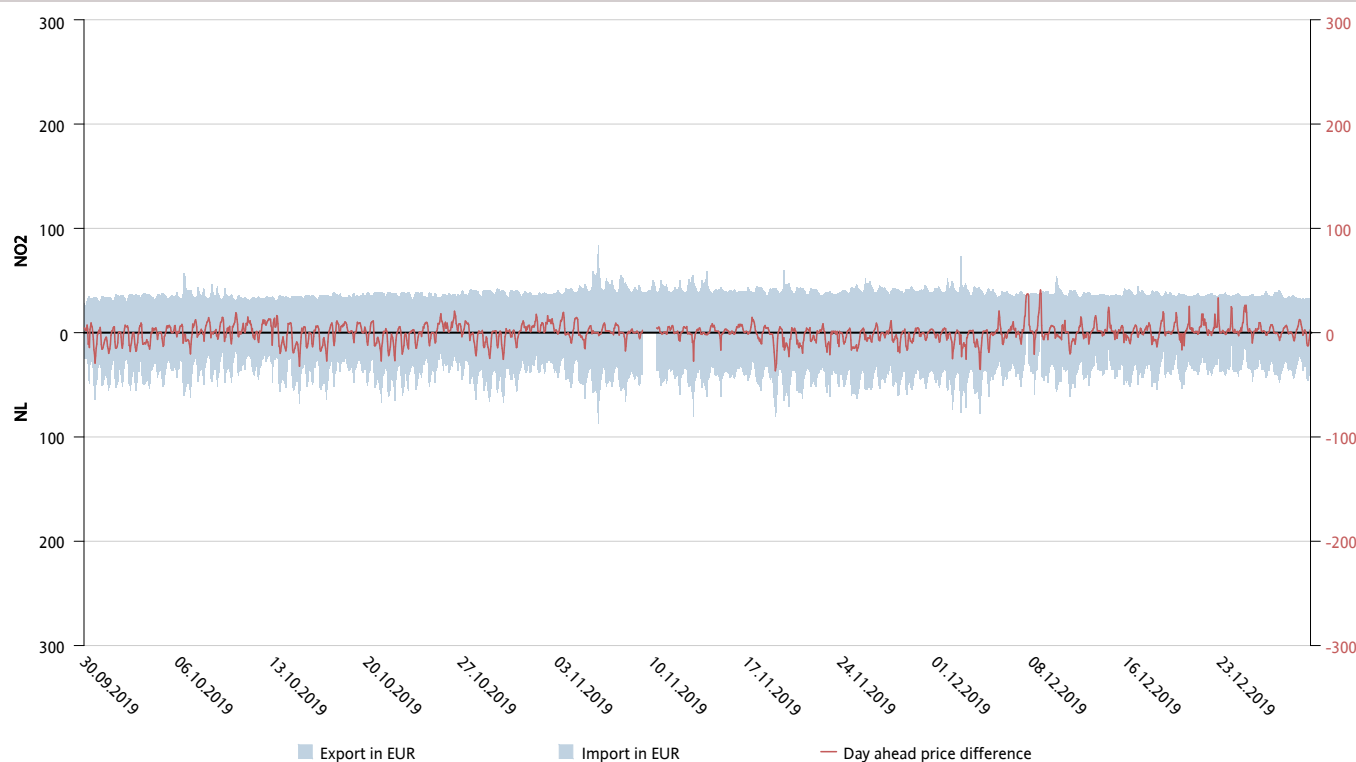


Figure 47: Shows day-ahead prices for the HVDC corridor NO2-NL, all prices are in EUR. The red line shows the price difference between the two areas.

NO3-SE2: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

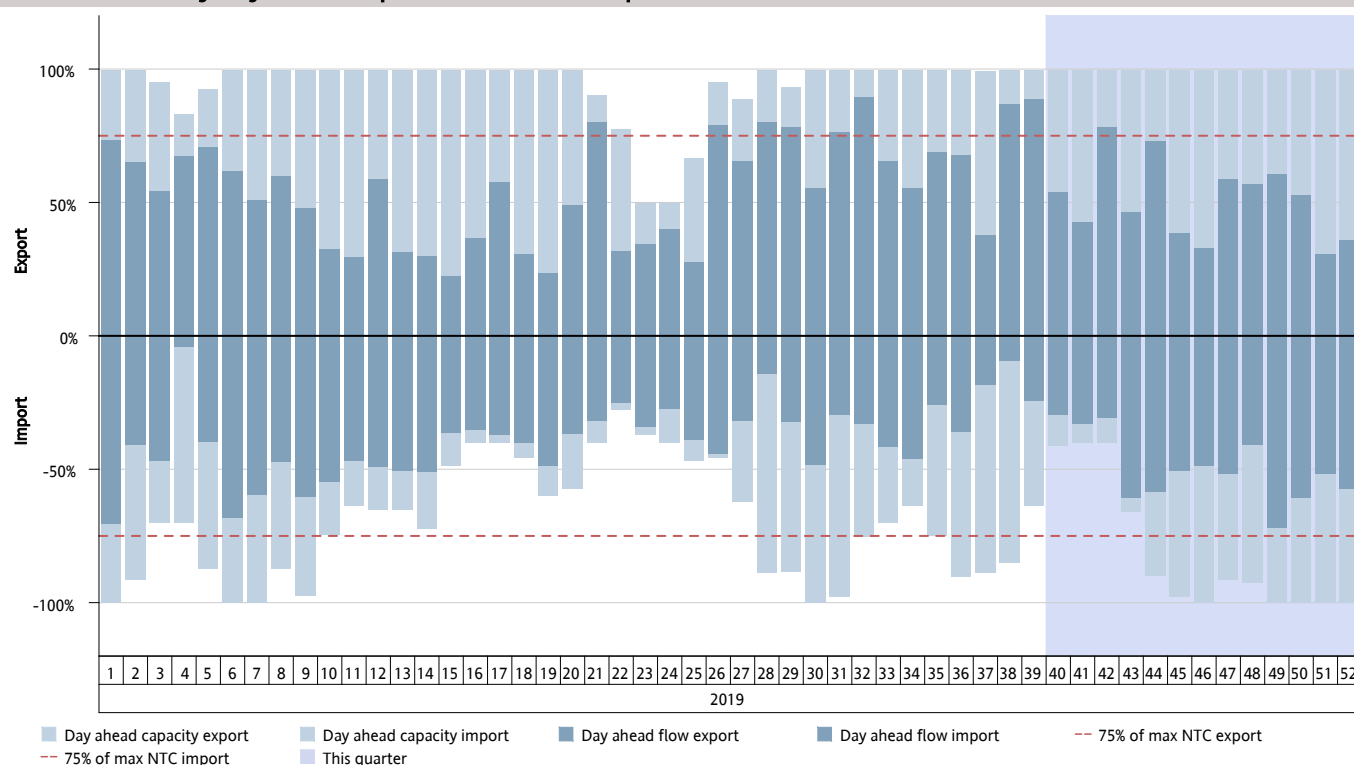


Figure 48: Shows cross-zonal day-ahead capacity result for the AC corridor NO3-SE2, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO3 to SE2, while import indicates flow from SE2 to NO3.

NO3-SE2: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

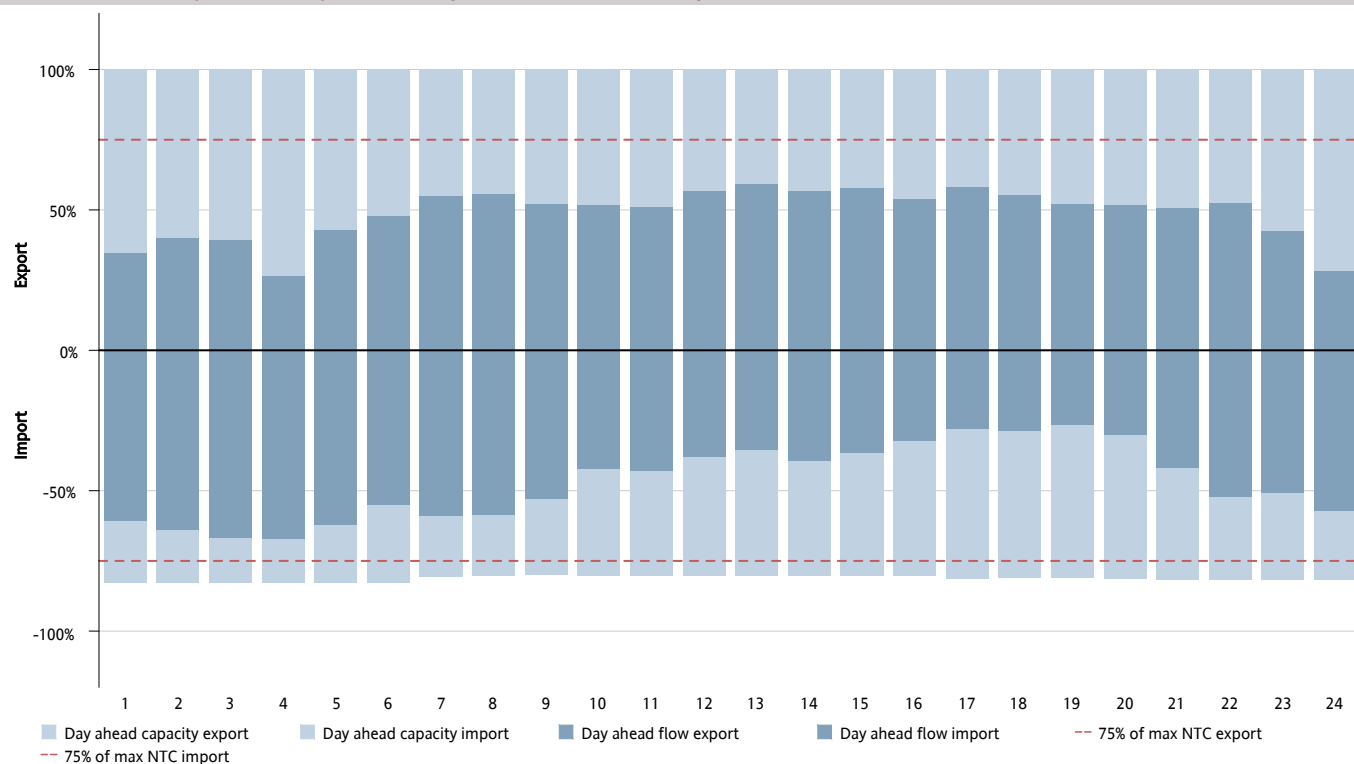


Figure 49: Shows cross-zonal day-ahead capacity result for the AC corridor NO3-SE2, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO3 to SE2, while import indicates flow from SE2 to NO3.

NO3-SE2: hourly day ahead capacities and flows – MW

Quarter 4, 2019

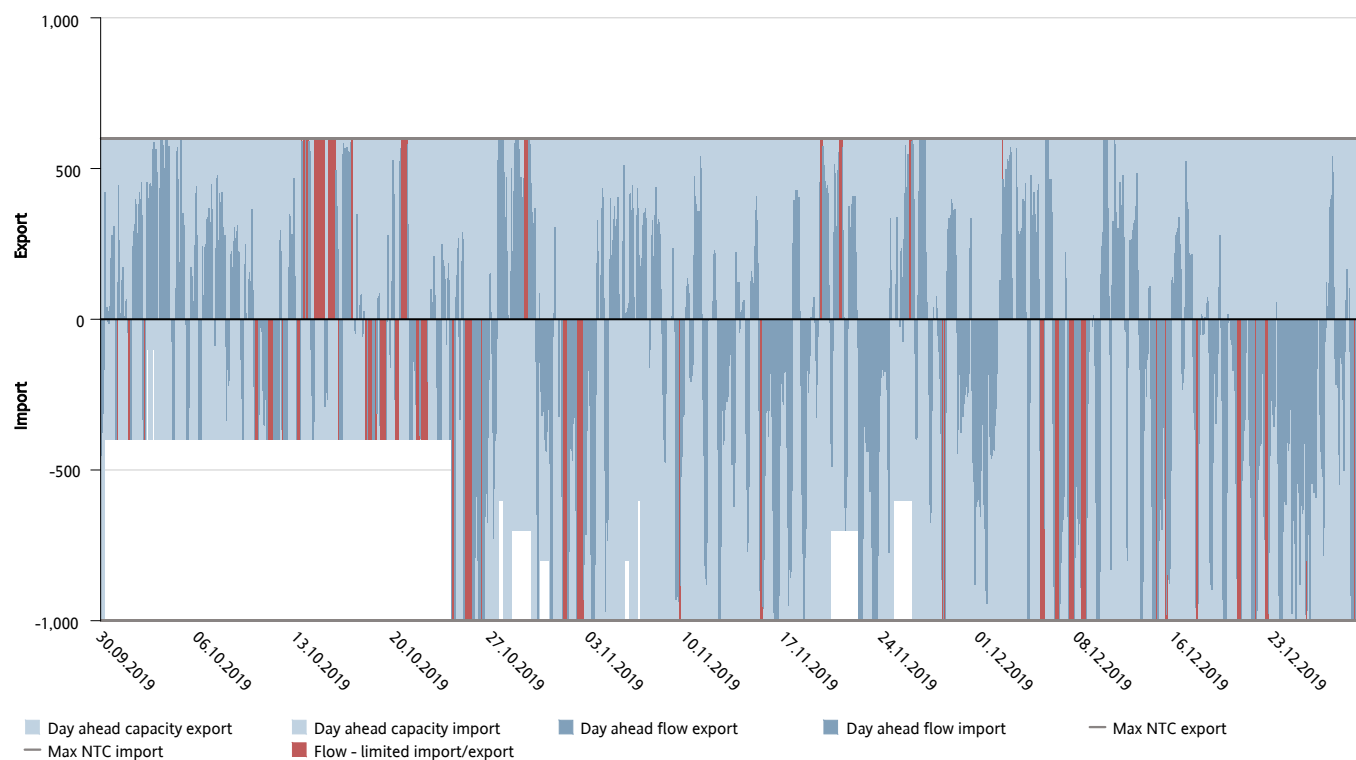


Figure 50: Shows cross-zonal day-ahead capacity result for the AC corridor NO3-SE2, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO3 to SE2, while import indicates flow from SE2 to NO3.

NO3-SE2: price comparison in EUR

Quarter 4, 2019

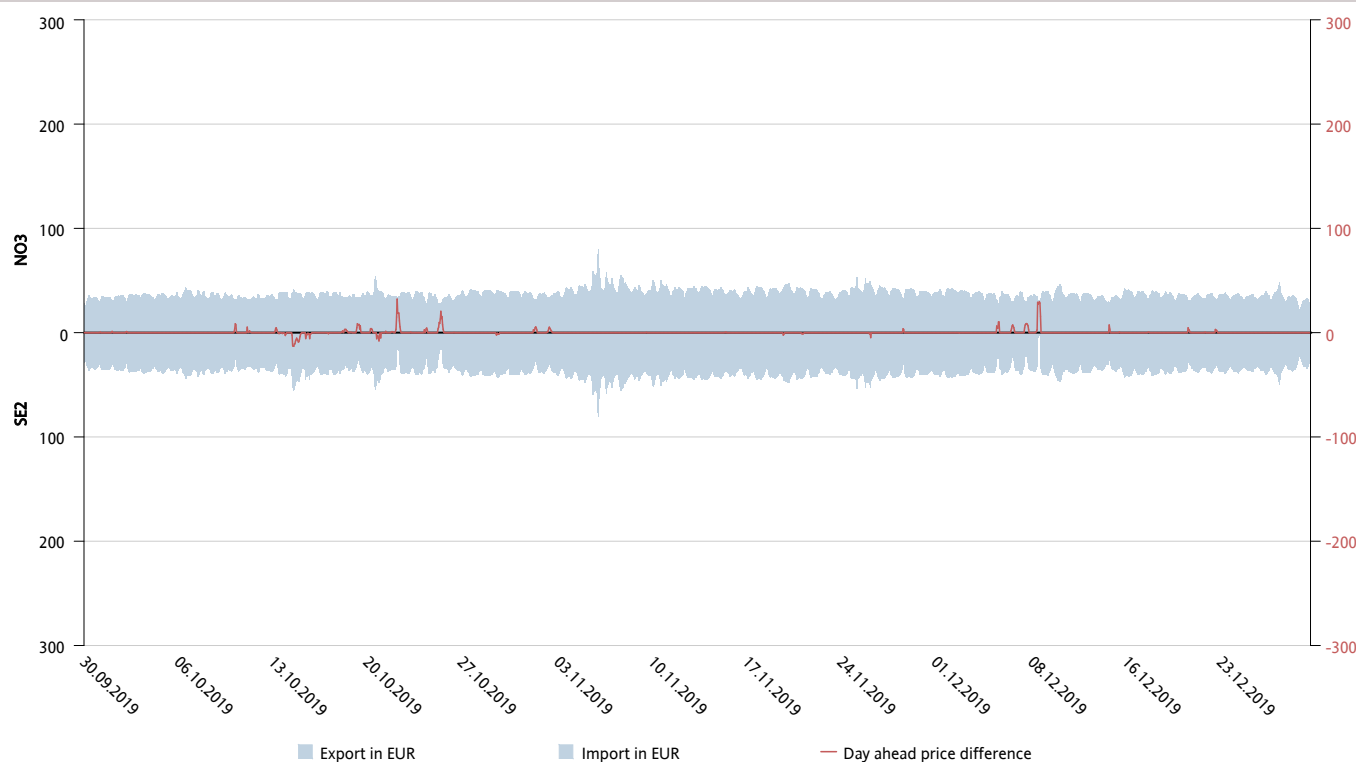


Figure 51: Shows day-ahead prices for the AC corridor NO3-SE2, all prices are in EUR. The red line shows the price difference between the two areas.

NO4-SE1: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

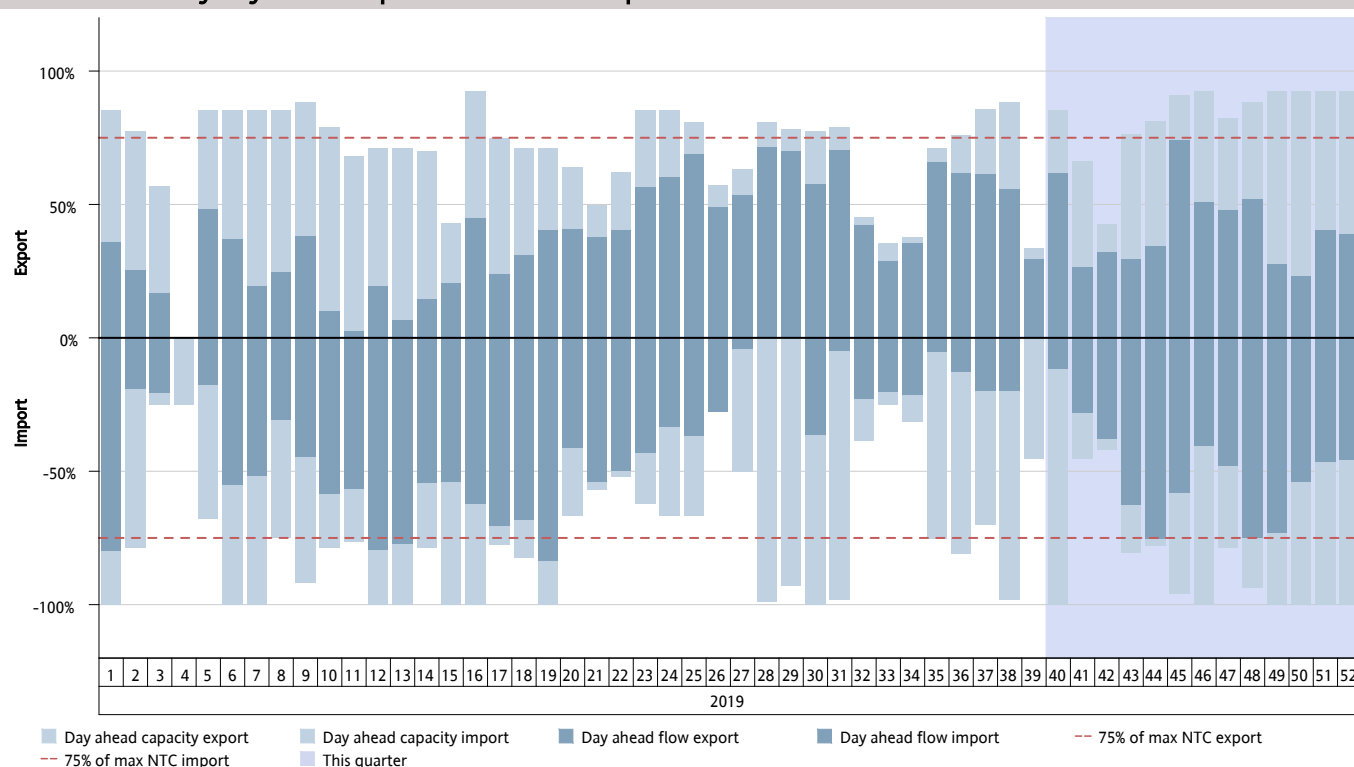


Figure 52: Shows cross-zonal day-ahead capacity result for the AC corridor NO4-SE1, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO4 to SE1, while import indicates flow from SE1 to NO4.

NO4-SE1: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

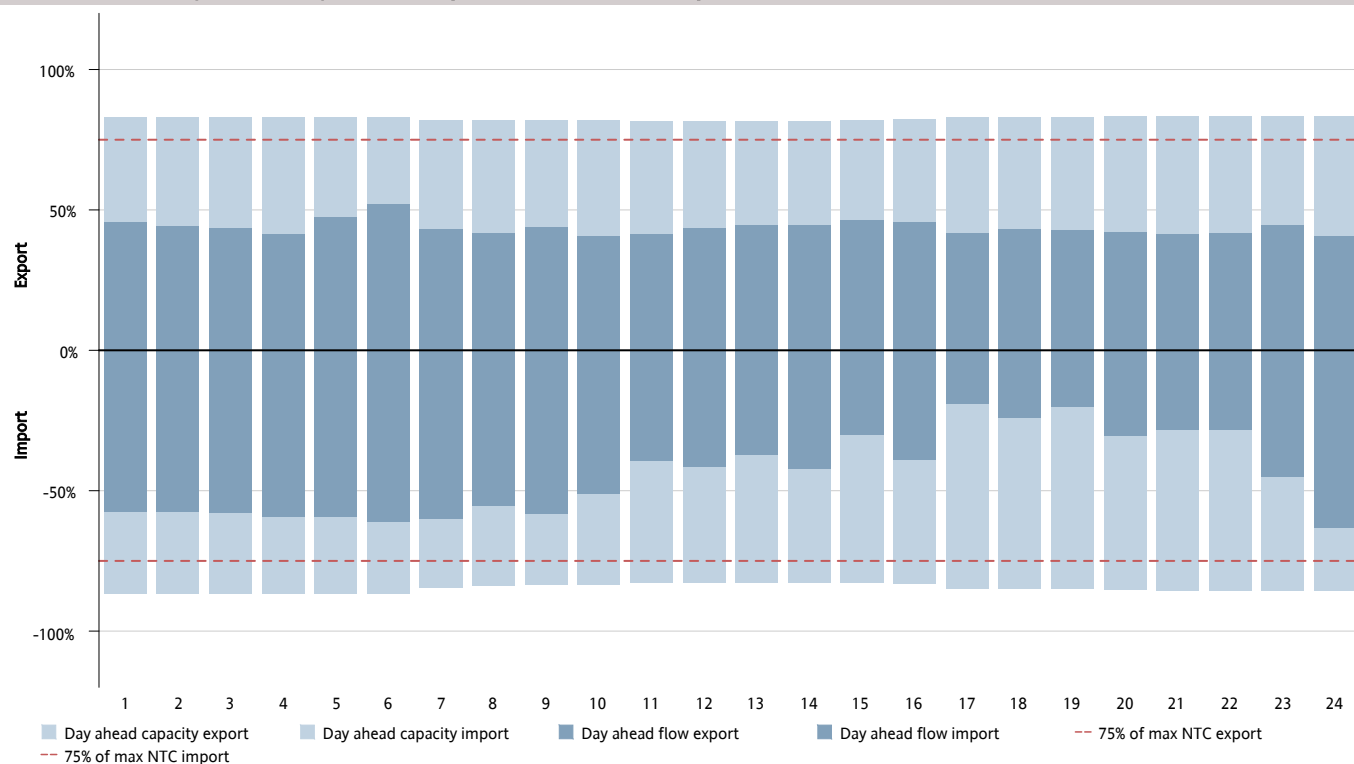


Figure 53: Shows cross-zonal day-ahead capacity result for the AC corridor NO4-SE1, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO4 to SE1, while import indicates flow from SE1 to NO4.

NO4-SE1: hourly day ahead capacities and flows – MW

Quarter 4, 2019

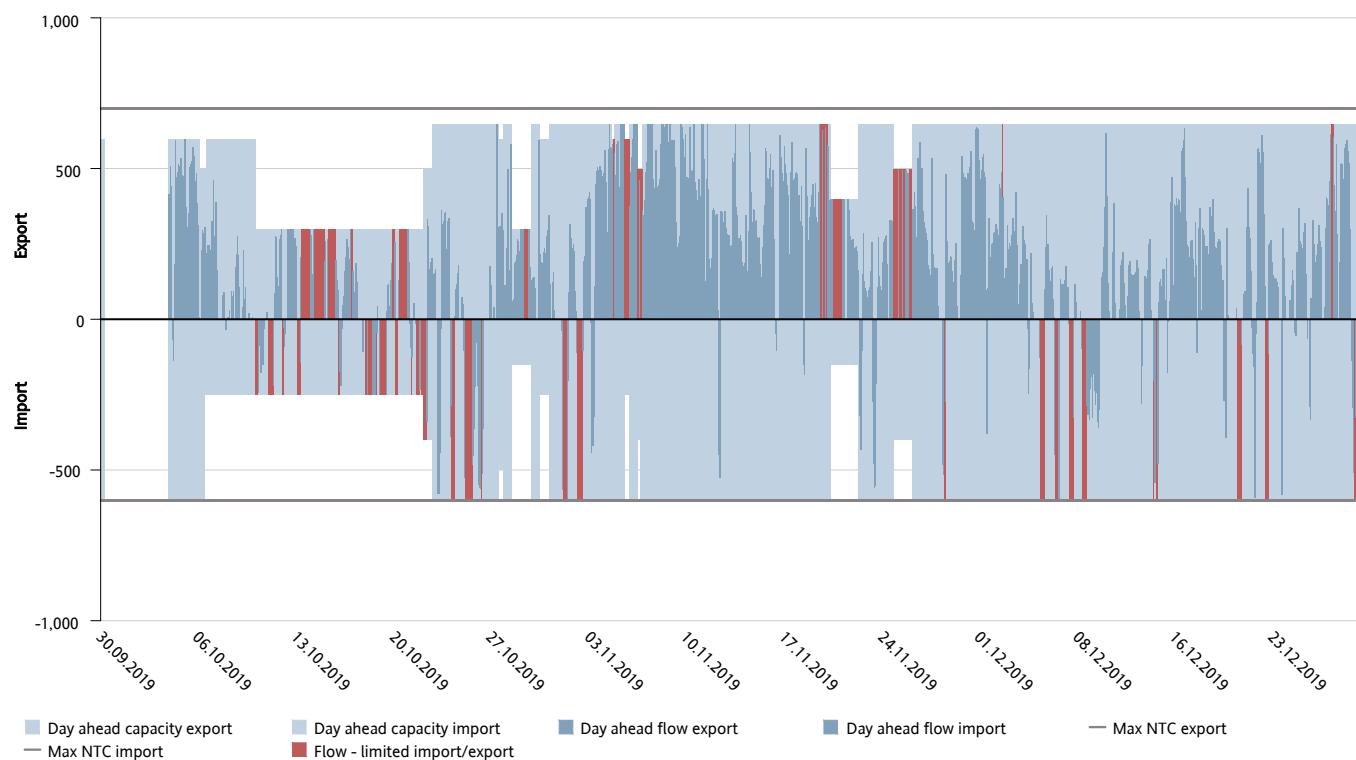


Figure 54: Shows cross-zonal day-ahead capacity result for the AC corridor NO4-SE1, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO4 to SE1, while import indicates flow from SE1 to NO4.

NO4-SE1: price comparison in EUR

Quarter 4, 2019

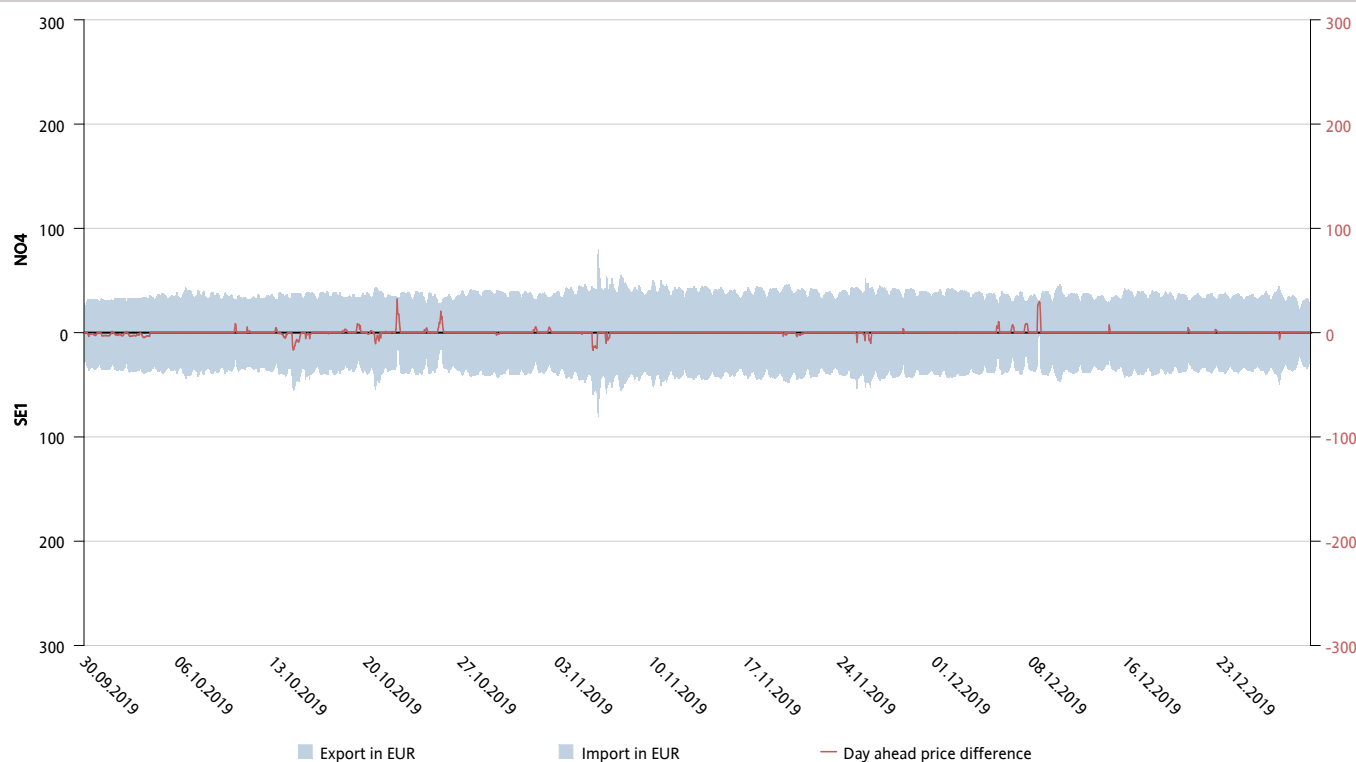


Figure 55: Shows day-ahead prices for the AC corridor NO4-SE1, all prices are in EUR. The red line shows the price difference between the two areas.

NO4-SE2: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

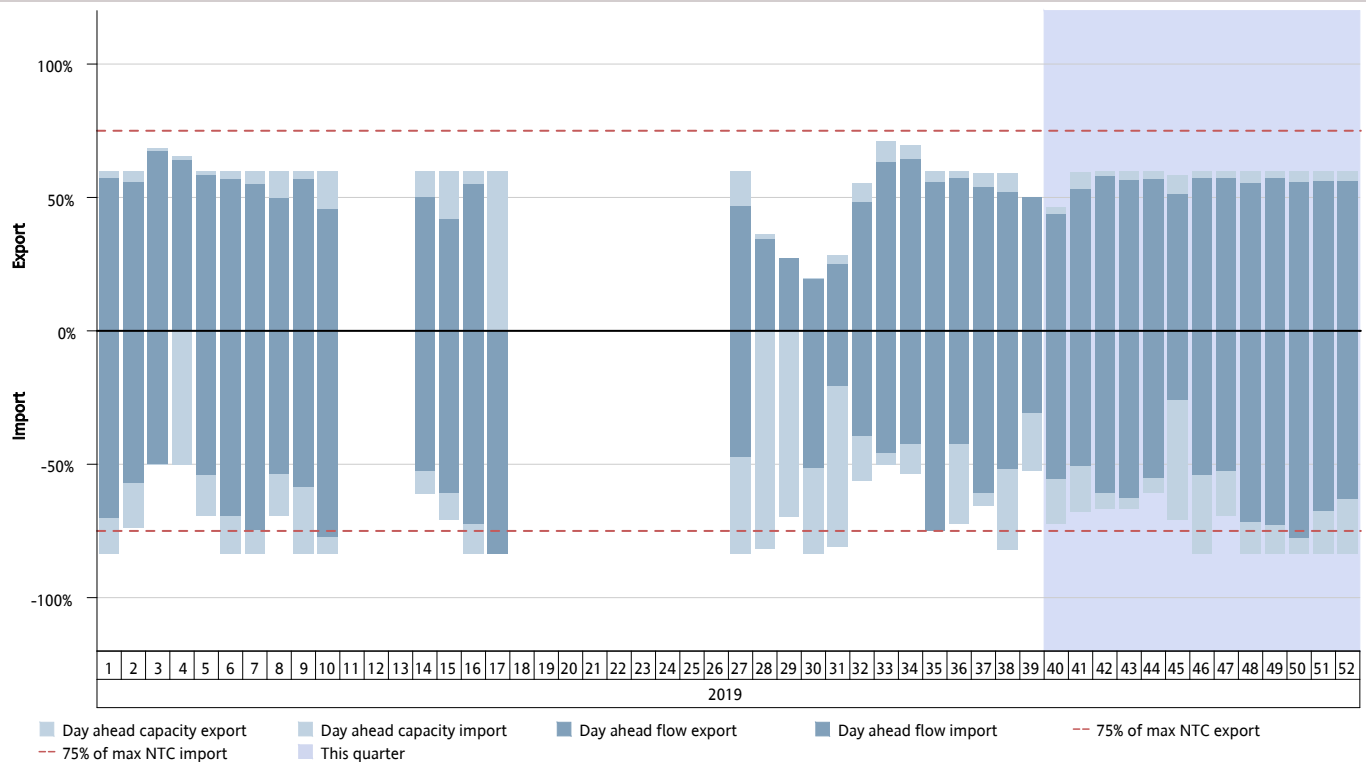


Figure 56: Shows cross-zonal day-ahead capacity result for the AC corridor NO4-SE2, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO4 to SE2, while import indicates flow from SE2 to NO4.

NO4-SE2: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

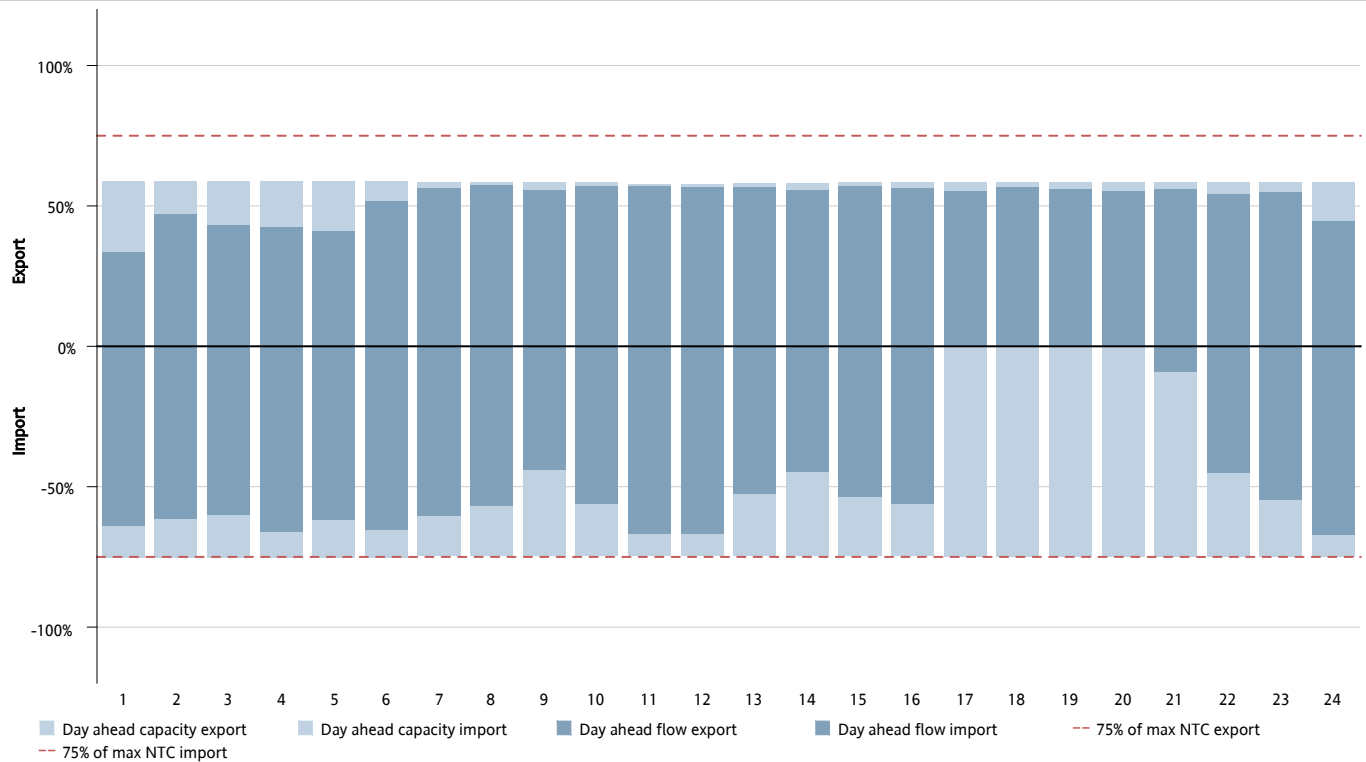


Figure 57: Shows cross-zonal day-ahead capacity result for the AC corridor NO4-SE2, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO4 to SE2, while import indicates flow from SE2 to NO4.

NO4-SE2: hourly day ahead capacities and flows – MW

Quarter 4, 2019

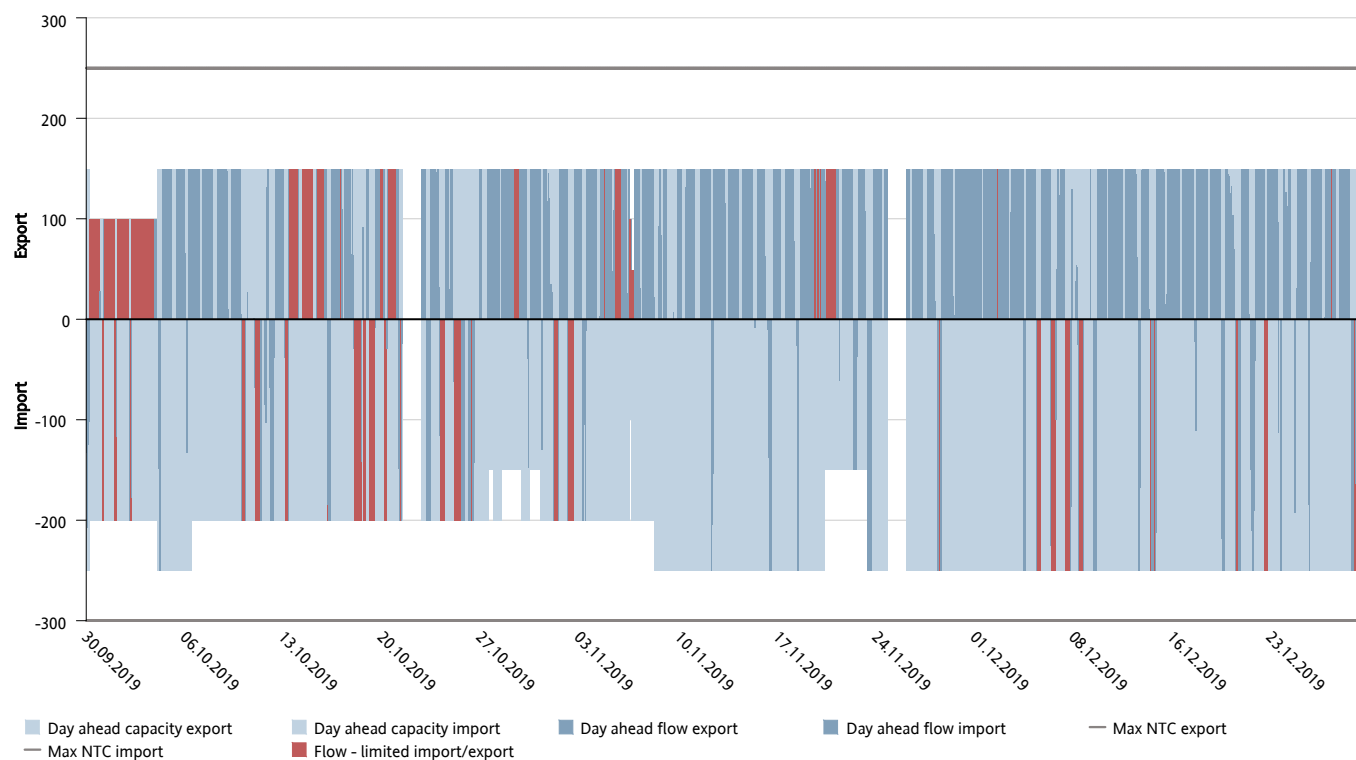


Figure 58: Shows cross-zonal day-ahead capacity result for the AC corridor NO4-SE2, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from NO4 to SE2, while import indicates flow from SE2 to NO4.

NO4-SE2: price comparison in EUR

Quarter 4, 2019

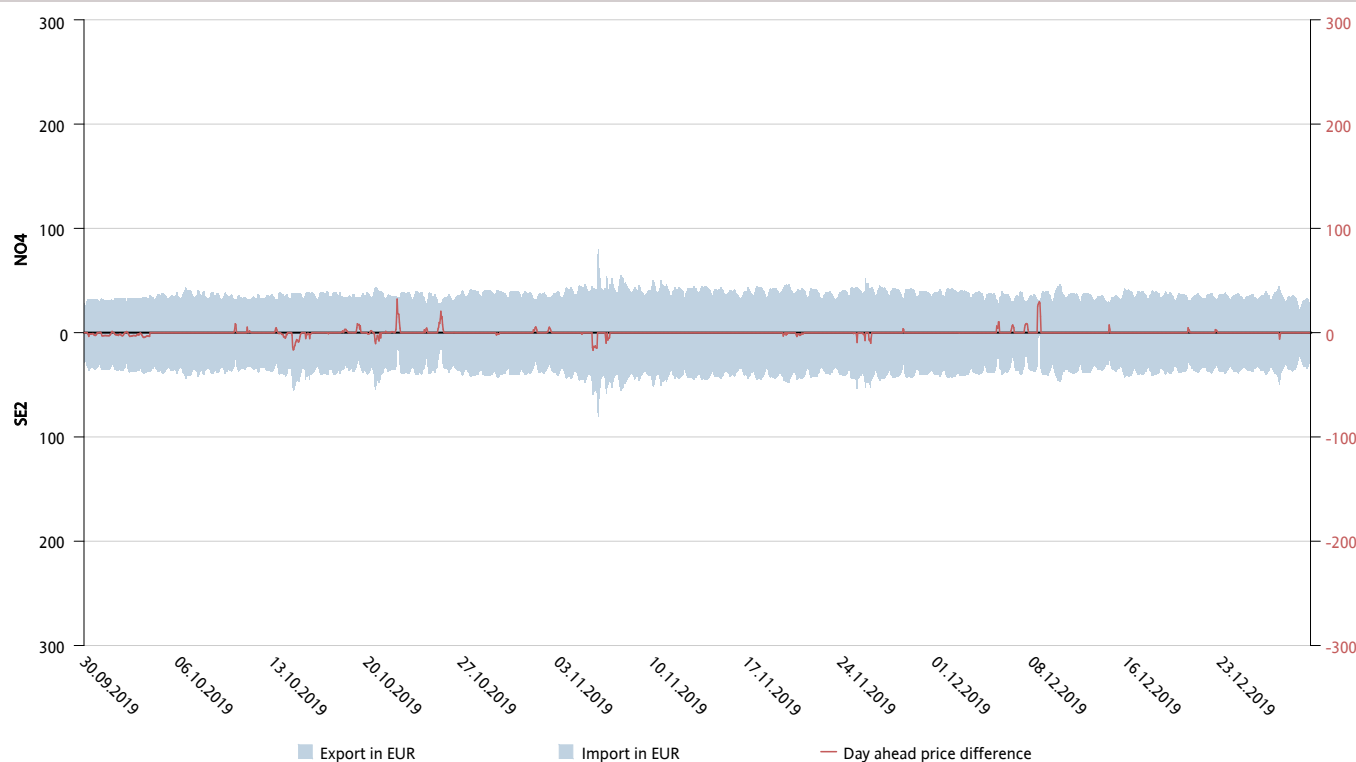


Figure 59: Shows day-ahead prices for the AC corridor NO4-SE2, all prices are in EUR. The red line shows the price difference between the two areas.

SE4-DE: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

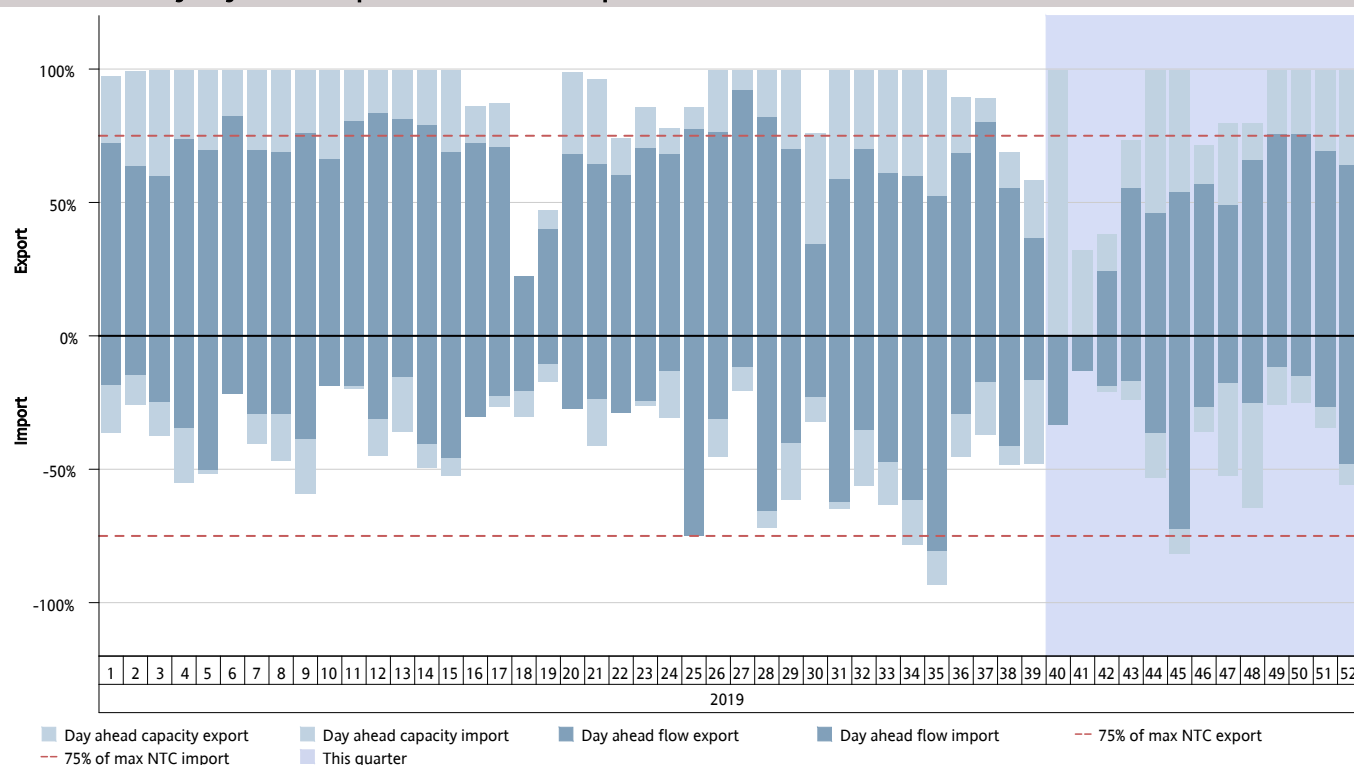


Figure 60: Shows cross-zonal day-ahead capacity result for the HVDC corridor SE4-DE, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from SE4 to DE, while import indicates flow from DE to SE4.

SE4-DE: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

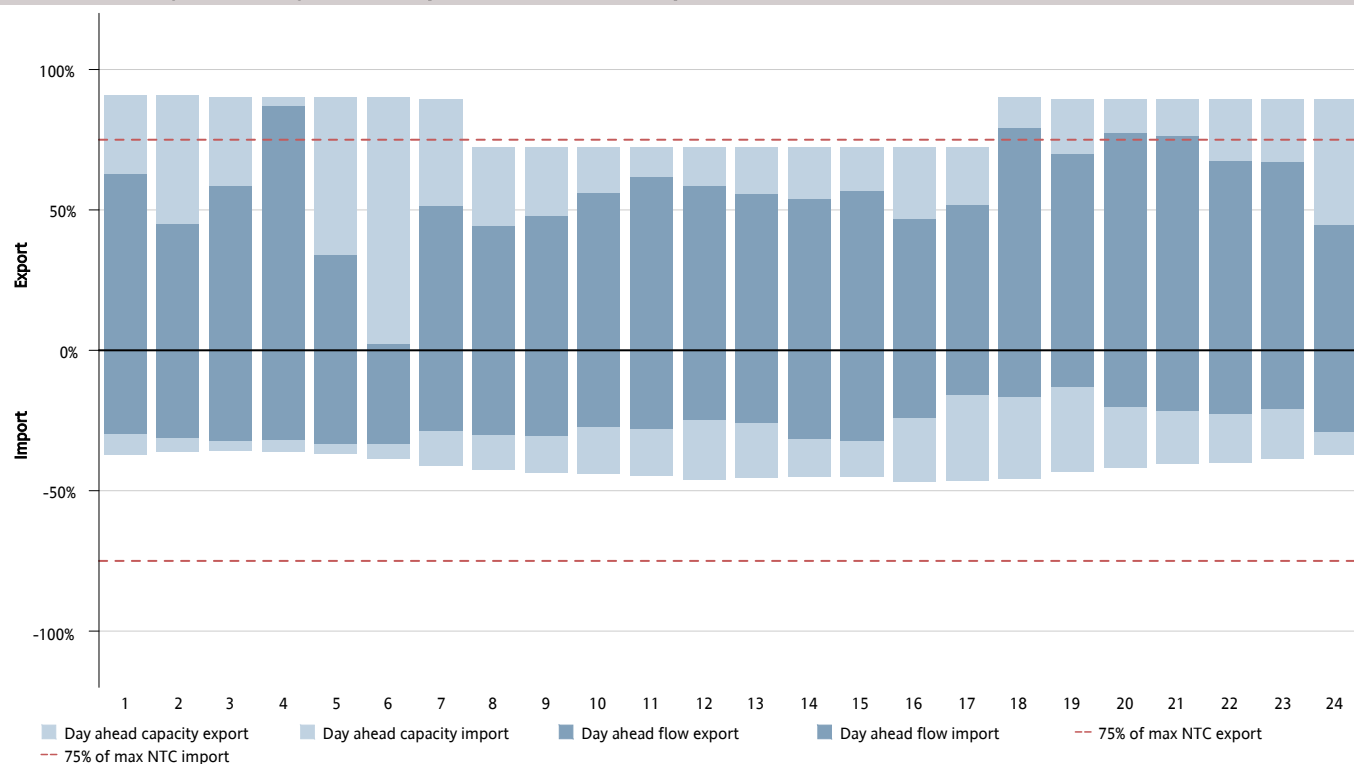


Figure 61: Shows cross-zonal day-ahead capacity result for the HVDC corridor SE4-DE, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from SE4 to DE, while import indicates flow from DE to SE4.

SE4-DE: hourly day ahead capacities and flows – MW

Quarter 4, 2019

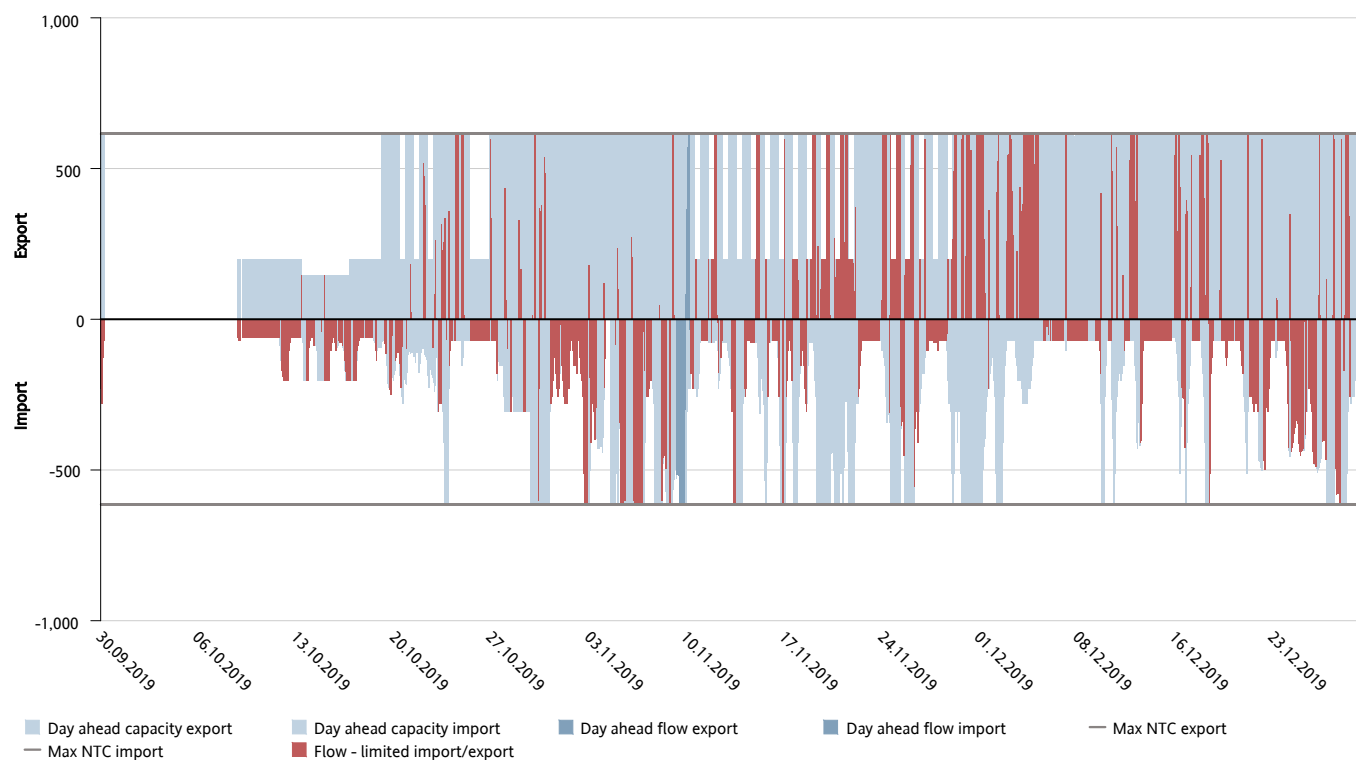


Figure 62: Shows cross-zonal day-ahead capacity result for the HVDC corridor SE4-DE, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from SE4 to DE, while import indicates flow from DE to SE4.

SE4-DE: price comparison in EUR

Quarter 4, 2019

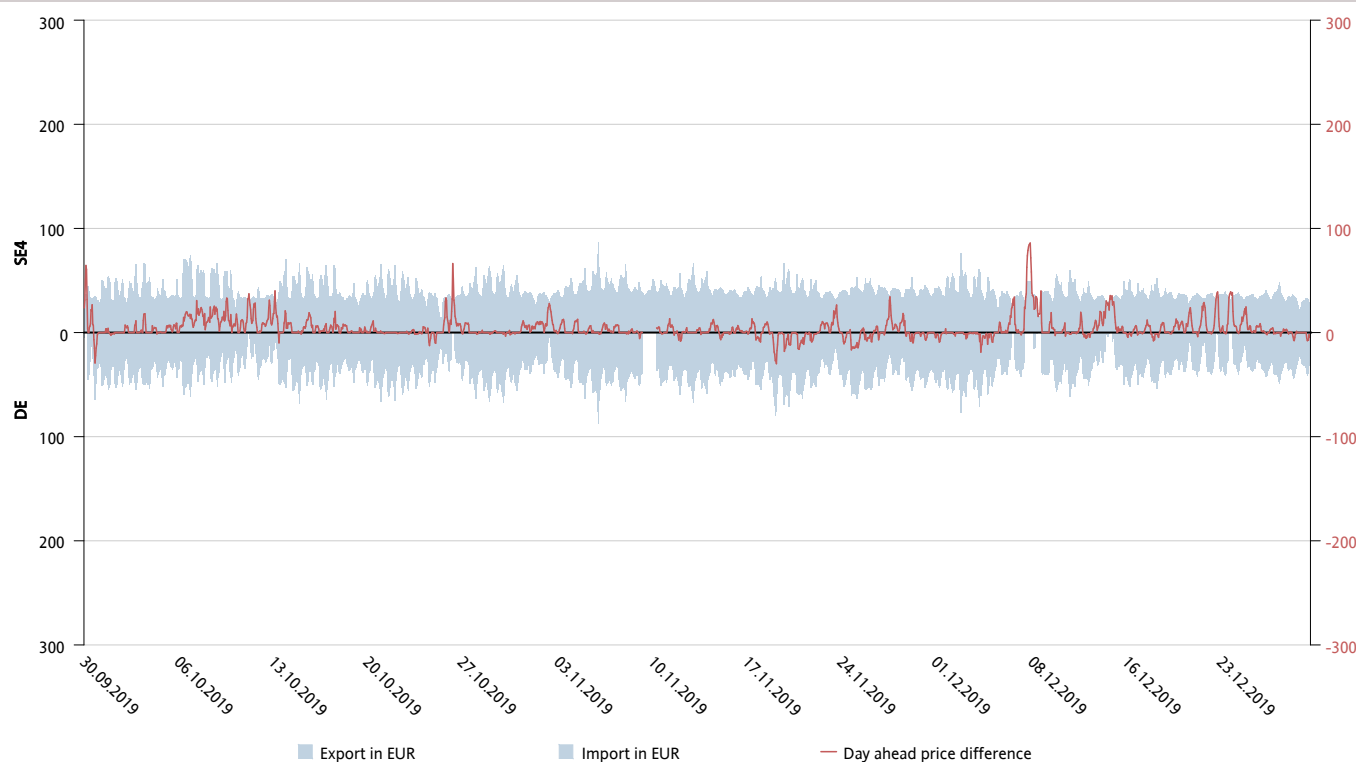


Figure 63: Shows day-ahead prices for the HVDC corridor SE4-DE, all prices are in EUR. The red line shows the price difference between the two areas.

SE4-LT: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

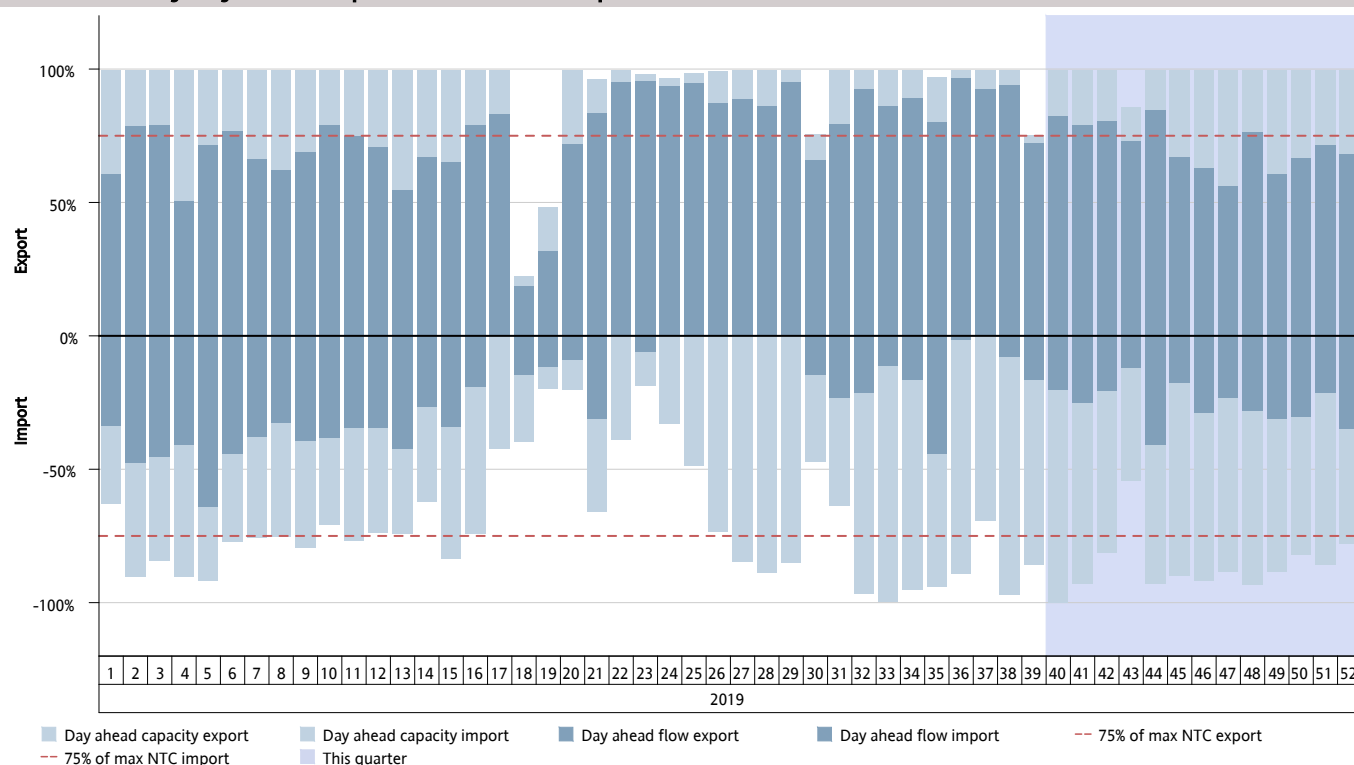


Figure 64: Shows cross-zonal day-ahead capacity result for the HVDC corridor SE4-LT, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from SE4 to LT, while import indicates flow from LT to SE4.

SE4-LT: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

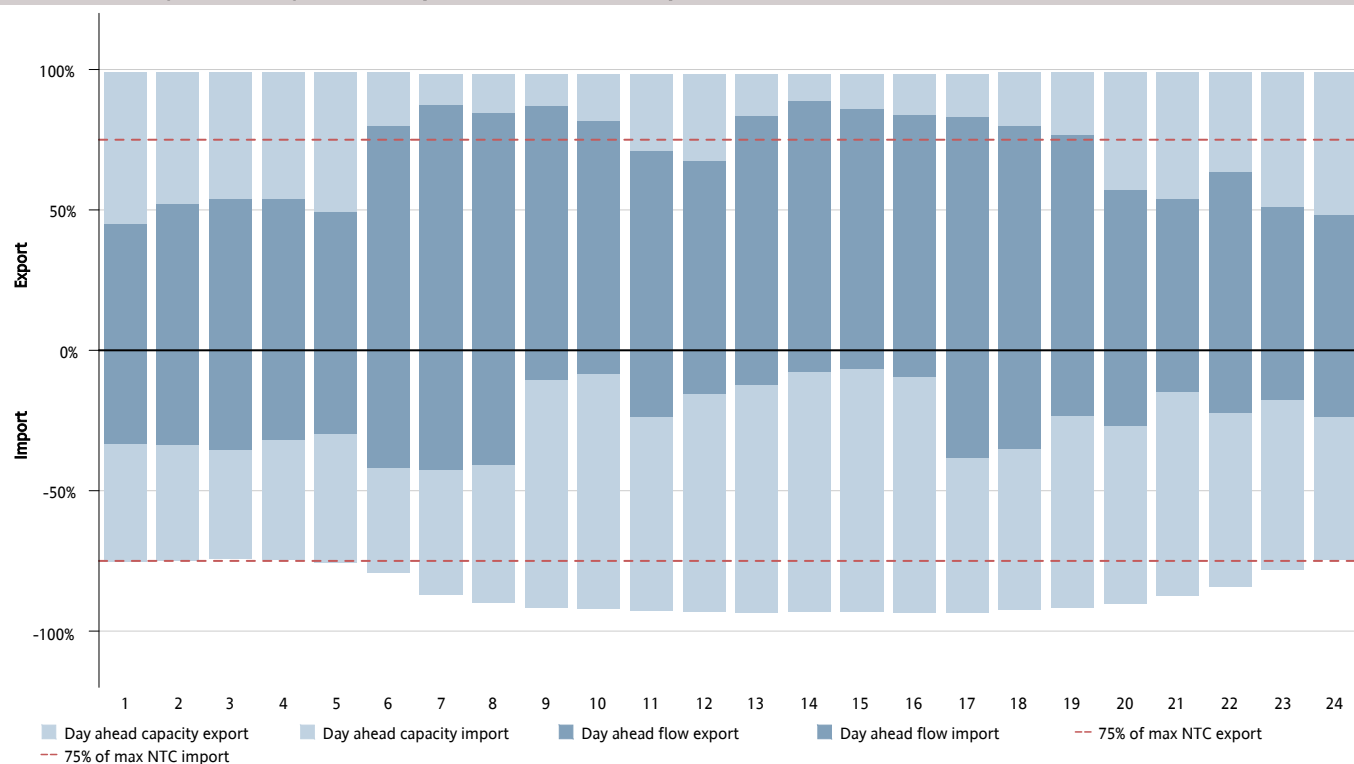


Figure 65: Shows cross-zonal day-ahead capacity result for the HVDC corridor SE4-LT, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from SE4 to LT, while import indicates flow from LT to SE4.

SE4-LT: hourly day ahead capacities and flows – MW

Quarter 4, 2019

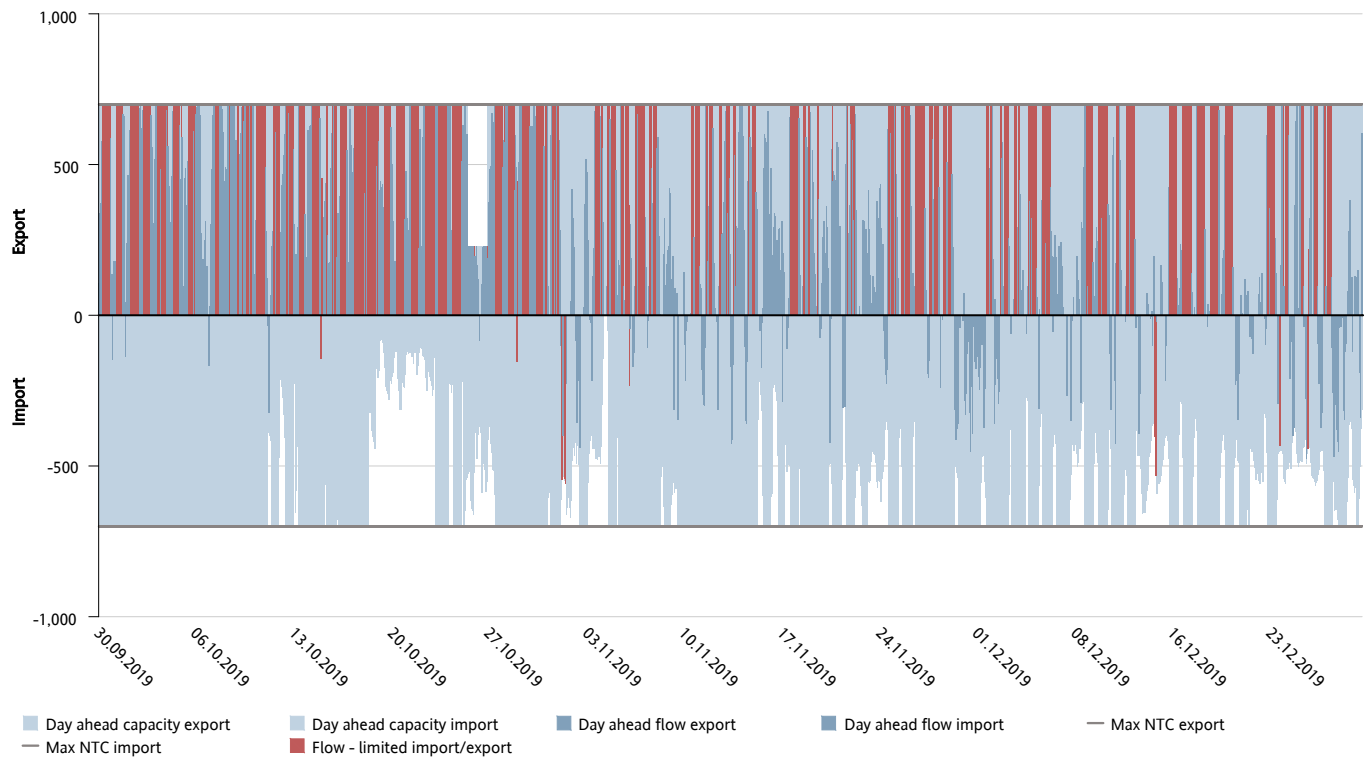


Figure 66: Shows cross-zonal day-ahead capacity result for the HVDC corridor SE4-LT, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from SE4 to LT, while import indicates flow from LT to SE4.

SE4-LT: price comparison in EUR

Quarter 4, 2019

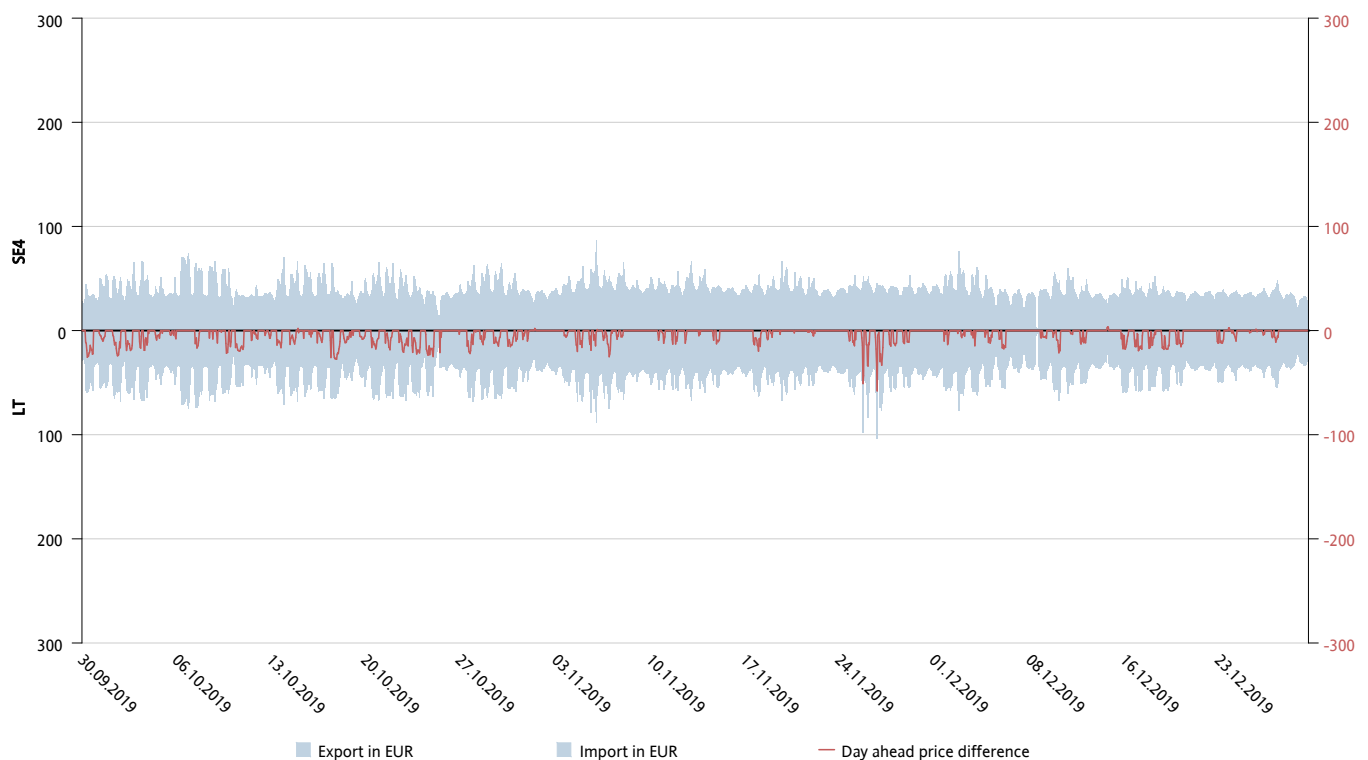


Figure 67: Shows day-ahead prices for the HVDC corridor SE4-LT, all prices are in EUR. The red line shows the price difference between the two areas.

SE4-PL: weekly day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

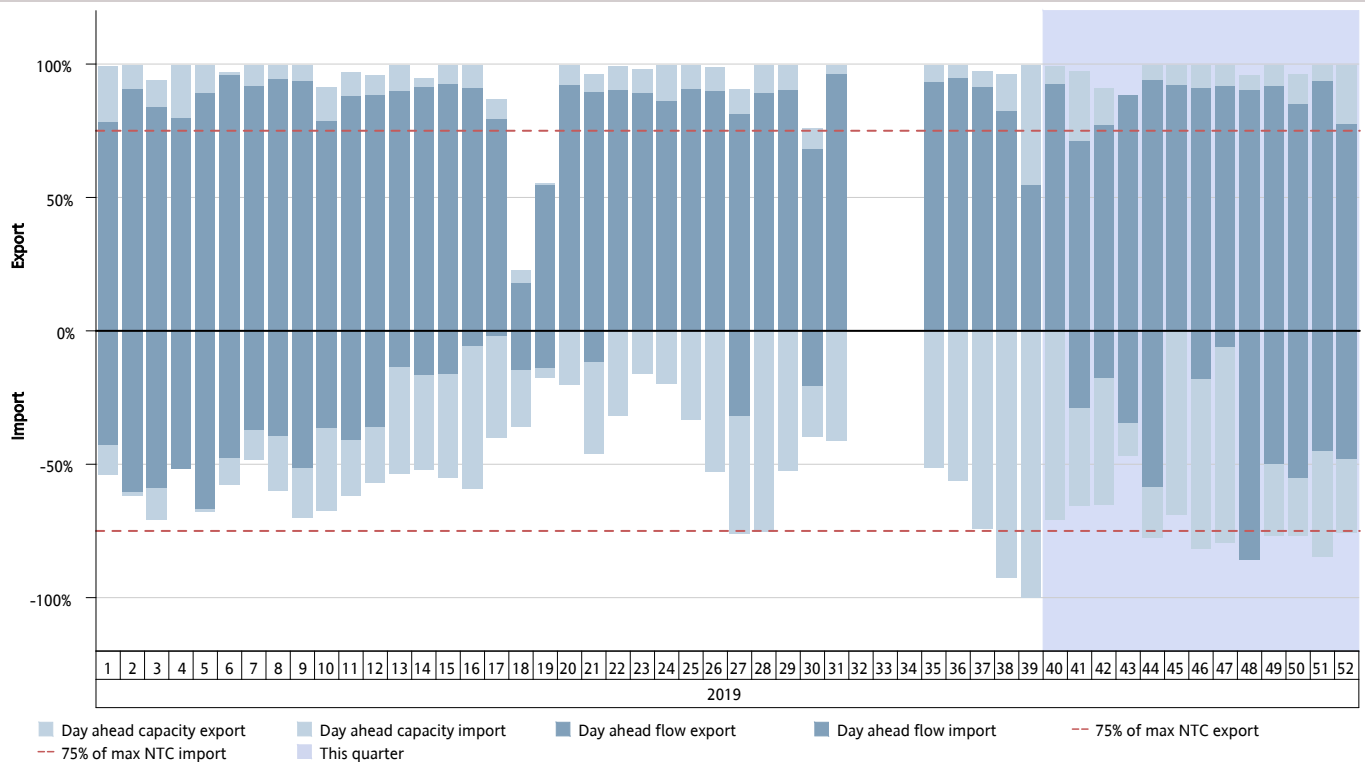


Figure 68: Shows cross-zonal day-ahead capacity result for the HVDC corridor SE4-PL, showing average weekly capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from SE4 to PL, while import indicates flow from PL to SE4.

SE4-PL: hourly mean day ahead capacities and flows – percent of max NTC

Quarter 4, 2019

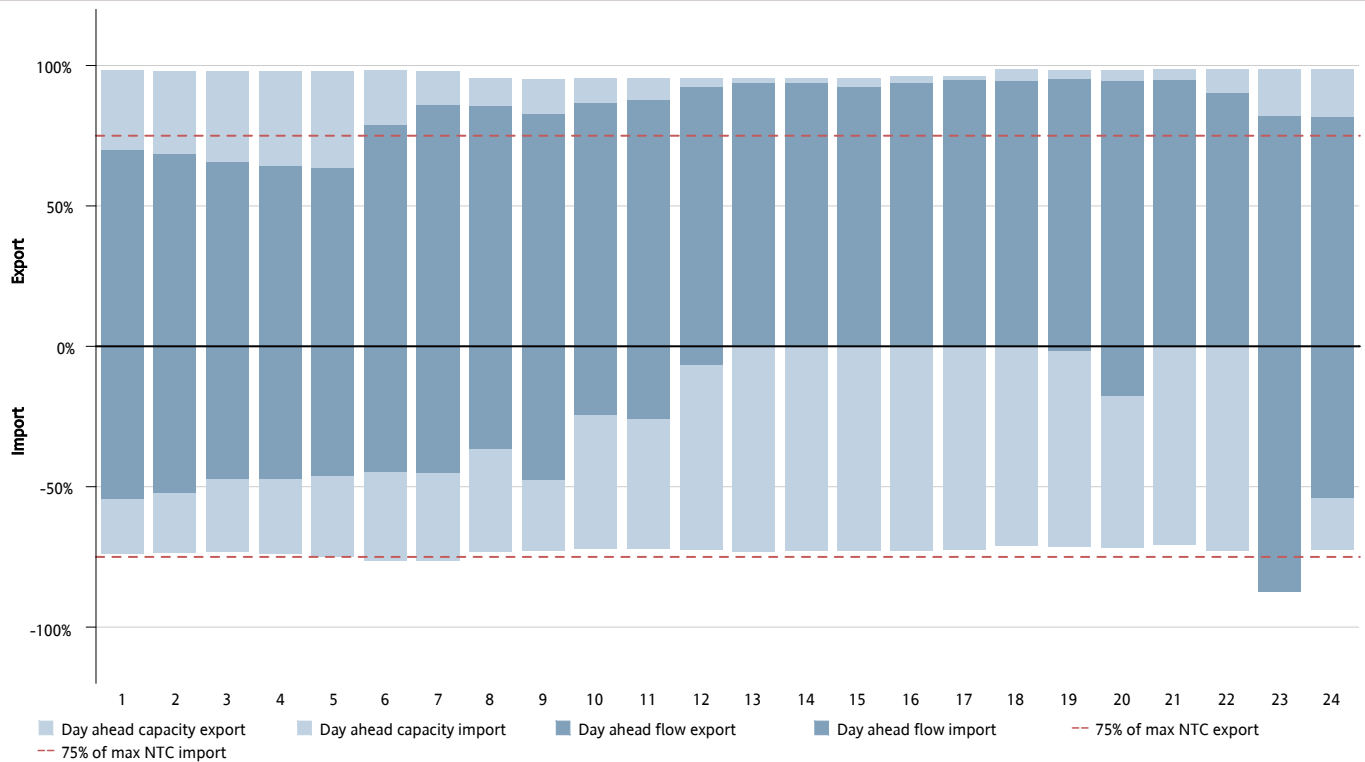


Figure 69: Shows cross-zonal day-ahead capacity result for the HVDC corridor SE4-PL, showing average per hour of the day (1-24) capacity given and flow as a percentage of max NTC. Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from SE4 to PL, while import indicates flow from PL to SE4.

SE4-PL: hourly day ahead capacities and flows – MW

Quarter 4, 2019

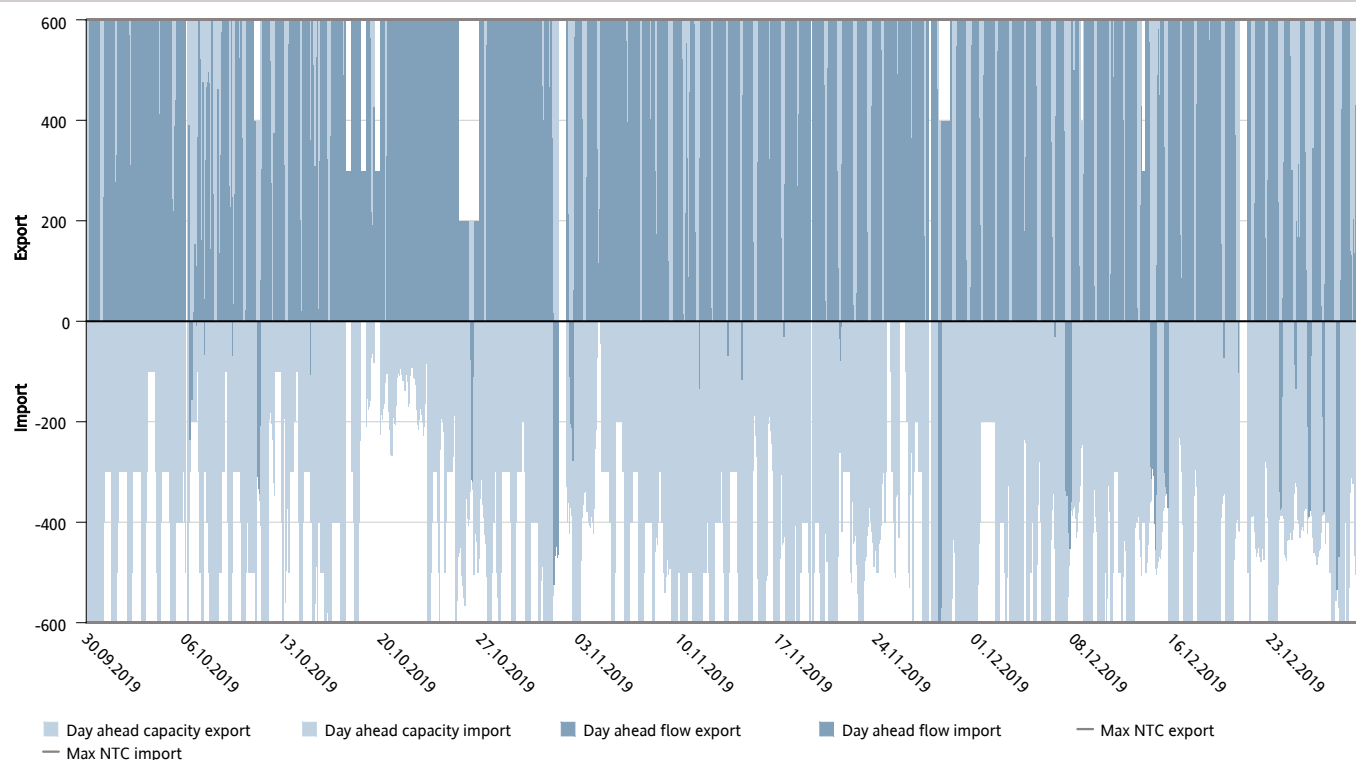


Figure 70: Shows cross-zonal day-ahead capacity result for the HVDC corridor SE4-PL, showing capacity given and flow (MW). Available capacity is given for all hours, but the average flow is only given for hours with flow in that direction. Export indicates flow from SE4 to PL, while import indicates flow from PL to SE4.

SE4-PL: price comparison in EUR

Quarter 4, 2019

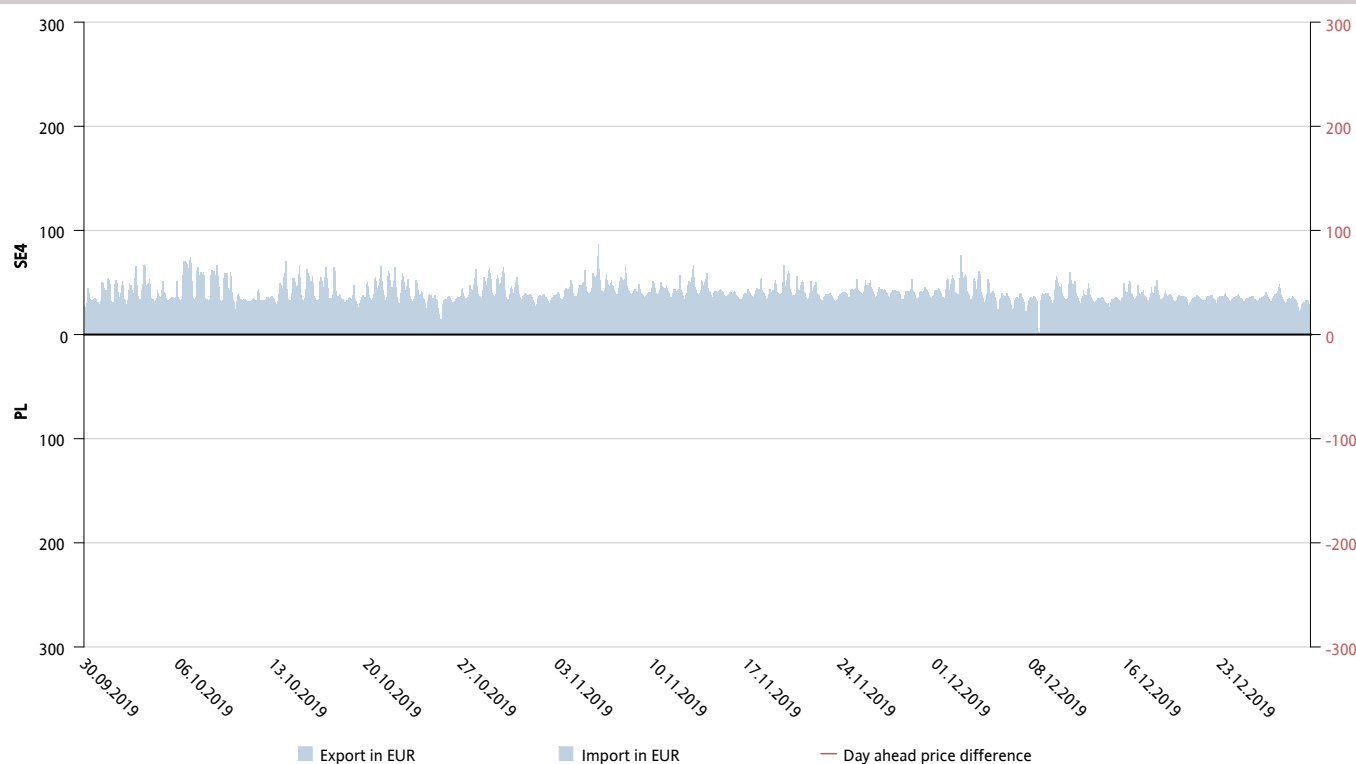


Figure 71: Shows day-ahead prices for the HVDC corridor SE4-PL, all prices are in EUR. The red line shows the price difference between the two areas.

DEFINITIONS AND CLARIFICATIONS

The table below defines the terms used in this report and provides clarifying text to assist the reader.

TERM	DEFINITION or CLARIFICATION
Net Transfer Capacity	•The Net Transfer Capacity (NTC, $NTC = TTC - TRM$) is the maximum exchange program between two areas compatible with security standards applicable in both areas and taking into account the technical uncertainties on future network conditions.
The Total Transfer Capacity	•The Total Transfer Capacity (TTC) is the maximum exchange program between two areas compatible with operational security standards applicable at each system if future network conditions, generation and load patterns were perfectly known in advance.
The Transmission Reliability Margin	•The Transmission Reliability Margin (TRM) is a security margin that copes with uncertainties on the computed TTC values arising from: a) Unintended deviations of physical flow during operation due to the physical functioning of load-frequency regulation b) Emergency exchanges between TSOs to cope with unexpected unbalanced situations in real time c) Inaccuracies, e. g. in data collection and measurements

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Description of capacity reductions below 75% of NTC in Q4 2019

Statnett

SE3->NO1: Reduced by Svk due to West Coast Corridor cut.

NO4->SE2: Reduced within the normal range and due to outages of lines in the Norwegian 420 kV grid.

SE2->NO4: Reduced within the normal range and due to outages of lines in the Norwegian 420 kV grid.

NO2->DK1: Reduced due to cable fault on SK4.

DK1->NO2: Reduced due to cable fault on SK4.

Fingrid:

FI-EE, Finland-Estonia

Q4: The capacity was reduced on the interconnector between FI and EE for week 52 due to Estlink 2 failure.

FI-SE1, Finland-Sweden North

Q4: The capacity was reduced on the AC interconnectors between FI and SE1 due to planned outages affected to the interconnectors. The outages were Letsi-Petäjäskoski transmission line W41, Keminmaa-Djuptjärn transmission line W42, Svartbyn- Djuptjärn transmission line W42 and Letsi-Petäjäskoski transmission line W46.

FI-SE3, Finland-Sweden Middle

Q4: The capacity was reduced on the interconnectors between FI and SE3 due to annual maintenance of Fenno-Skan 1 HVDC-links W40 and planned outages Hall-Hedenlunda transmission line W40- 42, Åker- Hedenlunda transmission line W43-45, Moliden-Grönviken+Hjälta-Stöde transmission lines W46 and Hamra-Åker transmission line W46.

Energinet:

DK1 –DE

Main portion of the limitations has been caused by expansion work in the northern part of the German grid. Project work has been ongoing on the Danish side of the interconnector as well. In Q4 2019 this work has mainly been related to the sectioning of the Danish 400 kV station Kassø in preparation for the strengthened 400 kV interconnector and following increased capacity. It is worth mentioning that the capacity released to the market is still virtual. The physical capacity is far lower than the day ahead capacity and vast amounts of energy is countertraded.

NO2 – DK1

The main reason for limitations on this interconnector in Q4 2019 has been repeated faults on the SK4 cable. Intense work has been carried out in order to repair the fault. The repair has been completed but the repeated faults have forced ENDK and SN to change the operational pattern of the connection as a whole (SK1234) in order

to facilitate system as well as asset security. The changed operational pattern has resulted in preliminary reduced capacity on the connection. The duration of this limitation is unknown.

DK1 – NO2

The main reason for limitations on this interconnector in Q4 2019 has been repeated faults on the SK4 cable. Intense work has been carried out in order to repair the fault. The repair has been completed but the repeated faults have forced ENDK and SN to change the operational pattern of the connection as a whole (SK1234) in order to facilitate system as well as asset security. The changed operational pattern has resulted in preliminary reduced capacity on the connection. The duration of this limitation is unknown.

DK1 – SE3

The control system for the Kontiskan connection has been replaced in Q4 2019 resulting in the capacity being decreased. Additional pieces of maintenance work have been carried out in the same period as well in order to best facilitate availability of the interconnector to the market.

Svenska Kraftnät

SE3-DK1, Western Denmark

The reasons for reductions set by Svenska kraftnät were congestion in the West Coast Corridor, planned outage on the interconnector, planned outage near the interconnector, and failure on the interconnector.

SE3-FI, Southern Finland

The reason for reductions set by Svenska kraftnät was planned outage near the interconnector

SE3-NO1, Southern Norway

The reasons for reductions set by Svenska kraftnät were congestion in the West Coast Corridor, planned outage on the interconnector, and planned outage near the interconnector.

Reoccurring capacity reductions in Q4 2019

Svenska Kraftnät

The West Coast corridor is a section in the Swedish national grid, close to Gothenburg in SE3, which might be congested in normal operation. This typically occurs during night and weekends with a large northbound transfer of power over the West Coast Corridor. The congestion leads to reduction of SE3 to NO1, DK1 to SE3, DK2 to SE4, DE to SE4, PL to SE4, and LT to SE4. For more information see:

<https://www.nordpoolgroup.com/message-center-container/newsroom/tso-news/2016/q4/no.-332016---updated-routine-for-congestion-management-for-the-west-coast-corridor-in-sweden/>