



Nordic Capacity Calculation Methodology Project (Nordic CCM) and
Nordic RCC

External Parallel Run Handbook

Version 2
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About this handbook

The Nordic Capacity Calculation Methodology (CCM) project is responsible for the methodology development and implementation of the Nordic Capacity Calculation Methodologies for the Long-Term (LT), Day-Ahead (DA), and Intraday (ID) timeframes. The methodologies are to be developed in line with the requirements from the Forward Capacity Allocation Guideline (FCA GL) and Capacity Allocation and Congestion Management Guideline (CACM GL), and to be approved by the National Regulatory Authorities (NRAs).

The Nordic CCM External Parallel Run relates to implementation of flow-based methodology for the day-ahead and intraday market time frame.

With this handbook, the CCM project and Nordic RCC hope to provide additional support to all stakeholders in utilising the data from the external parallel run (EPR) to prepare for go-live of flow-based in the Nordics.

Please note that this handbook will be updated and extended during the EPR.



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Common abbreviations

Abbreviation	Description
AAC	Already Allocated Capacity
AAF	Already Allocated Flow
AC	Allocation Constraint
Ac	Alternating current
AMR	Adjustment for minimum RAM
ATC	Available Transfer Capacity
ATCE	Available Transfer Capacity Extraction
BZ	Bidding Zone
CACM	EU Regulation 2015/1222: Guideline on Capacity Allocation and Congestion Management
CC	Capacity Calculation
CCC	Coordinated Capacity Calculator
CCM	Capacity Calculation Methodology
CCR	Capacity Calculation Region
CGM	Common Grid Model
CNE	Critical Network Element
CNEC	Critical Network Element with Contingency
D-1	1 Day before delivery day
D-2	2 Days before delivery day
DA	Day-Ahead market timeframe
Dc	Direct current
EDD	Energy Delivery Day
EIC	Energy information code
ENTSO-E	European association for the cooperation of transmission system operators (TSOs) for electricity
EPR	External parallel run
F_0	Flow on CNE in case all bidding zones operate at zero net-position
F_RA	Impact of remedial actions
F_ref	Reference flow on the network element
FAV	Final Adjustment Value (the same as IVA in the Nordic CCM)
FB	Flow-based
Fmax	Maximum allowed flow for the CNEC/maximum power flow on a CNE/Operational security limits of the CNE
(F)RM	(Flow) Reliability Margin
GSK	Generation Shift Key
ID	Intraday market timeframe
IGM	Individual Grid Model



Imax	Maximum operational current limit
IVA	Individual Validation Adjustment
JAO	Joint Allocation Office
LHF	Last Hour Flow
MAS	Modelling Authority Set
MC	Market Coupling
MTU	Market Time Unit
NEMO	Nominated Electricity Market Operator (i.e. power exchanges)
NP	Net Position (supply minus demand)
NRA	National Regulatory Agency
NRCC/RCC	The Nordic Regional Coordination Centre (replaced the earlier Nordic Regional Security Coordinator, RSC)
NTC	Net Transfer Capacity
OSL	Operational Security Limit
PTC	Power Transfer Corridor (the same as combined dynamic constraint in the Nordic CCM)
PTDF	Power Transfer Distribution Factor
PX	Power Exchange
RA	Remedial Action
RAM	Remaining Available Margin (margin of a CNEC available for cross-zonal trade within a CCR)
RM	Reliability Margin
SDAC	Single Day-Ahead Coupling
SEW	Socio-economic Welfare
SF	Simulation Facility
TP	ENTSO-E Transparency Platform
TSO	Transmission System Operator
VBZ	Virtual Bidding Zone
XBID	Intra-Day continuous trading platform
z2z	Zone-to-zone
z2s	Zone-to-slack

Table 1. Descriptions of common abbreviations.



High-level description of common terminology

Socio-economic welfare (SEW)

Socio-economic welfare (SEW) is calculated as the sum of consumer surplus, producer surplus and congestion income for each hour. SEW is used as the main optimization objective function and the Euphemia coupling algorithm tries to maximize the overall SEW gain among all bidding zones participating in Single Day-Ahead Coupling (SDAC).

Consumer and producer surplus are calculated by Euphemia and used as is without any further calculations.

Congestion incomes are calculated per bidding zone border, based on the flows and price differences. Flows are calculated based on border PTDF's and the net positions and prices are calculated by Euphemia. Congestion incomes are distributed among all borders based on the Congestion Income Distribution methodology¹.

Bidding zone prices

Prices for each bidding zone are calculated by Euphemia.

Net positions

Net positions of each bidding zone is calculated by Euphemia and used as is. Euphemia does not calculate net positions for virtual bidding zones (which are used for modelling HVDC links), but it calculates the flows on these links. Net positions of virtual bidding zones are calculated based on these flows.

Allocated flow – expected physical flow

Allocated flows (F_{AAC}) are calculated by summing the products of each bidding zone PTDFs and corresponding bidding zone net positions to the F_0 -flow.

The F_{AAC} can be calculated both on CNE(C) level, but also on border level by using a border CNE.

¹ The Congestion Income Distribution methodology is available for download at the ACER website: https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Individual%20decisions/ACER%20Decision%2007-2017%20on%20CIDM.pdf.



Flow for FB is calculated using the CNEC PTDF's and net positions from FB market coupling. Flow for NTC is calculated using the same CNEC PTDF's but taking the net positions from NTC market coupling instead. This flow corresponds to the expected physical flow on the element with the given net position.

The results from these calculations are not the same as scheduled exchanges which are currently used as commercial border flows.

The allocated flow F_{AAC} are calculated by:

$$F_{AAC} = \sum PTDF_k \times NP$$

While the expected physical flow is calculated by:

$$Physical\ flow_k = F_{0,k} + \sum PTDF_k \times NP$$

Where $F_{0,k}$ and $PTDF_k$ are the F_0 and PTDF parameters corresponding to the CNEC k.

Scheduled exchange

Scheduled Exchange (SE), i.e. the electricity transfer between neighbouring bidding zones derived using a SDAC algorithm "volume indeterminacy" feature based on DA Scheduled Exchanges Calculation Methodology).

The Nordic CCM project recommends the use of F_{AAC} , as this is not equal to the flow allocated by FB.



Nordic Flow-based Capacity Calculation Methodology

Nordic Day-ahead Capacity Calculation Methodology (Nordic CCM), consists of methodology relating to

- Day-Ahead (DA) and Intraday (ID) timeframes
- Long-Term (LT) timeframe.

The Nordic Capacity Calculation Methodology (CCM) project is responsible for the methodology development and implementation. The methodologies are to be developed in line with the requirements from the Forward Capacity Allocation Guideline (FCA GL) and Capacity Allocation and Congestion Management Guideline (CACM GL), and to be approved by the National Regulatory Authorities (NRAs).

The National Regulatory Authorities (NRAs) in Denmark, Finland and Sweden have each approved the amended Methodology for Day Ahead and Intraday Capacity Calculation. The NRAs have made their decision in their own national language.² The Nordic Long-term CCM was approved by ACER on 30 October, 2019.³

Additional information on the Nordic FB methodology approved by the Nordic NRAs is available at the Nordic RCC website: <https://nordic-rcc.net/flow-based/methodology/>.

² The decision of the Danish NRA (decision 20/05093) is available for download in Danish at the website of the Danish Utility Regulator (Forsyningstilsynet): <https://forsyningstilsynet.dk/el/afgoerelser/afgoerelse-om-aendret-metode-for-kapacitetsberegning-i-ccr-nordic-1>.

The decision of the Swedish NRA (decision 2020-102099) is available for download in Swedish at the website of the Swedish Energy Markets Inspectorate (Energimarknadsinspektionen): <https://ei.se/om-oss/nyheter/2020/2020-10-26-ei-har-fattat-beslut-om-ny-metod-for-kapacitetsberakning-i-norden>.

³ The ACER decision is available for download at the ACER website: https://www.acer.europa.eu/Individual%20Decisions/ACER%20Decision%2016-2019%20on%20the%20Nordic%20CCR%20TSOs%20proposal%20for%20LT%20CCM_1.pdf.

The annexes to the ACER decision is available for download at the ACER website: http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Pages/Annexes-to-the-DECISION-OF-THE-AGENCY-FOR-THE-COOPERATION-OF-ENERGY-REGULATORS-No-16-2019.aspx.



Capacity calculation methodology and day-ahead market coupling

A capacity calculation methodology is a description of the rules of the capacity calculation region (CCR) on how to calculate the amount of capacity available for trading between bidding zones in a market timeframe while keeping the grid operationally secure.

The purpose is to facilitate the socio-economic welfare maximization in capacity allocation.

The basic principle is that the network capacities are sent to the NEMOs. The NEMOs utilize the market coupling algorithm Euphemia to maximize the socio-economic benefits of the European day-ahead market, while respecting the network constraints of the TSOs, which results in traded volumes and prices.

Please note that the Nordic CCM External Parallel Run relates to implementation of flow-based methodology for the day ahead and intraday market time frame.

Capacity calculation today (NTC)

Today, with NTC, network capacities are set by the TSOs.

The TSOs calculate NTC capacities individually by (mostly) looking at their own grid constraints and critical network elements, and by translating these into a capacity on the bidding zone borders, subject to the day ahead market allocation.

When the TSOs give capacity in the form of NTC values, all border capacities are available at the same time to the day-ahead market for allocation.

For additional information on the NTC concept in general, we refer to the basic explanation provided by ENTSO-E in the document NTC User's information.⁴

⁴ The ENTSO-E document NTC User's information is available for download at the ENTSO-E website: [NTC User's information.PDF \(entsoe.eu\)](https://entsoe.eu/NTC%20User's%20information.PDF).



Capacity calculation with flow-based methodology

With FB, network capacities are derived from a coordinated, formalised and automated process where the Nordic RCC acts as a coordinated capacity calculator (CCC).

The TSOs provide the critical network elements (today's day ahead market allocation) instead of pre-calculating resulting capacities on the border in the form of a MW-value.

The individual TSOs do not have to make a distribution of the capacity between different bidding zone borders before the capacity is sent to the NEMOs. Instead, the maximum available capacity is given to the NEMOs and the market coupling algorithm. The capacity is then allocated to the energy transactions that provide the most socio-economic welfare, when prices and flows are calculated by the NEMOs.

The process of sending network capacities in Nordic FB

1. The TSOs provide the NRCC with data for each market time unit (MTU).
Input datasets include critical network elements with associated contingencies (CNECs), combined dynamic constraints, and the operational limits for these elements (Fmax).
2. The Nordic RCC uses the data to calculate the FB parameters.
These are based on an hourly common grid model (CGM) - the Remaining Available Margin (RAM) and Power Transfer Distribution Factors (PTDFs).
3. The TSOs validate the FB-parameters
4. The Nordic RCC sends the FB-parameters to the NEMOs

For detailed descriptions of the Nordic FB methodology approved by the Nordic NRAs, please visit the Nordic RCC website: <https://nordic-rcc.net/flow-based/methodology/>.



Day-Ahead Market coupling and Euphemia

NTC and the new capacity calculation methodology (i.e. FB) differ in many ways but they both aim to represent the grid in the best way to the marked coupling.

Market coupling is handled by the NEMOs utilising the market coupling algorithm Euphemia. NEMOs submit the network capacities they receive from the TSOs to Euphemia. The algorithm maximizes the socio-economic benefits of the market, while respecting the network constraints of the TSOs.

Euphemia returns the market clearing prices, the matched volumes, and the net position of each bidding zone as well as the scheduled flows between bidding zones. It also returns the selection of block, complex, merit, and PUN orders that will be executed. For curtailable blocks the selection status will indicate the accepted percentage for each block.

For information on how SDAC delivers fulfilment of economic surplus maximisation via the Euphemia algorithm, please refer to the NEMO publication Euphemia Public Description.⁵

Capacities for Intraday market: ATC Extraction

The Nordic Day-ahead Capacity Calculation Methodology describes a transitional solution for the calculation and allocation of intraday cross-zonal capacities for continuous trading in the intraday timeframe. The Nordic TSOs are to transform the FB domain into ATC-like values until the single intraday coupling is able to support FB parameters.

The ATC extraction data (ATCE) from the CCM EPR is published at the Nordic RCC website: <https://nordic-rcc.net/flow-based/simulation-results/>.

For more information on ATC extraction for Nordic CCM, we refer to the ATC Extraction Description.⁶

⁵ The Euphemia Public Description is available for download at the NEMO Committee website: https://www.nemo-committee.eu/assets/files/190410_Euphemia%20Public%20Description%20version%20NEMO%20Committee.pdf.

⁶ The ATC Extraction Description is available for download at the Nordic RCC website: https://nordic-rcc.net/wp-content/uploads/2022/05/ATC_Extracton_Description_20220413.pdf.



Implementation of FB in the Nordic CCR

The Nordic TSOs and Nordic RCC are currently working to implement Nordic Flow-based Capacity Calculation Methodology for the Day-Ahead and Intraday timeframes. The process is subject to NRA approval and adheres to their decided process.

Implementation process timeline⁷

The implementation timeline for a flow-based method for capacity calculation is dependent on successful parallel runs and confirmation from the Nordic NRAs. The parallel operations have been divided into phases (parallel runs). The entry criteria for each phase is the same as the exit criteria for the previous phase. The first four phases have TSO-defined entry criteria, based on the guidance from NRAs. The last phase also include criteria from other stakeholders, like NEMOs and SDAC.



Figure 1. Process timeline for the implementation of Nordic Capacity Calculation for the DA and ID timeframes.

⁷ The FB go-live timeline is currently being revised. More information will be provided in the next version of the handbook.



External parallel run

According to stipulated timeline, the external parallel operation must last for at least 12 months. The NRA reporting consists of three months of data.

The Nordic TSOs and the Nordic RSC jointly decided to start the external parallel run (EPR) of the Nordic flow-based methodology on 7 March 2022 for the Energy Delivery Day of 8 March 2022.

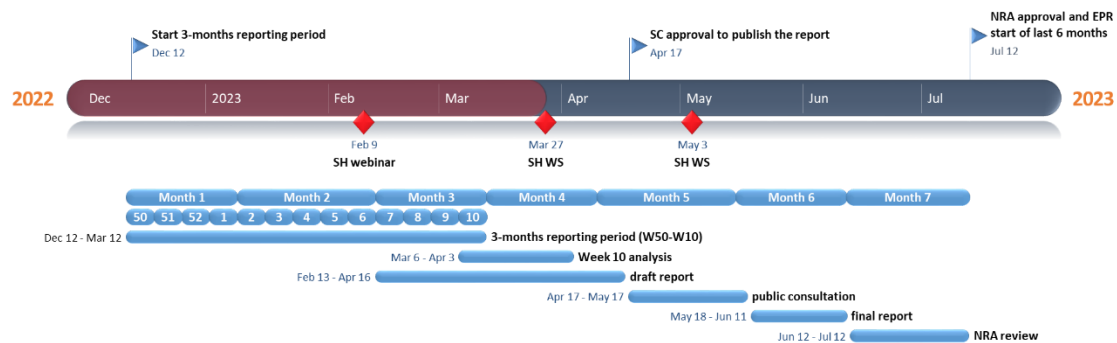


Figure 2. EPR timeline.

During the EPR, market simulations are performed by the NRCC together with the NEMOs. The daily process for EPR follow the same process as after go-live except for when it come to the process of simulating the market results.

Please note that the parallel run will generate data that can used as a basis to facilitate the adaptation of planning tools and/or business processes of all stakeholders concerned.

Market result simulation during external parallel run

A day-ahead market coupling simulation with the FB domain (RAM and PTDF) in the Nordic CCR are done by the NEMOs. The FB domains are accumulated for a 1-week-period before running the simulations. However, there is a grace period of 2 weeks after the EDD before the order books can be used. Market report elaborating on the market results will therefore be published 4 weeks after the last delivery day, where 2 week is the grace period.

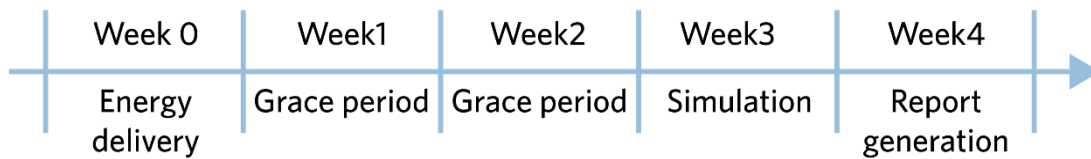


Figure 3. The timeline from Energy Delivery to Market Report publication.

The NRCC provides the Nordic CCM project with the FB market results from simulations. The market algorithm Euphemia provides prices, net positions, consumer and producer surplus for all bidding zones, amongst others. The socio-economic welfare (SEW) is calculated by summing up consumer surplus, producer surplus and congestion income. The calculated FB SEW is then compared to the NTC SEW, hour-by-hour, to evaluate the impact of the new capacity calculation and allocation.

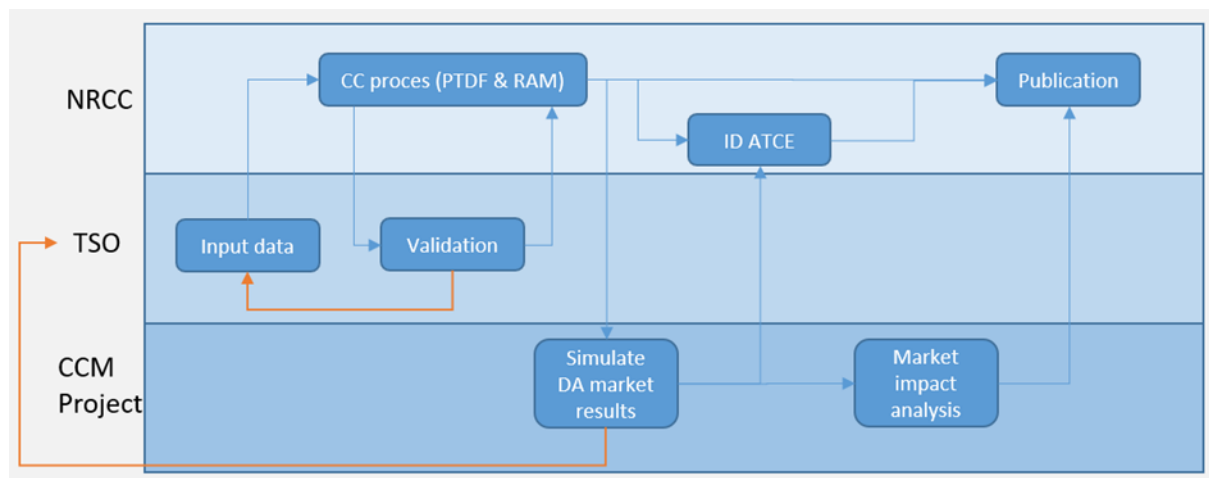


Figure 4. The high-level business process illustrating the roles, responsibilities and interactions among the Nordic RCC, TSO operators and the Nordic CCM project during the parallel run.

The simulation of market results

Before the summer of 2022, the simulations were calculated by Simulation Facility (SF). Both NTC and FB market results were simulated in this period. However, SF was unavailable from June 2022 to February 2023 due to failed updates in the system. Consequently, since this period, it has not been possible to produce simulations and, therefore market reports.



From December 2022, the Euphemia test environment at the NEMOs has been used to simulate the FB simulations. The NTC market results are taken directly from the production system of Euphemia.

SF is now back in operation, but it has been agreed with the NEMOs that they will continue with the simulation through the rest of the EPR. SF can then be used for extra simulations and analysis.

Both the test environments at the NEMOs and SF use the same market coupling algorithm that is used for day-ahead market coupling.

Handling of the external borders

External borders are interconnectors within the Hansa CCR or interconnectors within the Baltic CCR and capacity calculation for these interconnectors fall under the capacity calculation method of the Hansa CCR and Baltic CCR. The capacity calculation process for the Nordic CCR includes calculation of the internal Nordic constraints which may impose limits on external border. This is done by calculating cross zonal capacity towards the virtual bidding zone, e.g. NO2_ND where NordNed is connected to the Nordic CCR.

For more information on the capacity calculation in Hansa CCR, we refer to the Common Coordinated Capacity Calculation Methodology Proposal for HANSA CCR.⁸

In the EPR the capacity on external borders is set to the minimum value of either the physical constraint of the interconnector and the capacity provided by the neighbouring TSO. If the border in NTC was limited by an internal Nordic limitation this shall not limit the interconnector in FB as this will be handled by FB.

⁸ The Hansa CCR Common Coordinated Capacity Calculation Methodology Proposal is available for download on the Consultation page at the ENTSO-E website:
https://consultations.entsoe.eu/markets/commonccm_hansa-ccr/.



Publication of data from the EPR

During the EPR, the flow-based parameters are published daily on the JAO publication tool website: <https://test-publicationtool.jao.eu/nordic>.

EPR data and reports related to market simulations are published on the Nordic RCC website: <https://nordic-rcc.net/flow-based/simulation-results/>

FB parameters available on the JAO website

The following FB-parameters are published on JAO:

- Flow-based Domain
- Min and Max Net Positions (Max and Min Net Pos)
- Max Exchanges (MaxBex)
- Max Border Flow (MaxBflow)
- Validation Reductions
- Reference Net Position and Reference HVDC Exchange (Ref Net Pos. and HVDC exch.)
- FB Domain Backup
- CGM Vertical Load and Generation Forecast (CGM Forecast)

You can also use the JAO publication tool to get a Nordic market view, view market graphs and market maps.

To assist users, there is a JAO publication handbook: https://test-publicationtool.jao.eu/Nordic_PublicationHandbook

EPR results published on the Nordic RCC website

The weekly results published on the Nordic RCC website contain the following data (from week 50, 2022 onwards).

- CCM EPR Market report
- CCM EPR Market report Appendix
- Market Simulation Results
- ATCE results
- ATCE Graphical report
- Grid Constraint Matrix



Please note that the content of the files may be revised and more information added in response to the needs of stakeholders.

CCM EPR market report

The market report presents the comparison of the market results between the current Net Transfer Capacity (NTC) calculation method and the simulated flow-based (FB) capacity calculation method of the day-ahead market timeframe. NEMO simulations have produced the simulated FB market results by using Euphemia test environment. The market report is published weekly.

On 14 April 2023, the CCM EPR market report changed format. The content was condensed into two pages, focusing on providing a better overview of graphs and relevant results.

Content of current CCM EPR market report

Data quality

- Description of data quality for the week of analysis.
- IVA provision. Is used if operator sees a need for adjustments to the FB domain, this indicates if adjustments is given for specific day.
- Substituted IGM. If there is an error with IGMs, backup IGM will be used.
- Final domain acceptance means that the Nordic TSOs accepted flow-based domain to be used in the flow-based market coupling. 100 % means that all four TSOs accepted the domain.

Nordic prices – weekly average

- Weekly average prices (€/MWh) are shown for FB and current method.
- FB-NTC Price (€/MWh) means the absolute price difference between FB and current method.
- FB-NTC Price (%) means the relative price difference between FB and current method.

Nordic CCR socio-economic welfare results

- Represents socio-economic welfare change (M€) when comparing FB and current method in M€ for the Nordic CCR without Hansa/Baltic borders.
- Congestion income = change of congestion incomes (M€) between FB and current method.
- Producer surplus = change of producer surplus (M€) between FB and current method.



- Consumer surplus = change of producer surplus (M€) between FB and current method.

Daily Nordic socio-economic welfare

- Describes Nordic socio-economic welfare change (M€) for consumers, producers and congestion income on a daily level. Total SEW is a sum of these three elements.

Socio-economic welfare change per Nordic BZ

- Describes the total socio-economic welfare change (M€) per Nordic bidding zones from reported week.

Nordic prices - duration curve

- Price duration curve is a high-level indicator of price convergence (but not exhaustive). It is calculated for a difference of maximum and minimum price (€/MWh) from Nordic BZs per hour. For example, if the highest price is found from FI area and lowest price is found from NO4 area in a certain hour, the difference is calculated from these areas.
- If duration curve has values of 0, it means that prices have been uniform in the Nordics.

Nordic net position

Nordic net position is the sum of the NO, SE, DK and FI net positions. Positive net position means export from the Nordics and a negative means import to the Nordic CCR

Nordic price per bidding zone

Flow-based and NTC hourly price. Blue = Flow-based price, Orange=NTC price.

Nordic net position per bidding zone. Flow-based and NTC hourly net position.

Blue = Flow-based net position, Orange=NTC net position.

CCM EPR market report Appendix

The appendix provides in-depth tables and graphs related to the market report. Its content includes an overview of the TSO domain validation outcome, detailed SEW, prices, net positions and border flows graphs, complementary to the weekly market report. Published weekly with the CCM EPR market report.



Market Simulation Results

The market simulation results are shared in the Excel workbook format that contains the simulated market results of the FB market coupling in the Nordic region.

The file contains all data since week 50, 2022, and will be updated with the latest data every week.

The workbook contains the following sheets.

- BuyVol
- SellVol
- NetPositions
- F_AAC
- Prices
- PriceSpread
- Scheduled Exchange

BuyVol

Contains the simulated volumes bought in each bidding zone in the Nordic and in connected neighbouring countries for both FB and NTC.

SellVol

Contains the simulated volumes sold in each bidding zone in the Nordics and in connected neighbouring countries for both FB and NTC.

NetPositions

Contains the simulated market net position for each bidding zone and virtual bidding zone in the Nordic for both FB and NTC. The virtual bidding zones are without a value for NTC as the virtual bidding zones are not part of the NTC topology.

F_AAC

Contains the flow allocated by the FB domain. The TSOs recommend to use the F_AAC value instead of the SEC value for FB.

- For FB this is calculated as the simulated NP times the PTDF
- For NTC this is calculated as the actual day-ahead NP times the PTDF



Prices

Contains the simulated market price in each bidding zone in the Nordic and in connected neighbouring countries for both FB and NTC.

PriceSpread

Contains the simulated market price spread between the neighbouring bidding zones in the Nordic region for both FB and NTC. In each column, two bidding zones are specified and the price spread is the difference between the prices in the first and second bidding zones.

Scheduled Exchange

Contains the electricity transfer scheduled between neighbouring bidding zones on the cross borders for both FB and NTC. The TSO recommend to the use the F_AAC value for FB.

Scheduled exchange calculation (SEC) uses a SDAC algorithm 'volume indeterminacy' feature based on DA Scheduled Exchanges Calculation Methodology. The SEC differ from the flow actual allocated by flow based (F_AAC).

Pivot tables

In addition to the sheets mentioned above, there is a pivot table for each sheet and a graphical representation of the data. These tables make it possible for the user to investigate the areas and period they find interesting. It is possible both to compare the current method to FB for specific BZ or border but also to compare different values for FB.

For all these pivot tables the "EDD" (energy delivery date) is chosen as the row, and the "DOMAIN" (FB or NTC) is chosen as the column. In addition, "WEEK" and "YEAR" have been added as filters so it is possible to choose a certain week or year in the top left corner in the sheet. In the "Values" section of the pivot table, there are already some default values that are presented in both the table itself and the graph. Here, the user can easily add more bidding areas/borders by dragging the desired bidding areas/borders from the list at the top right, to the "values" field in the pivot table set-up field at the bottom right. Here, it might be necessary to change the calculation done by the pivot table. To do so, one can simply left click on the value field that needs to be changed, then "value field settings" and choose "sum" to match with the other values.

The graph will automatically update to add the selected value.



ATCE results

The weekly-published ATCE results are published in a zip file. It contains 7 csv files, 1 csv per energy delivery day (EDD). Figure 2 shows an ATCE result sample of the first 3 MTUs of the EDD 2022-12-23. For the demonstration purposes, only a few borders are shown.

MTU	Backup	FI-FI_EL	FI-FI_EL	FI-FI_EL	FI-FI_EL	NO2-NO2_	NO2-NO2_	NO2-NO2_	NO2-NO2_
MTU	Backup	NTC_initial	NTC_final	AAC	ATC	NTC_initial	NTC_final	AAC	ATC
2022-12-23T23:00Z	FALSE	1016.091	1016.091	886	130.091	723.094	723.094	-640	1363.094
2022-12-24T00:00Z	FALSE	1016.096	1016.096	886	130.096	723.097	723.097	-640	1363.097
2022-12-24T01:00Z	FALSE	1016.096	1016.096	886	130.096	723.097	723.097	-640	1363.097

Table 2. ATCE result sample.

ATCE graphical report

The Nordic TSOs and Nordic RCC publish a weekly graphical report to facilitate the understanding of comparison between the ATCE ID results and the ID offered capacity in the current NTC method.

The graphs are based on weekly batches of ATCE results. The reports include “lock-in” statistics, i.e. the number of MTUs where a bidding zone was operating at maximum import or export, or if there was MTUs where the bidding zone was not able to change its net position in either direction (lock-in).

An “NTC plot” is given for each border and direction as demonstrated in the example below.

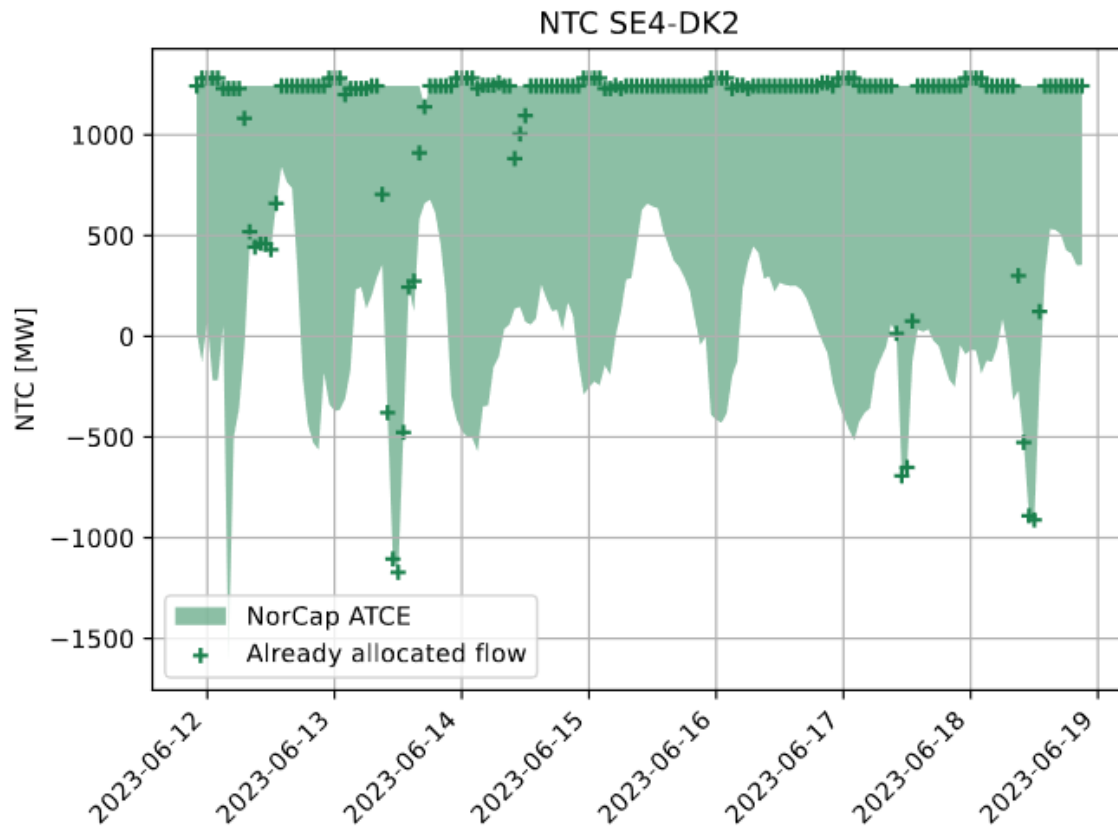


Figure 5. Example of NTC plot.

The coloured area in Figure 5 represents the possible exchange on this border and direction. The cross marks the simulated day-ahead market coupling flows. Any coloured area above the cross, means that the intraday market will be able to increase exchange over the day-ahead market coupling flows. Any coloured area below the cross means that the intraday market will be able to trade against the day-ahead market.

A trading space duration curve is given for each bidding zone. The duration curve shows the sum of import and export capacity per MTU for a given bidding zone. The values are sorted from smallest to largest trading space. A reference curve is provided based on data on capacity offered at intraday gate-opening available at the ENTSO-E transparency platform.



Descriptions and disclaimers

- MTUs are in Greenwich Mean Time (UTC +0). The first MTU of the EDD labelled as 23:00 of the day before.
- Flag for ‘Backup’: TRUE means that the ATCE tool cannot find an optimal solution, triggering the backup process. FALSE means otherwise.
- ‘NTC_initial’: the extracted NTC results from the ATCE industrial tool based on the DA FB domain
- ‘NTC_final’: the NTC values provided to the ID platform, which may be different from the NTC initial due to validation. Currently at this stage of the EPR, there is no validation being performed, resulting the same value of NTC_initial and NTC_final.
- ‘AAC’: in the ATCE ID context, it is the flow allocated by flow based (NP*PTDF)., NOT scheduled exchanges.
- ‘ATC’: refers to the ID ATC, to be computed by the ID platform for the ID gate-opening, computed by NTC_final minus AAC.

Bidding zone naming matching between FB and current NTC in the ID timeframe

Flow-based market topology and NTC market topology are different. In flow-based market topology virtual bidding zones are used to represent HVDC connections and ac interconnectors to external regions. In NTC market topology, certain virtual bidding zones (e.g. DK1A and NO1A) are used to represent sum limitations and sum ramping constraints.

ATCE is performed using the flow-based market topology. Results are afterwards mapped to the NTC market topology. This is done by summing AAC and NTC_final for specific borders in the flow-based topology to form the corresponding allocations and capacities in the NTC topology. The mapping of borders is given by table 3.

NTC market border	Mapping from FB topology
NO1-NO1A	Sum of NO1-NO5 and NO1-NO2
NO1A-NO1	Sum of NO5-NO1 and NO2-NO1
SE3-SE4	Sum of SE3-SE4 AC interconnector and SE4_SWL-SE4
SE4-SE3	Sum of SE4-SE3 AC interconnector and SE3-SE3_SWL
DK1-DK1A	Sum of NO2_SK-NO2 and SE3_KS-SE3
DK1A-DK1	Sum of DK1_SK-DK1 and DK1_KS-DK1

Table 3. Mapping of borders NTC-FB.



Grid Constraint Matrix

This file contains the flow-based parameters combined with the simulated results for FB and the actual NTC day ahead results of the selected business week. The grid constraint file is published weekly.

The Grid Constraint Matrix is published in CSV file format. A guide to importing the data into excel is provided under later in this document.

Please note that the headers are not fully harmonised with the CCM terminology. This is to be amended in the next Handbook release.

Description of table columns

DatetimeCET

The energy delivery date and MTU.

WEEK

The energy delivery week

Date

The energy delivery date 'yyyymmdd'.

MTU

The energy delivery MTU. Going from 1-24, e.g. Hour 0-1 is period 1.

JAO_CNEC_Name

Name of CNEC. The anonymization on the Swedish CNECs are not equal to the naming provided at JAO, this is something that is being worked on.

JAO_CNE_Name

Name of CNE. The anonymization on the Swedish CNECs are not equal to the naming provided at JAO, this is something that is being worked on.

JAO_Contin_Name

Name of the contingency. The anonymization on the Swedish CNECs are not equal to the naming provided at JAO. This is something that is being worked on.

Border

“TRUE”: The CNEC is a border CNE going between bidding zones. A border CNE has a Fmax= 9999 and will never constrain the domain

“FALSE”: A regular CNEC in the FB domain.

**Non_Redundant**

“FALSE”: The CNEC represents a redundant constraint.

“TRUE”: The CNEC is constraining the flow-based domain.

InOptimization

“TRUE”: The CNEC is applied in the optimization.

“FALSE”: The CNEC is not applied in the optimization.

All allocation constraints are always applied as input in the optimization, so they can be redundant and still have a TRUE value in the InOptimization.

Significant

“FALSE”: The CNEC is not significant and will therefore not constrain the domain.

“TRUE”: the CNEC is significant and is therefore considered in the domain.

Bidding Zone From

Bidding zone associated with sending end (according to positive flow direction) of the CNE.

Bidding Zone To

Bidding zone associated with sending end (according to positive flow direction) of the CNE.

TSO

The TSO where the CNE originate from.

fMAX

Maximum allowed flow for the CNEC. Value is stated in MW.

IVA

Individual validation adjustment provided by TSOs during domain validation in case of unplanned outages of incorrect input data is detected.

FRM

Flow reliability margin accounts for uncertainties in flows (e.g. due to forecast uncertainties).

fRef

Reference flow on the network element, i.e. the flow stated in the common grid model which was used as basis for the flow-based domain parameters calculation.

**F0**

Flow on the CNE in case all bidding zones operate at zero net-position.

FRA

Impact of remedial actions on flow on the CNE.

AMR

Adjustment for minimum RAM is used to ensure that RAM is always greater than or equal to 0.

FAAC

Already allocated capacity to reserves.

RAM_External

The RAM capacity provided by the neighbouring TSO on the external borders. See RAM_Aligned for the capacity used in FB market simulation.

RAM_FB

The remaining available margin from the Nordic Flow-based perspective.

This means the spare transmission capacity available for trade:

$$RAM = F_{\max} - F_{RM} - F_0 + F_{RA} + AMR - F_{AAC} - IVA$$

RAM_Aligned

The remaining available margin aligned between the Nordic FB and the External borders:

$$RAM_{Aligned} = \min(RAM_{External}, RAM_{FB})$$

OBS: $RAM_{External} = 0$ for all non-external borders, so the $RAM_{Aligned}$ are only taken the minimum value on external borders.

Type

The type of a CNEC.

”ALLOCATION_CONSTRAINT”: The allocation constraint representing the capacity on the HVDC-line.

“BRANCH”: All other CNECs

FAAC_FB

Flow allocated on the CNE with the simulated FB NP. $(PTDF * NP_FB)$.

**FAAC_NTC**

Flow allocated on the CNE with the day-ahead market NTC NP. $(PTDF * NP_NTC)$.

SHADOWPRICE

Shadow price on the CNE from the FB market simulations.

FLOW_FB

Excepted flow on the CNE including the internal flow with the simulated FB NP. $(PTDF * NP_FB + Fo)$.

FLOW_NTC

Excepted flow on the CNE including the internal flow with the simulated NTC NP. $(PTDF * NP_NTC + Fo)$.

Load_FB

Share of the allocated flow in FB related to the RAM. $(FAAC_FB / RAM)$.

Load_NTC

Share of the allocated flow in NTC related to the RAM. $(FAAC_NTC / RAM)$.

PTDFs

Power transfer distribution factors:

- Zone to slack PTDFs – Values describe how much the flow on a CNE would increase/decrease in response to a 1MW increase of the net-position of a given bidding zone.
- Zone to zone PTDFs – Values describe how much the flow on a CNE would increase/decrease in response to a 1MW increase with an exchange between two bidding zones.

Please note that names of certain network elements are anonymized, i.e. has been assigned a new unique and dynamic identifier, which cannot be used to identify the physical location of the asset. More information is available under [Anonymization of network elements](#) below.



Additional information published

Phenomena report

The phenomena report explains recurrent phenomena, or results occurring and pertaining over longer time periods, that have been observed during the parallel run phase of the Nordic CCM project. It shall support the market reports with detailed explanations of those recurring phenomena, and will be updated with new sections during the EPR when the TSOs have investigated the new findings in detail.

EPR process log

During the EPR, we publish an EPR process log on the RCC website: <https://nordic-rcc.net/flow-based/simulation-results/>. The process log is updated weekly.

The log contains the monitoring outcome of substituted individual grid models, substituted common grid models, number of backup FB domains and the reasons that trigger the substitutions.

Operational learning points

The document collects and explains operational learning points that the TSOs have encountered during the EPR. It covers both the KPI reporting period of the NRA report (12 December 2022 – 23 March 2023) but also findings that have been encountered after publishing that report. The report is updated according to need, but at most monthly. Please note that SEW impacts of the operational learning points may be either positive or negative when comparing FB to NTC, and depend on the specific case.



Further information

Topology: FB vs. NTC

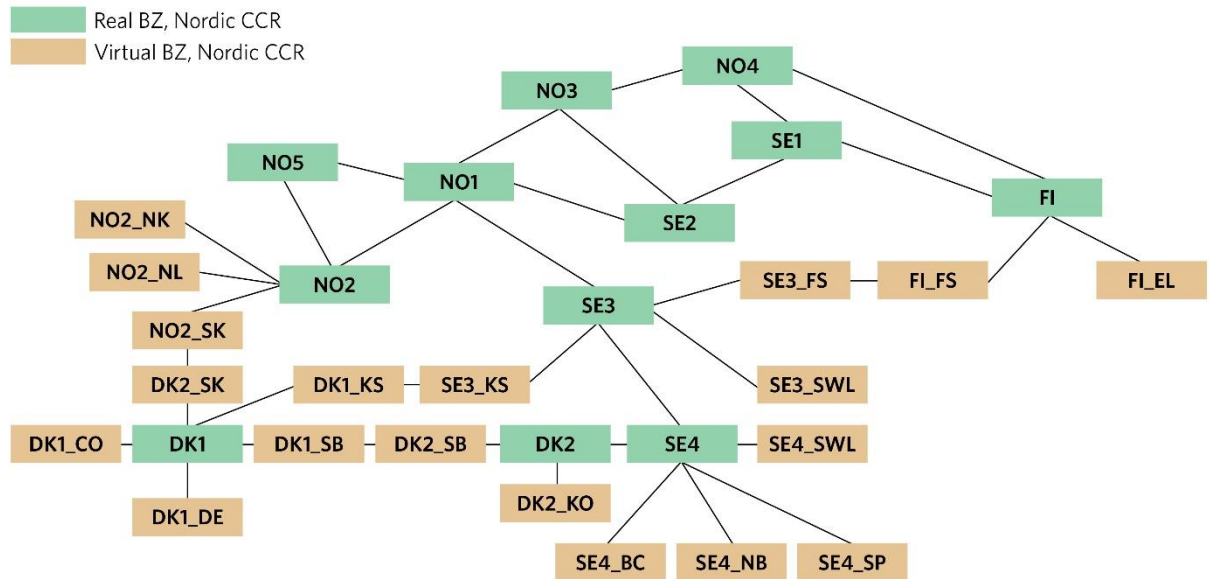
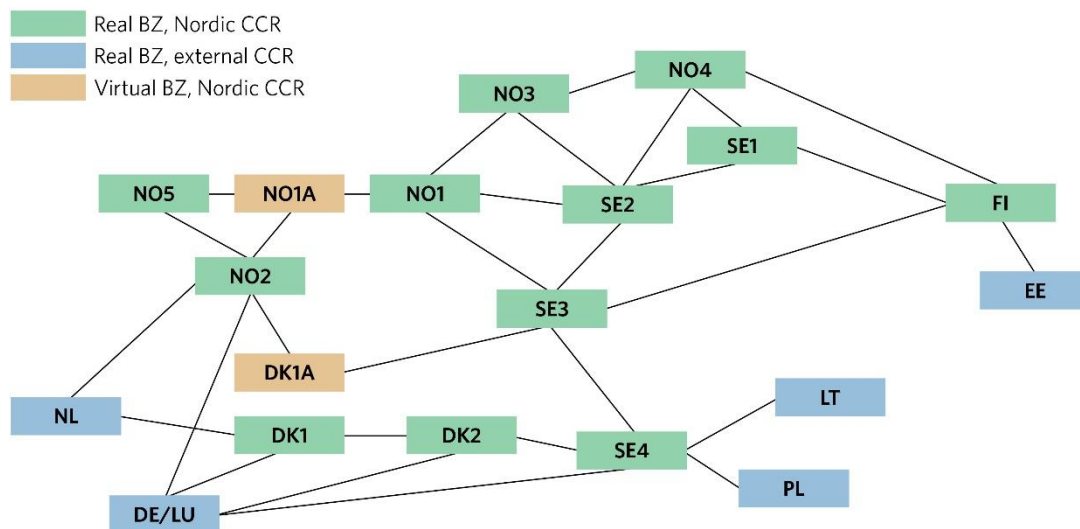


Figure 6. Flow-based Topology.



Additional virtual bidding zones NO2A and SE3A are under implementation in NorCap

Figure 7. NTC topology.



HVDC losses

Implicit net loss can be applied on the borders. In the Nordic area this is applied on the following borders.

3,1%	Nordlink
2,9%	Skagerak
2,4%	Baltic
3,2%	Norned

Table 4. Implicit net losses applied on borders in the Nordic area.

Anonymization of network elements

Names of certain network elements may be anonymized in accordance with Article 2(d) of Council Directive 2008/114/EC of 8 December 2008 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection.⁹

CNEC naming convention

Energinet

The screenshot shows a list of ACLineSegment (ZBR) entries with columns for Terminal, ENERGINET, and N-K. A red callout points to 'CNE' in the list. A 'View Contingencies' window is open, showing a table with Contingency ID and Contingency Name. A red callout points to 'Contingency' in the window title bar.

Contingency ID	Contingency Name
dc73c3fc-b0d9-48e8-a78b-d08349126eeb	400KV LINE C_REV-TJE

Figure 8. Energinet CNEC naming convention.

⁹ The Council directive 2008/114/EC is available for download on the EU website EurLex: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:345:0075:0082:en:PDF>.



Fingrid

General format: Area_Cut_CNE(from-to)_Contingency

Example: FI_Po_Pirttikoski-Pikkarala_Keminmaa-Pikkarala



Figure 9. Elaboration of Fingrid CNEC naming convention.

Statnett

General format: %x + y : X is contingency, Y is monitored element

12832_11 15% 420 Hasle-Rød + 300 Mauranger-Blåfalli

Figure 10. Example of Statnett naming convention.

Elaboration: Hasle-Rød the contingency, and Mauranger-Blåfalli is the monitored element

Please note that the percentage at the beginning of the Norwegian CNECs does not represent the actual loading of the CNEC in FB. It refers to the Statnett backoffice pre-computation of the loading of the CNE, thus lacking practical use for stakeholders. The actual loading of the CNEC in FB comes from the Nordic RCC.

Sweden

All CNECs that Svenska kraftnät utilise to determine the capacity for FB are anonymised in accordance with Swedish national legislation. This means that the network element or contingency, in question, has been assigned a new unique and dynamic identifier, which cannot be used to identify the physical location of the asset.

The anonymization is randomised on an hourly basis.



Importing the Grid Constraint Matrix in Excel

The Grid Constraining Matrix is published in CSV format (comma separated values format). This can be imported in Excel.

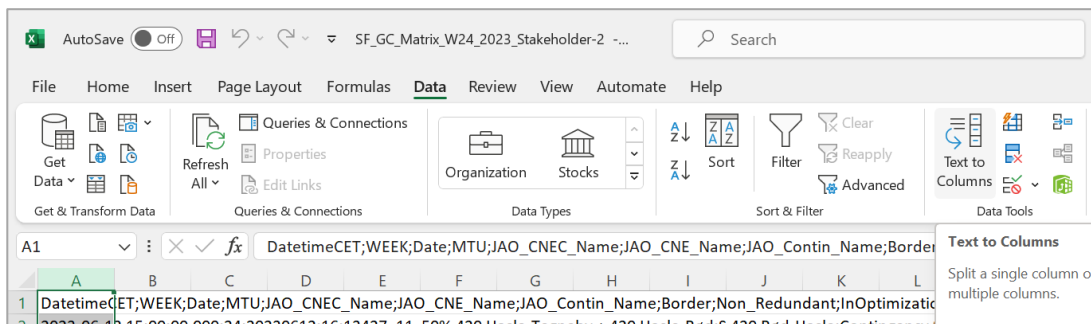
Do like this:

- Put your mouse pointer over the file and click right
- Select Open with ->Excel

After import, the file content will appear as a spread sheet with just one column (column A) populated with a lot of text. The text can then be distributed into separate columns.

Do like this:

- Select all content of column A
- Go to the “Data” menu and select “Text to Columns”



A prompt will then appear on screen, asking you to specify how the data is separated.

- Chose “Delimited” and click “Next”



Convert Text to Columns Wizard - Step 1 of 3

The Text Wizard has determined that your data is Delimited.

If this is correct, choose Next, or choose the data type that best describes your data.

Original data type

Choose the file type that best describes your data:

☒ Delimited - Characters such as commas or tabs separate each field.

☐ Fixed width - Fields are aligned in columns with spaces between each field.

Preview of selected data:

1	DatetimeCET;WEEK;Date;MTU;JAO_CNEC_Name;JAO_CNE_Name;JAO_Contin_Name;Borde
2	2023-06-12 15:00:00.000;24;20230612;16;13427_11_50% 420 Hasle-Tegneby + 4
3	2023-06-12 00:00:00.000;24;20230612;1;ACLineSegment ENDK DK1 E_VHA-ÅBØ 1
4	2023-06-12 18:00:00.000;24;20230612;19;8402C0521816033879E2B6866210ACC1;23
5	2023-06-12 20:00:00.000;24;20230612;21;AC_Minimum_SE4_NB;;BASECASE;FALSE;T
6	2023-06-12 03:00:00.000;24;20230612;4;D65C88F561D2405872E1E303E1D76151;E5E
7	2023-06-12 12:00:00.000;24;20230612;13;1489BC784208C88064D90916F5379395;3A

Cancel < Back Next > Finish

You will then be asked to choose delimiters.

- Chose “Semicolon” and click “Finish”

Convert Text to Columns Wizard - Step 2 of 3

This screen lets you set the delimiters your data contains. You can see how your text is affected in the preview below.

Delimiters

☐ Tab

☒ Semicolon

☐ Comma

☐ Space

☐ Other:

☐ Treat consecutive delimiters as one

Text qualifier: " " ' ' >

Data preview

DatetimeCET	WEEK	Date	MTU	JAO_CNEC_Name
2023-06-12 15:00:00.000	24	20230612	16	13427_11_50% 420 Hasle-Tegneby +
2023-06-12 00:00:00.000	24	20230612	1	ACLineSegment ENDK DK1 E_VHA-ÅBØ
2023-06-12 18:00:00.000	24	20230612	19	8402C0521816033879E2B6866210ACC1
2023-06-12 20:00:00.000	24	20230612	21	AC_Minimum_SE4_NB
2023-06-12 03:00:00.000	24	20230612	4	D65C88F561D2405872E1E303E1D76151
2023-06-12 12:00:00.000	24	20230612	13	1489BC784208C88064D90916F5379395

Cancel < Back Next > Finish

Please note that you now have to wait a short while for Excel to execute your request.

After successfully parsing the data, each cell should contain exactly one value without the semicolon.



Column A now holds the time stamps. Depending on locale settings, the time stamps may appear as plain zeros. This can be changed.

Do like this:

- Select column A
- Click right and select “Format Cells”.
- Go to “Category” and chose “Custom”
- Go to “Type” and enter the following string: *yyyy-mm-dd HH:MM*

This should render the display of time stamps in a readable format. *HH:MM* should render the display of time stamps in a readable format.

